

SANITARY SEWER
CONSTRUCTION SPECIFICATIONS
FOR
MONETT, MISSOURI

Presented by
Monett, Missouri



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CITY OF MONETT, MISSOURI
STANDARD SPECIFICATIONS FOR PUBLIC IMPROVEMENTS

GENERAL REQUIREMENTS AND PROVISIONS

1. DEFINITION OF TERMS - Whenever the following terms or pronouns in place of them are used in the general requirements and provisions, plans, specifications, proposal, and bond, the intent and meaning shall be interpreted as follows:

1.1 CITY - The City of Monett, Missouri, a municipal corporation, including the designated representative of the City of Monett.

1.2 OWNER - The City of Monett, Missouri.

1.3 BIDDER - Any individual, firm, association, or corporation submitting a proposal for the improvement contemplated, acting directly or through a duly authorized representative.

1.4 CONTRACTOR - The bidder who shall be licensed in the City of Monett, Missouri and furnish satisfactory bond and enter into a contract with the City of Monett, Missouri.

1.5 SURETY - The party who is bound with and for the Contractor to insure the payment of all lawful debts pertaining to and for the acceptable performance of the contract.

1.6 PROPOSAL - The written offer submitted by the bidder in the required manner to perform the work contemplated.

1.7 SPECIFICATIONS - The directions, provisions, and requirements contained herein as supplemented by such special provisions and supplemental agreements as may be necessary, describing the method and manner of performing the work, the quality and quantity of materials to be furnished under the contract.

1.8 PLANS - All official drawings or reproductions of drawings, made or to be made, pertaining to the improvement provided by the contract, or any work in connection therewith.

1.9 CONTRACT PRICE - The sum of the products of the estimated quantities and the respective unit prices or the lump sum set forth in the proposal and the construction contract-agreement, whichever is applicable to the particular project.

1.10 CONTRACT BOND - The approved form of security furnished by the Contractor and his surety as a guarantee that the Contractor will execute the work in accordance with the terms of the contract and will pay all lawful claims.

1.11 NOTICE TO PROCEED - A written notice from the City of Monett notifying the Contractor of the date on which he is to begin the prosecution of the work for which he has contracted. The date set forth in this notice shall be considered the official starting date and the time of completion shall be computed from that date.

1.12 CHANGE ORDER - Written authorization issued by the City of Monett as required for changes in the plans, specifications, or terms of contract. Such change orders shall be prepared on a specified form which shall set forth the nature of the change and the agreed-upon cost of same. The change order shall not be binding until such form is completed and signed by the Contractor and the authorized representative of the City of Monett.

1.13 A.S.T.M. - The American Society for Testing Materials.

1.14 A.A.S.H.T.O. - The American Association of State Highway and Transportation Officials.

1.15 M.H.T.D. - Missouri Highway and Transportation Department.

1.16 C.R.S.I. - Concrete Reinforced Steel Institute.

1.17 A.I.S.C. - American Institute Steel Construction.

1.18 P.C.A. - Portland Cement Association.

1.19 A.P.W.A. - American Public Works Association.

1.20 M.D.N.R. - Missouri Department of Natural Resources

2. PROPOSAL REQUIREMENTS AND CONDITIONS

2.1 SUBMISSION OF PROPOSALS - All proposals shall be made on the prescribed form furnished to each bidder with the contract documents. Each bidder will be supplied two copies of the proposal form; one shall be retained by the bidder for his record and one submitted for bidding, shall be placed in the special bid envelope furnished with these documents and deposited with the City at the time and place set forth in the Notice to Contractors.

2.2 IRREGULAR PROPOSALS - Proposals may be rejected that are not submitted on the prescribed form entirely free from erasures, omissions, or alterations of form. No bid will be considered which has been conditioned by the bidder. In case the bidder notes a requirement in any of the contract documents that he believes will require a conditioned or solicited alternate bid, he shall so notify the City in order that said City may review the matter and amend these specifications or plans by addendum prior to the time of receiving bids.

2.3 BIDDER'S DEPOSIT WITH BID - All proposals must be accompanied by a certified check on a solvent bank or trust company, or a bid bond by an incorporated surety company authorized to do business in the State of Missouri, in the amount of 5 percent of the bid price.

2.4 WITHDRAWAL OF PROPOSALS - Bidders will be given permission to withdraw, modify, or revise a proposal after it has been deposited with the City, provided the bidder makes his request in writing to said City before the actual opening of the proposals. Telegrams or communications that are received or show evidence that they were delivered to said City prior to the actual opening of bids for the items on which the proposals are submitted, will be accepted and corrections made in

proposals in accordance with such telegrams or communications. All telegrams and other communications that alter or modify proposals shall be opened and read prior to the opening of the bid proposals.

No proposal may be withdrawn, modified, or revised after any bid has been opened for the item, or items, upon which the particular proposal is submitted.

2.5 OPENING OF PROPOSALS - Proposals will be publicly opened and read at the time and place stated in the "Notice to Contractors". Bidders, or their authorized agents, and the public are invited to be present.

2.6 DISQUALIFICATION OF BIDDERS - More than one proposal from an individual, a firm, partnership, corporation, or an association under the same or different names will not be considered. Reasonable grounds for believing that any bidder is interested in more than one proposal for the work contemplated will cause the rejection of all proposals in which such bidder is interested. Any or all proposals will be rejected if there is reason for believing that collusion exists among the bidders and no participation in such collusion will be considered in future proposals for the same work. Proposals in which the prices are obviously unbalanced will be rejected. No contract will be awarded except to a bidder who is financially responsible and capable of performing the type of work contemplated.

2.7 FAMILIARITY WITH THE WORK AND LAWS - The submission of a proposal on the work shall be considered as a representation that the bidder has carefully examined the site of the proposed improvement and the plans, specifications, and other contract documents and that the bidder is fully informed concerning the conditions to be encountered, character, quality and quantity of work to be performed, and materials to be furnished; also, that the bidder is familiar with all state laws, the City of Monett ordinances that in any way affect the prosecution of the work, or persons engaged or employed on the work, or the materials and equipment used in the work.

2.8 QUALIFICATIONS OF BIDDERS - Prior to awarding the contract, the successful bidder must satisfy the City of Monett as to his competence to perform all the work required, and shall be licensed as a Contractor in the City of Monett.

2.9 QUANTITIES - The quantities shown on the estimate and in the proposal are approximate, and will not necessarily be used in establishing final payment. Each bidder shall make his own estimate of the quantities required and calculate his unit price bid accordingly. Payment on the contract will be based on actual number of units installed on the completed work.

3. AWARD AND EXECUTION OF CONTRACT

3.1 WITHDRAWAL OF PROPOSAL - After the opening of bids, no bidder may withdraw his proposal until thirty (30) days have elapsed after the date and time of opening bids.

3.2 RIGHT TO REJECT PROPOSALS - The City reserves the right to reject any or all bids and to advertise for new bids.

3.3 AWARD OF CONTRACT - After opening proposals, the City may require the three (3) low bidders to submit a financial statement, experience record, and a listing

of the equipment immediately available for the prosecution of the work. As soon as practical after opening bids, an award will be made by the City to the lowest and best bidder. This award shall require that all contract documents be executed in quadruplicate by the Contractor and his Surety and returned to the City within ten (10) days after the date of notice of award.

3.4 RETURN OF CERTIFIED CHECKS - The City will authorize the Director of Finance to return all certified checks or cash deposits except those of three (3) lowest bidders, which will be retained until the successful bidder has executed contract and bond.

3.5 PERFORMANCE AND MAINTENANCE BOND - The successful bidder at the time of execution of contract shall furnish a surety bond, otherwise known as a Performance Bond, and a Maintenance Bond executed by an incorporated surety company authorized to do business in the State of Missouri, in amounts and for periods as may be set out in the construction specifications for each contract; such bonds guaranteeing that said bidder will well and truly perform the covenants contained in the contract and will pay for the work and labor of all laborers, subcontractor teamsters, truck drivers, employed and owners of equipment used on the work, and for all materials therein, and further guaranteeing the City of Monett against faulty workmanship and materials incorporated in the work covered by the contract for a period of one year.

3.6 FAILURE TO EXECUTE CONTRACT - Failure to give satisfactory security in a sum equal to the contract price or failure to execute the contract within ten (10) days as specified shall be just cause for annulment of the award, or of the contract, if executed, and in the event of the annulment of the award of the contract because of such failure, it is agreed by the bidder that the certified check or cash deposited with the Director of Finance shall become the property of the City of Monett and will be retained, not as a penalty, but as liquidated damages.

3.7 SUBLETTING OF CONTRACT - The contract or any portion thereof shall not be sublet except with the written consent of the City . No such consent shall be construed as making the City of Monett a party to such subcontract, or subjecting said City of Monett to liability of any kind to any subcontractor. No subcontract shall, under any circumstances, relieve the Contractor of his liability and obligation under his contract, and all transactions with the City of Monett must be through the General Contractor.

Subcontractors will be recognized and dealt with only as workmen and representatives of the General Contractor and as such, shall be subject to the same requirements as to character and competence as set forth in Section 4.5 of this document.

4. GENERAL PROVISIONS

4.1 SCOPE OF WORK - The Contractor shall furnish all labor, materials, equipment, construction plant, and supervision necessary to construct and complete the improvements as set forth in the plans and specifications, excepting only those marked "to be done or furnished by others" or "not in contract". The Contractor shall fully complete the project and leave the work and site in a neat and finished condition. A detailed description of the scope of work will be given in the

construction specifications, but such description shall not limit the responsibility of the Contractor to fully complete his contract in accordance with the full intent of all contract documents.

4.2 UNAUTHORIZED WORK - Work done without lines and grades being given, work done beyond the lines and grades shown on the plans or as given, work done not shown on the plans or included in the specifications, except as herein provided, or any extra force account work done without written authority from the City will be considered as unauthorized and done at the expense of the Contractor. The City may order work so done removed or replaced at the Contractor's expense.

4.3 PROSECUTION OF THE WORK - The Contractor shall give his constant personal attention to the work, or shall provide a competent and reliable superintendent who shall have full authority to act for him. If at any time the City feels the work is not progressing in a satisfactory manner, the Contractor shall increase the force, tools, and equipment. Should the prosecution of work for any reason be discontinued with the consent of the City, the Contractor shall notify the City in writing at least twenty-four (24) hours before again resuming operations.

4.4 OTHER CONTRACTOR - The Contractor is required, as far as possible, to arrange his work and dispose of his materials so as not to interfere with the operations of other contractors engaged upon adjacent work. He shall also be required to join his work to that of others in a proper manner, in accordance with the spirit and intent of the plans and specifications, and to perform his work in the proper sequence in relation to that of other contractors.

4.5 CHARACTER OF WORKMEN AND EQUIPMENT - All subcontractors, superintendents, foremen, and workmen employed by the Contractor shall be careful and competent. The Contractor shall furnish such equipment as is considered necessary for the prosecution of the work in an acceptable manner and at a satisfactory rate of progress. Equipment used on any portion of the work shall be such that no unauthorized injury to adjacent property, roadways, walks, or other highways will result from its use.

4.6 COOPERATION OF CONTRACTOR REQUIRED - The Contractor will be supplied by the City with copies of the plans and specifications and he shall have available on the work at all times during the prosecution of the work one copy of each of said plans and specifications. He shall give the work his constant attention to facilitate the progress thereof and shall cooperate with the City in every possible way. He shall have at all times a competent and reliable representative on the work, authorized to receive orders and to act for him in case of his absence.

4.7 LAWS TO BE OBSERVED - The Contractor shall at all times observe and comply with all Federal and State laws, local bylaws, ordinances, and regulations which in any manner affect the prosecution of the work. The Contractor and his surety shall indemnify and save harmless the City of Monett and all its officers, engineers, representatives, agents, and employees against any claim or liability rising from or based on the violation of any such law, bylaws, ordinance, regulations, order, or decree, whether by himself, his employee, or his subcontractor.

4.8 PUBLIC CONVENIENCE AND SAFETY - The Contractor shall at all times observe city ordinances relating to obstructing streets, maintaining signals, keeping open passageways, and protection of same where exposed, and generally obey all laws and

ordinances controlling or limiting those engaged on the work; and said Contractor and his surety hereby expressly bind themselves to indemnify and save the City harmless from all suits or actions of every name and description, brought against said city for or on account of any injuries or damages received or sustained by any party or parties from the acts, omissions, or negligence of said Contractor or his servants or agents, including subcontractors in doing the work herein contracted for, or by or in consequence of any negligence in guarding the same, or in any improper materials used in its construction, or by or on account of any act or omission of the said contract, or on account of any claims or amounts recovered for infringement of patent, trademark, or copyright, or from any claims or amounts arising or recovered under the Workers' Compensation Law. In case there is any money due the Contractor, so much of the money due the said Contractor as the City shall deem necessary to protect the City will be retained until such suit or suits, action, or actions, claim or claims, injuries or damages, as aforesaid, shall have been settled and suitable evidence to that effect furnished to the City.

The Contractor shall put and maintain sufficient lights at night, and shall erect and maintain sufficient lights at night, and shall erect and maintain suitable barricades, and take any and all other proper precautions to guard against damage or injury to persons or property, and streets and alleys shall be open to traffic at all times during construction except when special permission is granted by the City for temporary closing of such streets and alleys.

4.9 PRESERVATION AND RESTORATION OF PROPERTY, TREES, MONUMENTS, ETC.: The Contractor shall not enter upon private property for any purpose without obtaining the permission of the owner and he shall be responsible for the preservation of all public and private property, trees, monuments, pole and pipelines, etc. along and adjacent to the line of work and shall use every precaution necessary to prevent damage or injury thereto. He shall use suitable precaution to prevent damage to pipes, conduits, and other underground structures, and shall protect carefully from disturbance or damage all land monuments and property landmarks until an authorized agent has witnessed or otherwise referenced their location and shall not remove them until directed. The Contractor shall not unnecessarily injure or destroy trees or shrubs in any right-of-way, and he shall not remove or cut them without proper authority. He shall be responsible during the prosecution of the work for all damage or injury to property of any character, or to persons, resulting from any act, omission, neglect, or misconduct in his manner or method of executing said work, his non-execution of said work, or due to defective work or materials. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, or in consequence of the non-execution thereof on the part of the Contractor, he shall restore, at his own expense, such property to a condition similar or equal to that existing before such damage or injury was done by repairing, rebuilding, or otherwise restoring, as may be directed, or he shall make good such damage or injury in an acceptable manner. In case of failure on the part of the Contractor to restore such property or to make good such damage or injury, the City may, upon forty-eight (48) hours written notice, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary and the cost thereof will be deducted from any monies due, or which may become due the Contractor under his contract.

4.10 CONTRACTOR'S RESPONSIBILITY FOR WORK - Until work is accepted by the City, it shall be in the custody and under the charge and care of the Contractor, and he shall take every necessary precaution against injury or damage to the work, by the

action of the elements or from any other cause whatsoever. The Contractor shall rebuild, repair, restore, and make good, at his own expense, all injuries or damages to any portion of the work before its completion and acceptance. Issuance of any estimate or partial payment on any part of the work done will not be considered as final acceptance of any work completed up to that time.

4.11 TEST OF SAMPLES OF MATERIALS - The Contractor shall furnish for approval such samples of materials proposed for use on the work as the City may require, and shall ship them prepaid to such person and address as directed. Samples shall be shipped in ample time to permit testing without delaying the work, and no materials of which samples are required shall be used until the samples have been approved.

4.12 INSPECTION OF MATERIALS AND WORK - The work will be conducted under the general direction of the City and is subject to inspection by its appointed inspectors to insure strict compliance with the terms of the contract. No inspector is authorized to change any provision of the specifications without written authorization of the City, nor shall the presence or absence of an inspector relieve the Contractor from any requirements of the contract.

4.13 CARE OF PIPES AND DRAINS, AND PROVISIONS FOR WATER - The Contractor shall provide for the flow of all water courses, sewer, drains, or channels interrupted during the progress of the work. Whenever water or gas mains or service pipes therefrom, or drains or other improvements are uncovered during the progress of the work, the Contractor shall use care in protecting same and shall promptly notify the owners thereof and allow them reasonable time to make the necessary removal or alteration.

4.14 INFRINGEMENT AND PATENT SUITS - The Contractor shall be liable for suits brought against the City by reason of infringement on the patent right of any material, method, machine, or appliance on the work, and shall assume all liability resulting from such suits against the City.

4.15 REJECTION OF MATERIAL AND WORK - If any work done and material furnished is found defective or not in accordance with the specifications, it shall be rejected and promptly removed from the work by the Contractor, and other material furnished and work done in substitution thereof. Any defective material or workmanship may be rejected at any time before the final acceptance of the work, even though the same may have been previously overlooked.

4.16 CONTRACT TIME FOR COMPLETION OF WORK - The contract time for the completion of work is specified in the construction specifications or contract documents. A working day is defined as any day when, in the opinion of the City, soil and weather conditions are such as would permit any then major operation of the project for six (6) hours or over. If conditions are such as to stop work in less than this time, the day shall not be counted as a working day. Saturdays, Sundays, national holidays, and holidays legal in the State of Missouri shall be excluded from the count of working days unless the Contractor utilizes such a day as a working day as indicated above. The count of working days shall start on the date the Contractor starts construction operation and in any event, not later than the date specified in the Notice to Proceed. The City shall be the sole judge of the number of working days to be charged under the contract. Each week, the representative of the City shall give written notice to the Contractor or to his representative in charge of the work, of the number of working days he has determined there were in the weekly period covered

by such notice. Any objection by the Contractor to such weekly decision shall be deemed waived, and shall not thereafter be made the basis of any claim, unless the Contractor shall, within three (3) days after receipt of such notice, file with the City his written protest setting forth his objections and specifying the reasons therefor. If the Contractor's objections to the working day count is made on the grounds that he is unable to work due to causes beyond his control, he shall state his reasons in writing, furnish proof to establish his claim, and state the approximate number of days he estimates he will be delayed.

4.17 LIQUIDATED DAMAGES -

4.17.1 Time is of the essence of all contracts. As delay in the prosecution of the work will inconvenience the public, obstruct traffic, interfere with business, and increase the cost to the City, it is important that the work be prosecuted vigorously to completion. Should the Contractor, or in case of default, the surety, fail to complete the work within the time stipulated in the construction specifications, or within such extra time as may be allowed in the manner set out in the preceding section, a deduction of an amount as set out in the Construction Specifications will be made for each and every calendar day that such contract remains uncompleted after the time allowed for the completion. The said amount set out in the Construction Specifications shall be the liquidated damages for loss to the City and the public due to obstruction of traffic, interference with business, and increased cost of engineering, administration, inspection, etc. after the expiration of the time stipulated in the Construction Specifications, or as amended as set forth in the preceding section, and will be deducted from any money due the Contractor under his contract, and the Contractor and his surety shall be liable for any liquidated damages in excess of amount due the Contractor. Permitting the Contractor to continue and to finish the work or any part of it after the expiration of the stipulated time, or after any extension of the time shall in no way operate as a waiver on the part of the City or any of its rights under this contract.

4.17.2 In any suit involving the collection of liquidated damages, the reasonableness of the amount per day stipulated in the Construction Specifications shall be presumed.

4.17.3 If the City or any of its agents should cause a delay in any part of the work or in the final completion of the job, this fact shall not void the provisions of the contract as to liquidated damages, but the Contractor shall be given such additional working days for the final completion of the job as the City may deem proper to compensate for such delay caused by the City or its agents.

4.18 ANNULMENT OF CONTRACT - If the Contractor fails to begin the work within the time specified, or fails to perform the work with sufficient workmen and equipment, or with sufficient materials to insure the prompt completion of said work, or performs the work unsuitably or neglects or refuses to remove materials or perform anew such work as shall be rejected as defective and unsuitable, or discontinues the prosecution of the work, or from any other cause whatsoever does not carry on the work in an acceptable manner, or if the Contractor becomes insolvent or declares bankruptcy, or commits any act of bankruptcy or insolvency, or allows any final judgment to stand against him unsatisfied for a period of forty-eight (48) hours; the City shall give notice, in writing, by registered mail, to the Contractor and his Surety, of such delay, neglect, or default. If the Contractor or his Surety, after such notice, does not proceed to take over and complete the work under the direction of

the City, then the City shall have full power and authority, without violating the contract or bond, to take over the completion of the work, to appropriate or use any or all materials and equipment on the ground that they may be suitable and acceptable, to enter into agreements with others for the completion of said contract according to the terms and provisions thereof, or to use such other methods as in his opinion may be required for the completion of said contract in an acceptable manner. Such declaration of annulment must be confirmed and ratified by Ordinance before having any force or effect. For all costs and charges incurred by the City of Monett together with the cost of completing the work, the Contractor and his surety shall be liable, and such cost may be deducted from any monies due or which may become due the Contractor. In case the expense so incurred by the City of Monett is less than the sum that would have been payable under the contract if it had been completed by the Contractor, then the Contractor will be entitled to receive the difference, and in case such expense exceeds the sum which would have been payable under the contract, then the Contractor and his Surety shall be liable and shall pay to the City of Monett the amounts of said excess.

4.19 PLANS AND SPECIFICATIONS - The plans and specifications on file in the City offices relating to any public work, and all plans that may be made by the City subsequent to the date of any contract, of an explanatory nature thereto, shall be a part of the contract and specifications.

4.20 ERRORS, OMISSIONS, ALTERATIONS - The specifications and plans are intended to supplement each other so that any work shown on the drawings and not mentioned in the specifications or vice versa is to be executed the same as if mentioned in the specifications and set forth in the plans, to the true intent and meaning of said drawings and specifications. The Contractor shall check over the plans before beginning construction work, and if any errors or omissions are discovered, he shall call the attention of the City to them in order that the necessary corrections may be made. In no case shall the Contractor make such corrections without first consulting the City. In case any plans of a supplementary or explanatory nature are necessary or desirable, they will be furnished by the City from time to time as the work progresses. In case changes are made in the work either in increasing or decreasing the cost thereof, corresponding additions to or deductions from the amount to be paid the Contractor shall be made. Such changes in work, additions or deductions in scope of work, and adjustment of the contract price shall be considered valid and authorized when a change order has been issued by the City.

4.21 COST OF EXTRA WORK - In case extra work not covered by the contract is deemed necessary to complete or perfect the project, the Contractor shall submit to the City a proposal stating in clear detail the scope of the extra work he promises to do. This proposal shall also include a statement of the Contractor's proposed manner or determining the cost or amount that he proposes as full settlement for the extra or additional work. The City may accept any of the below described means of computing the additional cost of doing extra work.

4.21.1 If the proposal and contract contains unit prices that are applicable to the additional work, they shall be used in determining the increase in cost.

4.21.2 The City may accept a lump sum proposal from the Contractor.

4.21.3 The additional or extra work may be done by force account in the manner described below:

4.21.4 The price paid the Contractor for extra work for which no unit price is named in the contract and for which no lump sum price can be agreed on shall be determined in the manner set forth below:

(a) The actual cost of salaries or wages for all labor used on the "extra work" including the proper proportionate time of the foreman or foremen, but not including the time of a superintendent or office personnel.

(b) The actual cost or value of all material or equipment incorporated into the "Extra Work".

(c) Rental, at rates not exceeding the current rental rates then prevailing in the City of Monett, for all power drive equipment for the time or proportionate time such equipment is employed on the "Extra Work".

(d) A fee of fifteen (15) percent of the sum of Items (a), (b), and (c) to cover superintendence, overhead expenses, rental, maintenance of tools, equipment, machinery, hand tools, bond, and profit.

(e) The total amount paid for extra work shall be the sum of (a), (b), (c), and (d) above, plus the amount that the Worker's Compensation, Public Liability, Property Damage, Contingent Public Liability and Property Damage, Special Hazard, and Social Security Insurance is increased by the performance of the "extra work".

When force account "Extra Work" is authorized, accounting procedures for such work, satisfactory to the City, shall be installed.

4.22 ESTIMATED QUANTITIES - If unit prices and estimated quantities are the bases of bidding on the base contract or any extras thereto, such quantities of work as shown on plans or stated in the proposal are only approximate, and during the progress of the work, the City may find it advisable, and it shall have the right to omit portions of the work and to increase or decrease quantities, and the City reserves the right to add or take from any item as may be deemed necessary or desirable. Only actual quantities will be paid for and under no circumstances or conditions will the Contractor be paid anything on account of anticipated profits upon the work, or any portion thereof covered by the contract which is not actually performed and which has not actually entered into the construction of said improvements.

4.23 MEASUREMENTS - The actual amount of work to be done may be more or less than shown on the plans and specifications, but no variation will be made in the unit rates on that account. No extra or customary trade measurements of any kind will be allowed in measuring the work under the specifications; but the actual length, area, solid contents, or number shall be considered.

4.24 TRADE NAMES - If trade names are used in the construction specifications, they are used merely to establish a standard of quality, performance, or economy of operation and the use of such trade name or trade names shall not be considered as restrictive against similar products of equal quality not named. Special consideration will be given to products manufactured within the corporate limits of the City of Monett, Missouri, when such products meet the requirements of the specifications.

4.25 SUBLETTING - The Contractor shall not sublet or assign his contract, or any part thereof, without the written approval of the City. No transfers shall, under any

circumstances, relieve the Contractor or his bondsmen of their liabilities and obligations under this contract.

4.26 CLEANING SITE - The Contractor shall not allow the site of the work to become littered with trash and waste material, but shall maintain the same in a neat and orderly condition through the construction period. The City shall have the right to determine what is or is not waste material or rubbish and the manner and place of disposal. On or before the completion of the work the Contractor shall, without charge therefor, tear down and remove all temporary structures built by him, and shall remove all rubbish of all kinds from any of the tracts or ground which he has occupied, and shall leave them in an orderly and neat condition.

4.27 CONTRACTOR AN INDEPENDENT CONTRACTOR - It is expressly agreed and understood that the Contractor is in all respects an independent Contractor as to such work, notwithstanding in certain respects the Contractor is bound to follow the direction of the City, and that the Contractor is in no respect an agent, servant, or employee of the City.

4.28 CHANGE IN PLANS - BONDSMEN NOT RELEASED - It is further stipulated and agreed that the liability of the surety shall not be affected by any extension of the time of the completion of said work which may be granted by Ordinance of the Council, or the changing of the plans and specifications, or the subletting of a part of the contract.

4.29 TAXES - The Contractor shall pay all Federal, State, and local taxes, including sales taxes, social security taxes, etc. that may be chargeable against the performance of the construction, materials used in construction, partially or wholly finished structures, until the time of final acceptance, and any other taxes properly assessable and payable, exclusive of real estate land taxes.

4.30 CITY NOT LIABLE FOR DELAYS - In no event shall the City of Monett be liable or responsible to the Contractor or to any other person for or on account of any stoppage or delay of the work herein provided for, by injunction or other legal or equitable proceedings, or from or by or on account of any delay from any cause over which the City has no control.

4.31 WATER - The Contractor shall furnish the water necessary for his operations or tests. The Contractor shall, at his own expense, install and maintain any water supply connections, piping and storage required for the prosecution of the work, but only at such locations and in such workmanlike manner as may be authorized by the City.

4.32 ELECTRICITY - All electric current required by the Contractor shall be furnished at his own expense. All temporary lines shall be furnished, installed, connected, and maintained by the Contractor in a workmanlike manner satisfactory to the City, and shall be removed by the Contractor in like manner at his expense at the completion of construction.

4.33 TEMPORARY HEATING - During construction operations, the Contractor shall furnish and install any temporary heating facilities required to provide heat for any trades whose installation work necessitates certain temperature requirements.

4.34 SHOP DRAWINGS - The Contractor shall submit to the City for approval four (4) copies of all shop drawings called for under the various headings of these specifications, or on the drawings. These drawings shall be complete and shall contain all required detailed information. If approved by the City, one set will be returned to the Contractor with the approval marked thereon.

4.35 GUARANTY - Any equipment furnished pursuant to any specifications shall be guaranteed for a period of one year from the date of final acceptance thereof against defective materials, design, and workmanship. Upon receipt of notice from the City of failure of any part of the guaranteed equipment during the guaranty period, the affected part or parts shall be replaced promptly with new parts by, and at the expense of the Contractor.

4.36 STAKES - The Contractor shall employ a competent surveyor, whose work meets the approval of the City, to set the line and grade stakes for all construction work. Should the City forces do the staking work, it will be the Contractor's responsibility to preserve them, and in the event of his failure to do so, the cost of the City in resetting them will be paid by the Contractor.

4.37 TIME FOR INSPECTION - Any inspection required by the specifications to be made by the City will be made within three days, by the City's authorized representative, after receipt by him of notice from the Contractor that said work is ready for inspection.

NOTE - If the execution of the work requires the closing of city streets to through traffic, it shall be the responsibility of the Contractor to notify the City forty-eight (48) hours in advance. It shall further be the responsibility of the Contractor to provide proper signs for detouring traffic with the minimum of confusion, and the Contractor shall make every effort to provide residents vehicular access to their homes and driveways, especially at night.

4.38 MDNR APPROVAL - As required by State law, work shall not commence on any water line or sewer construction project until such time as a construction permit has been received from the Missouri Department of Natural Resources, and City approval has been granted. Plans and specifications bearing the seal of a registered professional engineer and that comply with the requirements of the City and MDNR, shall be submitted to the City and MDNR concurrently for review.

5. INSURANCE REQUIREMENTS

5.1 CONTRACTOR'S INSURANCE - The Contractor shall not commence work under any contract until he has obtained all insurance required under this section and such insurance coverage has been approved by the City, nor shall the Contractor allow any subcontractor to commence work on his subcontracts until all similar insurance required of the subcontractor has been so obtained and approved.

5.1.1 Public Liability and Property Damage Insurance: The Contractor shall take out and maintain during the life of this contract such public liability and property damage insurance as shall protect him and any subcontractor performing work covered by this contract, from claims for damages for personal injury, including accidental death, as well as from claims for property damages, which may arise from operations under this contract, whether such operation be by himself or by any

subcontractor or by anyone directly or indirectly employed by either of them and the amount of such insurance shall be as follows:

Public liability insurance in an amount not less than:
\$500,000

For injuries, including accidental death to any one person, and subject to the same limit or each person, in an amount not less than:
\$1,000,000

on account of one accident, and property damage insurance, in an amount not less than
\$100,000

Automobile, truck and team public liability, and property damage insurance must be carried by each Contractor and/or subcontractor where automobiles, trucks, or teams are used at the project site by such Contractor and/or subcontractor where automobiles, trucks, or teams are used at the project site by such Contractor and/or subcontractor where automobiles, trucks, or teams are used at the project site by such Contractor and/or subcontractor

5.1.2 Insurance Covering Special Hazards - The following special hazards shall be covered by rider or riders to the public liability and/or property damage insurance policy or policies herein elsewhere required to be furnished by the Contractor or by separate policies of insurance, in amounts as follows:

Operation each vehicle away from project site
\$50,000

5.1.3 Contingent Insurance - The Contractor shall provide contingent or protective public liability insurance in an amount not less than:
\$100,000

and contingent or protective property damage insurance in amounts not less than:
\$50,000

if work is subcontracted, applicable to subcontractors as well in the event they sublet any of their work.

5.1.4 The City may accept insurance covering a Subcontractor in character and amounts less than the standard requirements set forth herein where such standard requirements appear excessive because of the character or extent of the work to be performed by the subcontractor.

5.1.5 Insurance Protecting the Owner - The Contractor shall provide and maintain insurance to protect the City of Monett, Missouri against any and all claims for damages for personal injury, including accidental death, as well as from claims for property damage that may arise from operations under this contract whether such operations be by the Contractor or any of his subcontractors, or by any one directly or indirectly employed by the Contractor or his subcontractors. The minimum protection provided for this coverage shall be of the same character and the same amounts set forth in the preceding paragraphs 5.1.1 and 5.1.2 of this section. This

coverage will be considered acceptable when provided in one of the following methods:

(a) By issuance of original policy designating the Contractor and the City of Monett, Missouri as the insured parties under the provisions of the policy.

(b) By endorsement to an original policy which endorsement shall extend to the City of Monett, Missouri the same coverage and protection stipulated in the paragraph above.

(c) By separate contingent policy providing the required insurance coverage for the protection of the City of Monett, Missouri.

5.1.6 Proof of Carriage of Insurance - The Contractor shall furnish the City, prior to start of any operation on the project, satisfactory proof of carriage of the insurance required. The certificate must show the cancellation provision of the policy. No policy is acceptable to the owner that can be cancelled by the insurer in less than ten (10) days after the insured, including the owner, has received written notice of such cancellation. It is requested that each insurance certificate contain a clause substantially as follows:

The policies referred to herein provide that they cannot be cancelled by the insurer in less than ten (10) days after the insured has received written notice of such cancellation."

6. PAYMENTS

6.1 SCOPE OF PAYMENT - The Contractor shall receive and accept the compensation provided for in the contract as full payment for furnishing all materials, labor, tools, and equipment, and for performing all work contemplated and embraced under the contract; also for all loss or damage arising out of the nature of the work, or from the action of the elements; also for all expenses incurred by, or in consequence of the suspension or discontinuance of the said prosecution of the work as herein specified, or from any unforeseen difficulties or obstructions for all risks of every description connected with the prosecution of the work until its final acceptance by the City. The compensation shall be considered as full payment for the completing of the work in an acceptable manner according to the plans and specifications, and it shall be understood that the Contractor and his Surety shall indemnify and save harmless Monett from any suit, cost, or penalty, for any infringement of patent, trademark, or copy right, which may be encountered in the prosecution of the said work. The payment of any current or final estimate or the acceptance of any portion of the work as provided in the standard specifications shall in no way or in no degree affect the obligation of the Contractor who, at his own expense, shall repair, correct, renew, or replace any defects or imperfections in the construction, strength, or quality of materials used in or about the construction of the work under the contract, and this payment shall in no way affect his responsibility for all damages due or attributable to such defects or imperfections that may be discovered before the final acceptance of the whole work, and of which defects or imperfections the City will be the judge.

CLEARING AND GRUBBING 02110

1. GENERAL

- 1.1 Description: The work in this section consists of furnishing all labor, materials, equipment, and tools necessary for performing all operations for the proper execution of all clearing and grubbing within the construction areas shown on the drawings and as necessary to complete this section.
- 1.2 Limits: Unless noted otherwise on the drawings, clearing and grubbing shall be performed within the limits of the "Permanent Easement" as shown on the drawings. Incidental clearing and grubbing shall be performed as necessary within the limits of the "Construction Easement" as shown on the drawings.

2. EXECUTION

2.1 Clearing:

2.1.1 Clearing shall consist of clearing the surface of the ground in the designated areas of all trees, stumps, roots, down timber, logs, snags, brush, undergrowth, hedges, heavy growth of grass or weeds, fences, structures, foundations, debris and rubbish of any nature.

2.1.2 Trees, stumps, roots, brush, and other vegetation in the areas to be cleared shall be cut below the original ground surface.

2.1.3 Trees and vegetation designated in the field by the Owner to remain standing shall be protected from any damage incidental to the clearing, grubbing, and construction operations.

2.2 Grubbing:

2.2.1 Grubbing shall consist of the removal and disposal of stumps, roots larger than two (2) inches in diameter, and matted roots from the areas designated to be grubbed. This material shall be removed to a depth of no less than twelve (12) inches below the original surface of the elevation.

2.2.2 Depressions created by grubbing operations shall be filled with suitable material and compacted.

2.3 Disposal of Materials:

2.3.1 All cleared and grubbed material including trees, stumps, roots, vegetation, organic material, rubbish, and otherwise shall be removed from the project site and disposed of in accordance with federal, state, and local laws.

2.3.2 Limited burning of debris on the site will be permitted if allowed by local, state, and federal law. Any ashes and/or debris left as a result of burning shall be removed from the site and taken to a landfill.

1. GENERAL

- 1.1 Description: The work in this section consists of excavation, filling, compacting, and satisfactory disposal of all materials within the limits of the work required to complete structures in conformity with the dimensions as shown on the drawings and with established elevations and contours. There will be no distinction made between wet or dry materials below the surface of the earth. Structure excavation shall be considered as unclassified, which shall consist of all materials of whatever character encountered in the work, including soil, solid rock, fragmented rock, water, or other.

2. COMMON EXCAVATION

- 2.1 Excavation: The Contractor shall excavate to the lines, grades, and elevations shown on the drawings all materials within the work area and place and/or dispose of the excavated materials as specified herein, as called for on the drawings or as directed by the Owner.

2.1.1 Foundations: All footings shall be founded on firm undisturbed soil or fill concrete.

2.1.2 Slabs on Grade: Where the drawings show compacted granular backfill under basement slabs or other slabs on grade, the excavation shall be carried deep enough to permit the minimum thickness of compacted granular material to be placed.

2.1.3 Over-Excavation: In no case shall any footings be founded above those elevations shown on the drawings. If soft or unsuitable soil is encountered at elevations where footings are to be founded, the excavation shall be taken through unsuitable material and brought back up to grade with fill concrete. Contractor shall notify the Owner when such conditions are encountered and prior to over-excavation of the unsuitable material, in order to be compensated. Compensation for the extra work shall be negotiated by the Owner and Contractor. Excavations carried below depths shown on the drawings, without prior notification being given the Owner, shall be brought to grade with fill concrete at the Contractor's expense.

- 2.2 Side Forms: Unless the utilization of earth as a side form for footings is requested by the Contractor in writing and approved by the Owner, side forms shall be required for all footings, grade beams, walls, and base slabs below grade. The excavation shall be large enough to allow for installation and removal of forms. In the cases where earth side forms are allowed, additional concrete thickness shall be utilized as directed by the Owner.

- 2.3 Excavation Bottom: Special care shall be taken to prevent disturbance of the bottom of excavations where the soil is to provide bearing for slabs, footings, etc. If surface water or other conditions which may decrease the bearing capacity of the foundation subgrade are present, then soil adequate to protect the foundation subgrade shall not be excavated until just before reinforcing steel and concrete are to be placed. The bottom of all excavations shall be inspected and approved by the Owner before the placement of any granular material, reinforcing steel, or concrete.

- 2.4 Borrow Excavation: When required, borrow excavation shall be the responsibility of the Contractor.

2.4.1 Borrow Characteristics: The soil to be utilized in construction of the earthen fill or backfill shall be an inorganic, low-plasticity clay containing from a trace to thirty percent chert fragments, and generally containing rocks no larger than 4-inches in its largest dimension.

- 2.5 Removal of Water: The Contractor shall at all times during the construction of the work provide and maintain ample equipment to remove and dispose of all water entering the excavations or other parts of the work, and keep said excavations dry until the structures to be built therein are completed. No reinforcing steel shall be placed in water, and no water shall be allowed to rise over any reinforcing steel before the concrete has been placed. No water shall be allowed to come in contact with any concrete within 24 hours after placing unless specifically required by the drawings, or specified herein. The Contractor shall be held responsible for the conditions of any sewers, drains, or other conduits, or pipelines which may be used for drainage purposes, and such pipes or conduits shall be clean and free from all sediment before acceptance by the Owner.

- 2.6 Sheeting, Shoring, or Bracing: Sheeting, shoring, or bracing shall be placed by the Contractor wherever necessary for the proper preservation of any excavation, embankment, or structure. Where the ground is of such a character or other conditions are such as to render it necessary, the sheeting shall be closely driven and shall be to such depth below the lowest point of the final excavation as may be directed. The Contractor shall be held responsible for the sufficiency of all sheeting and bracing used, and for any and all persons injured or property damaged as the result of improper quality, strength, placement, maintenance, or removal of the same. No extra compensation will be made for sheeting, shoring, or bracing, whether left in place or not. The Contractor shall, at his own expense, shore up, protect, and insure from injury all buildings, retaining walls, piers, and footings, storm sewers, sanitary sewers, gas lines, water lines, fences, curbs, trees, or other property liable to be injured during the process of the work, and he will be held responsible for all damage which may occur by reason of prosecution of the work. Sheeting, shoring, and bracing shall be provided, installed, and maintained to protect the excavation and insure the safety of workmen and shall be as required by applicable federal, state, and local laws, rules, and regulations.

3. BACKFILL AND COMPACTION

3.1 Cuts: When required on the drawings, the soil below grade in cut sections shall be scarified, broken up, adjusted to a moisture content within the designated moisture range and compacted to 95% maximum density as determined by Section 02250 - COMPACTION CONTROL AND TESTING. When the depth of compaction in cut sections is shown on the drawings to be more than six inches, all material shall be removed to within six inches of the lower limit of the compaction. The layer of material left in place shall be scarified, broken up, adjusted to a moisture content within the designated moisture range, and compacted to 95% maximum density as determined by Section 02250 - COMPACTION CONTROL AND TESTING. This process shall be repeated until the cut section has been compacted to the grade shown on the drawings. Compaction of low plasticity or non-plastic fine grained materials shall be considered adequate when additional passes of the roller do not bring the tamping feet closer to the surface of the lift, provided the entire weight of the roller is supported on the tamping feet and none by material directly in contact with the drum. Sand and gravel which cannot be compacted satisfactorily with a sheep'sfoot roller shall be rolled with a pneumatic-tired roller or other approved types. Each lift shall be rolled until no further consolidation is visually evident.

3.2 Around and Beneath Structures - General:

3.2.1 Prior to placing fill material, all topsoil and soft material shall be removed to a depth necessary to establish good bearing of the fill material. The surface of the ground shall be scarified to a depth of six inches and the moisture content of the loosened material shall be such that it will readily bond with the first layer of fill material.

3.2.2 When the drawings require the placement of fill beneath a proposed structure, the floor or footing subgrade shall be made with finely divided material sufficiently moist to compact readily when tamped. Fine grained material used as backfill shall be placed in six-inch compacted lifts and compacted to 95% maximum density as determined by Section 02250 - COMPACTION CONTROL AND TESTING. Granular soils used for backfill shall be placed in eight-inch lifts (compacted) and compacted to 100% of the maximum density as determined by Section 02250 - COMPACTION CONTROL AND TESTING.

3.2.3 Fill around and between structures shall be constructed, to as great an extent as possible, with earth obtained from the excavations for structures. The fill shall be compacted to Range "C" requirements as determined by Section 02250 - COMPACTION CONTROL AND TESTING.

<u>TRENCHING, BACKFILLING, AND COMPACTING</u>	<u>02221</u>
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1. GENERAL

- 1.1 Description: The work of this section consists of excavation for trenches relating to the construction of underground piping. There will be no distinction made in any definition or classification of excavation covered by this section between wet or dry materials below the surface of the earth. Trench excavation shall be considered as unclassified, which shall consist of all materials of whatever character encountered in the work, including soil, solid rock, fragmented rock, water, or other. Work under this section shall also include:
- 1.1.1 All sheeting, shoring, bracing, protection of adjacent property, preparation of all subgrades, storage of excavated materials, backfilling, tamping, grading, and surfacing.
- 1.1.2 Diversion of surface water, and all pumping, draining, or other means of dewatering excavations.
- 1.1.3 All subsequent handling and disposal of excavated material, together with the preparation of all trench subgrade.
- 1.2 Protection of Adjacent Property: The Contractor shall protect all excavations and trenches from settlement or displacement by approved means of bracing and shoring. All existing underground utilities and structures as well as all surface improvements and structures shall be protected and their functional purpose preserved.

2. CLASSIFICATION OF EXCAVATION

- 2.1 All excavation shall be considered as unclassified.

3. TRENCHING

- 3.1 Lines and Grades: The Contractor shall furnish and set all stakes for the lines and grades as shown on the drawings including all grade boards, uprights, and accessory materials required. Grade boards shall be installed across the trench at intervals not to exceed 25 feet. The Contractor shall be held responsible for verification of lines and grades as established and shown on the drawings. The Owner may check the line and grade at any given point before backfilling has been started, and if there is a variation of more than two-hundredths (0.02) of a foot from the true grade, the same shall be raised or lowered as required.
- 3.1.1 In the event a laser beam is used to set line and grade for the pipe laying operation, grade stakes shall be set at each manhole and at 25 feet, 50 feet, 100 feet, and then 100-foot increments thereafter, upgrade of the manhole. The laser must be checked at the beginning of each day and at each grade stake to insure the proper line and grade of the pipe.
- 3.2 Excavation: All excavation for trenches shall be made with a sufficient working space to permit the placement, inspection, and completion of all work contemplated in the contract. Excavated material that is unsuitable for backfill, and all boulders exposed by grading shall be removed from the work area. Trenches shall be excavated in accordance with the drawings for trench width relative to trench depths.
- 3.2.1 Trenches shall be excavated to six inches below the bottom of the pipe when set to established flow lines. Should the trench be excavated more than six inches below the bottom of the pipe, the Contractor shall use only granular stone bedding material to establish flow line grade.
- 3.2.2 Trench excavation shall, in all cases, be made continuous from the ground surface to the established trench depth. Materials excavated shall be stockpiled at the sides of the trench and within established area limits so as to minimize inconvenience to the public, and damage to vegetation and structures in the area.

3.2.3 Trenching, shoring, bracing, and shields shall be placed by the Contractor whenever necessary for the proper preservation of any excavation, embankment, or structure. Where the ground is of such a character or other conditions are such as to render it necessary, the sheeting shall be closely driven and to such depth below the lowest point of the final excavation as may be directed. The Contractor shall be held responsible for the sufficiency of all sheeting and bracing used, and for any and all persons injured, or property damaged as the result of improper quality, strength, placement, maintenance, or removal of the same. No extra compensation will be made for sheeting and bracing, whether left in place or not. The Contractor shall, at his own expense, shore up, protect, and insure from injury all building, retaining walls, piers, and footing, storm sewers, sanitary sewers, gas lines, water lines, fences, curbs, trees, or other property liable to be injured during the process of the work, and he will be held responsible for all damage which may occur by reason of prosecution of the work. Sheeting, shoring, and bracing shall be provided, installed, and maintained to protect the excavation, insure the safety of workmen, and as required by applicable federal, state, and local laws, rules, and regulations.

3.2.4 Trench width from six inches below the bottom the pipe to six inches above the pipe bell shall be held to 1.4 times the outside diameter of the pipe plus twelve inches. Trench width above these levels may be wider to accommodate shoring, bracing, and shields, but shall be kept within practical limits. Contractor shall not receive additional payment for extra trench width.

3.3 Removal of Water: The Contractor shall furnish and operate sufficient pumps and appliances, and shall provide all material, labor, etc. required to prevent interference with any work by water, ice, or snow. Damage of any kind resulting from insufficient pumping facilities or similar lack of proper conduct of the work shall be made good by the Contractor at his own expense. No structure and pipes shall be placed in water and water shall not be allowed to run into or cover any concrete work or pipe, or into or through any pipe, unless by special permission given by the Owner in writing.

3.4 Record Drawings: Even though all excavation shall be considered unclassified for pay purposes, the Contractor shall clearly indicate on the Record Drawings (which he shall submit to the Owner) the elevations and extent of all solid rock encountered during construction of the project.

4. BACKFILLING AND COMPACTING

4.1 Material used for backfilling of trenches shall be free from perishable matter and from other material liable to become unstable when saturated with water after having been compacted. No frozen material shall be used in backfill. No large stones or organic matter shall be placed within two feet of the top of the sewer pipe. Care shall be taken to prevent damage to the pipe and structures. Special precautions shall be taken in backfilling over pipes. No backfill shall be placed over any portion of pipes and/or joints not inspected by the Owner. The granular stone bedding material shall be brought to a depth of at least six inches over the top of the pipe bell, with this material carefully deposited in uniform layers not exceeding six inches in depth, and each layer carefully and solidly tamped with mechanical tampers in such a manner as to avoid damage to pipe or disturbing completed work. Unless noted otherwise on the drawings, backfilling for the remainder of the trench shall be previously excavated gravel, sand, or earth, and shall contain no stone over three inches in its largest dimensions. Stones smaller than that size may be used in proportion not exceeding one part of stone and three parts of earth in any place. This backfilling shall be deposited and spread in layers and solidly tamped. As the trenches are backfilled, the Contractor shall remove all surplus material and regrade the surface leaving it in good order. The trenches shall be filled to the ground surface elevation which previously existed, unless shown otherwise on the drawings.

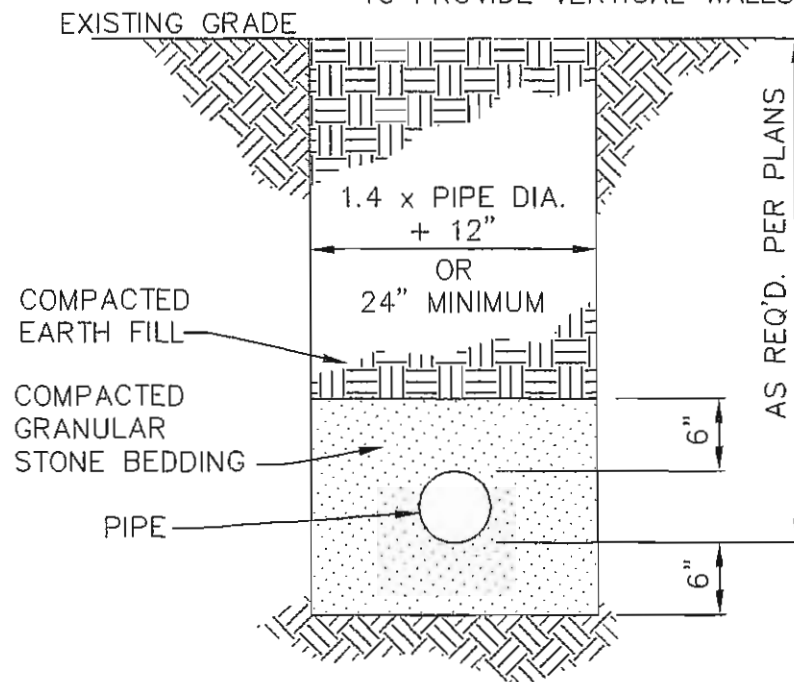
4.1.1 The Contractor may be required to settle certain backfill material with water, in addition to other backfilling procedures. The water will be furnished by the Contractor without cost to the Owner. Methods and procedures in using the water shall be approved by the Owner prior to carrying out the operation.

4.1.2 Whenever, in the opinion of the Owner, the excavated material is not suitable for backfilling the trench, or there is a deficiency of material, the Contractor shall, as his own expense, provide suitable material.

4.1.3 All excess excavation materials shall be cleaned up by the Contractor as directed. All backfilled trenches shall be maintained by the Contractor for a period of one year after Final Acceptance of the work by the Owner.

- 4.2 Roadway Crossings: At all open-cut roadway crossing, and as noted elsewhere, the trench shall be backfilled to grade with granular stone meeting the requirements of Section 0222 - GRANULAR STONE BEDDING AND BACKFILL. For roadway surface replacement, see Section 02575 - ROADWAY SURFACE REPLACEMENT.
- 4.3 Private Drives, Field Entrances, etc.: At all open-cut crossings of private drives, field entrances, and the like, the trench backfill shall be deposited and spread in layers and solidly tamped to Range "B" compaction requirements set forth in Section 02250 - COMPACTION CONTROL AND TESTING. Private drives, etc. shall be backfilled "immediately" upon completion of the pipe laying across the drive. The driving surface shall be restored to its original condition immediately following proper compaction of the backfill.

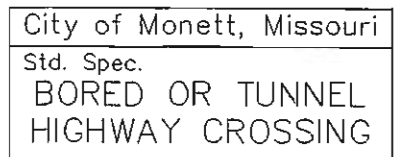
NOTE: TRENCH SHALL BE EXCAVATED
TO PROVIDE VERTICAL WALLS.



City of Monett, Missouri

Std. Spec.

SEWER LINE
TRENCH & BEDDING



GRANULAR STONE BEDDING AND BACKFILL 02222

1. GENERAL

- 1.1 Description: The work of this section shall consist of furnishing, hauling, placing, and compacting granular stone for bedding underground utility piping, and for granular stone backfill at street crossings and other locations shown on the drawings.

2. MATERIALS

- 2.1 Pipe Bedding: Aggregate shall be well-graded crushed stone conforming to ASTM Designation C33, Gradation 67, 1-inch to No. 8 as follows. Sand or chat will not be allowed.

<u>Laboratory Sieve</u>	<u>Amounts Finer than Weight %</u>
1 "	100
3/4"	90 - 100
3/8"	20 - 55
No. 4	0 - 10
No. 8	0 - 5

- 2.2 Pipe Backfill: When granular stone backfill is required, the aggregate shall be identical to the pipe bedding material specified in paragraph 2.1.

3. EXECUTION:

- 3.1 Pipe Bedding: Granular stone shall be placed in the trench and shaped so as to provide uniform support for the bottom quadrant of the pipe barrel. The bedding shall be not less than six (6) inches in thickness. Following the placement of the pipe, the trench shall be filled with granular stone bedding material to a minimum compacted depth of six (6) inches above the pipe bell. Bedding installation in trench shall be to the widths and depths as shown on the drawings.
- 3.2 Pipe Backfill: When granular stone backfill is required, it shall be of the specified gradation and shall be placed in the trench in maximum 24-inch thick layers and compacted to 80% of maximum density.

GRANULAR STONE BASE 02223

1. GENERAL

- 1.1 The work shall consist of furnishing and placing one or more courses of aggregate on a prepared subgrade as a part of roadway surface replacement in accordance with these specifications and in conformity with the lines, grades, thicknesses, and typical details shown on the plans.

2. MATERIALS

- 2.1 Granular Stone Base: Crushed stone shall conform to material specified as Type 1 aggregate by the Missouri Highway Department and produced by an approved source. Aggregate shall be mechanically crushed limestone or dolomite, graded to the following gradation ranges:

Amount by Weight Passing On:

1 Inch Sieve-----100%

½ Inch Sieve----- 60-90%

No. 4-----, 40-60%

No. 40-----15-35%

Plasticity Index, not greater than 6 for material passing No. 40 sieve.

Material shall be delivered with sufficient moisture content to provide specified densities when compacted.

3. METHODS

- 3.1 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 these specifications prior to the placing of any base material on that portion. Aggregate base shall not be placed on a frozen subgrade.
- 3.2 Placing: The maximum compacted thickness of any one layer shall not exceed six (6) inches. When the specified compacted depth of the base course exceeds six (6) inches, 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 eight (8) inches for shoulders and lightly traveled areas. Preliminary compaction shall be performed by means of pneumatic-tired rollers. After preliminary compaction has been secured, finish compaction shall be carried to completion by means of self-propelled steel-wheeled rollers weighing not less than ten (10) tons. Shaping and compacting shall be carried on until a true, even, uniform base course of proper grade, cross section and density is obtained. Proper moisture content shall be maintained by wetting the surface or allowing it to dry as required during shaping and compacting operations. The use of excess water, resulting in run-off or in the formation of a slurry on the surface shall be avoided. The stone base shall be compacted to not less than ninety-five (95%) percent of the maximum density at optimum moisture content.
- 3.3 Testing: The compacted base shall be tested as outlined in Section 02250 - COMPACTION CONTROL AND TESTING.

1. GENERAL

- 1.1 Description: The work in this section consists of undertaking all phases of work which relate to explosives and blasting, including, but not necessarily limited to, receiving, handling, transporting, storing, distributing, priming, loading, firing, and disposal of explosives. The Contractor shall exercise the utmost care at all times not to endanger life or property.
- 1.2 Legal Requirements: The Contractor shall comply with all applicable Federal, State and local laws and regulations pertaining to the use, storage, and handling of explosives, and shall secure all required permits for their use. It is the intent of these specifications to comply with all such laws and regulations. In the event of inconsistencies between these specifications and the laws and regulations, the laws and regulations take precedence.
- 1.3 Personnel: One competent, experience person shall be specifically designated as being in charge of explosives at all times. The designated person shall be required to present certification to the Owner that he has successfully completed a course in the handling and use of explosives, given by an accredited institution such as the U.S. Bureau of Mines, DuPont or other explosive manufacturing company. He shall exercise careful supervision of all work related to the use, storage, and handling of explosives. Only an absolute minimum number of competent, experienced men, consistent with efficient operation, shall be permitted to handle explosives. Anyone exhibiting carelessness, incompetence, or inexperience shall be immediately excluded from further handling of explosives.

2. EXECUTION:

- 2.1 Protection of Site: The Contractor shall make proper use of blasting mats and other protective devices and shall adopt whatever additional precautions are deemed necessary to prevent damage to trees, shrubs and other landscape features, as well as to buildings, utilities, monuments, and other structures. All materials lifted by the blasting shall be confined within the limits of the trench or other excavation. Every reasonable effort shall be made to prevent injury to life and damage to the natural and the constructed surroundings. The Contractor shall take special precautions to prevent damage to surface structures, water supply mains, sewers, storm drains, other buried structures, and the basin dikes and basin floor. In the event that damage does occur, the Contractor shall be responsible for restoring the damaged property to a condition at least as good as before the damage was incurred or shall make a damage payment to the Owner equal to the cost of restoration.
- 2.2 General Requirements: The Contractor shall at all times be bound by the National Fire Protection Association Code No. 495, Code for the Manufacture, Transportation, Storage, and Use of Explosives and Blasting Agents (latest edition), except when this code is in conflict with existing Federal, State, and local laws and regulations. If there is conflict between the code and the laws and regulations, the most stringent requirement among them shall take precedence over the others. Safety rules, safeguards, and recommendations contained in the Manual of Accident Prevention in Construction (latest edition) of the Associated General Contractors of America shall supplement the above codes and existing laws and regulations. The Contractor shall give special attention to the following specific rules:
 - 2.2.1 Magazines shall be located in accordance with the American Table of Distances for Storage of Explosives.
 - 2.2.2 Magazines shall be bulletproof, fireproof, burglarproof, weather-resistant, and constructed with adequate screened ventilation and dry wooden floors. All nails exposed to the interior of magazines shall be well countersunk. Magazines shall be of such physical weight to preclude movement without heavy equipment (front end loader, etc.). Magazines shall not be provided with artificial heat nor lights, and shall be kept securely locked.
 - 2.2.3 Detonators shall not be stored with other explosives but shall be stored in separate magazines.
 - 2.2.4 Magazines and roads to them shall be clearly marked with appropriate caution and danger signs arranged to minimize the possibility of a bullet hitting the magazine should the signs be shot at by vandals.
 - 2.2.5 The blast area shall be cleared of all unnecessary personnel and equipment prior to the delivery of any explosives to the site.
 - 2.2.6 No more than one day's supply of explosives shall be kept at or near the work site and these explosives shall be kept in approved portable magazines.
 - 2.2.7 Wooden tamping bars only shall be used for charging explosives into drill holes.
 - 2.2.8 Electricity from light or power circuits shall not be used for firing shots unless the electrical connection to the circuit is made within an enclosed switch box which shall be kept securely locked with switch in open position.
 - 2.2.9 A positive warning system shall be provided to give adequate warning in every direction immediately prior to the firing of explosives. The Contractor shall advise the Owner in advance of any detonating of charges.

All access points to the blast area shall be guarded by responsible employees of the Contractor, stationed to halt personnel and vehicles a safe distance from the blast. Intercommunication between guards and the person firing the blast shall be maintained to determine that the danger area is positively clear prior to firing.

2.2.10 The Contractor shall also provide special signs or signals at all access points. Signs shall include a warning to turn off radio transmitters whenever electric detonators are used.

2.2.11 A properly sized "Hell Box" shall be used for electrically detonated shots. The use of equipment starting batteries is prohibited.

- 2.3 Removal of Materials: After a blast is fired, the Contractor shall cause the excavation to be thoroughly scaled and all loose and shattered rock or other loose material which may be dangerous to workmen, pipes, or structures shall be removed and the excavation made safe before proceeding with the work. The fact that the removal of loose or shattered rock or other loose material may enlarge the excavation beyond the required limits shall not relieve the Contractor from the necessity for making such removal. All excavated rock which cannot be removed similar to earth shall be kept separate from other excavated materials and shall not be mixed with other backfill material except as directed by the Owner.
- 2.4 Insurance: An insurance certificate covering blasting shall be furnished to the Owner by the Contractor or Subcontractors, before any blasting is performed.
- 2.5 Seismograph: If any question arises as to the effect of blasting on adjacent utilities, structures, etc., the Contractor shall be responsible for providing a seismograph to record the shock resulting from blasting activities.

COMPACTION CONTROL AND TESTING 02250

1. GENERAL

- 1.1 Description: The work of this section shall consist of furnishing all equipment, labor, materials, and incidentals to compact the various backfills. The Contractor shall be responsible for providing all necessary on-site testing facilities and equipment.

2. EXECUTION

- 2.1 Maximum Density: The maximum density of the fill material shall be determined according to ASTM D698, "Standard Proctor Method". If more than one type of fill material is used, the maximum density for each type shall be determined. Determination of the maximum densities shall be the Contractor's responsibility. The Owner shall be provided with one copy of each maximum density test result, which shall include the maximum density and the optimum moisture content.

- 2.2 Compaction Operations: See Section 02221 - TRENCHING, BACKFILLING, AND COMPACTING.

- 2.3 Compaction Requirements: Compaction requirements for soils as controlled by methods of testing described herein shall be as follows:

Range A - In-place compacted density of soil shall be equal to or greater than one hundred (100) percent of maximum density at optimum moisture content.

Range B - In-place compacted density shall be equal to or greater than ninety (90) percent of the maximum density at optimum moisture content.

Range C - In-place compacted density shall be equal to or greater than eighty (80) percent of the maximum density at optimum moisture content.

Density range shall be as stated on the drawings. Compaction requirements for granular stone or sand, as controlled by methods of testing described herein, shall be to a density of not less than eighty (80) percent of maximum density.

- 2.4 Moisture Content Requirements: The moisture content requirements as determined under the methods of testing described herein shall be as follows:

Range A Compaction - The moisture content of the soil at the time of compaction shall be uniform and shall be not higher than five (5) percentage points above the optimum nor lower than the optimum of the soil involved.

Range B Compaction - The moisture content of the soil at the time of compaction shall be uniform and shall not be lower than three (3) percentage points below the optimum moisture content of the soil involved.

Range C Compaction - The moisture content of the soil at the time of compaction shall not be lower than five (5) percentage points below the optimum moisture content of the soil involved.

Compaction of Granular Stone or Sand - The moisture content shall be not less than ten (10) percentage points below the optimum content at the time of compaction.

- 2.5 Moisture Content Control:

2.5.1 Water Application: The moisture content of the soil at the time of compaction shall be within the moisture range designated. When the natural moisture content of the embankment soil does not fall within the required moisture range, water shall be added or the material shall be aerated, whichever is needed to adjust the soil to the proper moisture content. Water may be transported or distributed from calibrated tank truck or the water may be added to the soil in the borrow and cut areas before hauling, as long as the moisture content of the soil at the time of compaction is uniform and within the designated moisture range.

2.5.2 Visual Control: From other than the results of the moisture content test, the moisture content of the soil being compacted shall be considered as being too high to insure compaction when, after repeated rollings with the sheepfoot roller, the roller continues to pick up excessive amounts of soil and refuses to "build up" so that the tamping feet eventually ride on the compacted surface.

3. SOIL TESTING

- 3.1 Scope of Tests:

3.1.1 Borrow Areas: All areas selected to supply backfill and area fill materials requiring a specified compaction shall have moisture-density relationships determined by ASTM D698, latest revision, when the soil is initially excavated. In place density of compacted soil shall be tested in accordance with ASTM D2167, latest revision, to determine compliance with specifications. Specific testing locations will be determined by the Owner.

3.1.2 Granular Stone and Sand: Granular stone and sand shall have moisture-density relationships determined by ASTM D2049, latest revision. In place density shall be determined by ASTM D2167 or ASTM D1556, latest revision.

3.1.3 Compacted Soil Sub-Base Supporting Concrete, Steel, or Masonry Structures: The number of density tests shall be a minimum of three per structure, or two per 100 ft² of area for each two lifts of fill. In place density shall be as determined by ASTM D2167, latest revision.

3.1.4 Compacted Soil Sub-Base Supporting Rigid and Flexible Pavements and Crushed Stone Surfacing: The number of density tests shall be a minimum of three, or two per 300 S.Y. of area and for each 12 inches of fill, whichever is greatest.

3.1.5 Compacted Granular Stone or Sand Supporting Concrete, Steel, Masonry Structures, Rigid and Flexible Pavements: The number of density tests shall be a minimum of three per structure, or two per 300 S.Y. of area.

3.1.6 Compacted Trench Backfill over Granular Base: The Owner shall reserve the right to conduct density testing at a rate of one test per 100 L.F. of trench for each two lifts of fill. Density tests shall be performed as specified by ASTM D2167, latest revision. The costs of the initial density testing shall be borne by the Owner. Any retesting which is required as a result of a failure of the compacted backfill to meet the specified compaction requirements shall be paid for by the Contractor. Any area which fails to meet the specified compaction requirements shall be recompacted and retested until it meets the specified requirements.

FINISH GRADING02260

1. GENERAL

- 1.1 Description: The work of this section consists of bringing to finish grade all areas on the site and furnishing all labor, materials, tools, and equipment necessary to complete this section.

2. EXECUTION

- 2.1 The Contractor shall grade the earth as indicated on the drawings.
- 2.2 In those areas noted on the drawings to receive seeding and mulching, the top six inches of all excavated areas shall consist of topsoil. Topsoil shall not be placed until the area has been shaped, trimmed, and smoothed, and, if the existing surface has become hardened or crusted, it shall be disked or raked so as to provide a bond with the layer of topsoil. The surface of the topsoil shall be free from lumps, clods, rocks, and shall conform to the lines and grades shown on the drawings.
- 2.3 Areas within the construction limits, regardless of whether or not they are to be seeded and mulched, shall be graded smooth and left with a neat and sightly appearance. The final grade around all structures shall be pitched to drain water away from the structures, and toward the roadside ditches, and natural drainageway. The finished grade shall be free of any and all projections which could interfere with mowing of the site.

1. GENERAL

- 1.1 Description: The work defined by this section consists of furnishing all labor, equipment, tools, supervision, and materials for underground excavation. Materials excavated are unclassified and shall have no differentiation made for earth, rock, solid rock, sand, water, or other materials encountered.

2. MATERIALS

- 2.1 Welded Steel Encasement Pipe: Shall be smooth wall, welded steel pipe with a minimum wall thickness as specified in American Petroleum Institute Code No. 1102. The provision of this code is listed as follows:

Nominal Wall Thickness	
Nominal Diameter	(Uncoated)
Under 12-3/4"	0.188" Min.
12-3/4"	0.282" Min.
14" and 16"	0.313" Min.
18"	0.344" Min.
20"	0.375" Min.
22"	0.407" Min.
24" and 26"	0.438" Min.
28"	0.469" Min.
30"	0.501" Min.
32" and 34"	0.563" Min.
36", 38", and 40"	0.626" Min.
42"	0.688" Min.

3. EXECUTION

- 3.1 Where designated on the plans, the Contractor shall carry out underground excavation for installation of pipe. Underground excavation shall be accomplished by tunneling, boring, or jacking methods. Each method shall provide for removal of earth and rock coinciding with the installation of a primary liner or encasement pipe. Where jacking or tunneling is utilized, the annular space between the casing and earth shall be pressure grouted with sand cement grout.

The Contractor shall insure that traffic interruptions are minimized during the underground excavation operations. After the operation is completed, the Contractor shall slide the pipe into place. All pipe joints shall be completed outside of the tunnel and inspected by the Owner before the pipe is pushed into the tunnel. After the pipe is in place, the ends of the tunnel shall be sealed with sand bags prior to necessary backfilling. Pipe spacers shall be used on carrier pipe.

- 3.2 Any excavation required to provide equipment or personnel access to the tunnel work shall be considered incidental to the tunneling operation.
- 3.3 The Contractor shall make highway and railroad crossings where shown on the plans and shall obtain the permits and pay the necessary fees to make all crossings on the project. The Contractor shall comply with all requirements of the Highway Department and acquire necessary permits and bonds. Where the Highway Department or railroad company requires that the line be tunneled or bored through, the Contractor shall furnish all pipe, pipe encasement, tunneling, boring, timbering, shoring, bracing, rock excavation, cutting, and replacing pavement and base, and any other labor and material required. The Contractor shall receive no additional payment for any extra items involved.

SHORING02400

1. GENERAL

- 1.1 Description: The work of this section shall consist of furnishing all equipment, labor, materials, tools, and incidentals necessary to provide for the safety of the employees and to protect the excavations for both structural and trenching and existing structures; and as required by the applicable federal and state laws and regulations.

2. METHODS

- 2.1 Responsibilities: The Contractor is solely and totally responsible for the design, installation, maintenance, and safety of any shoring and/or bracing that may be required.
- 2.2 Type of Shoring & Bracing: The type of shoring and bracing shall be that which is removable following the installation of the buried pipe or structure. No permanent type of shoring or sheeting shall be used which must remain within the limits of the excavation. The shoring or bracing shall be removed following the excavation, installation of the buried pipe or structures and installation of required backfill material.

1. GENERAL

- 1.1 Description: The work of this section consists of furnishing all labor, materials, tools, and incidentals necessary to restore the surface of all areas affected by construction, including landscaping as required herein, replacement of fences, stone-lined ditches, walls and embankments, and restoration of miscellaneous structures (mailboxes, street signs, etc.).
- 1.1.1 Type A Surface Restoration: Regardless of the site's previous condition, restoration consists of furnishing and placing topsoil (which may need to be hauled in), liming, seeding, mulching, laying netting as required, and otherwise preparing and establishing a uniformly grassed area as specified herein. Areas requiring Type A surface restoration shall be so designated on the drawings.
- 1.1.2 Type B Surface Restoration: Consists of furnishing and placing all the necessary materials to restore areas affected by construction to a condition equal to that which existed prior to construction. Areas requiring Type B surface restoration shall be so designated on the drawings.
- 1.1.3 Pavement Repair and Replacement shall conform to Section 02575 - ROADWAY SURFACE REPLACEMENT.

2. MATERIALS

- 2.1 Topsoil Stripped and Stored: Topsoil stripped, stored, and placed shall be fertile, friable, with liberal content of humus, and capable of sustaining vigorous plant growth.
- 2.2 Topsoil to be Furnished: If the stripped topsoil is not adequate to complete the work, sufficient topsoil shall be furnished and shall be a natural, fertile, friable soil, possessing characteristics representative of productive soils in the vicinity. It shall be obtained from naturally well-drained areas. It shall not be excessively acid or alkaline (except for those plants requiring acid soil) nor contain toxic admixture of subsoil and shall be cleaned and reasonably free from clay lumps, stumps, roots, or similar substances, debris, or other objects which might be a hindrance to planting operations.
- 2.3 Lime: Lime shall be ground limestone containing not less than 85% of total carbonates and shall be ground to such a fineness that 50% will pass through a 100 mesh sieve and 90% will pass through a 20 mesh sieve. Coarser material will be acceptable, provided the specified rates of application are increased proportionately on the basis of quantities passing the 100 mesh sieve.
- 2.4 Fertilizer: Commercial fertilizer shall be formula 12-12-12, and shall conform to the applicable state fertilizer laws. It shall be uniform in composition, dry, and free flowing, and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, will not be accepted.
- 2.5 Herbicide: Herbicide shall be a pre-emergence type for mixing with soil designed to eliminate noxious weeds without harming landscape plants.
- 2.6 Lawn Materials: Grass seed shall be mixed and certified by the dealer and shall be a blend of K-31 fescue and Lespedeza, acceptable to the landowner. The seed shall be uniformly sown.
- 2.7 Water: The Contractor shall make, at his expense, whatever arrangements may be necessary to insure an adequate supply of water to meet the needs of this contract. He shall also furnish all necessary hose, equipment, attachments, and accessories for the adequate watering of plants as may be required to complete the work as specified.
- 2.8 Netting: Netting shall be a uniform, open, plain weave mesh of single jute yarn or 25 to 35 pound natural, unbleached kraft paper. Minimum width of netting fabric shall be 42 inches. Jute netting shall have 76 warp ends per 48 inch width and 41 weft ends per yard, minimum. Kraft paper netting shall have 5.5 warp yarns by 3.5 filling yarns per inch. Staples for anchoring netting shall be No. 11 gauge steel wire, six (6) inches long.
- 2.9 Mulch: Vegetative mulch shall be the shredded cereal straw from stalks of oats, rye, wheat, or barley. The straw shall be free of prohibited weed seeds as stated in the State Seed Law; shall be relatively free of all other noxious and undesirable seeds; and shall be clean, bright, and dry enough to spread properly. A binder emulsion shall be applied to prevent straw from blowing.

3. EXECUTION

- 3.1 All areas within the limits of fine grading not required to be developed otherwise shall be planted with grass.
- 3.2 Soils Test: The Contractor shall, at his own expense, contact the County Extension Agent and secure a soil test of the topsoil. If recommended by this test, the topsoil shall be limed in quantity recommended by the Extension

Agent. (Generally a soil pH of 6.0 to 6.5 is desirable.) Three copies of the soil test shall be sent to the Owner along with recommendations on lime use. Estimates of lime requirements are as follows:

POUNDS OF GROUND LIMESTONE PER 1,000 SQUARE FEET

<u>pH</u>	<u>Light Sandy Soil-Pounds</u>	<u>Medium Sandy Soil-Pounds</u>	<u>Loam & Silty Loam-Pounds</u>	<u>Clay Loam Pounds</u>
4.0	90	120	172	217
4.5	82	112	157	202
5.0	67	90	127	150
5.5	52	67	97	120
6.0	None	None	None	None

- 3.3 Time of Planting for Lawns: The Contractor shall coordinate the work so that lawn areas will be topsoiled and graded to meet the planting schedule as follows:
 - 3.3.1 Preferred Time of Planting: February 1 to April 20.
 - 3.3.2 Alternate Time of Planting: September 1 to October 30. For this time of planting, the Contractor shall keep the lawn well watered through the summer, or until the project is accepted by the Owner.
- 3.4 The Owner is aware that in some cases, it would create a hardship to maintain the above schedule. If the Contractor wishes to make recommendations on other times when seeding could be done, the Owner will consider these recommendations. However, methods or time of planting shall be agreed to, in writing, before commencing this portion of the work or the above schedule shall be followed.
- 3.5 Preparation of Topsoil: The topsoil shall be graded and uniformly compacted according to Section 02260 - FINISH GRADING.
- 3.6 Sulphur: If the addition of sulphur is necessary, it shall be applied at a rate of two pounds per 1000 square feet.
- 3.7 Applying Fertilizer: Commercial fertilizer shall be applied at the rate of 20 pounds per 1,000 square feet to the lawn areas being prepared for planting. Fertilizer may be applied with seed, however, application after sprouting of the lawn seed is preferred.
- 3.8 Sowing of Seed: Immediately before any seed is to be sown, the ground shall be scarified as necessary and shall be raked until the surface is smooth, friable, and of uniformly fine texture. Lawn areas shall be seeded evenly at the rate of 100 pounds per acre, lightly raked, and watered with a fine spray. The method of seeding may be varied at the discretion of the Contractor on his own responsibility to establish a smooth, uniformly grassed lawn.
- 3.9 Mulching: Within 24 hours after seeding, mulch with binder emulsion shall be spread evenly over the entire area at the rate of 2½ tons per acre.
- 3.10 Optional Establishment of Lawns: At the option of the Contractor, sod may be used for establishing all or part of grass lawn areas. Sod on slopes shall be held in place by wooden pins about one inch square and six inches long driven through the sod into the soil until they are flush with the top of the sod. Before any sod is laid, all soft spots and inequalities in ground shall be corrected. Fertilizer spread shall be raked in. Sod shall be laid so that no voids occur and shall be tamped or rolled. The complete sodded surface shall be true to finish grade, even, and firm at all points. Sod shall be placed so that the surface of the compacted sod will be slightly below the surrounding surface soil. All soils tests and pH adjustment specified previously shall be undertaken prior to sodding.
- 3.11 Clean-up: Any soil, manure, peat or similar material which has been brought onto paved areas by hauling operations, or otherwise, shall be removed promptly, keeping these areas clean at all times. Upon completion of the planting, all excess soil, stones, and debris which have not previously been cleaned up shall be removed from the site or disposed of. All lawns and planting areas shall be prepared for final inspection.
- 3.12 Maintenance: Maintenance shall begin immediately after planting and shall continue in accordance with the following requirements:
 - 3.12.1 Repairs: Repairs to lawns or replacement of plants necessary during the maintenance period due to removal, vandalism, or acts of neglect on the part of others may be done on request by the Owner and will be done at the expense of the Owner.
 - 3.12.2 Maintenance: Lawns shall be protected and maintained by the Contractor by watering, mowing, and replanting as necessary for at least thirty (30) days and as much longer as is necessary to establish a uniform stand of the specified grasses, and until acceptance by the Owner.

- 3.13 Inspection: Inspections of the work to determine completion of contract work exclusive of possible replacement, will be made by the Owner at the conclusion of the maintenance period upon written notice requesting such inspection submitted by the Contractor at least 10 days prior to the anticipated date. The condition of lawns will be noted and determination made by the Owner as to whether maintenance shall continue in any part. After inspection, the Contractor will be notified in writing by the Owner of acceptance of seeding work exclusive of the possible replacement.
- 3.14 Guaranty and Replacement: Lawns and planting shall be guaranteed for a maximum of one year after the conclusion of the maintenance period, or for the duration of one full growing season, after planting, whichever is longer, and shall be alive, and in satisfactory growth at the end of the guaranty period, subject to normal care as recommended by this Contractor after acceptance of the work. At the end of the guaranty period, inspection will be made by the Owner upon written notice requesting such inspection submitted by the Contractor at least 10 days before the anticipated date. Any planting required under this contract that is dead or not in satisfactory growth, as determined by the Owner, shall be removed from the site. These shall be replaced as soon as conditions permit, but during the normal planting season.

DEWATERING02530

1. GENERAL

- 1.1 Description: The work of this section consists of completing all dewatering work necessary for the initiation and prosecution of elements of work specified elsewhere.

2. EXECUTION

- 2.1 Workmanship: Maintain all excavations and trenches free from water at all times while construction is in progress using pump. Prevent surface runoff water from collecting in excavations or trenches or running down the faces of excavated cut or fill slopes, causing sloughing or caving, ponding in excavated areas or saturating the soils below foundations of structures by adjusting grades to provide temporary drainage facilities. The Contractor shall furnish and operate sufficient pumps and appliances, and provide all materials, labor, etc., required to prevent interference with any work by water, ice or snow. Damage of any kind resulting from insufficient pumping facilities or similar lack of proper conduct of the work shall be made good by the Contractor at his own expense. No structure or pipes shall be laid in water, and water shall not be allowed to run into or over any concrete work or pipe, or into or through any pipe.

ROADWAY SURFACE AND SIDEWALK REPLACEMENT 02575

1. GENERAL

- 1.1 Description: The work of this section shall consist of furnishing all labor, materials, tools, equipment, and incidentals necessary to replace all roadway surfaces and sidewalks removed during utility construction. This section shall include, but not be limited to, vehicular and pedestrian pavements, and surfacings of stone, gravel, asphalt, and Portland cement concrete, in addition to parking areas.

2. MATERIALS

- 2.1 Portland Cement Concrete: Shall conform to Section 03300 - CAST-IN-PLACE CONCRETE.
- 2.2 Hot-Mix Asphaltic Concrete: Shall conform to Missouri Highway and Transportation Commission Standard Specifications for type BP-1 Plant Mix Bituminous Pavement as set forth in Section 401 of the Standard Specifications.
- 2.2.1 Prime coat shall meet ASTM D-2506, D-2027, D-2028, latest revision for liquid asphalt.
- 2.3 Crushed Stone Surfacing: Crushed stone base shall conform to material specified and shall be produced by an approved source. Aggregate shall be mechanically crushed limestone or dolomite. It shall not contain more than 15 percent deleterious rock and shale. Sand may be added only for the purpose of reducing the plasticity index of the fraction passing the No. 40 sieve in the finished product. Any sand, silt, and clay, and any deleterious rock and shale shall be uniformly distributed throughout the mass. The aggregates shall conform to the following gradation requirements when tested utilizing wet preparation techniques:

Percentage by Weight Passing Each Sieve:

1 inch Sieve	100%
1/2 Inch Sieve	60-90%
No. 4	40-60%
No. 40	15-35%

Plasticity Index of the fraction passing the No. 40 sieve shall not exceed 6. The crushed stone base shall be compacted to not less than 95% of maximum density at optimum moisture content as determined by Mod. AASHTO T-99.

2.4 Chip and Seal Pavement Repair:

- 2.4.1 Aggregate: For aggregate seal asphalt paving, the aggregate shall consist of a combination of crushed stone and/or crushed gravel, well-graded within the following limits:

<u>Sieve Size</u>	<u>Percent Paving by Weight</u>
1/2"	90-100%
3/8"	48-80%
#4	0-15%
#6	0-5%

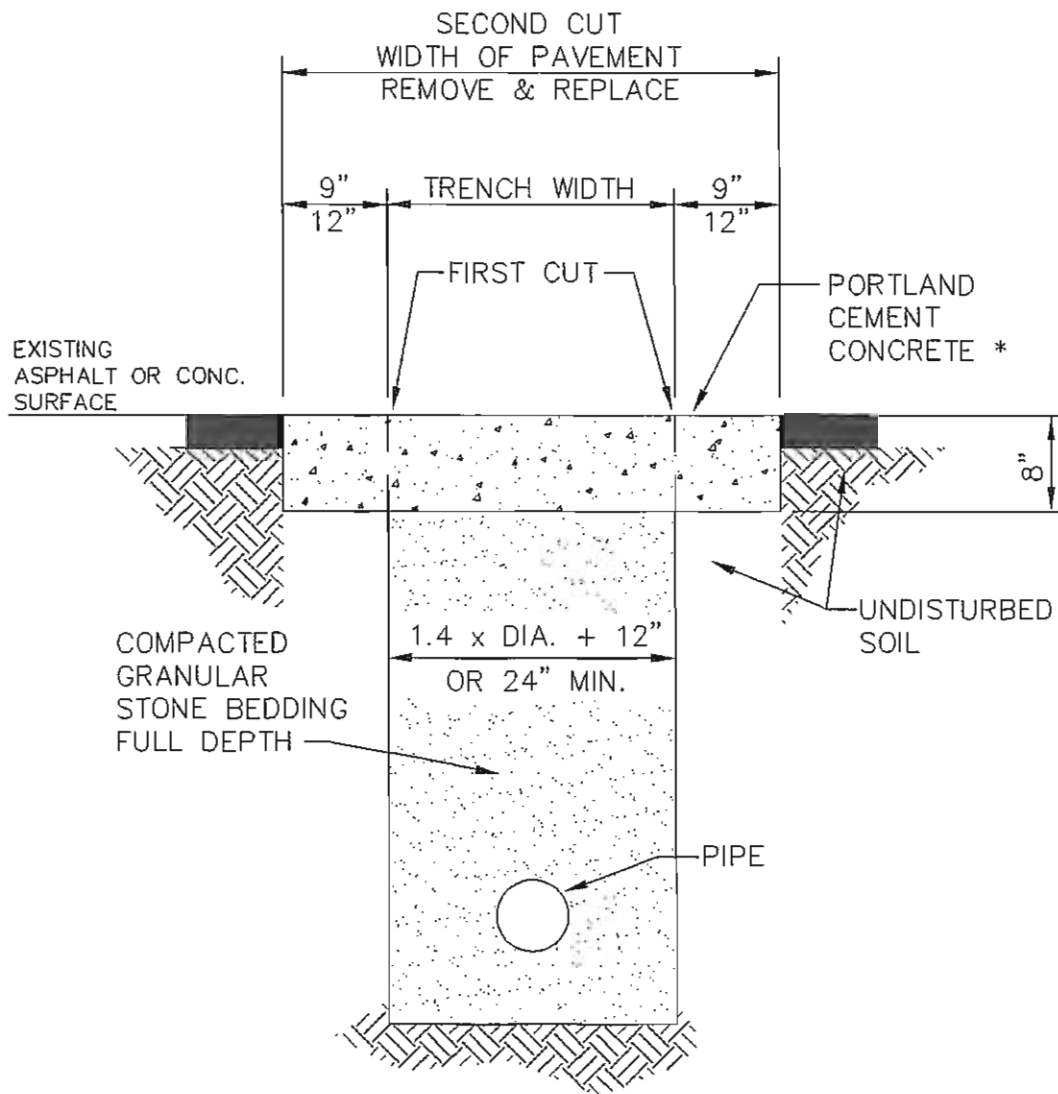
- 2.4.2 Liquid Asphalt: The liquid asphalt shall be grade CRS-2. Should the Contractor desire, (because of climatic conditions or otherwise) he may request a change in the liquid asphalt grade. No change shall be made until the Contractor receives written approval from the Owner.

3. EXECUTION

- 3.1 General: Existing paving shall be cut vertically and horizontally to straight lines. The trench shall be backfilled with granular stone bedding or controlled backfill material compacted to Range B compaction requirements (see Section 02250 - COMPACTION CONTROL AND TESTING) to within eight inches of the final roadway surface. The top eight-inches shall be backfilled with crushed stone base compacted level with the existing riding surface of the roadway. This level shall be maintained by the Contractor until all secondary settling has occurred. Any crushed stone required to maintain the trenches in a suitable condition for traffic during this period shall be furnished at the Contractor's expense. When the trench has been properly backfilled and has settled sufficiently to permit final repairs, roadway surfacing shall be applied according to this specification. At the time of final repairs, the Contractor shall remove sufficient material to allow placement of roadway surfacing to the thicknesses specified as follows.

3. EXECUTION

- 3.1 General: Existing paving shall be cut vertically and horizontally to straight lines. The trench shall be backfilled with well-graded, granular, crushed stone, or gravel meeting ASTM C33, Gradation 67 and compacted level with the existing riding surface of the roadway. This level shall be maintained by the Contractor until all secondary settling has occurred. Any crushed stone required to maintain the trenches in a suitable condition for traffic during this period shall be furnished at the Contractor's expense.
- 3.2 Roadway Surface Replacement:
- 3.2.1 Portland Cement Concrete: Edges of existing pavement at the trench shall be trimmed vertically to produce a neat even edge. A minimum 8-inch thick concrete slab shall be placed to match the elevation of the existing pavement, as shown on the drawings.
- 3.2.2 Hot-Mix Asphaltic Concrete: Edges of existing pavement at the trench shall be trimmed vertically to produce a neat, even edge. A minimum of 4-inches of hot-mix asphaltic shall be placed in two lifts to match the elevation of the existing pavement, as shown on the drawings.
- 3.2.2.1 The surface to receive the asphalt concrete shall be cleaned of all loose material, dust, and foreign matter prior to the application. The primer or tack coat, as required, shall be applied upon a dry surface only at a rate of 0.15 gallons per square yard. Forms may be of any material or design provided they secure the designed grade control. It shall be the responsibility of the Contractor to set and maintain necessary grade stakes and forms, and execute the work to the lines, grades, cross sections, and dimensions shown on the plans.
- 3.2.2.2 After spreading, the mixture shall be thoroughly and uniformly compressed by a three-wheel or tandem power-driven roller or rollers, weighing not less than 200 pounds per inch of tread width, as soon after being spread as it will bear the roller without undue displacement. Delays in rolling freshly spread mixture will not be tolerated. Rolling shall start longitudinally at the sides and proceed toward the center of the pavement overlapping on successive trips by at least one-half the width of a road wheel. Alternate trips of the roller shall be of slightly different lengths.
- 3.2.2.3 After final compression, the finished course shall at no point have a density less than ninety-five (95) percent of the laboratory compacted density. At least two (2) in-place density samples shall be taken and tested.
- 3.2.2.4 No traffic shall be permitted on the finished pavement until it has cooled to atmospheric temperature.
- 3.2.3 Chip and Seal Pavement Repair: For this type repair, a double layer of chip and seal resurfacing over the entire roadway width will be utilized.
- 3.2.3.1 The existing roadway shall be bladed to eliminate minor depressions and humps. Following the blading operation, the surface shall be thoroughly cleaned and swept to remove all mud, matted earth, dust, and other foreign material.
- 3.2.3.2 A prime coat of liquid asphalt shall be applied at the rate of 0.30 gallons per square yard at a minimum temperature of 120°F for asphalt grade CRS-2. On the primed base, a course of aggregate shall be spread at the rate of twenty-five (25) pounds per square yard. This stone shall be roller compacted from the sides to center with a steel wheeled roller weighing a minimum of five tons.
- 3.2.3.3 Immediately following the compaction of the first course of asphalt and aggregate, a second course, identical to the first, shall be applied. The finish surface shall be swept to remove any loose stones.
- 3.2.3.4 No traffic shall be allowed on the finished surface until it has cooled to atmospheric temperature.
- 3.2.4 Crushed Stone: Trenches along or across unpaved roadways, including country roads, and city streets, as well as on dirt, or gravel shoulders of paved streets, roads, or highways, shall be backfilled in compliance with these specifications. The trench shall be backfilled to a level with the existing riding surface of the roadway. When the trench has been properly backfilled and has settled sufficiently to permit final repairs, the backfill shall be removed as necessary for crushed stone surfacing. The crushed stone shall be rolled and thoroughly compacted in layers to a minimum finished thickness of six-inches.
- 3.3 Sidewalk Replacement: The existing concrete sidewalk and base material shall be removed for a distance equal to the trench width plus two feet as shown on the drawings. The trench shall be backfilled to a height that will allow the placement of four inches of crushed stone and a four-inch thick concrete walk above. The elevation of the top of the new sidewalk section shall match that of the existing walk.

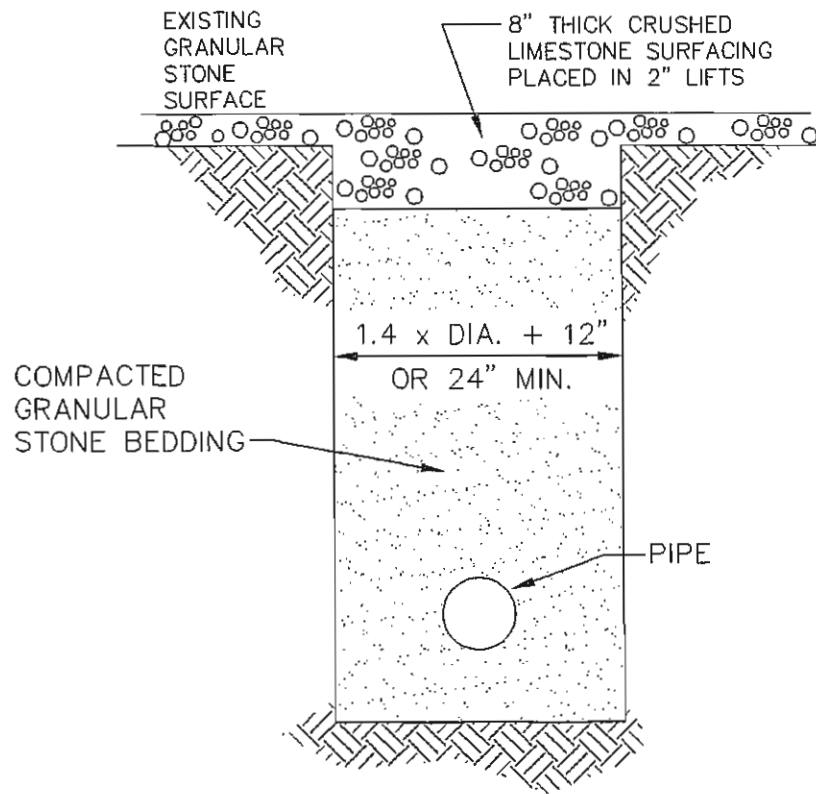


NOTE:

FIRST & SECOND CUTS OF EXISTING PAVEMENT
SHALL BE SAW CUT FULL DEPTH.

* FOR SIDEWALK REPAIR, CONCRETE SHALL BE
4" THICK.

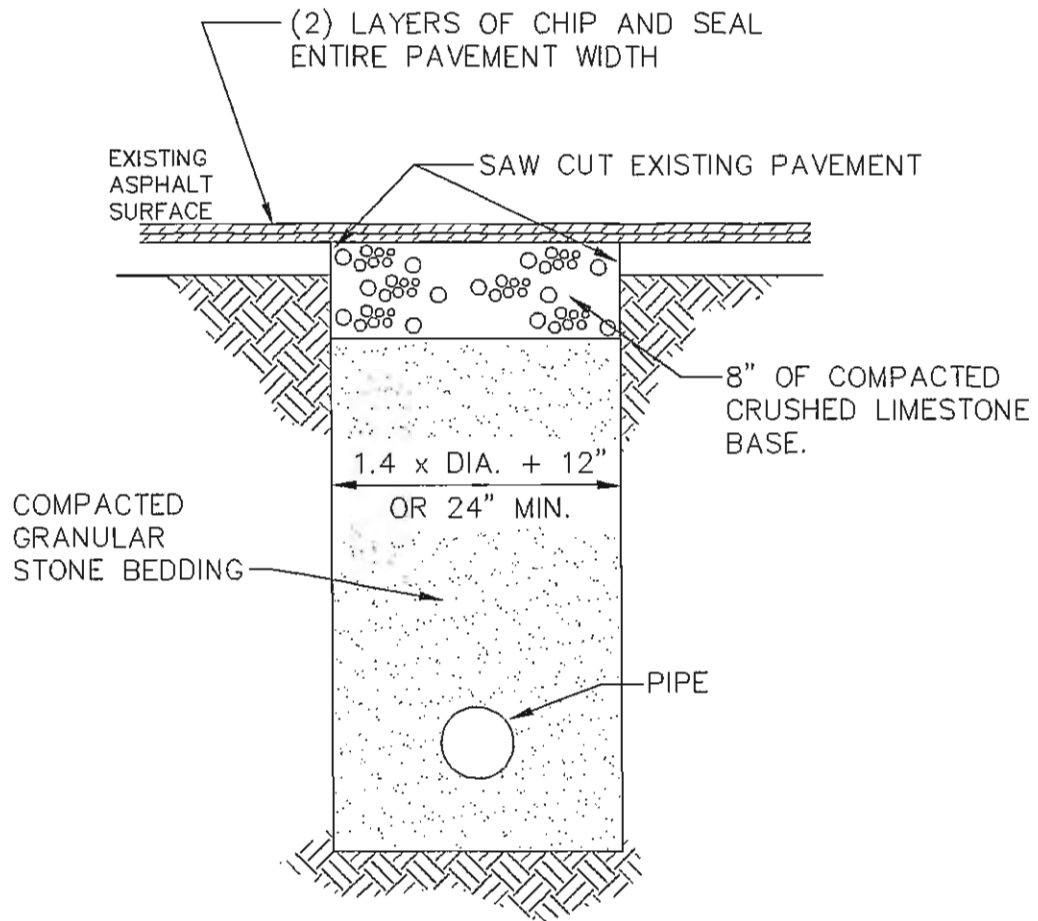
City of Monett, Missouri
Std. Spec.
PAVEMENT REPAIR
PORTLAND CEMENT CONCRETE



City of Monett, Missouri

Std. Spec.

PAVEMENT REPAIR
CRUSHED STONE



PRECAST MANHOLES 02601

1. GENERAL

- 1.1 Description: The work of this section shall consist of furnishing, hauling, and placing all precast concrete manholes shown on the drawings and as required for sewer line construction.
- 1.2 Precast concrete manholes shall be of the type, size, and configuration shown on the drawings, and all manholes shall be provided by one sole manufacturer.

2. MATERIALS

- 2.1 Portland Cement: Shall conform to ASTM C150, latest revision, Type I, II, or V.
- 2.2 Concrete Reinforcement: Shall be as specified in Section 03200 - CONCRETE REINFORCEMENT.
- 2.3 Aggregate: Shall conform to ASTM C33, latest revision, for coarse and fine aggregate.
- 2.4 Mortar: Shall conform to ASTM C270, latest revision, Type M.
- 2.5 Water: Mixing water shall be clean and potable.
- 2.6 Dampproofing: Shall conform to Koppers Specifications for Coal Tar Bitumastic Super Service Black or an approved alternate.
- 2.7 Joint Sealant: Shall meet AASHTO Specification M-198, and shall be suitable for application in vertical and horizontal joints. Sealant shall be as manufactured by Hamilton-Kent, Ram-Nek, or approved equal.
- 2.8 Grout: Grout shall be a pre-mixed, packaged, non-ferrous, aggregate non-shrink grout.
- 2.9 Manhole Castings: All castings shall be made of clean, even grain, tough gray cast iron. The casting shall be smooth, true to pattern, and free from projections, sand holes, warp and other defects which would interfere with the use of, or impair the serviceability of the casting. All castings shall be well cleaned before enamel coating is applied. The iron used for these castings shall conform to ASTM A48, latest revision, for Class 30 gray iron. The "B" test bar (1.2" diameter by 21" long) shall be used to prove the quality of iron used. Frame and cover shall have machined horizontal bearing surfaces. Castings shall be of the type and size noted on the engineering drawings, and shall have a minimum manhole access of 22 inches.
- 2.10 Manhole Steps: Cast iron steps shall conform to Necnah No. R-1981-1 dimensions, weights, and tolerances, Clay and Bailey No. 2115, or approved equal. Copolymer polypropylene plastic steps with ½ inch grade 60 steel reinforcement as manufactured by M.A. Industries, Inc., Model PSI-PF, or polyethylene steps with ¾ inch O.D. 6351 - T6 aluminum tubing as manufactured by MSU Mississauga Ltd., Model 360, or approved equal will also be allowed.

3. EXECUTION

- 3.1 Fabrication and Manufacturing: Precast reinforced concrete manholes shall be manufactured to requirements of ASTM C478, latest revision and shall be of the type, size, and configuration shown on the drawings. Manhole tops shall be of the eccentric type. The minimum allowable wall thickness shall be determined by the manhole depth as below:

<u>Depth</u>	<u>Minimum Wall Thickness</u>
0 to 16 feet	1/12 of internal diameter
16 feet or greater	1/12 of internal diameter + 1"

Minimum internal diameter of any manhole section shall be 4 feet. Dampproofing shall be factory applied on all interior and exterior surfaces except to the interior surface of the bottom section. Dampproofing shall be field applied to the interior surface of the bottom section after base and fillet have been placed. Dampproofing system shall be Koppers Coal Tar Bitumastic Super Service Black or an approved alternate, applied to manufacturer's specifications. Two coats, each of minimum 14 mils, dry thickness shall be applied. A 75-volt maximum wet sponge detector shall be employed to check for holidays in the dried finish film.

3.2 Construction:

3.2.1 Precast units shall be set into a reinforced concrete base constructed of 3,500 min. psi concrete, 4-inch max. slump, and #4 rebars at 12-inch on center each way. Bottom section shall set into the base a minimum of 12 inches. Base shall extend not less than 6 inches from outside manhole wall. The joints in the precast concrete manhole shall be set in a pre-molded mastic material or a rubber gasket to produce an absolutely watertight joint under full hydrostatic head conditions.

3.2.2 Precast manhole bases will be allowed on manholes where practical. Inverts shall be constructed within precast bases in the field as described by this specification. Precast manhole bases with integral inverts shall not be allowed except at the Owner's discretion after review of detailed shop drawings submitted by the Contractor.

3.2.3 Precast riser sections shall be set plumb and oriented with manhole steps and access opening to match the detailed drawings designations.

3.2.4 Inlet and outlet pipes shall extend through the walls of the structures a sufficient distance beyond the outside surface to allow for connections, and shall extend six inches beyond the inside surface of the wall. The new manhole shall be cleaned of silt, debris, or other foreign matter prior to acceptance.

3.2.5 Openings for sewer pipe in manhole sections shall be formed at the factory, either cast-in-place gasket or cut out opening. The minimum opening for cutouts shall be equal to outside diameter of pipe plus four inches and maximum opening shall be equal to outside diameter of pipe plus six inches.

3.2.6 Flexible watertight cast-in-place gaskets shall be used, and shall be A-LOK or approved equal.

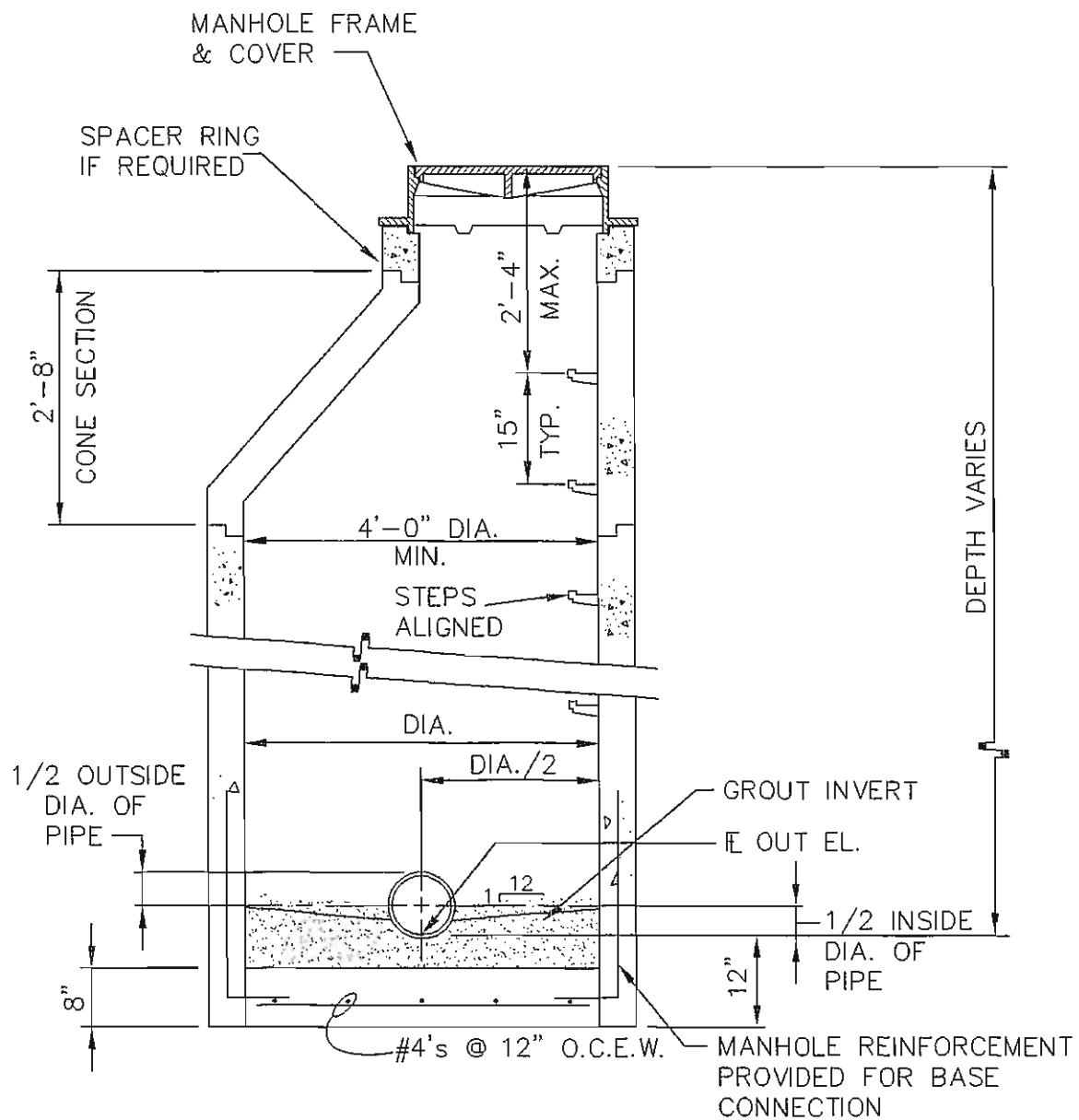
3.2.7 Invert channels shall be smooth and semi-circular in shape conforming to the inside of the adjacent pipe line sections with change in flow direction made by a smooth curve of as large a radius as the manhole size will permit, and changes in the size and grade of the channels being made gradually and evenly. Manhole floor shall rise a minimum of 1 inch per foot from side of channel to wall.

3.2.8 All lifting holes shall be thoroughly wetted and completely filled with non-shrinking grout to form a watertight seal.

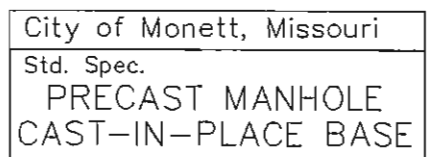
3.2.9 All castings, frames, and covers shall be set true to line and to correct elevation upon a mastic gasket. Manhole frames shall be attached to manholes with anchor bolts. Frames and covers shall have true common bearing surfaces, such that the covers will seat firmly without rocking or shifting.

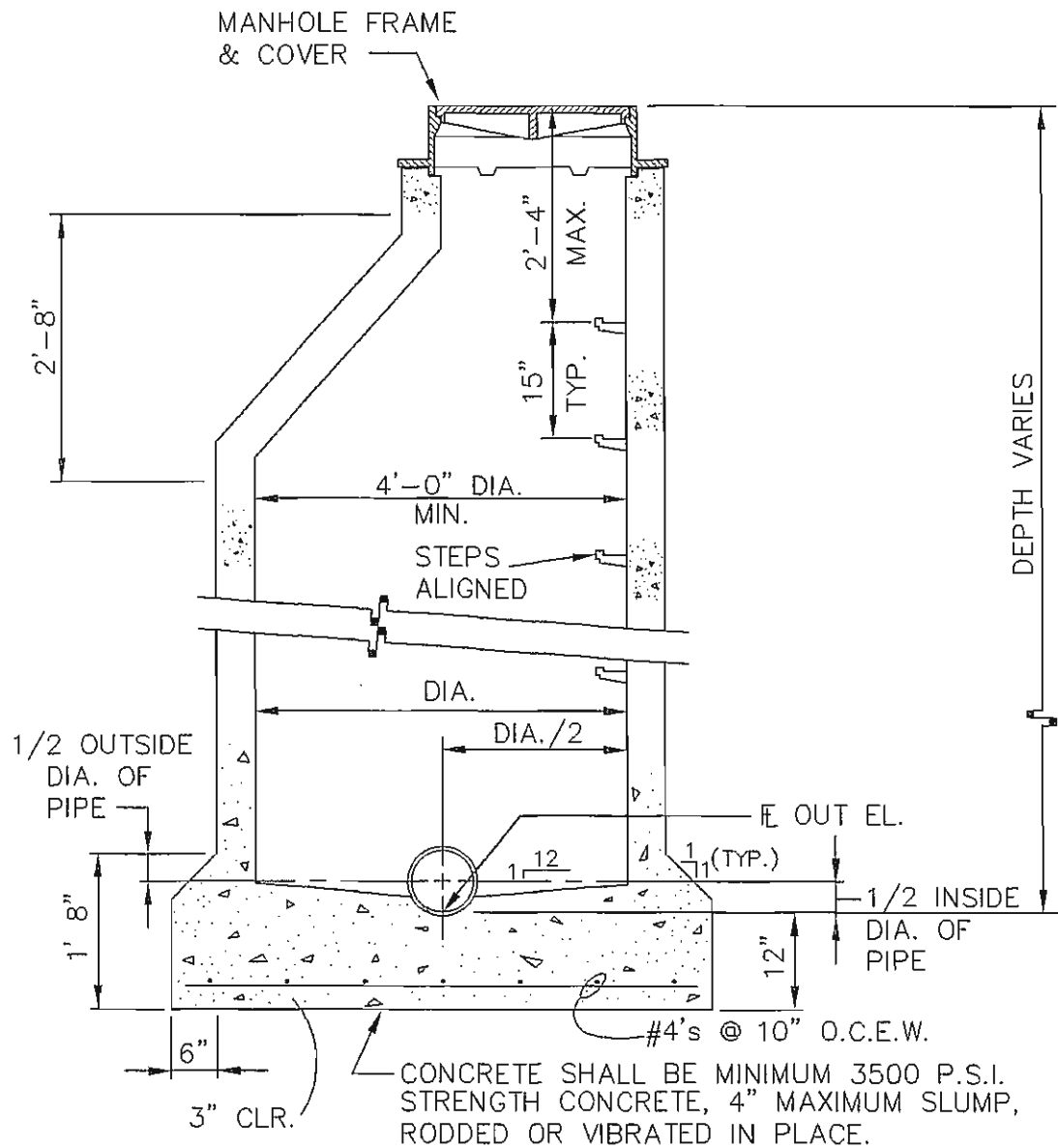
3.3 New Manhole Over an Existing Line: Manholes to be located over an existing sewer line will be built so that all of the manhole inverts will be smooth and continuous after the sewer tile is broken open.

3.4 Connections to Existing Manholes: Existing manholes used for connecting new sewer lines to the existing sewerage system shall have the new sewer line connected by core boring a hole in the side of the existing manhole at the new plan flowline elevation. The bore hole shall be of sufficient diameter to allow for the insertion of an A-lok gasket or equal such to provide a flexible watertight connection. The new sewer pipe shall then be inserted into the gasket and invert grouted to provide a continuous, uninterrupted flow of existing and new sewage.

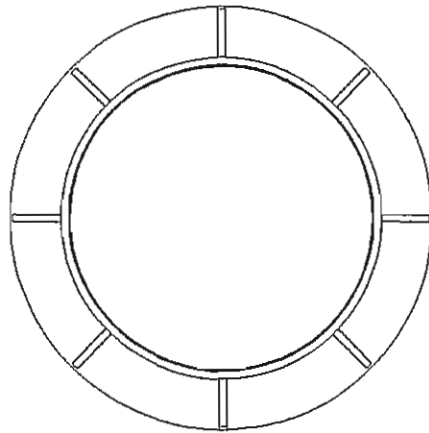


City of Monett, Missouri
 Std. Spec.
 PRECAST MANHOLE
 & PRECAST BASE





City of Monett, Missouri
Std. Spec.
CAST-IN-PLACE CONCRETE MANHOLE

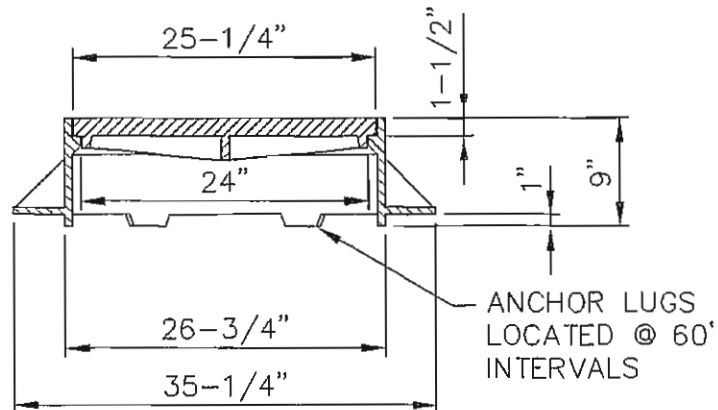


PLAN

NOTE

CASTING, WITH LID, SHALL
WEIGH NOT LESS THAN 400 LBS.
UNLESS OTHERWISE SPECIFIED.

TOTAL WEIGHT OF FRAME
& COVER, 450 LBS. (MIN.)



SECTION

City of Monett, Missouri

Std. Spec.

MANHOLE CASTING

NOTE:

TYPE 'A' DROP - 2' MIN. to 8' MAX.

PIPE - SDR-35 P.V.C.

TYPE 'B' DROP - OVER 8'

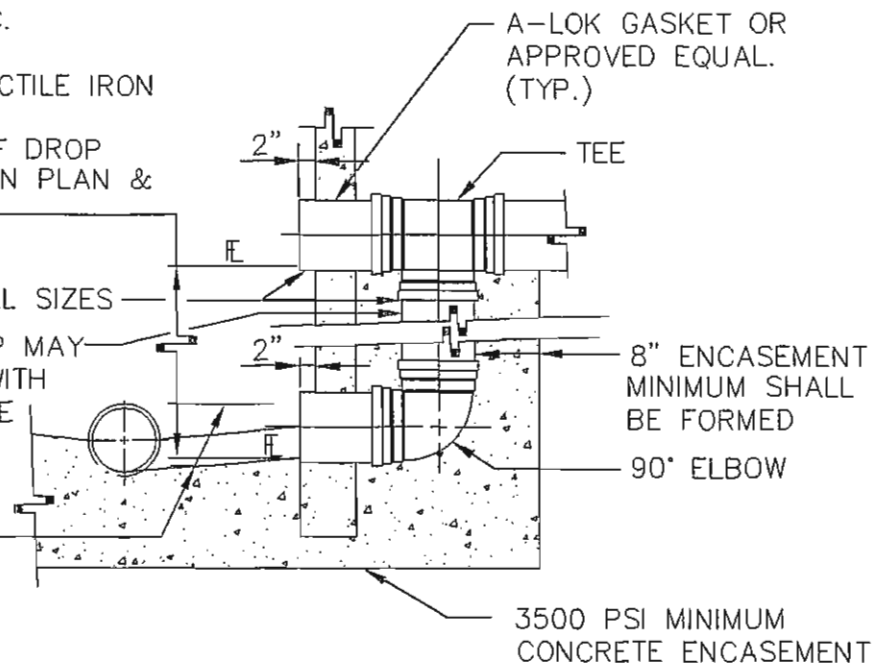
PIPE - CLASS 50 DUCTILE IRON

2'-0" MINIMUM - DEPTH OF DROP
VARIABLE. AS REQUIRED ON PLAN &
PROFILE DRAWINGS.

PIPE EQUAL SIZES

VARIABLE - OUTSIDE DROP MAY
BE CONSTRUCTED FLUSH WITH
OUTSIDE WALL OF MANHOLE

0.10' FALL MINIMUM ON
EQUAL SIDES OR MATCH
TOP OF PIPE.



City of Monett, Missouri

Std. Spec.

DROP MANHOLE

1. GENERAL

- 1.1 Description: The work in this section consists of furnishing, hauling, placing, and backfilling as necessary the ductile iron pipe, fittings, and fitting restraints in the designated locations and to the lines and grades as shown on the drawings.

2. MATERIALS

- 2.1 Ductile Iron Pipe: Unless otherwise specified or shown on the drawings, ductile iron pipe shall be Wall Thickness Class 51 and shall conform to the latest revision of ANSI A21.51 - (AWWA C151) Standard for Ductile Iron Pipe Centrifugally Cast in Metal Molds or Sand Lined Molds, for Water or Other Liquids. The pipe shall be standard asphaltic varnish coated on the outside. Pipe shall be cement mortar lined in conformance with ANSI A21.4-80 - (AWWA C104) unless specified otherwise.

- 2.2 Fittings: The fittings to be used with ductile iron pipe may be either gray iron or ductile iron, and shall conform to the requirements of ANSI/AWWA C110-77. All fittings shall be coated and lined in the same manner as the pipe. All fittings up to and including 12 inches shall be Class 250, with all larger fittings of Class 150. Flanged fittings shall be Class 125 unless noted otherwise on the drawings. Mechanical joint and push-on joint fittings shall meet all applicable requirements of ANSI 21.11-79 - (AWWA C111).

- 2.3 Joints: Unless specifically noted otherwise, joints for ductile iron pipe that is to be buried shall be either a push-on type or a mechanical joint. Unless noted otherwise, joints for pipe used inside buildings or structures shall be either flanged or a lock coupling for grooved-end pipe.

2.3.1 Push-on Type Joint: The push-on type joints consisting of a single neoprene gasket which are acceptable are "Tyton" as manufactured and licensed by the U.S. Pipe and Foundry Company; "Fastite" as manufactured and licensed by the American Cast Iron Pipe Company and "Bell-Tite" as manufactured and licensed by James B. Clow and Son, Inc. All required joint materials including the neoprene gasket and the lubricant shall be furnished with the pipe.

2.3.2 Mechanical Joint: Mechanical joint ends shall comply with the requirements of ANSI A21.11-79 - (AWWA C111). All required joint materials including neoprene gasket, gland, bolts, and nuts shall be included with the pipe.

2.3.3 Flanged Joint: The flanged joint shall be integrally cast and shall conform to the requirements of ANSI Specification B16.1 for Class 125. Screw-on flanges will be acceptable, but any required threading of pipe barrel shall be done by the factory in conformance with AWWA C115 utilizing Class 53 pipe. Flanges shall be ductile iron. The pipe barrel and flange shall not be field assembled. The flanges shall be furnished with factory purchased full face gaskets 1/8-inch thick of SBR rubber per ANSI/AWWA C111/A21.11.

2.3.4 Restrained Joint: The restrained joint for pipes 14-inch diameter and larger shall be a boltless connection type that utilizes a square, alloy steel, welded-on retainer ring in conjunction with a split ring and socket groove to provide the means of restraint. The joint shall be disassemblable using a closure-spreader mechanism integral to the split ring. The split ring, retainer ring, and all parts associated with the closure-spreader mechanism shall be corrosion-resistant, high strength, low alloy (HSLA) steel conforming to ANSI/AWWA C111/A21.11. All required joint materials including neoprene gasket and lubricant shall be supplied with the pipe. Restrained joint shall be "Lok-Ring Joint Pipe" as manufactured by American Ductile Iron Pipe. As an alternate to the preceding, the restrained joint may be TR-FLEX or TR-FLEX GRIPPER as manufactured by U.S. Pipe and Foundry Co., SUPER-LOCK as manufactured by Clow Corporation, or approved equal.

3. EXECUTION

- 3.1 Cutting, Cleaning, and Inspecting: All cutting of ductile iron pipe shall be done by a means of mechanical cutter. Wheel cutters shall be used wherever practical. After cutting, the interior of the pipe shall be thoroughly swabbed or cleaned of all foreign matter before being installed into the system and shall be kept clean during and after installation. Before installation of any pipe or fitting, each piece shall be inspected for defects and shall be rung with a light hammer to detect any cracks. All defective, damaged, or unsound pipe or fittings shall be rejected.

- 3.2 Installation:

3.2.1 Mechanical Joint: The last eight inches outside of the spigot and the inside of the bell of the mechanical joint or push-on fittings shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter from the joint, and then coated with a soap solution. The ductile iron gland shall then be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket or bell end. The rubber gasket shall be coated with soap solution and placed on the spigot end in the bell. The gasket shall then be pressed into place with the bell. Care shall be taken to locate the gasket evenly around the entire joint. The ductile iron gland shall be moved into position for bolting. Nuts spaced 180 degrees apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland.

3.2.2 Flanged Joint: When assembling the flange joint, the Contractor shall insure that the ring gasket is properly located and placed flat against the face of the flange. Flanges shall be assembled by alternately tightening bolts spaced 180 degrees apart in order to produce an equal pressure on all parts of the gland.

3.2.3 Restrained Joint: Installation of restrained joint fittings shall be in strict accordance with the manufacturer's printed literature.

VITRIFIED CLAY PIPE 02621

1. GENERAL

- 1.1 Description: The work of this section shall consist of furnishing, hauling, storing, and installing vitrified clay pipe for gravity sewers as shown on the drawings and specified herein.

2. MATERIALS

- 2.1 Vitrified Clay Pipe: Shall conform to dimensional and strength requirements of ASTM C-700, latest revision, for extra strength pipe. Compression joints shall conform to ASTM C-425, latest revision.

2.1.1 Plain End Pipe: Pipe in sizes 6, 8, 10, 12, 15, and 18-inch shall be joined using a factory applied sleeve or coupling manufactured of PVC in conformance with ASTM C-5.94-70 for compression coupling for vitrified clay plain end pipe, Type B.

2.1.2 Bell End Pipe: Pipe in sizes 4, 21, 24, 30 and 36-inches shall have factory-molded polyurethane gaskets fused to the outside of the spigot end and to the inside of the bell.

- 2.2 Fittings: Vitrified clay fittings shall be extra strength, supplied to correspond with the type of pipe specified. Compression joints on bell and spigot installations shall conform to ASTM C-425-66T, Type 1, or latest revision.

1. GENERAL

- 1.1 Description: The work of this section shall consist of furnishing, hauling, storing, and installing solid wall polyvinyl chloride (PVC) plastic pipe for gravity sewers.

2. MATERIALS

- 2.1 Gravity Sewer Pipe: PVC pipe for gravity sewers 4" through 15" in diameter shall meet the requirements of ASTM D3034, latest revision, SDR-26. PVC pipe for gravity sewers 18" through 24" diameter shall meet the requirements of ASTM F679, latest revision, Type 1, SDR-35. Pipe shall be extruded with one end to serve as a spigot end and the other as a bell end, with a gasket groove molded inside for retention of a rubber gasket used in making the joint. Joints shall meet the requirements of ASTM D3212. Standard laying lengths shall be 12.5 feet or 20 feet.

2.1.1 Drop Impact Test: Pipe shall withstand, without failure at 73°F, an impact of a falling missile (20 pounds TUP A) at the following levels, in accordance with ASTM D2444 latest revision:

<u>Nom. Size (In.)</u>	<u>Ft-Lbs.</u>
4	150
6	210
8	210
10	220
12	220
15	220
18	220
21	220
24	220

2.1.2 Pipe Stiffness: Minimum pipe stiffness (F/delta-y) at 5% deflection shall be 46 PSI for all sizes when tested in accordance with ASTM D2412, latest revision.

2.1.3 Flattening: There shall be no evidence of splitting, cracking, or breaking when a specimen of pipe, six-inches long, is flattened between parallel plates in a suitable press until the distance between the plates is forty percent of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is completed within two to five minutes.

SANITARY SEWER SYSTEMS 02722

1. GENERAL

- 1.1 Description: The work of this section shall consist of installing the gravity sewers to the lines and grades shown on the drawings and as specified herein.

2. MATERIALS

- 2.1 Gravity Sewer System: Gravity sewer lines shall be solid wall polyvinyl chloride (PVC) pipe meeting the requirements of Section 02622 - PLASTIC PIPE, ductile iron pipe (D.I.P.) meeting the requirements of Section 02615 - DUCTILE IRON PIPE AND FITTINGS, or Vitrified clay pipe (VCP) meeting the requirements of Section 02621 - VITRIFIED CLAY PIPE. Where noted, gravity sewers shall be constructed of ductile iron pipe as specified in Section 02615 - DUCTILE IRON PIPE AND FITTINGS. Manholes shall be as specified in Section 02601 - PRECAST MANHOLES.

3. EXECUTION

- 3.1 Handling, Receiving and Delivery of Materials: All materials shipped by rail shall be carefully inspected for damage in transit in the cars. If damaged material is found, it shall not be unloaded except upon instructions from the official freight agent. In the event of damaged pipe, it may be lifted out of the cars and placed along the switch site, but no material shall be removed from the railroad company property. If materials are delivered by truck, they shall be inspected as they are unloaded. Damaged pipe shall not be left at the job site, but shall be removed promptly so that rejected material will not mistakenly be used in construction. All pipe, pipe fittings, and other accessories and materials shall be unloaded in such a way as to avoid damage due to shock. Under no circumstances shall pipe be dropped to the ground from cars or trucks. Special precautions shall be taken to prevent one pipe from striking another forcefully.
- 3.2 Storage: All materials shall be placed for storage in suitable places. As pipe is placed along the intended alignment of the trench, it shall be placed with bell ends facing the direction in which work will proceed (upstream), unless otherwise directed.
- 3.3 Pipe Inspection: Before pipe is lowered into the trench, the pipe shall be inspected for defects. Ductile iron pipe shall be rung with a light hammer to detect cracks. Any defective, damaged, or unsound pipe shall be rejected.
- 3.4 Pipe Cleaning: A thorough cleaning of each pipe section shall be done just before the section is lowered into the trench. A suitable swab shall be pushed through the pipe to insure that all foreign matter and dirt is removed from the inside of the pipe. The pipe shall be kept clean by approved means during and after laying.
- 3.5 Cutting Pipe: All cutting of pipe shall be done in a neat manner with the least amount of waste of pipe involved and without damage to existing or new pipe lines.
- 3.6 Pipe Installation: All pipes, pipe fittings, etc. shall be lowered into the trench piece by piece by means of derricks, ropes, or other suitable equipment. Under no circumstances shall pipe or other materials be dropped into the trench. The pipe shall be laid with bell holes upstream, i.e., in the direction of laying operations. Pipe shall be laid in a bed of granular stone as shown on the drawings and as specified in Section 02222 - GRANULAR STONE BEDDING AND BACKFILL. In all cases, full length joints of pipe shall be used except in making closures. The pipe shall be laid on grade with a grade rod that has an iron heel for the invert and notches for the line stretched over the pipe between the grade boards. Grade lines shown on the profile drawings are the internal invert lines of the sewer pipe. Pipe laying machines, laser beams, or other devices may be used in lieu of a grade rod so long as comparable results are achieved. Bedding and backfilling of the pipe shall be in accordance with Section 02221 - TRENCHING, BACKFILLING, AND COMPACTING. At the close of each day's work, or when pipe is not being laid, the end of the pipe shall be stopped to overcome possible uplift and prohibit contamination. Any pipe which settles before acceptance, or which is not in true alignment, shall be taken up and replaced by the Contractor at his expense.
- 3.7 Joints: At all pipe joints, the granular stone bedding shall be excavated sufficiently so that the pipe bell will not rest on the bedding materials, but all the weight of the pipe shall be evenly distributed along the entire length of the barrel of the pipe. Care shall be taken to insure that the joints of the pipe are clean and free of any foreign material, and constructed watertight at all points. Any leaks or other defects discovered at any time before the final acceptance of the work shall be immediately repaired, or that portion of the sewer rebuilt, if necessary.
- 3.8 Removal of Buildings, Structures, and Improvements: Where buildings, structures, improvements, or materials of value are encountered in the area where sewer line is to be installed, the Contractor shall provide for the removal, protection, and disposition of these elements. The Contractor shall consult with the Owner relative to the proposed means of removal. All fences disturbed during construction shall be restored to a condition at least equal to that which existed prior to construction, unless specifically directed otherwise by the drawings. Certain repaired fence sections shall require installation of a fence gate. Locations of these gates shall be as called out on the drawings. Gates shall conform to the details shown on the drawings.
- 3.9 Stream Crossing: Stream crossing with sewer lines requiring special construction shall be installed as shown on

the drawings, with the length of the crossing being determined by the Plan and Profile drawings.

- 3.10 Separation of Sewer and Water Lines: When sanitary sewers are to be laid parallel to existing potable water lines, it will be necessary to maintain at least ten feet horizontal separation between the sewer and water lines. At points where sewers cross water mains with less than 18 inches of vertical separation, sewers shall be constructed of ductile iron or pressure class 200 PVC (DR14) for ten feet each direction from the crossing point.
- 3.11 Lateral Sewers: The exact location of all tee or wye branches and other special pieces shall be carefully ascertained by the Owner before concealment by backfilling, by accurate measure from the center of the manhole next below in the same line of pipe; that a true and exact record may be preserved for future use.

No tee or wye branch or special piece shall be covered before its exact location has been noted and recorded. If the sewer is being laid within the street right-of-way, all laterals shall extend to the right-of-way line.

CONTRACTORS PLEASE NOTE: A wood 2" x 2" or equivalent will be required at the end of each lateral or tee extending from the lateral or tee to within two (2) to six (6) inches below the ground surface.

4. TESTING

- 4.1 General: Completed gravity and pressure sewer shall require pneumatic or hydrostatic testing for the purpose of locating potential infiltration and/or exfiltration within the system. Testing shall be as specified in Section 02749 - SEWER AND MANHOLE TESTING.

5. MEASUREMENT AND PAYMENT

- 5.1 Scope: This section covers the method of measurement and basis of payment for the furnishing of all labor, equipment, tools, and materials, and for the performance of all related work necessary to complete the sewer and appurtenances.

- 5.2 Method of Measurement: The amount of completed and accepted work shall be determined as follows:

5.2.1 Pipe Sewer:

5.2.1.1 Open Trenched: Measurement of various size, type, and depth will be in linear feet, as listed in the proposal, based on the horizontal length of pipe measured from center to center on manholes and to inside faces of special structures, along the centerline of sewer pipe. Depth range as listed in the proposal and shown on the plans will not be measured unless changed field conditions result in a change in the plans by the Owner.

5.2.1.2 Tunneler, Bored, and Jacked: Measurement will be made in linear feet for the applicable size of cast or ductile iron pipe sewer, tunneled, bored, jacked, as listed in the proposal, based on the horizontal length of pipe measured from end to end of tunnel liner or casing pipe along centerline of pipe sewer.

5.2.2 Manholes: Measurement will be made for the applicable type, size, and depth of manhole as listed in the proposal. The manhole depth shall be determined by measuring from top of casting to outfall pipe flowline.

5.2.3 Encasement: Standard concrete encasement will be measured in linear feet for the applicable size pipe, as listed in the proposal, based on true length of encasement measured along the centerline of pipe. Concrete collars placed with adjacent encasement will be measured as one (1) linear foot of concrete encasement. Where concrete collars only are required, measurement will be made per each.

5.2.4 Seeding and Sodding: Seeded and sodded areas will be measured horizontally in linear feet along centerline of sewer, regardless of width of disturbed areas or type of seed and/or sod used. Seeding and/or sodding will be measured only when centerline of sewer lies in grassed areas to be seeded and/or sodded, as shown on the plans. When centerline of sewer lies in area that are not grassed, such as street paving, driveways, parking areas, gardens, etc., no measurement will be made. Areas that are disturbed that lie outside the contractor's normal trenching operations areas will not be measured for payment, but shall be restored to a condition equal to or better than that existing prior to construction. Each area measured will be measured as either seeding or sodding, but not as both. When sewer ends in a grassed area, measurement will be made only to centerline of manhole.

- 5.3 Basis of Payment: Payment for the completed and accepted work shall be made as follows:

5.3.1 Pipe Sewer:

5.3.1.1 Open Trenched: Payment will be made at the contract unit price per linear foot for the applicable size, type, and depth of pipe sewer, as listed in the proposal. Such payment and price shall constitute full compensation for all the labor, materials, equipment, and for the performance of all work necessary to complete the sewer, including excavation, sheeting and shoring, dewatering, preparation of stone subgrade, installation of pipe sewer, backfilling, disposal of excess material, and replacement of pavement.

5.3.1.2 Tunneler, Bored, or Jacked: Payment will be made at the contract unit price per linear foot for

cast or ductile iron pipe sewer, tunneled, bored, or jacked as listed in the proposal. Such payment and price shall constitute full compensation for all labor, material, equipment, and for the performance of all work necessary to complete the sewer, including all excavation, sheeting and shoring, dewatering, installation of casing pipe or tunnel liner plates, grouting, installation of carrier pipe, sand fill, end seals, and disposal of excess material.

5.3.2 Manholes: Payment will be made at the contract unit price per each for the applicable type, size, and depth of manhole as listed in the proposal. Such payment and price shall constitute full compensation for all labor, materials, equipment, and for the performance of all work necessary to complete the manholes, including excavation, concrete base, manhole steps, manhole ring and cover, waterproofing, reinforced concrete, backfilling, and disposal of excess material.

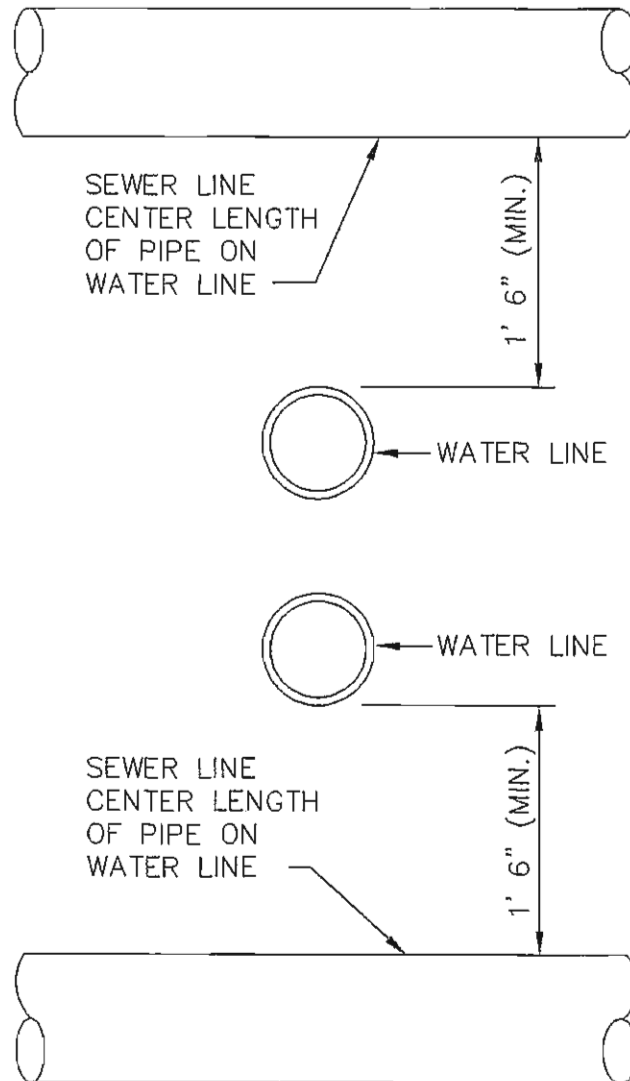
5.3.3 Encasement: Payment will be made at the contract unit price per linear foot, for the applicable size pipe as listed in the proposal. Such payment shall constitute full compensation for all labor, materials, equipment, and for the performance of all work necessary to complete the item, including reinforced concrete collars if placed with adjacent encasement.

Where collars only are required, payment will be made at the contract unit price per each as listed in the proposal. Such payment shall constitute full compensation for all labor, materials, equipment, and work necessary to complete the item, including concrete, forming, and reinforcing steel.

5.3.4 Seeding: Payment will be made at the contract unit price per lineal foot, regardless of type of seed, as listed in the proposal. Such payment shall constitute full compensation for all labor materials, equipment, and all work necessary to complete the item, including grading, tilling, fertilizing, application of seed, compaction, and mulching.

5.3.5 Sodding: Payment will be made at the contract unit price per linear foot, regardless of type of sod, as listed in the proposal. Such payment shall constitute full compensation for all labor, materials, equipment, and all work necessary to complete the item, including grading, fertilizing, tilling, placement of sod, anchoring of sod, rolling of sod, and watering.

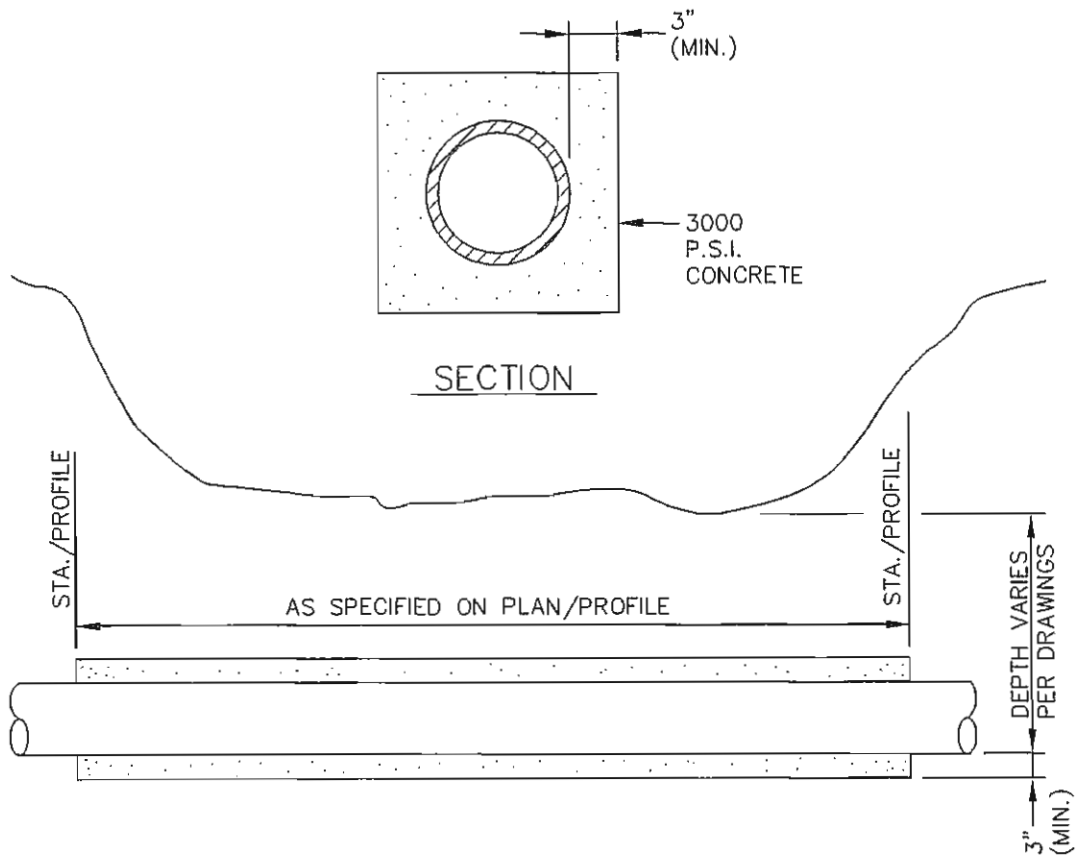
5.3.6 Items Not Listed in the Proposal: There shall be no measurement or separate payment for any items not listed in the proposal and all costs pertaining thereto shall be included in the contract unit prices for other items listed in the proposal.



City of Monett, Missouri

Std. Spec.

WATER / SEWER
CROSSING



SEWER AND MANHOLE TESTING027491. GENERAL

- 1.1 Description: The work of this section consists of pneumatic and hydrostatic testing of completed sewers, manholes and appurtenances for the purposes of measuring the amounts of infiltration and/or exfiltration prevailing or possible within any section of sewer line, any manhole or appurtenances. All acceptance tests for both sewer lines and manholes shall be conducted in the presence of the certifying engineer, his representative, or the City representatives.

2. MATERIALS AND EQUIPMENT

- 2.1 Pneumatic Testing Equipment: Equipment used shall meet the following minimum requirements:

2.1.1 Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.

2.1.2 Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

2.1.3 All air used shall pass through a single control panel.

2.1.4 Three individual hoses shall be used for the following connections:

2.1.4.1 From control panel to pneumatic plugs for inflation.

2.1.4.2 From control panel to sealed line for introducing the low pressure air.

2.1.4.3 From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

2.1.5 Equipment shall be equal to Cherne Air-Loc Equipment or approved equal.

2.2 Sewer Pipe Plugs: Shall be as manufactured by Cherne, Halliburton or approved equal.

2.3 Hydrostatic Testing Liquid: Shall be potable water or non-potable clean water. Raw sewage shall not be used.

2.4 Deflection Testing Equipment: Shall be rigid ball or mandrel with an outside diameter equal to 95 percent of the inside diameter of the line to be tested.

3. EXECUTION

- 3.1 Pneumatic Testing: The Contractor shall perform low pressure air testing on all sections of completed sewer, 6-inch through and including 24-inch diameters, in the presence of the Owner. It will be the responsibility of the Contractor to furnish and operate equipment capable of making the required tests. Testing methods and air leakage rates shall conform to ASTM C828-80T, Practice for Low-Pressure Test of Vitrified Clay Pipe or F1417-92 entitled Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines using Low-Pressure Air, or latest revision thereof, as a minimum. A copy of ASTM F1417-92 is included herewith for review.

3.1.1 Procedures, Above Groundwater Table: All pneumatic plugs shall be seal-tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

3.1.1.1 After a manhole to manhole reach of pipe has been backfilled and cleaned and pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average back pressure of any groundwater that may be over the pipe. At least two (2) minutes shall be allowed for the air pressure to stabilize.

3.1.1.2 After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "Acceptable" if the time required in

minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any groundwater that may be over the pipe) shall not be less than the time shown for the given diameters as found in ASTM F1417-92.

3.1.2 Procedures, Below Groundwater Table: In areas where groundwater is known to exist, the Contractor shall install a one-half diameter capped pipe nipple, approximately 10" long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the test, the groundwater shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The hose shall be held vertically and measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of water is 11 ½ feet, then the added pressure will be 5 psig. This increases the 3.5 psig to 8.5 psig and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing remain the same.)

3.1.3 Test Failures: If the sewer installation fails to meet these requirements, the Contractor shall, at his own expense, determine the source of leakage. He shall then repair or replace, at his own expense, all defective materials and/or workmanship.

- 3.2 Testing of Manholes: The Contractor will be required to make either hydrostatic or vacuum infiltration/exfiltration tests of all manholes in the presence of the City, to demonstrate that the manholes are free of leaks.

3.2.1 Hydrostatic Testing: Where the top of the sewer is below water level, a non-half inch (1/2") galvanized pipe nipple is to be cast into each manhole wall and capped on the inside. The pipe nipple is to be located at the top of the inside bore of sewer pipe. All tests are to be conducted in the following manner:

3.2.1.1 Test plugs are to be placed in the end of each sewer pipe on the downstream and upstream side of each manhole and inflated to a maximum pressure of 16 psig. Plugs are to be thoroughly blocked to prevent them from blowing out. The manhole is to be filled with water to a level four and one-half feet (4 ½') above the groundwater level or seven (7') feet above the pipe invert, or 2 feet (2') minimum above top of manhole rim elevation, whichever is higher. Ten minutes shall then be allowed for absorption, after which the water level shall be brought back to the test elevation.

3.2.1.2 The specified head shall be maintained on the manhole for a period of eight (8) hours. Sufficient water shall be added to maintain this level. All water added shall be metered to within one-tenth of a gallon and recorded. The maximum allowable leakage shall be as specified herein.

3.2.1.3 The Contractor shall provide all water, pumping facilities, and metering facilities necessary to perform the tests. After each test, all test water is to be pumped out.

3.2.2 Vacuum Testing: An approved vacuum type manhole tester shall be used to test manhole. The manhole ring shall be installed and tested as part of the manhole.

3.2.2 The procedure for testing manholes shall be as follows:

1. Each manhole shall pass two tests; the first test shall be after assembly but prior to backfilling and the second test shall be after backfilling.
2. Place the vacuum "test head" assembly inside the manhole cover cast iron frame. The vacuum test shall include testing of the seal between the cast iron frame and concrete cone, slab or grade rings.
3. Plug all pipes entering the manhole at least eight inches into the sewer pipe. The plug must be inflated at a location past the manhole/pipe gasket.
4. Brace all plugs to prevent the plug or pipe from being dislodged and drawn into the manhole.
5. A vacuum of at least ten and one-half inches of mercury shall be drawn on the manhole. Shut valve on vacuum line to manhole and disconnect vacuum line. Open the vacuum line valve and adjust vacuum to ten inches of mercury.
6. The pressure gage shall be liquid filled and have a 3 ½ inch diameter face with a reading from zero to thirty inches of mercury. The test equipment shall be capable of having two gages

connected. The gage supplied with the test equipment shall match the reading of a gage furnished by the Utilities Department. The gage reading is to be verified on each project.

7. The time for the vacuum reading to drop from ten inches of mercury to nine inches of mercury must be equal to or less than the following values for the manhole to be considered as passing the vacuum test:

<u>MANHOLE DEPTH</u>	<u>TIME (minutes)</u>
10 feet or less	2
10.1 to 15 feet	2.5
15.1 to 25 feet	3

If vacuum drops less than one inch mercury within the test time, the manhole is considered acceptable and passes the test. If manhole fails and leaks, the contractor shall make the needed repairs and test again until satisfactory results are obtained. Test may be done before backfilling, but shall be repeated after backfill.

All safety procedures, placing of plugs, and bracing, labor, and other work required for testing will be the responsibility of the contractor.

The contractor shall supply all required test plugs, vacuum plate, and vacuum pump.

3.3 Infiltration/Exfiltration Allowance:

3.3.1 Sewers 6" through 24" Diameter: Exfiltration or infiltration shall not be permitted to exceed 200 gallons per inch of pipe diameter per mile per day for any section of sewer and 1.14 gallon per day per foot of vertical depth per manhole.

3.3.1.1 After the air test is carried out, a measurement of any flow in the sewers shall be made by the Contractor, in the presence of the Owner, to determine if the flow is below 200 gallons per inch diameter per mile per day limitation. Hydrostatic testing of manholes may then be conducted.

3.3.1.2 Infiltration/exfiltration for manholes shall not exceed 1.14 gallons per day per vertical foot of manhole, determined by hydrostatic testing as specified by paragraph 3.2.

3.4 Infiltration/Exfiltration Elimination: The Contractor shall locate all sources of infiltration and exfiltration in the sewer lines, manholes, and appurtenances and shall correct deficiencies and eliminate infiltration/exfiltration sources. All sections of sewer line, manholes and appurtenances shall be re-tested after corrections are finalized. The Contractor shall carry the sole responsibility for providing a sewer system having infiltration or exfiltration below the specified limits.

4.0 DEFLECTION TEST ON FLEXIBLE PIPE

4.1 Requirement: The rules of the Department of Natural Resources, State of Missouri, 10 CSR 20-8.120, Paragraph (G)5, state that a deflection test shall be performed on all flexible pipe not less than thirty (30) days after the placement of final backfill.

4.2 Performance: The deflection test shall be performed by hand pulling a rigid ball or mandrel through the installed pipe in the presence of the Owner. The rigid ball or mandrel shall have a diameter equal to 95 percent of the inside diameter of the pipe. If the rigid ball or mandrel fails to pull through the pipe, the section being tested fails the test and will be replaced by the Contractor at no expense to the Owner.

Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air¹

This standard is issued under the fixed designation F 1417; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method provides procedures for testing plastic pipe sewer lines, using low-pressure air to prove the integrity of the installed material and the construction procedures. Two procedures are included to find the rate of air leakage—the constant-pressure method and the time-pressure drop method.

1.2 This test method shall be performed on lines after all connections and service laterals have been plugged and braced adequately to withstand the test pressure. The time between completion of the backfill operation and low-pressure air testing may be specified by the approving authority.

1.3 This test method also may be used as a preliminary test, which enables the installer to show the condition of a buried line prior to final backfill, paving, and other construction activities.

1.4 This test method is applicable to all gravity sewer lines made of thermoplastic pipe, reinforced thermosetting resin (RTRP) pipe, and reinforced plastic mortar (RPM) pipe, defined in Terminology D 883, D 1600, and F 412.

1.5 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. For specific precautionary statements, see Section 5.*

2. Referenced Documents

2.1 ASTM Standards:

- C 828 Practice for Low-Pressure Air Test of Vitrified Clay Pipe Lines (4 to 12-in.)²
- C 924 Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method²
- D 883 Terminology Relating to Plastics⁴
- D 1600 Abbreviations, Acronyms, and Codes for Terms Relating to Plastics⁴
- D 2122 Method for Determining Dimensions of Thermoplastic Pipe and Fittings⁴
- D 3567 Practice for Determining Dimensions of Reinforced Thermosetting Resin Pipe (RTRP) and Fittings⁴
- F 412 Terminology Relating to Plastic Piping Systems⁴

¹ This test method is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.62 on Sewer.

Current edition approved July 15, 1992. Published September 1992.

² Annual Book of ASTM Standards, Vol 04.05.

³ Annual Book of ASTM Standards, Vol 08.01.

⁴ Annual Book of ASTM Standards, Vol 08.04.

2.2 Uni-Bell PVC Pipe Association Standard:

UNI-B-6-90 Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe⁵

3. Significance and Use

3.1 This low-pressure air test detects damaged piping or improper jointing by measuring the rate at which air under pressure escapes from an isolated section of sewer.

3.2 The rate of air loss will indicate the presence or absence of damaged piping or leaking joints. This test method is not intended to show total system water leakage limits and cannot be used as a quantitative measure of leakage under service conditions for infiltration or exfiltration.

NOTE 1—A finding of acceptable air loss specified in this test method can be interpreted as an installation acceptance test in lieu of infiltration or exfiltration test.

3.3 This test method will ensure the best possible initial condition and quality workmanship of all property-installed sewer pipe.

4. Summary of Test Method

4.1 The section of the line to be tested is plugged. Air, at low pressure, is introduced into the plugged line. The line passes the test if the rate of air loss, as measured by pressure drop, does not exceed a specified amount in a specified time. Pressure drop may be determined by using Table 1 or Table 2, or calculated by use of the formulas in 9.1.

5. Apparatus

5.1 *Plugs*—Mechanical or pneumatic type.

5.2 *Air Compressor*—A properly calibrated portable, oil-free air source with a singular control panel containing a main shut-off valve, pressure-regulating valve, 9 psig pressure-relief valve, input pressure gage, and a continuous monitoring pressure gage having a pressure range from 0 psi to at least 10 psi with minimum divisions of 0.10 psi and an accuracy of ± 0.04 psi.

5.3 *Rotameter*, standard CFM reading with an accuracy of $\pm 2\%$.

6. Safety Precautions

6.1 This low-pressure air test may be dangerous to per-

⁵ Available from Uni-Bell PVC Pipe Association, Suite 155, 2655 Villa Creek Drive, Dallas, TX 75234.

TABLE 1 Minimum Specified Time Required for a 1.0 psig Pressure Drop for Size and Length of Pipe Indicated for Q = 0.0015

NOTE 1—See Practice UNI-B-6-90.

NOTE 2—Consult with pipe and appurtenance manufacturer for maximum test pressure for pipe size greater than 30 in. in diameter.

Pipe Diameter, in.	Minimum Time, min:s	Length for Minimum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

TABLE 2 Minimum Specified Time Required for a 0.5 psig Pressure Drop for Size and Length of Pipe Indicated for Q = 0.0015

NOTE—Consult with pipe and appurtenance manufacturer for maximum test pressure for pipe size greater than 30 in. in diameter.

Pipe Diameter, in.	Minimum Time, min:s	Length for Minimum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	0.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760 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
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

sonnel if, through lack of understanding or carelessness, a line is overpressurized or plugs/caps are installed or restrained improperly. It is extremely important that the various plugs be properly installed to prevent the sudden expulsion of a poorly installed or partially inflated plug. Observe the following minimum safety precautions:

6.1.1 No one shall be allowed in the manholes during testing.

6.1.2 Install and restrain all caps and plugs securely.

6.1.3 When lines are tested, it is mandatory that all the caps and plugs be braced as an added safety factor.

6.1.4 Do not overpressurize the lines. Do not exceed 9.0 psig.

NOTE 2—The axial force on a plug at 4 psig internal pressure is $F = P \pi D^2/4$ lb, where D is the inside diameter in inches. Thus, the axial force on an 8-in. plug at the start of a properly-conducted test is over 200 lb. Restraint systems must be designed to handle these forces with adequate safety factors. Every effort should be made to maintain backfill over the pipe during air testing.

6.1.5 A regulator or relief valve set no higher than 9 psi shall be included on all pressurizing equipment.

7. Preparation of the Line

7.1 Clean the section of sewer line to be tested by flushing or other means prior to conducting the low-pressure air test.

This cleaning serves to eliminate debris and produce the most consistent results.

8. Procedures

8.1 Isolate the section of sewer line to be tested by inflatable stoppers or other suitable test plugs.

8.1.1 Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test to prevent air leakage. All plugs and caps shall be securely braced to prevent blow-out. One of the plugs or caps should have an inlet tap, or other provision for connecting a hose to a portable air control source.

8.1.2 Connect the air hose to the inlet tap and portable air control source. The air equipment shall consist of necessary valves and pressure gages to control an oil-free air source and the rate at which air flows into the test section to enable monitoring of the air pressure within the test section.

8.1.3 Add air slowly to the test section until the pressure inside the pipe reaches 4.0 psig.

8.1.4 After the pressure of 4.0 psig is obtained, regulate the air supply so that the pressure is maintained between 3.5 to 4.0 psig for at least 2 min depending on air/ground temperature conditions. The air temperature should stabilize in equilibrium with the temperature of the pipe walls. The pressure will normally drop slightly until equilibrium is

obtained; however, a minimum of 3.5 psig is required.

8.2 Determine the rate of air loss by either the constant pressure method or the time-pressure drop method.

NOTE 3—All test pressures are measured as gage pressure, which is any pressure greater than atmospheric pressure. Since water produces a pressure of 0.43 psi for every foot of depth, air test pressures must be increased to offset the depth of ground water over the sewer line. If the ground water level is 2 ft or more above the top of the pipe at the upstream end, or if the air pressure required for the test is greater than 9-psi gage, the air test method should not be used. Before the air test method is used, the ground water level should be lowered by pumping or dewatering.

8.2.1 *Constant Pressure Method*—Add air until the internal air pressure of the sewer line is raised to 4.0 psig and the test pipe section is stabilized as in 8.1. Release the pressure to 3.5 psig to run the constant pressure test. The air-flow rate in standard cubic feet per minute is read directly by a rotameter. Convert this air-flow rate to actual cubic feet per minute of air leaking from the test section by using the absolute pressure and temperature in the test section. The requirements for air loss under the constant pressure method shall be considered satisfied if the air loss does not exceed the specified leakage rate in cubic feet per minute per square foot of internal pipe surface area.

8.2.2 *Time-Pressure Drop Method*—Air is slowly introduced into the section of pipe to be tested, until the air pressure is raised to approximately 4.0 psi and the test pipe section is stabilized as in 8.1. Disconnect the air supply and decrease the pressure to 3.5 psi before starting the test. Determine the time required for the pressure to drop from 3.5 psi to 2.5 psi, and compare this interval to the required time to decide if the rate of air loss is within the allowable. Minimum holding times required by pipe diameter are shown in Tables 1 and 2.

NOTE 4—The time-pressure drop method assumes an atmospheric pressure of 14.7 psia. Locations of high altitude need compensation for variation in atmospheric pressure to maintain the same air leakage test criteria.

8.3 Upon completion of the test, open the bleeder valve and allow all air to escape. Plugs should not be removed until all air pressure in the test section has been reduced to atmospheric pressure.

9. Test Time Calculations

9.1 *Test Time Criteria*—No test section shall be accepted if air loss is more than a specified leakage rate (in cubic feet per minute per square foot) determined by the approving authority.

9.2 Calculate all test times by the following formula:

$$T = 0.085 DK/Q$$

where:

T = shortest time allowed for the air pressure to drop 1.0 psig, s,

K = 0.000419 DL but not less than 1.0,

Q = leak rate in cubic feet/minute/square feet of internal surface = 0.0015 CFM/SF,

D = measured average inside diameter of sewer pipe (see Method D 2122 and Practice D 3567), in., and

L = length of test section, ft.

Table 1 contains the specified minimum times required for a 1.00 psig pressure drop from a starting pressure of 3.5 psig to a final pressure of 2.5 psig using a leakage rate of 0.0015 ft³/min/ft² of internal surface.

9.3 The total leakage from any test section shall not exceed 625 Q .

9.4 If the pressure drops 1.0 psig before the appropriate time shown in Table 1 has elapsed, the air loss rate shall be considered excessive and the section of pipe has failed the test. If the line fails the test, segmented testing may be utilized solely to find the location of leaks. Once leaks are located and repaired, retest the completed pipe installation to requirements of this test method.

9.5 For testing of long sections or sections of larger diameter pipes, or both, a timed-pressure drop of 0.5 psig shall be used in lieu of a 1.0 psig timed-pressure drop. If a 0.5 psig pressure drop is used, the appropriate required test time shall be exactly one-half the values shown in Table 1. (See Table 2.)

NOTE 5—It is not necessary to hold the test for the entire period of time in Table 1 or Table 2 when it is evident that the rate of air loss is zero or less than the allowable, and is authorized by the approving authority.

9.6 If lateral or service lines are included in the test, their length may be ignored for computing required test time if the test time requirements are met. The maximum permissible air loss should not exceed 625 Q . If the test section fails, time shall be recomputed to include all the lateral lengths using the following formula:

$$T = 0.085 \left[\frac{D_1^2 L_1 + D_2^2 L_2 + \dots + D_n^2 L_n}{D_1 L_1 + D_2 L_2 + \dots + D_n L_n} \right] \frac{K}{Q}$$

where:

T = shortest time allowed for the air pressure to drop 1.0 psig, s,

K = 0.000419 ($D_1 L_1 + D_2 L_2 + \dots + D_n L_n$), but not less than 1.0,

Q = 0.0015 CFM/SF,

D_1, D_2 , etc. = nominal diameter of different size of pipe being tested, and

L_1, L_2 , etc. = respective lengths of the different size pipes being tested.

If the recomputed test time is short enough to allow the section tested to pass, then the test section meets the requirements of this test method.

10. Precision and Bias

10.1 This test method provides qualitative data only; therefore, a precision and bias statement is nonapplicable.

11. Keywords

11.1 air test; plastic; sewer

APPENDIXES

(Nonmandatory Information)

XI. EXAMPLES

X1.1 In order to show the technique of applying this test method, the following examples have been prepared. The examples have been designed to illustrate the use of Tables 1 and 2 and the formula in 9.1 that uses a leakage rate of 0.0015 CFM/ft².

X1.2 A manhole-to-manhole reach of nominal 12 in. pipe is 350 ft long. No lateral connections exist in the reach. What is the required test time for a 1.0 psig pressure drop?

X1.2.1 Solution—The required test time can be read directly from Table 1. For 350 ft of 12 in. pipe, the required test time is 19:56 (19 min and 56 s).

X1.3 A 350 ft section of nominal 12 in. pipe is ready for testing. A total of 128 ft of 4 in. lateral sewer pipe is connected to the 350 ft section and will be included in the test. What will be the required test time for a 0.5 psig pressure drop?

X1.3.1 Solution—Lateral sewers may be disregarded when selecting test times (see 9.1). Therefore, the required test time will be 9 min and 58 s as shown in Table 2.

NOTE X1.1—If the lateral sewers had not been disregarded, the required test time would be 10 min and 22 s, that is, only 24 s longer.

X1.4 What should the required test time be for a 1.0 psig pressure drop in 327 ft of nominal 8 in. diameter pipe between two manholes?

X1.4.1 Solution—The exact test time is easily calculated by using Table 1. Table 1 is used because a 1.0 psig pressure drop is specified. Since 327 ft exceed the 298 ft length associated with the minimum test time for an 8 in. pipeline, the fourth column in Table 1 is used to calculate the required test time as follows:

$$T = 1.520 \times L = 1.52 \times 327 = 497 \text{ s}$$

Therefore, the required test time for a 1.0 psig pressure drop is 497 s or 8 min and 17 s.

X1.5 A manhole-to-manhole reach of nominal 24 in. pipe is 82 ft long. What is the required test time for a 0.5 psig pressure drop?

X1.5.1 Solution—Table 2 is used because a 0.5 psig pressure drop is specified. Since 82 ft is less than the 99 ft length associated with the minimum test time for a 24 in. pipeline, the minimum test time shall apply. Thus, the required test time for a 0.5 psig pressure drop is 11:24 (11 min and 24 s).

X1.6 A 412 ft section of nominal 15 in. sewer pipe has been readied for air testing. A total of 374 ft of nominal 6 in. lateral piping and 148 ft of nominal 4 in. lateral piping branch off the 15 in.-sewer line. All laterals have been capped or plugged, or both, and will be tested together with the 15

in. main line. The specified pressure drop, which will be timed, is 0.5 psig. What is the appropriate test time for this pipe network?

X1.6.1 Solution—All lateral sewer sizes and lengths may be disregarded since their influence is generally not significant enough to warrant computation. Table 2 is used for a 0.5 psig pressure drop. The fourth column in the table gives the appropriate formula for calculating the required test time because 412 ft is longer than the third column value of 159 ft.

$$T = 2.671L = 2.671 \times 412 = 1100 \text{ s}$$

The required test time is 1100 s or 18 min and 20 s.

X1.7 A manhole-to-manhole reach of nominal 8 in. pipe is only 100 ft long. A total of 300 ft of nominal 4 in. lateral piping is connected to the 100 ft section and will be included in air testing the section. What will be the required test time for a 1.0 psig pressure drop?

X1.7.1 Solution—The required test time can be read directly from Table 1. Thus, for 100 ft of 8 in. pipe, the required holding time is 7:34 (7 min and 34 s). However, should the section fail to meet this test, recalculate the required holding time, taking into account the connected laterals. This recalculation is required because the total internal pipe surface area is less than 625 ft².

$$\begin{aligned} \text{Total area} &= \pi \left[\frac{D L_1 + D L_2 + \dots + D_n L_n}{12} \right] \\ &= \pi \left[\frac{(8 \times 100) + (4 \times 300)}{12} \right] = 524 \text{ ft}^2 \end{aligned}$$

Using the equation provided in 9.1, the required test time should be recomputed as follows:

$$\begin{aligned} K &= 0.000419 [(8 \times 100) + (4 \times 300)] \\ &= 0.838 \\ 0.838 &= 1.0 \rightarrow K = 1.0 \end{aligned}$$

NOTE X1.2—K will always be 1.0 when the total area is less than 625 ft².

$$T = 0.085 \left[\frac{(8^2 \times 100) + (4^2 \times 300)}{(8 \times 100) + (4 \times 300)} \right] \frac{1.0}{0.0015}$$

$$T = 317$$

The required test time is actually only 317 s or 5 min and 17 s for a 1.0 psig pressure drop. Therefore, if the section can meet this test time, it shall be accepted.

NOTE X1.3—For a specified 0.5 psig pressure drop, the test holding time would be only half as long, that is 2 min and 38 s.

X2. RATIONALE (Refs 1, 2, and 3)⁶

X2.1 Low-pressure air testing is a fully accepted means of testing sewer lines.

X2.2 It is true that due to the differing physical properties of water and air, no direct numerical correlation exists between air loss and water leakage. This does not mean that the two are unrelated. It has been established that lower air loss rates are associated with lower leakage rates.

X2.3 The data in these studies are based on installed sewer of concrete, clay, and asbestos cement sanitary sewers and were useful in deriving Practices C 828 and C 924.

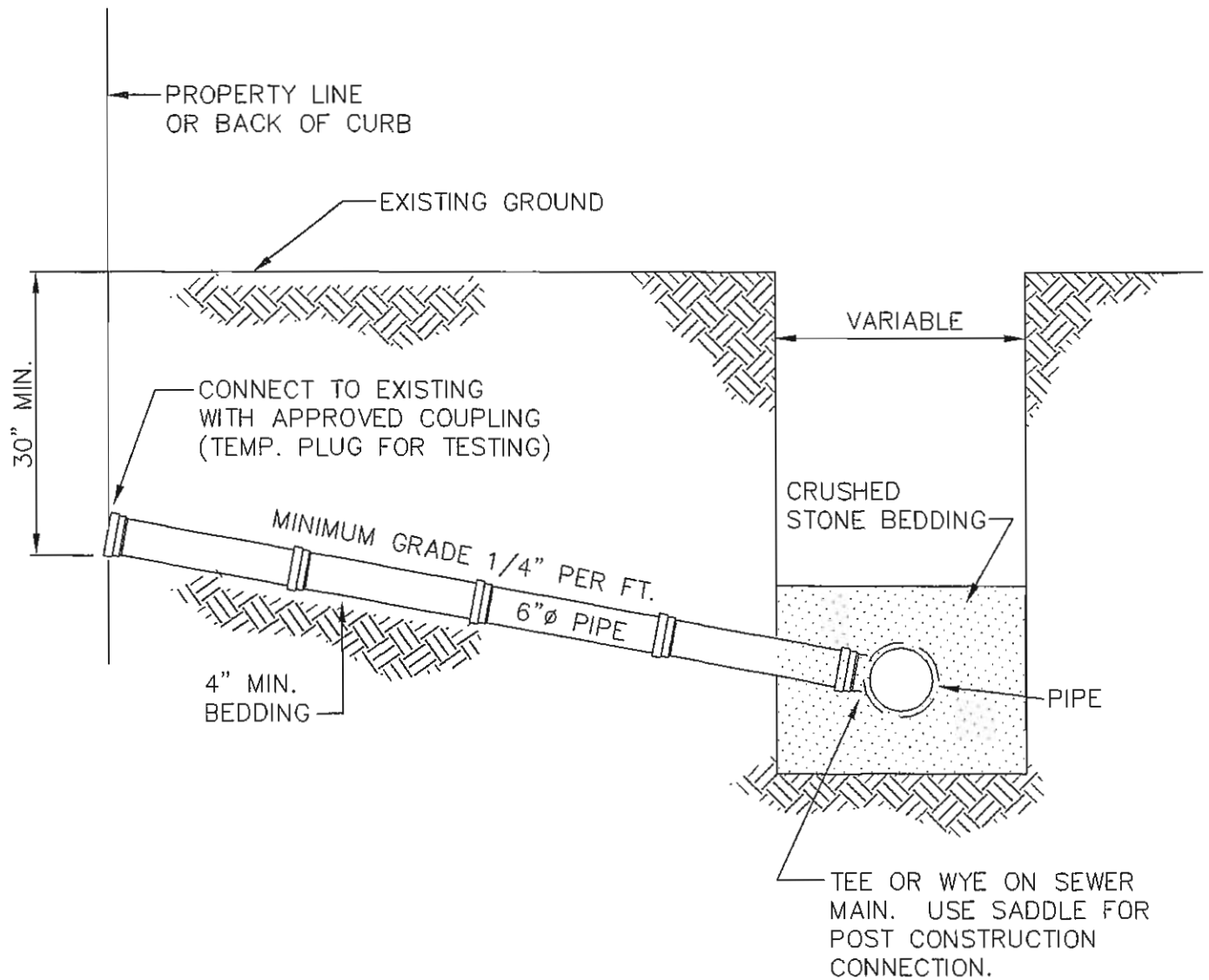
⁶ The boldface numbers in parentheses refer to the references listed at the end of this test method.

REFERENCES

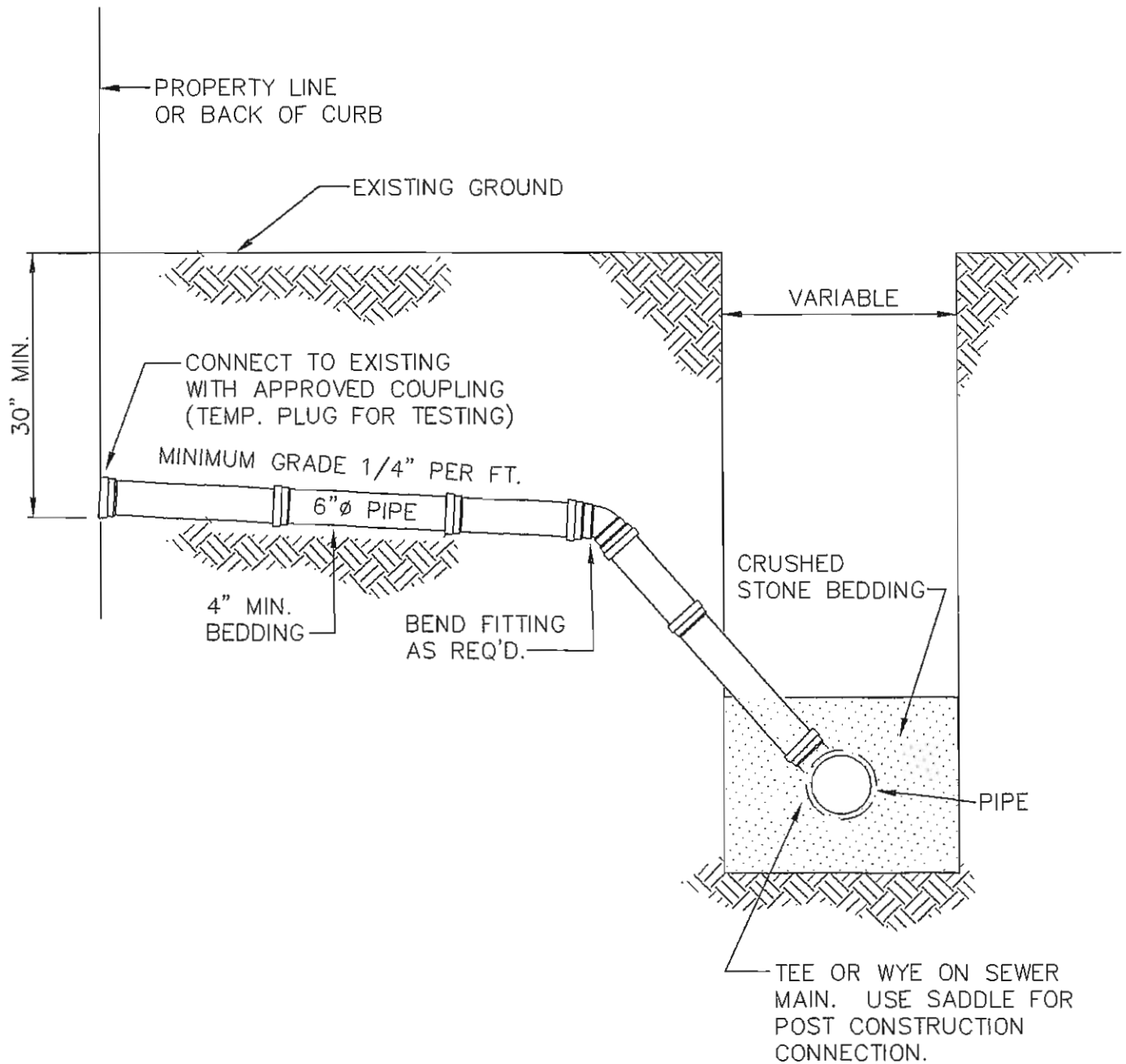
- (1) Hobbs, S. H., and Cherne, L. G., "Air Testing Sanitary Sewers," *WPCF Journal*, April 1968.
- (2) Ramseier, R. E., "Low Pressure Air Test for Sanitary Sewers," *Journal of the Sanitary Engineering Division, ASCE*, April 1964.
- (3) Ramseier, R. E., "Testing New Sewer Pipe Installation," *Water Pollution Control Federation Journal*, April 1972.

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City of Monett, Missouri Std. Spec. SERVICE LATERAL (RUNOUT)
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City of Monett, Missouri
Std. Spec.
SERVICE LATERAL (STACK)

CONCRETE REINFORCEMENT 03200

1. GENERAL

- 1.1 Description: The work of this section consists of furnishing and hauling all reinforcement materials and all tools, labor, equipment, and incidentals necessary to complete this section.

2. MATERIALS

- 2.1 Reinforcing Steel: Reinforcing bars shall conform to "Standard Specifications for Deformed Billet-Steel Bars for Concrete Reinforcement", ASTM 615 or to the "Standard Specifications for Axle-Steel Deformed Bars for Concrete Reinforcement" ASTM A617, and shall be Grade 40.
- 2.2 Welded Wire Fabric: Welded wire fabric shall conform to "Standard Specifications for Welded Steel Wire Fabric" or ASTM A185.

3. EXECUTION

- 3.1 General: Unless otherwise indicated on the drawings or specified herein, all cutting and bending of reinforcement bars shall be done at the mill or shop prior to shipment. Cutting and bending in the field will be permitted only where shown on the Plans or to correct errors, damage by handling and shipping, and minor omissions in shop bending.
- 3.2 Storing and Cleaning:
- 3.2.1 All reinforcement shall be stored above ground on skids, pallets, or other supports and shall be protected from mechanical injury and from deterioration by exposure.
- 3.2.2 When placed in the work, reinforcement shall be free from dirt, detrimental scale, concrete, paint, oil, or other foreign materials. Tight, thin rust is not considered detrimental and will not require cleaning.
- 3.3 Placing: Except as shown on the drawings or specified herein, all placement of reinforcing bars, welded wire fabric, and bar supports shall conform to the latest edition of "Placing Reinforcing Bars, CRSI-SCRSI Recommended Practices", published by the Concrete Reinforcing Steel Institute. Bars may be moved as necessary to avoid interference with other reinforcing steel, pipes, or other embedded items.
- 3.4 Splices: When splices other than those shown on the Plans become necessary, they shall be located at areas of low stress and shall be subject to approval by the Owner.

CAST-IN-PLACE CONCRETE 03300

1. GENERAL

- 1.1 Description: The work of this section shall include the furnishing, hauling, placing, curing and testing of all portland cement concrete required by the Construction Drawings and herein specified.

2. MATERIALS

- 2.1 Portland Cement: Portland cement shall conform to "Standard Specifications for Portland Cement: ASTM C150 Type 1 or Type 1A. One sack of cement shall be considered as one cubic foot of volume or 94 pounds by weight.
- 2.2 Aggregates: Fine and coarse aggregates shall conform to "Standard Specifications for Concrete Aggregates", ASTM C33. The nominal maximum size of the coarse aggregate shall not be larger than one-fifth of the narrowest dimension between sides of forms, one-third the depth of the labs, nor three-fourths of the minimum clear distance between reinforcing bars or between bars and forms, whichever is least. Coarse aggregate gradation shall conform to ASTM C33 Size 57.
- 2.3 Admixtures: Refer to Section 03301 - CONCRETE ADMIXTURES.
- 2.4 Mixing Water: Mixing water for concrete shall be fresh, clean and potable. Non-potable water may be used only if it produces mortar cubes having 7- and 28-day strengths equal to the strength of similar specimens made with distilled water, when tested in accordance with "Method of Test for Compressive Strength of Hydraulic Cement Mortars", ASTM C109.
- 2.5 Water Stops:
- 2.5.1 Water stops shall be provided for construction joints where noted on the Plans. Water stops shall be made of polyvinylchloride resin plastic.
- 2.5.2 Polyvinylchloride water stops shall be Serviced/Durajoint Polyvinylchloride water stops, Type 3, as manufactured by Construction Products Division, W. R. Grace and Company, or approved equal.
- 2.6 Curing Compounds: All curing compounds shall conform to specifications for liquid membrane forming compounds for curing concrete ASTM C209 applied in accordance with manufacturer's recommendations.

3. PROPORTIONING CONCRETE

- 3.1 General: Proportions of aggregate to cement and water shall be such to provide a concrete mix which will work readily into corners and angles for forms and around reinforcement and other embedded items without causing segregation of materials.
- 3.2 Proportioning Ingredients: All ingredients shall be proportioned in order to obtain the following:

Type of Concrete	Min. 28-Day Comp. Strength	Water-Cement Ratio (Maximum)	Air-Entrainment Percent	Min. Cement Content
Structural	3,500 psi	5-1/4 gal/sack	3-1/2 to 6-1/2 by volume	6 Sk/C.Y.
Fill	2,500 psi	6-1/2 gal/sack	3-1/2 to 6-1/4 by volume	5-1/2 Sk/C.Y.

Slump

- 4" max., 2" min. - footings, heavy walls, piers, buttresses
5" max., 3" min. - light walls, slabs, beams, columns, stairs
3" max., 2" min. - concrete floors with monolithic finish

3.2.1 In no case shall the amount of fine aggregate be more than the amount of coarse aggregate (measured by weight) nor shall the amount of coarse aggregate be such as to produce honeycombing.

3.2.2 Portland cement concrete shall be proportioned and placed to provide an average compressive strength sufficiently high to minimize the number of compressive strength tests falling below the specified compressive strength for the concrete structure. Portions of concrete ingredients, including water-cement ratios, shall be established on the basis of laboratory trial batches to provide conformance with compressive strength requirements, workability, and consistency. When different materials are used for different portions of the project, each combination shall be evaluated separately. Strength tests shall be conducted on test specimens in accordance with ASTM C39 and ASTM C192, from the trial batches using different water-cement ratios. Tabular data showing the compressive strength of the concrete proportions with various water-cement ratios shall be provided to the Owner prior to placing of concrete on the jobsite.

3.2.3 Concrete shall be provided to develop a compressive strength of not less than 3,500 psi at 28-days for field cured cylinders. Concrete that, after curing, will be subjected to freezing temperatures while wet shall contain entrained air from 3.5 to 6.5 percent by volume. Concrete that is intended to be water-tight shall have a maximum water-cement ratio of 0.48 by weight.

3.3 Moisture: Moisture in the aggregate shall be measured and the quantity must be included in the water-cement ratio specified above.

3.4 Trial Batches: Full sized trial batches shall be made in the laboratory using the aggregates selected for the job to establish the correct proportions to give proper workability, strength, and texture with the water-cement ratio specified.

4. MIXING CONCRETE

4.1 Ready-Mixed Concrete: Ready-mixed concrete will be permitted provided it conforms to the "Standard Specification for Ready-Mixed Concrete", ASTM C94 and to the applicable portions of these Specifications.

4.2 Batch Mixing at Site:

4.2.1 The concrete shall be mixed in a batch mixer, conforming to the requirements of the Mixer Manufacturer's Bureau of the Associated General Contractors of America. The mixer shall bear a manufacturer's rating plate indicating the rated capacity and the recommended revolution per minute and shall be operated in accordance with these recommendations. It shall be equipped with a suitable charging hopper, water storage tank, and a water-measuring device and shall be capable of thoroughly mixing aggregates, cement and water into a uniform mass within the specified mixing time and discharging the mix without segregation.

4.2.2 The batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates. Water shall continue to flow for a period which may extend to the end of the first 25 percent of the specified mixing time. Controls shall be provided to insure that the batch cannot be discharged until the required mixing time has elapsed. Controls shall be provided to insure that no additional water may be added during mixing. The entire batch shall be discharged before the mixer is recharged.

4.2.3 Each batch of two cubic yards or less shall be mixed for not less than 1 ½ minutes. The minimum mixing time shall be increased 15 seconds for each additional cubic yard or fraction thereof.

4.3 The mixer shall be clean, and the pick-up and throw-over blades shall be replaced when they have lost 10 percent of their original depth.

4.4 Admixtures:

4.4.1 Air-entraining and chemical admixtures and calcium chloride shall be charged into the mixer as a solution and shall be dispensed by an automatic dispenser or similar metering device. Powdered admixtures shall be weighted or measured by any admixture shall be within \pm three percent.

4.4.2 Two or more admixtures may be used in the same concrete, provided such admixtures are added separately during the batching sequence and provided further that the admixtures used in that combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other.

4.4.3 Addition of retarding admixtures shall not be significantly delayed after the addition of the cement.

4.5 Retempering: Concrete shall be mixed only in quantities for immediate use. Concrete which has set shall not be retempered, but shall be discarded.

4.6 Indiscriminate addition of water to increase slump or workability shall be prohibited. When concrete arrives at the project with slump below that suitable for placing, water may be added only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded. The water must be incorporated by additional mixing equal to at least half of the total mixing required. Any addition of water above that permitted by the limitation on water-cement ratio must be accompanied by a quantity of cement sufficient to maintain the proper water-cement

ratio.

4.7 Weather Conditions:

4.7.1 Cold Weather: To maintain the temperature of the concrete above the minimum placing temperature required herein, the as-mixed temperature shall not be less than 55°F. when the mean temperature falls below 40°F.

4.7.2 If the water or aggregate has been heated, the water shall be combined with the aggregate in the mixer before cement is added. Cement shall not be added to the mixtures of water and aggregate when the temperature of the mixture is greater than 100°F.

4.7.3 Hot Weather: The ingredients shall be cooled before mixing if necessary to maintain the temperature of the concrete below the maximum placing temperature required herein.

5. CONCRETE PLACEMENT

5.1 Preparation Before Placing: Hardened concrete and foreign materials shall be removed from the inner surfaces of the conveying equipment.

5.2 Formwork shall be completed; reinforcement shall be secured in place; expansion joint material, waterstops, anchors, pipe sleeves, and other embedded items shall be positioned; and the entire preparation shall be approved by the Owner before any concrete is placed. Subgrades shall be sprinkled sufficiently to eliminate absorption of water from the concrete before any concrete is placed.

5.3 Before placing concrete slabs on grade, where required, a polyethylene vapor barrier of 4 mil. thickness, or approved equal, shall be installed in accordance with the manufacturer's recommendations. A layer of sand shall be placed on the granular fill to protect the vapor barrier during placement of concrete.

5.4 Conveying: Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients and in a manner which will assure that the required quality of the concrete is obtained.

5.5 Conveying equipment shall be of size and design to insure a continuous flow of concrete at the delivery end. Conveying equipment and operations shall conform to the following requirements:

5.5.1 Truck mixers, agitators, and nonagitating units and their manner of operation shall conform to the applicable requirements of "Specifications for Ready-Mixed Concrete", ASTM C94.

5.5.2 Belt conveyors shall be horizontal or at a slope which will not cause segregation or loss. An approved arrangement shall be used at the discharge end to prevent separation. Long runs shall be discharged without separation into a hopper.

5.5.3 Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.

5.5.4 Pumping or pneumatic conveying equipment shall be without "Y" sections, and with adequate pumping capacity. The equipment shall be cleaned at the end of each operation. Pneumatic placement shall be controlled so that separation is not apparent in the discharged concrete. The maximum loss of slump in pumping or pneumatic conveying equipment shall be 1 ½ inches.

5.6 Depositing: Concrete shall be deposited continuously or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be located at points as provided for in the drawings or as approved by the Owner. Placing shall be carried on at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened or has been contaminated by foreign materials shall not be deposited. Temporary spreaders in forms shall be removed when the concrete placing has reached an elevation rendering their service unnecessary. They may remain embedded in the concrete only if made of metal or concrete and if prior approval has been obtained.

5.6.1 Placing of concrete in supported elements shall not be started until the concrete previously placed in columns and walls is no longer plastic.

5.6.2 Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to flowing or rehandling and shall drop vertically into the center of the forms. In no case shall concrete be allowed to fall more than five feet.

5.7 Where surface mortar is to be the basis of the finish, the coarse aggregate shall be worked back from the forms

with a suitable tool so as to bring a full surface of mortar against the form without the formation of excessive surface voids. All concrete shall be consolidated by vibration, spading, rodding or forking so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting or planes of weakness. Mechanical vibrators shall have a minimum frequency of 7,000 revolutions per minute and shall be operated by competent workmen. Overvibrating and use of vibrators to transport concrete within forms shall not be allowed. Vibrators shall be inserted and withdrawn at many points, from 18 to 30 inches apart. At each insertion the duration shall be sufficient to consolidate the concrete but not sufficient to cause segregation, generally from 5 to 15 seconds duration. A spare vibrator shall be kept on the job site during all concrete placing operation.

5.8 Weather Conditions:

5.8.1 Unless adequate protection is provided, concrete shall not be placed in rain, sleet, or snow. Rain water shall not be allowed to increase the mixing water nor to damage the surface finish.

5.8.2 When the mean daily temperature falls below 40°F., the minimum temperature of concrete as place shall be 50°F.

5.8.3 Concrete deposited in hot weather shall have a placing temperature which will not cause difficulty from loss of slump, flash set or cold joints (usually somewhat less than 90°F.).

5.9 Concreting Under Water: No concrete shall be placed under water without the approval of the Owner.

6. JOINTS

6.1 Construction Joints: Construction joints shown on the plans are recommended and any deviation from these shall be approved by the Owner. When joints not shown on the plans are required, they shall be placed so as to least impair the strength of the structure. Water stops shall be required at all construction joints.

6.1.1 All reinforcing bars and welded wire fabric shall continue across construction joints. Construction joints shall conform to the details shown on the plans and shall be keyed as shown. Construction joints shall be thoroughly wetted and coated with a mixture of 1:2 mortar immediately before the new concrete is placed.

6.1.2 The surface of the concrete at all joints shall be thoroughly cleaned and all laitance shall be removed. Immediately before placing fresh concrete, the surface of the existing concrete at the joint shall be dampened but not saturated. The edges of all joints which are exposed to view shall be carefully finished true to line and elevation.

6.2 Expansion Joints:

6.2.1 Reinforcement or other embedded metal items bonded to the concrete shall not be permitted to extend through any expansion joint.

6.2.2 Premolded expansion joint filler shall be of the size shown on the plans and shall conform to "Specifications for Preformed Expansion Joint Filler for Concrete (Standard Cork, Type II)", ASTM. The joint shall be sealed with two component non-staining gray sealing compound with polysulfide liquid polymers, gun grade with primer, installed in accordance with the manufacturer's recommendations.

6.3 Water Stops: Each piece of PVC Waterstop shall be of maximum practicable length in order that the number of splices be held to a minimum. Joints at intersections and at ends of pieces shall be made according to the manufacturer's recommendations and shall develop watertightness fully equal to that of the continuous waterstop material. Care shall be taken during installation of the waterstops so that no leakage will occur across the joint.

7. FINISHES

7.1 General: After removal of forms the concrete shall be given one or more of the finishes specified herein.

7.2 Formed Surfaces: All formed surfaces which are to be exposed to view shall be given a smooth rubbed finish. The inside walls of structures, even though the structure will retain liquid, will be considered as exposed to view. All concrete surfaces not exposed to view may be left with a rough or board form finish.

7.3 All necessary patching shall have been done immediately after forms have been removed and rubbing shall be completed not later than the following day. Surfaces shall be wetted and rubbed with carborundum brick or other abrasive until a uniform color and texture are produced. Cement grout or slush may be used other than the cement paste drawn from the green concrete itself during the rubbing process.

7.4 Related Uniformed Surfaces: Tops of walls and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be floated to a texture reasonably consistent with that of the formed surfaces. Final treatment on formed surfaces shall continue uniformly across the unformed surfaces.

7.5 Floor Finishes: Except as specified herein, all concrete floors shall be given a floated finish. After the concrete

has been placed, struck off, consolidated and leveled, the concrete shall not be worked further until ready for floating. Floating shall begin when the water sheen has disappeared and/or when the mix has stiffened sufficiently to permit the proper operation of a power-driven float. The surface shall then be consolidated with power-driven floats. Hand floating which wood or cork-faced floats shall be used in locations inaccessible to the power-driven machine. Trueness of surface shall be rechecked at this stage with a 10-foot straightedge applied at not less than two different angles. All high spots shall be cut down and all low spots filled during this procedure to a tolerance of one-quarter inch in 10 feet as determined by a 10-foot straightedge placed anywhere on the slab in any direction.

- 7.6 Sidewalk slabs and other exterior slabs established for walking surfaces shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface. This operation shall follow immediately after floating. Floating shall be performed as specified above.
- 7.7 Interior floor slabs of buildings shall be given a steel troweled finish. The surface shall be finished first with power floats, as specified above where applicable, then with power trowels, and finally with hand trowels. The first troweling after power floating shall be done by a power trowel and shall produce a smooth surface which is relatively free of defects but which may still contain some trowel marks. Additional trowelings shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be free of any trowel marks, uniform in texture and appearance and shall be finished to a tolerance of one-eighth inch in 10 feet as determined by a 10-foot straightedge placed anywhere on the slab in any direction.
- 7.8 Interior floor slabs of buildings which are not to receive floor coverings shall be hardened after curing and drying with three coats of aqueous solution of magnesium fluosilicate and zinc fluosilicate, or approved equal, applied in accordance with the manufacturer's directions.

8. PATCHING

- 8.1 General: All tie holes and all repairable defective areas shall be patched immediately after form removal.
- 8.2 Defective Areas: All honeycombed and other defective concrete shall be removed down to sound concrete. The area to be patched and an area at least six inches wide surrounding it shall be dampened to prevent absorption of water from the patching mortar. A bonding grout shall be prepared using a mix of approximately one part cement to one part fine sand passing a No. 30 mesh sieve, shall be mixed to the consistency of thick cream and shall then be well brushed into the surface.
- 8.3 The patching mixture shall be made of the same material and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 1 ½ parts sand by damp loose volume. White portland cement shall be substituted for a part of the gray portland cement on exposed concrete in order to produce a color matching the color of the surrounding concrete as determined by a trial patch.
- 8.4 The quantity of mixing water shall be no more than necessary for handling and placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel without addition of water until it has reached the stiffest consistency that will permit placing.
- 8.5 After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, it shall be left undisturbed for a least one hour before being finally finished. The patched area shall be kept damp for seven days. Metal tools shall not be used in finishing a patch in a formed wall which will be exposed.
- 8.6 Tie Holes: After being cleaned and thoroughly dampened, the tie holes shall be filled solid with patching mortar.
- 8.7 Proprietary Materials: If desired by the Contractor, proprietary compound for adhesion or as patching ingredients may be used in lieu of or in addition to the foregoing patching procedures. Such compounds shall be used in accordance with the manufacturer's recommendations and shall be Standard Dry Wall products, or approved equal.

9. CURING AND PROTECTION

- 9.1 General: Exposed surfaces of concrete shall be protected from premature drying and excessively hot or cold temperatures for the period of time necessary for the hydration of the cement and proper hardening of the concrete.
- 9.2 Curing: Initial curing shall immediately follow the finishing operation. Concrete shall be kept continuously moist at least for 24 hours by one of the following materials or methods:
 - 9.2.1 Ponding or continuously sprinkling.

- 9.2.2 Absorptive mat or fabric kept continuously wet.
- 9.2.3 Sand or other covering kept continuously wet.
- 9.3 Immediately following the initial curing and before the concrete has dried, final curing shall be accomplished by one of the following materials or methods:
 - 9.3.1 Continuation of method used for initial curing.
 - 9.3.2 Waterproof paper conforming to "Specifications for Waterproof Paper for Curing Concrete", ASTM C171.
 - 9.3.3 Other moisture retaining coverings as approved by the Owner.
- 9.4 The final curing shall continue for a cumulative number of seven days, not necessarily consecutive, during which the temperature of air in contact with the concrete is above 50°F. If high-early-strength cement has been used, the final curing shall continue for a total of three days. When the mean daily temperature of the atmosphere is less than 40°F., the temperature of the concrete shall be maintained between 50°F. and 70°F. for the required curing period. When necessary, arrangements for heating, covering, insulating or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature and moisture conditions without injury due to concentration of heat or carbon dioxide build up.
- 9.5 During hot weather, arrangements for installation of windbreaks, shading, spraying, sprinkling, ponding or wet covering shall be made in advance of placement and such protective measures shall be taken as quickly as concrete hardening and finishing operations will allow.
- 9.6 Changes in temperature of the concrete shall be as uniform as possible and shall not exceed 5°F. in any one hour or 50°F. in any 24-hour period.
- 9.7 Protection From Mechanical Injury: During curing the concrete shall be protected from damaging mechanical disturbance, heavy shock or excessive vibration. All finished surfaces shall be protected from damage caused by construction equipment, materials or methods and rain or running water.
- 9.8 Temperature & Shrinkage Cracks: Temperature and shrinkage cracks which develop prior to the final acceptance of the structure by the Owner shall be repaired and waterproofed as specified herein and other applicable parts of the Specifications.
- 10. TESTING
 - 10.1 General: The Contractor shall keep a log identifying the exact locations of poured concrete represented by each test cylinder and shall furnish two copies of the test reports and logs to the Owner as they become available.
 - 10.2 All strength tests shall be performed by a reputable testing laboratory hired by the Contractor at his expense. The costs of performing all strength tests as specified herein shall be borne by the Contractor and no extra compensation will be allowed.
 - 10.3 Slump Tests: Slump tests will be routinely performed, and shall conform to "Standard Method of Test for Slump of Portland Cement Concrete", ASTM C143.
 - 10.4 Strength Tests: Test cylinders shall be taken by the Contractor and shall be cured and tested in accordance with the "Standard Method of Making and Curing Concrete Compressive and Flexural Strength Test Specimens in the Field", ASTM C31. Not less than three specimens shall be made for each 20 cubic yards of concrete or fraction thereof in each day's pour, except that in no case shall a given mix design be represented by less than five tests. The standard age of test shall be 28 days, but 7-days tests and 14-day tests may be used provided that the relation between the 7-day, 14-day and 28-day strengths of the concrete is established in advance by test for the materials and proportions used. If the Contractor desires, extra cylinders may be made and tested for the purpose of indicating sufficient concrete strength for form removal or other purposes. If the average of the strengths of the test cylinders fail to obtain the specified strength so as to justify doubt as to the quality of the concrete, further tests shall be made at the Contractor's expense, of the concrete in place to determine its fitness to remain in the structure. These tests shall be performed in accordance with the "Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete", ASTM C42. The strength level of the concrete will be considered acceptable if the average of three, 28-day test strength results equal or exceed the specified compressive strength and no individual tests fall below the specified compressive strength by more than 200 psi.
 - 10.5 Air Content Tests: Air content tests may be requested by the Owner at his discretion and shall conform to the "Standard Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method", ASTM C173 or the "Standard Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method", ASTM C231. The Contractor shall provide all necessary equipment, materials, sampling, and testing.
- 11. GROUT
 - 11.1 General: This item includes furnishing, placing and finishing the grout for the manhole covers and other locations

as required.

11.2 Materials: Materials are specified herein.

11.3 Proportioning & Mixing: Grout shall consist of a mixture of 1 part portland cement and 2 parts fine aggregate with a slump of three inches to five inches. The water-cement ratio shall be maintained at not more than 4½ gallons per bag of cement. The ingredients shall be mixed in accordance with the applicable portions of this Specification so as to produce a uniform mass of material.

11.4 Placing: Before placing grout, the concrete shall be thoroughly cleaned of all dust, dirt or other deleterious material and then shall be thoroughly wetted. Grout shall be placed in one continuous operation to the thickness shown on the plans with no construction joints allowed.

11.5 After the grout is placed, it shall be given a floated finish as specified in this Specification and shall be cured as specified under Section 9 of this Specification.

12. CURING & PROTECTION DAMPPROOFING

12.1 General: The following areas shall be dampproofed as specified herein:

12.1.1 Slab on grade for all buildings.

12.1.2 Basement floor slabs and floor slabs below grade.

12.2 Dampproofing: Dampproofing for all floor slabs specified above shall be by the installation of a 4 mil. thickness polyethylene vapor barrier installed in accordance with the manufacturer's recommendations. Before placing the vapor barrier, a layer of sand shall be placed over the granular fill to protect the vapor barrier from damage during concrete placement.

1. GENERAL

- 1.1 Description: The work of this section consists of furnishing and using materials and procedures for air-entrainment of and/or addition of chemical admixtures to concrete.

2. MATERIALS

- 2.1 Air-entrainment Admixtures: Air-entrainment shall be accomplished by the use of Type 1 portland cement with the addition of an approved air-entrainment admixture or by the use of Type 1A portland cement. Air-entrainment admixtures shall conform to "Standard Specifications for Air-Entraining Admixtures for Concrete", ASTM C260.
- 2.2 Water Reducing, Retarding, and Accelerating Admixtures: Water reducing, retarding, or accelerating admixtures, if permitted by the Owner, shall conform to "Standard Specifications for Chemical Admixtures for Concrete", ASTM C494.
- 2.3 Fly Ash: Fly ash may be allowed as an admixture in the concrete mix provided the following requirements are satisfactorily addressed.
- 2.3.1 Its use is in strict accordance with ASTM C618, latest revision;
- 2.3.2 Fly ash shall be sampled and tested in accordance with ASTM C311, latest revision;
- 2.3.3 Prior to being approved for use, fly ash shall be tested in combination with the cement and aggregates proposed for use to ascertain its suitability with regard to water requirements, strength development, shrinkage, heat of hydration, and durability.

3. EXECUTION

- 3.1 Water Reducing, Retarding, and Accelerating Admixtures: Such admixtures may be used when such use is requested by the Contractor subject to review and approval by the Owner. For certain uses, the Owner reserves the right to require the use of a retardant or other admixtures for specific uses such as a retardant in extensive wall pours to assure elimination of cold joints or for other such purposes. No additional compensation will be allowed when such admixtures are used. However, when certain such admixtures are used, it will be allowable to reduce the cement content of the mix to a minimum of 5 ½ bags of cement per cubic yard of concrete, subject to the following conditions: A trial batch and test cylinders taken therefrom demonstrate that the mix will meet the strength, workability, slump, and durability requirements of the specified mix previously herein stated. The strength shall be determined from seven-day test cylinders from a trial batch utilizing the admixture and made using the aggregates selected for the job, to establish the correct proportions to give proper workability with the water-cement ratio specified. The seven-day test strength shall equal 95 percent of the specified minimum 28-day strength.
- 3.2 Air-entraining and chemical admixtures shall be charged into the mixer as a solution and shall be dispensed by an automatic dispenser or similar metering device. Powdered admixtures shall be weighed or measured by volume as recommended by the manufacturer. The accuracy of measurement by any admixture shall be within ± three percent.
- 3.3 Two or more admixtures may be used in the same concrete, provided such admixtures are added separately during the batching sequence and provided further that the admixtures used in that combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other.
- 3.4 Addition of retarding admixtures shall not be significantly delayed after the addition of the cement.
- 3.5 The addition of calcium chloride to the mix will not be allowed.