2015 STANDARD SPECIFICATIONS FOR CONSTRUCTION

CITY OF ROYAL OAK, MICHIGAN

Royal Oak
COMMUNITY
DEVELOPMENT

www.romi.gov

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April 8, 2015

TO ALL PROSPECTIVE BIDDERS

The 2015 Edition of the **"Standard Specifications for Construction"** is hereby issued by the City of Royal Oak, Michigan, in an effort to ensure the use of uniform, adequate and acceptable construction methods and materials.

Copies may be obtained from the city website at: www.romi.gov/169/Engineering

These specifications have been formatted for double-sided printing.

These standards will be used for all work performed in City of Royal Oak Public Right of Way and, Engineering Projects, for work and materials placed under Permit or Contract after April 8, 2015.

CITY OF ROYAL OAK

Matthew J. Callahan, P.E.
City Engineer

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CITY OF ROYAL OAK, MICHIGAN

2015 STANDARD SPECIFICATION FOR CONSTRUCTION

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CITY OF ROYAL OAK

ADDRESSES / PHONE NUMBERS

ADDRESSES

ROYAL OAK CITY HALL
211 WILLIAMS STREET
ROYAL OAK, MICHIGAN 48067

ROYAL OAK DEPARTMENT OF PUBLIC SERVICE
600 N. CAMPBELL ROAD
ROYAL OAK, MICHIGAN 48067

SOUTHEASTERN OAKLAND COUNTY WATER AUTHORITY
3910 W. WEBSTER ROAD
ROYAL OAK, MICHIGAN 48073

PHONE NUMBERS

R.O. POLICE MAIN DESK..... 248.246.3500

R.O. FIRE MAIN DESK..... 248.246.3800

ENGINEERING DEPARTMENT 248.246.3260

DEPARTMENT OF PUBLIC SERVICE..... 248.246.3300

SOUTHEASTERN OAKLAND COUNTY
WATER AUTHORITY 248.288.5150

MISS DIG (underground utility staking)..... 1.800.482.7171
or 811

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STANDARD INSTRUCTIONS TO BIDDERS

1. **GENERAL PURPOSE AND INTENT**: These "Standard Instructions to Bidders" contain information and requirements pertinent to the proposed work. Such instructions and requirements apply to this Contract except as may be modified and supplemented by specific requirements contained elsewhere in these Contract Documents.

In addition to these instructions, the "Advertisement" and "Special Instructions to Bidders" contain information for bidders. Bidders must familiarize themselves with all provisions of the Contract Documents and their effect.

2. **THE CONTRACT DOCUMENTS**: The Contract Documents consist of the material outlined in Paragraph 1.01 of the "General Conditions".

In addition to the above, any and all Addenda become a part of the Contract Documents.

In the process of assembling and binding the Contract Documents, individual pages or drawings may have been inadvertently omitted. Each bidder shall carefully examine his copy of the Contract Documents for completeness, for no claim of any bidder will be allowed on the basis that his copy of the Contract Documents was incomplete.

Titles, sub-titles, headings, running headings and tables of contents as used throughout the Contract Documents are merely for convenience and in themselves are not a contract provision or requirement and are not to be taken into account in any way in construing any of the rights or obligations of the parties to the Contract.

3. **INTERPRETATION OF CONTRACT DOCUMENTS**: Should any prospective bidder be in doubt as to the true meaning of any portion of the Contract Documents, or should he find any patent ambiguity, inconsistency, or omission thereon, he shall request the Engineer, in writing, for an official written interpretation or correction. The person making the request will be held responsible for its prompt delivery.

Such interpretation or correction will be made only as an Addendum which will be mailed or delivered to each person recorded as having received a copy of the Contract Documents.

Only the Addenda duly issued by the Engineer shall be binding. Prospective bidders are cautioned that oral interpretation, information, or instructions by any officer or employee of the owner or Engineer is not authorized.

4. **BIDDER'S EXAMINATIONS AND INVESTIGATIONS**: The prospective bidder shall carefully and thoroughly examine all parts of the Contract Documents with maps, drawings, and other data mentioned therein as being on file in the Owner's or Engineer's office for examination.

The bidder shall make an inspection of the site of the proposed work as well as its adjacent area, and determine for himself all conditions under which he will be obligated to work.

No plea of ignorance of conditions that may exist or that may hereafter exist, or of difficulties that may be encountered in the execution of the work under this Contract, as a result of the bidder's failure to make prudent examinations and investigations, will be accepted as an excuse for any failure or omission on the part of the Contractor to fulfill in every detail all requirements of the Contract Documents, nor will same be accepted as a

basis for a claim for extra compensation, damages, or for an extension of he time of completion.

5. **LABOR AND MATERIAL**: The bidder shall make his own investigation as to the availability of labor needed and the wage rates which will have to be paid in the prosecution of the Contract. No claim for extra cost or damages shall be made or allowed because of shortages of the required labor or any change in the wage rates which the Contractor is required to pay.

The bidder shall make his own investigation and determination of the probable availability of the required materials in the amounts and at the times necessary to complete the work within the time allowed for completion.

6. **BIDDER'S QUALIFICATIONS**: Bids are solicited only from responsible bidders known to be skilled and regularly engaged in work of similar character and magnitude to that covered by the Contract Documents.

7. **BIDDER'S REQUIREMENTS**: The following requirements **shall** be provided with the bid:

A. Address and description of bidder's place of business.

B. Five references of similar jobs. The references shall include a one sentence job description, the year of work, and the owner's representative name, title and phone number.

The successful low bidder will be required to provide documentation of having performed this type, quantity item / volume or dollar amount of work for a Public Agency (Village, City, or County) in the past two (2) years.

C. A detailed Construction Schedule showing all major items of work including 24 hour emergency call out numbers. The Construction Schedule shall include staffing to be used by the Contractor in the execution of the Contract and shall include but not be limited to the following:

1. Start and End date for the work
2. Intermediate milestone dates required by Contract
3. Sequence of work with specific geographic locations
4. Crews to be assigned to the work
5. Number of men in each crew
6. Contractor shall indicate crews on construction schedule.

D. Equipment to be on site and used on the project.

E. Itemized list of equipment available for use on the project.

F. List of contracts on which the bidder is currently engaged.

G. List of names of proposed subcontractors to be used on the project.

H. Such additional information as will satisfy the owner that the bidder is adequately prepared, in technical experience and otherwise, to fulfill the Contract.

8. **JOINT BIDDING**: A bid submitted by two or more parties will be considered as a joint bid. When bidding jointly, each party will be jointly and severally responsible for the total amount of the bid and the costs. The bidders shall state their bid is a joint bid and list all parties involved.

9. **FORM OF PROPOSAL**: All Proposals are to be made upon the Form of Proposal provided with bid documents, of which additional copies may be obtained at the office of the City Engineer. Proposals must be made in full conformity to all the conditions as set forth in the bid documents.

10. **PREPARATION OF PROPOSALS**: Proposals must be carefully prepared in strict accordance with these instructions; otherwise, the bid may be rejected and not considered in the award of the Contract. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

The Form of Proposal (FOP) supplied shall be used and shall be submitted intact as originally bound. No changes shall be made in the working of the form or in any of the items mentioned therein. Proposals shall be filled out legibly in ink. Erasures or other changes in the bid shall be explained or noted over the signature of the bidder. Failure of the bidder to submit the required information or the submission of information in an incomplete form **may be cause for rejection of the entire proposal**.

Any stipulation or qualification contrary to the Contract requirements made by the bidder in his FOP as a condition for the acceptance of the Contract will not be considered in the award of the Contract and may cause the rejection of the entire Proposal.

When the FOP provides for evaluated bids, full information shall be supplied and computations shall be made by the bidder in accordance with the manner and method provided for in the Proposal. If, during the review of the FOPs, the Engineer reserves the right to make the necessary corrections, including the changing of any values used in the computations found to be at variance with the basic information or data furnished by the bidder. On unit price proposals, quantities shown shall be extended at the unit price given by bidder to verify the total cost of item.

If the bid is signed by an individual acting as an agent for the principal in whose name the FOP is submitted, in addition to the above applicable requirements, there shall be attached to the proposal a power-of-attorney evidencing authority of the individual to sign and submit the bid in the name of the designated principal.

11. **SUBMITTING PROPOSAL**: The Form of Proposal shall be submitted in the bound documents together with the required bid deposit. These documents shall be securely sealed in the envelope furnished, labeled with the title of the project as shown on the cover sheet of these Contract Documents, the date and time of bid opening and the bidder's name and address.

Bids will be received until the time stated in the "Advertisement" or until the time as extended by Addenda. Bids may be delivered in person or mailed, but delivery is the

bidder's entire responsibility. Any bid received after the stated hour, even through the mail, will be returned unopened to the bidder.

Bids received prior to the scheduled time for receipt of bids will be kept securely, unopened. Bidder may not withdraw his bid after the hour of opening. See Item 21 "Withdrawing Proposal" for more information.

12. **PRICES BID**: The prices shall cover costs of any nature, incident to and growing out of the work, in explanation, but not in limitation thereof the prices stated in the proposal by the bidder, shall include the cost of everything necessary for the performance and completion of this Contract in the manner and time prescribed, including the furnishing of all materials, tools, equipment, transportation, labor, supervision, all costs on account of loss by damage or destruction of the work and unforeseen difficulties encountered, for settlement of damages, for replacement of defective work and materials, and for all else necessary therefore and incidental thereto.

All items of work in the Contract will be measured and paid at the units and prices shown on the Form of Proposal (FOP). The miscellaneous items not shown on the FOP such as clean-up, etc. will be considered as included as part of the Contract and done at no extra cost to the City.

13. **LEGAL STATUS OF BIDDERS**: The legal status of the bidder, whether corporation, partnership, or individual, shall be stated in the Proposal. A corporation bidder shall give the state in which incorporated; a partnership bidder shall give the full names of all the partners. Partnership and individual bidders will be required to state in the Proposal the names of all persons interested therein.

14. **ADDRESS OF THE BIDDER**: The place of residence of each bidder, or the office address in the case of a firm or company, with county and state, must be given after his signature.

15. **AGENCY**: Anyone signing a proposal as an agent of another or others must submit with his proposal evidence of his legal authority to do so.

16. **BID DEPOSITS**: Each Proposal shall be accompanied by a certified check or a Bid Bond by a recognized surety company, similar to a U.S. Government Standard Form Bid, in the amount of five percent (5%) of the amount of the bid, payable to the City of Royal Oak, Michigan, to be forfeited to said City in case of failure on the part of the successful bidder to enter into the attached form of agreement to do the work covered by such proposal at the price and within the time stated therein. The bid deposit of the three lowest acceptable bidders will be returned within 48 hours after the executed Contract has been finally approved by the City. The bid deposit of the other bidders shall be returned within 48 hours after the bids are opened.

17. **AWARD OF CONTRACT**: The Contract will be awarded to the lowest responsible bidder complying with the requirements of the Contract Documents. Provided his bid is reasonable and the best interest of the subdivided among two or more bidders on designated parts of the work listed in the Form of Proposal (FOP) when the total of the lowest responsible bid for the individual parts is less than the lowest responsible bids for the entire work. A Contractor shall bid on all items/parts listed in the FOP.

The Contract, with the City, will be awarded after the formal approval of the governing body, and written notice issued by the City to the intended awardee. The Contract will not, however, be valid or binding upon the City until the "Agreement" has been duly executed by both parties, the surety bonds and evidence of insurance furnished and the executed Contract Documents have been endorsed and confirmed in accordance with the specific City Charter and/or Ordinance.

18. **EXECUTION OF THE CONTRACT**: The bidder to whom the Contract is awarded will be required to execute the Contract and to furnish Certificates of Insurance and Bonds as hereinafter specified, within ten (10) days (Sunday and legal holidays excluded) after the award and, in the case of his refusal or failure to do so, he may be considered by the City to have abandoned his right and interest in the Contract, and his certified check or Bid Bond may be declared to be forfeited to the City, and the Contact may be awarded to another.

19. **BONDS**: The successful bidder will be required to execute the bonds, on the forms included in this section, with sureties acceptable to the City; one bond to be executed to the City and to be conditioned for the faithful performance and fulfillment of the Contract work for a period of one (1) year after the date of the final Contract payment estimate. The other bond to be executed to the People of the State of Michigan and to be conditioned for the payment of all labor and materials used in the work and the protection of the City from all liens and damages arising there from; each of which bonds shall be based on the total amount of the Contract as calculated at the time the bids are received.

In the interest of insuring compliance with the Contract, the RFP, the Zoning Ordinance and any other applicable standard or provision, protecting the natural resources and health, safety and welfare of the residents of the City of Royal Oak and future users or inhabitants of the area for which this RFP is being issued, the City of Royal Oak shall require the successful bidder to deposit a performance guarantee as set forth herein.

The purpose of the performance guarantee is to insure completion of the improvements required in the RFP including but not limited to streets, lighting, utilities, sidewalk drainage, fences, screens, walls and landscaping.

Performance Guarantee Bond as used herein shall mean **a cash deposit or certified check, irrevocable bank letter of credit (ILOC) in the amount of 125% of the estimated cost of the improvements to be made**, as determined by the applicant and verified by the City, provided, however, all amounts required to be deposited in excess of $100,000 may be in the form of a corporate surety bond approved as to form and substance in the City Attorney's discretion.

A letter of credit and corporate surety bond shall cover a time period equal to or longer than the time set in the building permit, and shall require 30 days advance notice to the City Attorney prior to its termination.

The City shall be authorized to employ the City Engineer and Building Official to review cost estimates and conduct periodic inspection of the progress of improvements.

Irrevocable Letter of Credit (ILOC) shall include the following provisions:

A. The ILOC shall be automatically renewing and be valid for the duration of the contract until closed out;

B. The ILOC shall allow partial draws;
C. The ILOC shall list the Contract name and number that the bond is covering in the draw statement but NOT any specific operation, location or project;
D. The ILOC shall include provisions for draws to be made "**via mail or courier**";
E. The ILOC shall not include any language that conflicts with any provision of the contract.

PERFORMANCE, MAINTENANCE AND GUARANTEE BOND

KNOW ALL MEN BY THESE PRESENTS, THAT WE _____,
Contractor, as Principal, and _____ as surety, are held and firmly bound unto the City of Royal Oak, Michigan (hereinafter called the CITY) in the sum of:_____ Dollars ($_____) to be paid to the CITY for which payment well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally to those presents.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT,

WHEREAS, the above named Principal did on the _____ day of _____, 20_____ by articles that date, enter into a Contract with the CITY for the _____.

NOW THEREFORE, if the said Principal shall save and hold harmless the said CITY from all public liability and damages of every description in connection therewith, shall well and faithfully in all things fulfill the said Contract according to all the conditions and stipulations therein contained, in all respects, and shall save and hold harmless the said CITY from and against all liens and claims of every description in connection therewith and for a period of one year after the completion of the work upon certification of the Engineer shall replace all work performed and materials furnished that are not performed or furnished according to the requirements of the Contract and make good all defects thereof which shall become apparent before the expiration of said period of one year, then the obligation shall be void and of no effect, but otherwise it shall remain in full force and virtue, and in the event that the said CITY shall extend the time for the completion of said work or otherwise modify elements of the Contract in accordance with the provisions thereof, such extension of time or modification of the Contract shall not in any way release sureties on this bond.

NOW THEREFORE, the Principal guarantees that for a period of one (1) year from the date of the final estimate he will, without cost to the CITY, keep in good order and repair any defect in the work done under said Contract by his employees, agents, subcontractors, or material suppliers, that may develop during said time due to improper materials, defective equipment, workmanship or arrangements, and that he will likewise restore to good condition any work disturbed while correcting such defects, excepting only such part or parts of said work which may have been disturbed without his consent or approval after acceptance thereof by the CITY: and that whenever directed to do so by the CITY, through written notice served personally or by mail upon the Principal at

_____ or upon the Surety (Sureties) at _____, he will proceed at once to make the repairs specified, and in case of failure to do so, within one week from the date of service of said notice or such additional time as may be fixed therein the CITY shall have the right to purchase such materials and employ such labor and equipment as may be necessary to undertake, do and make such repairs, and to be reimbursed by the Principal or Surety (Sureties) for the full expense thereof. If it is necessary to make any repair or set a barricade at once to protect life and property, the CITY may take such action immediately without notice to the Principal or Surety (Sureties). The CITY shall not be obligated to obtain the lowest bids for doing the work, or any part thereof, but all sums actually paid therefor shall be reimbursed by either the Principal or Surety (Sureties). In this connection, the judgment of the CITY shall be final and conclusive. If the Principal, for a period of one (1) year from the date of the final estimate, shall keep the work done under the aforesaid Contract in good order and repair, excepting only such part or parts of said work which may have been disturbed without his consent or approval after acceptance thereof by the CITY, and shall, whenever given notice as herein provided, immediately proceed to make specified repairs, or, in default thereof shall reimburse the CITY for expenses incurred in making such repairs, and shall fully indemnify, defend and save the CITY harmless from all suits and actions for damages of every name and description brought or claimed against it, for or on account of any injury or damage to person or property received or sustained by any party or parties, by or from any of the acts or omission or through the negligence of the Principal's employees, agents, subcontractors or material suppliers in the performance of the work required by said Contract, and from any and all claims arising under the Workers' Compensation Act of the State of Michigan, as amended, then the above obligation shall be void, otherwise to remain in full force and effect.

IN WITNESS THEREOF, the parties herein have caused this instrument to be executed by their respective officers this _____ day of _____, 20_____.

Signed, Sealed and Delivered
in the presence of:

_____ _____(Seal)

_____ _____(Seal)
Principal

BOND CORRECT AS TO FORM:

_____ _____(Seal)
Mark Liss
Interim City Attorney

Performance Bond
(Maintenance Stipulation)

LABOR AND MATERIAL BOND

KNOW ALL MEN BY THESE PRESENTS, that we _____, Contractor, as Principal, and , as Surety, are held and firmly bound unto the City of Royal Oak, Michigan (hereinafter called the CITY) in the sum of _____ Dollars ($_____) to the payment whereof, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally to these presents.

THE CONDITION OF THIS OBLIGATION is such that:

WHEREAS, the above named Principal did on the _____ day of _____, 20_____, by articles that date, enter into a Contract with the CITY for the _____.

AND WHEREAS, this bond is given in compliance with and subject to the provisions of Act No. 187 of the Public Acts of Michigan (1905) as amended, the same being sections 570.101 to 570.105 inclusive, of the Compiled Laws of the State of Michigan for 1948 and P.A. 213 (1963), as amended.

NOW THEREFORE, if the above named principal, legal representatives, or successors shall pay or cause to be paid to all subcontractors, persons, firms and corporations as the same may become due and payable, all indebtedness which may arise from said principal to a subcontractor, to any person, firm or corporation on account of any labor performed or materials furnished in connection with the Contract, construction and work herein referred to, then this obligation shall be void; otherwise to remain in full force and effect.

This bond is given upon the express condition that any changes, alterations, or modifications that may be hereafter recorded or made in the construction and complete installation of the work herein referred to, or the placing of an inspector or superintendent thereon by the CITY shall not operate to discharge or release the sureties thereon.

IN WITNESS THEREOF, the parties hereto have caused this instrument to be executed by their respective officers this _____ day of _____, 20_____.

Signed, Sealed and Delivered
in the presence of:

_____ _____(Seal)

_____ _____(Seal)
Principal

BOND CORRECT AS TO FORM:

_____ _____(Seal)
Mark Liss
Interim City Attorney

Labor and Material Bond

20. **RIGHT TO REJECT AND TO WAIVE DEFECTS**: The City reserves the right to reject any or all Proposals, and to waive any defects or irregularity in any Proposal if it appears to be in the best interest of the City to do so.

21. **WITHDRAWING PROPOSAL**: A Proposal after being submitted may be withdrawn when request therefore is made in writing by the bidder before the time designated in the Advertisement for the opening of the Proposals.

22. **CONSTRUCTION SCHEDULE**: The Construction Schedule submitted by the Contractor is subject to the approval of the Engineer. The Engineer may revise the Construction Schedule when he determines it is in the best interest of the City. Construction Schedule changes are incidental to the Contract and shall be made at no increased cost to the City.

23. **SUNDAY AND HOLIDAY WORK**: In general, no work shall be performed pursuant to this Contract on Sunday and holidays except work of an emergency nature that is necessary in order to safeguard life and property. Permission must be obtained in advance from the City Engineer for Sunday and holiday work. The Contractor shall notify the City Engineer in writing at least two days in advance concerning work that he plans to perform on Sunday and / or holidays.

24. **TAXES**: All Federal, State, and Local Taxes, when applicable, shall be included in the Proposal and shall be paid by the Contractor.

25. **MISS DIG NOTIFICATION**: It will be the responsibility of the Contractor to notify utility companies 72 hours prior to excavating, by calling Miss Dig at 1.800.482.7171 or 811. It is the Contractor's responsibility to protect and maintain MISS DIG markings or stakes once placed by the utility, and comply with Public Act 53, Public Acts of 1984 (Miss Dig Law), and any amendments to that act.

26. **PROJECT AND CONSTRUCTION SIGNING & BARRICADING**: The Contractor shall provide all signing and barricading required to perform the work specified in this Contract and shall be removed immediately after work is complete. This work shall be done in accordance with **Public Act 315 of 2003 effective April 8, 2004**, the provisions of Sections 104.11 and 812 of the MDOT 2012 Standard Specifications for Construction, and signing shall conform to the current edition of the **Michigan Manual of Uniform Traffic Control Devices** (MMUTCD) except as otherwise specified herein.

In addition to working only one side of the street, the Contractor shall perform his work in such a manner so as to keep the street open to traffic. The Contractor shall utilize a sufficient number of traffic regulators to maintain one lane of traffic in each direction as a minimum traffic requirement on major roads. The traffic regulator material shall be maintained during and after working hours or until, in the judgment of the Engineer, the roadway is ready to be opened to traffic. Traffic regulator material shall consist of traffic cones, Type II and Type III Lighted Barricades. Arrow Panels may be required with required lane tapers per MMUTCD. Traffic Regulating Personnel (flagger) will be required, when their use is directed by the Engineer. All traffic control shall be in compliance with the MMUTCD and as directed by the Engineer. "Road Work Ahead" signs (W20-1) shall be posted on streets and all abutting streets affected by construction. "Fresh Tar" signs (W21-2) shall be posted prior to prime coating all roads.

The addition of "Road Closed to Thru Traffic" (R11-4) signs placed along the construction zone may be required. Additional signs may be required as directed by the Engineer once the project begins. "Road Closed" and "Road Closed to Thru Traffic" signs shall be placed on Type III barricades at side street locations as directed by the Engineer. All traffic control work not specifically covered as a pay item shall be considered as part of the Contract, construction signing and barricading shall be included as part of the Contract unless bid as a separate contract item to the Contract and shall be provided and maintained at no increased cost to the City.

27. **SWEEPING TO BE DONE BY THE CONTRACTOR**: The Contractor shall be required to wash and sweep all streets that he has paved, excavated or disturbed, as well as those over which he has hauled excavated material. The Contractor shall not rely upon hiring the City to do it for him. The Contractor shall water street pavement with a truck, tank or hoses from approved fire hydrants, then sweep with a mechanical pick-up type street cleaner approved by the Engineer. This material shall be hauled to an approved dump site. Paved surfaces shall be swept as often as necessary as directed by the Engineer. This sweeping shall be included (unless bid as a separate item) as part of the Contract and shall be performed at no increased cost to the City.

28. **ASPHALT SURFACE & CURB**: The removal and disposal of asphalt surface over gravel and of asphalt curb will be considered the same as earth excavation and no extra allowance will be made. Where concrete pavement which has been resurfaced with asphalt is to be removed, payment will be made for the number of square yards of concrete pavement removed and no additional allowance will be made for the asphalt surfacing. In either case, the Contractor is expected to exercise the care necessary to avoid damage to that portion of the asphalt or concrete pavement which is to remain in place. **Any damage beyond the limits of the work shall be restored at the expense of the Contractor by a method approved by the Engineer.**

29. **STAKES AND MARKS**: Unless shown in Contract Documents, the Contractor shall furnish substantial stakes and marks conveniently placed showing the location and elevation of the various parts of the work. No work shall be undertaken until such marks and stakes have been set by the Contractor. The Contractor shall take due and proper precautions for the preservation of these marks and stakes and shall see to it that the work at all time proceeds in accordance therewith.

If it shall become necessary to replace any mark or stake due to failure of the Contractor to take proper precautions for its preservation, or because of carelessness upon the part of his employees, or those of his subcontractor, or suppliers of materials the Contractor will replace the mark or stake with no increased cost to the City.

30. **MEASUREMENTS**: Due and proper measurements shall be taken by the Engineer during the progress of the work, or any part thereof, either before or after commencement of construction. If such alterations diminish the quantity of the work to be done, they shall not warrant any claim for damages of or for anticipated profits on the work to be dispensed with; if such alterations increase the amount of the work to be done such increase shall be paid for according to actual quantity done at the contract unit price stipulated for such work on the Proposal.

The City reserves the right to increase or decrease any quantity given in the Contract which the City determines is in its best interest during the construction of the project with no change in the contract unit price for the work.

31. **NOTICE OF INSPECTION**: The Contractor shall give the Engineer written notice forty-eight (48) hours (minimum) in advance of the manufacture and delivery of materials and beginning of construction for the purpose of proper and timely inspection. Materials may be inspected at the point of manufacture, or upon delivery as the Engineer may decide.

32. **PUBLIC SAFETY AND CONVENIENCE**: Protection of life and property are of the first importance and shall be provided for by the Contractor in an adequate and satisfactory manner. The Contractor shall also conduct his work with the least possible obstruction or inconvenience to pedestrian, vehicular and other traffic as well as to utilities, business enterprise, the general public and the residents and property owners affected by the work being done under this Contract. The Contractor shall properly barricade any materials, equipment debris and obstructions.

33. **PROTECTION OF EXISTING SURFACE AND UNDERGROUND STRUCTURES**: The Contractor shall protect, secure and support existing pavements, driveways, sidewalks, curbs, poles, foundations, sewers, drains, gas mains, water mains, house services and any other surface or underground structures so as to avert their being damaged through his operations, and he shall repair or replace any damage caused through his operations so that at the completion of the work, the condition of existing surface and underground structures shall be as safe and permanent as before the Contractor commenced his work. The Contractor shall indemnify, defend and save harmless the City and the Contractor shall indemnify, defend and save harmless the City and the Owner of the surface or underground structures against all damages or alleged damage to any such structures damaged as a result of his work. The Contractor shall not start with his work until he has made diligent inquiry at the proper offices of the City, the Utility Companies, Owners and other authorities to determine the location of any underground structures. Although the City will assist in locating underground structures as far as its records are concerned, the Contractor shall assume full responsibility as to determining the locations, it being understood that the information as given is the best available at the time.

If it shall become necessary to remove or change the location or grade of any pipes, structures or utilities, by reason of the construction of the work, the Contractor shall, in writing, notify the Engineer, the Utility Companies and other authorities, which may be affected, at least 72 hours previous to commencing the work at the point or points affected; or on failing to do so, any damage or injury which may result shall be repaired immediately by the City or the owners of such structures or utilities, and the cost thereof charged against the Contractor.

The Contractor shall maintain in continuous and effective service all sewer, drains and water courses touched during the progress of the work. If it shall become necessary, temporarily, to divert or obstruct the flow of any such sewer, drain or water course, written consent must first be obtained from the Engineer and the Contractor shall assume full responsibility for the consequences. Any sewer, drain, or water course disturbed during construction shall be restored to its original condition at the expense of the Contractor.

34. **STORAGE OF MATERIAL, ETC.**: Materials, tools and equipment shall not be distributed upon or near the site of the work in such manner as to obstruct traffic or cause unnecessary inconvenience. All materials and equipment shall be properly barricaded. The Contractor shall be held responsible for all materials until they are finally incorporated into the work and accepted. He shall be held responsible for and make good any damage done by reason of the storage of tools, materials and equipment. The Contractor shall not rely on the City to provide storage area(s) for equipment and materials.

35. **CARE OF HYDRANTS**: The Contractor shall be held responsible for the care of hydrants used during the scope of work and shall see that they are properly opened and closed. Hydrant wrenches shall be provided by the Contractor and shall be used to open and close hydrants. Hydrants shall be opened and closed slowly to prevent disturbance in the system. **The Contractor shall after use of a Hydrant, pump out the Hydrant during the period October through May**. Whenever possible, a space of ten feet in the clear shall be maintained around fire hydrants and all materials accumulated during the progress of the work shall be promptly removed.

The Contractor shall first obtain permission from the Water Department before opening or operating any fire hydrant, and shall pay for any charges for the privilege or for the use of water, or for any damage he has caused to the hydrant.

36. **PROTECTION AGAINST ACCIDENTS**: The Contractor shall provide Traffic Regulating Personnel (flagger), and shall put up and maintain such barriers, barricades and required lighting and take such other precautions as may be necessary as a consequence of his work, to protect life and property, prevent accidents and injury and he shall be liable for all damage occasioned in any way by his acts or his neglect, or by the acts of his agents, employees or workers.

The Contractor, where directed shall erect directionally, detour and closure signs to direct vehicular and pedestrian traffic. All traffic control shall meet the current requirements of the “Michigan Manual of Uniform Traffic Control Devices” and shall be considered incidental to the Contract.

37. **PROTECTION OF TREES, SHRUBS AND PLANTED GROWTH**: Where the work is to be performed adjacent to trees, shrubs or planted growth, ample precautions must be taken to protect the trees, shrubs and planted growth form injury by workers, equipment, or any other cause. Where necessary, in the opinion of the Engineer, trees, shrubs and planted growth shall be fenced in before construction starts, properly cared for, and replaced by the Contractor after his construction is completed. The protection shall be incidental to the Contract. The Contractor shall replace any damaged trees, shrubs or plant material.

38. **PERMITS, CERTIFICATES AND LICENSES**: Unless otherwise noted in the Contract, the Contractor shall obtain all permits, certificates and temporary licenses necessary at his own expense, and shall conduct his work in full conformity with such permits, certificates and temporary licenses. The Contractor shall bear the cost of shutting or closing off and turning on all services of any nature which may be required by his operations. He shall furnish the City, at his own expense, with all necessary inspection certificates.

39. **UTILITIES**: The Contractor shall make arrangements for and shall pay for all connections, extensions and services for electricity, gas, water, sewer and other utilities necessary for the prosecution of the work.

40. **MATERIAL CERTIFICATIONS**: All materials supplied by the Contractor shall be certified in writing by the manufacturer showing that the materials supplied meet the specification of the Contract. Their certification shall include the specification of the material supplied. No work may be done on the project with materials supplied by the Contractor without a written material certification approved by the Engineer.

41. **TESTS AND SAMPLING**: When specified that materials are to be tested they shall be tested at the expense of the Contractor, unless otherwise indicated in the specifications. The Contractor shall provide the necessary facilities for taking samples, shall furnish samples, and deliver them to the testing laboratories as the Engineer may direct. Samples shall be prepared for testing by the Contractor, if so required. Unless otherwise specifically provided, materials and products shall be sampled and tested in accordance with the requirements of the American Society for Testing Materials. The cost to the Contractor in connection with tests and sampling shall be included in the prices bid for the various items scheduled on the Proposal, and no extra allowance will be made.

42. **CONTRACTOR'S EMPLOYEES AND ORGANIZATION**: The Contractor shall employ competent workers, experienced enough to perform their work in a neat and proper manner. Superintendents, foremen, or other supervisory employees shall be competent and authorized to receive and carry out instructions at all times during the progress of the work.

Whenever the Engineer shall inform the Contractor in writing that any man engaged in the work is, in his opinion, disobedient, disorderly, disrespectful, incompetent or intemperate or that a superintendent, foreman or other supervisory personnel refuses, or neglects to comply with the order of the Engineer, they shall be promptly discharged and shall not thereafter be re-employed on the work. The superintendents and number of workers shall be sufficient, in the opinion of the Engineer, to insure completion of the work within the time limited.

When specified in the Contract, the Contractor shall establish and maintain a temporary office for use by the Engineer on the site of the work or provide other facilities at some convenient point thereto, during the continuance of the work. Copies of the plans and specifications shall at all times be kept on file by the Contractor at readily accessible points near the work. The temporary office shall be incidental to the Contract.

43. **PARTIAL USE IN THE WORK**: The City shall have the right to use and place in use, any of the work as soon as the same is available, and such use shall not be considered as an acceptance of the work or any part thereof, nor shall it affect the maintenance period, where such period is called for.

City to do work by other Contractors or by City forces and to permit public utility companies and others to do work during the progress and within the limits of or adjacent to the work included in this Contract. Cooperation with such other parties will be expected by the City so as to cause as little interference as possible with such other work as the Engineer may direct.

The Contractor shall agree and hereby does agree to make no claims against the City for additional payment due to delays or other conditions created by the operations of such other parties. If there is a difference of opinion as to the respective rights of the Contractor and others doing work within the limits of or adjacent to the work being done under this Contract, the Engineer will decide as to the respective rights of the various parties involved in order to secure the completion of the City's work in general harmony and in a satisfactory manner, and his decisions shall be final and binding on the Contractor.

44. **TIME AND SEQUENCE OF WORK**: The order and sequence of the work to be done under this Contract shall be under the general direction of the Engineer who may make such reasonable requirements as may, in his judgment be necessary for the protection of work partially or wholly completed; and to these requirements the Contractor shall strictly conform.

45. **CLEANING UP**: Upon the completion of the work, the Contractor shall clean up and leave in neat condition all the premises that he has occupied during the construction period. The Contractor shall remove from his work area all debris and rubbish, and all unused materials when directed to do so by the Engineer. The Contractor shall remove all equipment, tools, and ground restoration shall be complete before the final estimate is processed.

46. **CUTTING EXISTING PAVEMENT**: Existing pavement, sidewalks, curbs, driveways, gutters, crosswalks and other bituminous or concrete surfaces to be removed shall be removed to the limits shown or as required by the Engineer. Removal work shall be carefully done and to a neat line. Concrete saws or other mechanical equipment approved by the Engineer shall be used in this work.

47. **NOTIFICATION TO FIRE DEPARTMENT**: The Contractor shall notify the Fire Department of the City of Royal Oak (phone 248.246.3800) whenever his construction work shall in any way interfere with the use of a street by fire vehicles. In case of doubt, the City may, in the interests of public safety, notify the Fire Department but such notification shall in no way relieve the Contractor of his responsibility.

48. **USE OF WATER**: When paving or other construction work requires the use of water, the Contractor shall be required to furnish all pipe and fittings and make all connections under the supervision of and in accordance with the requirements of the Water Department. Specific fire hydrants approved by the Engineer will be designated as water sources for the Contractor (See Item 35 "Care of Hydrants"). The Contractor **shall not** request or use private water from private property owners.

49. **PRESERVATION OF MONUMENTS OR TITLE CORNERS**: When monuments, permanent title markers, or street corners are encountered, the Contractor shall not disturb them without the approval of the Engineer. He shall take every care to preserve their locations. If directed by the Engineer, he shall raise or lower them, or enclose them in standard monument castings. When they occur within the sidewalk and pavement area, they shall be relocated or enclosed in monument boxes as a part of the sidewalk and pavement construction, and no extra allowance will be made. For others outside the sidewalk and pavement area, they shall be paid for as extra work. Monuments, permanent title markers or street corners moved without permission of the Engineer shall be relocated or replaced at the expense of the Contractor.

50. **EMERGENCY CALLS**: The Contractor shall provide a 24-hour emergency telephone number with the Construction Schedule. In the event the Contractor is contacted by the City of Royal Oak Police Department or the Engineer to respond to emergency situations, the Contractor shall respond immediately or the City of Royal Oak will proceed with the necessary emergency response and take all action the City deems necessary. The Contractor shall reimburse the City of Royal Oak for all expenses incurred for the emergency response upon receipt of billing.

51. **COMPLAINTS**: The Engineer will investigate all complaints received from property owners regarding work done by the Contractor and / or its subcontractors, and shall also have the right to make investigations on his own initiative. If, in the opinion of the Engineer, any work has not been done in accordance with this Contract and specifications, he shall immediately so notify the Contractor, informing him of the nature of the defect, location, remedies desires and a time limit within which the defect may be remedied. Should the Contractor fail to remedy the defect within the time limit allowed, the Engineer may do so with City forces and deduct the cost thereof from the amount due the Contractor at the time of final estimate; or the Engineer may, in the alternative notify the Contractor to stop all other work under this Contract until the defect has been remedied. The City shall not be required to pay for any work done by the Contractor in violation of any such stop order, and the amount due for any such work shall be regarded as liquidated damages due the City as a result of such breach of this Contract.

52. **CLEANING OF DRAINAGE STRUCTURES**: Manholes, catch basins and other underground structures lying within the limits of the construction shall be kept free of dirt, debris, concrete and all other materials which might cause stoppage or other damages to sewer lines. Contractor shall inspect and clean such structures immediately after the street has been excavated and again as soon as pavement has been placed. In the event that sewer troubles develop, they shall be investigated and repaired by the City. If the investigation reveals that the trouble has been caused by carelessness or failure to take proper precautions for the protection of the sewers and drainage structures on the part of the Contractor and / or subcontractors, their employees, or equipment, the City may deduct the cost of the repairs from the amount due the Contractor at the time of the final estimate.

53. **RESPONSIBILITIES OF CONTRACTOR FOR DAMAGES TO WORK**: The Contractor shall be responsible for any and all damages that the work may sustain prior to its final acceptance. He shall, at his own expense, and as directed by the Engineer, rebuild, repair, restore and make good all injuries and damages to any portion of the work by the action of the elements or from any cause whatsoever including mechanical, human or animal that it may sustain prior to its final acceptance.

54. **PUBLIC UTILITIES**: The Contractor shall check the location and status of all existing utilities within the limits of this project with the Owners before construction is started as a precaution against damaging them in consequence of any act or omission on his part of on the part of his employer or agents. No additional compensation will be paid to the Contractor for any delays, damages, repairs, or other expenses due to existing utilities within the project limits. The Owner of existing poles and other service structures that are within grading or structure limits will move them to locations designated by the Engineer or will remove them entirely from the highway right-of-way.

Owners of public utilities will not be required to move additional poles and structures in order to facilitate the operation of construction equipment unless it is determined by the Engineer that such pole lines or structures constitute a hazard to the public or are extraordinarily dangerous to the construction operation.

55. **CONTRACTOR'S RESPONSIBILITY FOR UTILITY WORK COORDINATION**: The Contractor shall coordinate his work so as not to delay or interfere with other contractors, utility companies and City of Royal Oak forces working in the right-of-way. The Contractor shall make every effort to cooperate with other contractors, utility companies and City of Royal Oak forces working in the immediate area. No compensation whatsoever shall be sought from the City of Royal Oak because of delays due to coordinating with other contractors, utility companies or City of Royal Oak forces working in the right-of-way.

56. **HAUL ROUTES**: The Contractor shall secure permission from the authorities having jurisdiction, for the use of a particular road as a haul route. Loading restrictions shall be observed.

Trucks hauling excavated materials, cement, sand, stone or other loose materials from or to site, shall be tight so that no spillage will occur on adjacent streets (or Haul Routes). Before trucks start away from the site, their loads shall be carefully trimmed, by hand, and covered if necessary.

57. **DRIVEWAYS**: Driveway approaches that are removed shall be temporarily replaced the same day with material approved by the Engineer, as provided for in the Contract, and shall be maintained thereafter.

58. **TREE BORING**: This item of work shall be done as called for on the Construction Plans or as directed by the Field Engineer. All trees eight (8) inches in diameter or less shall require a boring of eight (8) feet long. Trees over eight (8) inches in diameter, measured four (4) feet above the ground surface, shall require a boring of the length of one (1) foot for each inch of tree diameter.

This work shall be done with an approved boring machine. The boring will be done with or without a sleeve, depending on the type of soils, and the diameter of the auger shall not exceed four (4) inches over the outside diameter of the pipe to be installed. The approval of any type of tunneling other than with an approved boring machine shall be denied. The cavity between the outside of the pipe and undisturbed ground shall be sealed at both ends of the bore with 2500 p.s.i. concrete a minimum of eight (8) inches thick.

59. **CONTRACTOR RESIDENT NOTIFICATION AND SIGNING**: The Contractor is responsible for written notification to residents and businesses in construction areas with notices approved by the Engineer.

For construction operation(s) that will require closure of a portion of a road for more than 24 hours, the Contractor or Permittee shall provide written notice of the closure to the occupants of all properties immediately adjacent to the portion of the road that is to be closed at least seven (7) calendar days prior to commencing operation(s). Prior to commencing any operation(s), the Contractor or Permittee shall provide the Engineering

Department with written confirmation that notice has been provided consistent with this Policy.

Signing construction areas for no parking is the Contractor's responsibility. The "No Parking Tow Away Zone" signs will be supplied by the City, however, sign stakes or holders are the responsibility of the Contractor. Trees CANNOT be used as sign posts. Signs must be placed no more than 100 feet apart and no further than 3 feet from the back of curb in construction areas. Signs shall be posted 12 hours before construction begins, and shall be removed following completion of the work.

60. **WINTER CONSTRUCTION**: The City shall have authority to over see the prosecution of work which is contracted to be done during the winter months. The Contractor shall provide adequate weather protection, temporary heating and any other measures which are necessary to ensure that work performed during the winter months is properly installed and protected against damage from freezing.

Permanent pavement replacement shall be limited to the period of April 1st to November 15th or as approved by the Engineer. Any street crossing or driveway crossings made after November 15th shall be backfilled with sand compacted to 95% Standard Proctor Density and a temporary pavement installed of 3" of asphalt cold patch or temporary hot mix over 4" crushed concrete base. The Contractor is responsible for maintenance of the temporary pavement throughout the term of the project including the winter months. Snow removal shall be the responsibility of the City. When, in the opinion of the City, the temporary pavements requires repair, the Contractor will be notified. Once notified, the Contractor will have 24 hours to make the necessary repairs.

If the Contractor fails to make the repairs in the allotted time period and City forces are required to do the work, any costs incurred by the City will be deducted from the payment due the Contractor. Any costs involved in installing or maintaining the temporary pavement shall be considered incidental to the Contract.

61. **CROSSING EXISTING CITY WATER MAIN OR SEWER MAIN OR PRIVATE SEWER SERVICES**: This item of work shall include all equipment, labor and materials (including fittings) required to install water main or sewer main over or under existing sewer, catch basin lead, water main or private sewer lead that is live (in service) and either marked or unmarked in the field or shown on the project plans. This item includes compensation for any delays locating, damage repairs, water main fittings, and relaying of pipe. This item shall include supporting utilities if necessary, and all work associated with replacing the portion of water main, sewer, or lead that has been damaged or removed. Payment for this item of work shall be for each crossing as described above that is performed during open-cut water main or sewer main installation. **This item does not apply to crossings required to install water services.** If the crossing necessitates installation of water main at depth of cover exceeding 8 feet, additional compensation shall be paid as extra depth water main installation.

This item of work shall not be paid as compensation for installing water main beneath abandoned pipes, either marked or unmarked in the field. If the abandoned pipe is shown on the Plans and a portion of the pipe is damaged or removed, the Contractor shall install a 12" thick watertight masonry bulkhead in open end of the pipe incidental to the Contract. If the abandoned pipe is now shown on the Plans and the Engineer directs the installation of bulkheads, the work shall be paid as bulkheads shown on the Form of

Proposal. Any pipe encountered that is not indicated on the Plans shall be classified as live, unless the Engineer directs the installation of bulkheads.

When water main is installed over or beneath existing sewer or catch basin lead that is indicated on the Plans to be replaced, payment shall be made as indicated above. In addition, the bid unit price for the sewer repair or catch basin lead shall be paid for replacing pipe within the replacement limits shown on the Plans. However, if sewer or catch basin lead is damaged or removed outside of the replacement limits shown on the Plans due to water main installation, the bid unit price for the sewer repair or catch basin lead shall not be paid for replacing the portion of pipe damaged or removed outside the limits shown on the Plans. The pipe used for replacing water main shall be ductile iron pipe of the same nominal diameter as the existing pipe.

The pipe used for replacing sewer, private sewer leads and catch basin leads shall be of the same size and material as the existing pipe. The section(s) of pipe replaced shall be reconnected using flexible rubber couplings with stainless steel clamps when the pipe is 15" diameter or less.

When the pipe is 18" to 36" diameter, the section(s) of pipe replaced shall be reconnected using Cadillac Wrap and a non-reinforced concrete encasement as shown in the detail on SD-12 for Sewers. When the pipe is 42" or 48" diameter, the section(s) of pipe replaced shall be reconnected using Cadillac Wrap and a reinforced concrete encasement.

62. **CROSSING OF UNKNOWN EXISTING WATER SERVICES THAT ARE NOT FIELD STAKED**: The Contractor shall be paid a unit price for each crossing under an unknown existing water service that is not field staked for the installation of new water main or sewer main as shown on the form or proposal. This item of work shall include all materials including fittings, equipment and labor required for excavating and installing, relocating, re-laying going under, deviating around unknown existing water services that are not field staked for the installation of water main or sewer main. The repair of damaged unknown existing water services that are not field staked shall be paid for at unit prices as shown on the form of proposal. No additional compensation shall be paid for damage repairs or delays due to construction around unknown existing water services that are not field staked for the installation of new City water main or sewer main.

Installation of water main at a depth over eight (8) feet of clear cover will be paid for at the contract unit price for "Extra Depth of Water Main Installation".

The repair or replacement of damaged unknown existing water services will also be paid for at the contract unit price for "Copper Tubing", "Curb Stop Valve' and "Corporation Stop Valve' when these items are used for the repair.

63. **TRENCH SUPPORTS**: The Contractor shall provide pipe-laying boxes, sheeting, tie backs, and anchors as required to protect personnel and to contain excavations within the rights-of-way, easements, and construction limits shown on the Plans. Refer to Section 2.10 of the Excavating and Backfilling for sheeting, shoring, and bracing. The Contractor shall provide trench supports which shall be included as part of the Contract, and shall conform to current Michigan Occupational Safety and Health Act (M.I.O.S.H.A.) requirements.

64. **CONFINED SPACE ENTRY**: Required Confined Spaces as defined by Michigan Occupational Safety and Health Act (M.I.O.S.H.A.) Standard 1910.146, Part 90 inclusive. The Contractor must comply with M.I.O.S.H.A. requirements for The City has determined that all utility structures and pipes under its jurisdiction are potentially Permit-practices and procedures to protect employees from the hazards of entry into permit-required confined spaces. Prior to commencing any underground work, the Contractor shall furnish the Engineer written certification that the company has implemented a Permit-Required Confined Space program conforming to M.I.O.S.H.A. requirements. Questions concerning the M.I.O.S.H.A. requirements should be directed to the Construction Safety and Health Division at 517.322.1856.

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GENERAL CONDITIONS

1.00 DEFINITIONS

1.01 **CONTRACT DOCUMENTS**: shall mean the following documents, including all additions, deletions and modifications incorporated therein before the execution of the Contract:

Part I	Contract Forms Advertisement Special Instructions to Bidders Standard Instructions to Bidders Proposal, Part I and II Agreement Insurances Performance, Maintenance & Guarantee Bond Labor and Material Bond Contractor's Affidavit General Conditions
Part II	Specifications General Construction Specifications Project Specifications
Part III	Contract Drawings

1.02 **ACT OF GOD**: means an earthquake, flood, cyclone, or other cataclysmic phenomenon of nature. Rain, wind, flood, or other natural phenomenon of normal intensity for the locality shall not be construed as an Act of God.

1.03 **ADDENDA OR ADDENDUM**: shall mean any additional contract provisions or changes, revisions or clarification of the Contract Documents, issued in writing by the Engineer, on behalf of the City, to respective bidders prior to the receipt of bids.

1.04 **AUTHORIZATION**: The City's written approval of recommended contract changes, adjustments or extras to the Contract.

1.05 **AWARD**: The City's formal execution of the Contract.

1.06 **BIDDER**: shall mean any individual, firm or corporation submitting a formal Proposal for construction under this Contract.

1.07 **CONTRACT MODIFICATION**: shall mean a written notice authorizing or directing a Contractor to do Extra Work or to authorize deviation from the Plans and / or Specifications.

1.08 **CITY**: shall mean the party of the first part as shown on the Contract.

1.09 **CONTRACT**: is the agreement covering the performance of the work described in the Contract Documents and includes all supplemental agreements thereto.

1.10 **CONTRACT UNIT PRICE**: The unit price of a contract item.

1.11 **CONTRACTOR**: shall mean the party of the second part as shown on the Contract.

1.12 **ENGINEER**: shall mean the City Engineer of the City of Royal Oak, Michigan or his duly authorized agents, assistants, or representatives, limited to the specific duties assigned or entrusted to them.

1.13 **EXTENSION OF TIME**: Additional contract time authorized by the Engineer.

1.14 **EXTRA WORK**: Typically work issued by the Engineer through a Speed Letter or Contract Modification that was not originally included in the original Contract Documents.

1.15 **HOLIDAYS**: Recognized City holidays are: New Year's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and the Friday after, Christmas Eve, Christmas Day and New Year's Eve.

1.16 **IMPLIED or INCIDENTAL WORK**: shall mean any work, except Extra Work as hereinafter defined, which may have been omitted in the description of said work, but the need of which is implied or necessary and is included in the cost to perform the item of work.

1.17 **INSPECTOR**: The representative of the Engineer, assigned to make inspections of contract performance.

1.18 **PERFORMANCE BOND**: The security furnished by the Contractor and the Contractor's Surety to guarantee performance of the work in accordance with the Contract.

1.19 **PLANS**: shall mean drawings or reproductions of drawings prepared by the Engineer pertaining to the construction or details of the work included in the Contract.

1.20 **PLAN QUANTITY**: The original contract quantity of an item of work.

1.21 **PROGRESS SCHEDULE**: A sequential listing of all the controlling operations and the estimated time the operations will remain controlling. The Progress Schedule is submitted by the Contractor and approved by the Engineer prior to award of the Contract and becomes part of the Contract.

1.22 **PROJECT**: shall mean the entire improvement proposed by the City to be constructed, in part or in whole, pursuant to the Contract.

1.23 **PROPOSAL**: is the offer of a bidder to perform the work described by the Contract Documents when made out and submitted on the prescribed Proposal Form, properly signed and guaranteed.

1.24 **RESIDENT ENGINEER and / or INSPECTOR**: shall mean a duly authorized representative of the Engineer.

1.25 **SPECIFICATIONS OR CONTRACT SPECIFICATIONS**: shall mean all of the Contract Documents and Supplemental Agreements.

1.26 **SUBCONTRACTOR**: shall mean a person, firm or corporation, other than the Contractor, supplying labor and material or labor to the Contractor for work at the side of the project, but shall not include one who furnished materials or equipment, only.

1.27 **SURETY**: The legal entity or individual other than the Contractor, executing a bond(s) furnished by the Contractor.

1.28 **TRAFFIC CONTROL DEVICES**: Signs, signals, lighting devices, barricades, delineators, pavement markings, traffic regulators and all other equipment for protecting and regulating traffic in accordance with the current edition of the M.M.U.T.C.D, unless otherwise specified in the Contract.

1.29 **THE WORK**: shall mean all structures, equipment, plant, labor, material and facilities or things new or hereafter required to be furnished, installed or done by the Contractor under or pursuant to this Contract including Extra Work.

1.30 **WORK**: shall mean any component structure, equipment, plant, labor, material or facility of The Work.

1.31 **WRITTEN NOTICE**: shall be considered served when delivered in person or sent by U.S. mail to the last business address known to him who serves this notice. It shall be the duty of each party to advise the other party to the Contract as to any change in his business address until completion of the Contract.

1.32 **A.S.T.M.** American Society for Testing Materials

1.33 **A.W.W.A.** American Water Works Association

1.34 **A.S.A.** American Standard Association

1.35 **A.C.I.** American Concrete Institute

1.36 **C.R.S.I.** Concrete Reinforcing Steel Institute

1.37 **MDOT** Michigan Department of Transportation

1.38 **N.E.C.** National Electric Code

1.39 **A.A.S.H.O.** American Association of State Highway Officials

1.40 **M.D.P.H.** Michigan Department of Public Health

1.41 **M.M.U.T.C.D.** Michigan Manual of Uniform Traffic Control Devices

2.00 DRAWINGS, SPECIFICATIONS, AND GENERAL INFORMATION

2.01 INTENT OF PLANS AND SPECIFICATIONS: The intent of the Plans and Specifications is that the Contractor furnishes all labor, materials, equipment, and transportation necessary for the proper execution of the work unless specifically noted otherwise. The Contractor shall do all work shown on the Plans, described in the Specifications, and all implied work considered necessary to complete the project in a substantial and acceptable manner, ready for use, occupancy, and / or operation by the City.

2.02 COORDINATION OF SPECIFICATIONS, PLANS AND SPECIAL PROVISIONS: The precedence of various parts of the Contract Documents are given below in the order of their priority for evaluating contract disputes.

1. Contract
2. Project Plans and Drawings
3. Special Instructions to Bidders
4. Project Specifications
5. City of Royal Oak Standard Specifications for Construction

Any table, gradation, size, dimension, rate, mix, method, nomenclature, pay item number, basis of payment or method of measurement shown on the plans, which is a variance with the Standard Specifications, shall be considered a supplement or amendment to the applicable specification.

In interpreting the Contract Documents, work describing materials or work which has a well-known technical or trade meaning, unless otherwise specifically defined in the Contract Documents, shall be construed in accordance with such well-known meaning recognized by Engineers and the trade.

2.03 DISCREPANCIES IN PLANS: Any discrepancies found between the Plans and Specifications and site conditions, and any errors or omissions in the Plans and Specifications must be immediately reported to the Engineer who shall promptly correct such discrepancies, errors, or omissions in writing. Any work done by the Contractor after his discovery of such discrepancies, errors, or omissions shall be done at the Contractor's risk.

2.04 ADEQUACY OF PLANS AND SPECIFICATIONS: The location and general character of the work embraced in this Contract are shown upon the Plans. Responsibility for adequacy of the design and for sufficiency of the Plans and Specifications shall be borne by the City. Additional drawings showing detail, in accordance with which the work is to be constructed, may be furnished from time to time by the Engineer if required. These drawings, taken together, constitute the Plans for the work and are an essential part of the Contract. The work shall be executed in strict conformity with the Plans and Specifications and the approved shop drawings.

2.05 **USE OF UNDERGROUND INFORMATION**: The Contractor hereby agrees to accept full responsibility for his conclusions relative to the nature and probable difficulties of the work, using in part such underground information as the City has obtained and furnished; and the Contractor hereby waives all claims for any damages which he may suffer by reason of the inadequacy or incompleteness of any such data. The making of test borings by the City is not to be construed as relieving the Contractor of his obligation to make such supplementary or independent investigation as he may deem necessary or desirable. Locations of existing underground utilities shown on the plans represent the information at hand when the Plans were prepared and shall not be taken as conclusive evidence of either the exact locations of such utilities or the completeness of such information at the time of executive of the Contract.

2.06 **PROTECTION OF STAKES AND MONUMENTS**: The Contractor shall have the responsibility to carefully preserve bench marks, reference points and stakes and, in the case of destruction thereof by the Contractor of any of his employees, resulting from his negligence, the Contractor shall be charged with the expense and damage resulting therefore and shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such bench marks, reference points and stakes.

When staking is the City's responsibility: should it become necessary in the prosecution of the work to remove basic horizontal or vertical control points or marks that are a part of the public records and that are located outside of the normal work area, the Contractor shall notify the Engineer in ample time to permit him to obtain such additional information as may be necessary to replace or transfer said points to other locations.

2.07 **ADDITIONAL INSTRUCTIONS**: Further instructions may be issued by the Engineer during the progress of the work by means of drawings, notices, or Contract Modifications to clarify the Plans or Specifications or to correlate the work to unforeseen local situations or working conditions. The Engineer's instructions shall be confirmed in writing upon request from the Contractor.

2.08 **PLANS AND SPECIFICATIONS FURNISHED**: Except as provided for otherwise, all required copies of Plans and Specifications necessary for the execution of the work shall be furnished to the Contractor without charge.

2.09 **PLANS AND SPECIFICATIONS AT JOB SITE**: One complete set of all Plans and Specifications, including approved shop drawings, shall be maintained at the job site and shall be available to the Engineer at all times. Approved Contract Modifications shall also be available at the job site. It is the Contractor's responsibility that their subcontractors and / or suppliers have been furnished with the latest Plans and Specifications.

2.10 **DIMENSIONS**: Dimensions shown in figures or which can be determined by computation from other figures shown, shall take precedence over dimension scaled from the drawings. When the work of the Contractor is affected by finished dimensions, these shall be determined by the Contractor at the site and he shall assume the responsibility therefor.

2.11 **LAND BY CITY, OWNER**: The City shall furnish all land and rights-of-way to be occupied by the project, and will use due diligence in acquiring said land and rights-of-way as speedily as possible. But it is possible that all lands and rights-of-way may not be obtained as herein contemplated before construction begins, in which event the Contractor shall begin his work upon such land and rights-of-way as the City may have previously acquired and no claim for damage whatsoever will be allowed by reasons of the delay in obtaining the remaining lands and rights-of-way, as long as work remains to be done on the project.

2.12. **LAND BY CONTRACTOR**: Any additional land and access that may be required for temporary construction facilities or for storage of materials shall be provided by the Contractor with no liability to the City.

2.13. **SANITARY REGULATIONS**: The Contractor shall provide and maintain adequate sanitary accommodations considered as part of the contract for the use of his employees and those of his subcontractors, properly secluded from public observations, and their use shall be strictly enforced. The Contractor shall vigorously prohibit the committing of nuisances about the work or upon adjacent private or public property.

2.14. **PRIVATE PROPERTY**: The Contractor shall restrict his operations to the public rights-of-way, City property or easements within private property. The Contractor shall not trespass on private property and he shall not use nor request the use of any utility, including water, from a property owner. Where the plans indicate work outside of an easement on private property, or when the Engineer directs the Contractor to perform work outside of an easement, the City will secure a permit from the property owner prior to the commencement of work.

Any damage to private property caused by the Contractor's operations shall be remedied by the Contractor. The Contractor shall be responsible to resolve all property damage or personal injury claims made against the Contractor during construction operation covered under the Contract. All property damage or personal injury claims shall be processed with the insurance company listed on the Certificate of Insurance for the Contract in a timely manner before the final estimate payment.

3.00 ENGINEER-CITY-CONTRACTOR RELATION

3.01 **ENGINEER'S RESPONSIBILITY AND AUTHORITY**: All work shall be done under the general supervision of the Engineer. The Engineer shall decide any and all questions which may arise as to the quality and acceptability of the material furnished, work performed, rate of progress of work, interpretation of Plans and Specifications, and all questions as to the acceptable fulfillment of the Contract on the part of the Contractor.

This responsibility and authority shall be confined to the direction or specification of what is to be accomplished under this Contract, and shall not extend to the actual execution of the work, which shall be under the control of the Contractor, and for which the Contractor is alone responsible. The Engineer shall have the authority, with the approval of the City, to change the Plans and order Extra Work. The Engineer has sole agency to act on behalf of the City with regard to the direction of this work.

Communications of the Contractor to the City or by the City to the Contractor shall be directed through the Engineer.

3.02 **ENGINEER'S DECISIONS**: All claims of the City or the Contractor shall be presented to the Engineer for decision. The decision shall be made in writing within a reasonable time. All decisions of the Engineer shall be final except in cases where time and / or financial considerations are involved, in which case the decision shall be subject to arbitration.

3.03 **SUSPENSION OF WORK**: The Engineer shall have the authority to suspend the work, wholly or in part, for such period or periods, as he may deem necessary, due to unsuitable weather, or such other conditions as are considered unfavorable for prosecution of the work, or failure on the part of the Contractor to carry out the provisions of the Contract or to supply materials to meet the requirements of the Specifications. The Contractor shall not suspend operations for more than 72 hours without the Engineer's permission.

3.04 **ARBITRATION**: Should there be any dispute or any questioned decision or action by the City, the Engineer or the Contractor which involves the application or interpretation of any section of this Contract which is subject to arbitration, it shall be promptly submitted to arbitration upon demand by either party to the dispute. The Contractor shall not delay the work because arbitration proceedings are pending unless he shall have written permission from the Engineer to do so and such delay shall not extend beyond the time when the arbitrators shall have opportunity to determine whether the work shall continues to be suspended pending decision by the arbitrator to such a dispute. Any demand for arbitration shall be in writing and shall be delivered to the Engineer and any adverse party by registered mail addressed to the last known address of each within ten (10) days of receipt of the Engineer's decision, and in no event after final payment has been made and accepted, subject, however, to any express stipulation to the contrary in the Contract Documents. Should the Engineer fail, within a reasonable period, to make a decision, a demand for arbitration may then be made as if the Engineer's decision has been rendered against the party demanding arbitration.

The arbitrators, if they deem that the case demands it, are authorized to award to the party whose contention is sustained, such sums as they shall deem proper for the expenses incident to the appeal but unless the award of the arbitrators is to the contrary, the reasonable compensation and expenses of the arbitrator shall be shared equally by the parties involved.

No one shall be qualified to act as an arbitrator who has, directly or indirectly, any financial interest in the Contractor, who has any business or family relationship with the City, the Contractor, or the Engineer.

Each arbitrator selected shall be qualified by experience and knowledge of the work involved in the matter to be submitted to arbitration.

All claims, disputes and other matters in questions arising out of or relating to this Agreement except claims which have been waived by the making or acceptance of final payment shall be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association. Any reward rendered hereunder shall be final and judgment may be entered based upon said award in accordance with the Michigan Statutes and General Court Rules pertaining thereto. Any award rendered hereunder may be vacated solely upon the grounds specified in said statue and court rules and in addition on the basis that the award is contrary to law.

3.05 **INSPECTION**: All materials in each part or detail of the work shall be subject at all times to inspection by the Engineer. Such inspection may include mill, plant, or shop inspection, and any material furnished under these specifications is subject to such inspection. The Engineer shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as in required to make a complete and detailed inspection.

3.06 **EXAMINATION OF COMPLETED WORK**: If the Engineer requests, the Contractor at any time before acceptance of the work shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portion of the work to the standard required by the Specifications. Should the work thus exposed or examined prove acceptable; the uncovering or removing, and replacing of the covering or making good of the parts removed shall be paid for as extra work, but should the work so exposed or examined prove unacceptable, the uncovering, removing and replacing shall be at the Contractor's expense.

3.07 **GENERAL INSPECTION**: The Contractor shall notify the Engineer as to the exact time at which he proposes to begin any part of the work at least 48 hours in advance of any such start, so that the Engineer may provide for inspection by resident Engineers and / or inspectors under his direction, of all materials used and all work done under this Contract.

Inspectors shall have authority to reject defective material and to suspend any work that is being done improperly, subject to the Engineer's decision. They shall have no authority to permit deviation from, or to relax or extend, any of the provision for the Specifications without written permission from the Engineer.

3.08 **SUGGESTIONS TO CONTRACTOR ADOPTED AT HIS OWN RISK**: Any plan or methods of accomplishing the work suggested to the Contractor by the Engineer or other representative of the City, but not specified or required, shall be used at the Contractor's own risk and responsibility. The Engineer and the City assume no responsibility therefor.

3.09 **CONTRACTOR'S RESPONSIBILITY**: The Contractor shall assume and have sole charge of and responsibility for all work included in this Contract until the termination thereof, unless otherwise specified in this Contract, and shall be solely liable for all damaged occasions in any way by his act or neglect, or that of his agents, employees, workmen, or any person or persons in or about the work embraced in this Contract.

3.10 **CONTRACTOR'S SUPERINTENDENCE**: A qualified superintendent, who is acceptable to the Engineer, shall be maintained on the work and give efficient supervision to the work until its completion. The superintendent shall have full authority to act in behalf of the Contractor, and all directions given to the superintendent shall be considered given to the Contractor.

3.11 **ASSIGNMENT OF CONTRACT**: Neither the Contractor nor the City shall sublet, sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or his right, title or interest therein, or his obligations thereunder, without written consent of the other party.

3.12 **CITY'S RIGHT TO CORRECT DEFICIENCIES**: Upon failure of the Contractor to perform the work in accordance with the Contract Documents, including any requirements with respect to the schedule of completion, the City may, without prejudice to any other remedy it may have, correct such deficiencies, beginning such work not less than five (5) days from the date of serving written notice to the Contractor and his Surety of his intent to do so.

3.13 **CITY'S RIGHT TO TERMINATE CONTRACT AND COMPLETE THE WORK**: The City may terminate the employment of the Contractor in the event of any default by the Contractor and upon receiving written notice from the Engineer certifying cause for such action, after given ten (10) days written notice of termination to the Contractor.

The Contractor shall be considered in default whenever he shall:

A. Declare bankruptcy, become insolvent, or assign his assets for the benefit of his creditors.

B. Disregard or violate important provisions of the Contract Documents or Engineer's instructions, or fail to prosecute the work according to the agreed schedule of completion, including extensions thereof, or unnecessarily or unreasonable delaying the performance of completion of the work.

C. Fail to provide a qualified superintendent, competent workmen or subcontractors, or property materials, or fail to make proper payment therefore.

Prior to any action by the City to terminate the Contract and finish the work, it shall serve written notice upon the Surety, and the Surety shall have the right to take over and perform the Contract, provided, however, that if the Surety does not commence performance thereof in thirty (30) days from the date of the mailing to such Surety of notices of termination, the City may take over the work and prosecute the same to completion by Contract for the account and at the expense of the Contractor, and the Contractor and the Surety shall be liable to the City for any extra cost occasioned to the City thereby.

In the event of such termination, the City may take possession of the work and all materials, tools, and equipment thereon, and may finish the work by whatever methods and means it may select.

3.14 **CONTRACTOR'S RIGHT TO SUSPEND WORK OR TERMINATE CONTRACT**: The Contractor may suspend work or terminate the Contract upon any of the following reasons:

A. If an order of any court, or other public authority, causes the work to be stopped or suspended for a period of ninety (90) days through no act or fault of the Contractor or his employees.

B. If the Engineer should fail to act on any request for payment with ten (10) days after it is presented in accordance with the General Conditions of the Contractor.

C. If the City should fail to act upon any request for payment within thirty (30) days after its approval by the Engineer.

D. If the City should fail to pay the Contractor any sum within thirty (30) days after its award by arbitrators.

E. If the City fails to provide land to be occupied by the project.

3.15 **RIGHTS OF VARIOUS INTERESTS**: Whenever work being done by the City's forces or by other contractors is contiguous to work covered by this Contract, the respective rights of the various interests involved shall be established by the Engineer, to secure the completion of the work in general harmony.

3.16 **SEPARATE CONTRACTS**: The City may let other contracts in connection with the work of the Contractor. The Contractor shall cooperate with other contractors with regard to storage of materials and execution of their work and shall carefully fit his own work to that provided under such other contracts. It shall be the Contractor's responsibility to inspect all work by other contractors affecting his work and to report to the Engineer any irregularities which will not permit him to complete his work in a satisfactory manner. His failure to notify the Engineer of such irregularities shall indicate the work of other contractors has been satisfactorily completed to receive his work. The Contractor shall not be responsible for defects of which he could not have known which develop in the work of others after the work is completed. The Contractor shall not commit or permit any act which will interfere with the performance of work by any other contractor.

3.17 **SUBCONTRACTORS**: The Contractor shall submit to the Engineer for approval by the City, the names of subcontractors proposed for the work. The Contractor shall not employ any subcontractors that the City objects to as incompetent or unfit. Subs may not be changed except at the request or with the approval of the City.

If the Contractor has submitted, as a part of his proposal, a list of subcontractors, and the change of any name on such list is required by the City after execution of the Agreement, the contract price shall be increased or diminished by the difference in cost occasions by such change.

The Contractor is responsible to the City for the acts or omissions of his subcontractors, and of their direct and indirect employees. The Contract Documents shall not be construed as creating any contractual relationship between any subcontractor and the City.

The Contractor shall bind every subcontractor by the terms of the Contract Documents and every subcontractor shall be bound by the terms of the Contract Documents as far as applicable to his work, unless specifically noted to the contrary.

For convenience of reference, the Specifications are separated into titled sections. Such separations shall not, however, operate to make the Engineer arbiter to establish limits of the contracts between Contractor and subcontractors.

3.18 **WORK DURING AN EMERGENCY**: The Contractor shall perform any work and shall furnish and install any materials and equipment necessary during an emergency endangering life of property. In all cases, he shall notify the Engineer of the emergency as soon as practicable, but he shall not wait for instructions before proceeding to protect both life and property.

The Contractor shall immediately stop all construction operations and notify the City of Royal Oak Fire Department and appropriate utility company in the case of leaking gas mains, leaking gas services, electrical wires either downed or dug up, or any other potentially hazardous condition.

The Contractor shall not seek to recover damages or monies from the City of Royal Oak for Contractor down time during potentially hazardous conditions.

3.19 **ORAL AGREEMENTS**: No oral order, objection, claim or notice by any party to the others shall effect or modify any of the terms or obligations contained in any of the Contract Documents, and none of the provisions of the Contract Documents shall beheld to be waived or modified by reason of any act whatsoever, other than by a definitely agreed waiver or modification thereof in writing, and no evidence shall be introduced in any proceeding of any other waiver or modification.

4.00 MATERIALS AND WORKMANSHIP

4.01 **MATERIALS BY THE CONTRACTOR**: The Contractor shall furnish all material necessary for the completion for the work unless portions of the required material are specifically set up for the City to furnish. It shall be the Contractor's responsibility to prove to the City that all materials furnished are in full compliance with the requirements of the Contract. All materials and equipment incorporated in the work shall be new.

4.02 **MATERIALS BY THE CITY, OWNER**: The fact that the City is to furnish material is conclusive evidence of its acceptability for the purpose intended, and the Contractor may continue to use it unless otherwise directed. If the Contractor discovers any defects in materials furnished by the City, he shall notify the Engineer before installing said material in the structure.

4.03 **STORAGE OF MATERIALS**: Materials shall be so stored as to insure the preservation of their quality and fitness for the work. When considered necessary, they shall be placed on wooden platforms or other hard, clean surfaces, and / or placed under cover. Stores of materials shall be so located as to facilitate prompt inspection and shall not be located as to affect pedestrian or vehicular traffic. The Contractor shall not store or place materials on private property. The Contractor shall not store or place materials in city parks without obtaining written permission from the Engineer.

4.04 **SAMPLES**: All samples called for in the Specifications or required by the Engineer shall be furnished by the Contractor and shall be submitted to the Engineer for his approval. Samples shall be furnished so as not to delay fabrication, allowing the Engineer a reasonable time for the consideration of the samples submitted.

4.05 **QUALITY OF EQUIPMENT AND MATERIALS**: In order to establish standards of quality, the Engineer has, in the Project Specifications and / or on the Plans, referred to certain products by name and catalog number. This procedure is not to be construed as eliminating from competition other products of equal or better quality which are fully suitable in design. The specific article, material, or equipment mentioned shall be understood as indicating the type, function, minimum standard of design, efficiency and quality desired and shall not be construed in such a manner as to exclude manufacturer's products of comparable quality, design and efficiency.

If the Contractor desires to use materials other than those specified:

A. He shall furnish as complete list of desired substitutions together with such Engineering and catalog data as the Engineer may require prior to ordering any such substitutions.

B. He shall defer to the Engineer's judgment when proposed substitute materials or items of equipment are judged to be unacceptable and shall furnish the specified material or items of equipment in such case.

All proposals for substitutions shall be submitted in writing by the Contractor and not by individual trades or material suppliers.

The Engineer will approve or disapprove proposed substitutions in writing within thirty (30) days. No substitute materials shall be used unless approved in writing.

4.06 **EQUIPMENT APPROVAL DATA**: The Contractor shall furnish six (6) copies of complete catalog date for every manufacturer's item of equipment and all components thereof to be used in the work, including specific performance data, material gage or thickness, brand name, catalog number, etc. This submission shall be compiled by the Contractor and approved in writing by the Engineer before any of the equipment is ordered. Each data sheet or catalog in the submissions shall be indexed according to Specification Section and Paragraph for easy reference. After written approval, this submission shall become a part of the Contract and may not be deviated from except upon the written approval of the Engineer.

Catalog data for equipment approved by the Engineer does not in any case supersede the Engineer's Contract Documents. The approval of the Engineer shall not relieve the Contractor from any responsibility for deviation from Plans or Specifications, unless he has in writing called the Engineer's attention to such deviation at the time of submission, nor shall it relieve him from responsibility for errors of any sort in the item submitted. The Contractor shall check the catalog data with Engineer's Contract Documents for deviations and errors.

It shall be the responsibility of the Contractor to insure that items be furnished to fit the space available. He shall make necessary field measurements to ascertain space requirements, and shall notify the Engineer in the event of any conflict.

Where equipment requiring different arrangements of connections from those shown is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly and in harmony with the intent of the Plans and Specifications, and to make all changes in the work required by the different arrangement of connections.

The Contractor shall provide the Engineer with equipment rental rates determined by the current MDOT Blue Book per Schedule C for equipment approved for cost-plus work per section 7.05 D of the General Conditions.

4.07 **SHOP DRAWINGS**: The Contractor shall provide shop drawings, settings, schedules and such other drawings as may be necessary to determine conformity of buy out items with the Plans, Specifications or Engineer's constructions. Deviations from the Plans and Specifications shall be called to the attention of the Engineer at the time of the first

submission of shop drawings and other drawings for approval. The Engineer's approval for any drawings shall not release the Contractor from responsibility for such deviations. Shop Drawings shall be submitted according to the following schedule:

A. Six (6) copies shall be submitted in sufficient time to secure final approval and delivery of materials before the materials indicated thereon are to be needed in orderin order to prevent delay of the work.

B. The Engineer shall within fourteen (14) days of the submittal of any shop drawings, return three (3) copies to the Contractor marked with all corrections and changes required to secure conformance with the Plans and Specifications.

C. The Contractor shall then correct the shop drawings to conform to the corrections and changes requested by the Engineer, and return six (6) copies to the Engineer for final approval.

D. The Engineer shall, within fourteen (14) days of the submittal of corrected shop drawings, return three (3) copies to the Contractor marked with any additional corrections and changes, or marked as approved.

E. Following receipt of approved shop drawings, the Contractor shall order his materials.

4.08 **MANUFACTURER'S DIRECTIONS**: Manufactured articles, material and equipment shall be applied, installed, connected, erected, tested, programmed, cleaned and conditioned as directed by the manufacturer unless herein specified to the contrary.

4.09 **CHARACTER OF WORKMEN**: The Contractor shall at all times be responsible for the conduct and discipline of his employees and / or any subcontractor or persons employed by subcontractors. All workmen must have sufficient knowledge, skill, and experience to perform properly the work assigned to them. Any foreman or workman employed by the Contractor or subcontractor who, in the opinion of the Engineer does not perform his work in a skillful manner, or appears to be incompetent or to act in a disorderly or intemperate manner shall, at the written request of the Engineer, be discharged from the work and shall not be employed again in any portion of the work without the approval of the Engineer. If any employee is not immediately removed when required, any work done by the Contractor after the employee's requested discharge will not be estimated or accepted.

The Contractor and its' subcontractors shall have and administer a Drug-Free Workplace Policy. The purpose is to provide a workplace that is free from substance abuse. Workers under the influence of drugs or alcohol cannot work safely, productively and jeopardizes the welfare and safety of the jobsite. The following guidelines list violations which shall be grounds for immeditateimmediate action:

A. A worker who posses, use, distribute, sell or offer for sale narcotics, or any controlled illegal substance, including marijuana, while on duty.

B. Report for work or work while under the influence of alcohol, narcotics or any controlled or illegal substance, including marijuana, except a drug prescribed for the employee by a licensed physician.

C. A worker taking a physician prescribed drug whose ability to work is impaired.

4.10 **REJECTED WORK AND MATERIALS**: All materials which do not conform to the requirements of the Contract Documents, or are not equal to samples approved by the Engineer, or are in any way unsatisfactory or unsuited to the purpose for which they are intended shall be rejected and immediately removed from the site of the work. Any defective work whether the result of poor workmanship, use of defective materials, damage through carelessness or other cause, shall be removed with ten (10) days after written notice is given by the Engineer, and the work shall be re-executed by the Contractor. The fact that the Engineer may have previously overlooked such defective work shall not constitute an acceptance of any part of it.

4.11 **CUTTING AND PATCHING**: The Contractor shall do all necessary cutting and patching of the work that may be required to properly receive the work of the various trades or as required by the Plans and Specifications to complete the structure, and shall make good after them as may be directed by the Engineer. Any cost caused by defective or ill-timed work shall be borne by the party responsible therefor.

4.12 **CLEANING UP**: The Contractor shall remove from the City's property, and from all public and / or private property, all temporary structures, all rubbish, waste materials, excess dirt and broken concrete resulting from his operations or caused by his employees, and all surplus materials, leaving the site smooth, clean and true to line and grade by the end of each work day. At the termination of this Contract, before acceptance of the work by the Engineer, the Contractor shall remove all of his equipment, tools and supplies from the property of the City. Should the Contractor fail to remove such equipment, tools and supplies, materials debris, excess dirt, and broken concrete, the City shall be the right to remove them and the Contractor shall reimburse the City for all expenses incurred. Materials and dirt required for backfill shall be properly barricaded and not an obstacle for the public.

The Contractor shall systematically and thoroughly clean and make any needed repairs. Cleaning and repairing shall be arranged, insofar as practical, to be completed upon finished the construction work. The Engineer will not prepare his final estimate of the work until the final inspection has been made. During this final inspection, the Contractor shall furnish such equipment and labor as may be necessary to accomplish and expedite same without additional compensation.

4.13 **GUARANTEE PERIOD**: The Contractor shall warrant all equipment furnished and work performed by him for a period of one (1) year from the date of written acceptance of the work.

5.00 INSURANCE, LEGAL RESPONSIBILITY AND PUBLIC SAFETY

5.01 **CONTRACT SECURITY**: The Contractor shall furnish a Performance and Guarantee Bond in an amount equal to at least 100% of the Contract price as security for the faithful performance of this Contract.

Bond forms for the aforementioned securities have been made a part of the Contract Documents and the Contractor shall insure that each executed copy of the bond form is complete and sealed.

5.02 **INSURANCE**: The Contractor shall not commence work under the Contract until he has obtained the insurance required under the Contract. All provided coverages shall be with insurance companies licensed and admitted to do business in the State of Michigan. All coverages shall be with insurance carriers acceptable to the City of Royal Oak, Michigan.

5.03 **PROTECTION OF PROPERTY**: The Contractor shall be responsible for the preservation of all public property, trees, monuments, etc., exercising every precaution necessary to prevent damage or injury thereto. He shall use suitable precautions to prevent damage to pipe, conduits, and other underground structures, and shall protect carefully from disturbance of damage all monuments and property marks until an authorized agent has witnessed or otherwise referred their location and shall not remove them until directed.

5.04 **PERMITS**: Permits and licenses of a temporary nature necessary for the prosecution of the work shall be secured by the Contractor. Permits and licenses of a permanent nature will be secured by the City.

5.05 **NOTIFYING UTILITIES**: The Contractor shall notify all utilities that may possibly have existing facilities in the construction area, in writing, of his starting date **72 hours** (minimum) before work under the Contract commences. **Call Miss Dig 1-800-482-7171 or 811.** The Contractor shall comply with the requirements of Public Act. No. 53 of 1974 and all amendments.

5.06 **LAWS TO BE OBSERVED**: The Contractors shall give all notices and comply with all Federal, State and Local laws, ordinances and regulations, in any manner affective the conduct of the work, and all such orders and decrees as exist, or may be enacted by bodies or tribunals having any jurisdiction or authority over the work, and shall indemnify and save harmless the City, against any claim or liability arising from, or based upon, the violation of any such law, ordinance, regulation, decree, whether by himself or his employees. Littering, burning, and drinking of alcohol on public property are in violation of City Ordinances. Violations will be reported to the City of Royal Oak Police Department.

5.07 **FAIR EMPLOYMENT PRACTICES ACT**: The Contractor agrees that neither he nor his subcontractors will discriminate against any employee or application for employment, to be employed in the performance of the Contract, with respect to his hire, tenure, terms, conditions or privileges of employment or any matter directly or indirectly related to employment because of his race, color, religion, national origin or ancestry, or because of age or sex except where based upon a bona fide occupational qualification. Breach of this covenant may be regarded as a material breach of the Contract, (Aft 251 P.A. Mich. 1955).

5.08 **WARNING SIGNS AND BARRICADES**: The Contractor shall provide adequate signs, barricades, lights, traffic regulator personnel (flagmen and watchmen) and take all necessary precautions for the protection of the work and the safety of the public. All barricades and obstructions shall be protected at night by adequate approved properly lighted / reflective barricading and fencing as required from sunset to sunrise. Barricades shall be of suitable construction and shall be maintained and kept clean to increase their visibility at night.

Suitable warning signs shall be so placed and illuminated at night as to show in advance where construction, barricades, or detours exist. The Contractor shall maintain one lane of traffic in each direction in the construction area where directed by the Contract or City Engineer. All signing and barricading shall be done in accordance with **Public Act 315 of 2003 effective April 8, 2004** the provisions of Sections 1.04.11 and 812 of the MDOT 2012 Standard Specifications for Construction and signing shall conform to the current edition of the **Michigan Manual of Uniform Traffic Control Devices** except as otherwise specified herein and shall be approved by the Engineer.

5.09 **PUBLIC SAFETY AND CONVENIENCE**: The Contractor shall at all times so conduct his work to insure the least possible obstruction to traffic and inconvenience to the general public and the residences in the vicinity of the work, and to insure the protection of persons and property in a manner satisfactory to the Engineer. No road or street shall be closed to the public except with the permission of the Engineer and proper governmental authorities. The Contractor shall confer with and keep police and fire departments of the municipality fully informed as to streets or alleys which are to be closed to traffic for construction purposes. Fire hydrants on or adjacent to the work shall be kept accessible to fire fighting equipment at all times. Temporary provisions shall be made by the Contractor where applicable to insure the usability of sidewalks and the proper functioning of all gutters, sewer inlets and drainage ditches.

5.10 **SAFETY:** The Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the project. Such responsibility does not relieve subcontractor of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety laws and regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

-all persons on the site or who may be affected by the project
-all the work and materials and equipment to be incorporated therein
-other property at the site or adjacent thereto

Contractor shall inform the Engineer of the specific requirements of the Contractor's safety program with which the Engineer's employees and representatives must comply while at the project site.

5.11 **PATENTS AND ROYALTIES**: The Contractor shall pay for all royalties and patents in connection with the work except that the City will pay for any license fee or royalties for processes involved in this operation facilities.

6.00 PROGRESS AND COMPLETION OF WORK

6.01 **SUNDAY, HOLIDAY AND NIGHT WORK**: In general, no work shall be done between the hours of 8:00 p.m. and 7:00 a.m., nor on holidays or Sunday, except as it is necessary for the proper care and protection of work already performed or, in the case of an emergency.

6.02 **ORDER OF WORK AND SCHEDULE OF COMPLETION**: The Contractor shall submit, as such times as may reasonably be requested by the Engineer, schedules which show the order in which the Contractor proposed to carry on the work and tentative dates for

starting and completing each major items of work. Upon approval, the schedule shall be adhered to as closely as practical in prosecuting the work.

6.03 **RECORD DOCUMENTS**: Contractor shall maintain in a safe place at the project one record copy of all drawings, specifications, addenda, contract modifications, and other written directives and clarifications in good order and annotated to show changes made during construction. These record documents shall be available to the Engineering for reference. Upon completion of the project, the record documents shall be delivered to the Engineer.

6.04 **CHANGES IN THE WORK**: The Engineer may, with the approval of the City, as the need arises, order changes in the work in the form of Contract Modifications without invalidating the Contract. Compensation and time of completion affected by the Contract Modifications shall be adjusted at the time of ordering such changes (see section 7.05 for payment).

If the Contractor claims that any instructions by drawings or otherwise involve extra costs under this Contract, he shall give the Engineer written notice thereof within ten (10) days after receipt of such instructions and in any event before proceeding to execute the work, except in an emergency endangering life and property. No claim for extra work will be considered in the absence of a written Contract Modification.

Extra work shall be performed in accordance with these Specifications where applicable and work not covered by the Specifications or Special Provisions shall be done in accordance with the best practice as approved by the Engineer. Extra work required in an emergency to protect life and property shall be performed by the Contractor as required.

Deviations from the Contract Documents cannot be authorized by an inspector. Any deviations to the work must be authorized in writing by a City Engineer, by means of an executed speed letter / work order.

Construction operations completed outside of Contract specifications shall be done at the Contractors own risk and shall not relieve the Contractor from fulfilling the obligations of the Contract Documents.

6.05 **CLAIMS**: All claims shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such claims.

Written notice stating the general nature of each claim shall be delivered by the claimant to the Engineer promptly (but in no event later than 30 calendar days) after the start of the event giving rise thereto. The responsibility to substantiate a claim shall rest with the party making the claim. Notice of the amount or extent of the claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such claim).

Each claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of

said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

The Engineer will review each claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

- deny the claim in whole or in part;
- approve the claim; or
- notify the parties that the Engineer is unable to resolve the claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the claim, such notice shall be deemed a denial.
- In the event that Engineer does not take action on a claim within said 30 days, the claim shall be deemed denied.

The Engineer's written action or denial will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure within 30 days of such action or denial.

No claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph.

6.06 **EXTENSION OF CONTRACT TIME**: A delay beyond the Contractor's control, occasions by an Act of God, or act or omission on the part of the City, or by strikes, lockouts, fire, etc., may entitle the Contractor to an extension of time in which to complete the work, provided, however, that the Contractor shall within **five (5) days** following the beginning of such delay give written notice to the Engineer of the cause of such delay and of his intention to request an extension of time because of the delay. Extensions of time will only be granted by formal Contract Modifications. The Contractor is advised that normal seasonal weather conditions and delays in securing equipment and materials will not be considered adequate grounds for an extension of time.

6.07 **USE OF COMPLETED PORTIONS**: The City shall have the right to take possession of and use any completed or partially completed portions of the work, not withstanding that the time for completing the entire work of such portions may not have expired; that such taking possession and use shall not be deemed as acceptance of any work not completed in accordance with the Contract Documents. If such prior use increases the cost of or delays the completion of uncompleted work or causes refinishing of completed work, the Contractor shall be entitled to such extra compensation, or extension of time or both, as the Engineer may determine.

7.00 MEASUREMENT AND PAYMENT

7.01 **DETAILED BREAKDOWN OF CONTRACT AMOUNT**: As follows:

A. In cases where a lump sum forms the basis of payment under the Contract, the Contractor shall, prior to and as a condition of the first partial payment, submit a complete breakdown of the contract amount showing the value assigned to each part

of the work, including an allowance for profit and overhead. Upon approval of the breakdown of contact amount by the Engineer, it shall be used as a basis for all progress payments.

B. To assure proper performance of a construction contract by the Contractor, the City shall retain a portion of each progress payment otherwise due as provided in the Contract Documents.

7.02 **PAYMENT FOR IMPLIED WORK**: Implied work shall be deemed to be included in this Contract and shall be furnished by the Contractor the same as if the same had been stated specifically, without any additional charge to the City.

7.03 **PAYMENT FOR UNCORRECTED WORK**: Should the Engineer order the Contractor to leave in place work that has been damaged or that was not performed in accordance with the Contract Documents, an equitable deduction in the contract amount shall be made to compensate the City for the uncorrected work.

7.04 **PAYMENT FOR REJECTED WORK AND MATERIALS**: The removal of work and materials rejected under section 4.10 and any resulting re-execution of acceptable work by the Contractor shall be at the expense of the Contractor, and he shall pay the cost of replacing the work of other Contractors destroyed or damaged by the removal of the rejected work or materials or the subsequent replacement of acceptable work.

7.05 **PAYMENT FOR CONTRACT MODIFICATIONS**:
Contract Modification shall specify any extension of the contract time and one of the following methods of payment:

A. Unit prices or combination of unit prices which formed the basis of the original Contract.

B. Supplemental proposal giving an amended schedule of process covering the additional items of work.

C. A lump sum based on the Contractor's estimate, approved by the Engineer, and accepted by the City.

D. A "Cost-Plus" basis defined as the cost of labor and documented cost of fringe benefits, materials and equipment rental, plus 15% of said cost to cover superintendence, general overhead and profit. Extra work performed by subcontractors shall be computed the same as above, plus a 5% allowance calculated before superintendence, general overhead and profit for the General Contractor. Costs furnished to the Engineer by the Contractor for labor and equipment used on any extra work to be paid on a "Cost-Plus" basis shall be the actual rate of wages paid as certified by the payroll supervisor and the Rental Rate Blue Book For Construction Equipment, Volume No. 1, 2 or 3 as applicable; the edition which is current at the time the extra work was started will apply.

7.06 **PROCEDURES OR EXECUTING WORK UNDER COST-PLUS METHOD OF PAYMENT**: During the progress of any extra work which is to be paid for on the basis of “Cost-Plus”, the Contractor will furnish to the Engineer at the end of each day, suitable time slips, showing the name of and the number of hours worked by each workman employed thereon, the nature of the work performed by him, and his rate of pay, together with suitable and adequate memorandum of the materials used therein, and

showing the character and amount of such materials, the source of which it was purchased, and the price paid, or to be paid therefor. The City may, at its discretion, furnish to the Contractor any materials or supplied required for extra work, and the Contractor shall not be entitled to receive allowance or percentage on account of materials or supplies so furnished.

7.07 **PAYMENT FOR WORK BY THE CITY**: The cost of the work performed by the City in removing construction equipment, tools and supplies in accordance with section 4.12 and in correcting deficiencies in accordance with section 3.12 shall be paid by the Contractor within thirty (30) days after receipt of an invoice thereof.

If the Contractor does not pay the expenses of such removal and after ten (10) days written notice being given by the City of its intent to sell the material, the City may sell the material at auction or at private sale and shall pay to the Contractor the net proceeds there from after deducting all the costs and expense that should have been borne by the Contractor.

7.08 **PAYMENT FOR WORK BY THE CITY FOLLOWING ITS TERMINATION OF THE CONTRACT**: Upon termination of the Contract by the City in accordance with section 3.13, no further payments shall be due the Contractor until the work is completed. If the unpaid balance of the Contract amount shall exceed the cost of completing the work, including all overhead costs, the excess shall be paid to the Contractor. If the cost of completing the work shall exceed the unpaid balance, the Contractor shall pay the difference to the City. The cost incurred by the City, as herein provided, and the damage incurred through the Contractor's default, shall be certified by the City and approved by the Engineer.

7.09 **PAYMENT FOR WORK TERMINATED BY THE CONTRACTOR**: Upon suspension of the work or termination of the Contract by the Contractor in accordance with section 3.14, the Contractor shall recover payment from the City for the work performed, plus loss on plan and materials plus 10% profit and established damages, as approved by the Engineer.

7.10 **RELEASE OF LIENS**: The Contractor shall deliver to the City a complete release of all liens arising out of this Contract before the retained percentage or before the final request for payment is paid. If any lien remains unsatisfied after all payments have been made, the Contractor shall refund to the City such amounts as the City may have been compelled to pay in discharging such liens, including all costs and reasonable attorney's fees. The Contractor shall execute the "Contractor's Affidavit" form as shown as follows:

CONTRACTOR'S AFFIDAVIT

STATE OF MICHIGAN

County of _____

The undersigned, _____
hereby represents that on the _____ day of _____, 20__ , he (it) was awarded a Contract by the City of Royal Oak, hereinafter called the Owner to _____and the undersigned further represents that the subject work has now been accomplished and the said Contract has now been complete.

The undersigned hereby warrants and certified that all of his (its) indebtedness arising by reason of the said Contract has fully been paid or satisfactorily secured; and that all claims from subcontractors and others for labor and material used in accomplishing the said project, as well as all other claims arising from the performance of the said Contract, have been fully paid or satisfactorily settled. The undersigned further agrees that, if any such claims should hereafter arise, the (it) shall assume responsibility for the same immediately upon request to do so by the Owner.

The undersigned, for a valuable consideration, the receipt of which is hereby acknowledged, does further hereby waive, release and relinquish any and all claims or right of lien which the undersigned now has or may hereafter acquire upon the subject premises for labor and material used in accomplishing said project owned by the Owner.

This affidavit is freely and voluntarily given with full knowledge of the facts, on this _____ day of _____, 20_____.

Contractor: _____

By: _____

Title: _____

Subscribed and sworn to before me, a Notary Public
in and for _____ County, Michigan,
on this _____ day of _____, 20___.

_____
Notary Public
My Commission expires _____.

7.11 **TERMINATION OF CONTRACTOR'S RESPONSIBILITY**: The Contract will be considered complete when all work has been finished, the final inspection made by the Engineer, and the project accepted in writing by the City. The Contractor's responsibility shall then cease, except as set forth in his Performance Bond, as required by the Guarantee period in accordance with section 4.13 and as provided in section 7.12.

7.12 **CORRECTION OF FAULTY WORK AFTER FINAL PAYMENT**: The approval by the Engineer of the final request for payment and the making of the final payment by the City to the Contractor shall not relieve the Contractor or responsibility for faulty materials or workmanship and the Contractor shall promptly replace any such defects discovered within one (1) year from the date of written acceptance of the work.

7.13 **PROGRESS PAYMENTS AND ESTIMATES**: At the end of each month or at such other time intervals as may be mutually agreeable, the Engineer will make an estimate of the quantity and value of the work done by the Contractor since the date of the previous estimate, and as soon as practicable thereafter the City will pay the Contractor, as a partial payment, not less than 80% of the amount of such estimate, except that the City may at any time retain from such partial payments a sum sufficient to meet any undischarged indebtedness of the Contractor in connection with the work performed. Payments shall be made in accordance with Public Act No. 524 of 1980 and all amendments.

7.14 **FINAL ESTIMATE AND PAYMENT**: As soon as practicable after completion of all work included in this Contract, and after all known defects and deficiencies have been remedied, the Engineer will make a final inspection of said work and prepare a final estimate of the amount of money due to the Contractor. The Contractor shall file with the Engineer, as a condition precedent to final payment, an affidavit that all payrolls, material bills, and all other indebtedness incurred by them in connection with the work have been paid, or an affidavit showing in detail the nature and amount of any such indebtedness that is unpaid. The City shall hold from final payment an amount of money sufficient to meet any such undischarged indebtedness of the Contractor until an affidavit that such indebtedness is paid if filed with the Engineer.

The City may also withhold from final payment an amount of money, not to exceed 10% of the total contract price for not more than six months as security against hidden defects in the work included in the Contract. If at the end of said six month period, no such defects have been discovered, the City shall make payment to the Contractor of any such money withheld. If, at the end of such period, such defects have been discovered, the City may continue to withhold said sum of money until any such defects have been repaired by the Contractor, or may use such money to make the necessary repairs and pay to the Contractor any money unexpended.

GENERAL SPECIFICATIONS FOR MATERIALS TESTING

1.00 GENERAL PROVISIONS

1.01 **WORK INCLUDED**: The Contractor shall furnish all materials reasonably required for testing purposes; labor for taking, preparing and assembly samples, transportation of samples to testing laboratories; and analysis by independent testing laboratories.

1.02 **TESTING LABORATORY**: Selection of the testing laboratory will be made by the City.

1.03 **REPORTS REQUIRED**: The Engineer will require two (2) copies of all laboratory reports and one (1) additional copy will be mailed directly to the Contractor.

1.04 **TESTS REQUIRED**: All testing shall follow A.S.T.M. procedures and requirements. In general, the following will be the minimum test required:

A. **Cement** - Certificates of tests by producer or by independent laboratory as required by the Engineer.

B. **Concrete aggregates and Mortar Sand** - Certified tests by producer or independent laboratory as required by the Engineer.

C. **Concrete** - For each class of concrete being used, at least three standard 6" cylinders shall be taken each day. The point, time and method of securing these samples shall be determined by the Engineer. The cylinders shall be protected on-site **by the Contractor** at a controlled temperature between 60 degrees and 80 degrees Fahrenheit. The cylinders shall be kept onsite for 48 hours after molding; the samples shall then be taken to the testing laboratory for curing. The cured samples shall be tested at three, seven and twenty-eight (28) days, unless otherwise requested by the Engineer. Slump tests shall be made on the job by the Contractor in accordance with A.S.T.M., one for each 25 cubic yards of concrete or as directed by the Engineer to maintain the desired consistency of the concrete.

D. **Brick and Concrete Block for Manholes, Catch Basins, etc**, - Visual inspection on site by the Engineer.

E. **Brick and Concrete Block for Building** - Under 30M, visual inspection on site by Engineer; over 30M, test by independent laboratory.

F. **Non-ferrous Pipe** - Independent laboratory tests, 1/2% of each size and class; minimum of three pieces each size and class.

G. **Ferrous Pipe and Asbestos - Cement Water Main** - Certified tests by producer or independent laboratory as required by the Engineer.

H. **Reinforcing steel, structural steel and Miscellaneous Metal** - Visual inspection on site by the Engineer for rust, dimensions welding, shop painting, etc.

I. **Welding** - 1% of structural welds.

1.05 **BASIS OF PAYMENT**: The City shall pay the fees charged by independent testing laboratories for testing materials. All other costs of testing are considered incidental. All specimens for destructive testing shall be provided without expense to the City.

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GENERAL SPECIFICATIONS FOR EXCAVATING AND BACKFILLING

1.00 GENERAL PROVISIONS

1.01 **WORK INCLUDED**: Work under this section shall consist of furnishing all materials, equipment and labor for excavating, trenching, shoring, sheeting, dewatering, bedding, backfilling, boring and jacking, disposal of unsuitable material, surface restoration, pavement replacement and special work below grade for construction.

1.02 **CONSTRUCTION SAFETY**: The Contractor shall alone be responsible for safety, efficiency and adequacy of his plant, appliances, equipment and methods, and for any damage which may result from their failure or their improper construction, maintenance or operation.

Job site and environs shall be regularly patrolled and maintained to reduce hazardous conditions and litter.

Excavations and trenches left unattended shall be barricaded against pedestrians and vehicular traffic, backfilled, or adequately covered and fenced.

Construction equipment and excavated material shall be stocked in such locations that it does not obstruct vision on the traveled portion of the right-of-way and in such a manner that will not interfere with the flow of traffic. Excavated material shall be stockpiled in such locations that it does not obstruct roadway drainage. The Contractor is directly and solely responsible for disposal of all broken concrete, reinforcing steel, unsuitable material and debris.

1.03 **PROTECTION TO EXISTING UNDERGROUND LINES OR STRUCTURES**: Where service lines or structures are encountered which are in active use, the Contractor must provide adequate protection for them and he will be held responsible for any damages to such utilities arising from his operations. The Contractor shall provide stand-by-utility service if temporary removal is necessary for a period exceeding two (2) hours.

Where utility service connections to occupied buildings must be temporarily disconnected, the Contractor shall give twenty-four (24) hours written notice to the affected occupants stating the time and duration of the anticipated shut-off.

1.04 **PUBLIC SAFETY**: The Contractor shall follow safe practices. In public rights-of-way, the Contractor shall provide sufficient traffic control, fencing and barricading in accordance with the current edition of the Michigan Manual of Uniform Traffic Control Devices. If traffic speed or volume warrant, the Contractor shall promptly furnish sufficient Traffic Regulator Personnel (flagmen) to effectively and safety direct traffic around or through the work area. In railroad, state highway, county highway or municipal street rights-of-ways, barricading, lighting and Traffic Regulator Personnel (flagmen) requirements shall meet standards of the agency having jurisdiction.

1.05 **CLEAN-UP**: Clean-up shall follow directly behind the pipe installation or at the end of every working day. The Contractor shall not delay the clean-up so that public use of streets is held up needlessly. Surface restoration (including pavement) is considered as a part of the clean-up and the general provisions of "clean-up" apply. “Clean-up" shall mean:

A. Removing and hauling all excess fill, broken concrete, miscellaneous debris and other material generated by the project to a landfill approved by the City.

B. Obtaining rough grade in all lawn areas in preparation for lawn restoration.

C. Watering pavement with hoses from fire hydrants, then sweeping with a mechanical pick-up type street cleaner approved by the Engineer.

D. Sweeping public sidewalks.

Dust shall be controlled by thoroughly watering pavement with water using hoses attached to approved fire hydrants, then sweeping with a vacuum type street cleaner approved by the Engineer. The materials generated from sweeping shall become the property of the Contractor and removed from the project incidental to the Contract.

1.06 **SEASONAL CONSIDERATIONS AND CONSTRUCTION SCHEDULE**: The Contractor shall prepare and present at the preconstruction meeting a detailed work schedule, and taking into consideration the following conditions:

A. Permanent pavement removal shall be limited to the period of March 15th to November 15th.

B. Permanent pavement replacement shall be limited to the period of April 1st to November 15th.

C. Severe weather conditions during January and February may cause the Engineer to order operations discontinued pursuant to the General Conditions, section 3.03 "Supervision of Work".

D. Special conditions imposed by the Project Specifications.

The above conditions may be modified by specific weather conditions or techniques proposed by the Contractor and acceptable to the Engineer. Such authorization for modification will be issued in writing.

The Construction Schedule shall list separately major items of work whether pay items or incidental work.

2.00 EXCAVATION AND TRENCHING

2.01 **EXCAVATION**: Excavation shall include the clearing of the site of the work and the removal of all of the materials to a depth which is sufficient to permit the construction of the structure or installation of water main, sewer or drain lines in accordance with the plans. Excavated materials from trenches may be temporarily stored along the trench in a manner that will not cause damage to trees, shrubbery or other properties, and that will not endanger the banks of the trench by imposing too great of load thereon. Bituminous material or bituminous pavement removal shall be considered the same as earth excavation.

All excess excavation, fill, broken concrete, and other miscellaneous debris or other material generated by the project shall be hauled away expeditiously the same day it is removed from the trench to a landfill approved by the Engineer. All required excavation and removal of excavated material from the project site shall be incidental to the Contract.

2.02 **EXCAVATION FOR STRUCTURES**: Excavation for structures will usually be stockpiled for use on the site as shown on the plans. Topsoil, unless provided otherwise, shall be salvaged and stockpiled for spreading over the entire graded area. The dimensions of the excavation shall be sufficient for dewatering facilities and to provide adequate working area around the forms. During construction, the excavation shall be kept dewatered until concrete or mortar has attained initial set. Concrete shall not be poured under water without express written authorization of the Engineer. Excess excavation below grade of the structure's base shall be backfilled with 1,500 p.s.i. concrete.

2.03 **EXCAVATION BY TRENCHING TO GRADE**: The trench for water main, sewer or drain lines shall be excavated to the depth required so as to provide a uniform and continuous bearing and support for the pipe barrel on solid and undisturbed ground. The Engineer may require excavation of the last 4 inches of depth to grade using hand tools.

If, in the opinion of the Engineer, soil conditions are encountered at subgrade which require all or part of this work to be done in accordance with section 2.05 A, the Engineer shall have the authority to order the work done. All excavation below ground shall be done to current MIOSHA guidelines and requirements.

2.04 **WIDTH AND LENGTH OF TRENCH**: The width of the trench shall be ample to permit the pipe to be laid and joined properly, and the backfill to be placed and compacted as specified. Trenches shall be of such extra width, when required, as will permit the convenient placing of timber support, sheeting and bracing, and dewatering facilities.

In order to limit excessive loads on the pipe, the maximum width of trench shall be 30 inches for pipe 6 inch to 10 inch inclusive. For pipe diameters 12 inch through 30 inch, the width shall not be more than 2 feet greater than the inside diameter of the pipe. For pipe over 30 inches in diameter, the trench width shall not be more than 2 feet greater than the outside diameter of the pipe. For elliptical pipe, trench width restrictions shall be determined by the pipe horizontal dimension in place. This limitation shall apply to the width of the trench at the top of the pipe.

On any run in public right-of-way, not more than 200 feet of open trench will be permitted at a time, unless pedestrian bridges are maintained at 200-foot intervals and at least a one-lane vehicular crossing is maintained at 300-foot interval. Streets shall not be completely blocked without written permission from the Engineer.

2.05 **EXCAVATION BELOW GRADE**: As follows:

A. Where called for on the plans or required by the Engineer because of soil conditions, the trench shall be excavated to at least 3 inches and not more than 6 inches below the specified grade in order to modify subgrade. Before the pipe is laid, the subgrade shall be prepared by backfilling with an approved material in 3-inch compacted layers. The layers shall be thoroughly tamped so as to provide a uniform and continuous bearing and support for the pipe barrel. Compaction shall not be less than 95 percent Standard Proctor Density.

B. For excavation greater than 6 inches below the specified grade, the Contractor shall remove the unsuitable material and replace same with an approved porous material, thoroughly compacted to 95 percent Standard Proctor density in 3-inch layers to the specified grade.

2.06 **SPECIAL FOUNDATION IN POOR SOIL**: Where the bottom of the trench at subgrade is found to consist of material which is unstable to such a degree that in the opinion of the Engineer, it cannot be removed or replaced with an approved material thoroughly compacted in place to support the pipe properly, the Contractor shall construct a foundation for the pipe, consisting of piling, timber or other materials in accordance with plans prepared by the Engineer.

2.07 **CLEARANCE IN ROCK**: Ledge rock, boulders and large stones shall be removed to provide the following clearances:

A. At lease 6 inches below and on each side of all water pipe, valves and fittings for water service.

B. At least 3 inches below and a minimum of 12 inches on either side of the pipe and fittings for sanitary sewers and storm drains. The specified clearances are the minimum clear distances which will be permitted between any part of the pipe or appurtenances being laid and any part, point or projection of the rock.

2.08 **ROCK EXCAVATION**: The word "rock", wherever used as the name of an excavated material, shall mean boulders and pieces of concrete or masonry exceeding 2,000 pounds in weight, or solid ledge rock and masonry which in the opinion of the Engineer, requires for its removal drilling and blasting, wedging, or breaking up with a power-operated tool. Pavements, soft disintegrated rock which can be removed with a handpick or power-operated excavator or shovel; loose, shaken or previously blasted rock or broken stone in rock fillings or elsewhere; and rock, exterior to the minimum limits of measurements allowed, which may fall into the excavation, will not be measured nor be allowed as an extra.

2.09 **BLASTING**: Blasting for excavation will be permitted only after securing the approval of the Engineer and only when proper precautions are taken for the protection of persons or property. The hours of blasting will be fixed by the Engineer. Any damage by blasting shall be repaired by the Contractor at his expense. The Contractor's methods of procedure in blasting shall conform to state and local regulations.

2.10 **SHEETING, SHORING AND BRACING**: Where required to properly support the surfaces of the excavations to protect the construction work, adjacent work or workmen, sheeting, bracing and shoring shall be provided, as required by current MIOSHA guidelines and requirements. If the Engineer is of the opinion that, at any point, sufficient or proper supports have not been provided, he may order additional supports at the expense of the Contractor. An approved pipe-laying box may be used in lieu of sheeting where safety or workmen is the sole consideration. Care shall be taken when the box is moved to avoid dislocation of pipe of loosening in pipe joints.

In removing the sheeting and bracing after the construction has been completed, special care shall be taken to prevent any collapse of the excavation and injury to the completed work or adjacent property.

The trench bracing, except that which must be left in place, may be removed when the backfilling has reached the respective levels of such bracing. Sheeting, except that which has been ordered left in place, shall be removed as the backfilling progresses. Special care shall be taken to fill and compact voids created by removal of bracing and sheeting.

Where required to protect the work, adjacent structures or property, sheeting, shoring and bracing shall be left in place, but shall be cut off or left not less than 2 feet below the established surface grade.

2.11 **PUMPING, BAILING AND DRAINING**: The Contractor shall provide and maintain adequate pumping and drainage facilities for removal and disposal of water from trenches or other excavations. He shall provide pumping and drainage facilities for bulk-headed sewer sections and shall operate same until bulkheads have been removed or constructions completed if bulkheads are to be left in place.

Where work is in ground containing free water, the Contractor shall provide, install and maintain suitable drainage facilities such as well points connected to manifolds and reliable pumping equipment and shall so operate them to insure proper working conditions. In impervious materials, the Contractor shall construct suitable drains, under-drains, sumps and provide adequate pumping facilities to maintain the trench in a dry condition. The Contractor shall take measures to protect pipe or structures from hydrostatic uplift. Drainage or discharge lines shall be connected to adjacent public sewers or extended to nearby water courses wherever possible. In any event, all pumping and drainage shall be done without damage to the roadway, receiving sewers, or other property. The Contractor shall ascertain the availability of adequate drainage for dewatering operations.

Gravel, stone or other material used in lieu of well points to drain water shall be considered an alternate method of dewatering or draining. Should the drainage contain sand, gravel, etc., which, in the opinion of the Engineer, should be kept from entering the sewer or water course, suitable sand traps shall be used.

2.12 **ABANDON PIPES DURING EXCAVATION**: The Contractor shall install a one (1) foot thick bulkhead of brick and concrete in all piping determined to be abandoned by the Engineer. Bulkhead work for pipes under 24 inches in diameter shall be considered as included in the Contract.

2.13 **SOIL EROSION AND SEDIMENTATION CONTROL**: Soil erosion and sedimentation control shall be done in accordance with Public Act No. 451 of 1994 including all amendments. Permits from Oakland County Water Resources Commission (OCWRC) shall be obtained by the Contractor and shall be incidental to the Contract. Soil erosion and sedimentation control measures including labor and materials shall be incidental to the Contract.

3.00 BACKFILLING

3.01 **GENERAL**: Backfilling includes the replacement and compaction of suitable material to restore site to grade. Compaction requirements shall be as specified. Flooding or any other method of compaction allowed by the Engineer shall not relieve the Contractor of the responsibility of the specified density requirements. Flooding the trench with water for compaction requirements shall not be allowed.

If there is a deficiency due to a rejection of unsatisfactory excavated material, the Contractor shall furnish the required amount of sand, gravel or other approved material as an extra.

3.02 **BACKFILLING AROUND PIPES**: From the bottom of the trench to 1 foot above the top of the pipe, the trench shall be backfilled by hand with sand, gravel or approved excavated materials and tamped in 3-9 inch layers, to 95 percent Standard Proctor Density. All sand or gravel backfill shall be incidental to the Contract.

At manholes, valve chambers, metering chambers and other points or rigid pipe support, special measures, including, if necessary, 2,500 p.s.i. concrete backfill, shall be provided to prevent shearing stress on the pipe line.

3.03 **BACKFILLING TO GRADE UNDER LAWN AREAS**: From 1 foot above the pipe to the original grade, the balance of trench may be backfilled by approved mechanical methods. Fill shall be compacted in maximum 1 (one) foot layers by machine methods to 90 percent Standard Proctor Density.

Backfill material shall be free of cinders, ashes, refuse, sod, vegetable or other organic material, boulders, rocks or stones, pavement, or other materials which, in the opinion of the Engineer is unsuitable. The backfill shall be nearly rounded over the trench to a sufficient height to allow for settlement to grade after consolidation.

3.04 **BACKFILL UNDER PERMANENT PAVEMENTS, DRIVEWAY SURFACES AND SIDEWALKS**: Where the excavation is made through permanent pavement, curb, driveway surfaces, sidewalks or where structures are undercut by the excavation, the backfill from 1 foot above the pipe to the subgrade shall be made with new sand or Engineer approved existing excavated sand compacted to 95 percent Standard Proctor Density. Fill shall be compacted in maximum 1 (one) foot layers by machine method. All sand backfill shall be incidental to the Contract, unless sand backfill is listed as an item in the contract's Form of Proposal.

3.05 **SPECIAL BACKFILLING REQUIREMENTS**: The Contractor will be required to comply with the regulations of state highway, county road, or railroad company's engineering department with regard to backfilling and compaction in their respective rights-of-way; and shall be responsible for determining these regulations prior to bidding.

3.06 **BACKFILL AT STRUCTURES**: Backfill shall be placed against structures only after the structure has reached 75 percent of design strength. The backfill shall be compacted to 95 percent Standard Proctor Density. Backfill shall be placed in 8-inch layers and compacted with a hand or mechanical vibrator.

3.07 **COMPACTION TESTING**: The Engineer will perform all tests for compaction. The Contractor shall cooperate with the Engineer, furnishing such equipment and personnel as required. All density percentages shall be based on the Standard Proctor Method for compaction.

4.00 RESTORATION AND MAINTENANCE OF SURFACE PROPERTY OR STRUCTURES

4.01 **GENERAL**: Surface restoration shall include replacement of topsoil and seed, sod, shrubs and decorative plantings, signs, mailboxes, guard posts, gravel, walks, curbing shoulders, driveways and parking areas, alley and streets, castings, or other surface features existing prior to start of construction.

4.02 **PAVEMENTS**: The term pavements shall include street, highway, parking lot, alley and driveway surfaces, and sidewalks.

Cuts through concrete pavement shall be at right angles to the pavement centerline. Removal of concrete pavement, either plain or reinforced, shall be done by cutting the pavement with powered, diamond blade saws or method approved by the Engineer. Opening shall be trimmed in straight liens with right angle corners and vertical edges. When pavement cuts are 5 feet or less from expansion or construction joints, the pavement shall be removed to the joints. The pavement shall be cut so that the pavement removal is 1(one) foot wider than the trench on each side. Sidewalks and curb, and curb and gutter, shall be removed to contraction or expansion joints.

Cuts through blacktop pavement may be made at any angle with the pavement centerline. Removal of blacktop pavements shall be done by cutting through the pavement with a powered saw or other approved cutting device. After cutting, blacktop may be removed with power equipment. Pavement shall be removed to expansion or contraction joints when the pavement cut is 5 feet or less from a joint.

Gravel replacement of streets, alleys, driveways, parking areas and walks shall include backfill, backfill compaction to 95 percent Standard Proctor Density, grading of the sub-base as well as placement, compaction and final shaping of an 8-inch compacted gravel surface. Shoulder area shall be stabilized with gravel to bear traffic, unless otherwise provided in the project specifications. Bituminous replacement shall include removal and disposal of the pavements and sub-base; placement and compaction of special backfill; placement, compaction and shaping of a 6-inch compacted gravel base; trimming of existing asphalt edges, priming of edges; and the placement and compaction of bituminous pavements to the thickness as directed by the Engineer.

Concrete replacement shall include sawing, breaking and removal, special backfill requirements for compaction, preparation of subgrade, all form work, expansion, contraction and load transfer joints, expansion anchors, furnishing, placing and curing the concrete. The pavement area shall be temporarily patched and maintained with 4" of compacted smooth cold patch (bituminous) or crushed concrete at the completion of each and every day if permanent pavement is not installed the same day. The permanent pavement replacement shall be completed within five (5) working days of completion of underground work or three (3) working days for pavement replacement projects.

Materials used for surface replacement shall conform to the following standards:

Gravel Surface of Base Course.....	MDOT 21AA
Bituminous Surface	MDOT 36A, MDOT 4C
Concrete pavement, sidewalk, ... curb and gutter	Air Entrained Concrete (3500 p.s.i.) or as called for in the Contract

Concrete thicknesses shall be as follows:

Street pavements as removed - 6 inch minimum
Major Roads & Intersections – 8" minimum
Sidewalk - 4 inch
Handicapped sidewalk ramps - 6 inch minimum
Sidewalk across drives and alleys - 6 inch (residential), 7 inch (streetscape), 8 inch (commercial)
Driveways and Alleys - 6 inch (residential), 7 inch (streetscape), 8 inch (commercial)

No permanent pavement shall be restored unless and until, in the opinion of the Engineer, the condition of the backfill is such as to properly support the pavement. Pavement replacement shall follow as closely as practical to clean-up operations.

4.03 **TREES, SHRUBS AND LAWNS**: The Contractor shall remove only those trees and shrubs which are so designated on the plans, protecting all others from damage. When tree roots are removed because of trenching, the top of the trees shall be trimmed sufficiently to balance the loss of roots. This trimming shall be done by the Contractor under the direction of the Engineer. Any branches of trees damaged by equipment shall be neatly trimmed.

The Contractor is responsible for obtaining permission and instructions from the City of Royal Oak Department of Public Service (DPS) prior to trimming any trees. All trees 8 inches in diameter or less will require a tunnel for pipe installation 8 feet long. Trees over 8 inches in diameter, measured 4 feet above the ground surface, will require a tunnel length of one foot for each inch of tree diameter. Trees shall be tunneled or augured whenever any portion of an excavation approaches within a distance equal to one half of the required tunnel length. Tunneling shall be done with a boring machine; tunneling with a backhoe will **not** be permitted.

All vegetation which is in the construction operations(s) area shall be carefully protected from damage or injury during all construction work. The Contractor shall replace, at the Contractor's expense, all damaged, dead or dying trees or plantings, as directed by the Engineer, with equip size and species of the damaged vegetation.

The Contractor shall be responsible to restore all lawn areas disturbed in conjunction with the construction operations. Restoration of lawn areas on local streets shall be with minimum of 2 inches of topsoil and MDOT class A fertilized sod. The topsoil and sod shall be approved by the city prior to installation. Restoration of lawn areas on major streets shall consist of minimum of 2 inches of topsoil, and seeding by means of hydro-seeding and shall have the following composition of seeds:

30% Park Kentucky Bluegrass
30% Dawson Red Fescue

30% Fults Puccenelia
10% Penfine Perennial Rye

This seed composition shall be certified by the supplier of the seed mixture. The Contractor shall be responsible to establish growth of lawn areas for a period of 90 days after sod is installed or 90 days after the lawn seed has germinated and has started to grow.

5.00 **BORING AND JACKING**: Where called for on the plans or in the Project Specifications, pipe of the size and type shown on the plans shall be placed by boring and jacking method as approved by the Engineer without disturbing the ground or pavement surface above the pipe. The tunnel shall be adequately sheeted or shored to prevent the sides and top from collapsing or the pavement form settling or cracking. Where possible, boring and jacking pits shall be at least ten (10) feet from the edge of the pavement. Direct boring of concrete tongue and groove pipe shall be Class V with joints as specified. The proper line and grade of the pipe shall be maintained. When jacking or tunneling pipe under railroad tracks, the face of the excavation shall be braced during passage of trains, at times when work is shut down, as directed by the railroad.

During boring operations, the auger shall not be advanced beyond the end of the casing. Casing pipe as shown on the plans is a minimum for the pipe being installed therein. The Contractor may at his option, elect to use larger casing pipe. Diameter, thickness and schedule of such alternate casing must be approved by the Engineer. The annular void between the casing and the carrier pipe shall be filled with cementitious grout as specified in MDOT 2012 Standard Specifications for Construction, Section 702.02. Filler material is to be placed by an approved method which will provide a uniform and thorough filling of the void. The casing shall be filled to within 1 inch of the top +- 1/2 inch. Upon completion of the filling operation, the ends of the casing shall be sealed with a 1 foot thick bulkhead of 3500 p.s.i. grade concrete. When a casing pipe is not used, the cavity between the outside of the pipe and undisturbed ground shall be sealed at both ends of the bore with 2500 p.s.i. concrete a minimum of eight (8) inches thick.

6.00 METHOD OF MEASUREMENT AND BASIS OF PAYMENTS

6.01 **GENERAL**: The cost of work performed in excavating and backfill shall be included in the price quoted in the Proposal where the specific items of improvement are listed. Surface restoration, unless shown as a pay item in the Proposal, shall be considered as incidental. Extra work such as sheeting left in place or rock excavation ordered will be paid for as provided in the Contract.

6.02 **EXISTING UNDERGROUND STRUCTURES AND UTILITIES**: When existing underground utilities require raising, lowering, or moving to another location, the City will be responsible for the cost thereof. Sheeting, bracing, or other means used to support a utility exposed or endangered by the Contractor's operations, is considered incidental. Relocating, raising, or lowering of a utility for the Contractor's convenience, repair of utilities damaged by the Contractor and related temporary services necessary because of extended periods of service outages are also considered incidental.

For buildings and structures, all existing utilities shown on plans and requiring removal and / or relocations are considered incidental to excavation for said buildings and structures.

6.03 **EXCAVATION**: Excavation to a point of 6 inches below grade maybe required by plans or by soil conditions is considered incidental. Additional excavation below this point, explained in sections 2.05 B (Excavation Below Grade) and 2.06, will be paid for as extra work. No compensation will be allowed for delays in the Contractor's schedule due to these conditions.

6.04 **SHEETING**: When sheeting and bracing have been ordered left in place, payment for same shall include the upper 2 feet of "cut-off" section of sheeting. Sheeting and bracing not left in place and the expense of using a sewer box are considered incidental.

6.05 **PUMPING, BAILING AND DRAINING**: The providing, maintaining or operating of any dewatering or drainage facilities are incidental and the cost thereof shall be included in the unit price bid for sewers, water mains, drains, or structures. Gravel, stone or other material used in lieu of well points or under drains to stabilize the trench will be considered an alternate method of dewatering, and therefore, an incidental expense.

6.06 **BACKFILL**: Removal and disposal of rejected backfill material from trenches (other than under pavements), and the furnishing and placing of an acceptable material, shall be considered as extra work. Measurement will be by truckload count, loose measure. Load tickets will be required and must be delivered to the inspector at the site. Removal and disposal of excess excavated material from trenches under pavements, driveway surfaces, and sidewalks and as defined under sections 2.03 and 2.05 shall be considered incidental to the Contract.

Backfill and compaction around pipes, under pavements, and special backfill requirements, as defined under sections 2.05 A, 3.02, 3.04 and 3.05, are considered incidental to sewer, drain and / or water main construction and no extra payment will be allowed for this work, not withstanding that sand backfill may be listed as an item in the Proposal.

6.07 **ROCK EXCAVATION**: Rock excavation will be measured by profiling the rock surface and computing minimum volume requiring removal to install the proposed facility. Payment shall be computed by cubic yard measure when listed as an item in the Proposal or as extra work, except that with building and structures, cost of rock is incidental when indicated on plans.

6.08 **PAVEMENTS**: Restoration of pavement is incidental unless centerline of pipe is under the pavement. Stabilization of shoulders is incidental. See section 6.01 of these specifications.

Pavement replacement for services is considered incidental if pipeline lies under the same pavement. Pipeline laid in the same trench (force main and sewer) will be considered as a single unit when measured for surface replacement.

6.09 **BORING AND JACKING**: Boring and jacking including the casing pipe when required will be paid for on a linear foot basis. The price bid shall include the cost of required special permits, the jacking pit and shoring, labor, equipment and material required to install the pipe line and casing, backfill of the pit and cleanup, but shall not include the sewer or water main installed through the jacking area. Casing pipe size over minimum shown on plans will be considered incidental for Contractor's convenience.

6.10 **RAILROAD CROSSING**: Railroad inspection costs will be paid by the City, but all other costs and requirements are to be borne by the Contractor.

6.11 **BUILDINGS AND STRUCTURES**: Payment for work under this heading shall be on a lump sum basis. No claim for extra work will be considered unless ordered by the Engineer.

6.12 **CLEANUP**: Cleanup work is considered incidental to the item bid; however, failure to perform this work as required by the Engineer will be sufficient cause to withhold money for this work, or to order work on the project stopped until cleanup is accomplished under section 1.05.

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GENERAL SPECIFICATIONS FOR SEWERS

1.00 GENERAL

1.01 **SEWER LOCATION**: City sewers shall be located 10 feet clear horizontally and 1.5 feet clear vertically from all water mains. The Contractor is to notify the City Engineering Department if either criteria cannot be met during the course of the work for approval of installation.

1.02 **DEFINITION**: As used herein, sewers shall be considered to mean all pipe or conduits and appurtenances intended to transport waste waters and / or storm waters and lying within street rights-of-way or easements.

1.03 **WORK INCLUDED**: The Contractor shall, unless otherwise noted in the project specifications, furnish all materials, equipment, tools, and labor necessary to do the work including all unloading, hauling, and distributing of materials required under this Contract. The Contractor shall also lay and test the sewer, clean up the site of the work, and maintain the street or other surface over the trench. Excavation and backfill shall be in accordance with the General Specifications for Excavating and Backfilling accompanying this document.

1.04 **LOCATION AND SCOPE**: The location and grade of the proposed sewers and the approximate depth at which they are to be laid is shown on the plans. An estimate of the quantity of work to be done is given in the Proposal. The Engineer reserves the right to make minor changes in lines and grades of pipe line, locations of pipe and manholes, when such changes maybe necessary or advantageous. Major changes will be made as prescribed in the General Conditions entitled "Changes in the Work".

1.05 **CLEAN-UP**: The sewer, manholes, inlets, services and appurtenances shall be cleared of all scaffolding, rubbish, dirt dams or other obstructions as work progresses. House services shall be installed as sewer laying progresses and within cleanup limitations unless otherwise provided. Clean-up work, including trench backfill and surface replacement shall follow pipe laying operations not to exceed 400 feet unless specific authorization is obtained from the Engineer.

1.06 **CERTIFICATION OF PIPE**: All pipe delivered to the jobsite shall be accompanied by certification papers showing that the pipe has been tested in accordance with the applicable specifications and that the pipe meets the specifications for this project.

1.07 **TESTS**: The presumptive tests, air testing, infiltration / exfiltration tests and television inspections will be done as specified hereinafter.

1.08 **SHOP DRAWINGS**: Furnish, as prescribed under the General Conditions, shop drawings of the items proposed under this section of the Contract. Design details of the joint shall be submitted to the Engineer for his consideration and approval before ordering any pipe.

2.00 MATERIALS – SEWERS

2.01 **GENERAL**: All materials furnished by the Contractor must conform in all respects to the following standard specifications. Where reference specifications are used, they shall be considered as referring to the latest issue. Unless otherwise indicated, any material furnished by the Owner will also conform to these specifications.

ASTM F-477	Joint Gaskets
ASTM D-2680	ABS Truss Pipe
ASTM D-2751	ABS Solid Plastic Pipe
SDR 23.5	ABS Solid Plastic Pipe
ASTMD-3034	PVC Solid Plastic
NCPI-ER4	Vitrified Clay Pipe (VCP)
ASTM C-700	Vitrified Clay Pipe (VCP)
ASTM C-76	Reinforced Concrete Sewer Pipe (RCSP)
ASTM C655	Reinforced Concrete Sewer Pipe (RCSP)
ASTM C425	Clay Pipe Joints
ASTM C594	Clay Pipe Joints
AASHO-M-36	Corrugated metal Pipe
ASTM C443	Joints in Concrete or Reinforced Concrete Pipe
AWWA C320	Joints in Concrete or Reinforced Concrete Pipe
ASTM C361	Joints in Concrete or Reinforced Concrete Pipe
AWWA C301	Joints in Concrete or Reinforced Concrete Pipe
AWWA C302	Joints in Concrete or Reinforced Concrete Pipe

2.02 **SEWER PIPE**: The locations of the various types of pipe are shown on the plans. Sanitary sewer pipe shall be designed for air testing.

All sewer pipe used in this work shall meet the requirements of the standard specifications of the National Clay Pipe Institute (NCPI), American Society for Testing and Materials (ASTM), or American Standards Association (ASA). Sewer pipe shall be of the following types as noted on the plans.

Vitrified Clay Pipe (VCP) - NCPI-ER4 and
ASTM C-700 Extra Strength
ABS Truss Pipe - ASTM D-2680
ABS Solid Plastic Pipe - ASTM D-2751, SDR 23.5
PVC Solid Plastic Pipe - ASTM D-3034. SDR26
Reinforced Concrete Sewer Pipe (RCSP) - ASTM C-76, Class as designated on the drawings or special design conforming to ASTM C655

2.03 **JOINTS IN CLAY PIPE**: Joints in clay pipe shall be the low profile or bell type with a factory applied compression sealing element. Joints shall meet or exceed the performance requirements of ASTM. Low profile pipe joint collars shall be PVC or Fiberglass reinforced polyester. Joint sealing element shall be polyurethane or polyester-rubber. Lubricant to be used in making up joints shall be supplied by the pipe manufacturer and the joints shall be connected in accordance with the manufacturer's recommendations.

Joints in tee branches, fittings, rise pipes and service laterals shall conform to joints furnished for the sewer pipe.

Where special field joints or adapters are required, they shall be the compression coupling type meeting the requirements or ASTM.

Adjustable shear rings or concrete cradle shall be required on all couplings larger than 6 inch. Clamps and shear rings shall be stainless steel.

2.04 **JOINTS IN TRUSS PIPE:** Joints in ABS truss pipe shall be sleeve coupling type "SC" chemically welded joint as specified in ASTM Standard D2680. Gasket quality shall meet Section 3 of ASTM Standard C443.

2.05 **JOINTS IN CONCRETE OR REINFORCED CONCRETE SEWER PIPE**: As follows:

A. Sanitary Sewers - Joints in concrete sewer pipe for sanitary sewers shall be bell and spigot or tongue and groove, ASTM or AWWA concrete, with rubber gasket, or equal.

Modified groove tongue concrete pipe shall have a compression type rubber gasket snapped into a groove cast into the tongue. The modified groove or bell end of the pipe shall be made smooth and shall have not over a three (3) degree slope tapered to fit the rubber gasket to tolerances as detailed by the gasket manufacturer.

Rubber gaskets shall meet the physical requirements of ASTM.

Lubricant shall be supplied by the manufacturer to be used on the groove and on the tongue in making up joints, and the joints shall be coupled in accordance with the pipe manufacturer's requirements.

B. Storm Sewers - Joints in concrete or reinforced concrete sewer pipe for storm sewers 30 inches in diameter or small shall be bell and spigot or tongue and groove, ASTM or AWWA, with compression type rubber gasket or approved equal.

Lubricant shall be supplied by the pipe manufacturer and the joint shall be coupled in accordance with the manufacturer's instructions.

Rubber gaskets shall supplied by the pipe manufacturer and the joint shall be coupled in accordance with the manufacturer's instructions.

Rubber gaskets shall meet the physical requirements of ASTM.

2.06 **ASBESTOS CEMENT SEWER PIPE**: ASTM C428-63T, of the class shown on the plans.

2.07 **CEMENT MORTAR JOINTS**: Cement mortar joints shall consist of one part cement and two parts of sand.

A. Cement - Portland cement shall conform to the requirements of ASTM Type 1, C-150.

B. Masonry sand shall conform to the requirements of masonry sand 2Ms of the Standard Specifications of the Michigan Department of State Highways.

C. Water used in mixing cement mortar shall be fresh and clean and free from injurious amounts of oil, acid, alkali, organize matter or other deleterious substances.

D. Jute - Best quality Manila yard, closely twisted, in one piece for each joint and of proper size to fit the barrel dimensions.

2.08 **DIE-CAST BITUMINOUS JOINTS**: Die cast, tapered joints, pre-cast onto the pipe, shall be made by fitting the bell and spigot end of the pipe with collars of bituminous compound having a melting point of 240^{o}F and penetration of 4.7 at 77^{o}F.

The ring of bituminous compound shall be die-cast into the bell of the pipe and around the spigot of the pipe of such size and dimension that when the spigot is shoved firmly into the bell, a tight fit between the bell and the spigot will be made and the inverts will be in alignment.

Primer material for jointing die-cast bituminous joints shall, when applied to the joint surfaces, cause the surface to become plastic. When the pipes are shoved firmly together, the joint material shall unify with diffusion of the solvent, congeal and become on homogenous body.

2.09 **COLD MASTIC JOINT COMPOUND**: Sewer joint trowel compound shall consist of bituminous compounds which, when installed, shall provide a joint which will withstand 10 feet of static head. Both the bells and spigots of the pipe shall be primed with priming material as manufactured specifically for the joint material supplied. Material shall conform to Federal Spec. SS-S-00201 or shall be pre-molded plastic.

2.10 **RUBBER JOINTS ON CONCRETE PIPE**: Joints shall meet all requirements of ASTM C-443-63T modified to include "O" rings on grooved pipe ends. Type of joint and the jointing materials proposed to be used by the Contractor together with reference to similar installation shall be submitted to the Engineer for approval. Solvents, adhesives and/or lubricants used shall conform to the Manufacturer's recommendations.

2.11 **PREMIUM JOINTS ON CLAY PIPE**: Joint material pre-cast on the pipe spigots and in the pipe bells shall meet requirements of ASTM C-425, Type I, II or III.

2.12 **RUBBER JOINTS FOR ASBESTOS CEMENT PIPE**: Rubber joints for asbestos cement pipe shall be ASTM D-1869.

2.13 **RUBBER GASKETED JOINTS FOR PVC SDR26**: Joints for P.V.C. pipe shall be bell-and-spigot type rubber gasketed joints conforming to the requirements of ASTM F477.

3.00 **RESPONSIBILITY FOR MATERIALS**

3.01 **MATERIAL FURNISHED BY THE CONTRACTOR**: The Contractor shall be responsible for all material furnished by him and shall replace, at his own expense, all such material found defective during the life of the Contract

3.02 **MATERIAL FURNISHED BY THE OWNER**: The Contractor's responsibility for materials furnished by the owner shall begin at the point of delivery thereof to the Contractor. Materials already on the site shall become the Contractor's responsibility on the day of award of Contract.

The Contractor shall examine all materials furnished by the Owner at the time and place of delivery to him and shall reject all defective material. Any material furnished by the Owner and installed by the Contractor without discovery of such defect will, if found defective prior to final acceptance of the work, be replaced with sound material furnished by the Owner. The Contractor, however, shall at his own expense, furnish all supplies, labor, and facilities necessary to remove such defective material and install sound material in a manner satisfactory to the Engineer.

3.03 **STORAGE**: The Contractor shall be responsible for the safe storage of all materials furnished by or to him and intended for his work. Pre-jointed pipe shall be stacked or strung to prevent bearing on the spigot end, or any other damage to the exposed joint material. The Contractor shall not store or place materials on private property. The Contractor shall not store or place materials in city parks without obtaining written permission from the Engineer.

3.04 **DISPOSITION OF DEFECTIVE MATERIALS**: Any material found during the progress of the work to have cracks, flaws or other defects, will be rejected by the Engineer. All defective material furnished by the Contractor shall be promptly removed by him from the site. Any material furnished by the Owner and found defective shall be set aside by the Contractor and removed from the site by the Owner.

4.00 LINE AND GRADE

4.01 **STAKES BY OWNER**: The Owner will furnish all line and grade control unless otherwise specified in Contract documents. Re-staking required by changes or delay in Contractor's schedule shall be paid for by the Contractor.

4.02 **CONTRACTOR'S ASSISTANCE IN STAKING**: The Contractor shall furnish necessary labor and equipment (except survey instruments) to assist in this work.

4.03 **LINE AND GRADE CONTROL**: As follows:

A. Laser Alignment - The Contractor shall furnish all necessary equipment and personnel required to operate the laser equipment.

The laser beam projection is to be rigidly mounted to its support platform in a manner to be approved by the Engineer. This will assure that all ground equipment vibrations will be kept to a minimum and will permit the laser beam to be projected coaxially through the center of the pipe. All units shall be furnished with equipment to control atmospheric conditions in the pipe which could affect the acceptable standard of construction.

The laser aligning method selected must be shown to have performed satisfactorily on at least three previous projects of a similar nature. The equipment shall be operated by competent, trained operators.

The Engineer will establish centerline stakes and offset stakes at each manhole and other centerline and offset stakes as required for check points.

The Contractor shall furnish openings in the pipe, as required for the installation of the laser equipment, at no additional cost to the Owner. Details of these openings shall be approved by the Engineer.

B. Allowable Tolerances in Sewer Grade - Sewers shall be constructed and laid to the alignment and grade indicated on the plans or as designated by the Engineer. The grade as shown on the profile or as furnished by the Engineer is that to which the work must conform. A variation of one-quarter (1/4) inch from this will be deemed sufficient reason to cause the work to be rejected and re-laid.

C. Deviation from the above specified method of obtaining line and grade will not be permitted unless the deviation has been approved in writing by the Engineer.

5.00 LAYING

5.01 **INSPECTION**: If the Contractor wishes to lay pipe at more than one location on a given day, or work more than one pipe-laying crew, he must notify the Engineer at least two days in advance so that an adequate number of inspectors can be assigned to the job. Pipe laid in absence of an inspector shall not be accepted.

5.02 **HANDLING**: Pipe shall be protected during handling against impacts, shocks and free fall. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground. Pipe shall be carefully lowered into the trench in such a way as to avoid danger to the workmen, or damage to the pipe, work completed, or existing utilities.

5.03 **DIRECTION OF LAYING**: Work shall start at the lower end of the sewer system and proceed up-grade with the individual pipes being laid with the spigot or tongue end downstream.

5.04 **BEDDING**: As follows:

A. Trench - Pipe shall be laid with a firm and even bearing the full length of the barrel, with a small additional excavation being made below grade under the bell in cases where bell and spigot type pipe is being used. See SD-2 entitled "Methods of Laying Pipe".

B. Encasements - Sewers within encasements shall be secured true to line and grade by thoroughly and completely bedding in sand, fine gravel or a lean grout, blown or pumped in place.

5.05 **PLACING**: All pipe shall be laid with joints fully made and true to line and grade. Successive pipes shall be carefully centered so that when laid they form a sewer with a uniform invert. Each pipe shall be held firmly in place against the previous pipe while the joint is being made and fixed in place by immediate bedding of the pipe to 1 foot above top of pipe. On tongue and groove pipe, 30 inches in diameter and larger, pressure must be applied to each pipe as it is laid by a winch and cable or other mechanical means to insure that the spigot is all the way home in the socket. Care shall be exercised to prevent joints on pipe from opening up as subsequent lengths of pipe are laid.

The Contractor will be required to leave joints of the type specified smooth and clean. The pipe layers shall inspect each joint after it is made to see that the joint is properly pulled home and that no part of the joint material is left on the inside of the pipe.

No pipe shall be laid upon a foundation in which frost is present. Under no conditions shall pipe be laid in or under water. The trench shall be kept free of water during the jointing and, if necessary, for a sufficient period thereafter to allow the jointing material to become fully set and completely resistant to water penetration or damage.

The Contractor will be required to leave joints of the type specified smooth and clean.

5.06 **SPECIAL SUPPORTS**: Where sewer pipe, including services, cross existing pipe lines in close proximity, both pipes shall be saddled with concrete. Utilities crossing the

trench shall be temporarily supported during pipe laying operations, and permanently supported on compacted backfill.

5.07 **PIPE KEPT CLEAN**: The interior of the sewer shall be cleared of all jointing material, dirt and material of any description as the work progresses. On small sewers where cleaning after laying may be difficult, a swab or drag shall be kept in the pipe line and pulled forward past each joint immediately after its completion.

6.00 PIPE JOINTS

6.01 **CEMENT MORTAR JOINTS**: Mortar shall be applied only to thoroughly moistened pipe bells, spigots, tongues, and grooves.

On bell and spigot pipe, plastic mortar shall be spread in the bottom one-third of the bell of the pipe previously laid. A coarsely twisted gasket of jute of the proper thickness and of sufficient length to span around the pipe at the top shall then be wrapped around the spigot end of the next pipe, the pipe entered into the bell and shoved home. After the pipe has been thoroughly bedded to line and grade, the jute gasket shall be caulked into the annular space with a suitable caulking tool. The remainder of the space shall then be filled with mortar and beveled off. Joints on pipes 24 inches and larger in diameter shall also be pointed and smoothed from the inside.

On tongue and groove type pipe, the mortar shall be placed on the outside upper half of the tongue of the pipe to be laid on the lower half of the groove of the pipe previously laid. The pipe shall then be forced home, aligned and graded. Sufficient mortar shall be placed on each pipe to fill the joint when the pipe is forced into place. Joints on pipe 24 inches or larger in diameter shall also be pointed up from the inside. Visible voids on the outside of the joints shall also be filled with mortar, troweled into place. Excess mortar shall be removed from the inside of joints, regardless of size of pipe.

6.02 **COLD MASTIC JOINTS**: The cold mastic shall be troweled into the primed tongue end of the pipe while the pipe is on the bank. Jute shall be used to center bell and spigot pipe, as specified for mortar joints. Care shall be taken in lowering the pipe into the trench to keep dirt and stones out of the mastic. The pipe shall be brought firmly home, aligned and graded.

6.03 **RUBBER GASKET JOINTS**: The gasket or spigot shall be fitted over or glued onto the outer end of the tongue of each pipe to be laid and the pipe pushed home. The "O" rings shall be checked for correct position in the pipe groove. Solvents, adhesives and / or lubricants shall be used as recommended by the joint manufacturer.

6.04 **PREMIUM JOINTS**: Premium joints shall be painted with Manufacturer's approved lubricant or solvent and the joint fully made. If difficulty is encountered in seating, the joint shall be disassembled and carefully inspected for obstructions and proper dimensions. Type III joints shall be checked after assembly for proper gasket position.

6.05 **CORRUGATED METAL PIPE JOINTS**: Corrugated metal pipe joints shall be made by carefully matching the pipe and collar corrugations, with the collar centered on joint. The neoprene gasket shall be lubricated to prevent binding or bunching up. The collar shall be carefully and evenly tightened to fully engage the pipe corrugations. If deflection of joints is required, joints shall be made prior to deflecting the pipe to plan alignment.

7.00 CONNECTIONS

7.01 **EXISTING SEWERS**: Where a manhole exists at the point of connection of new and existing sewers, it shall be re-pointed and any loose bricks and / or blocks in the walls of the existing manhole shall be re-laid. The cost of such work shall be included in the contract price unless payments are specifically provided in the Proposal.

Connections of new sewers to existing sewers when encountered in construction and not shown on the plans shall be made where ordered by the Engineer. Such connections shall be made within a manhole except for house service and drain connections. When such sewer connections are made within an existing manhole, any added work involved will be paid for i accordance with the procedure outlined in the "General Conditions".

When connections are made with sewers carrying sewage or water, a flume or dam must be installed and pumping maintained as necessary to keep the new work dry until the joints and the concrete have had sufficient time to set.

7.02 **FUTURE SEWERS**: Connections for future sewers stubs indicated on the plans shall be plugged or bricked off at the ends, the cost to be included in the contract price for the manholes or sewers. The ends of such future connections in sizes 4 through 21 inches shall be sealed with an appropriate sized disc and with the same type of jointing materials used on the new sewers. For sewers 24 inches and larger, the end of the sewer shall be bricked off and plastered on the outside.

7.03 **SERVICES**: Wyes or tees for house service connections shall be placed at locations indicated in the field by the Engineer.

All house service connection openings shall be "Y" branches with the spur set on the barrel of the pipe at an angle of 45^{o} for pipe sizes to 24 inches. Tees or wyes may be used for pipe 24 inches and larger. Service connection openings in concrete pipe shall be case in the upper quarter of the pipe with spur having standard bell dimensions for the service connection. Joint type and material for the services shall be the same as specified for the sewer. The ends of house service shall be closed with standard plugs or caps securely blocked to resist test pressure and sealed with the same jointing material used on the service pipe.

Where the sewer has over 12 feet of cover, risers shall be constructed as shown on SD-4.

The location of each house service connection at the lot line shall be marked by a 2 inch by 2 inch wooden stake which shall have at its lower end a piece of 2 inch by 6 inch lumber, 12 inches long nailed horizontally. In lawn or paved areas, the staked shall be cut off 4 inches below grade and in undeveloped areas, the stake shall be cut off 6 inches above grade. Wyes or tees plugged for future service connections shall not require markers. The Contractor shall assist the Engineer in locating and keeping a record of all wye and / or tee openings left for service connections by measurement to the nearest downstream manhole, and the ends of services by measurements from permanent surface witness points.

House services shall be laid at right angles to the street line unless otherwise directed and shall be laid on a uniform line and grade from the sewer opening to the property line unless otherwise specified. The minimum depth at the property line shall be 8 feet below the approved street grade centerline. Where this depth cannot be obtained, the house connections shall be laid with a minimum rise of 1/8 inch per foot between the sewer and the property line. Depths greater than 8 feet at property line may be required where basement elevations are lower than normal.

7.04 **CONNECTION TO EXISTING SEWERS**: Any connections between new pipe and existing lines up to 15 inches in diameter shall be the compression coupling type with bushings as supplied by the manufacturer, meeting the requirements of ASTM Standards. Adjustable rings shall be required in all couplings 6 inches or larger. Clamps and shear rings shall be stainless steel. The following types of pipe couplings are approved for this work:

Logan LCP Coupling
Fernco Series 1001

Any connections between new pipe and existing lines 18 inches in diameter and larger shall require a concrete collar conforming to the detail on SD-12 of the City of Royal Oak Standard Specifications for Construction.

7.05 **CONNECTIONS TO EXISTING MANHOLES**: The Contractor shall furnish all labor and materials required for the connection of sewers and catch basin leads under the Contract to existing manholes, structures and catch basins as called for on the plans. When breaking holes for connections to existing manholes or catch basins, care shall be taken to prevent debris from entering the existing sewers or leads. After installation of pipe, the manhole or catch basin shall be pointed up around the pipe, both on the inside and outside of the manhole or catch basin, so that it is restored to a watertight condition. New flow channels shall be installed in the existing manholes where called for on the drawings. The cost of this work shall be included in the unit price bid for sewers and / or catch basin leads.

7.06 **PRIVATE SEWER LATERAL TAP ON EXISTING MAIN LINED SEWER (CIPP)**: After a main pipe has been interior lined with a cast in place piping (CIPP) and placed in service, all new service connections shall be made with a saddle fitting where the service lead meets the main sewer. The old exterior pipe surface shall be properly cleaned of debris and materials so that a clean cut may be made with a tapping machine. Do not tap near a joint. Make the cut all the way through the old pipe and the interior CIPP layer to the actual interior of the main line sewer. Remove the cut out portion carefully. Inspect the cut and trim carefully so the CIPP and old existing pipe thicknesses line up properly. Do not use hammers or other devices to break out the old pipe away from the CIPP.

Install the saddle fitting at the prepared service hole and inspect for tight fit. Properly seal the service connection pipe to the main line sewer by using one of several multi-grout or epoxy resin mixes approved by the Engineer. Backfill the service lead connection and service lead footage properly in order to provide strong support and minimize shifting or breakage of the service connection.

7.07 **PRIVATE SEWER LATERAL TAP ON EXISTING SEWER**: All new service connections shall be made with a saddle fitting where the service lead meets the main

sewer. The exterior pipe surface shall be properly cleaned of debris and materials so that a clean cut may be made with a tapping machine. Do not tap near a joint. Tap all the way through the pipe and remove the disk carefully. Install the saddle fitting at the prepared service hole and inspect for tight fit. Properly seal the service connection pipe to the main line sewer by using one of several multi-grout or epoxy resin mixes approved by the Engineer. Backfill the service lead connection and service lead footage properly in order to provide strong support and minimize shifting or breakage of the service connection.

8.00 **TESTING**: All tests shall be under the supervision of the Engineer. Prior to connecting any active sewer services or extending services beyond the properly line, the new sewers and services shall be tested for alignment and leakage. The sewer shall be thoroughly cleaned before the Engineer is requested to witness or perform any tests.

8.01 **ALIGNMENT**: Sewers must be straight between manholes and will be tested for straightness by flashing a light from manhole to manhole or by other suitable means.

8.02 **LEAKAGE**: Unless otherwise call for in the project specifications, the maximum allowable infiltration / exfiltration shall be 100 gallons per day per inch of diameter per mile of pipe. The joints shall be tight and any visible leakage in the joints and leakage in excess of that specified shall be repaired.

Branch fittings and ends of house service stubs shall be securely plugged to withstand test pressure. The section of line being tested shall also be securely plugged as required. All plugs shall be adequately braced.

No section tested may show a leakage of over twice the allowable limit and the average leakage for the project shall not exceed the allowable limit. All manholes will be inspected for visible leakage and the Contractor shall make all necessary repairs.

A. Water Testing - The Contractor shall furnish, install, and maintain a "V" notch weir, tightly secured to the low end of each section of sewer, so that the infiltration may be checked. The Contractor shall remove the weirs and all framing, leaving the sewers and manholes clean and free of any debris.

   Exfiltration tests will be required only when the natural or induced ground water table is less than 2 feet over the highest point in the pipeline under test, including house services. Exfiltration tests shall be made by filling the line to a minimum depth of 2 feet above the high point of the line under tests, with allowance for ground water level, and measuring the water required to maintain this level.

B. Low Pressure Air Testing - The Contractor shall furnish all equipment and personnel to conduct an acceptance test using low pressure air.

   Air shall be slowly supplied to the plugged pipe line until the internal air pressure reaches 4.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe. At least two minutes shall be allowed for temperature stabilization before proceeding further.

   The rate of air loss shall then be determined by measuring the time interval required for the internal pressure to decrease from 3.5 to 2.5 pounds per square inch.

The pipe line shall be considered acceptable if the time interval for the 1.0 psi pressure drop is not less than the holding time listed in the following air test table.

MINIMUM HOLDING TIME IN SECONDS REQUIRED FOR PRESSURE TO DROP FROM 3 ½ TO 2 ½ PSIG

PIPE DIAMETER

LF	4”	6”	8”	10”	12”	15”	19”	21”	24”	27”	30”	33”	36”	39”
25	4	10	18	28	40	62	89	121	158	200	248	299	356	418
50	9	20	35	55	79	124	178	243	317	401	495	599	713	837
75	13	30	53	83	119	186	267	364	475	601	743	898	1020	1105
100	18	40	70	110	158	248	356	485	634	765	851	935		
125	22	50	88	138	198	309	446	595	680					
150	26	59	106	165	238	371	510							
175	31	69	123	193	277	425								
200	35	79	141	220	317									
225	40	89	158	248	340									
250	44	99	176	275										
275	48	109	194	283										
300	53	119	211											
350	62	139	227											
400	70	158												
450	79	170												
500	88													
550	97													
600	106													
650	113	170	227	283	340	425	510	595	680	765	851	935	1020	1105

AIR TEST TABLE

8.03 **TELEVISION INSPECTION**: All sewer sections in which spot repairs are made shall be internally inspected by televising upon completion of the work.

The Contractor shall furnish all materials, labor, equipment and all else necessary for performing a television inspection of new sanitary sewers. Included will be any necessary cleaning and pumping of sewage.

The inspection shall be carried out under the direct supervision of the Engineer's representative with all television inspection being observed by the Engineer.

All television inspection shall be recorded in a digital color video format which shall be turned over to the Owner. The recording must be continuous with audio commentary. The inspection shall involve the visual observation by closed circuit television. The inspection shall be performed at a rate of speed and sufficient lighting which will allow examination of all points of infiltration, cracked or crushed pipe, defective joints, misalignment in line or grade, location of wye openings and any defects which may appear. Any items which, in the opinion of the Engineer, require repair shall be precisely located and described by a detailed statement of the condition.

As part of the television inspection, the precise location of each wye shall be noted in relation to manholes. These locations shall be entered on the wye location sheet supplied by the Contractor.

If the camera encounters a dip in the sewer such that water is standing above the springline of the sewer pipe, and if the camera lens becomes submerged because of this condition, the camera rig shall be withdrawn from the sewer and inserted from the other end as far as possible. At all times, backflooding into the reach from the adjacent section shall be prevented.

Two copies of all notes, wye locations, and other pertinent information shall be made as part of the television inspection. One set of this information shall be turned over to the Engineer upon the completion of the inspection of each line. The second copy of the information shall be held by the Contractor until completion of the project, at which time it shall be neatly assembled and turned over to the Engineer.

9.00 MANHOLES AND CATCH BASINS

9.01 **DESCRIPTION OF WORK**: Work included shall consist of the furnishing and construction of manholes and catch basins including inlets as detailed on the drawings and at the locations shown on the drawings. Concrete, excavation and backfill shall be as specified herein before. Manholes and catch basins shall be complete with frames, covers and steps, unless otherwise addressed in FOP. Adjustment of frames, inlets, etc., in new manholes and catch basins to meet new or existing pavement surfaces of sidewalks shall be included in the work under this section of the Contract.

9.02 <u>QUALITY ASSURANCE</u>: As follows:

A. Materials -
All materials furnished by the Contractor must conform in all respects to the following standard specifications. Where reference specifications are used, they shall consider as referring to the latest edition. Unless otherwise indicated, any material furnished by the Owner will also conform to these specifications.

ASTM A-48.....Cast Iron
ASTM C478.....Precast Reinforced Concrete
ASTM C443.....Joints
ASTM C923.....Resilient Connectors
ASTM C55.....Concrete Brick (Grade N)
ASTM C139.....Concrete Block
ASTM C76.....Concrete Pipe Reinforcement

Drainage Structure Covers:

<u>STRUCTURE</u>	<u>CASTING</u>
Gate Well	*E.J. 1040 w/ "WATER SUPPLY" Cover with Royal Oak logo (EJ Part # 001040185)
Sanitary or Combined Manhole	*E.J. 1040 w/ "SANITARY SEWER" Type AGS Solid Cover with Royal Oak logo (EJ Part # 001040183)
Storm Manhole	*E.J. 1040 w/ "STORM SEWER" Type C 2 Hole Vent Cover with Royal Oak logo (EJ Part # 001040184)
Catch Basins & Inlets within Lawn Areas	*E.J. 1040 w/Type N Oval Grate (EJ Part # 00104042) or Type 02 Beehive Grate (EJ Part # 00104044)
Catch Basins & Inlets within Pavement	*E.J. 1040 w/Type M Grate or Type #100199 Grate with either 2 slots (EJ Part # 001040186) or 4 slots (EJ Part # 001040399)
Catch Basin & Inlets within Curb & Gutter	*E.J. 7045 w/Type M1 Grate (if full height curb) (EJ Part # 00704500) *E.J. 7065 w/Type M1 Grate (if drop curb) (EJ Part # 00706500)

*EJ formally known as East Jordan Iron Works

B. Certification of Materials -
All pre-cast concrete manhole sections, resilient connectors between manhole sections and pipes and castings delivered to the jobsite shall be preceded or accompanied by certification papers or stamped markings showing that the materials have been tested in accordance with applicable standard testing procedures and that the materials meet the Specifications for this Contract.

9.03 **SUBMITTALS**: Shop Drawings and Guarantees - Furnish, as prescribed under General Conditions, shop drawings and guarantees of the items included under this section of the Contract.

Shop drawings shall include dimensions and reinforcement of pre-cast concrete units, joint details, orientation and elevation of preformed openings in riser sections, pipe to manhole connection details, casting details, and certification papers.

9.04 **MANHOLE MATERIALS (SANITARY SEWERS ONLY)**: Manholes on new sanitary sewers of 48 inches diameter and smaller shall be pre-cast reinforced concrete with flexible watertight connections between the manhole wall and the sewer pipe.

Manholes on new sanitary sewers larger than 48 inches in diameter shall be pre-cast reinforced concrete set on integrally cast pipe tee sections. Pipe reinforcement shall meet ASTM specification with class as indicated on the drawings for the adjoining pipe. Vertical risers shall be set on the tangent of the horizontal pipe. As an alternate, manholes may be constructed according to details shown on the drawings.

Manholes on existing sanitary sewers shall be pre-cast reinforced concrete with preformed arched openings and the sewer pipe grouted into the opening and made watertight.

Manholes on new or existing storm sewers, water mains and pumping mains, shall be pre-cast reinforced concrete or of concrete block or concrete brick unless otherwise noted on the drawings.

Manhole slabs shall be constructed of concrete and manhole channels and fillets shall be constructed of concrete according to the details given on the drawings. Unless otherwise directed, all surfaces of concrete channels and filets shall be screed and floated to a smooth, uniform surface and trowel to a hard finish.

9.05 **MANHOLE STEPS**: Manhole steps shall be steel reinforced high density polypropylene plastic. They shall be a minimum 10 inches wide and placed a maximum of 16 inches apart. Steel reinforced plastic steps shall be PSI-45 as manufactured by M.A. Industries, Inc., or equal.

9.06 **CEMENT MORTAR JOINTS**: Joints shall consist of one part cement and two parts of sand.

A. Cement - Portland cement shall conform tot he requirements of ASTM Type 1, C-150. Masonry Sand shall conform to the requirements of Masonry Sand 2NS of the Standard specifications of the Michigan Department of State Highways.

B. Water used in mixing cement mortar shall be fresh and clean and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

9.07 **FRAMES AND COVERS**: Cast iron frames and covers shall be furnished and placed on each manhole by the Contractor. Castings shall meet the requirements of ASTM, and shall be of the size and type as called for on the drawings. On all sanitary sewer manholes, lids shall be self-sealing type. Castings shall be set flush with sidewalk, pavement or ground surface and shall be securely cemented in place.

Where noted on the drawings, bolted gasketed frames and covers shall be provided. The frames shall be anchored to the concrete manhole sections according to details shown on the drawings.

9.08 DROP CONNECTIONS: Where shown on the drawings, directed by the Engineer or where a sanitary branch sewer is brought into a manhole more than 24 inches above the invert elevation in the manhole, a drop connection shall be provided according to the details shown on the drawings.

9.09 PRECAST REINFORCED CONCRETE MANHOLES: As follows:

A. Joints - Premium modified tongue and groove joints with rubber gaskets meeting the requirements of ASTM shall be provided for all sanitary sewer manholes. Joints in storm sewer, water main and pumping main manholes shall be either premium joint as specified for sanitary manholes or shall be tongue and groove with a cold-applied plastic joint-sealing compound and primer.

The joints around the inside circumference of the manhole shall be pointed with cement mortar. All holes provided for handling and lifting shall be filled with mortar and made watertight.

B. Foundations - Foundations for pre-cast manholes shall be constructed as a cast-in-place concrete slab, pre-cast reinforced concrete slab, or pre-cast reinforced concrete base riser section with integral floor as shown on the drawings. Steel reinforcing for pre-cast base slabs shall meet the requirements of ASTM.

C. Pipe to Manhole Connections - Pipe to manhole connections on new sanitary sewers shall be made with resilient connectors meeting the requirements of ASTM and shall be adequate for hydrostatic pressures of 10 psi, without leakage, when tested in accordance with ASTM Specifications.

9.10 MASONRY MANHOLES (STORM SEWERS ONLY): As follows:

A. Foundations - Foundations shall be constructed as cast-in-place concrete slab, or pre-cast reinforced concrete base slab as shown on the drawings.

B. Masonry - Masonry units for manholes shall be either concrete brick or concrete manhole blocks, and shall meet the requirements of the standard specifications of the American Society of Testing Materials.

C. Laying Brick - All brick shall be clean and shall be thoroughly wetted by immersion, when practical to do so, just before laying. If immersion is impractical, brick shall be thoroughly sprinkled just before laying. All brick and block shall be laid in a full bed of mortar, without requiring subsequent grouting, flushing, or fillings, and shall be thoroughly bonded. Bricks shall be laid with long dimensions radially in the manhole and all joints must be entirely filled with mortar. Each 7^{th} course shall be laid as a "stretcher" course. The outside surface of each manhole shall be plastered with mortar to a depth of not less than 1/2 inch.

D. Laying Concrete Manhole Blocks - All blocks shall be clean and shall be laid in full bed of mortar, in courses with full and close mortar joints. The courses shall be level throughout, except where otherwise specified. Adjoining courses shall break joints by one-half the length of the block as nearly as practicable. The outside surface of each manhole shall be plastered with mortar to a depth of not less than 1/2 inch.

E. Cement Mortar - Mortar for laying masonry work in manholes and other appurtenances shall be mixed in the proportion of one (1) part portland cement to three (3) parts sands. Hydrated lime may be added in proportions not to exceed 10% of the volume of the cement.

F. Mortars mixed by hand shall be prepared in a suitable, clean, watertight box. The ingredients, except the water, shall first be thoroughly mixed dry until of uniform color; then water shall be added and the mixing continued until mortar is of proper consistency and uniform texture is produced.

No re-tempered mortar or mortar that has been mixed for more than 30 minutes shall be used in the work. No cement mortar shall be mixed when the temperature is below 30^{o}F without properly heating the sand and water.

G. Backfilling - No backfilling shall be placed about masonry manhole walls within 12 hours after the plaster coat has been applied to the outside of the walls.

9.11 **CATCH BASIN MATERIALS**: Catch basins shall be constructed of pre-cast reinforced concrete units. These pre-cast units shall conform to the requirements of ASTM. Inside grouting with either cold-applied, ready-to-use plastic joint-sealing compound or rubber gasket shall be used to connect the units. The use of concrete manhole block conforming to ASTM as an alternate will be permitted. If block is used, a mortar coating shall be applied the same as with masonry construction of manholes. Catch basins shall be constructed with two (2) foot deep sumps.

9.12 **CATCH BASIN BACKFILLING**: No backfilling shall be placed about masonry structure walls within 12 hours after the plaster coat has been applied to the outside of the walls.

9.13 **CATCH BASIN FOUNDATIONS**: Foundations shall be constructed as a cast-in-place concrete slab according to details given on the drawings or pre-cast reinforced concrete base slabs as specified under manholes.

9.14 **CATCH BASIN FRAMES AND COVERS**: Frames and covers shall be as noted on the drawings and meet the Owner's standards. Castings shall be set flush with sidewalk, pavement or ground surface and shall be securely cemented in place. Elevations of castings shall be established as addressed in the Contract documents at the time of construction.

9.15 **CATCH BASIN STEPS**: Catch basin steps shall be furnished and installed in catch basins if shown on the drawings. Steps shall be steel reinforced high density polypropylene plastic. They shall be a minimum of 10 inches wide and placed a maximum of 16 inches apart. Steel reinforced plastic steps shall be PSI-45 as manufactured by M.A. Industries, Inc., or equal.

9.16 **TRAPS**: Storm manholes immediately upstream of connections to combined sewers shall be trapped as required in the Specification Details.

10.00 REMOVALS, REPLACEMENTS AND MODIFICATIONS

10.01 **REMOVING EXISTING MANHOLES**: Existing manholes shall be removed, where indicated on the drawings or as directed by the Engineer. The frame and cover shall be removed and delivered to the Owner. All abandoned pipes shall be bulk headed and either the manhole removed and the area backfilled as specified under "Excavation and Backfill", or, if in good condition, removed to a depth of 24-inches below grade, filled and compacted to 95% Standard Proctor Density with approved granular fill materials.

10.02 **REMOVING EXISTING CATCH BASINS**: Existing catch basins shall be removed, where indicated on the drawings or as directed by the Engineer. The frame and cover shall be removed and delivered to the Owner. The masonry, or pipe, shall be completely broken, removed and disposed of by the Contractor. All abandoned pipe connections shall be bulk headed at both ends where accessible. The area occupied by existing catch basins shall be backfilled after their removal as specified under "Excavation and Backfill.

10.03 **REPLACING EXISTING CASTING**: Where noted on the plans and / or as directed by the Engineer, existing manhole and / or catch basin castings shall be removed and replaced with a new casting as hereinbefore specified.

This item includes adjustment of the structure as specified in section 10.05 below.

10.04 **REPLACING EXISTING CASTING**: Where noted on the drawings and / or as directed by the Engineer, existing manhole and / or catch basin castings shall be removed and replaced with a new casting as hereinbefore specified.

This item includes adjustment of the structure as specified in section 10.05 below.

10.05 **REHABILITATING EXISTING MANHOLES**: Existing manholes shall be rehabilitated as directed by the Engineer. Rehabilitation consists of all work required to improve the condition of manholes which does not necessitate the removal of the manhole wall structure. Work may include grouting and sealing of the manholes, removing and replacing flow channels, replacing manhole castings and any other work required by the Engineer.

10.06 **ADJUST MANHOLE, CATCH BASIN, INLET, WATER BOXES, OR GATEWELL FRAME AND COVER**: Refer to section 9.10, “Masonry Manholes”, for sewer wall construction on structures. Adjusting shall consist of setting a casting to the proper elevation and also include saw cutting, removal and replacement of pavement, deteriorated brick or mortar to a depth of three rows of brick or 15 inches as measured from the top of the casting. Brickwork below this depth shall be considered a reconstruct.

The item includes replacement of pavement up to 8 inches thick and up to an area of 6 feet by 6 feet area including hook bolts or lane ties as required, or directed by Engineer. This item also includes placement of granular backfill and removal and disposal of unsuitable excavated material and debris such as brick or block to a recognized landfill.

10.07 RECONSTRUCT CATCH BASIN, MANHOLE OR GATEWELL TO THREE FEET BELOW TOP OF MASONRY STRUCTURE: Refer to section 9.10, "Masonry Manholes", for sewer wall construction on structures. Reconstruction shall consist of removing all loose or deteriorated brick, block and mortar to a solid base or to 3 feet below the bottom of casting.

This item also includes setting the casting to the proper elevation, placement of granular backfill or sand around the structure and the disposal of unsuitable excavated material and debris such as brick or block to a recognized landfill.

10.08 RECONSTRUCT CATCH BASIN, MANHOLE, INLET OR GATEWELL (ADDITIONAL DEPTH) FROM THREE FEET BELOW TOP OF MASONRY STRUCTURE TO BASE: Refer to section 9.10,"Masonry Manholes", for sewer wall construction on structures. This item covers reconstruction of structure from 3 feet below top of masonry structure to the footing or cookie (base). This item also includes the installation of traps if required, placement of granular backfill or sand around the structure and the disposal of unsuitable excavated material and debris such as brick or block to a recognized landfill. Payment of this item shall be by the vertical foot.

10.09 CLEANING: During construction, all debris shall be removed from flow channels and sewage flow shall be maintained. Prior to final acceptance by the City of any contract or project, all structures shall be thoroughly cleaned of all debris as a result of the construction. All inlets and catch basins shall be vacuumed clean of all debris, which shall be disposed of at a recognized landfill. Cleaning shall be included as part of other contract or project unit costs.

10.10 4 INCH OR 6 INCH CORRUGATED PLASTIC EDGE DRAIN INCL. GEOTEXTILE WRAP AND BACKFILL: Refer to 2012 MDOT Standard Specifications for Construction, Sections 404, and Subsections 909.07B and 910.05, as well as the detail shown with the plans. All edge drain installed shall be 6 inch diameter, except where 4 inch diameter edge drain is indicated on plan sheets. Edge drain shall be corrugated polyethylene tubing with perforations and a geo-textile wrap conforming to MDOT section 910.05. The edge drains shall be installed as indicated on plans and the work shall include connections to existing edge drain when indicated on the plans or directed by the Engineer.

The installation of the edge drain shall be done as follows:

1) The invert elevation shall be 36 inches below finish grade or as directed by the Engineer.
2) The upstream end shall be plugged with the manufacturer's recommended cap.
3) The backfill up to subgrade elevation shall be done with MDOT 34R Aggregate (pea gravel).
4) The connection to the catch basins or inlets, when the edge drain will be installed in both directions from the structures, shall be done with a tee and the connection will be incidental to the edge drain item.
5) Payment shall be by the linear foot measured in place.

11.00 SEWER LINING

11.01 DESCRIPTION OF WORK: As follows:

A. Work Included - This work shall include mobilization; cleaning of sewers, including removal of all debris; inspection; lining the sewer and restoring the area.

This work shall also include dewatering of existing sewers to a degree necessary for the lining operations with payment incidental to work under this section and an inspection report.

B. Work Under Other Contracts - The Owner will provide access to manholes and furnish installation and flushing water from designated fire hydrants. The Contractor shall contact the Owner to coordinate these items. The Owner will not provide a dump site for disposal of debris removed from sewers.

11.02 QUALITY ASSURANCE: As follows:

A. Reference Standards - Performance and material requirements shall meet specific Reference Standards referred to hereinafter under individual items.

B. Tests - Testing shall be accomplished as specified hereinafter under individual items.

11.03 SUBMITTALS: As follows:

A. Shop Drawings and Guarantees - Furnish Shop Drawings and Guarantees covering the items included under the Contract.

B. Lining Inspection Report - After completion of the work under this Section, the Contractor shall furnish to the Owner, a complete bound report in four copies of the television inspection, logging each section of sewer televised and giving specific details as to service connections, broken tile, water infiltration from the joints, root growth from joints, and any other points of interest noted during the inspection. Included in the report shall be the exact location and limits of the relining.

11.04 SITE CONDITIONS: It is required that the Contractor familiarizes himself with site and working conditions by making a personal examination of the site or sites and its surroundings.

11.05 MOBILIZATION: This item shall include the furnishing of all machinery, tools, materials, equipment, transportation and labor to accomplish the work specified herein. Also included are the proper cleanup of the premises and removal of all unused materials, tools, machinery and equipment from the site upon completion of the work.

11.06 CLEANING: The Contractor shall provide all equipment necessary for the proper rodding, brushing, flushing and dewatering of the sewers prior to the lining operation.

All dirt, debris, roots and other material removed from the sewers shall be loaded and hauled away by the Contractor to a landfill acceptable to the Engineer.

Dewatering shall include necessary pumping equipment, plugs and temporary piping between manhole sections.

Cleaning of the sewer shall be carried out to the extent that he sewer section can be accurately inspected to evaluate and prepare the section for lining.

11.07 <u>TELEVISION INSPECTION</u>: This work shall include dewatering or diverting flow in sewers to the degree necessary for the television inspection for lining operations.

Dewatering shall include necessary pumping equipment, plugs and temporary piping between manhole sections.

The Contractor shall, prior to starting work, furnish the Engineer for approval, his proposed method for dewatering sewers.

A. Closed-Circuit Television - The Contractor shall furnish all labor, electronic equipment and technicians to perform the closed-circuit television inspection of the sewers. Operation of the equipment is to be controlled from above ground with a skilled technician at the control panel in the television studio, controlling the movement of the television studio, controlling the movement of the television camera. The technician shall have the capability to adjust the brilliance of the built-in lighting system and be able to change the focus of the television camera by remote control. The technician will provide clear audio description during the video taping.

   The monitor shall be located inside a mobile TV studio. The stationing of the television camera shall be continuously displayed on the television monitor while the sewer line is inspected. The Contractor's mobile studio sewer line is inspected. The Contractor’s mobile studio shall be large enough to accommodate up to 3 people for the purpose of viewing the monitor while the inspection is in progress. The Owner's representative shall have access to view the television screen at all times. The deliverable shall be color digital video.

B. Instant Photographs - The Contractor shall furnish all equipment required for taking instant photographs of the view which appears on the monitor. During the course of the inspection, the Engineer shall indicate the specific views which are to be photographed.

C. Obstructions in the Line: - If after viewing the video tape of the sewer to be lined, the Contractor feels he will have difficulty passing the service lead cutter or any other necessary equipment through the lines sewer, he shall, at his own expense, run a gauge of sufficient size through the unlined pipe to determine if the equipment can pass through. Any obstructions which may need to be cleared must be identified to the Engineer prior to lining of the sewer. Obstructions encountered after lining of the sewer which have not previously been identified by the Contractor shall be repaired at the Contractor's expense. The Owner reserves the right to delete lining of sections of sewer in which spot repairs are required prior to sewer lining.

11.08 <u>LINING</u>: The locations of the existing sewer sections to be lined are shown on the plans. Where indicated on the plans, the liner shall be equal to a liquid thermosetting resin impregnated polyester felt installed by hydraulic inversion.

Lining with Polyethylene Pipe:

A. Material - The liner pipe shall meet the requirements of the following specifications:

ASTM/ANSI F585-78 - Standard Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers

ASTM D1248-81a - Polyethylene Plastics Molding and Extrusion Materials

ASTM D1238-70 - Measuring Flow Rates of Thermoplastics by Extrusion Plastometer

ASTM D1505-68 - Density of Plastics by the Density-Gradient Technique

ASTM D1693-70 - Environmental Stress Cracking of Ethylene Plastics

ASTM 1928-70 - Preparation of Compression Molded Polyethylene Test Samples

ASTM D2657-67 - Heat Joint of Thermoplastic Pipe and Fittings

ASTM 3035-83 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter

ASTM F714-83 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

ASTM D2837-69 - Obtaining Hydrostatic Design Basis for Thermoplastic Pipe materials

ASTM D3350-83 - Polyethylene Plastic Pipe and Fitting Materials

Referring to ASTM D1248-72, the pipe and fittings shall be made of polyethylene resins classified as Type III, Category 5, Grade P34 (pipe designation PE3058 defined per ASTM D3035-83), having specific base resin densities of 0.932 g/cc minimum and 0.945 g/cc maximum, respectively; and having melt indexes of 2.5 g/10 minute maximum.

Pipe made from these resins must have a long term strength rating of 1600 psi or more.

The polyethylene resin shall contain anti-oxidants and be stabilized with carbon black against ultraviolet degradation to provide protection during processing and subsequent weather exposure.

The polyethylene resin compound as extruded shall have a resistance to environmental stress cracking as determined by the procedure detailed in ASTM D1693-70 Condition C with sample preparation by Procedure C of ASTM D1928-70 for not less than 200 hours.

B. Method of Installation - The construction methods to be used in the installation of polyethylene pipe as a liner in existing sewers are as followed below. Other methods must be approved by the Engineer. Care shall be taken to protect the polyethylene pipe from damage at all items during storage and installation of the pipe.

Excavations shall be carried out both for main insertion pits and to accommodate lateral or manhole bypasses. The length of excavation for main insertion pits shall allow a reverse bend of the lining material, under its own weight, so that a bending radius of less than 25 times the outside diameter of the pipe liner is not imposed. The trench shall slope gradually from the ground surface to the top of the existing line. The trench shall be approximately 4 to 5 feet wide and dug to the bottom of the sewer to expose the existing pipe.

If permitted by the Engineer, the top half of the existing pipe to be lined may be broken out at the access area and the polyethylene liner may be inserted according

to the methods of installation stated in these Specifications. Following installation of the liner and grouting it is in place, the existing sewer shall be capped with concrete. The cost of concrete capping over the pipe shall be incidental to the lining of the pipe.

If jointed pipe is used, the liner may be inserted form inside the junction chambers. If polyethylene pipe is pulled through the existing line, run a winch cable through the existing line and connect to pulling head of joined polyethylene sections. Pull polyethylene pipe through existing line. Care shall be taken to insure a steady pull on liner to keep it moving without jerking. If necessary, a vibrating head can be used to assist in the pulling operation. Care shall be taken to protect against overstressing the liner or damaging it at the insertion point.

The polyethylene pipe may be pushed through the line. Procedures for the pushing operation must be submitted to the Engineer in writing and approved by the Engineer prior to the work.

Secondary access shafts for lateral drain connections may be excavated at every private or lateral drain connection. The Contractor may connect the lateral drain connection from inside the existing liner, provided the procedures for this work be submitted in writing to the Engineer and approved by the Engineer. If drain connection is within a street, the secondary access shaft shall be excavated clear of the traveled portions of the street. The secondary access shafts shall be 4 feet by 4 feet and shall be dug to a depth 12 inches below the soffit of the exposed lateral; the resulting 12 inches below the soffit of the exposed lateral. The resulting 12 inch pit shall be used to receive wastes from the property while relining is in progress. The lateral drains shall be cleaned to remove deposits and root intrusions in the immediate area of the connection. Remove a 2 foot length of lateral to provide access for the subsequent insertion of cutting tools through the drain to the new liner. Board over secondary access shafts until it is time to cut the liner.

The liner must be restrained at lateral drain connections to prevent vertical movement at these connections. Dry cement may be used, if approved by the Engineer.

If the liner terminates before a manhole as shown on the plans, a terminal shall be constructed of sufficient size to retrieve the pulling head.

Prior to cutting in laterals, four (4) hours shall be allowed after the liner has been inserted for the temperature and any stresses in the liner to stabilize.

From previously excavated secondary shafts, the cutting tool shall be inserted into the laterals and holes cut into the liner. All cutting refuse shall be retrieved from the liner.

Prior to grouting the annular space, the Contractor shall submit to the Engineer for approval, the proposed method for maintaining existing grade on the HDPE liner.

Flow-through grout bags shall be inserted through the laterals, positioned and inflated to prevent the grout from flowing either up the lateral or into the liner.

The annular void between the polyethylene liner and the existing pipe shall be grouted with a liquid grout. The grout shall be approved by the Engineer, in writing, prior to use. The grade of the liner shall match the grade of the existing sewer to be lined.

At the downstream manhole, a one (1) inch diameter vent pipe shall be installed through the packing into the annular void and carried to the surface. A one (1) inch diameter grout feed line shall be connected to the feed pump and installed through the packing into the annular void.

Grout may be pumped into the annular space from inside the relined pipe, if permission is requested from and given by the Engineer before this alternate is implemented.

With the valve at the lower manhole open, a visual inspection shall be made to ensure that there is a flow of grout.

When this flow appears, the valve shall be closed and pumping continued until an overflow appears at the ground level vent pipes at both the downstream and upstream manholes.

Time allowed for grout to set shall be six (6) hours.

When grout is set, all grout bags to lateral drains shall be deflated and removed.

After inspection, each excavation where the existing sewer pipe has been broken into shall be capped and encased in concrete. All access shafts for sewer lining and lateral drain connections shall be backfilled and the area restores to its original condition.

Lining with Impregnated Felt:

A. General - All materials used in the lining and in the insertion process under the Contract shall be of their best respective kinds and to the satisfaction of the Engineer. The Contractor shall supply shop drawings / submittals for approval of materials prior to manufacturing of the liner. Shop drawings shall include resin make-up and epoxy type and shall list all fillers and pigments used, if any. Also indicate reinforcing materials, mechanical strengtheners or if membrane of other materials are used. Thickness of cured liners and quantity of layers shall be indicated. Any materials not approved by the Engineer shall be rejected prior to the insertion of the liner into the sewer. These rejected materials shall then be replaced, with approved materials, at the Contractor's expense.
   The liner shall be fabricated to a size that, when installed, will neatly fit the internal circumference of the conduit to be lined as specified by the Engineer. Allowance for longitudinal and circumferential stretching of the liner during insertion shall be made by the Contractor

B. Material -
   1. Resin - The polyester resin shall be a resin catalyst system compatible with the requirements of the project and approved by the Engineer. A sample of each batch, suitably labeled, shall be tested or certified as specified and approved by the Engineer prior to its use.

2. Alkaline Resistance of Polyester Resin. - Test pieces will be prepared form a sample of resin and catalyst as supplied form any one batch of resin to be used by the Contractor. The sample will then be tested by a method approved by the Engineer prior to execution.
   After the test cycle, samples will be weighed and the resin shall be deemed to be acceptable if the weight loss is less than 10% of the original weight of the samples under test.
3. Fillers and Pigments - The resins used shall not contain fillers, except those required for viscosity control or fire retardance. Up to 5% of mass thixotropic agent which will not interfere with visual inspection may be added for viscosity control. Resins may contain pigments, dyes or colorants which will not interfere with visual inspection of the cured liner.
4. Epoxy Resin - The use of epoxy resins compatible with the system to impregnate the liner bag may be permitted in some circumstances. The use of suitable fillers maybe permitted. The use of epoxy resin in any liner bag maybe requested by the Contractor, if conditions are deemed to warrant their use, but approval in writing must be given to the Engineer before installations.
5. Reinforcing Material - The reinforcing material of the felt liner bag shall be of a needle interlocked polyester felt, or other material approved by the Engineer, formed into sheets of required thickness as shown on the drawings. Bags shall be made of single or multiple layer construction where any layer shall not be less than 1.5 mm thick. A suitable mechanical strengthener membrane or strips may be sandwiched in between layers where required to control longitudinal stretching. A polyurethane membrane used during insertion maybe left on the internal surface of the liner after curing. A bonded polyurethane membrane and inner liner, if used shall not affect the structural dimension requirements of the cured liner.
6. Liner Thickness - The thickness of the cured liner shall be accurately measured and shall not be more than 5% less than the thickness specified.
7. Felt and Resin Content of Liner - The samples shall be visually inspected to ensure the number of layers of felt conforming to the specified number of layers and thickness.
   Cured resin shall be leached from the liner by a suitable process and the resin to felt ratio by weight calculated shall conform to that specified.
8. Mechanical Properties - The cured liner shall meet the following minimum strength requirements:
   Tensile stress at yield 20^{o} C per ASTM D638 - 3000 psi
   Flexural stress per ASTM D790 - 5,000 psi
   Flexural Modulus per ASTM D790 - 500,000 psi
   The Contractor shall supply a representative sample of cured liner form each inversion procedure. This sample may be from waste pieces at manholes, and may be formed inside a section of pipe. The sample for testing shall be representative of the entire section of liner. An independent lab test from this final product shall confirm these properties with testing costs paid by the Contractor. If the sample fails to meet minimum strength requirements, the Contractor may be required to line the sewer again, at no additional cost to the Owner.
9. Finish - The finished lining shall be continuous over the entire length of an insertion run between two manholes and be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, air bubbles, pinholes, pimples and delamination. The lining shall be impervious

and free of any leakage from the pipe to the surrounding ground or from the ground to the inside of the lined pipe.

The inner surface shall be free of cracks and crazing with smooth finish and with an average of not over two pits per 300 mm square, providing the pits; are less than 3 mm diameter and not over 1 mm deep and are covered with sufficient resin to avoid exposure of the inner fabric. Some minor waviness that in the Engineer's opinion, will not appreciably decrease the flow cross-section to affect the flow characteristics or be the cause of a possible chokage shall be permissible.

The polyurethane membrane, inflation bag, if permanently bonded and attached to the felt bag, may be allowed to remain as an inner liner. This bag, if allowed to remain, is not to be considered as part of the liner or to contribute to any of the specified properties required of the liner.

Any defects which will affect, in the foreseeable future, the integrity or strength of the lining, shall be repaired or the liner replaced at the Contractor's expense.

C. Design, General - The Contractor shall submit with the Proposal the recommended liner thickness for each manhole to manhole section. The Contractor shall supply design calculations indicating how liner dimensions were obtained. All calculations used in the liner design will assume a Factor of Safety of 12, and the liner shall be a very close fit in the existing conduit. Liner shall be designed to withstand internal and / or external water pressures as indicated by site conditions or as directed by the Engineer.

D. Method of Installation:

1. General - The Contractor shall deliver the uncured resin impregnated liner bag to the site and provide all equipment required to place and invert he liner into the sewer and cure it once in place.
2.

The Contractor shall notify residents a minimum of 48 hours prior to interruption of service with estimated duration of interruption.

The Contractor shall bypass the sewage around the sections of line that are to be line. The bypass shall be made by plugging an existing upstream manhole if necessary and pumping the sewage into a downstream manhole or adjacent system. Bypassing sewage shall be incidental to all lining work. Bypassing shall include all work of dewatering or diverting flows, pumping equipment rentals and all plugs and temporary piping between manhole sections. The pump and bypass lines shall be of adequate capacity and size to handle the flow. If pumping is required on a 24 hours basis, engines shall be equipped in a manner to keep noise to a minimum. All bypassing systems shall be approved by the Engineer. Approval of the Bypassing System by the Engineer shall in no way be construed as relieving the Contractor of any responsibility under this Contract as related to the protection of the interest of the Owner and the general public. Sewer service shall not be interrupted for longer than 24 hours and work shall be done at the times causing least inconvenience to residents as directed by the City of Royal Oak. Under no circumstances will be dumping of raw sewage on private property or in City streets be allowed.

It shall be the responsibility of the Contractor to clean the line of obstructions, solids, dropped joints, protruding services, or collapsed pipe that will prevent the insertion of the liner. If inspection reveals an obstruction, such as a badly dropped or misaligned joint, or service protrusion, then the Contractor shall make a point repair excavation to uncover and remove or repair the obstruction.

Such excavation shall be approved in writing by the Engineer prior to the commencement of the work and shall be considered as a pay item as listed in the Proposal if the misalignment or protrusion is equal to or more than fifteen (15) percent of the internal diameter of the sewer pipe being lined - as determined by the Engineer from television pictures. If the obstruction or protrusion is less than fifteen (15) percent of the sewer internal diameter, or could have been removed by bucket machines, or swabbing using conventional cleaning methods, payment will not be made.

3. Transportation to Site - The liner bag shall be impregnated with resin not more than 48 hours before the proposed time of installation and stored out of direct sunlight at a temperature of less than 50^0F (4^0C).

4. Liner Inversion - Clean water at ambient mains temperature shall be available from the Owner at the nearest fire hydrant to the inversion location.

5. Liner Curing - The Contractor shall supply a suitable heat source and water recirculation equipment capable of delivering hot water to the far end of the liner for curing purposes.

6. After the liner has been cured, all existing active services shall be reconnected within 24 hours. All other service connections shall be connected within 72 hours. All service connections shall be restores to their full diameter within one week of the time that the pipe was lined. The Contractor shall be responsible for damages resulting from any house-lead backups which result from service laterals not being fully opened.

   The reconnection of services shall be done without excavation, from the interior of the pipeline by means of a television camera directed cutting device. Location of the service shall be from the pre-lining internal inspection records and camera observation.

   The camera directed cutting device shall re-establish the service in such a way that a smooth edge is established between the lateral and the pipeline. The liner shall be sufficiently tight so that there is no annular space between the connection and the line. The cost of testing and pre-connection service shall be incidental to the cost of lining in each section.

12.00 SPOT SEWER REPAIRS

12.01 DESCRIPTION OF WORK: This work shall include the furnishing of labor, materials and construction equipment necessary for the repair of segments of existing sewer as shown on the drawings or as directed by the Engineer. Work shall include furnishing

and installation of the pipe and bedding, connecting to existing sewers, and televising of the installed pipe.

12.02 **QUALITY ASSURANCE**: All materials furnished by the Contractor must conform in all respects to the following standard specifications. Where reference specifications are used, they shall be considered as referring to the latest edition. Unless otherwise indicated, any material furnished by the Owner will also conform to these specifications.

A. Reference Standards:

NCPI-ER4	Vitrified Clay Pipe (VCP)
ASTM C-700	Vitrified Clay Pipe (VCP)
ASTM C14, C1.3 Concrete	Sewer Pipe (CSP)
ASTM C-76	Reinforced Concrete Sewer Pipe (RCSP)
ASTM C655	Reinforced Concrete Sewer Pipe (RCSP)
ASA A21.4	Ductile Iron Pipe (DIP) cement lined, standard thickness
ASA A21.51	Ductile Iron Pipe (DIP) cement lined, standard thickness
ASTM C425	Clay Pipe Joints
ASTM C594	Clay Pipe Joints
ASTM C443	Joints in Concrete or Reinforced Concrete Pipe
AWWA C320	Joints in Concrete or Reinforced Concrete Pipe
ASTM C361	Joints in Concrete or Reinforced Concrete Pipe
AWWA C320	Joints in Concrete or Reinforced Concrete Pipe
ASTM C361	Joints in Concrete or Reinforced Concrete Pipe
AWWA C301	Joints in Concrete or Reinforced Concrete Pipe
AWWA C302	Joints in Concrete or Reinforced Concrete Pipe
ASA A21.11	Joints in Ductile Iron Pipe
MDOT 8.02.06	Natural Sand 2NS
ASTM - D-2680	ABS Truss Pipe
ASTM D-2751 & SDR 23.5	ABS Solid Plastic Pipe
ASTM D-2241	PVC Pipe
ASTM D-1784	PVC Compounds
ASTM D-3139	Joints in PVC Pipe
ASTM F-477	Joint Gaskets

B. Certification of Pipe - All pipe delivered to the jobsite shall be accompanied by certification papers showing that the pipe has been tested in accordance with the applicable Specifications and that the pipe meets the Specifications for this project.

C. Tests - The television inspection will be done as specified hereinafter.

12.03 **SUBMITTALS**: Shop Drawings - Furnish shop drawings of the items proposed under the Contract. Design details of the joint shall be submitted to the Engineer for his consideration and approval before ordering any pipe.

12.04 **SEWER PIPE:** All sewer pipes shall meet the requirements of the Quality Assurance Reference Standards shown hereinbefore.

All joints shall meet the requirements of the Quality Assurance Reference Standards shown hereinbefore.

Replacement pipe shall be of the same diameter as the existing sewer or, in case of odd-sized pipe, replacement pipe shall be the next larger, commercially available pipe size. Clay pipe 12 inches in diameter or larger shall be replaced with a like size of reinforced concrete sewer pipe, as listed in the Proposal. Lines smaller than 12 inches may be replaced with plastic PVC pipe. Connections shall be made with appropriate "Fernco" couplers.

12.05 LAYING PIPE: Prior to placement of any pipe, the actual sewer grade between the end points of the repair shall be determined. End points of the dig-up repair shall be exposed in order to determine the correct grade. The Contractor shall be responsible for determining the grade and reporting the grade to the Engineer.

Each pipe shall be inspected for defects prior to being lowered into the trench. The inside of the pipe and outside of the tongue shall be cleaned of any direct or foreign matter. Joint materials shall be placed as recommended by the manufacturer.

All 15 inches diameter and larger sewer shall be installed with stone bedding from a minimum 4 inches below bottom of pipe up to the mid-point of the pipe. The stone to be supplied shall be MDOT Coarse Aggregate 6A placed in 6 inch layers and compacted to 95% Modified Proctor Density. When directed by the Engineer, a concrete cradle shall be placed in lieu of the stone bedding.

The pipe shall be centered in the grooves, and pushed tight together to form a smooth and continuous invert. Mechanical means shall be used for pulling the pipe home in making up the joint and for holding the pipe joints tight until completion of the line. Mechanical means shall consist of a cable placed inside of the pipe with a suitable winch, jack, or come-along for pulling the pipe home and holding the pipe in position.

The Contractor shall verify the grade of the repair by running a stringline along the entire repair prior to backfilling of placing flowable fill. The grade shall be within ¼ inch +- of constant grade.

After the pipe is laid, the bedding, specified hereinafter, shall be carefully compacted under the haunches of the pipe, and the trench shall be backfilled to 12 inches above the pipe as specified under "Excavation and Backfill" section. Sufficient backfill shall be placed after each joint is made along the sides of the pipe to offset conditions that might tend to move the pipe off line and grade. Any pipe found off grade or out of line shall be re-laid properly by the Contractor at no expense to the Owner.

12.06 SEWER BEDDING (CONCRETE CRADLE) AND BACKFILLING: The replacement sewer pipe shall be bedded on a concrete cradle as hereinafter specified. The cradle shall extend at least 12 inches under the portion of existing pipe that is to remain and along the replacement pipe from the connection point. The pipe shall be locked into correct alignment and grade prior to placement of the concrete cradle. The grade at the connection shall be checked by a string line prior to placement of the cradle and prior to backfilling the trench. After setting the pipe, the space between the outside of the pipe and the undisturbed trench bank shall be filled with concrete as shown on the drawings. The concrete shall be technically vibrated to insure complete filling of the annual space between the excavated face of the original ground and the outside face of the pipe. The

concrete shall be allowed to set up for a minimum of 24 hours or have achieved a minimum strength of 400 psi prior to backfilling of the trench.

Sewer bedding and backfilling, other than as specified herein, shall conform to "Excavation and Backfill" section.

12.07 **TRENCH EXCAVATION**: Excavation of the trench for spot sewer repairs shall conform to "Excavation and Backfill" section. The Contractor shall limit the trench width such that the maximum width at the level on top of the pipe is not more than the O.D. of the pipe plus 12 inches on each side. The Contractor shall carefully select his excavation equipment to ensure that this maximum width is not exceeded.

12.08 **SEQUENCE OF CONSTRUCTION**: Once the spot repair has been completed, the trench shall be backfilled and compacted. Temporary pavement shall be placed on the trench the same day the repair is backfilled. Temporary pavement shall consist of cold patch for paved streets and road gravel for unpaved streets. Within two (2) weeks of completion of the repair, it shall be televised and the digital video and reports form the inspection delivered to the Engineer. The City shall then review the videos and determine the acceptability of the repair. Within two (2) weeks after acceptance of the repair, final pavement restoration shall be completed. Spot repairs which are not accepted by the City shall be re-excavated and corrected within two (2) weeks of notification to the Contractor from the City.

12.09 **CONNECTION TO EXISTING SEWERS**: All connections between new pipe and existing lines including private laterals shall be the compression coupling type with bushings as supplied by the manufacturer, meeting the requirements of ASTM Standards. Adjustable rings shall be required in all couplings 6 inches or larger. Clamps and shear rings shall be stainless steel. Private laterals, where found in the length of repaired pipe, shall be reconnected, providing uninterrupted service.

The following types of pipe couplings are approved for this work:

Logan LCP Coupling
Fernco Series 1001

Replacement pipes which are greater than 18 inches in diameter shall be jointed to the existing pipe with Cadillac wrap and concrete collar.

The connection to the existing sewer shall be constructed such that there is no offset or gap at the joint. Joints offset more than 1/2 inch and joints gapped more than one (1) inch apart are unacceptable and shall be repaired by the Contractor prior to final payment.

12.10 **CONTROL OF FLOW**: The Contractor shall bypass pump all flow entering the manhole upstream of the repair either to the manhole downstream of the repair or to a manhole on an adjacent sanitary or combined sewer. The sewer trench shall be kept dry at all times during the duration of the repair.

12.11 **CONCRETE CUTS**: When the trench must be cut through concrete pavement, driveway or sidewalk, particular care shall be taken not to unnecessarily damage the adjoining areas of the pavement driveway or sidewalks. All cuts through existing surfaces shall be made with a concrete saw, sawing full depth.

12.12 **CONCRETE ENCASEMENT**: Concrete for encasement shall be concrete as specified in the Contract specifications, with that below the pipe mixed dry. Concrete encasement shall be built to the form and dimensions shown on the plans. Particular care shall be taken to bed the pipe in concrete so that a complete support of the pipe shall be made. Encasement at the sides and top shall be placed in a manner so that the pipe will not be disturbed or floated form its bedding.

12.13 **CONNECTIONS TO EXISTING MANHOLES**: The Contractor shall furnish all labor and materials for the connections of sewers and catch basin leads under the Contract to existing manholes, structures and catch basins as called for on the drawings. When breaking or cutting holes for connections to existing manholes or catch basins, care shall be taken to prevent debris from entering the existing sewers or leads. After installation of pipe, the manhole or catch basin shall be pointed up around the pipe, both on the inside and outside of the manhole or catch basin, so that it is restored to a watertight condition. New flow channels shall be installed in the existing manholes where called for on the drawings. The cost of this work shall be included in the unit price bid for sewers and / or catch basin leads.

12.14 **WYE BRANCH CONNECTIONS**: Wye branch connections shall be provided at such points as are shown on the drawings or as directed by the Engineer. This shall be of the size and character indicated on the drawings. Branch connections shall be formed by the use of standard wye-branches. Wyes shall only be installed with standard bell and spigot sections. Wyes shall be provided to connect existing services only.

12.15 **CORED TAP**: For sewers 15 inches or larger in diameter, cored taps may be used in place of wyes. The cored tap shall be made with a coring machine which will create a clean and circular opening in the sewer pipe. The opening shall not be larger than the outside diameter of the surface lateral pipe plus 10%.

A rubber boot assembly to be inserted in the cored opening shall be equal to a Kor-N-Tee Assembly with a stainless steel Korband shall be used to connect the service lateral to the pipe. The lateral shall not protrude into the pipe. Cored taps shall be positioned away from joints on the proposed combined sewer, and shall be drilled to align the center of the proposed sewer lead with the center of the proposed combined sewer. The core diameter shall be as recommended by the manufactures of the rubber boot. The external stainless steel band on the boot shall be tightened to manufacturer's recommendation upon insertion of the proposed sewer lead.

12.16 **RISER PIPE**: Where directed by the Engineer, or shown on the drawings, the Contractor shall furnish and place risers, of the size and type shown on the drawings and / or as listed on the Proposal, extending form the branch opening of the sewer up to the established elevation of the house sewer service lateral, as hereinafter specified or to such an elevation as will provide existing or future service. These risers shall be laid up and held in place in a substantial manner and surrounded by concrete as shown on the drawings. Openings in the top of the riser pipe shall be closed by means of stoppers as specified.

12.17 **SERVICE LATERAL CONNECTIONS**: Whenever indicated or noted on the drawings, house connection sewers shall be installed and connected to existing house plumbing. The connections shall be constructed with couplings as hereinbefore specified. The

service lateral shall have a minimum fall of ¼ inch per foot. Connections shall use 4 or 6 inch P.V.C. (SDR 25) pipe.

12.18 **TELEVISION INSPECTION**: Under the work the Contractor shall furnish all materials, labor, equipment and all else necessary for performing a television inspection of repaired sanitary sewers. Included will be any necessary cleaning and bypass pumping of all sewage from the upstream manhole.

The inspection shall be carried out under the direct supervision of the Engineer's representative with all television inspection being observed by the Engineer.

All television inspection shall be digitally recorded in color video which shall be turned over to the City. The recording must be made on a continuous running where both sound and video information is recorded.

The inspection shall involve the visual observation by closed circuit television. The inspection shall be performed at a rate of speed and with sufficient lighting which will allow examination of all points of infiltration, cracked or crushed pipe, defective joints, misalignment in line or grade, location of wye openings and any defects which may appear. Any items which, in the opinion of the Engineer, require repair shall be precisely located and described by a detailed statement of the condition.

As part of the television inspection, the precise location of each wye shall be noted in relation to the manholes. These locations shall be entered on the wye location sheet supplied by the Contractor.

If the camera encounters a dip in the sewer such that water is standing above the springline of the sewer pipe, and if the camera lens becomes submerged because of this condition, the camera rig shall be withdrawn from the sewer and inserted from the other end as far as possible. At all times, back-flooding into the reach from the adjacent section shall be prevented.

Two copies of all notes, wye locations and other pertinent information shall be made as a part of the television inspection. One set of this information shall be turned over to the Engineer upon the completion of the inspection of each line. The second copy of the information shall be held by the Contractor until completion of the project, at which time it shall be neatly assembled and turned over to the Engineer.

13.00 **METHOD OF MEASUREMENT AND BASIS OF PAYMENT**: Upon the completion of the Contract, the items listed in the Proposal will be measured and / or counted in the presence of the Contractor. Payment will be made at the listed unit prices.

Any work not specifically listed as a payment item in the Proposal will be considered as incidental to one or more of the payment items.

13.01 **SEWERS**: Sewers will be measured from center to center of manholes with no deductions for wyes or other fittings. The depth of the sewer connecting two adjacent structures shall be considered as being the average of the depth from earth grade to the sewer invert at these structures.

13.02 **SEWERS THROUGH ENCASEMENTS**: Sewers through encasements under highways, railroads, etc., will be measured through the encasement. Bedding of sewer in the encasement is considered incidental.

Stubs shall be considered as footage of sewer. Adapters and plugs are considered incidental.

13.03 **HOUSE SERVICES**: House services shall be measured horizontally from sewer centerline and the unit price shall include the cost of the elbow and plug, blocking and marker. No deduction will be made for wyes, elbows or risers.

13.04 **RISERS, CLEANOUTS, WYES AND TEES**: Risers, cleanouts, wyes and tees shall be paid for at the contract unit price.

13.05 **MANHOLE DEPTHS**: Manhole depths will be measured from the lowest invert to the top of the casting.

13.06 **SURFACE RESTORATION**: See standard specifications for Excavating and Backfilling.

GENERAL SPECIFICATIONS FOR SEWERS- SEWER CLEANING

1.00 **GENERAL**: Sewer cleaning shall include all work required to clean sewers for inspection by closed circuit television and / or chemical grouting operations. Work included in cleaning of sewers shall include providing necessary equipment and personnel, dislodging materials from the sewer pipe, removal of the debris from the system and the transport and disposal of debris removed. A disposal site will not be provided by the Owner.

1.01 **CLEANING EQUIPMENT**: The equipment used for sewer cleaning shall be capable of removing all dirt, grease, rocks, roots and other deleterious materials. The equipment shall be selected by the Contractor to prevent damage to the pipe. The equipment may include high velocity water-jetting equipment, vacuum machines, hydraulically propelled equipment or mechanically powered equipment. If a rodding unit is used, it shall be able to pull brushes, swabs and other cleaning equipment as well as the television camera. The rodding unit shall have a footage meter attached so that the location of the cleaning tools and / or television camera will be known at all times. Necessary pulleys and supports shall be installed in manholes so as not to restrict the cleaning operation or damage existing manholes.

Cleaning equipment capable of cleaning lengths up to 1000 feet shall be provided. Equipment must be able to clean this length with vehicular access to one manhole only.

1.02 **CLEANING PRECAUTIONS**: During sewer cleaning operations, satisfactory precautions shall be taken in the use of cleaning equipment. When hydraulically propelled cleaning tools or tools which retard the flow in the sewer line are used, precautions shall be taken to insure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer. When possible, the flow of sewage in the sewer shall be utilized to provide the necessary pressure for hydraulic cleaning devices. When additional water from the fire hydrants in necessary to avoid delay in normal work procedures, the water shall be conserved and not used unnecessarily. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant.

1.03 **SEWER CLEANING**: Sewer cleaning shall consist of removing dirt, grease, rocks, sand, roots and other materials and obstructions from the sewer lines and manholes. Cleaning shall be of the entire reach between manholes. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning again attempted.

The majority of roots shall be removed in the sections where chemical root treatment has been used. Special attention should be used during the cleaning operation to assure almost complete removal of roots from the joints in any lines designated for joint testing. Any roots which could prevent the proper application of chemical sealants shall be removed. Procedures may include the use of mechanical equipment such as rodding machines, and winches using root cutters and porcupines, and equipment such as high-velocity jet cleaners.

1.04 **SEWER CLEANING PRIOR TO ROOT TREATMENT**: Sewer cleaning which is being performed to facilitate root treatment is intended to clear the line of large accumulations of dirt, grease, and other materials which hamper root treatment. Cleaning prior to root treatment shall thoroughly clean the line of dirt and sediment. High pressure jet cleaning shall be used for pre-cleaning of sewers unless other methods are approved by the Engineer. Mechanical cutting tools shall not be used in sewers prior to root treatment unless there is such dense root intrusion or solid material in the pipe that the flow of treatment would be rendered ineffective. Sewers which are designated for television inspection prior to root treatment shall be cleaned to the extent required under inspecting.

1.05 **REMOVAL AND DISPOSAL OF DEBRIS**: All sludge, dirt, sand, rocks, grease, roots and other solid or semisolid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing material from manhole section to manhole section, which could cause line stoppages, accumulations of sand in wet wells, or damage to pumping equipment, shall not be permitted. All solids or semisolids resulting from the cleaning operations shall be removed from the site and disposed of. All material shall be removed form the site no less often than at the end of each workday. Under no circumstances will the Contractor be allowed to accumulate debris, etc., on the site of work beyond the stated time, except in totally enclosed containers and as approved by the Owner.

1.06 **ACCEPTANCE OF SEWER CLEANING**: Acceptance of sewer line cleaning shall be made upon the successful completion of the television inspection and shall be to the satisfaction of the Engineer. If TV inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to re-clean and reinspect the sewer line until the cleaning is shown to be satisfactory.

GENERAL SPECIFICATIONS FOR SEWERS- SEWER FLOW CONTROL

1.00 SEWER FLOW CONTROL

1.01 GENERAL: This work shall include dewatering or diverting flow in sewers to the degree necessary for the television inspection. Flow control shall be incidental to other work performed under the Contract.

Flow control shall be used whenever required to bring the depth of flow within the range specified below for television inspection.

The Contractor shall, prior to starting work, furnish the Engineer, for approval, his proposed method for dewatering sewers.

1.02 DEPTH OF FLOW: When sewer line depth of flow at the upstream manhole of the manhole section being worked is above the maximum allowable for television inspection, joint testing and / or sealing, the flow shall be reduced to the level shown below plugging or blocking of the flow, or by pumping and bypassing of the flow as specified.

Depth of flow shall not exceed that shown below for the respective pipe sizes as measured in the manhole when performing television inspection, joint testing and / or sealing.

Maximum Depth of Flow – Television Inspection

6”-10” Pipe.....20% of pipe diameter
12”-24” Pipe.....25% of pipe diameter
27” & up Pipe.....30% of pipe diameter

1.03 PLUGGING OR BLOCKING: A sewer line plug shall be inserted into the line upstream of the section being worked. The plug shall be so designed that all or any portion of the sewage can be released. During TV inspection, testing and sealing operations, flow shall be reduced to within the limits specified above. After the work has been completed, flow shall be restored to normal.

1.04 PUMPING AND BYPASSING: When pumping and bypassing is required, the Contractor shall supply the pumps, conduits, and other equipment to divert the flow of sewage around the manhole section in which work is to be performed. The bypass system shall be of sufficient capacity to handle existing flow plus additional flow that may occur during a rainstorm. The Contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. If pumping is required on a 24 hour basis, engines shall be equipped in a manner to keep noise to a minimum.

1.05 FLOW CONTROL PRECAUTIONS: When flow in a sewer line is plugged, blocked or bypassed, sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. Further, precautions must be taken to insure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved.

GENERAL SPECIFICATIONS FOR SEWERS- TV INSPECTION / ROOT TREATMENT

1.00 TELEVISION INSPECTION

1.01 **GENERAL**: Under this work, the Contractor shall furnish all materials, labor, equipment and all else necessary for performing a television inspection of existing sewers.

The flow in the section being inspected will be suitable controlled as specified (see Sewer Flow Control). The inspection shall be carried out under the supervision of the Engineer.

1.02 **EQUIPMENT**: The television camera used for the inspection shall be one specifically designed and constructed for such inspection and the equipment shall be capable of televising sewer run lengths of up to 800 feet. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable for producing picture quality to the satisfaction of the Owner, and if unsatisfactory, equipment shall be removed and no payment will be made.

All television inspection shall be recorded in color on DVD (Digital Versatile Disc) and on an external hard drive approved by the Engineer and the recordings shall be provided to the City. Recordings shall have both audio and video of acceptable quality and free of interference and background noise. The DVD recordings shall be provided in a standard media format which can be read by a Microsoft Windows media player. No proprietary software programs shall be needed to view and hear the recordings.

Each DVD turned over to the Owner shall be furnished with a hard case having external labeling that can be seen without opening the case. All DVDs shall be finalized by the Contractor so that they can not be accidently recorded over. The Contractor shall store and transport each DVD in an upright position away from magnetic sources and within temperatures above 40°F to below 80°F.

1.03 **PROCEDURE**: The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds, or other devices that do not obstruct the camera view of interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line.

If the camera encounters a dip in the sewer such that water is standing above the springline of the sewer pipe, and if the camera lens becomes submerged because of this condition, the camera rig shall be withdrawn from the sewer and inserted from the other end as far as possible. At all times, backflooding into the reach from the adjacent section shall be prevented.

When manually operated winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two manholes of the section being inspected to insure good communications between members of the crew.

The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be above ground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to the Owner.

1.04 **DOCUMENTATION OF TELEVISION INSPECTION**: Two sets of printed location records shall be kept by the Contractor and will clearly show the location in relation to an adjacent manhole of each infiltration point observed during inspection. In addition, other points of significance such as locations of building sewers, unusual conditions, roots, storm sewer and corrosion, and other discernible features will be recorded. One set of this information shall be turned over to the Engineer upon the completion of the inspection of each line. The second copy of the information shall be held by the Contractor. Upon completion of the project, two copies of an inspection report shall be submitted to the Owner.

2.00 ROOT TREATMENT

2.01 **GENERAL**: This work shall include treating sections of sewer as shown on the plans with a chemical root control agent capable of killing roots within the sewer line and inhibiting their re-growth without permanently damaging the vegetation producing the roots. The Contractor shall take all precautions up into buildings through building sewer connections. Any damage resulting from the agent being forced into buildings shall be repaired at no cost to the Owner.

The work shall include providing suitable root control agent; storage for the agent; proportioning, mixing and installing the instructions; keeping necessary records; hauling the materials in accordance with all necessary safety and cleanup requirements; and diverting the existing flow in the sewer line when required. Adequate ventilating system shall be provided to comply with applicable safety requirements.

Root treatment shall precede sewer cleaning except when flow is sluggish and contains sludge and grease accumulations or where TV inspection prior to root treatment is called for. In these instances, the sewer shall be cleaned as hereinafter specified before root treatment. Cleaning, when required, shall precede root treatment by a minimum of six (6) weeks.

Root treatment shall be scheduled to allow a minimum of thirteen (13) weeks prior to cleaning for the dead root mass of the smaller roots to decompose and slough off and to allow some of the heavier root branches to become brittle.

2.02 **ROOT CONTROL MATERIAL**: The active component for destroying intruding roots shall be a potent, nonsystematic toxin which will kill contacted roots at low concentrations but which will not permanently affect parts of the plant distant from the treated roots. The active ingredient must be spontaneously detoxified by natural chemical or biochemical processes in a relatively short interval following its use. The Contractor shall submit evidence that the ingredient will not adversely affect the performance of the wastewater treatment plant, may be removed by the normal treatment processes at the plant, and has EPA approval for use in sewer lines.

The active ingredient for destroying root intrusions shall be sodium methyldithiocarbamate or diquat dibromide.

In all applications the root control agent shall be dispersed into clear cool (less than 80°F, above 40°F) water free of acid, alkali, oxidizing agents, or large amounts of oil or other organic compounds or materials. Tanks used for transportation or storage of make-up water shall be free of material listed above. Extra precautions must be taken during cold weather to ensure that solution temperatures above 40°F are maintained until treatment is complete.

All foam delivered to line segments shall be generated form a solution which has been mixed for not more than 10 hours.

All materials shall be delivered to the site in undamaged, unopened containers bearing manufacturer's original labels. A sufficient quantity of root control agent shall be stored at or near the site of the work to insure that operations will not be delayed by shortages arising from spillage or from leakage in the treated line. The Contractor shall be solely responsible for storing root treatment chemicals. The chemicals shall be stored and handled in accordance with all applicable local, state and federal regulations governing storage and handling of potentially hazardous materials.

Root chemical solutions shall be mixed in accordance with the label precautions and instructions. Solutions shall be mixed in the presence of a representative of the City.

Mixing and handling of the root control agent, which may be toxic under certain conditions of contact and inhalation, shall be in accordance with the recommendations of the manufacturer and applicable safety codes and shall be performed in such a manner as to minimize hazard to personnel. It is the responsibility of the Contractor to provide appropriate protective measures to insure that chemicals are under the control of the Contractor at all times and are not available to unauthorized persons or accessible to animals. Any damage to vegetation resulting from the misuse of the root control agent will also be the responsibility of the Contractor.

2.03 **METHOD OF APPLICATION**: Application of the chemical root control agent shall be by foaming in accordance with recommendations of the root control agent manufacturer based on conditions present in the line under treatment except soaking shall be used when directed by the Engineer. Storm sewers and combined sewers shall not be treated during rain events, unless prior approval is received from the Engineer.

A. Foaming –

1. Foaming Agent - The chemical root control agent used in foam application shall be formulated with a surfactant capable of producing a foam able to transmit a pressure of 30 pounds per square inch and of yielding 20 gallons of foam per gallon of solution. The surfactant system shall produce a dense, small bubble, clinging foam that maintains its shape for at least 60 minutes.

2. Volume - The volume of foam injected shall be sufficient to completely fill the section of line under treatment, according to the manufacturer's instructions.

3. Application - Application of the foaming agent shall be by one of the following methods:

    a. The fumigant hose shall be inserted at the downstream manhole and pulled through the sewer to the upstream manhole. Foam generation shall begin until foam appears at the upstream manhole. The hose shall then be withdrawn at a rate given by the equipment supplier until the foam appears in the downstream manhole.

    b. A split manhole technique may be used when desired by the Contractor. In this technique, a hose may be drawn from both manholes, such that the hoses meet at some point in the line. The hoses shall then be withdrawn at a rate specified by the equipment manufacturer until foam appears in the manholes at either end.

    c. For line sizes larger than 24 inches in diameter, the line may be treated by the foam coat method. The amount of foam applied shall be equal to a minimum of a 2 inch coat of foam on the inside of the pipe. The foam shall be applied by means of a foam coat nozzle. The hose shall be pulled at such a rate that cocooning of the nozzle does not occur. If necessary to prevent cocooning, the hose shall be repeatedly pulled through the line until the required volume of foam is applied. If repeated applications are required to coat the line, the hose shall be pulled, not jetted, through the line.

    The method of foam application in which a plug is inserted at one end and foam is generated into the line until it appears at the opposite end shall not be used.

B. Root Treatment Equipment - The equipment used in chemical root treatment shall be in good working order. All measuring devices, such as flow-meters, shall read accurately. The Engineer may require that the accuracy of gauges be checked in there is reason to suspect their accuracy.

C. Soaking -

1. Soaking Agent - The chemical root control agent to be applied by soaking shall be formulated as recommended by the manufacturer of the agent.

2. Application - A section of the line to be treated shall be filled with a freshly prepared and well-mixed solution containing no less than 1%, by volume, of the chemical agent. The section shall be fully charged for a soaking period of net less than 60 minutes with the solution being replenished as required to maintain the level of the solution above the upper end of the section under treatment and the concentration at 1%, by volume, of root control agent. Following the specified soaking period, the solution may be passed downstream to treat additional segments of lines. Additional root control agent shall be added as required to maintain the concentration of the solution at 1% and each segment shall be fully charged for not less than 60 minutes by the addition of solution as necessary.

GENERAL SPECIFICATIONS FOR SEWERS- SOIL EROSION CONTROL

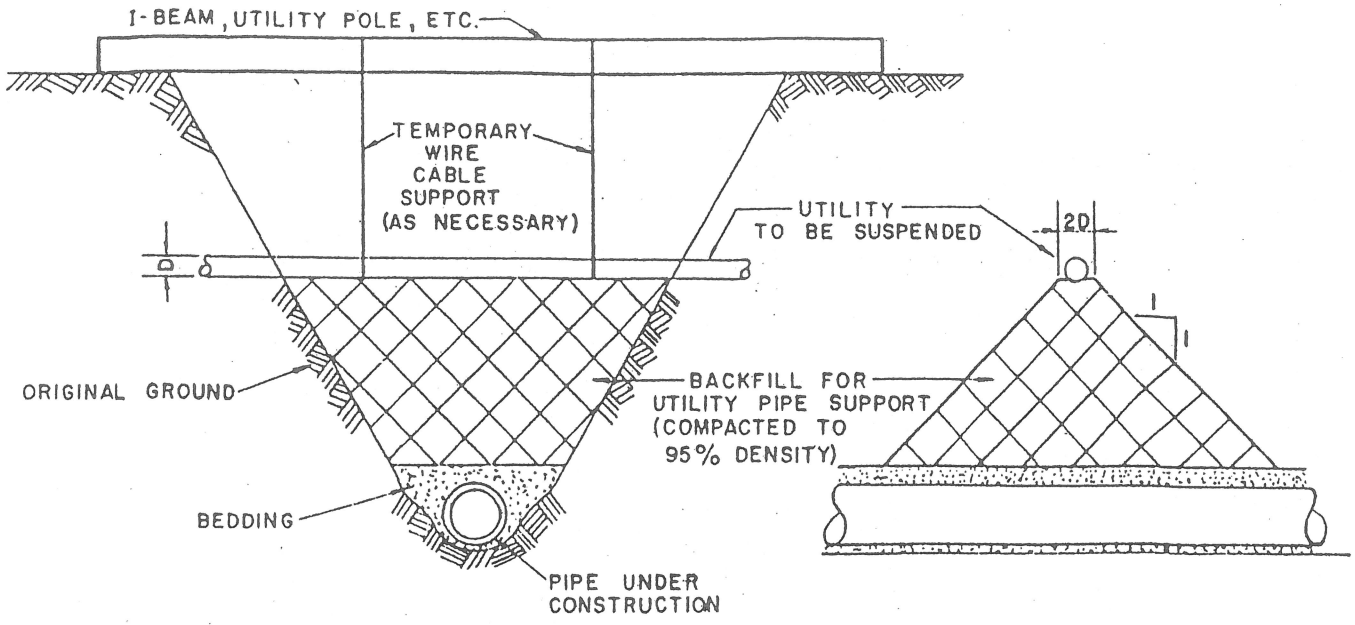
1.00 SOIL EROSION

1.01 GENERAL: The Contractor shall obtain at his own expense any Soil Erosion and Sedimentation Control permit as may be required by the Oakland County Water Resources Commissioner (O.C.W.R.C.). Refer to "General Conditions", section 5.04 of the City of Royal Oak Standard Specifications for Construction. All work in Public Right of Way such as on roads, sidewalk, sewers, water main, lighting, parks, and parking lots under control of the City are required to obtain the required permits and install inlet filters as a minimum City requirement.

Under this work, the Contractor shall furnish all materials, labor, equipment and all else necessary for performing the installation and maintenance of required soil erosion control measures as required by the City and under a permit obtained from and issued by the Oakland County Water Resource Commission (WRC).

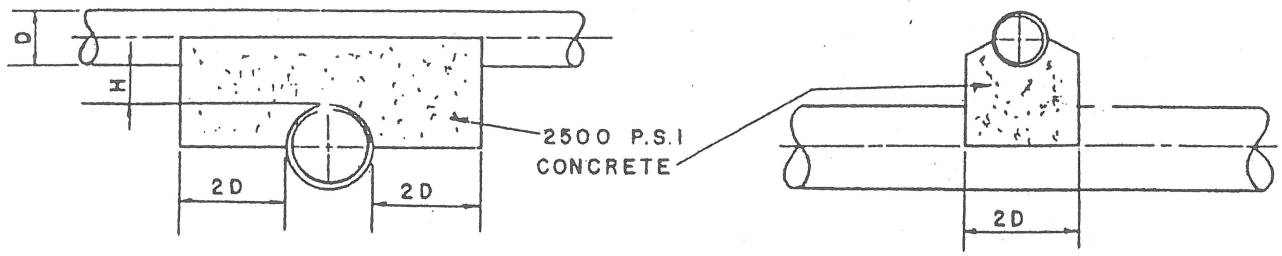
1.02 PROCEDURE: The Contractor will be required to install soil erosion inlet filters at all catch basins and inlets within the project limits. All work and costs associated with soil erosion and sedimentation control shall be considered included with and part of the Contract.

Refer to the Inlet Filter detail on page SD-15 and also any additional details and requirements that may apply once a permit is obtained from WRC.



NOTE:
SIMILAR SUPPORT METHODS APPLY TO UTILITIES PARALLELING AND ABOVE THE SEWER UNDER CONSTRUCTION.

SPECIAL SUPPORTS FOR UNDERGROUND UTILITIES

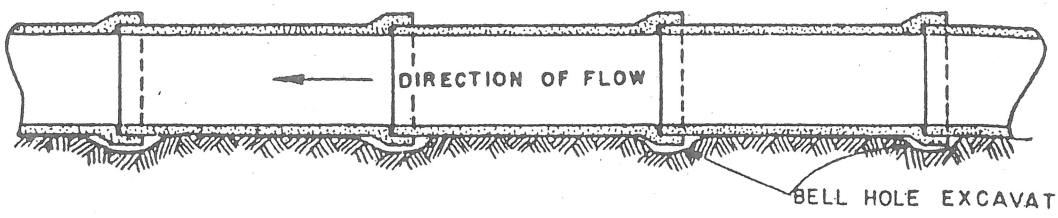


SADDLES REQUIRED WHERE:

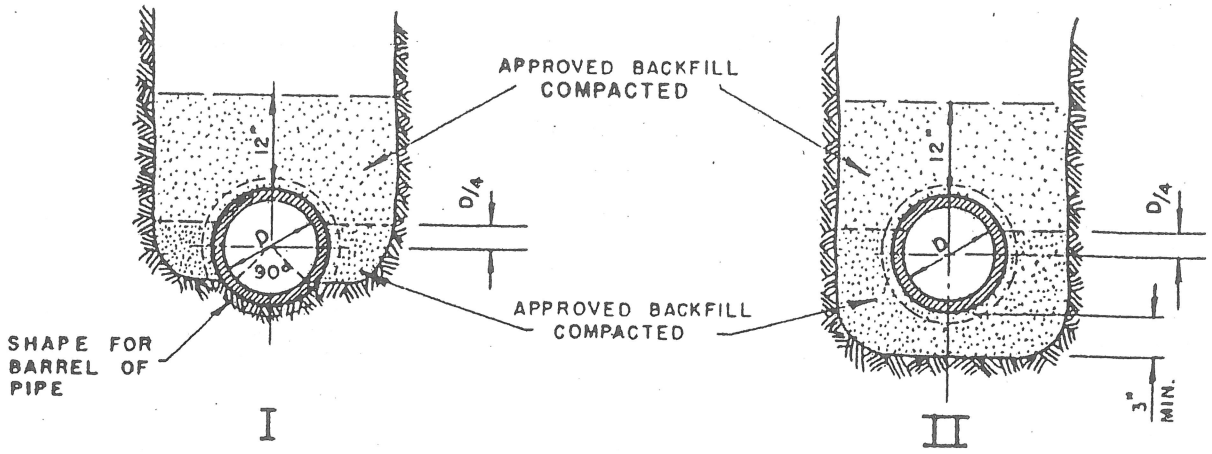
H = LESS THAN 3"	FOR	D = LESS THAN 15" DIA.
H = LESS THAN 6"	FOR	D = 18" THRU 36" DIA.
H = LESS THAN 12"	FOR	D = 42" AND GREATER DIA.

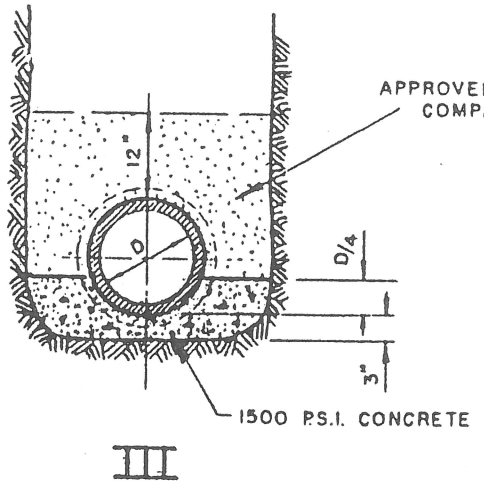
NOTE:
SADDLES NOT REQUIRED FOR WATER MAIN OR GAS MAIN SERVICE PIPES 2" OR LESS IN DIA.

PIPE SADDLES



EXCAVATION FOR BELLS





NOTES–

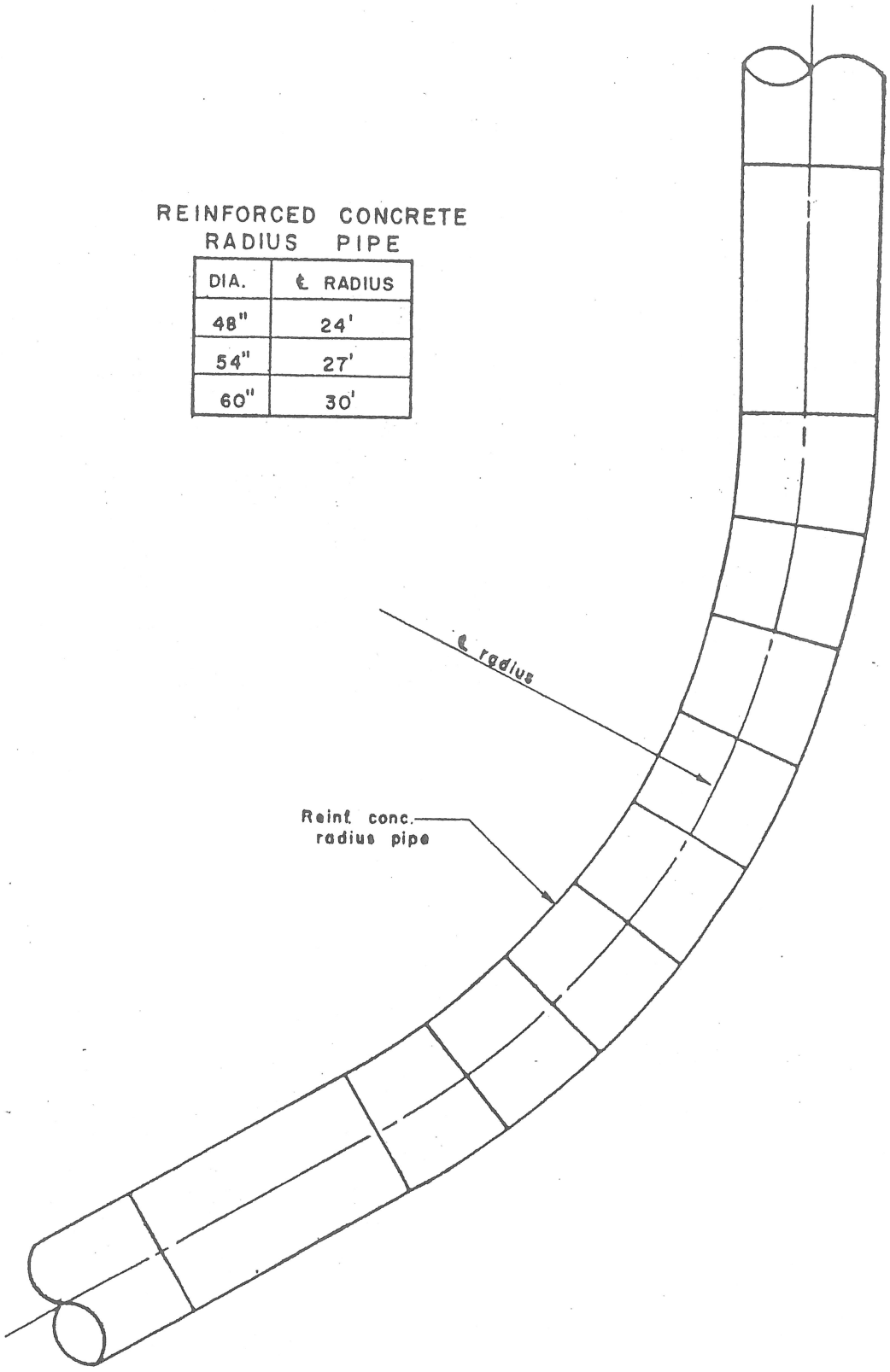
1. METHOD I SHALL BE USED IN AREAS OF UNCONSOLIDATED SOILS. (SAND, GRAVEL & ETC.)
2. METHOD II SHALL BE USED IN AREAS OF CONSOLIDATED SOILS. (CLAY HARDPAN, ROCK & ETC.)
3. METHOD III – CONCRETE BEDDING IN AREAS AS NOTED ON PLANS.

ALL BACKFILL INDICATED SHALL BE HAND COMPACTED TO 95% OF MAXIMUM DENSITY.

METHODS OF LAYING SEWER PIPE

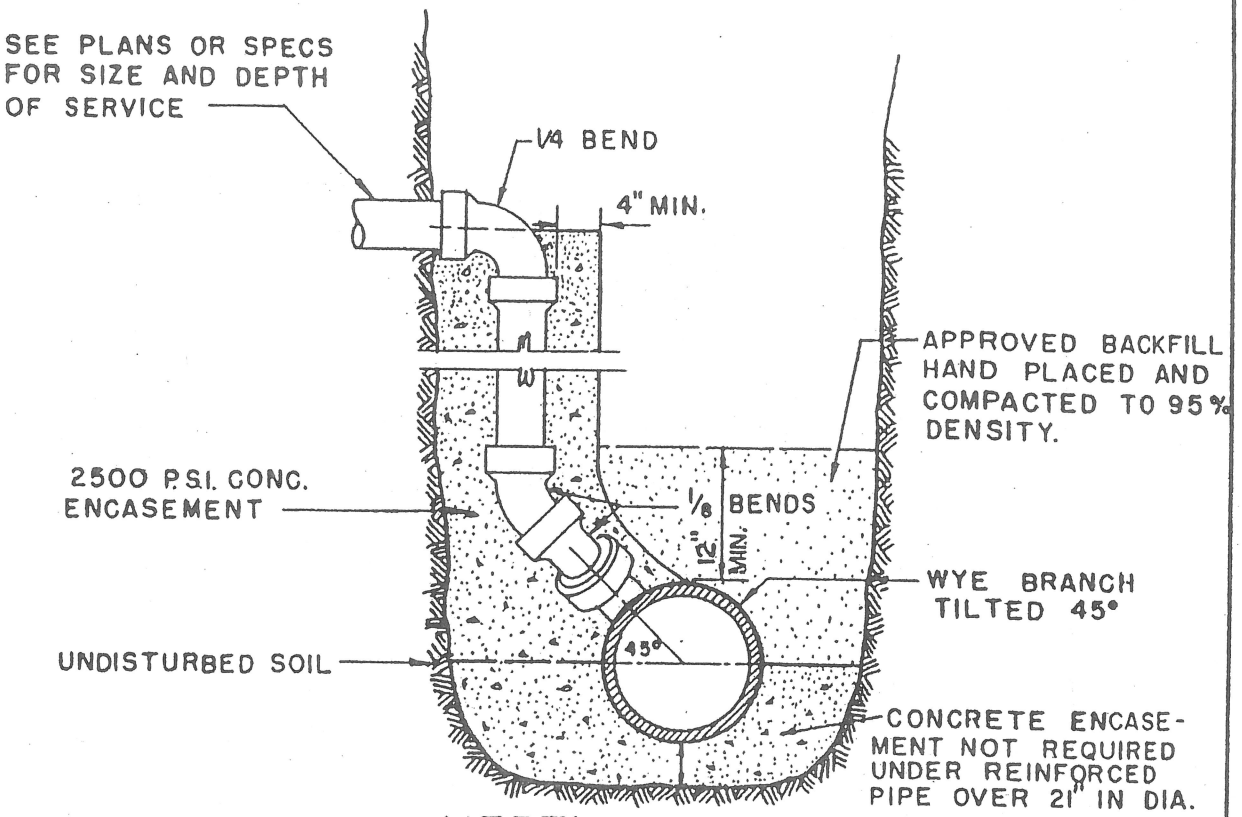
REINFORCED CONCRETE
RADIUS PIPE

DIA.	℄ RADIUS
48"	24'
54"	27'
60"	30'

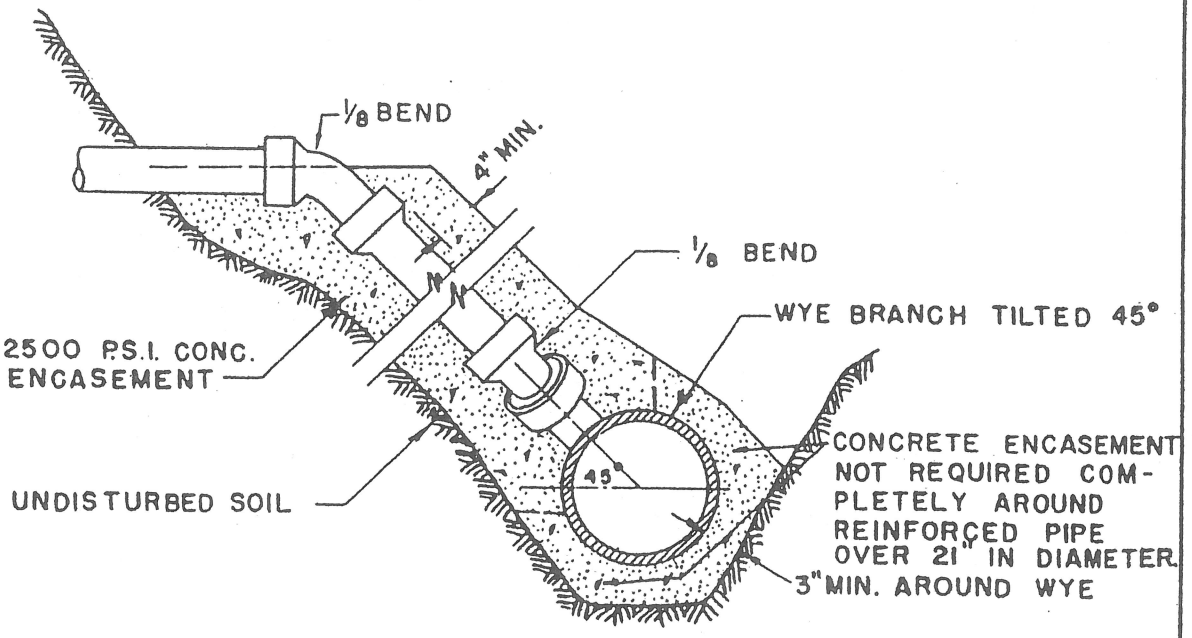


DETAIL CURVED SEWER AT BENDS

(on 48" dia. pipe & over)



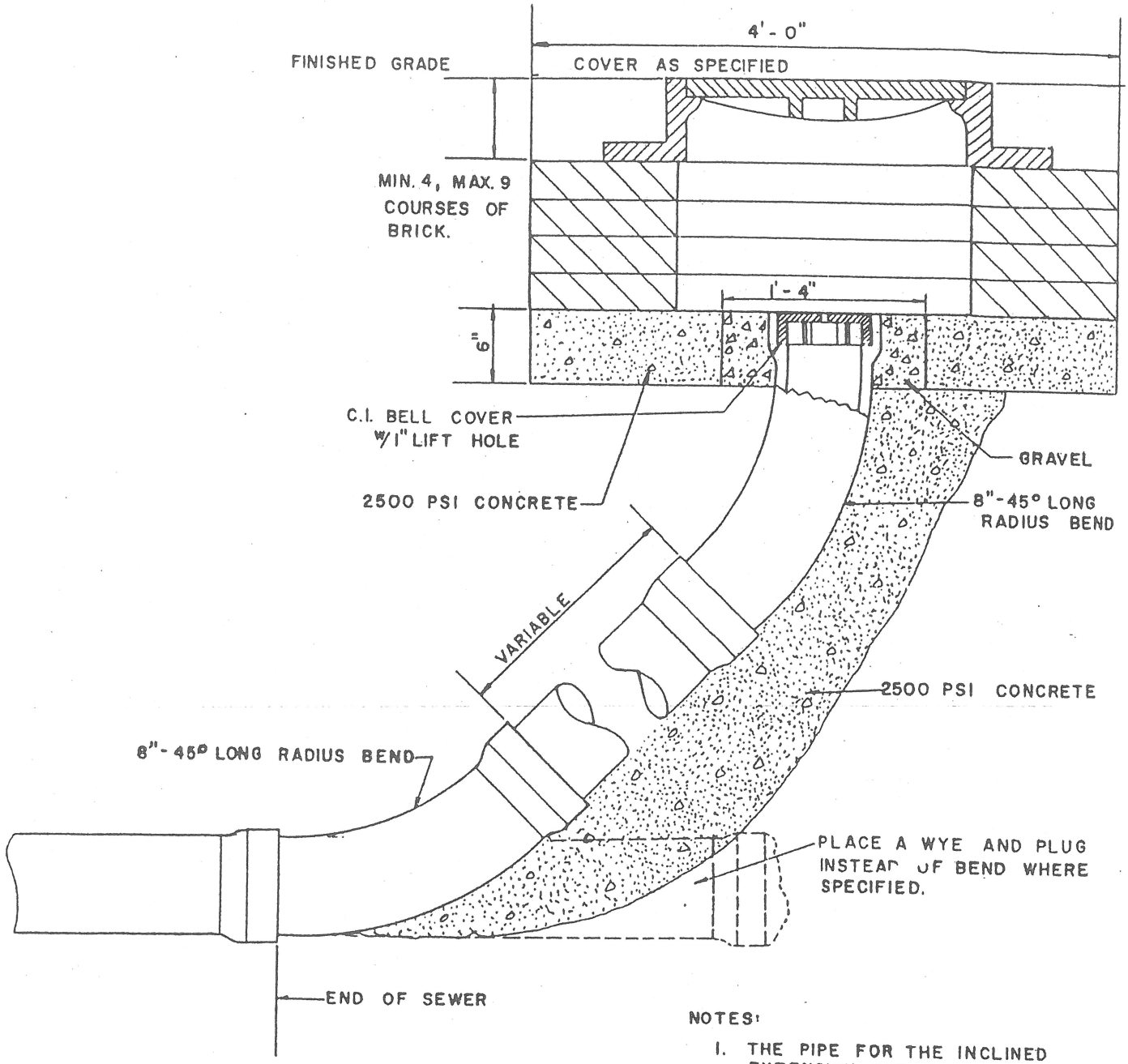
VERTICAL TRENCH



SLOPING TRENCH

STANDARD RISER DETAILS

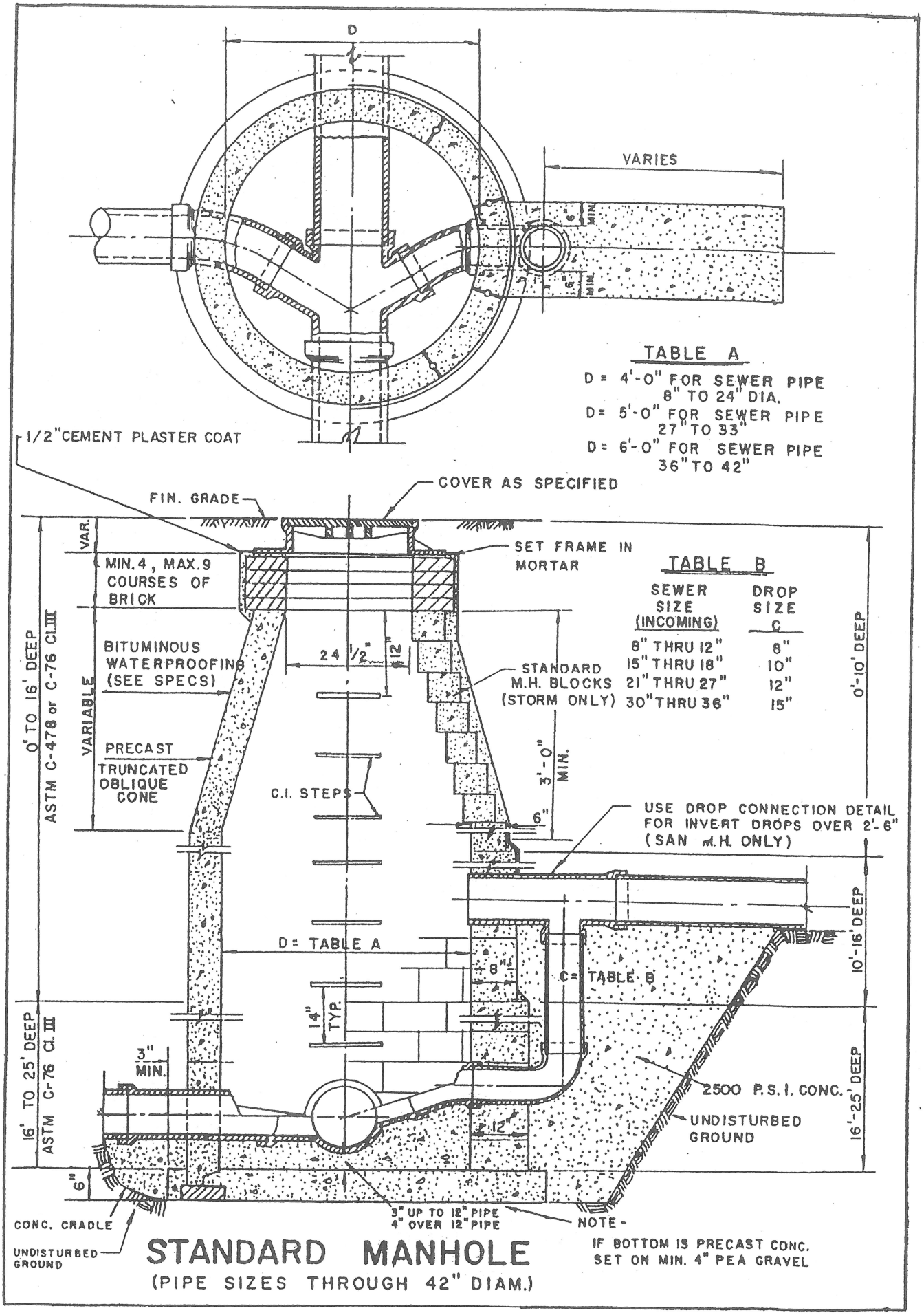
(REQUIRED ONLY IF DEPTH TO TOP OF SEWER IS GREATER THAN 12 FEET.)



NOTES:

1. THE PIPE FOR THE INCLINED EXTENSION FOR CLEANOUT SHALL BE 8" DIA. IF SEWER IS LARGER THAN 8", THEN A REDUCER SHALL BE PLACED BETWEEN END OF SEWER AND LONG RADIUS BEND.
2. JOINTS SHALL BE SAME AS SPECIFIED FOR SEWER CONSTRUCTION.

SEWER CLEANOUT



STANDARD MANHOLE

(PIPE SIZES THROUGH 42" DIAM.)

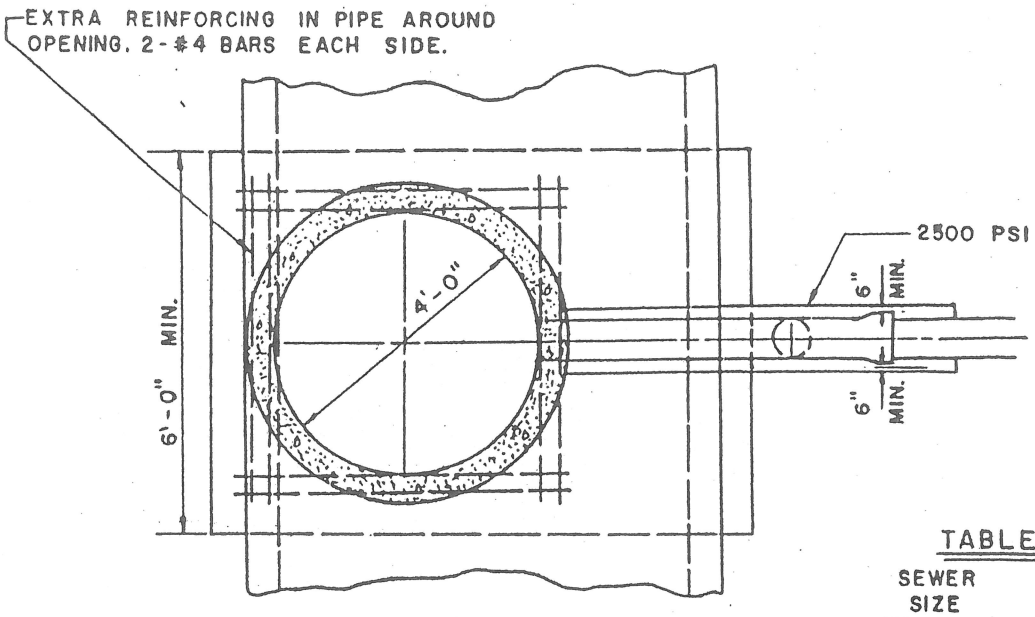
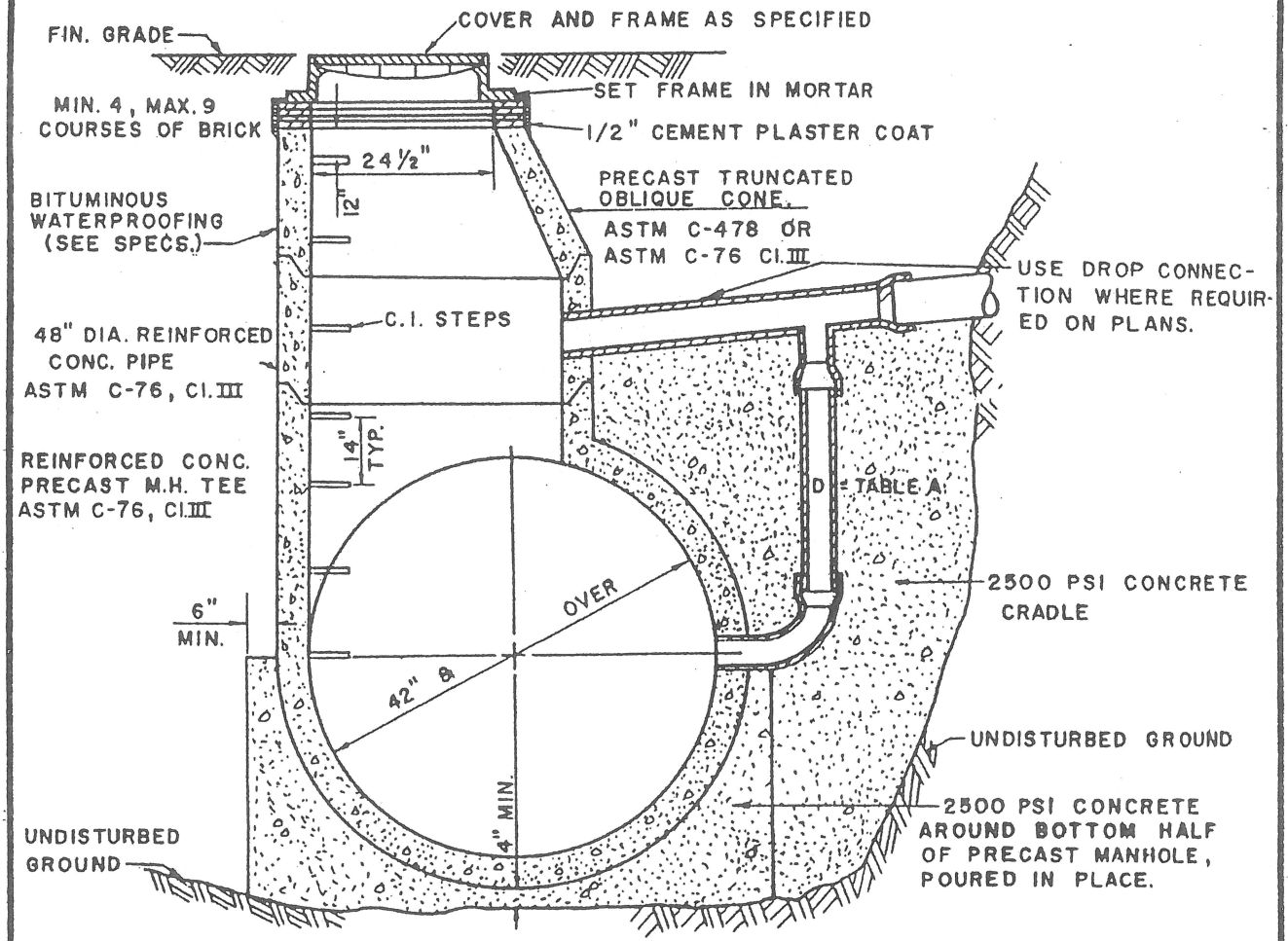


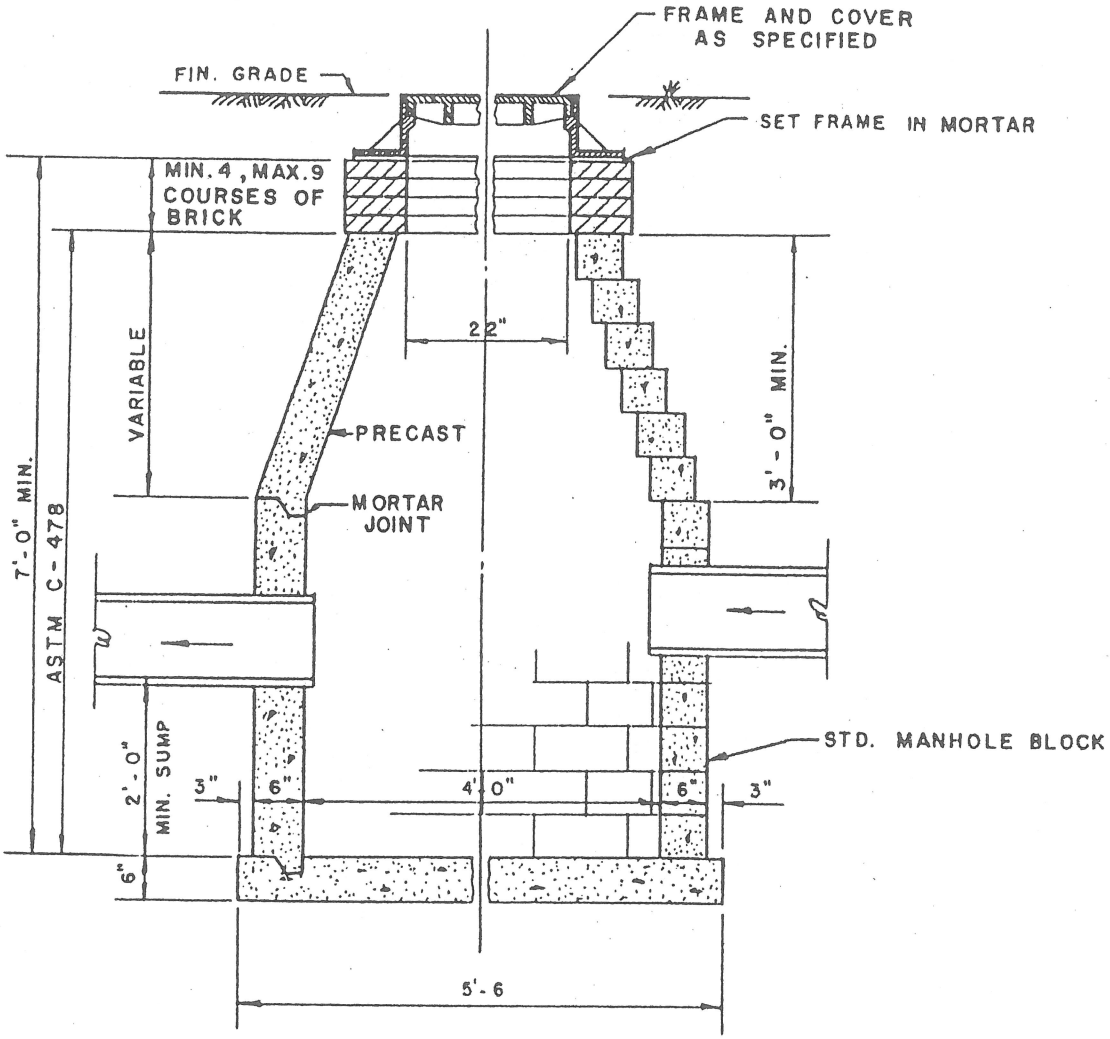
TABLE A

SEWER SIZE (INCOMING)	DROP SIZE D
8" THRU 12"	8"
15" THRU 18"	10"
21" THRU 27"	12"
30" THRU 36"	15"

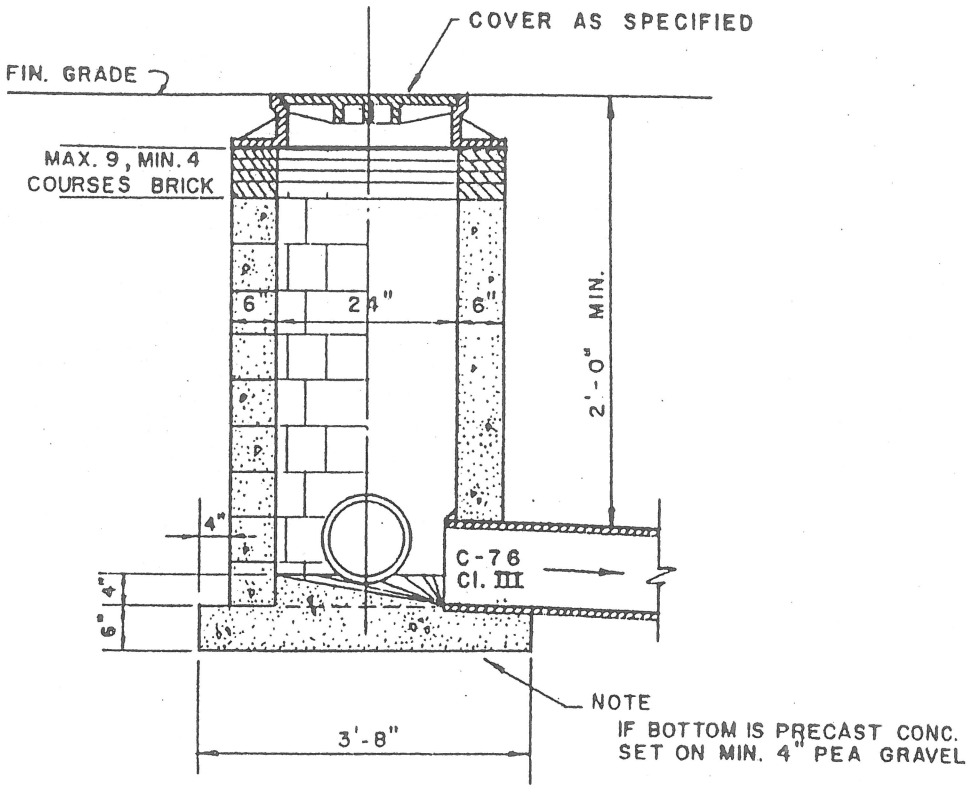


STANDARD TEE MANHOLE

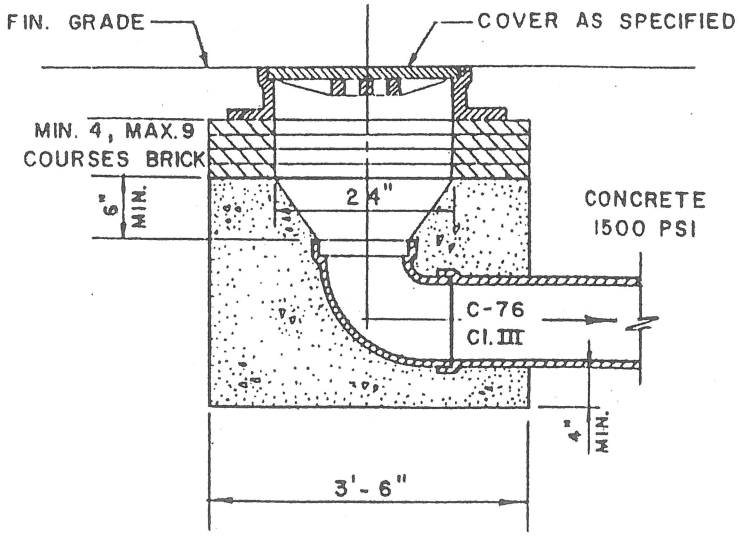
(PIPE SIZES 42" AND GREATER IN DIAM)



STANDARD CATCH BASIN

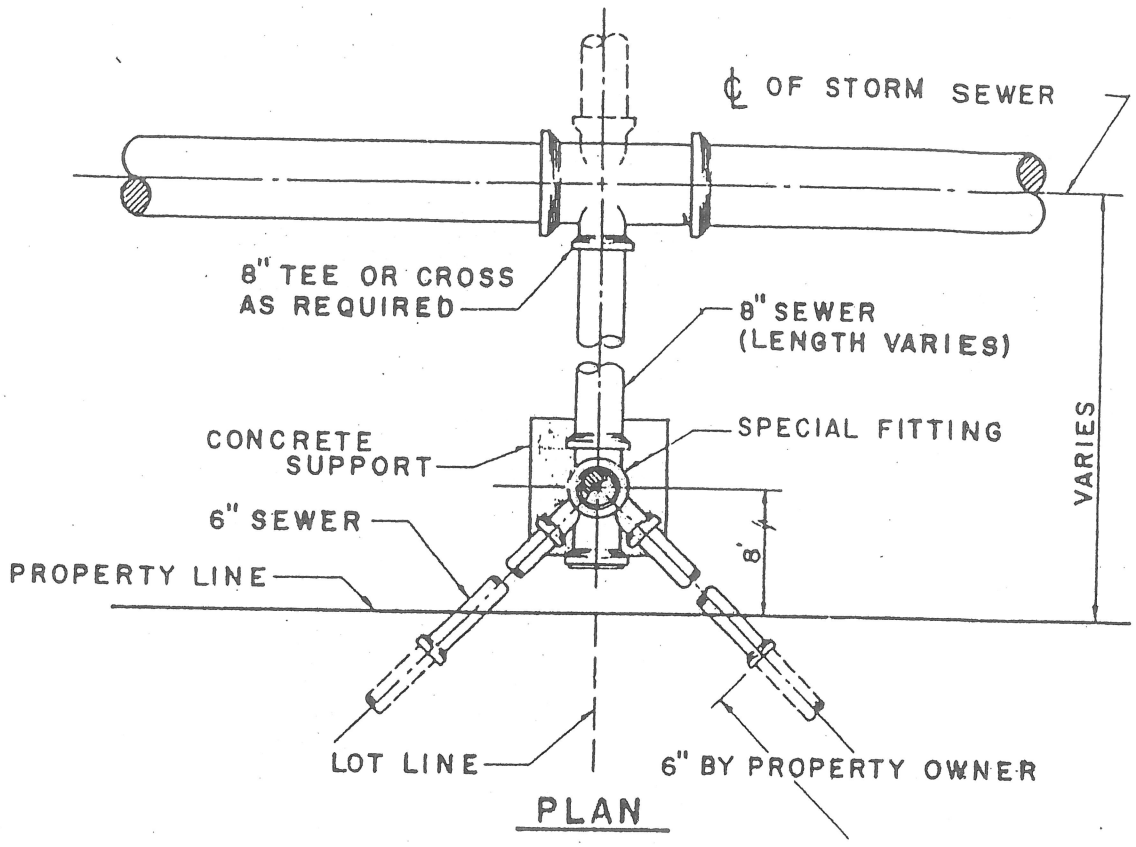


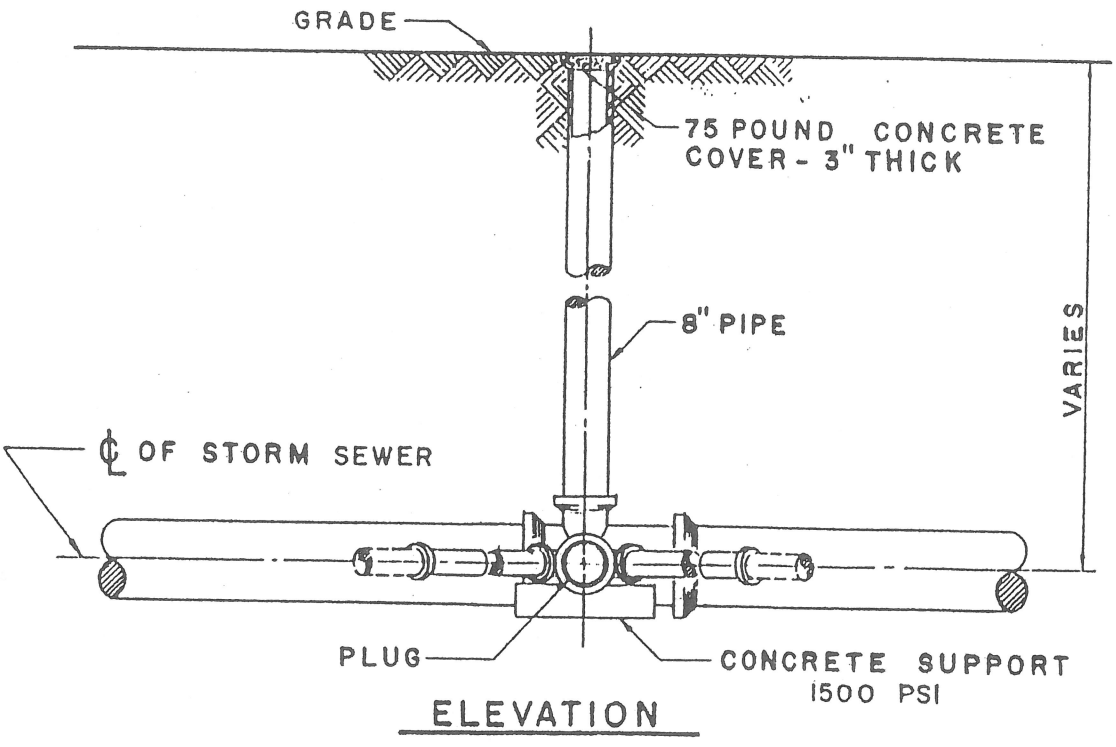
2' DIA. INLET



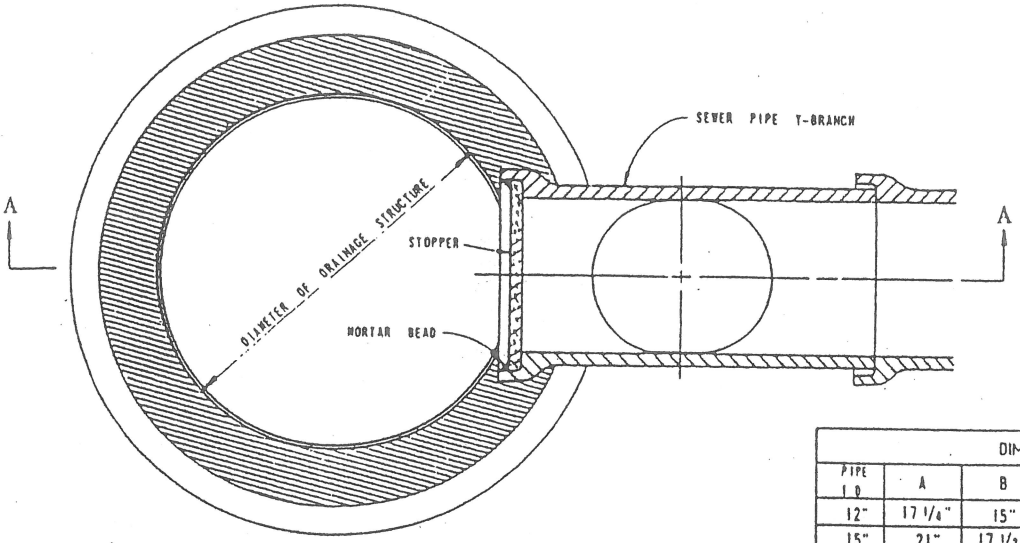
CURB INLET

STANDARD INLETS



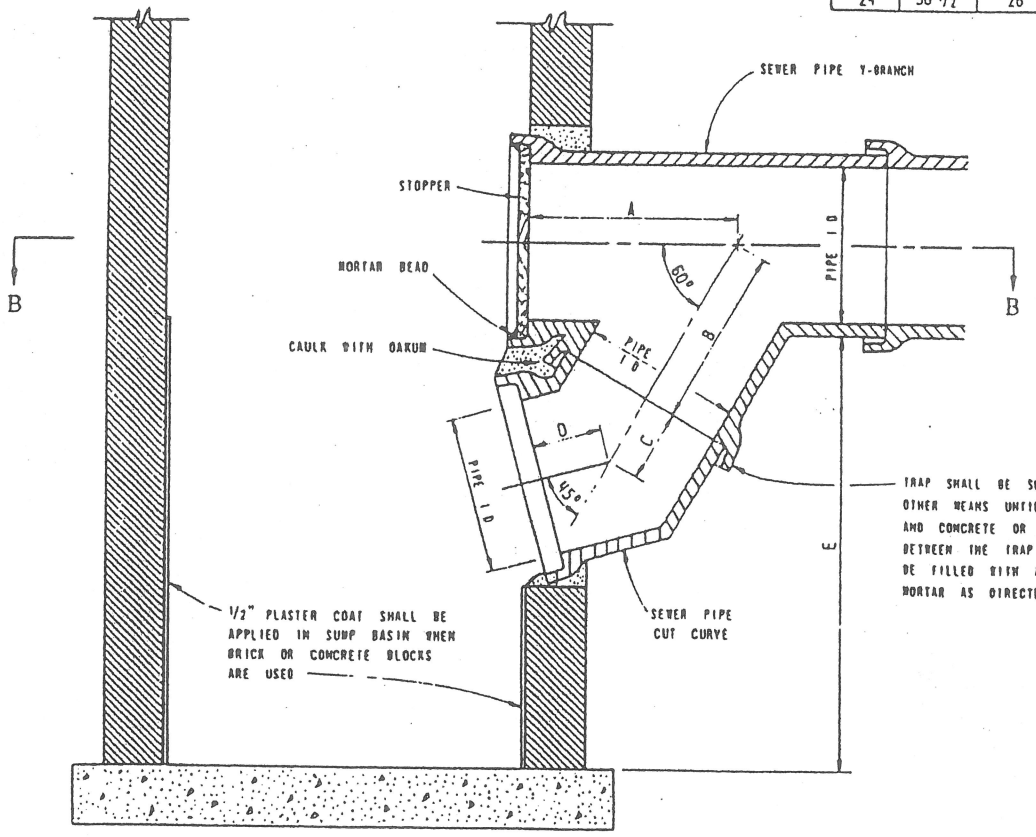


FOOTING DRAIN CONNECTION
(STORM SEWERS)



SECTION B-B

PIPE I.D.	DIMENSIONS				
	A	B	C	D	E
12"	17 1/4"	15"	5 7/8"	5 7/8"	3'-0"
15"	21"	17 1/2"	7 1/8"	7"	3'-0"
18"	25 1/2"	21 1/2"	8 3/8"	8 3/8"	4'-0"
21"	28"	24"	9 1/2"	9 1/2"	5'-0"
24"	30 1/2"	26"	9 7/8"	10 1/2"	5'-0"



SECTION A-A

NOTES:

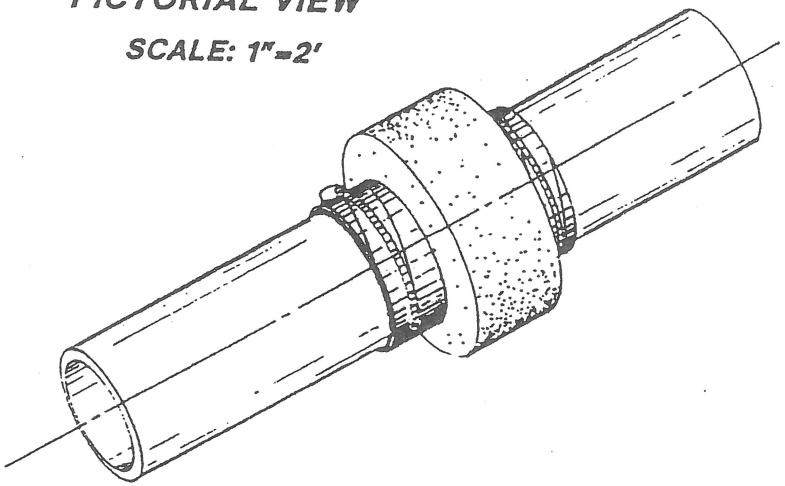
A CATCH BASIN, WHERE A SEWER TRAP IS TO BE PLACED, SHALL BE CONSTRUCTED IN ACCORDANCE WITH STANDARD PLAN I-S SERIES EXCEPT AS SHOWN ON THIS PLAN.

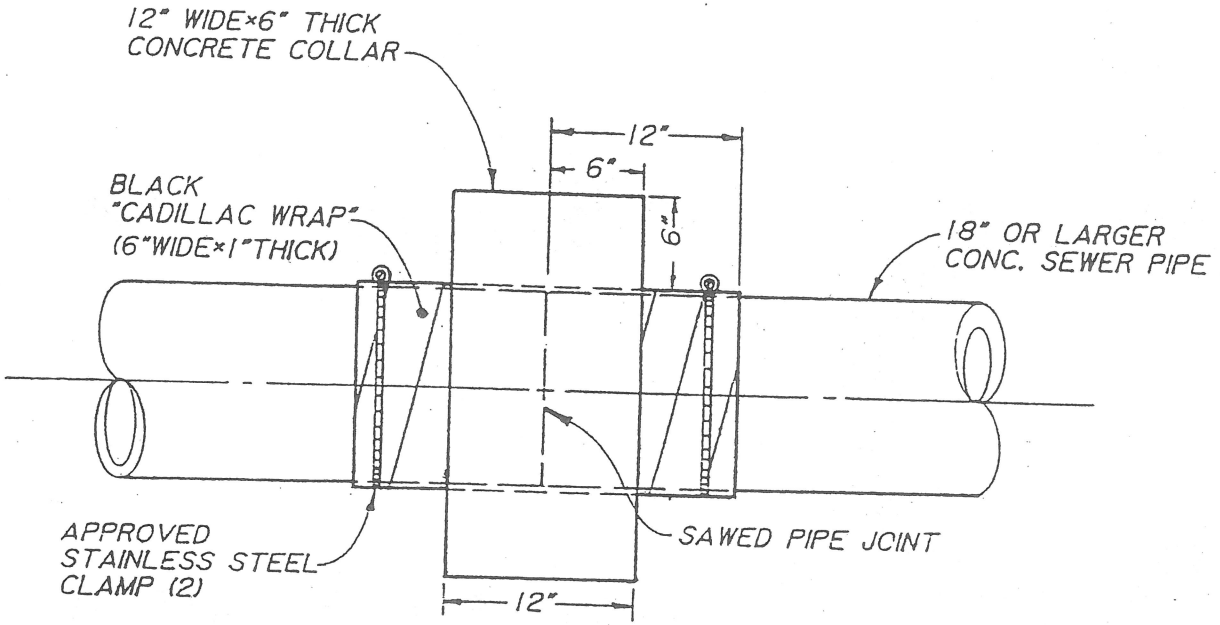
SEWER TRAP SHALL BE MADE OF THE SAME MATERIAL AND HAVE THE SAME STRENGTH AS INLET SEWER PIPE.

PREPARED BY DESIGN DIVISION	ENGINEER OF ROAD DESIGN	ENGINEER OF DESIGN	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAYS STANDARD PLAN FOR
DRAWN BY H.A.A.	ENGINEER OF TESTING AND RESEARCH	DEPARTMENT DIRECTOR JOHN P. WOODFORD	SEWER TRAP
CHECKED BY Y.H.	ENGINEER OF CONSTRUCTION	BY DEPUTY DIRECTOR - HIGHWAYS	F.H.W.A. APPROVAL 3-4-80 DATE; PLAN DATE 12-20-79; I-19B; SHEET 1 OF 1

PICTORIAL VIEW

SCALE: 1"=2'

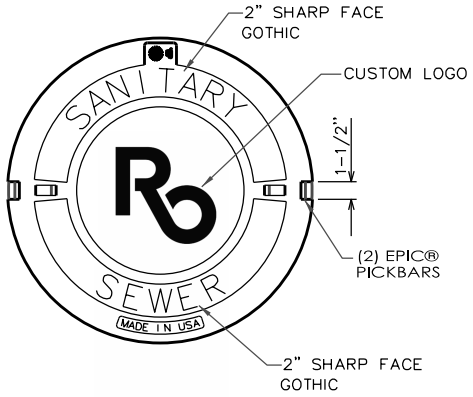




SEWER COUPLING DETAIL FOR 18" DIAMETER OR LARGER SEWER PIPE

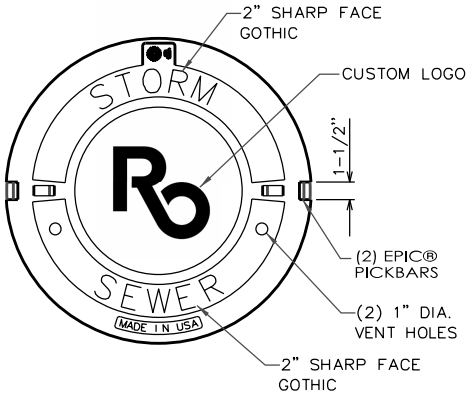
SCALE: 1"=1'

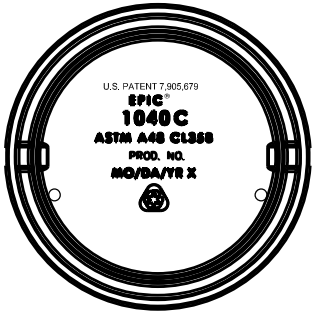
SAN. / COMB.
1040 TYPE A
EJ#001040183



BOTTOM VIEW

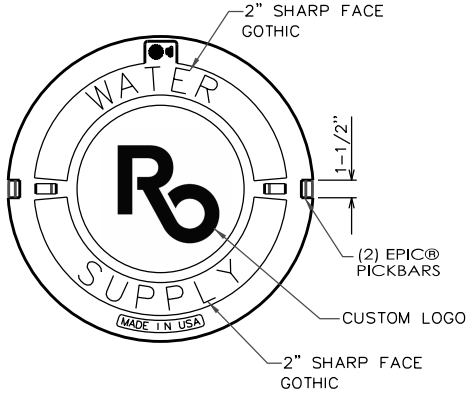
STORM
1040 TYPE C
EJ#001040184





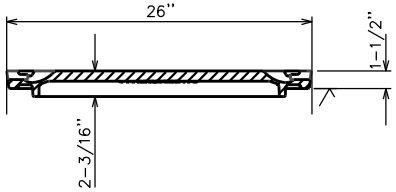
BOTTOM VIEW

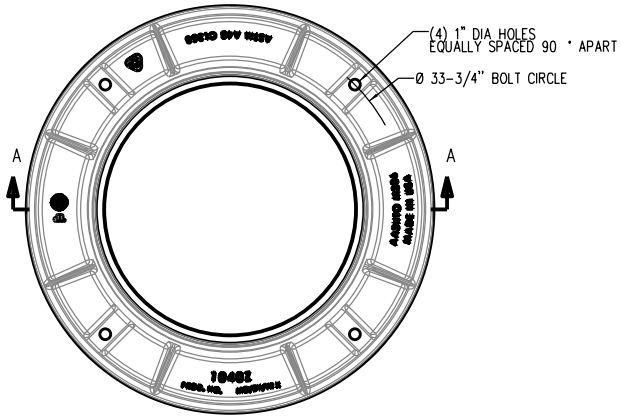
GATE WELL
1040 TYPE A
EJ#001040185

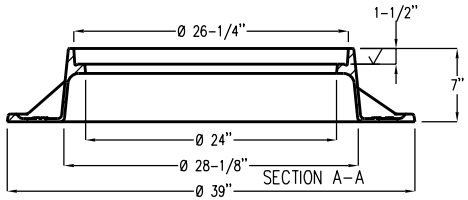


BOTTOM VIEW

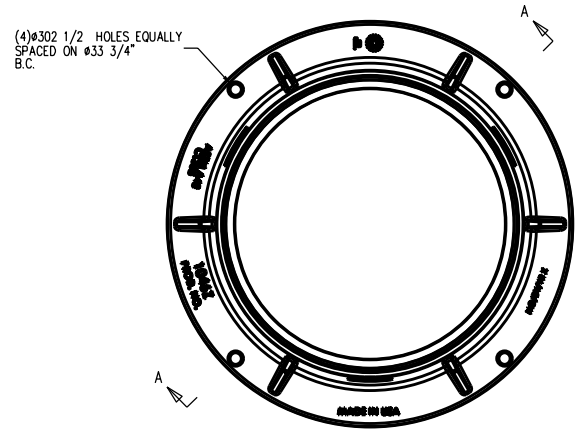
SECTION

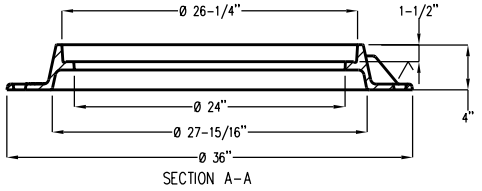




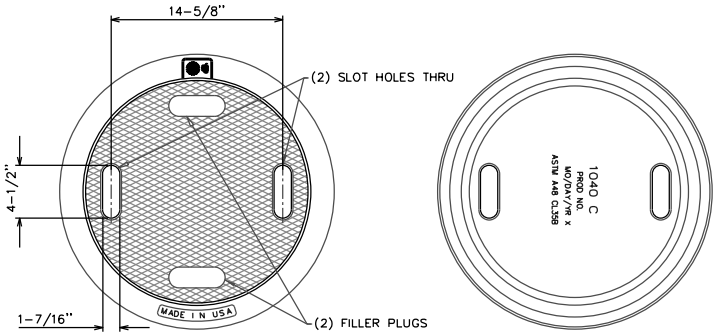


STANDARD 1040Z FRAME
EJ#00104010



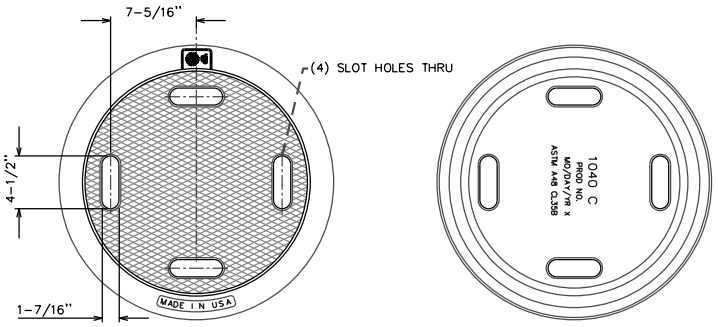


1046Z FRAME
EJ#00104610



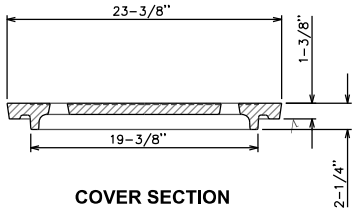
BOTTOM VIEW

RESTRICTED CATCH BASIN 2-SLOT
1040 TYPE C
156 LB.
EJ#001040186



BOTTOM VIEW

RESTRICTED CATCH BASIN 4-SLOT
1040 TYPE C
156 LB.
EJ#001040399

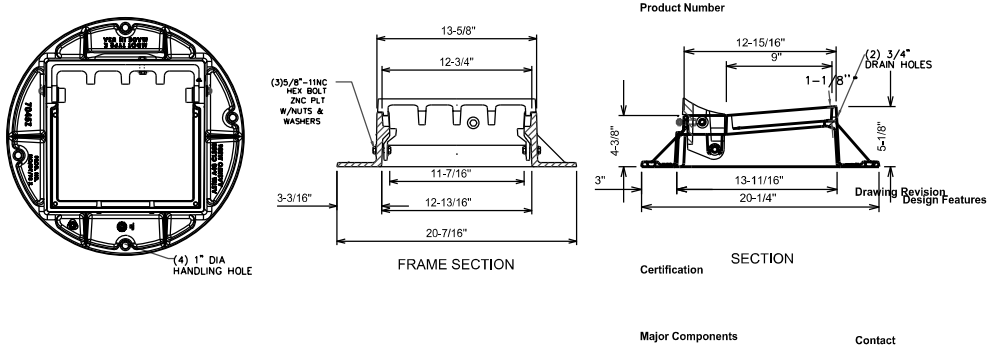


COVER SECTION

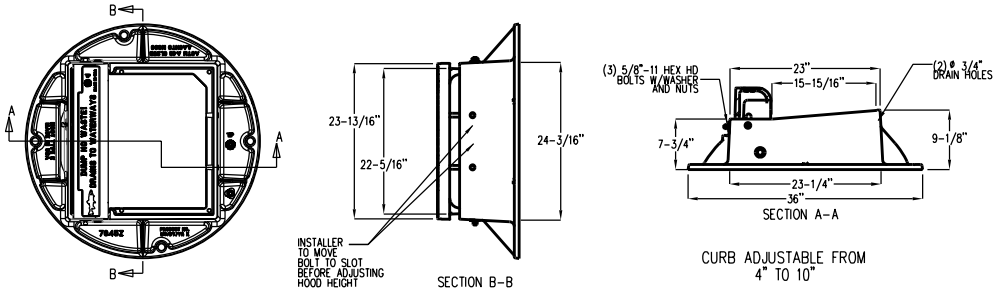
NOTE:
FOR GREENBELT CATCH BASINS, ACCEPTABLE COVERS INCLUDE:

BEEHIVE:
1040 TYPE 02
EJ#00104044

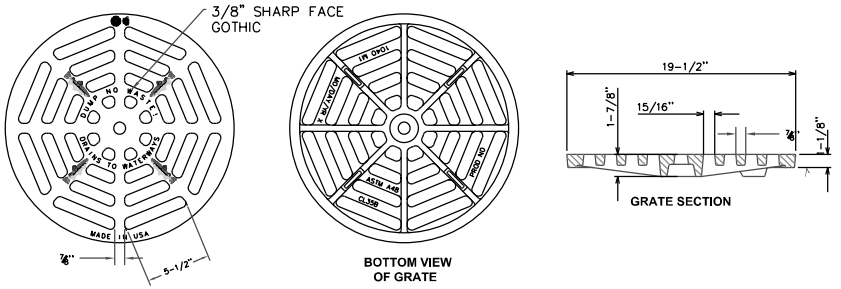
OVAL:
1040 TYPE N
EJ#00104042



CATCH BASIN GRATE
1040 TYPE M1 - DROPPED CURB
EJ#00706500



CATCH BASIN GRATE
1040 TYPE M1 - FULL CURB HEIGHT
EJ#00704500



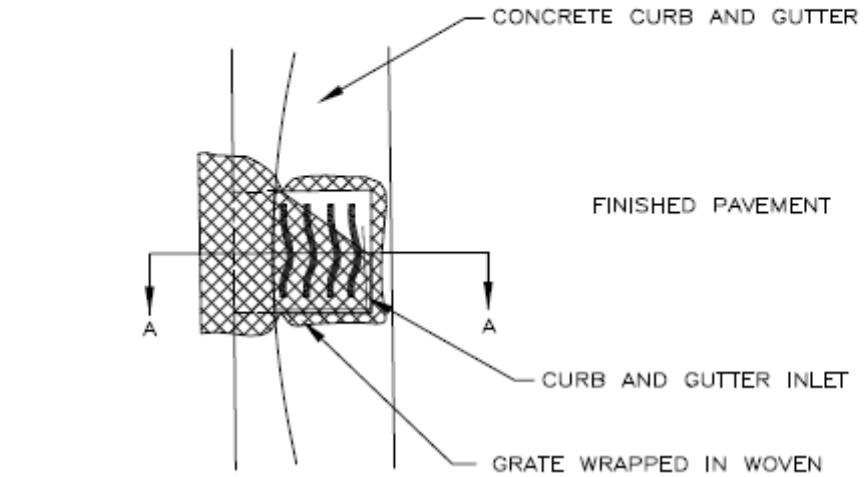
BOTTOM VIEW OF GRATE

RADIAL FLAT CB GRATE
1040 TYPE M1
EJ#00104030

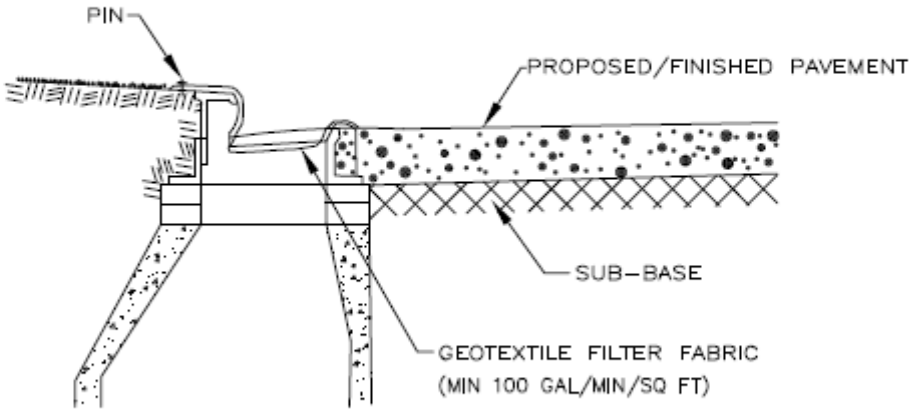
CURB AND GUTTER INLET FILTER (SI-4)

(BEFORE AND AFTER PAVING)

ALTERNATIVE INLET FILTER MUST BE USED IN AREAS THAT MAY BECOME A SAFETY HAZARD DUE TO FLOODING OR FREEZING.



PLAN VIEW



SECTION A-A

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GENERAL SPECIFICATIONS FOR WATER MAIN

1.00 GENERAL

1.01 WORK INCLUDED: The Contractor shall, unless specified otherwise, furnish all materials, equipment, tools and labor necessary to do the work required under the Contract, and unload, haul and distribute all pipe, castings, fittings, valves and accessories. The Contractor shall also provide barricades, guard and warning lights; lay test and chlorinate the pipe, castings, fittings, valves, hydrants and accessories.

The Contractor shall also furnish all equipment, tools, labor and material required to rearrange existing branch connections to main services, or rearrange existing services, conduits, ducts, pipe or other existing structures in accordance with the contract drawings and stipulations included herein.

1.02 SHUTTING OFF FOR CONNECTIONS: The existing water supply and fire protection systems shall not be disturbed, except as absolutely necessary, by the Contractor's operations. Special care shall be exercised where pipes are being removed and replaced with new lines. The Contractor shall carefully plan his work in order to avoid contamination and lengthy shutdowns of existing water mains.

Prior to commencing work on any existing water main, the Contractor shall provide men and tools to shut off the water for making connections, only if City crews cannot provide assistance. The Contractor shall not operate any water main valves unless an Engineer or Water Department employee is present at the water main valve location.

The Contractor shall meet with the Engineer and determine shut down limits for affected property owners and **shall provide one day notice (24 hour notice)** prior to shutting off water.

The Department of Public Services and the Fire Department shall be notified when shutting off the water, they shall be informed of the limits of the shut down, time duration, and what fire hydrants are affected.

1.03 CLEAN UP: Surplus water main materials and appurtenances furnished by the City shall be delivered by the Contractor to the City's warehouse or yard, and all surplus construction materials shall be removed from the site by the Contractor.

Main line - water main installation shall be limited to single sections of pipe that can be valved off. Clean-up shall be done prior to or concurrent with installing the next pipe section between valves.

Spot water main or hydrant installations shall be limited to one location at a time. Clean-up shall be done at each spot location prior to or concurrent with the exit spot water main or hydrant installation.

"Clean-up" shall mean -

A. Removing and hauling all excess fill, broken concrete, miscellaneous debris and other material generated by the project to a landfill approved by the City.

B. Obtaining rough grade in all lawn areas in preparation for lawn restoration.

C. Watering street pavement with hoses from fire hydrants and then sweeping with a mechanical pick-up type street cleaner approved by the Engineer.

D. Sweeping public sidewalks.

2.00 MATERIALS

2.01 GENERAL: Water main materials furnished by the Contractor shall conform in all respects to the following specifications. Where reference specifications are used, they shall be considered as referring to the latest edition. Unless otherwise indicated, materials furnished by the City will also conform to these specifications. All pipe, regardless of material, shall be full diameter as called for in the Proposal.

All water main pipe, valves, hydrants, fittings and associated materials shall be manufactured in the United States, unless authorized by the City Engineer.

2.02 PIPE: The ductile iron pipe to be furnished, delivered and installed under this specification shall conform in all respects with the requirements of the current United States of American Standard Institute Standard for "Ductile-Iron Pipe, Centrifugally Cast in Metal or Sand-Lined Molds for Water or other Liquids: (USAS-A21.51) except as may otherwise be specified herein.

All sizes of pipe shall be of a class conforming to the dimensions shown in the following table:

Size Nominal Inside Diameter Inches	Outside Diameter Inches	Pipe Barrel Thickness Inches
4	4.80	0.35
6	6.90	0.37
8	9.05	0.39
12	13.20	0.43
16	17.40	0.46
20	21.60	0.51

The manufacturer shall furnish a sworn statement with Section 51.4.2 of USAS-A 21.51.

2.03 LINING: The pipe shall be lined with a cement mortar lining in accordance with the requirements of the current standard for "Cement Mortar Lining for Cast-Iron Pipe and Fittings for Water" (USAS-A21.4). The lining shall be double thickness.

2.04 CAST IRON PIPE: Cast iron pipe is no longer allowed on any new installations in the City of Royal Oak. However, there is considerable existing cast iron water main that of a contract or new installation may be required to connect to. Be aware this existing cast iron pipe may be oversized or out of round.

If existing lead joints are exposed when making a connection, the joint shall be cut-out and removed.

2.05 ASBESTOS-CEMENT PIPE: Asbestos-cement is not allowed for new water main installations within the City of Royal Oak, however, there are some existing runs of pipe.

2.06 **FITTINGS**: As follows:

ANSI/AWWA C153-A21.53-84
ANSI/AWWA C111/A21.11-85

The standard for ductile iron and gray iron fittings is 3 through 48 inches for water main. Working pressure rating shall be 350 p.s.i.

All fittings and glands shall be ductile iron with the exception of oversize solid sleeves which shall be gray-iron. All couplings used to joint water main shall be of the solid sleeve type. If the pipe is oversize, special oversize solid sleeves shall be used. No Dresser style solid sleeves shall be allowed. All bolts shall be Corten.

The City of Royal Oak's standard for fittings is the **Tyler Pipe** line of Mechanical Joint fittings.

Substitutions shall be approved by the Engineer in writing prior to use on the project and be equal to or greater than the equivalent Tyler fitting for flange and wall thickness.

2.07 **VALVES**: Valves shall be ANSI/AWWA C-500-86 solid wedge non-rising stem **E.J. series MJ** (refer to Water Main Details) with mechanical joint ends as shown on page WD-5 and WD-6. Valves shall be manufactured as right hand to **open** when operating nut is turned in a **clockwise direction**.

2.08 **HYDRANTS**: Fire Hydrant shall be East Jordan Iron Works – 6 inch (**Model 5-BR-250 - WaterMaster**) ductile iron hydrant ANSI/AWWA Standard C502-85 with (2) 4 inch pumper nozzles in accordance with the City of Royal Oak Standard as described on page WD-9.

New hydrants are to be Rustoleum Industrial 5A271 Federal Safety Red and have one nozzle fitted with a 3 ½ inch "Harrington" Integral Hydrant Storz (H1HS) adapter.

2.09 **TYPE OF JOINTS**: As follows:

A. Rubber joints shall be similar to J.B. Clow Company's "Bell-Tite" or U.S. Pipe Foundry Company's "Tyton" joints for ductile iron pipe. Two bronze wedges per unit shall be used to provide electrical continuity.

B. Asbestos-Cement pipe joints shall have the following minimum thickness:

4" - 0.84 inches	6" - 0.95 inches
8" - 1.05 inches	10" - 1.28 inches
12" - 1.42 inches	14" - 1.75 inches
16" - 1.92 inches	

C. Fittings, valves and hydrants shall be mechanical joints in accordance with (a) above unless specified otherwise in the Project Specifications.

D. Fittings for copper water services shall be flared type. Soldered joints shall not be used where pipe is buried.

2.10 **VALVE BOXES**: Valve boxes shall be of good quality cast iron and of the three-sectional type as shown in the Water Main Details. The center sections shall be a minimum of 5 inches inside diameter. The base section shall be large enough to fit over

the valve bonnet. The upper section shall be arranged to screw down on the adjoining lower section and shall be full diameter throughout. Valve boxes shall be provided with case iron lids or covers. Lids or covers shall be marked with the work "WATER". The overall length of valve boxes shall be sufficient to permit the top to be set flush with the established pavement or ground surface grade.

2.11 **MISCELLANEOUS**: As follows:

A. Copper pipe shall be in accordance with ASTM Spec. B88-55 "Type K", or Federal Spec. WW-T-799 "Type K".

B. Corporation stops shall be Mueller #H-15000, or Engineer approved equal.

C. Saddles- 2 inch - shall be Mueller BR2S and BR2W series bronze service saddles-double strap with 304L stainless steel straps, or Engineer approved equal.

D. Curb stops shall be Mueller #H-15204, #H-25209, or Engineer approved equal.

E. Curb boxes shall be Mueller, #H-10334 for 1", #H-10308 for 1 ½" and #H-10310 for 2" or Engineer approved equal.

F. Service fittings or reducers for service connections shall be:

1. Mueller #H-15400, or Engineer approved equal, for copper tube nut by copper tube nut, or Mueller #H-15403 for compression connection.
2. Mueller #H-15480, #H-15485 and #H-15490 for straight, 45˚ bend and 90˚ bend coupling thread by copper tube nut, respectively, or Engineer approved equal.
3. Mueller #H-15505 and #H-15513 for straight & 90˚ bend extra strong lead flange by copper tube nut, respectively or Engineer approved equal.
4. Mueller #H-15428 or #H-15429 for straight male coupling from copper to iron, or Engineer approved equal.
5. Mueller #H-15062 & H-15068 for straight & 90˚ bend female copper service thread by copper tube nut, respectively, or Engineer approved equal, or Mueller #H-15428N for compression connection.

2.12 **DISPOSITION OF DEFECTIVE MATERIAL**: All material found during the process of the work to have cracks, flaws or other defects will be rejected by the Engineer. All defective materials furnished by the Contractor shall be promptly removed by him from the site. Any material furnished by the city and found defective shall be set aside by the Contractor and removed from the site by the City.

2.13 **SOCKET CLAMPS**: Socket clamps shall be "Clow F-740", or approved equal, with appropriate tie rods.

3.00 RESPONSIBILITY FOR MATERIAL

3.01 **MATERIAL FURNISHED BY THE CONTRACTOR**: The Contractor shall be responsible for all material furnished by him and shall replace, at his own expense all such material found defective during the life of the Contract.

3.02 **MATERIAL FURNISHED BY THE CITY**: The Contractor's responsibility for materials furnished by the city shall begin at the point of delivery thereof to the Contractor. Materials already on the site shall become the Contractor's responsibility on the day of award of the Contract. The Contractor shall examine all materials furnished by the City at the time and place of delivery to him and shall reject all defective material. Any material furnished by the City and installed by the Contractor without discovery of such defect will, if found defective prior to final acceptance of the work, be replaced with sound material by the City. The Contractor, however, shall at his own expense, furnish all supplies, labor and facilities necessary to remove such defective material and install the sound material in a manner satisfactory to the Engineer. The Contractor's unit prices will be assumed to include an allowance for this responsibility.

3.03 **STORAGE**: The Contractor shall be responsible for the safe storage of all materials furnished by or to him and intended for this work. Interior of pipe and other materials shall be kept free from dirt and foreign matter. Pipes shall be stacked in safe rows / levels and properly secured against collapse. Height of stacking shall not exceed four feet. Valves and hydrants shall be stored so that they will drain and be protected from damage by freezing. The Contractor shall not store or place materials on private property. The Contractor shall not store or place materials in City parks without obtaining written permission from the Engineer. Fencing of stored materials may be required as determined by the City.

4.00 HANDLING MATERIAL

4.01 **HANDLING**: Pipe, fittings, valves, hydrants and accessories shall be loaded and unloaded so as to avoid shock or damage either to the castings, or to the pipe, or pipe coating, or pipe lining. Under no circumstances shall such material be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground. Suitable slings shall be used when handling asbestos-cement pipe.

4.02 **PIPE COATING AND LINING**: If any part of the lining or coating is damaged, the repairs shall be made by the Contractor at his expense in a manner satisfactory to the Engineer.

5.00 ALIGNMENT AND GRADE

5.01 **GENERAL**: The water mains shall be laid and maintained to the required lines and grades with fittings, valves, and hydrants at the required locations. Valves and hydrants shall be set plumb.

5.02 **DEVIATIONS**: Wherever an obstruction, not shown on the plans, is encountered during the progress of the work and interferes to such an extent that an alteration in the plan is required, the Engineer shall be notified at once and shall make such changes in the plans as he deems necessary. If the change in plans results in a change in the amount of work required of the Contractor, such change will be paid for. Deflections for obstructions, if necessary, shall be governed by allowable limits in section 6.07.

5.03 **DEPTH OF PIPE**: If no cover or grade is shown on the plans, the top of the pipe shall be placed five and one half feet (5.5') below the final surface of the ground, except where abrupt changes occurring the surface of the ground. High points in the pipe line shall be avoided in intersections and when crossing.

When located under streets the top of the pipe shall be laid five and one half feet (5.5') below the lowest grade at gutter line of streets. Variations in the depth of cover as shown on the plans may be made only on written order of the Engineer.

5.04 **PIPE BEDDING**: Pipe bedding shall be 6 inches of compacted porous material having a maximum size of 1 inch when requested by the Engineer. Shape ditch bottom so that the entire length of pipe barrel is evenly supported once placed. A section not exceeding 12 inches in length may be disturbed in order to remove cable slings or chains used in handling pipe or for making up pipe joints. Asbestos-cement couplings shall be carefully backfilled and tamped to provide even and full bearing on both pipe and couplings. Wood blocks or earth mounds shall not be used under the pipe line for any purpose.

6.00 LAYING PIPE

6.01 **CLEANING PIPE AND FITTINGS**: As follows:

A. Existing Cast Iron Pipe - All lumps, blisters and excess coal tar coating shall be removed from the spigot end of the pipe, and shall be wire brushed, wiped clean and dry and free from oil and grease before the joint is made.

B. Existing Ductile Iron or Asbestos-Cement Pipes - Remove clay, sand or mud from the machined end of the pipe by using clean water or scrubbing with sand. Wipe excess water from end and allow to dry prior to assembling the joint. Oil or grease can be removed by wiping the surface with a suitable solvent.

6.02 **HAMMER TEST**: Cast iron fittings shall be inspected by the Contractor for defects and while suspended, be rung with a light hammer to detect cracks.

6.03 **LAYING PIPE**: Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. If the pipe laying crew cannot put the pipe into the trench and in place without getting earth into it, the Contractor shall, before lowering the pipe into the trench, install a heavy, tightly woven canvas bag of suitable size over each end and left there until the connection is to be made. During the laying operations no debris, tools, clothing or other materials shall be placed in the pipe.

When pipe laying is not in progress, the open end of the main shall be closed by water-tight plugs. If water is in the trench, the seal must remain in place until the trench is pumped completely dry. If, for any reason, the pipe laying is left unattended, the end shall be plugged to prevent entry of small animals and debris.

All pipe, regardless of material and joint used, shall be laid to allow 1/8 inch or 1/4 inch clearance between successive lengths in order to provide for expansion of the pipe line.

For Ductile Iron Pipe, after placing a length of pipe in the trench, the spigot end shall be centered in the bell, and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped around it. Pipe and fittings which do not allow a sufficient and uniform space for joints shall be removed and replaced with pipe and fittings of proper dimension to insure such uniform space. Precautions shall be taken to prevent dirt from entering the joint space. Once in place, new pipe sections shall receive two (2) Brass Wedges installed at the pipe joint to insure for electrical continuity.

6.04 **CUTTING PIPE**: The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner, without damage to the pipe or lining, and so as to leave a smooth end at right angles to the axis of the pipe.

A. Cast Iron - Cutting shall be done with a roller or shear type cutter or abrasive disk for pipe sizes up to 20 inches in diameter. When machine cutting is not available for cutting pipe 20 inches in diameter or larger, the electric arc cutting method will be permitted, using a carbon or steel rod. Only qualified and experienced workmen shall be used on this work.

   The flame cutting of pipe by means of an oxyacetylene torch will **not** be allowed.

B. Asbestos-Cement and Ductile Iron - Cutting the pipe shall be done by hand saw, abrasive discs or with a special pipe cutting tool. All pipe cutting tools must be of the true cutting variety. Under no circumstances is the asbestos-cement pipe to be cut with a roller or shear type cutting tool.

6.05 **BELL ENDS TO FACE DIRECTION OF LAYING**: Pipe shall be laid with bell ends facing in the direction of laying, unless otherwise directed by the Engineer.

6.06 **CUTTING-IN TO EXISTING WATER MAINS**: Cut-ins shall be made with line pressure on or off according to the Project Specifications. Existing pipe lines shall be adequately supported during the cut-in operations and prior to placement of backfill. Reaction backing shall be placed behind all cut-in fittings.

Cut-ins to asbestos - cement pipe shall be made by machining cut ends in the field or by removal of a full length of pipe and installation of special machined lengths.

For Asbestos-Cement Pipe; after placing a length of pipe in the trench, it shall be lined up with the previous lengths and the joint made up. Pipe and fittings which do not allow sufficient uniform space for the joint shall be removed and replaced with pipe and fittings of proper dimension to insure such uniform space. The coupling shall be installed so that the final position of the pipe spigots is midway in the coupling.

The bedding may be disturbed for a distance of 12 inches to set joint assembly jacks, but the area disturbed must be thoroughly compacted prior to backfilling the pipe.

Prior to cutting existing pipe lines, the surface of the existing pipe shall be thoroughly cleaned by wire brushing and scraping. When cut-in is made under pressure, the existing pipe surface shall be washed down with a 4% solution of chlorine prior to installing the cutting-in tee. All fittings, pipe, valves, etc., used in the connection shall be swabbed out with a 4% or stronger solution of chlorine ("Roman Cleanser", "Clorox", etc.) during assembly. Care shall be exercised in order to prevent contamination of the existing water mains, and failure to comply with this requirement will necessitate chlorination of existing water mains at the Contractor's expense.

After connection is made, the Contractor shall drain sufficient water from the connection to effect removal of the chlorine solution.

The Contractor is advised that the dimensions of existing water mains may not allow use of standard mechanical joint fittings, since these water mains may be pit cast pipe, asbestos-cement pipe and / or in classes other than standard. All connections, fittings

and reaction backing shall be included in the Contract. The Contractor shall install a 1 (one) foot thick bulkhead of brick and concrete in all abandoned water main. This work shall be considered in part of the Contract items of work.

6.07 **PERMISSIBLE DEFECTIONS AT JOINTS**: Wherever it is necessary to deflect pipe from a straight line, either in a vertical or horizontal plane, to avoid obstruction or to plum valves and hydrants or where long radius curves are permitted, the amount of deflection allowed shall not exceed that shown in the following tables:

MAXIMUM PERMISSIBLE DEFLECTIONS

A. Ductile Iron: Mechanical joint or "roll-on" rubber joints:

Dia.	Deflection	Maximum Deflection per Length		Approx. Radius of CurveProduced by Succession Of Joints	
		12'	18'	12'	18'
4"	8° - 18	21"	31"	85'	125'
6"	7° - 7	18"	27"	100'	145'
8"	6° - 21	13"	20"	130'	195'
10"	6° - 21	13"	20"	130'	195'
12"	6° - 21	13"	20"	130'	195'
14"	3° - 35	9"	13-1/2"	190'	285'
16"	3° - 35	9"	13-1/2"	190'	285'
18"	3° - 00	7-1/2"	11"	230'	340'
20"	3° - 00	7-1/2"	11"	230'	340'
24"	2° - 23	6"	9"	280'	450'

B. Asbestos-Cement Pipe: "Fluid-tite" or "Ring-Tite" couplings:

Dia.	Deflection	Maximum Deflection per Length		Approx. Radius of Curve Produced by Succession Of Joints	
		6-1/2 '	13'	6-1/2 '	13
4"	3°	4.0"	8.1"	124 '	248'
6"	3°	4.0"	8.1"	124'	248'
8"	3°	4.0"	8.1"	124'	248'
10"	3°	4.0"	8.1"	124'	248'
12"	3°	4.0"	8.1"	124'	248'
14"	3°	4.0"	8.1"	124'	248'
16"	3°	2.7"	8.1"	124'	248'
18"	3°	2.7"	8.1"	124'	248'
20"	2°	1.4	5.4"	186'	372'
24"	2°	2.7"	5.4"	186'	372'
30"	1°	1.4"	2.7"	374'	748'
36"	1/2°	0.7"	1.4"	750'	1500'

7.00 BORING

7.01 BORING WITHOUT CASING: This item of work shall consist of boring beneath the influence of driveways, trees and landscaped areas for the installation of the water main indicated on the plans. The work shall be performed at the locations shown on the plans or as directed by the Engineer.

The work shall be performed with an approved boring machine. The boring shall be performed without a sleeve, and the diameter of the auger shall be no more than four (4) inches greater than the outside diameter of the pipe to be installed. The approval of any type of tunneling will be denied. If unstable granular soils are encountered during excavation, the Engineer may direct the installation of a casing. Boring with a steel casing shall be made paid as described below.

All trees eight (8) inches in diameter or less, measured four (4) feet above the ground surface shall require a boring length of eight (8) feet. Trees over eight (8) inches in diameter shall require a boring length of one (1) foot for each inch of tree diameter. Boring lengths shown on the plans are only approximate lengths, and lengths may vary in the field as directed by the Engineer.

The cavity between the outside of the pipe and undisturbed ground shall be sealed at both ends of the bore with 2,500 p.s.i. concrete a minimum of eight (8) inches thick. Payment for each bore shall be made by the linear foot of undisturbed ground directly above the bore.

7.02 BORING WITH STEEL CASING: This item of work consists of furnishing and installing various steel casing if the Engineer directs installation of a casing at any location where water main is placed by boring method. During boring operations, the auger shall not be advanced beyond the end of the casing.

The work includes cutting and welding sections of the casing as required, jacking the casing in place. If directed by the Engineer or indicated on the drawings, work shall also include strapping 4 feet x 4 feet timbers to the water main or sewer, filling voids between the pipe and casing with non-shrink grout to within 1 inch of the top of the casing, and bulkheading both ends of the casing. In addition, any cavity between the outside of the casing and undisturbed ground shall be sealed with 2,500 p.s.i. concrete with a minimum of eight (8) inches thick. The size of the casing shall be sufficient to safely contain the pipe diameter to be installed, and the work and materials to be furnished and installed as directed by the Engineer.

Payment for this item of work will be by the linear foot of steel casing installed as indicated on the Plans or as directed by the Engineer.

8.00 JOINTING

8.01 MECHANICAL JOINTS: Soapy water may be used to lubricate the rubber gasket. The normal range of bolt torque to be applied to ¾ inch bolts is 60-90 foot-pounds. A torque limiting wrench shall be used to prevent overstressing of bolts.

If effective sealing is not obtained at the maximum torque of 90 foot-pounds, the joints shall be disassembled and reassembled after a thorough cleaning. Overstressing of bolts to stop leaks will not be permitted.

When tightening bolts, it is essential that the gland be brought up evenly toward the pipe flange, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket (uneven stresses in the glad ring may cause failure under pressure test stresses).

If when connecting to an existing cast iron water main – if there are any visible lead joints they **shall** be cut out and replaced with ductile pipe.

8.02 **ROLL ON RUBBER JOINTS**: Roll on rubber joints ("Tyton", "Bell-Tite", etc.) shall be installed according to manufacturer's directions. All field cut pipe shall have spigot end beveled with a grinder or file to the same dimensions as manufacturers standard spigot for joint being made. Field beveling will not be required on pipe joints at mechanical joint fittings. Brass wedges (2) shall be placed at all joints.

8.03 **ASBESTOS-CEMENT PIPE JOINTS**: Joints for asbestos-cement pipe shall be in accordance with the following:

A. Roll-On-Type - This joint shall be made on a dry pipe. The rubber rings shall be installed on the end of the pipe line previously placed and rolled vigorously back and forth to relieve stresses and twists. The coupling shall then be pulled evenly into position for join assembly. After assembly, the position of the gaskets shall be checked with an appropriate gage to ascertain correct positioning of the rubber rings.
B. Shaped Rubber Joints - This type of joint shall be assembled using the appropriate recommended lubricant. The spigot end of the pipe shall be thoroughly cleaned, the lubricant applied and the joint immediately assembled.

8.04 **REPAIRS**: Leakage or other failures in water main and joints installed under the Contract shall be repaired as follows:

A. Mechanical Joint - as follows:

1. Check bolts with torque wrench.

2. Remove gland and clean out joint and gasket: reassemble.

3. Cut out section of pipe; replace gasket and gland and reassemble, using a solid mechanical joint sleeve.

B. Roll-on Rubber Gasket - Cut out section of pipe, replace gasket and gland and reassemble, using a solid mechanical joint sleeve.

C. Asbestos-Cement - Remove length of pipe and replace defective material. A solid mechanical joint sleeve may be used, see section 8.03.

9.00 SETTING VALVES - FITTINGS AND FIRE HYDRANTS

9.01 **GENERAL**: Valves, fittings, fire hydrants, plugs and caps shall be set and jointed to the pipe in a manner heretofore specified for cleaning, laying and joining the pipe.

9.02 **VALVE BOXES AND MANHOLES**: A valve box or manhole shall be provided for every valve. The valve box shall not transmit shock or stress to the valve when the box cover is flush with the surface of the pavement or such other level as may be directed. The base section of the valve box shall be set 2 inches above the flanged bonnet joint of the valve and accurately centered on the valve operating nut.

A manhole shall be provided for valves as specified in the project specifications or shown on the plans. The valve nut shall be readily accessible for operation through the manhole cover which shall be set flush with the finished grade or such other level as may be specified.

Manhole covers shall be E.J. 1040 with "WATER SUPPLY" cover and Royal Oak logo (EJ Part # 001040185).

9.03 **FITTINGS, VALVES, ETC., IN ASBESTOS-CEMENT PIPE**: Short lengths (3'3") of asbestos-cement pipe shall be used on either side of mechanical joint cast iron valves of fittings placed in asbestos-cement pipe line. Valves shall be supported and anchored with tie rods to the concrete pad. Rods shall be 5/8 inch diameter, firmly imbedded in the concrete and coated with bitumastic paint after setting.

9.04 **HYDRANT LOCATION**: Hydrants shall be located as shown or as directed by the Engineer in a manner that the possibility of damage from vehicles or injury to pedestrians will be minimized. See details on pages WD-3 and WD-4. Location of hydrants on any improved lot may be varied if the lot owner requests such change in writing to the Engineer.

9.05 **HYDRANT POSITION**: All hydrants shall stand plumb and have hose nozzles facing the back of the curb of the roadway at 45^{o}.

Hydrants shall be set to the established grade, with the nozzles at least 12 inches above grade or as directed by the Engineer. Hydrants set with elbows or hydrant tees shall be rotated 90^{o} to conform to the above.

9.06 **HYDRANT ASSEMBLY**: Each hydrant must be connected to the main with a 6 inch ductile iron branch, regardless of the material used for main construction, and controlled by a 6 inch independent gate valve. The cost of the branch connection shall be included in the hydrant setting cost. Auxiliary valves and fittings are included in the Hydrant Assembly item.

10.00 TAPPING WATER MAIN: As follows:

LIST OF MAXIMUM TAP SIZES

TYPE OF PIPE: TAP	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"
CAST IRON DIRECT	3/4"	1"	1 1/4"	1 1/2"	2"	2"	2 1/2"	2 1/2"	3"	4"
ASBESTOS - CEMENT DIRECT	3/4"	3/4"	1"	1"	1"	1"	1"	1"	1"	1"
ASBESTOS - CEMENT W/DOUBLE STRAP SADDLE	1"	1 1/2"	2"	2"	2"	2"	2"	2"	2"	2"

Threads on taps shall be Mueller type or owner's standard. Corporation cocks shall be set at recommended depth in pipe wall without over-stressing pipe wall or the corporation cock.

All services shall be tapped at an angle of 45^{o} and a minimum cover of 5 feet maintained over the service.

11.00 REACTION BACKING

11.01 GENERAL: Reaction backing shall be concrete having a compressive strength not less than 2,000 p.s.i. at 28 days. Backing shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground in each instance shall be that shown in the tables below. The backing shall be placed such that the pipe and fitting joints will be accessible for repair.

REACTION BACKING

PIPE SIZE	TEES PLUGS	HYDRANT 90^{O} Els	WYES 45^{O} Els	WYES 45^{O} Els	WYES 11 1/4 ^{O} Els
4"	1	2	1	1	1
6"	3	3	2	1	1
8"	4	6	3	2	1
10"	7	9	5	3	2
12"	9	11	6	3	2
14"	11	15	8	5	3
16"	13	20	10	6	3
18"	16	25	12	7	4
20"	20	28	14	8	4
24"	28	40	20	11	6

Minimum Bearing Area against undisturbed trench wall, in square feet, for sand. Details of placement are shown on page WD-2.

Other Soil Conditions:

Cemented sand or hardpan.....Multiply above by 0.5
Gravel.....Multiply above by 0.7
Hard dry clay .....Multiply above by 0.7
Soft Clay.....Multiply above by 2.0

Muck - secure all fittings with tie rod clamps or retainer glands, with concrete reaction backing the same as listed for sand conditions.

Example: 12" tee in a gravel soil

A 12" tee required 9 sq. ft. of reaction backing for sand;
or 9 S.F. x 0.7 = 6.3 S.F. for gravel

Bearing area against undisturbed trench wall must be 2' x 3.2' or 1.5 x 4.2'

11.02 PLUGS, TEES AND BENDS: All plugs, caps, tees and bends deflecting 11 ¼ inches or more shall be provided with reaction backing or suitable metal harness to prevent movement.

11.03 HYDRANTS: The bowl of each hydrant shall be well braced against unexcavated earth at the end of the trench with concrete backing poured in place.

12.00 TESTING, FLUSHING AND CHLORINATING WATER MAINS

12.01 GENERAL: Testing, flushing and chlorinating shall be under the direct supervision of the Engineer.

12.02 WATER USE REQUIREMENTS: The Contractor may use City water for flushing and pressure tests, when the following requirements have been met:

A. The water shall flow through a sanitary hose / pipe or tubing and a Michigan D.E.Q. approved backflow prevention device RPZ shall be used to prevent contamination of the existing water supply.

B. The device shall be on the list, approved by the Michigan Department of Environmental Quality (MDEQ). The list is available within the latest version of the Cross Connection Rules Manual at the following website:

http://www.michigan.gov/deq/0,4561,7-135-3313_3675_3691---,00.html

C. Access to City water shall be done by way of existing, Engineer approved, hydrant or a corporation stop valve on an existing water main.

12.03 PRESSURE TESTS: After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure test (included as part of the Contract) of at least 1.5 times the working pressure at the point of testing.

A. Test Pressure Restrictions - Test pressures shall:

1. Be 150 p.s.i.
2. Not exceed pipe or thrust-restraint design pressures.
3. Be of at least 2-hour duration

4. Not vary by more than 5 p.s.i.
5. Not exceed twice the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants. NOTE: Valves shall not be operated in either direction at differential pressure exceeding the rated pressure.
6. Not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.
7. Test "tree's"' shall be clean, free of leaks, have a meter capable of reading 10^{th}'s of gallons, and a pressure gauge that reads steady and accurate.

B. Pressurization - Each valved section of pipe shall be filled with water slowly and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the City. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test.

C. Air Removal - Before applying the specified test pressure, air shall be expelled completely from the pipe, valves and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place at the discretion of the City.

D. Examination - Any exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until it is satisfactory to the City.

12.04 **LEAKAGE TEST**: A leakage test (incidental to the Contract) shall be conducted concurrently with the pressure test.

A. Leakage Defined - Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 p.s.i of 150 p.s.i. after the air in the pipeline has been expelled and the pipe has been filled with water. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

B. Allowable Leakage - No pipe installation will be accepted, if the leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

In which: L = the allowable leakage, in gallons per hour
S = the length of pipe tested, in feet
D = the nominal diameter of the pipe, in inches
P = the average test pressure during the leakage test, in pounds per square inch gauge.

Allowable Leakage per 1000 ft of Pipeline*--gph•

Avg. Test Pressure	Nominal Pipe Diameter - Inches															
Psi	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450	0.4	0.6	0.9	1.2	1.5	1.9	2.2	2.5	2.8	3.1	3.8	4.7	5.7	6.6	7.6	8.6
400	0.4	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.6	4.5	5.4	6.3	7.2	8.1
350	0.4	0.5	0.8	1.1	1.4	1.6	1.9	2.2	2.5	2.8	3.3	4.2	5.0	5.9	6.7	7.5
300	0.3	0.5	0.7	1.0	1.3	1.5	1.8	2.0	2.3	2.6	3.1	3.9	4.6	5.4	6.2	7.0
275	0.3	0.5	0.7	1.0	1.2	1.4	1.7	1.9	2.2	2.4	2.9	3.7	4.4	5.2	5.9	6.7
250	0.3	0.4	0.7	0.9	1.1	1.4	1.6	1.9	2.1	2.3	2.8	3.5	4.2	499	5.7	6.4
225	0.3	0.4	0.6	0.9	1.1	1.3	1.5	1.8	2.0	2.2	2.7	3.3	4.0	4.7	5.4	6.0
200	0.3	0.4	0.6	0.8	1.0	1.2	1.4	1.7	1.9	2.1	2.5	3.1	3.8	4.4	5.0	5.7
175	0.3	0.4	0.5	0.8	0.9	1.1	1.3	1.5	1.7	1.9	2.3	2.9	3.5	4.1	4.7	5.3
150	0.2	0.3	0.5	0.7	0.9	1.1	1.2	1.4	1.6	1.8	2.2	2.7	3.3	3.8	4.4	4.9
125	0.2	0.3	0.5	0.6	0.8	1.0	1.1	1.3	1.5	1.6	2.0	2.5	3.0	3.5	4.0	4.5
100	0.2	0.3	0.4	0.6	0.7	0.9	1.0	1.2	1.3	1,5	1.8	2.2	2.7	3.1	3.6	4.0

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

12.05 **ELECTRICAL CONTINUITY**: Ductile iron mains may be tested for electrical continuity at the City's expense. The Contractor shall locate and repair any breaks found in the electrical circuit.

12.06 **FLUSHING WATER MAIN**: The water main shall be flushed by providing taps in sufficient size or number to provide a flow rate of 2 1/2 gallons per second in the line being flushed. Hydrants may be used providing the requirements listed below are met:

A. Procedure - The Contractor shall submit to the Engineer a procedure schedule outlining the method he proposed to use for flushing water mains. Mains shall be flushed at a maximum of 1/4 mile intervals.

B. Time for Flushing - Flushing may be done prior to pressure testing or following pressure testing, but in any case, prior to chlorination of the water main.

C. Flushing points shall extend the water outlet via hose to the street gutter line or near an existing catch basin. Hose ends shall be secured and protected by barricade.

12.07 **CHLORINATION**: All newly laid lines shall be chlorinated. The Contractor shall furnish all necessary equipment and materials and shall furnish all necessary assistance for effective disinfection of the water mains.

A. Procedure - After the water main has been pressure tested and flushed the Contractor shall pump a chlorine solution into the water main in such a manner and at such strength that the residual free chlorine shall be 50 to 100 ppm.

1. High Test Calcium Hypochlorite - ("HTH", "Perchloren", Pittchlor"). Prepare a 10,000 parts per million solution water (1) and pump at a constant rate into the water main while bleeding off the water at the extreme end. The bleed rate will determine the feed rate of the chlorine in order to arrive at a 50 to 100 ppm solution in the water main.
2. Liquid Chlorine - Liquid chlorine may be applied to the water main much in the same way as the hypochlorite solution listed above. The rate of application will have to be adjusted for the degree of concentration of the liquid chlorine.
3. Chlorine Gas - Chlorine gas shall not be used to chlorinate the water main directly, but shall be applied through an appropriate chlorinating device to place the chlorine into a water solution prior to injecting it into the water main. Adequate safety devices and procedures will be used to prevent leaking of chlorine gas. Prior to this method of disinfecting, the procedure and equipment shall be checked and approved in writing by the Engineer.

B. Point of Application - The chlorinating agent shall be applied at the supply end of the line through a corporation cock. The water for injecting the chlorine into the new main may be taken from the pressure side of the isolation valve or by utilizing a pressure pump. Care shall be exercised to prevent any of the strong chlorine solution from entering the existing water main.

C. Retention Period - The chlorinated water shall be retained in the new water main for a period not to exceed 24 hours nor less than 16 hours in the event 50 parts per million is used, or not to exceed 12 hours nor less than 8 hours if a 100 parts per million solution is used. In cases where a shorter retention period if necessary, a stronger solution may be used and the retention period reduced accordingly. For these stronger solutions, the approval of the Engineer must be secured in writing as to the length of retention time in relationship to chlorine strength.

   While the chlorine solution is in the line, the Contractor shall operate valves in the chlorinated section to insure the complete disinfection thereof.

D. Flushing and Testing - Chlorinated water shall be flushed from the main at the end of the retention time so that the entire line is clear of any residual chlorine.

   After the line is flushed, two (2) consecutive day samples shall be taken from the line by the **Southeastern Oakland County Water Authority** (SOCWA @ 248-288-5150) for bacteriological analysis. These test samples are taken Monday through Thursday and must be scheduled by the Contractor with SOCWA.

   In the event the water does not pass this bacteriological test, the test procedure outlined above shall be repeated until the quality of water is substantially the same as that being delivered from existing distribution system.

12.08 PRESSURE TESTS AND CHLORINATING REPORT FORMS: All information relative to pressure tests and chlorinating, the procedures and the results shall be reported on standard forms available at the office of the Engineer. These reports will be submitted immediately upon completion of said tests and disinfecting. Water sample tests reports shall be mailed to the Engineer.

13.00 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

13.01 **WATER MAIN**: Water main shall be measured in place by linear feet along the centerline of the pipe. No deductions will be made in this measurement for the laying length of fittings.

13.02 **HYDRANTS & VALVES**: Hydrants and valves will be counted and paid for under the appropriate item in the Proposal.

13.03 **REACTION BACKING**: Reaction backing, tie rods, clamps and retainer glands will be considered as incidental to water main construction. Their cost shall be included under the appropriate fitting item in the Proposal.

13.04 **FITTINGS**: Fittings will be paid as water main by linear feet in place along the centerline of the fitting, unless paid as extra fitting in the Proposal.

GENERAL SPECIFICATIONS FOR WATER MAIN- WELL DRILLING

1.00 **WORK INCLUDED**: Unless specifically excluded in the Project Specifications, the work under the Contract shall include all equipment, labor and materials required for the drilling, casing, testing, developing, and proper finishing of the well(s) in accordance with the accompanying Contract Documents. The Contractor shall provide all tools, derricks, engines and other machinery and appliances of whatever description necessary for the expeditious construction and completion of the well in a workmanlike manner.

1.01 **LAND BY CITY**: The City shall furnish all land, right-of-way, access roads and clear the same of obstructions that will interfere with the Contractor's work. Access roads will be constructed and maintained to permit the ingress and egress without the use of special equipment, such as bulldozers, which are not normally owned by Well Contractors.

Where Contractor's work schedule is involved, any delay in furnishing these lands and access by the City shall be deemed proper cause for adjustment of the work schedule.

1.02 **FIELD MEASUREMENTS**: All measurements for depths shall be taken from the existing surface of the ground at the well site to the lowest point of the bore hole or to the bottom of the screen if the screen is set below the bore hole. To determine the depth of the various sized holes, the Contractor shall verify the measurements of the holes with the Engineer representing the City as soon as a particular sized hole is completed. The Contractor shall not start on the next smaller size (except in case of emergency) until both the Contractor and the Engineer has agreed as to the depth of the completed hole.

1.03 **SOILS LOG**: The Contractor shall keep an accurate written soils log on the job site. The log shall show the top and bottom of each stratum penetrated. The log shall be available for inspection during the regular working day.

1.04 **SOIL SAMPLES**: The Contractor shall collect, save and deliver to the Engineer a complete set of one (1) pint size samples representative of each stratum or 5 foot interval (whichever is the lesser) penetrated. In sand and / or gravel, all of the materials removed shall be collected, drained and thoroughly mixed in a clean, durable container or sufficient size to hold the materials without spillage. After mixing, the quantity of material collected shall be reduced in size to provide at least two full one (1) pint size containers of samples. The reduction in size shall be accomplished by alternately mixing and removing 1/4 of the original bulk sample until the quantity remaining equals that required herein, plus any amount required by the Contractor. The Contractor shall forward one complete set of sand and / or gravel formation samples to a laboratory acceptable to the Engineer for standard sieve analyses and shall deliver the like set of samples to the Engineer. Two complete copies of the laboratory sieve analyses reports are to be forwarded to the Engineer.

1.05 **WELL CASING(S) AND LINER(S)**: Casing(s) and liner(s) to be used as a part of the permanent well shall be of new black steel pipe conforming to the requirements of Table l, "Steel Pipe, Black or Galvanized", on page 34 "AWWA Standard Specifications for Deep Wells", (AWWA A-100-66).

Inserted casing(s) or liner(s) that are installed without driving may be lighter than the standards referred to above, if, in the opinion of the Engineer, conditions permit its use. Sections of casing(s) or liner(s) maybe jointed with standard couplings or by butt

welding. Where welding is used, it shall conform to the standard of the American Welding Society.

Each string of casing or liner shall be straight and plumb and shall not deviate from a straight and plumb line by an amount sufficient to interfere with the successful operation of a standard deep well turbine type pump of the largest size designed for operation within the casing or liner in question. Prior to the final acceptance of the well(s), the Contractor at his own expense shall demonstrate to the Engineer's satisfaction that this requirement has been met. In the event the requirement for straightness and plumbness is not met, the Contractor shall, without undue delay and at his own expense, do whatever work is necessary to correct the work in a manner approved by the Engineer.

In those instances where reductions in diameter of successive overlapping casings or liners of a permanent nature occur; permanent casings or liners are seated on or in the bedrock; or, non-overlapping casings or liners of a permanent type are required or found to be necessary; each string of casing shall be securely seated and sealed in such a manner so as to prevent the infiltration of water, sand, silt, or other undesirable matter. Where an overlap occurs between such casings and / or liners, the smaller casing or liner may be cut off at a point which will provide an overlap of not less than five feet.

Casing subject to being driven into place shall be provided with a drive shoe of an approved type.

1.06 **WELL SCREEN(S)**: Where necessary, the collecting portion(s) of the well shall be finished with a screen constructed of a single metal or alloy. All intake openings shall be designed so as to prevent clogging and shall be free from jagged edges, irregularities, or other defects that will hinder passage of sand during the development of the well or accelerate clogging and corrosion. The screen shall be of such length and size of intake openings as deemed advisable by the Contractor and the Engineer after the waterbearing formation(s) has been prospected and the materials analyzed. The screen(s) shall be provided with such fittings as are necessary to tightly seal the screen to the casing(s) and to close the bottom if placed in the bottom of the bore hole. Where the screen is installed inside the casing or liner and a lead packer is used at the top, the top of the screen shall be so located that there is a 12 inch overlap of the well casing and screen. If the screen is of the same diameter as the casing or liner, a suitable coupling shall be provided or the screen shall be welded to the casing or liner. All fittings, including couplings where required for joining sections of the screen, shall be constructed of the same material as the screen except that plugs and seals may be of different materials. Sections of casing over five feet in length used to connect sections of screen are not considered as fittings.

1.07 **WELL DEVELOPMENT**: The Contractor shall furnish all necessary pumps, compressors, surge blocks, materials, and accessory equipment needed for well development. The Contractor shall develop the well by such approved methods which shall be necessary to result in the maximum yield of water per foot of available drawdown and to extract from the waterbearing formation the maximum practical quantity of sand so that the water produced from the waterbearing materials under normal operating conditions shall be "sand free".

1.08 **SPECIAL BORE HOLD SURVEYS**: Whenever the Engineer calls for logging or sampling surveys to be made, the Contractor is to furnish one man to assist in accomplishing such surveys. This work is considered incidental to the completion of the Contract and is not a separate pay item.

1.09 **AQUIFER TEST**: After the well has been completely constructed, developed, cleaned out, and the depth accurately measured, the Contractor shall notify the Engineer to that effect and shall make the necessary arrangements to conduct a pumping test.

The Contractor shall furnish and install all test pumping equipment, all tools, power materials and labor associated with said installation unless this condition is specifically modified in the Project Specifications.

The pumping equipment shall be capable of extended continuous operation at such rate(s) as the Engineer deems necessary to test the well and aquifer. The equipment shall include a suitable gate valve on the pump discharge sot he rate of pumping may be varied as the Engineer deems necessary. The Contractor shall furnish and install all necessary discharge piping for the pumping unit to conduct the water being pumped to such point as the Engineer deems necessary. The discharge piping shall include an outlet which prevents scouring of the land surface at the point of discharge.

The Contractor shall test all observation wells and prove good hydraulic communication with the aquifer exists.

The Contractor shall arrange to have nearby wells either shut-down or pumped at a constant rate from the beginning of the rest period to the end of the recovery period and shall report any departures from this arrangement.

Water level readings in the observation well(s) and pumped well shall be measured to the nearest 0.01 foot by either the wetted-tape or electrical probe method. Water level readings of any nearby bodies of surface water shall be measured every two hours.

After the installation of the testing equipment has been completed to the satisfaction of the City and the Engineer, the test will be started. Unless otherwise agreed, the minimum test pumping period shall be 8 hours and the maximum shall be 72 hours. The Contractor is responsible for the complete running of the test and shall furnish the Engineer with two copies of the aquifer test data.

Aquifer test calling for 12 hours or more of pumping shall be composed of rest, pumping and recovery periods. The rest period, recovery period and any re-running of the pumping portion of the test due to breakdown are considered part of the completion of the test and will not be considered a separate pay item.

A. Rest Period - The rest period shall be at least 1/4 as long as the pumping period. A minimum of five (5) uniformly spaced water level readings in all wells are required. The last reading shall be just prior to starting the pumping portion of the test.
B. Pumping Period - The following schedule of water level readings shall be used:

Every minute for the first 5 minutes
Every 5 minutes for the next 25 minutes
Every 10 minutes for the next 30 minutes

Every 15 minutes for the next 2 hours
Every 30 minutes for the next 24 hours
Every hour for the next 6 hours
Every 2 hours thereafter

After the first 30 minutes, the pumping rate shall be recorded with each water level reading.

C. Breakdown - If a breakdown occurs during the pumping period, the following downtime can be tolerated:

1. Water Table Conditions:
   First Hour .....rest 1 hour and start over
   Second Hour .....5 Minutes
   Third Hour .....10 Minutes
   Fourth Hour .....15 Minutes

   Add 6 minutes for each hour of pumping thereafter for a maximum of 30 minutes of downtime. For more than 30 minutes, start over after a rest period equivalent to 1/3 of the completed pumping period.

2. Artesian Conditions:
   Not over 5 minutes of downtime is permissible in the first 3 hours, no more than 10 minutes for the remainder of the test. If downtime requires a restart of the test, accomplish a rest period as in (1) above before restarting.

3. Recovery Period:
   The recovery period shall be 1/3 as long as the pumping period. Use the same reading schedule as during the pumping period.

1.10 **DISINFECTION OF WELL AND TEST PUMP**: After the well has been completely constructed, it shall be thoroughly cleaned of all foreign substances, including tools, timbers, rope, debris of any kind, cement, oil, grease, joint dope, and scum. The casting pipe shall be thoroughly swabbed, using alkalis if necessary, to remove oil, grease or joint dope. The wells shall then be disinfected with a chlorine solution.

The chlorine solution used for disinfecting the well shall be of such volume and strength and shall be so applied that a concentration of at least 100 ppm of chlorine shall be obtained in all parts of the well. Chlorine solution shall be prepared and applied in a manner approved by the Engineer and shall remain in the well for a period of at least 24 hours.

In the even that the test pump is installed after the well has been disinfected, the test pump shall be disinfected in a manner approved by the Engineer.

1.11 **TEMPORARY CAPPING OF WELLS**: At all times during the progress of the work, the Contractor shall protect the well(s) in such manner to prevent either tampering with the well(s), or the entrance of foreign matter into it. Upon completion of the well(s), the Contractor shall provide and set a substantial screwed, flanged or welded cap satisfactory to the Engineer.

1.12 **PLUGGING AND ABANDONMENT**: Prior to plugging and abandonment, the well shall be checked to insure freedom from obstructions that may interfere with the plugging operation. Concrete or neat cement shall be placed form the bottom of the well to the top by a dump bailer or conductor pipe to prevent segregation or dilution of the material.

GENERAL SPECIFICATIONS FOR WATER MAIN- FORCE MAINS

1.00 **MATERIALS**: Force mains may be constructed of the following materials unless limited by the Project Specifications.

Cast Iron Pipe ASA-A21.6, Class 22 cement lined in accordance with ASA-A21.4-53 (AWWA-C-104-53), except that lining shall be one-half thickness (Enameline, or equal). Joints shall be ASS-A21.11 mechanical thickness joints or "Roll-on" rubber gaskets as manufactured by J.B. Clow & Sons, or equal. Fittings shall be ASA-A21.10 or AWWA C-100-08, Class D, for 3 inch and 12 inch and AWWA C-100-08, Class B or D, as specified for 14 to 24 inches. Fittings shall be lined same as pipe.

Asbestos Cement Pipe AWWA C-400-64T, Class 150 - Joints shall be manufacturer's standard joints for 150 psi water service. Fittings shall be case iron as specified above.

Cement mortar lined steel pipe AWWA C-202, C-203 and C-205, or equal to Armco Specification CML-1A-62. Joints to be AWWA C-202 or equal to Armco Specification CML-A1-62.

All valves shall be Owner Standard or AWWA C-500, double disc, open left. Valve boxes shall be 3-section Clow 2450, or approved equal.

1.01 **PIPE BEDDING AND BACKFILL**: All pipes, regardless of the materials, shall be bedded along the entire length with bell holes excavated to prevent supporting the pipe line on bells or couplings. Shape the trench so that the entire length of pipe barrel is evenly supported. All pipes shall be bedded in a minimum of 4 inches of sand completely around the pipe.

1.02 **REACTION BACKING**: See pages W-12 thru W-13 of Water Main for general information.

1.03 **TESTING**: The force main shall be plugged and pressure tested at 100 p.s.i. The lines shall be adequately saddled with earth to maintain alignment during the pressure test. Leakage will be limited to a total of one (1) gallon per 100 ft. / in. diameter when subjected to a continuous internal hydraulic pressure of 100 p.s.i. for a period of two hours.

GENERAL SPECIFICATIONS FOR WATER MAIN- PUMPS

1.00 **PUMP DRAWING**: Detail drawings showing the exact dimensions of the pumps to be furnished shall be submitted to the Engineer prior to shipment of the equipment.

1.01 **PUMP HEADS**: The pump heads shall be of heavy fine grained cast iron construction for above ground discharge with suitable machined center ring to receive the hollow shaft motor. The discharge flange shall be standard, permitting flanged connection to the discharge piping.

1.02 **DISCHARGE COLUMNS**: Discharge columns shall be black steel with screwed coupling, furnished in interchangeable sections not over 10 feet long.

1.03 **SHAFTS**: The correct length of precision ground steel shafts of proper diameter to transmit the power required to drive the pumps shall be furnished. The line shaft bearings shall be of rubber, water lubricated type. Bearings shall be held in bronze retainer rings not to exceed five feet, center to center, for 3,600 rpm units or 10 feet for 1,800 rpm units.

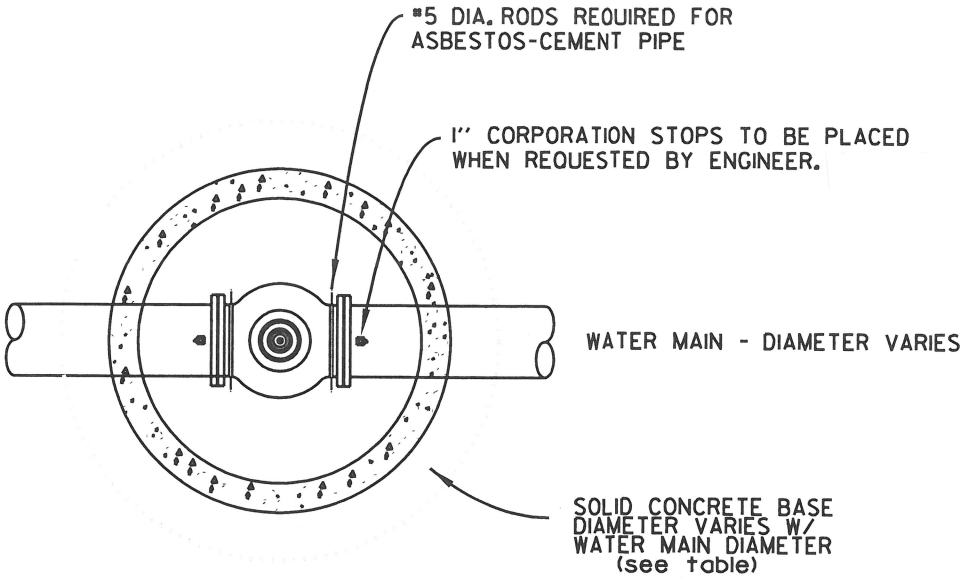
1.04 **BOWLS**: The castings shall be free of blow holes, sand holes and other detrimental defects. The bowls shall be capable of withstanding a hydrostatic pressure equal to twice the pressure at rated capacity or 1 and 1/2 times shutoff head, whichever is greater. Bowls may be equipped with replaceable seal rings on the suction side of enclosed impellers.

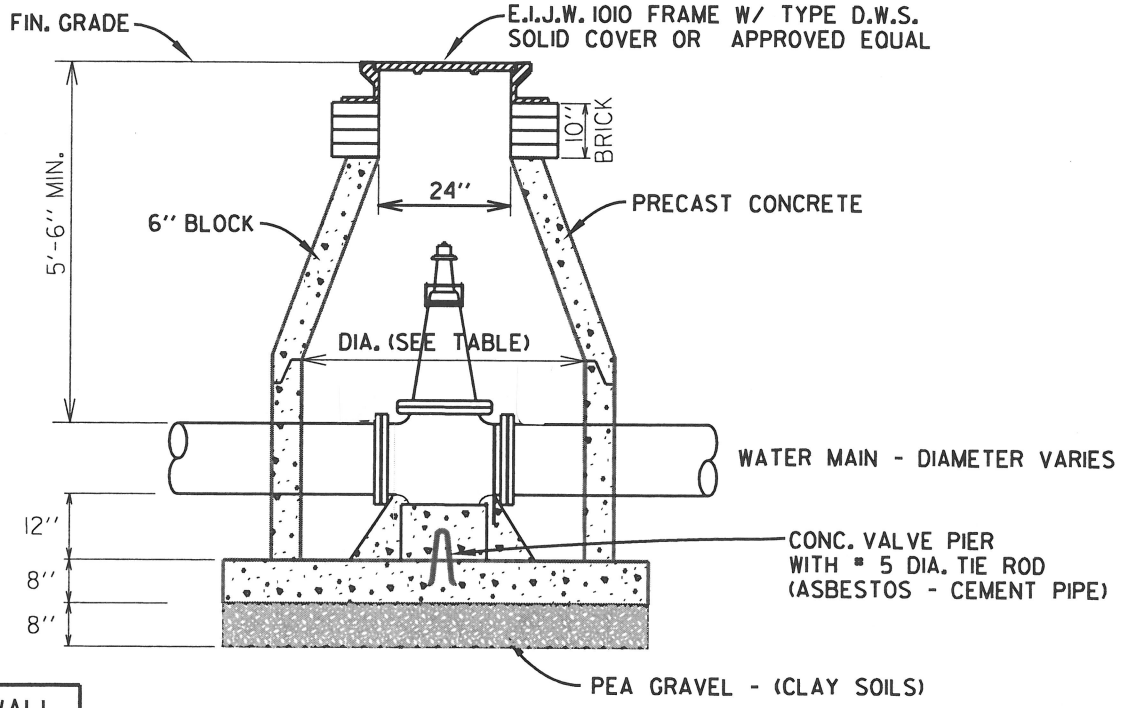
1.05 **IMPELLERS**: The impellers shall be bronze, accurately machined and finished, and perfectly balanced mechanically and hydraulically. The impellers shall be securely locked to the shaft. Impeller shafts shall be properly aligned by bearings above and below each impeller. The impeller shafts shall be made of stainless steel with lathe cut threads.

1.06 **SUCTION PIPE**: Sufficient suction pipe, having the same nominal diameter as the column pipe, shall be provided with each pump to terminate the pump at the elevation called for in the Project Specification.

1.07 **MOTORS**: The motors shall be vertical, drip proof, squirrel cage, induction type, ball bearing, oil lubricated, directly connected to the pump shaft and shall be equipped with non-reverse ratchets. Motors shall be 220 / 440 volt, 3 phase, 60 cycle, 40 degrees centigrade; speed shall not exceed that stated in the Project Specifications. An adequate oil lubricated thrust bearing shall be provided.

1.08 **AIRLINE**: Unless stated in the Project Specifications, the airline water level indicating device shall include sufficient 1/4 inch plastic tubing to terminate near the top of the suction pipe below the pump bowls. The water level indicating gages shall be of the direct reading type, securely mounted so as to permit convenient operation and reading. Suitable hand operated air pumps are to be provided by the pump contractor.



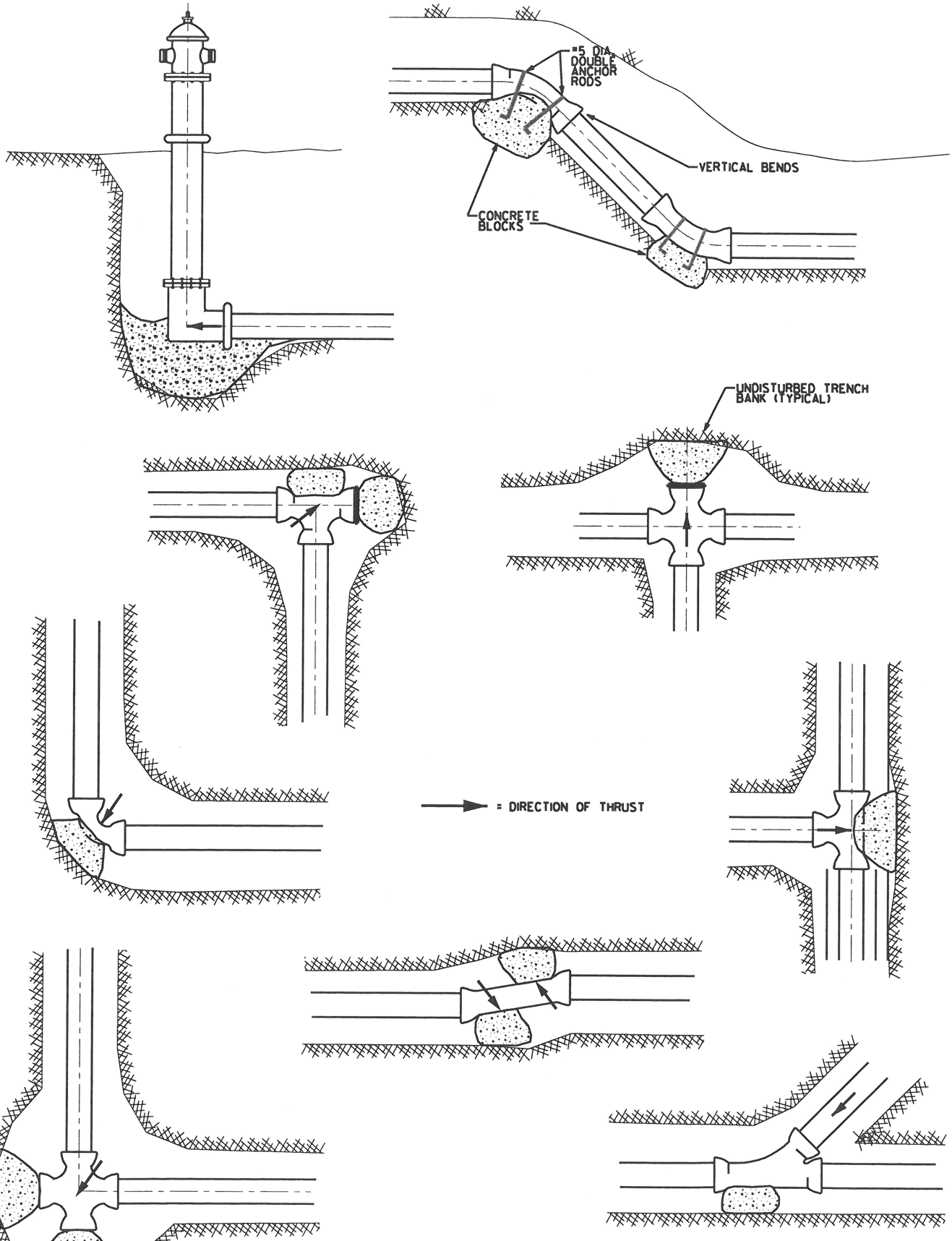


SIZE	DIA.	WALL THICK.
6"	5"	5"
8"	5"	5"
12"	6"	6"
16"	6"	7"

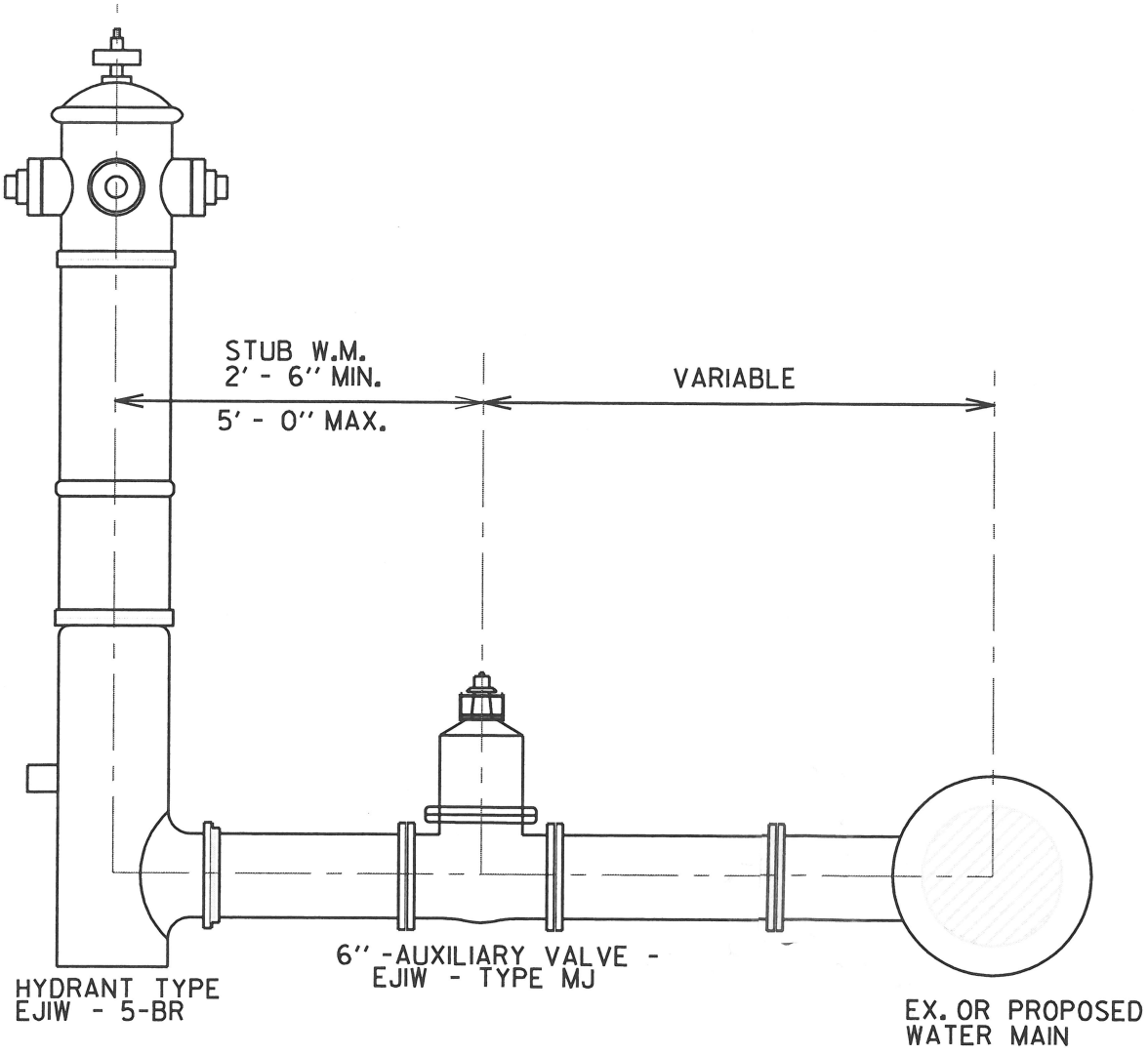
NOTE: MANHOLE CONC. BASE SHALL BE PLACED ON COMPACTED MATERIAL.

STANDARD VALVE MANHOLE

(GATEWELL)



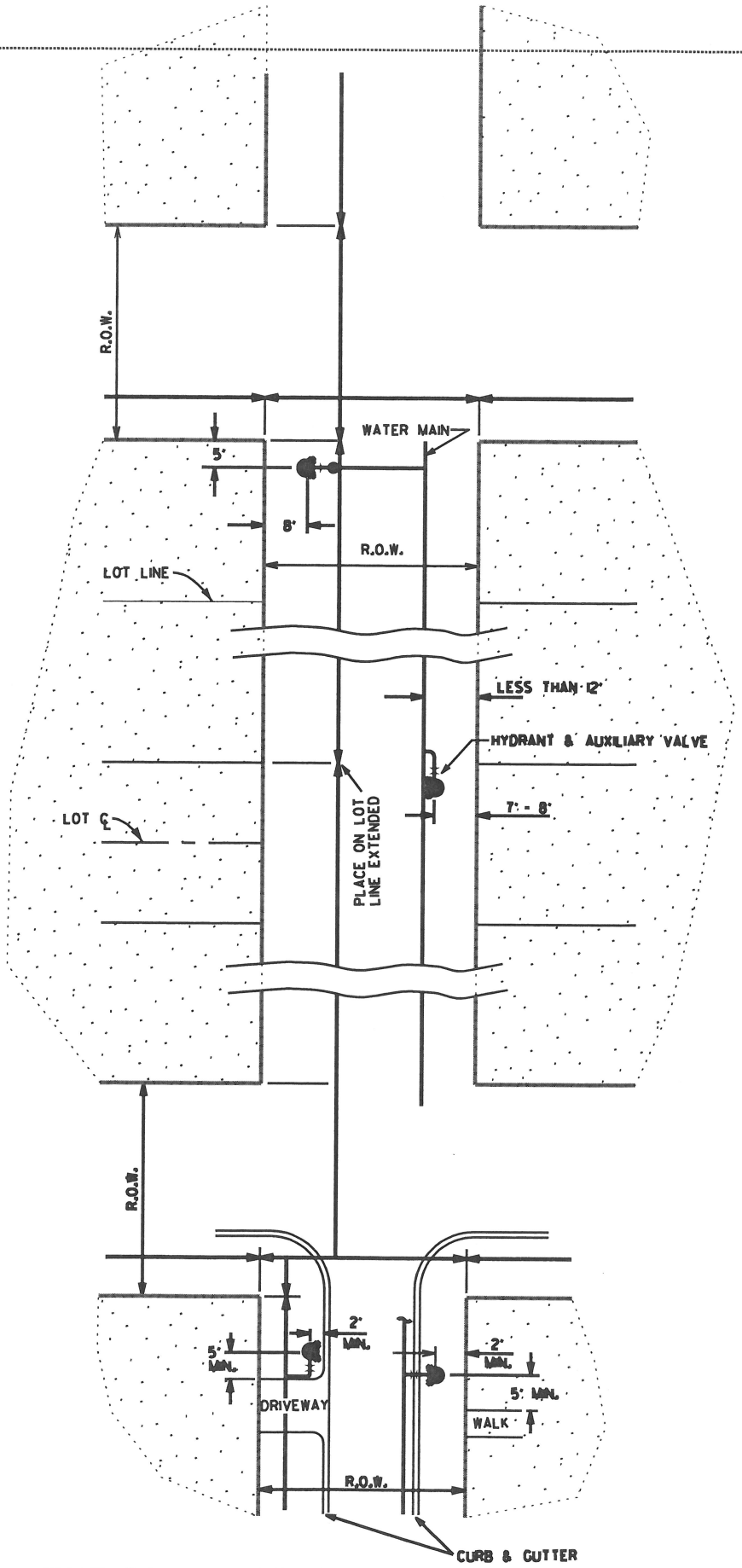
LOCATION OF REACTION BACKING (TYP.)



NOTES:

1. ACTUAL LENGTHS OF STUB WATER MAIN BETWEEN THE HYDRANT AND AUXILIARY VALVE WILL BE SET IN THE FIELD BY THE ENGINEER

AUXILIARY VALVE LOCATION (TYP.)

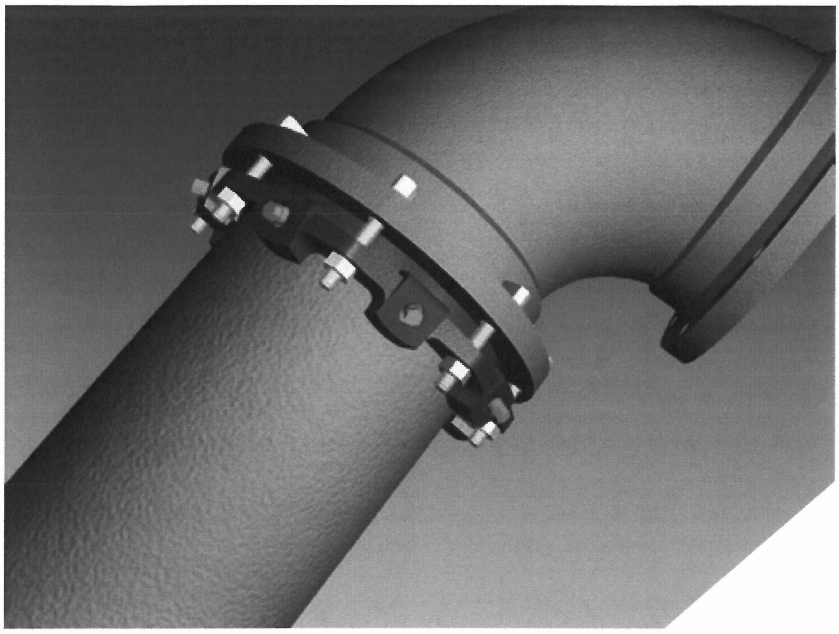


TYPICAL HYDRANT AND VALVE LOCATIONS

EBAA IRON INC
Your Connection to the Future™

MEGALUG®
Series 1100

Mechanical Joint Restraint for Ductile Iron Pipe



Nominal Pipe Size	Series Number	Shipping Weights	Post Assembly Deflection	Pressure Rating (PSI)
3	1103	6.1	3°	350
4	1104	7.7	3°	350
6	1106	11.9	3°	350
8	1108	14.8	3°	350
10	1110	23.9	3°	350
12	1112	31.2	3°	350
14	1114	48.5	2°	350
16	1116	56.4	2°	350
18	1118	63.1	1½°	250
20	1120	72.3	1½°	250
24	1124	133.1	1½°	250
30	1130	194.6	1°	250
36	1136	234.0	1°	250
42	1142	536.0	1°	250
48	1148	653.0	1°	250

NOTE: For applications or pressures other than those shown please contact EBAA for assistance.

Features and Applications:

- Sizes 3 inch through 48 inch
- Constructed of ASTM A536 Ductile Iron
- Torque Limiting Twist-Off Nuts
- MEGA-BOND®
  Restraint Coating System
  For more information on MEGA-BOND, refer to www.ebaa.com
- The Mechanical Joint Follower Gland is incorporated into the restraint
- Heavy Duty thick wall design
- Support Products Available:
  Split repair style available 3 inch through 48 inch.
  EBAA Series 1100SD

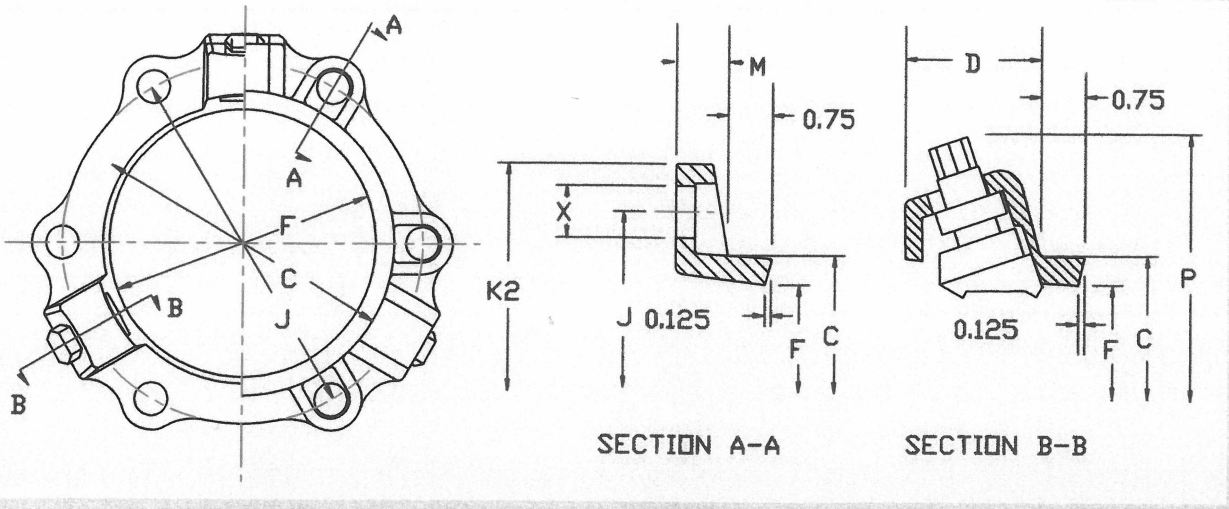
  Solid restraint harness available for push-on pipe bells.
  EBAA Series 1700

  Split restraint harness available for existing push-on bells.
  EBAA Series 1100HD
- All MEGALUG and related restraint products can be furnished as packaged accessories complete with appropriate restraint, gasket, lubrication, and bolting hardware
- For use on water or wastewater pipelines subject to hydrostatic pressure and tested in accordance with either AWWA C600 or ASTM D2774

Made In The USA

Series 1100 Submittal Reference Drawing

EBAA IRON



MADE IN USA

Nominal Pipe Size	Series Number	C	D	F	M	P*	X	J	K2	Wedge QTY.	Bolt QTY.	Weight (LBS.)	Pressure Rating (PSI)
3	1103	4.48	2.27	4.06	0.62	9.06	0.750	6.19	7.69	2	4	6.1	350
4	1104	5.92	2.27	4.90	0.75	9.90	0.875	7.50	9.12	2	4	7.6	350
6	1106	8.02	2.27	7.00	0.88	12.00	0.875	9.50	11.12	3	6	11.8	350
8	1108	10.17	2.31	9.15	1.00	14.15	0.875	11.75	13.37	4	6	14.9	350
10	1110	12.22	2.37	11.20	1.00	16.20	0.875	14.00	15.62	6	8	23.9	350
12	1112	14.32	2.37	13.30	1.25	18.30	0.875	16.25	17.88	8	8	31.2	350
14	1114	16.40	2.69	15.44	1.50	20.94	0.875	18.75	20.25	10	10	49.7	350
16	1116	18.50	2.69	17.54	1.56	22.90	0.875	21.00	22.50	12	12	56.4	350
18	1118	20.60	2.69	19.64	1.63	25.00	0.875	23.25	24.75	12	12	63.6	250
20	1120	22.70	2.69	21.74	1.69	27.10	0.875	25.50	27.00	14	14	71.0	250
24	1124	26.90	3.20	25.94	1.81	32.64	0.875	30.00	31.50	16	16	128.7	250
30	1130	33.29	3.20	32.17	2.25	38.87	1.125	36.88	39.12	20	20	190.7	250
36	1136	39.59	3.20	38.47	2.25	45.17	1.125	43.75	46.00	24	24	226.5	250
42	1142	45.79	4.56	44.67	3.88	55.57	1.375	50.62	53.48	28	28	518.9	250
48	1148	52.09	4.56	50.97	3.88	61.87	1.375	57.50	60.36	32	32	608.3	250

* With Twist-Off Nuts twisted off.

NOTE: Dimensions are in inches and are subject to change without notice.

Important Notes

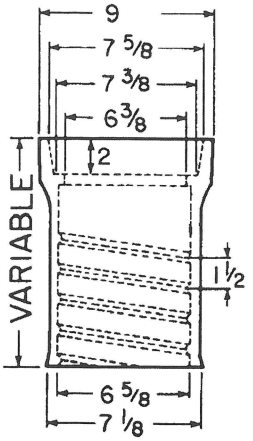
- The Series 1100 MEGALUG should not be used on plain end fittings.
- If encased in concrete, polyethylene wrap must be used to prevent concrete intrusion into the wedge pocket.
- For test pressures above the rated pressures shown, contact EBAA for recommendations, such as tandem restraint for high pressure applications.
- If you experience the need to install the Series 1100 MEGALUG in an unconventional manner please consult our engineering department.
- EBAA-Seal™ Mechanical Joint Gaskets are provided with 30 inch through 48 inch MEGALUG restraints. These are required on the above referenced sizes to accommodate the pressure ratings and safety factors shown.
- Extra length T-bolts are provided with the 42 inch and 48 inch sizes to facilitate easier assembly of the mechanical joint.
- All Series 1100 MEGALUG components are made of ductile iron conforming to ASTM A536. The wedges are heat treated to a hardness range of 370 to 470 BHN.
- LISTINGS AND APPROVALS: Sizes 3 inch through 24 inch are listed by Underwriters Laboratories, Inc. Category HJKF "Fittings, Retainer Type" with a deflection angle of 5 degrees (3 inch through 12 inch) and 2½ degrees (14 inch through 24 inch). The listing file number is EX2836, Sizes 3 inch through 12 inch are Factory Mutual approved.
- The Series 1100 MEGALUG is intended for use on ductile iron pipe. The restraint can be used on grey iron pipe if the pipe is not severely corroded and is in sound condition and has an outside diameter that can be accommodated. For more information on the use of the MEGALUG restraint on grey iron pipe ask for Connections Bulletin DI-1.

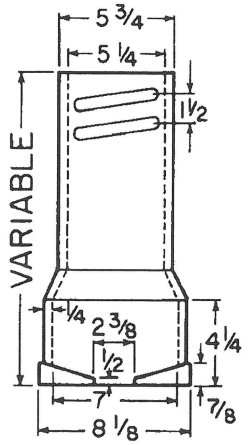
TYLER UNION®

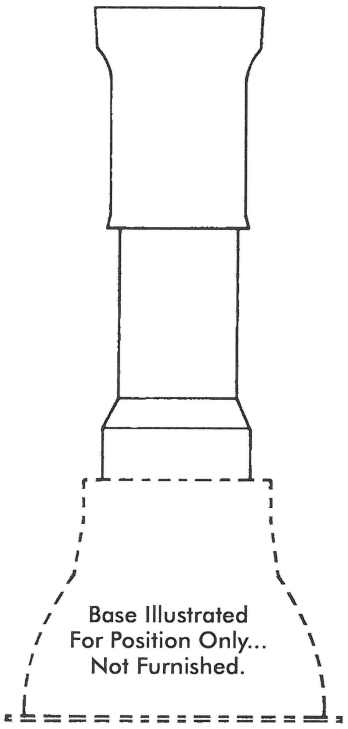
6860 SERIES
CAST IRON THREE-PIECE VALVE BOXES
for 3" through 20" valves, 5 1/4" shaft, screw-type
*****(Base required, order separately)**

TYLER UNION valve boxes are available either pre-assembled or as individual tops and bottoms. For assembled boxes, The UPC codes shown represent a combination of one top and one bottom in the sizes shown. For unassembled boxes, the UPC code represents only a top or a bottom, not a complete box. Therefore, unassembled boxes require ordering tops and bottoms separately.

****NOTE: Domestic Valve Boxes available in Heavy Duty Only**
Non-Domestic available in Standard or Heavy Duty







Box Assembled
(Less Lid)

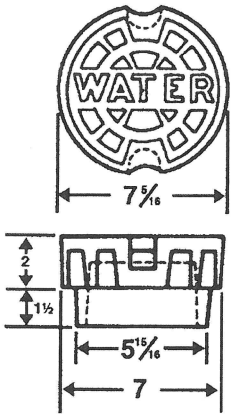
Box (Components)	Extension Height	*(D-HD)UPCode 670610	*(ND-HD)UPCode 670610	Wt	*(ND-Std.)UPCode 670610	Wt
AA (10T + 12B)	27-37	145912	----	42	136668	29
A (16T + 18B)	33-42	145929	----	65	136651	38
B (16T + 24B)	39-49	145936	----	69	136675	51
C (16T + 30B)	45-54	145943	----	73	136682	55
CC (16T + 36B)	51-60	145950	----	75	136699	59
D (26T + 30B)	45-66	145967	502357	88	136811	71
DD (26T + 36B)	51-72	145974	502364	90	136828	75
E (16T+24B+60 Ext)	63-72	145981	----	105	136835	80
F (26T+24B+60 Ext)	63-84	145998	----	120	136842	96
G (26T+36B+60 Ext)	74-94	146001	502371	126	136859	104

Lids marked "WATER" will ship unless otherwise specified:
Also available 5¼" Drop Lids"
1)WATER OMA 2)SEWER 3)MWW
4)PLAIN 5)GAS 6)REUSE
Note: Special Lettering Available
Contact Tyler Union for Setup Charge

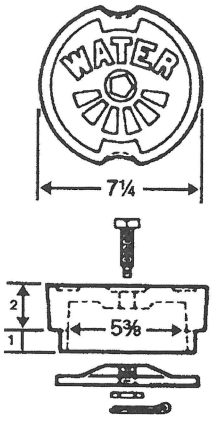
*NOTE: D=Domestic ND=Non-Domestic HD=Heavy Duty Weight Std=Standard Weight
***NOTE: Base Selection Guide (#4 Base for 6" valves or less) (#6 Base for 12" valves or less) (#160 Base for 24" valves or less)

TYLER UNION®

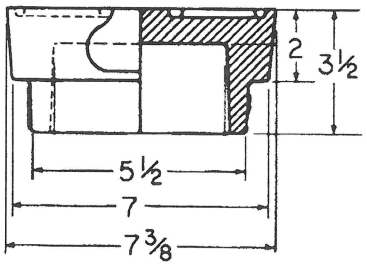
CAST IRON - STANDARD, SPECIAL DROP, AND LOCK LIDS



Drop Lid



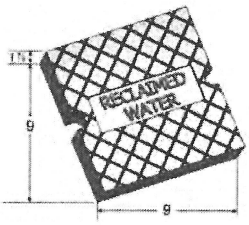
Lock Lid



5¼" MWW DROP LID

*(D-HD)UPCode 670610	*(ND-HD)UPCode 670610	Wt.
145370	136880	12

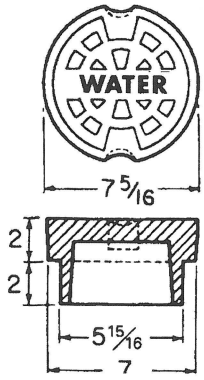
*D=Domestic ND=Non-Domestic
HD=Heavy Duty Weight

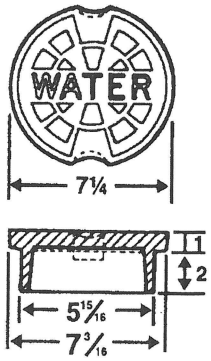


RECLAIMED WATER LID

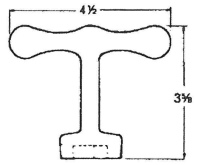
*(D-HD)UPCode 670610
458892

NOTE: Square Valve Box Tops for this Lid will be available in 2012. Call Tyler Union for information.
*D=Domestic HD=Heavy Duty Weight





1 1/8" Lid



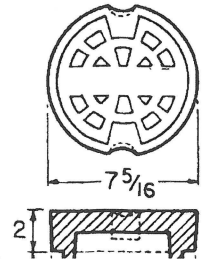
WRENCH
Fits Standard Waterworks Pentagon Head 27/32" Brass Screws

UPCode 670610	Ship Code	Description	Wt
144908	S	Wrench	0.5

5¼" OMA DROP LID**

*(D-HD)UPCode 670610	*(ND-HD)UPCode 670610	Special Markings	Wt.
145301	136927	**WATER OMA	12

*D=Domestic ND=Non-Domestic HD=Heavy Duty wt.
**OMA marking is inside lid.



LIDS (WATER)

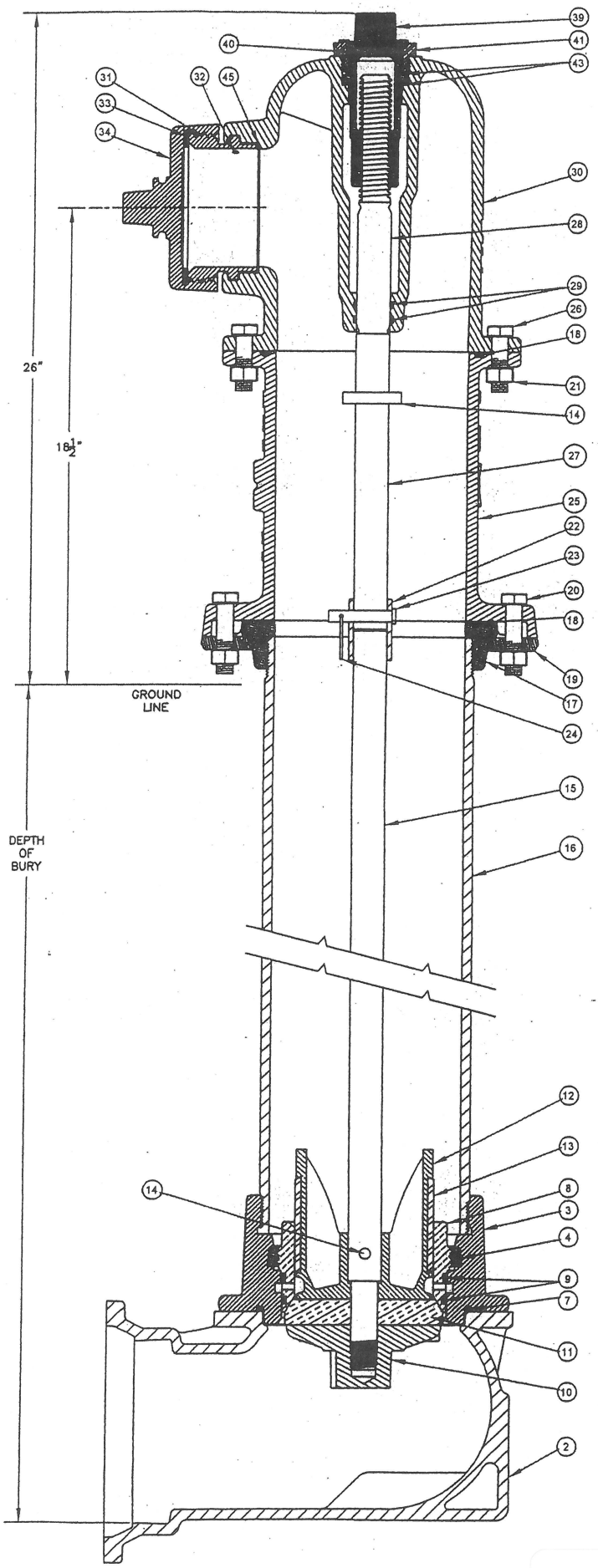
Item/Description	*(D-HDUP)Code 670610	Wt	*(ND-Std)UPCode 670610	Wt	*(ND-HD)UPCode 670610	Wt
5¼ Drop Lid	145325	12	136910	9	---	---
5¼ Lock Lid	145462	11	136866	11	---	---
1⅛ Lid**	145509	11	112532	9	---	---

(Use with 1⅛" Riser Only)
*NOTE: D=Domestic ND=Non-Domestic HD=Heavy Duty Weight Std=Standard Weight

5¼" DROP LID W/SPECIAL MARKINGS**

*(D-HD)UPCode 670610	Wt.	*(ND-Std)UPCode 670610	Wt.	Special Mark
145332	12	136873	9	GAS
145349	12	136903	9	SEWER
145356	12	136897	9	PLAIN
458975	12	---	---	REUSE

****Lids marked with "WATER" will be shipped unless otherwise specified.**



5BR 250 WaterMaster® HYDRANT

CAT NO.	PARTS LIST	MATERIAL	NO. REQ
2	BOTTOM INLET	D.I.	1
3	VALVE SEAT FLANGE	D.I.	1
4	BRASS LINER ††	BR	1
5	LOWER FLANGE BOLTS - 2" *	STN. STL.	6
6	LOWER FLANGE NUTS *	STN STL W/ZN PL.	6
7	LOWER FLANGE O-RING	BUNA-N	1
8	VALVE SEAT	BR	1
9	VALVE SEAT O-RING	BUNA-N	2
10	VALVE WASHER	C.I.	1
11	SEATING VALVE RUBBER	RUBBER	1
12	DRIP SHUT OFF	BR	1
13	INSERTS	RUBBER	2
14	DRIVE-LOC PIN	STN.STL.	2
15	OPERATING STEM LOWER	STEEL	1
16	STANDPIPE LOWER SECTION	D.I.	1
17	STANDPIPE TOP FLANGE	D.I.	1
18	UPPER FLANGE O-RING	BUNA-N	2
19	SWIVEL FLANGES	C.I.	2
20	BREAKABLE FLANGE BOLTS - 2 3/4"	ZN.PL.STL.	6
21	FLANGE NUTS	ZN.PL.STL.	12
22	STEM COUPLING - BREAKABLE	GALV. STL	1
23	COUPLING PIN	STN.STL.	2
24	HAIRPIN COTTER PIN	STN.STL.	2
25	STANDPIPE UPPER SECTION	D.I.	1
26	UPPER FLANGE BOLTS - 2"	ZN. PL. STL.	6
27	OPERATING STEM UPPER	STEEL	1
28	BRASS SLEEVE ††	BR	1
29	RESERVOIR O-RINGS	BUNA-N	2
30	TOP BONNET	D.I.	1
31	PUMPER NOZZLE	BR	1
32	NOZZLE SET SCREW	STN.STL.	3
33	PUMPER NOZZLE GASKET	RUBBER	1
34	PUMPER NOZZLE CAP	C.I.	1
35	HOSE NOZZLE **	BR	2
36	HOSE NOZZLE GASKET **	RUBBER	2
37	HOSE NOZZLE CAP **	C.I.	2
38	RETAINING CHAINS **	ZN. PL. STL.	3
39	OPERATING NUT	BR	1
40	WEATHER SEAL O-RING	BUNA-N	1
41	HOLD DOWN NUT	BR	1
42	SET SCREW **	STN.STL.	1
43	THRUST WASHER	DELRIN	2
44	DRAIN BUSHING **	BR	2
45	PUMPER NOZZLE O-RING	BUNA-N	1
46	HOSE NOZZLE O-RING **	BUNA-N	2

** NOT SHOWN
†† NOT A REPLACEMENT PART

* MEETS ANSI/AWWA C502
* RATED WORKING PRESSURE-250 PSI

REVISIONS

TITLE: 5BR 250 WaterMaster®
WITH 6" MJ SHOE

DRAWN | DATE 04/22/04 | CHK'D | SCALE

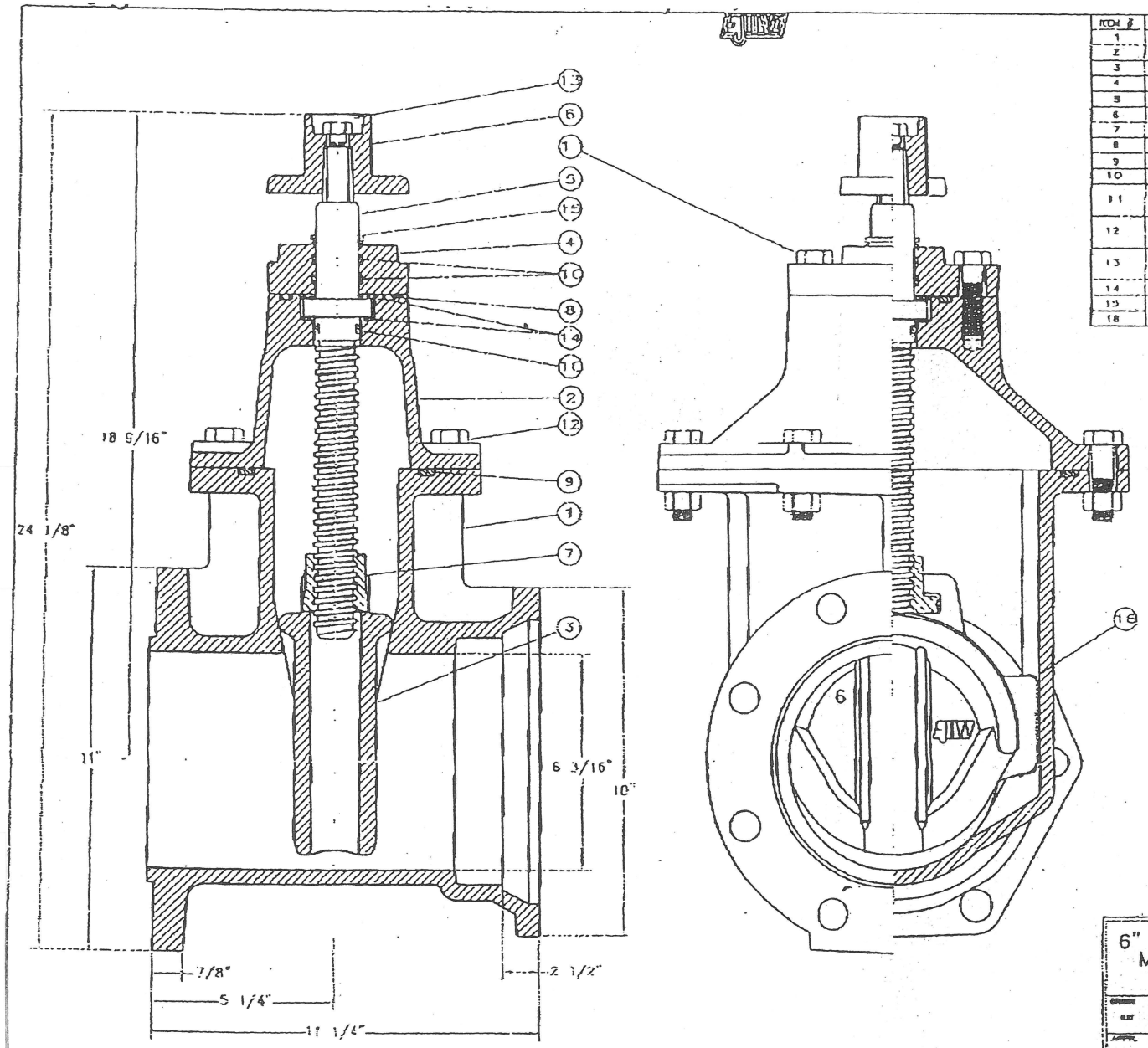
EAST JORDAN IRON WORKS
INCORPORATED
EAST JORDAN, MICH.

DRAWING NUMBER:

WATER MAIN

WD-10

WATER MAIN



ITEM #	QTY.	DESCRIPTION	MATERIAL
1	1	BODY	DUCTILE IRON
2	1	BONNET	DUCTILE IRON
3	1	WEDGE	O.L/SYNTHETIC RUBBER
4	1	SEAL PLATE	DUCTILE IRON
5	1	STEM	MANGANESE BRONZE
6	1	OPERATING NUT	CAST IRON
7	1	STEM NUT	MANGANESE BRONZE
8	1	O-RING	RUBBER, BUNA-N
9	1	BODY O-RING	RUBBER, BUNA-N
10	3	O-RING	RUBBER, BUNA-N
11	2	3/8"-11 NC X 2" LG. HEX CAP SCREW	STAINLESS STEEL
12	6	3/8"-11 NC X 2 1/2" LG. HEX CAP SCREW W/NUT	STAINLESS STEEL
13	1	1/4"-20 NC X 1 1/2" LG. HEX CAP SCREW	STAINLESS STEEL
14	2	THRUST WASHER	POLYMER
15	1	SHAFT SEAL	RUBBER, BUNA-N
16	2	EAR CAP	POLYMER

NOTES:

1. MECHANICAL JOINT END CONNECTION IN ACCORDANCE WITH ANSI/AWWA C111/A21.11
2. FLANGE END OF TAPPING VALVE IN ACCORDANCE WITH MSS SP-60
3. EJIW 6" RW GATE VALVE CONFORMS TO: AWWA C515 AWWA C550 (COATING)
4. WORKING PRESSURE = 250 PSI TEST PRESSURE = 500 PSI
5. APPROX. WEIGHT = 131 LBS
6. NUMBER OF TURNS TO OPEN = 20
7. POST INDICATOR VALVES ARE AVAILABLE

6" RESILIENT WEDGE GATE VALVE MECHANICAL JOINT x TAPPING (MJ x TAP)

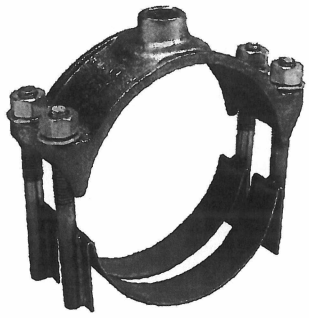
DRAWN	DATE	EAST JORDAN IRON WORKS, INC.
CHK'D	DATE	P.O. BOX 439, EAST JORDAN, MI 49727
APPR.	DATE	1-800-874-4100
		FAX 616-536-7058

MUELLER® BR2S & BR2W SERIES BRONZE SERVICE SADDLES - DOUBLE STRAP

Mueller Co.

MUELLER® Service Saddles for use on A-C, cast iron, ductile iron, and AWWA C900 PVC plastic pipe

- ❑ Outlet tapped with either AWWA taper (C.C.) or AWWA I.P. thread (F.I.P.T.)
- ❑ For use on A-C pipe, cast iron or ductile iron pipe and cast iron O.D. PVC pipe
- ❑ 200 psig (1379 kPa) maximum working pressure
- ❑ Available in double strap designs
- ❑ Brass body
- ❑ Flattened silicon bronze straps (standard)
- ❑ Optional 304L stainless steel straps
- ❑ Rolled strap threads
- ❑ O-ring sealed outlet
- ❑ 3/4" thru 2" tap sizes (5/8" some styles)
- ❑ Meets all applicable parts of ANSI/AWWA C800
- ❑ NSF 61 Certified



BR 2 S Series
BR 2 W Series

MUELLER® Service Saddles with Stainless Steel Double Straps

Pipe O.D. Range*		Kind and Size of Pipe			Bronze Double Straps						
Inch	mm	A-C	Cast or Ductile Iron, C900 PVC	Tap*** Thread	Base Catalog Number	5/8"	3/4"	1"	1-1/4"	1-1/2"	2"
4.74-5.32	121.0-135.0	**	4"	CC or IP	BR2S0474	062†	075	100	-	-	-
4.74-5.10	121.0-129.4		4"	CC or IP	BR2S0474	-	-	-	125	150	200
5.10-5.60	129.4-142.2		4"	CC or IP	BR2S0510	-	-	-	125	150	200
6.84-7.45	174.0-189.0		6"	CC or IP	BR2S0684	062†	075	100	125	150	200
8.99-9.67	229.0-245.0		8"	CC or IP	BR2S0899	062†	075	100	125	150	200
11.04-12.12	281.0-307.0		10"	CC or IP	BR2S1104	062†	075	100	125	150	200
13.14-14.58	334.0-370.0		12"	CC or IP	BR2S1314	062†	075	100	125	150	200
15.22-16.88	386.6-428.7		14"	CC or IP	BR2S1522	-	075	100	-	150	200
17.32-19.19	439.9-487.4		16"	CC or IP	BR2S1732	-	075	100	-	150	200
18.00-19.50	457.2-495.3		18"	CC or IP	BR2W1800	-	075	100	125	150	200
20.00-24.30	508.0-624.8		20"	CC or IP	BR2W2000	-	075	100	125	150	200
24.00-25.80	609.6-655.3		24"	CC or IP	BR2W2400	-	075	100	125	150	200

*A-C pipe, classes 150-200 per ASTM C295 and AWWA C400 – actual O.D. of pipe being used must fall within the pipe O.D. range listed in the preceding charts. Centrifugally cast pipe, classes 50-250 per ANSI/AWWA C102/A21.2; ANSI/AWWA C106/A21.6; ANSI/AWWA C108/A21.8, and Federal specification WW-P-421. Ductile iron pipe, classes 50-56 per ANSI/AWWA C151/A21.51; Cast iron O.D. PVC plastic pipe per AWWA C900.

** The outside diameter of A-C pipe varies from manufacturer to manufacturer., to make certain you select the proper clamp: 1) Determine the O.D. of the pipe at the point of saddle installation; 2) From the pipe O.D. range column of the above chart, choose a saddle that has a pipe O.D. range that includes the determined pipe diameter.

***CC=AWWA Taper; IP=AWWA IP thread (F.I.P.T)

†The 5/8" tap is available in CC thread only for a Stainless Steel strap saddle.

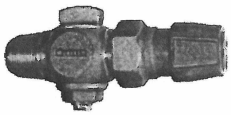
These machines may be used with the service saddles illustrated on this page

Machine	Service Saddle Tap Size					
	5/8"	3/4"	1"	1-1/4"	1-1/2"	2"
E-5™	X	X	X	-	X	X
D-5™	-	X	X	X	X	X
TRU-CUT™	-	X	X	-	-	-
MEGA-CUT™	X	X	X	-	-	X
PL-2™	-	X	X	-	-	-

TO ORDER SPECIFY QUANTITY, OUTLET TAPPING SIZE AND CATALOG NUMBER

WARNING: Use on A-C pipe, which contains a known carcinogen, requires appropriate protective equipment and procedures be employed.

1/2" - 2" GROUND KEY DESIGN CORPORATION VALVES



H-15006N

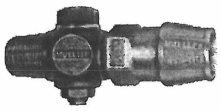
Ground Key Corporation Valve
Inlet: AWWA taper (MUELLER "CC") thread
Outlet: MUELLER® INSTA-TITE® Connection for CTS PE tubing*

3/4"	3/4" x1" ‡	1"

H-15024N

Ground Key Corporation Valve
Inlet: AWWA I.P. thread
Outlet: MUELLER® INSTA-TITE ® Connection for CTS PE tubing*

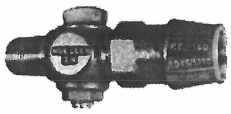
3/4"	1"



H-15005N

Ground Key Corporation Valve
Inlet: AWWA taper (MUELLER "CC") thread
Outlet: MUELLER INSTA-TITE Connection for IPS PE pipe*

3/4"	3/4" x1" ‡	1"



H-15026N

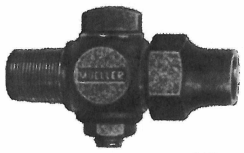
Ground Key Corporation Valve
Inlet: AWWA I.P. thread
Outlet: MUELLER INSTA-TITE Connection for IPS PE pipe*

3/4"	1"

H-15000N

Ground Key Corporation Valve
Inlet: AWWA taper (MUELLER "CC") thread
Outlet: Copper flare straight connection

5/8"	1/2"‡	5/8" x 3/4"	3/4"	3/4" x 1"	1"
1-1/4"	1-1/2"	1-1/2"x2"		2"	



H-15025N

Ground Key Corporation Valve
Inlet: AWWA I.P. thread
Outlet: Copper flare straight connection

1/2"	3/4"	1"	1-1/4"	1-1/2"	2"

H-15010N

Ground Key Corporation Valve
Inlet: AWWA taper (MUELLER "CC") thread
Outlet: Copper flare eighth bend connection

3/4"	1"	1-1/2"	2"

H-15035N

Ground Key Corporation Valve
Inlet: AWWA I.P. thread
Outlet: Copper flare eighth bend connection

3/4"‡	1"‡	1-1/2"	2"

H-15020N

Ground Key Corporation Valve
Inlet: AWWA taper (MUELLER "CC") thread
Outlet: Copper flare quarter bend connection
Ground Key Corporation Valve

5/8"x3/4"	3/4"	3/4"x1"	1"	1-1/2"	2"

H-15045N

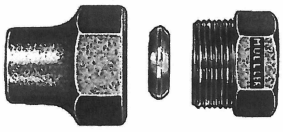
Inlet: AWWA I.P. thread
Outlet: Copper flare quarter bend connection
Ground Key Corporation Valve

3/4"‡	1"	1-1/2"	2"

*See charts on pages 5.12-5.16 for tubing and pipe that may be used on these connections.
‡ Requires minimum ordering quantity. Contact MUELLER Customer Service Center for minimum order requirements and availability.
NOTE: Sizes shown above represent nominal size of inlet and outlet connections. When two sizes are given, the first is size of inlet and the second is size of outlet.

MUELLER Corporation Valves are manufactured and tested in accordance with ANSI/AWWA C800. Components in contact with potable water will also comply with latest requirements of the Federal Safe Drinking Water Act.

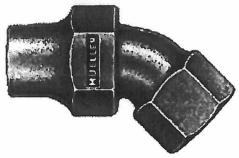
SERVICE FITTINGS WITH COPPER FLARE CONNECTION



Two Part Union
Copper flare nut x female copper flare thread

H-15405N

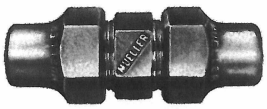
3/4"	1"	1-1/2"	2"



Eighth bend coupling
Copper flare nut x F.I.P.

H-15455N

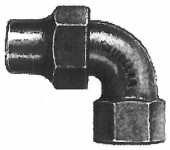
3/4"	1" ‡



Straight three part union
Copper flare nut–**both ends**

H-15400N

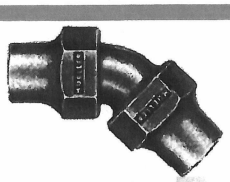
1/2"	5/8"	5/8" x 1/2"	5/8" x 3/4"	3/4"	3/4" x 1/2"
3/4" x 1"	1"	1-1/4"	1-1/4' x 1"	1-1/2"	2"



Quarter bend coupling
Copper flare nut x F.I.P.

H-15460N

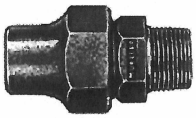
3/4"	1"	1" x 3/4"	1-1/4"‡	1-1/2"‡	2"



Eighth bend three part union
Copper flare nut–**both ends**

H-15522N

3/4"	1"



Straight coupling
Copper flare nut x M.I.P.

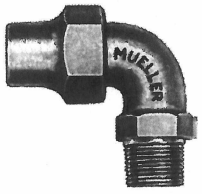
H-15425N

1/2"‡	1/2" x 3/4"		5/8" x 3/4"	3/4"	5/8" x 1/2"	3/4" x 1/2"
3/4" x 1"	1"	1" x 3/4"	1" x 1-1/4"‡	1-1/4"	1-1/2"	2"

Quarter bend three part union
Copper flare nut–**both ends**

H-15525N

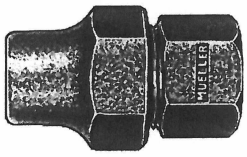
3/4"	3/4" x 1"	1"	1-1/2"	2"



Quarter bend coupling
Copper flare nut x M.I.P.

H-15530N

1/2"‡	3/4"	3/4" x 1"	1"	1" x 3/4"	1-1/2"‡	2"



Straight coupling
Copper flare nut x F.I.P.

H-15450N

1/2"	1/2" x 3/4"‡	5/8" x 3/4"	3/4"	3/4" x 1/2"	1"
1" x 3/4"	1-1/4"	1-1/2"	2"		

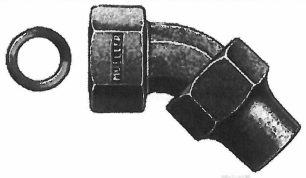
Eighth bend coupling M.I.P x copper flare nut

H-15539N

3/4"	1"

NOTE: Sizes shown above represent normal size of fitting. When two sizes are given, the first is size of copper flare nut and second is size of threaded end.
‡Requires minimum ordering quantity. Contact MUELLER Customer Service Center for minimum ordering requirements and availability.
MUELLER Service Fittings are manufactured and tested in accordance with ANSI/AWWA C800. Components in contact with potable water will also comply with latest requirements of the Federal Safe Drinking Water Act.

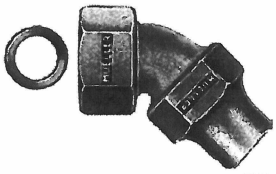
SERVICE FITINGS WITH COPPER FLARE CONNECTION



Eighth bend coupling Swivel nut with female copper flare thread x copper flare nut

H-15064N

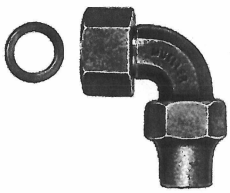
3/4"	1"



Eighth bend coupling Swivel nut with female MUELLER® Coupling thread x copper flare nut

H-15486N

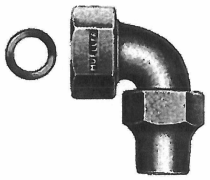
1/2" x 3/4"	5/8" x 3/4"	3/4"	3/4" x 1"	1"



Quarter bend coupling Swivel nut with female copper flare thread x copper flare nut

H-15069N

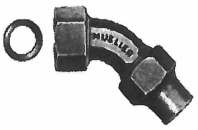
3/4"	1"	3/4" x 1"	1-1/2"	2"



Quarter bend coupling Swivel nut with female MUELLER Coupling thread x copper flare nut

H-15491N

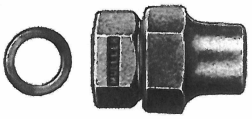
1/2" x 3/4"	5/8" x 3/4"	3/4"	3/4" x 1"	1"



Eighth bend coupling Swivel nut with female increasing I.P. thread (this thread is one size larger than nominal size of fitting) x copper flare nut

H-15471N

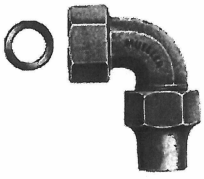
3/4"	1"‡



Straight coupling Female copper flare thread x copper flare nut

H-15062N

3/4"x1"	1"x3/4"	1"x1-1/4"



Quarter bend coupling Swivel nut with female increasing I.P. thread (this thread is one size larger than nominal size of fitting) x copper flare nut

H-15476N

3/4"	1"

Eighth bend coupling Female copper flare thread x copper flare nut

H-15063N

3/4"	1"	1-1/2"	2"

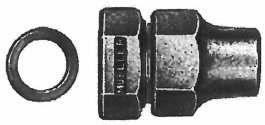
Note: Sizes shown above represent nominal size of fitting. When two sizes are listed, the first is the size of threaded end and the second is size of copper flare nut.
‡Requires minimum ordering quantity. Contact MUELLER Customer Center for minimum order requirements and availability.
MUELLER Service Fittings are manufactured and tested in accordance with ANSI/AWWA C800. Components in contact with potable water will also comply with latest requirements of the Federal Safe Drinking Water Act.

SERVICE FITTINGS WITH COPPER FLARE CONNECTION

H-15068N

Quarter bend coupling Female copper flare thread x copper flare nut

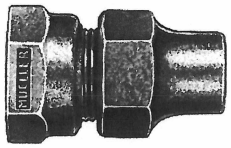
3/4"	1"	1"x3/4"	1-1/4" ‡	1-1/2"	2"



H-15480N

Straight coupling Female MUELLER® Coupling thread x copper flare nut

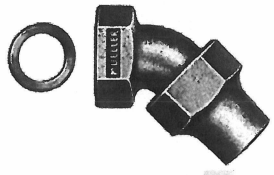
1/2"x 3/4"	5/8"x 3/4"	3/4"	3/4" x 1"	1"	1" x 3/4"



H-15465N

Straight coupling Female increasing I.P.thread (this thread is one size larger than nominal size of fitting) x copper flare nut

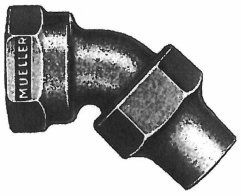
3/4"	1-1/2" ‡	2" ‡



H-15485N

Eighth bend coupling Female MUELLER Coupling thread x copper flare nut

1/2"x3/4"	5/8"x3/4"	5/8" x 1"	3/4"	3/4"x1"	1"	1"x3/4"



H-15470N

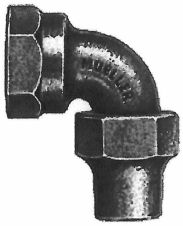
Eighth bend coupling Female increasing I.P. thread (this thread is one size larger than nominal size of fitting) x copper flare nut

3/4"	1"	1-1/4"	1-1/2"	2"

H-15490N

Quarter bend coupling Female MUELLER Coupling thread x copper flare nut

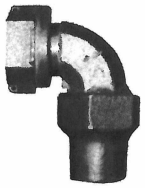
1/2"x3/4"	5/8"x3/4"	3/4"	1"	1"x3/4"



H-15475N

Quarter bend coupling Female increasing I.P. thread (this thread is one size larger than nominal size of fitting) x copper flare nut

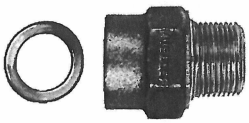
3/4"	1"	1-1/2"	2"



H-15551N

Quarter bend coupling Internal swivel connection for 110 compression or pack joint CTS x copper flare nut

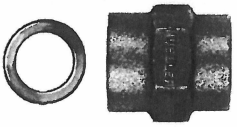
3/4"	1"



H-15098N

Straight coupling Female copper flare thread x M.I.P. thread

3/4"	1"



H-15082N

Straight coupling Female copper flare thread x F.I.P. thread

3/4"	1"	1-1/2"	2"

NOTE: Sizes shown above represent nominal size of fitting. When two sizes are listed, the first is the size of the threaded end and the second is size of copper flare nut.

‡Requires minimum ordering quantity. Contact MUELLER Customer Service Center for minimum order requirements and availability.

MUELLER Service Fittings are manufactured in accordance with ANSI/AWWA C800. Components in contact with potable water will also comply with latest requirements of the Federal Safe Drinking Water Act.

SERVICE FITTINGS WITH MUELLER 110® COMPRESSION CONNECTION

H-15403N

Straight three part union MUELLER 110® Conductive Compression Connection for CTS O.D.* tubing-**both ends**

1/2"	1/2"x3/4"	5/8"x3/4"	5/8"	3/4"	1"	1"x3/4"
1"x3/4"	1-1/4"	1-1/4"x1"	1-1/2"	1-1/2"x1"	2"	

H-15428N

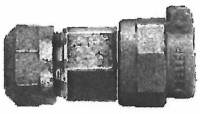
Straight coupling MUELLER 110 Conductive Compression Connection for CTS O.D.* tubing x M.I.P. thread

1/2"‡	1/2" x 3/4"	5/8" x 3/4"	3/4"	3/4" x 1/2"	3/4" x 1"
1"	1" x 3/4"	1-1/4"	1-1/4" x 1"		1-1/2"
1-1/2" x 1"		1-1/2" x 2"	1" x 2"	2"	2" x 1-1/2"

H-15404N

Straight three part union MUELLER 110® Compression Connection for IPS PE* pipe-**both ends**

3/4"	1"	1"x3/4"



E-15409N

Straight coupling MUELLER 110 Conductive Compression Connection for CTS O.D. tubing x Pack Joint Connection for IPS PE pipe

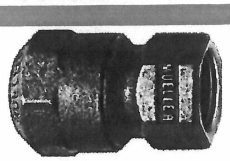
**Note: 3/4" size only may also be used on PVC

3/4"**	3/4"x1"	1"	1"x3/4"	1"x1-1/4"

H-15413N

Straight Female MUELLER Coupling Thread x 110 CTS Conductive Compression Connection for CTS O.D.

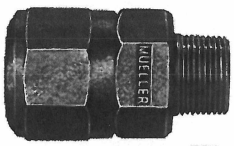
1"



H-15451N

Straight coupling MUELLER 110 Conductive Compression Connection for CTS O.D.* tubing x F.I.P. thread

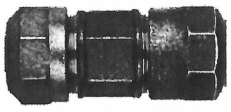
1/2"	1/2" x 3/4"	5/8" x 3/4"	3/4"	3/4" x 1/2"	3/4" x 1"
1"	1" x 3/4"	1" x 1-1/4"	1-1/4"	1-1/4" x 1"	1-1/2"
1-1/2" x 1"		2"	2" x 1-1/2"		



H-15429N

Straight coupling MUELLER 110 Compression Connection for IPS PE* pipe x M.I.P. thread

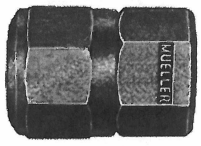
3/4"	1"	1"x3/4"



H-15409N

Straight three part union MUELLER 110 Conductive Compression Connection for CTS O.D.* tubing x 110 Compression Connection for IPS PE* pipe

3/4"	3/4"x1"	1"	1"x3/4"



H-15454N

Straight coupling MUELLER 110 Compression Connection for IPS PE* pipe x F.I.P. thread

3/4"	1"	1"x3/4"

H-15413N

Straight coupling MUELLER 110 Conductive Compression Connection for CTS O.D. tubing x copper flare nut

3/4"	1"

*See chart on page 6.11 for tubing and pipe that may be used with these connections.

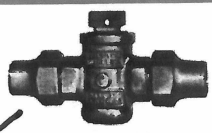
‡Requires minimum ordering quantity. Contact MUELLER Customer Service Center for minimum ordering requirements and availability.

NOTE: Sizes shown above represent nominal size of fitting. When two sizes are given, first is size of MUELLER 110 Compression Connection and second is size of threaded end.

MUELLER Service Fittings are manufactured and tested in accordance with ANSI/AWWA C800. Components in contact with potable water will also comply with latest requirements of the Federal Safe Drinking Water Act.

MUELLER® MARK II ORISEAL® CURB VALVES WITH COPPER FLARE CONNECTION

Shaded area indicates change Rev. 8-13



✓ **H-15204N**

MUELLER MARK II
ORISEAL Curb Valve
Copper flare nut - **both ends**
Quarter turn check

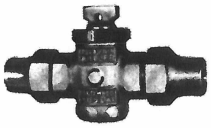
3/4"	1"	1-1/4"	1-1/2"	2"

NOTE: 3/4" and 1" sizes are bi-directional and can be installed with flow from either direction. Sizes larger than 1" are one way flow and must be installed with flow as indicated by arrow and in/out lettering cast on valve body.

H-15214N

MUELLER MARK II
ORISEAL Curb Valve
Copper flare nut - **both ends**
Quarter turn check and drain

3/4"	1"	1-1/4"	1-1/2"	2"

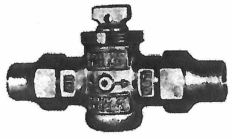


H-15154N

MUELLER MARK II
ORISEAL Curb Valve Copper flare nut - **both ends**
Quarter turn check and Minneapolis thread top

3/4"	1"	1-1/4"	1-1/2"	2"

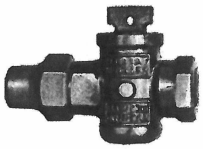
NOTE: 3/4" and 1" sizes are bi-directional and can be installed with flow from either direction. Sizes larger than 1" are one way flow and must be installed with flow as indicated by arrow and in/out lettering cast on valve body.



H-15164N

MUELLER MARK II
ORISEAL Curb Valve
Copper flare nut - **both ends**
Quarter turn check,
Minneapolis thread top and drain

3/4"	1"	1-1/4"	1-1/2"	2"

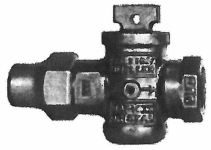


H-15174N

MUELLER MARK II
ORISEAL Curb Valve
Inlet: Copper flare nut
Outlet: F.I.P. thread
Quarter turn check

3/4"	1"	1-1/4"	1-1/2"	2"

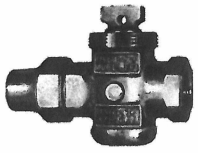
NOTE: 3/4" and 1" sizes are bi-directional and can be installed with flow from either direction. Sizes larger than 1" are one way flow and must be installed with flow as indicated by arrow and in/out lettering cast on valve body.



H-15184N

MUELLER MARK II
ORISEAL Curb Valve
Inlet: Copper flare nut
Outlet: F.I.P. thread
Quarter turn check with drain

3/4"	1"	1-1/2" ‡□	2" ‡□



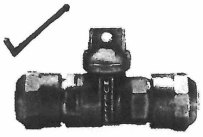
H-15124N

MUELLER MARK II
ORISEAL Curb Valve
Inlet: Copper flare nut
Outlet: F.I.P. thread
Quarter turn check and Minneapolis top thread

3/4"	1" ‡□

NOTE: Sizes shown above represent nominal size of valve.
‡Requires minimum ordering quantity. Contact MUELLER Customer Service Center for minimum ordering requirements and availability.
MUELLER Curb Valves are manufactured and tested in accordance with ANSI/AWWA C800. Components in contact with potable water will also comply with latest requirements of the Federal Safe Drinking Water Act.

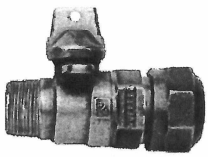
MUELLER® 300™ BALL CURB VALVES WITH MUELLER 110® CONNECTION



B-25209N

MUELLER 300 Ball Curb Valve MUELLER 110 Conductive Compression Connection for CTS O.D.* tubing - **both ends**. Quarter turn check - this valve may be ordered with 360° turn option by adding -3 to end of catalog number (B-25209-3)

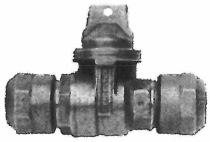
3/4" R	3/4"	1" R	1"	1-1/2"	1-1/2"x2"
2"					



B-25122N

MUELLER 300 Ball Curb Valve
Inlet: MUELLER 110 Conductive Compression Connection for CTS O.D.* tubing
Outlet: M.I.P. thread. Quarter turn check - this valve may be ordered with 360° turn option by adding -3 to end of catalog number (B-25122-3)

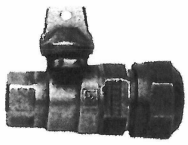
3/4"R	3/4"	3/4"x1"	1"R	1"	1-1/2"	2"



B-25155N

MUELLER 300 Ball Curb Valve MUELLER 110 Conductive Compression Connection for CTS O.D.* tubing - **both ends**. Quarter turn check and Minneapolis top thread - this valve may be ordered with 360° turn option by adding -3 to end of catalog number (B-25155-3)

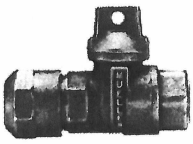
3/4"	1"	1-1/2"	2"



B-25171N

MUELLER 300 Curb Valve
Inlet: MUELLER 110 Compression Connection for IPS PE* pipe
Outlet: F.I.P. thread
Quarter turn check - this valve may be ordered with 360° turn option by adding -3 to end of catalog number (B-25171-3)

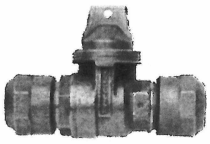
3/4"	1"



B-25172N

MUELLER 300 Ball Curb Valve
Inlet: MUELLER 110 Conductive Compression Connection for CTS O.D.* tubing
Outlet: F.I.P. thread. Quarter turn check this valve may be ordered with 360° turn option by adding -3 to end of catalog number (B-25172-3)

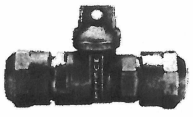
3/4"R	3/4"	3/4"x1"	1"R	1"	1-1/2"	2"



B-25152N

MUELLER 300 Ball Curb Valve
Inlet: MUELLER 110 Conductive Compression Connection for CTS O.D.* tubing
Outlet: MUELLER 110 Compression Connection for IPS PE* pipe
Minneapolis top thread - this valve may be ordered with 360° turn option by adding -3 to end of catalog number (B-25152-3)

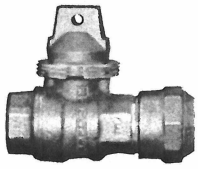
3/4"	1"



B-25210N

MUELLER 300 Ball Curb Valve
Inlet: MUELLER 110 Conductive Compression Connection for CTS O.D.* tubing
Outlet: MUELLER 110 Compression Connection for IPS PE* pipe
Quarter turn check - this valve may be ordered with 360° turn option by adding -3 to end of catalog number (B-25210-3)

3/4"	1"



B-25163N

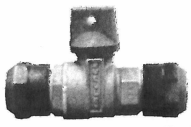
MUELLER 300 Ball Curb Valve
Inlet: MUELLER 110 Conductive Compression Connection for CTS O.D.* tubing
Outlet: F.I.P. thread
Minneapolis top thread - this valve may be ordered with 360° turn option by adding -3 to end of catalog number (B-25163-3)

3/4"	1"	1-1/2"	2"

B-25211N

MUELLER 300 Ball Curb Valve MUELLER 110 Conductive Compression Connection for IPS PE* pipe - **both ends**.
Minneapolis top thread - this valve may be ordered with 360° turn option by adding -3 to end of catalog number (B-25211-3)

3/4"	1"



B-25219N

MUELLER 300 Ball Curb Valve MUELLER 110 Conductive Compression Connection for CTS O.D.* tubing with drain - **both ends**.
Minneapolis top thread - this valve may be ordered with 360° turn option by adding -3 to end of catalog number (B-25219-3)

3/4"

*See page 7.18 for tubing and pipe that can be used with this connection.
NOTE: Sizes shown above represent nominal size of valve.
"R" means Reduced port. Ball waterway is one nominal size smaller than inlet/outlet.
MUELLER Curb Valves are manufactured and tested in accordance with ANSI/AWWA C800. Components in contact with potable water will also comply with latest requirements of the Federal Safe Drinking Water Act.

CURB BOXES - EXTENSION TYPE WITH ARCH PATTERN BASE

Extension type curb box with arch pattern base-for 1/2" through 2" curb valves

The arched base rests on top of the valve and extends down around the valve head to help exclude dirt and debris. The box is cast iron and is furnished with a cast iron lid and brass pentagon plug (the H-10314 is furnished with a one piece lid that requires a spanner wrench to remove – wrench ordered separately). The upper part of the box is spring loaded and telescopes into the base to allow for grade adjustment within the range given in the dimension charts. Stationery rods, shut-off rods, and pentagon keys are optional and are ordered separately.

Box Selection

Curb Valve & Size	Box	
	Catalog Number	Inside Diameter
300™ Ball		
3/4"	H-10306	1-1/4"
	H-10308	1-1/2"
	H-10314	1"
	H10334	1"
1"	H-10306	1-1/4"
	H-10308	1-1/2"
	H-10314	1"
	H10334	1"
1-1/2"	H-10310	2"
MARKII®		
3/4"	H-10306	1-1/4"
	H-10308	1-1/2"
1"	H-10306	1-1/4"
	H-10308	1-1/2"
1-1/4"	H-10310	2"
	H-10314**	1"
	H-10334**	1"
1-1/2"	H-10310	2"
2"	H-10310	2"
ORISEALIII®		
3/4"	H-10306	1-1/4"
	H-10308	1-1/2"
	H-10314**	1"
	H-10334**	1"
1"	H-10306	1-1/4"
	H-10308	1-1/2"
	H-10314**	1"
	H-10334**	1"
Inverted Key Curb Valve		
3/4"	H-10306	1-1/4"
	H-10308	1-1/2"
	H-10314**	1"
	H-10334**	1"
1"	H-10306	1-1/4"
	H-10308	1-1/2"
	H-10314**	1"
	H-10334**	1"

**The H-10314 and H-10334 boxes are the same except the H-10314 is furnished with a one piece lid, the H10334 has a combination lid and pentagon plug.

TO ORDER BOXES SPECIFY EXTENDED LENGTH AND CATALOG NUMBER

CURB BOXES - EXTENSION TYPE WITH ARCH PATTERN BASE

Dimensions and Optional Stationary Rod

H-10306 and H-10308 Curb Boxes

Curb box catalog number	Box length extended		Box length fully retracted		Weight		Optional stationary rod	
	Inch	mm	Inch	mm	lbs.	kg.	Part No.	L'gth inch
H-10306	24	610	18.00	457.0	12.0	5.4	84774	12.75
	30	762	18.00	457.0	14.0	6.4	84346	15.0
	36	914	24.00	610.0	15.0	6.8	84275	21.0
	42	1067	30.00	762.0	16.0	7.3	84233	27.0
1-1/4" upper section	48	1219	36.00	914.0	17.0	7.7	84245	33.0
	54	1372	42.00	1067.0	18.0	8.2	84247	39.0
	60	1524	48.00	1219.0	19.0	8.6	84154	45.0
	66	1676	54.00	1372.0	20.0	9.1	84261	51.0
	72	1829	60.00	1524.0	22.0	10.0	84341	57.0
	78	1981	66.00	1676.0	23.0	10.4	84297	63.0
	84	2134	72.00	1829.0	24.0	10.9	84152	69.0
	90	2286	78.00	1981.0	25.0	11.3	88703	75.0
	96	2438	84.00	2143.0	26.0	11.8	84274	81.0
H-10308	24	610	20.44	519.2	13.0	5.9		
	30	762	20.44	519.2	15.0	6.8	84742	15.0
	36	914	24.00	610.0	16.0	7.3	84256	21.0
	42	1067	30.00	762.0	17.0	7.7	84326	27.0
1-1/2" upper section	48	1219	36.00	914.0	18.0	8.2	84305	33.0
	54	1372	42.00	1067.0	20.0	9.1	84338	39.0
	60	1524	48.00	1219.0	21.0	9.5	84353	45.0
	66	1676	54.00	1372.0	22.0	10.0	88702	51.0
	72	1829	60.00	1524.0	23.0	10.4	84255	57.0
	78	1981	66.00	1676.0	25.0	11.3	83299	63.0
	84	2134	72.00	1829.0	26.0	11.8	80643	69.0
	90	2286	78.00	1981.0	27.0	12.2	84832	75.0
	96	2438	84.00	2143.0	28.0	12.7	88139	81.0

H-10310, H-10314 and H-10334 Curb boxes

Curb box catalog number	Box length extended		Box length fully retracted		Weight		Optional stationary rod*	
	Inch	mm	Inch	mm	lbs.	kg.	Part No	L'gth inches
H-10310	24	610	21.44	544.5	21.0	9.5		
	30	762	21.44	544.5	23.0	10.4	84146	15.0
	36	914	24.00	610.0	25.0	11.3	84162	21.0
	42	1067	30.00	762.0	27.0	12.2	84147	27.0
2" upper section	48	1219	36.00	914.0	28.0	12.7	84176	33.0
	54	1372	42.00	1067.0	30.0	13.6	84139	39.0
	60	1524	48.00	1219.0	32.0	14.5	84140	45.0
	66	1676	54.00	1372.0	34.0	15.4	84128	51.0
	72	1829	60.00	1524.0	35.0	15.9	84143	57.0
	78	1981	66.00	1676.0	37.0	16.8	84222	63.0
	84	2134	72.00	1829.0	39.0	17.7	84169	69.0
	90	2286	78.00	1981.0	41.0	18.6		
	96	2438	84.00	2134.0	43.0	19.5		
H-10314**	24	610	18.00	305.0	9.5	4.3	82875	11.25
H-10334**	30	762	18.00	457.0	10.0	4.5	82892	16.75
	36	914	24.00	610.0	11.0	5.0	82862	21.0
	42	1067	30.00	762.0	12.0	5.4	82863	27.0
	48	1219	36.00	914.0	14.0	6.4	82864	33.0
1" upper section	54	1372	42.00	1067.0	15.0	6.8	82865	39.0
	60	1524	48.00	1219.0	16.0	7.3	82866	45.0
	66	1676	54.00	1372.0	17.0	7.7	82867	51.0
	72	1829	60.00	1524.0	18.0	8.2	82868	57.0
	78	1981	66.00	1676.0	19.0	8.6	82869	63.0
	84	2134	72.00	1829.0	20.0	9.1	82870	69.0
	90	2286	78.00	1981.0	21.0	9.5	82871	75.0

Extra lids and plug

Lids are cast iron with an integrally cast brass bushing which allows for easy removal of pentagon plug.

Lid with Plug

Plug only

One piece lid

Curb Box Catalog number	One piece lid part number	Lid with brass pentagon plug - part number	Lid with brass bushing and cast iron plug	Plug only part number	
				Cast Iron	Brass
H-10306	-	89369	89375	58039	63670
H-10308	-	581642	89980	58116	63683
H-10310	89982	681714	89981	59478	63684
H-10314	-	-	-	-	-
H-10334		89376	89376	-	36571

* Stationary rods are supplied with H-10314 and H-10334 only. Stationary rods are optional with all other boxes shown on this page and must be ordered separately.

** The H-10314 and H-10334 boxes are the same except the H-10314 is furnished with a one piece lid, the H-10334 has a combination lid and pentagon plug.

TO ORDER BOXES SPECIFY EXTENDED LENGTH AND CATALOG NUMBER

GENERAL SPECIFICATIONS PAVEMENT-CONCRETE WORK

1.00 GENERAL

1.01 WORK INCLUDED: The work in this section includes materials, mixing proportioning, sampling, testing, placing and finishing of all reinforced regular and lightweight concrete. Included also are formwork, reinforcing, scaffolding (as required), curing and related items. All of this work as mentioned shall be included in the unit price of the item.

2.00 APPLICABLE STANDARDS

2.01 AMERICAN SOCIETY FOR TESTING MATERIALS (CURRENT ISSUE REQUIRED): As follows:

A-615	Specifications for Billet-Steel Bars for Concrete Reinforcement
A-616	Specifications for Rail-Steel Bars for Concrete Reinforcement
A-617	Specifications for Axle-Steel Bars for Concrete Reinforcement
A-184	Specs for Fabricated Steel Bar or Rad Masts for Concrete Reinforcement
A-185	Specs for Welded Steel Wire Fabric for Concrete Reinforcement
C-31	Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Field
C-33	Specifications for Concrete Aggregates
C-39	Method of Test for Compressive Strength of Molded Concrete Cylinders
C-42	Method of Securing, preparing and Testing Specimens from Hardened Concrete for Compressive and Flexural Strengths
C-94	Specifications for Ready-Mixed Concrete
C-143	Method of Test for Slump of Portland Cement Concrete
C-150	Specifications for Portland Cement
C-172	Method of Sampling Fresh Concrete
C-175	Specifications for Air-Entraining Portland Cement
C-192	Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Laboratory
C-231	Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method
C-260	Specifications for Air-Entraining Admixtures
C-330	Specifications for Lightweight Aggregates for Structural Concrete
C-494	Specification for Chemical Admixtures for Concrete
C-595	Specification for Blended Cements

The Contractor shall comply with the aforementioned standards; should copies be required, they may be obtained at the Contractor's expense from:

American Society for Testing Materials
http://www.astm.org/

2.02 **AMERICAN CONCRETE INSTITUTE (CURRENT ISSUE REQUIRED)**: As follows:

ACT 214	Recommended Practice for Evaluation of Compression Test Results of Field Concrete
ACT 301	Suggested Specifications for Structural Concrete Buildings
ACT 306	Recommended Practice for Cold Weather Concreting
ACT 318	Building Code Requirements for Reinforced Concrete
ACT 347	Recommended Practice for Concrete Formwork
ACT 605	Recommended Practice for Hot Weather Concreting
ACT 613	Recommended Practice for Selecting Proportions for Concrete
ACT 614	Recommended Practice for Measuring, Mixing & Placing Concrete

The Contractor shall comply with the above standards; should copies be required, they may be obtained at the Contractor's expense from:

American Concrete Institute
http://www.concrete.org/general/home.asp

2.03 **CONCRETE REINFORCING STEEL INSTITUTE**: As follows:

CRSI 59	Recommended Practice for Placing Reinforcing Bars
CRSI 63	Recommended Practice for Placing Bar Supports, Specifications and Nomenclature 1963.

The Contractor shall comply with the above standards; should copies be required, they may be obtained at the Contractor's expense from:

Concrete Reinforcing Steel Institute
http://www.crsi.org/

2.04 **COMPLIANCE WITH THE PRECEDING SPECIFICATIONS**: Any procedure, material or operation specified by reference to the American Society for Testing and Materials (ASTM), the American Concrete Institute (ACI), the Concrete Reinforcing Steel Institute (CRSI), Local Building Code, or others, shall comply with the requirements of the current specification or standard listed. This specification shall govern in conflict between this specification and listed standards; in conflicts between listed standards, the more stringent requirements shall govern.

3.00 MATERIALS

3.01 **CEMENT**: Cement shall be Portland Cement conforming to the current ASTM Specification C-150, type 1, or ASTM Specification C-175, Type 1A.

3.02 **REGULAR AGGREGATE**: Fine and coarse aggregates shall conform to current ASTM Specification C-33.

3.03 **LIGHTWEIGHT AGGREGATES**: Aggregate shall be expanded shale, clay, slate, or slag and shall conform to ASTM C-330. Natural sand shall conform to C-33.

3.04 **WATER**: The water shall be clean and free from injurious amounts of oil, acids, alkalis, organic materials or deleterious substances.

3.05 **AIR-ENTRAINING AGENT**: Air-entraining agent shall be neutralized vinsol resin solution or approved substitute conforming to ASTM C-260.

3.06 **WATER-REDUCING, SET-CONTROLLING ADMIXTURE**: The water-reducing agent shall be Pozzolith conforming to ASTM C-494, Type A.

3.07 **METAL REINFORCEMENT**: Metal reinforcing bars shall conform to the requirements of the Specifications for Steel Bars for Concrete Reinforcement.

3.08 **EXPANSION JOINT FILLER**: Joint fillers shall extend full depth of slab or joints and be of thickness shown on drawings.

3.09 **CONTROL JOINT FILLER**: Control joint filler shall be as shown on the drawings.

4.00 PROPORTIONING OF MATERIALS

4.01 **COMPOSITION**: The concrete shall be composed of Portland Cement, fine aggregate, coarse aggregate, water, admixtures, and air-entraining agent as required.

4.02 **PROPORTIONING OF MIXTURES**: Regular concrete shall be proportioned in accordance with ACI-613 and lightweight concrete in accordance with ACI-613A to attain properties of strength slump, entrained air content and rate of hardening in conformance with the following requirements:

A. Maximum Size Coarse Aggregate - Maximum size coarse aggregates shall be not larger than one-fifth of the narrowest dimension between the sides of the forms of the member for which the concrete is to be used, nor larger than three-fourths of the minimum clear spacing between reinforcing bars.

B. Strength and Slumps - All concrete shall have a minimum 28-day compressive strength and maximum slump as follows:

TYPE Of CONSTRUCTION	MIN. COMPRESSIVE STRENGTH	MAXIMUM SLUMP
Reinforced Concrete	3,500 p.s.i.	4"
Non-reinforced Heavy mass concrete	3,500 p.s.i.	4"

C. Air Entrainment: - The air content in all concrete exposed to weathering shall be maintained in accordance with the recommended total air content of 6.5%± 1-1/2%. All concrete for floor slabs which are to receive metallic or non-metallic dustcoat surface hardener, the air content shall not exceed 3% C-260 and C-494.

D. Rate of Hardening - The rate of hardening for structural concrete over 90^{o} F shall be retarded and under 50^{o} F shall be accelerated. All other concrete shall have a normal rate of hardening, ACI-306, ACI-605 and C-494.

E. Limits - All concrete shall be proportioned to meet strength, workability and durability requirements in accordance with ACI-301 and ACI-318.

4.03 **STATEMENT OF PROPORTIONS**: **At least 14 days prior to beginning work, the Contractor shall submit a statement of the proportions proposed for the concrete.** This shall be accompanied by reports and data regarding proportions previously used and strength tests performed on concrete of the same or similar requirements, or by a report in detail from an approved testing laboratory or inspection service showing, for at least three different water contents, the 7-day and 28-day concrete strength obtained when using the materials proposed for the work.

All such reports and tests shall be made at the expense of the Contractor.

4.04 **GROUT**: Proportions of grout, by volume, for filling block cores are 1 part Portland cement, 2-1/2 parts fine aggregate and 1-1/2 parts coarse aggregate, maximum size 3/8 inch.

5.00 BATCHING OF MATERIALS AND PLACING

5.01 **READY-MIXED CONCRETE**: Ready-mixed concrete shall be used and shall conform to ASTM C-94 (alternate No. 2) ACI-301 and ACI-614 and MDOT 2012 Standard Specifications for Construction Section 601.01 thru 601.03. Concrete sidewalk shall contain 6 sacks (564 lbs.) of cement per cubic yard with a **30% Slag Cement** content.

A load ticket shall be provided for load used on the project. The ticket shall indicate the mixture composition, batch time and loading time. The driver shall note the time of load completion and the amount of water added at the job site.

5.02 **COLD WEATHER BATCHING**: When the temperature falls below 40^{o} F or is likely to fall below 40^{o} F during the 24 hour period after placing, equipment shall be provided for heating the concrete materials. Place concrete shall be protected with insulating blankets or 12 inches of straw covered with plastic visqueen; heaters shall be used where necessary to maintain a concrete temperature of 50^{o} F or higher. When cold weather addressed above is expected the Slag Cement mixture noted above may be reduced to 20% slag cement content. No frozen materials or materials containing ice shall be used in cold weather. Temperatures of the separate materials, including the mixing water, when placed in the mixer shall not exceed 90^{o} F. When placed in forms, the concrete shall have a temperature between 50^{o} F and 90^{o} F, ACI-306, refer to MDOT requirements, see section 5.01 above.

5.03 **RETEMPERING**: Concrete shall be mixed in such quantities as are required for immediate use and shall be placed while fresh, before loss of slump occurs. Retempering (adding water to restore slump lost during excessive mixing or during too long an elapse of time since initial mixing) will not be permitted.

5.04 **CONVEYING**: Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of materials. Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete out the delivery end without separation of the materials.

5.05 **PLACING OF CONCRETE**: Placing of concrete shall be in accordance with ACI-614. Concrete shall be consolidated by means of mechanical vibrating equipment. The number of vibrators used shall be sufficient to consolidate the concrete properly. At

least one standby vibrator shall be on hand at all times that concrete is being placed. The concrete shall not drop freely more than 3 feet.

5.06 **PLACING OF GROUT**: Placing of grout in block cores shall be done in a continuous pour, in lifts not exceeding 4 feet. It shall be consolidated by puddling, rodding or vibrating during placing and reconsolidated after excess moisture has been absorbed, but before plasticity is lost.

Grout shall be placed by pumping, poured from buckets equipped with spouts or an approved alternate method.

5.07 **NEW CONCRETE ON SET CONCRETE**: Before depositing new concrete on or against concrete which has set, the surface of the set concrete shall be roughened as required, and cleaned of all foreign matter and laitance. It shall be saturated with water and with a coat of mortar grout applied, and the concrete placed while the grout is still soft.

5.08 **TEST SPECIMENS**: The Engineer will make arrangements with an independent laboratory, for performing quality control tests. Test cylinders shall be protected by the Contractor as required in the Materials Testing specification.

5.09 **PAYMENT FOR TEST SPECIMENS**: As specified in the "General Specifications for Materials Testing".

6.00 FORM WORK

6.01 **INSTALLATION**: Forms shall conform with the working drawings to shape, line and dimensions of members and shall be substantially free from surface defects, full height, sufficiently tight to prevent leakage. They shall be properly braced and tied to maintain position and shape. Forms shall be in accordance with ACI-347.

6.02 **REMOVAL**: Remove forms in a manner and at such time to insure complete safety of the structure. In no case shall supporting forms or shoring be removed until sufficient strength has been obtained to support weight and load.

7.00 EXPOSED FINISH

7.01 **RUBBED FINISH**: Where called for, all exposed concrete shall receive a rubbed finish. All projections shall be removed, damages repaired and all offsets leveled. The first rubbing shall be done with coarse carborundum stones as soon as the concrete is hard enough so that the aggregate is not pulled out by the operation. The concrete will then be cured until the final rubbing is done with a fine carborundum stone and water. This rubbing shall be continued until the entire surface is of a smooth texture and uniform color. After the final rubbing and surface has dried, it shall be rubbed with burlap to remove loose powder. The final surface shall be uniform, smooth and clean.

7.02 **CLEANING NEW CONCRETE**: When a rubbed finish is not called for, all exposed surfaced shall be cleaned with a grout. Grout shall consist of 1 part Portland cement and 1-1/2 to 2 parts fine sand. Apply the grout by rubbing it on with burlap, completely filling all pits. When dried sufficiently so that it will not smear, remove most excess grout by rubbing with clean burlap. Continue curing for 2 days. Allow surface to dry and

thoroughly rub with clean burlap to remove all excess grout. The final surface shall be smooth and of uniform color and texture.

7.03 **HORIZONTAL SURFACES (SLABS, WALKS, ETC.)**: Walks shall be struck off and floated to a smooth uniform surface with a metal float. All edges shall be rounded to a radius of 1/3 inch with an approved finished tool. The surface shall then be brushed to slightly roughen the surface.

All other exposed horizontal concrete surfaces shall be struck off and floated to a smooth uniform surface and troweled to a hard finish with a steel trowel.

Floor slabs shall drain to floor drain as shown on plans.

8.00 METAL REINFORCEMENT

8.01 **CLEANING AND BENDING**: Reinforcement, at the time concrete is placed, shall be free from rust scale, hardened concrete, or other coatings that will destroy or reduce the bond. Bars shall be bent cold.

8.02 **PLACING REINFORCEMENT**: Metal reinforcement shall be accurately placed in accordance with the plans and shall be adequately secured in position by concrete or metal chairs and spacers.

8.03 **SPLICES**: Necessary splices not shown on drawings shall be lapped in accordance with the ACI-318 Specifications.

9.00 CONSTRUCTION JOINTS

9.01 **USE AND LOCATION**: The use and location of monolithic construction joints shall be subject to prior approval of the Engineer. Where a joint is to be made, the surface of the concrete shall be roughened, as required, thoroughly cleaned, and all laitance removed. In addition, vertical joints shall be thoroughly wetted and immediately applied with a coat of neat cement grout before the placing of new concrete.

At least 2 hours must elapse after depositing in the columns or walls before depositing in beams or slabs supported thereon.

10.00 **CURING**: Curing membrane shall be applied **immediately** after the concrete has been broomed / textured and setup sufficiently to prevent damage thereto.

Curing compounds shall meet the requirements of Section 903.06 of the MDOT 2012 Standard Specifications for Construction.

Failure to cure concrete immediately following placement can result in cancellation of further pours and shall be considered as justification for future removal and replacement of subject concrete as warranted.

Other curing methods may be used only with the written acceptance of the Engineer.

11.00 STANDARDS FOR CONCRETE PAVEMENT REMOVAL AND REPLACEMENT

11.01 SAW CUTS: As follows:

A. All saw cuts shall be parallel to existing joints or back of curbs. All transverse saw cuts and joints shall be perpendicular to back of curbs and existing longitudinal joints. All longitudinal saw cuts and joints shall be parallel to back of curbs or existing longitudinal joints.

B. No saw cuts shall be made closer than 5 feet to an existing joint and any pavement removal shall be to a width of no less than 5 feet.

C. The preceding standards shall apply to all saw cuts except for the following three conditions:

1. When replacing a spalled transverse joint, saw cuts may be done 2 feet from each side of the transverse joint.

2. When replacing integral curb, saw cuts shall be done 2 feet in from the back of curb.

3. When replacing spalling at the intersection of a transverse and longitudinal joint, saw cuts may be done at a 45 degree angle to the existing joints provided that the saw cuts begin and end no more than 5 feet and no less than 2 feet from the intersection of the transverse and longitudinal joint.

D. All saw cuts for pavement removal shall be full depth of the pavement thickness.

E. Slurry produced from saw cutting within pedestrian areas shall be washed away immediately to prevent hazardous conditions.

11.02 DIAMOND GRINDING: Concrete diamond grinding shall only be performed at the direction of the Engineer. All work shall conform to the 2012 MDOT Standard Specifications for Construction, Section 603.

11.03 FORMS: All forms shall be straight and secured to insure rigidity so that the finished pavement does not exceed the following limits when tested with a 15 foot straight edge.

A. Vertical Limit - the variation of the surface from the testing edge of the straight edge shall at no point exceed 3/16 inches.
B. Horizontal Limit - The variation of a joint or back of curb from the testing edge of the straight edge shall at no point exceed 3/4 inches.

11.04 BULKHEAD JOINTS: As follows:

A. Bulkhead joints between new and existing pavement shall be made with hook bolts whenever possible. Hook bolts shall be 5/8 inches in diameter and anchored to the existing pavement at 3 feet on center maximum for transverse joints and 4 feet on center maximum for longitudinal joints. Hook bolts may be omitted if a shear key is present in the existing slab, if approved by the Engineer.

B. When an existing longitudinal crack intersects a transverse bulkhead joint and longitudinal joint is not provided in the new pour, a 2 foot long and 1/2 inch thick expansion shall be installed within 5 feet of the crack. The expansion paper shall be recessed 1 inch below pavement surface. The preceding standard shall also apply when an existing transverse crack intersects a longitudinal bulkhead joint.

C. When a longitudinal and transverse bulkhead joint intersect and a transverse or longitudinal joint is not present is the existing pavement, a 2 foot long and 1/2 inch thick expansion paper shall be installed at the intersection of the bulkhead joints and recessed 1 inch below pavement surface.

   If a transverse joint is not present in the existing pavement, a transverse joint shall be saw cut in the pavement so that it is continuous between back of curbs.

D. In lieu of hook bolts, epoxy coated deformed dowel bars or lane ties shall be used for full-depth pavement repairs. Lane ties shall be installed in-place using a grouting material as directed and approved by the engineer. Lane ties shall be straight deformed epoxy coated bars grouted into the existing pavement with a grout selected from the prequalified materials listed in the MDOT Material Source Guide under adhesive systems for grouting dowel bars and tie bars for a full-depth pavement repairs.

E. When an existing transverse crack intersects a longitudinal joint and a transverse joint is not provided at the existing crack, lane ties shall be omitted between the crack and the next closest established transverse joint. When a transverse joint is provided on a new concrete pavement between the existing transverse joint and the existing transverse crack, lane ties shall be omitted between the existing and the new transverse joints. Lane ties omissions shall conform to the details shown on MDOT standard plan for concrete pavement repair, R-44-F.

11.05 LONGITUDINAL JOINTS: As follows:

A. Longitudinal joints within new pavement shall be made with 2 foot long epoxy-coated #5 bars at 4 feet on center maximum.

B. When replacing 1/2 width or more of roadway, intermediate longitudinal joints shall be provided between centerline and back of curb if any of the following conditions exist at both ends of the new pour:

   1. An expansion joint.
   2. An existing longitudinal joint or crack that is no less than 5 feet from centerline of back of curb.

C. When replacing roadway, it is desirable to locate any new longitudinal saw cuts or joints at the 1/4 width and centerline of the roadway.

11.06 TRANSVERSE JOINTS: As follows:

A. No more than 15 feet between transverse joints. All transverse joints shall be continuous between back of curbs.

B. New pavement shall be constructed with two #4 epoxy-coated bars located at 4 inches and 20 inches in from back of curb, which shall be continuous through transverse contraction joints.

C. Transverse expansion joints shall be made using 1 inch fiber board recessed 1 inch below pavement surface. The expansion joints must terminate at a free edge and shall e located as follows:

1. At all radius returns.
2. At intervals not exceeding 300 feet
3. Away from low points whenever possible.

D. When replacing roadway, it is desirable to locate any new transverse saw cuts or joints at either the mid-point or third-point of existing slabs.

E. The transverse relief joints of the new concrete pavement shall be extended all the way through the adjacent existing concrete pavement when directed by the engineer.

11.05 CURBING: As follows:

A. When installing a curb drop and a sidewalk exists directly adjacent to and paralleling the back of curb, the back of curb shall drop longitudinally from full height to the drop curb section over a distance that provides less than 1 inch of drop per foot of curb.

B. Concrete curb and gutter shall be at least 2 feet. wide, reinforced with two continuous epoxy-coated #4 bars, and shall be jointed at no greater than 10 feet intervals.

C. Straight face curbing shall be a minimum of 18 inches in height and reinforced with one continuous #4 epoxy-coated bar located at mid-depth and the curbing shall be jointed at no greater than 10 feet intervals.

D. Handicapped ramps and driveway approaches **shall not** be poured integral with any curbing.

E. Any new curbing installed at a crosswalk shall be poured to accommodate handicap ramps. All handicap ramps shall have a ramp slope that provides less than 1 inch of drop per foot and shall conform to the detail shown on page PD-2, Detail B.

11.06 DRIVEWAY APPROACHES: As follows:

A. Driveway approaches shall be replaced according to the plan on detail page PD-1, Detail A. A ½ inch fiber joint shall be added at the base of the drive approach only under the following conditions:

1. The concrete roadway at the base of the drive approach has substantial cracking or deterioration.

2. The concrete roadway at the base of the drive approach contains a transverse expansion joint.

B. The preceding standard shall also apply to crosswalks.

11.07 **CURING**: After finishing operations have been completed and immediately after the free water has left the surface of the slab, the slab **shall** be completely coated and sealed with a uniform layer of white membrane curing compound. Failure to provide proper curing will be considered as sufficient cause for immediate suspension of the concreting operations. Concrete pavement base which will receive a bituminous cap-shall receive a "red" cure.

Refer to MDOT 2012 Standard Specifications for Construction, Section 903.06 for additional requirements.

11.08 **CONCRETE SURFACE FINISH**: All concrete surfaces shall have a broomed or burlapped finish and shall be free of spalling, popping or imperfections over the length of the warranty period.

11.09 **PLACEMENT**: All concrete road pavement up to 31 feet wide, both 6 and 8 inches thick installed in public right of way shall be placed with a self propelled paving profiler (Pav-Saver or equal) running on steel full height forms capable of installing the full width of road pavement in one pass. Alley paving may be placed using a machine capable of installing the full width of alley pavement with one pass. Other paving means shall be approved by the City Engineer.

Upon placement of the concrete mixture on an approved wetted base, all edges shall be vibrated with a mechanical vibrator and the use of a roller bug or equivalent is prohibited. Once forms are removed, all voids (honeycombs) in the back of the curb **shall** be filled with a sand and cement mix.

GENERAL SPECIFICATIONS FOR PAVEMENT-SIDEWALK AND HANDICAP RAMPS

1.00 SIDEWALK

1.01 CONCRETE SIDEWALKS: Sidewalk shall consist of installing new concrete sidewalk including handicap ramps in the thickness indicated on the plans or form of proposal. The concrete sidewalk shall contain 6 sacks (564 lbs.) of cement per cubic yard with a **30% Slag Cement** content.

The consistency (slump) of the concrete mixture shall not exceed 3½ inches. All sidewalks and driveways are to be replaced within 5 days of removal. This item includes all **earth excavation, grading, or fill required** to set proper grades for replacement sidewalk or the installation of new sidewalk where none previously existed, and all clean up and restoration including top soil, irrigation repairs, and clean up as required within 10 days of removing the sidewalk following the new sidewalk installation.

Payment for this item will not be made until all items of work are complete.

New Concrete sidewalks shall be 5 feet wide, shall have joint spacing at 5 foot intervals and shall be minimum of 4 inches thick.

New concrete sidewalks falling within a driveway shall be 6 inches thick and the **entire flag** (5'x5') shall be that same uniform thickness, the joint between the 4 inch and 6 inch or 8 inch walk shall have placed a 6" x ½" fiber expansion paper. See sidewalk details on pages PD-1 through PD-9. At handicap ramps, the first 5 feet of ramp placed back of the curbing shall be 6 inches thick.

1.02 STAMPED COLORED CONCRETE SIDEWALK – MATCHING EXISTING SECTIONS WITHIN THE CENTRAL BUSINESS DISTRICT: Provide documentation of experience placing and finishing colored, stamped concrete as specified herein. Placement and finishing of the decorative concrete shall be performed by experienced personnel.

The stamped concrete brick paver pattern shall be running bond pattern rectangular pavers with beveled top edges placed perpendicular to the curb. Paver dimensions shall be 3 5/8" wide x 7 5/8" long. Samples of the paver stamps shall be furnished to the Engineer for approval.

Paver stamp dimensions shall not vary more than 1/8 of an inch from approved samples. The stamping equipment and materials shall be from a single manufacturer throughout the entire project.

The colors of previous Central Business District (CBC) areas of the cured concrete have matched or be equal to existing Fendt brand concrete Brick color "Red" or Scofield Chromix admixture C-32 "Quarry Red", or as directed by the Engineer. The color shall be approved prior to placement of any stamped concrete to match existing areas of the CBD.

All stamped concrete area's installed shall have consistent coloring and be free of cracks and breakage. Refer to Concrete Sidewalk above for concrete mix requirements, the concrete mixture shall also conform to requirements of the color admixture manufacturers Scofield Chromix.

Curing compound shall be clear seal and shall conform to the requirements of the color admixture manufacture such as Scofield Lithochrome “colorwax”.

1.03 **STAMPED COLORED CONCRETE SIDEWALK – NEW INSTALLATIONS IN THE CENTRAL BUSINESS DISTRICT (CBD)**: This item of work consists of constructing a decorative (colored and stamped) concrete sidewalk at the locations specified in the plans. Complete this work according to the details provided in the plans, Standard Plan R-44 series, with Sections 601, 602 and 604 of the MDOT 2012 Standard Specifications for Construction.

Submit a plan showing types and locations of joints and sequence of construction. Submit a report detailing the concrete mix designs to be used including manufacturers and / or suppliers of mixture components. Submit technical data sheet for a single manufacturer's complete system for products and / or materials including admixtures, colorants, curing compounds decorative concrete sealer, dry-shake finish materials, imprinting tools and others requested by the Engineer.

Ensure that the Contractor has a Michigan Concrete Association (MCA) Decorative Concrete Certification, or proven equivalent manufacturer training and certification for placing decorative concrete.

Use a single manufacturer's complete system for products and / or materials.

Concrete Colorant - Use complete pigment system including integral colorants, dry shake colorants, and / or release hardeners from one of the following manufactures or other sources approved by the Engineer. Submit ASTM C 979 test data to Engineer for all non-approved manufactures.

Brickform 989-792-9009
Decorative Concrete Resources..... 866-792-9000
Increte Systems..... 800-752-4626
L.M. Scofield Co. 586-292-1492
Prism Pigments 888-440-4250
Proline Concrete Tools..... 800-795-4750
Vexcon Chemicals..... 616-299-8897

A. Concrete Intefral Color - Pre-weighed and dry-packaged high-grade coloring pigment in either powder or granular form. Ensure materials comply with ASTM C 979 standards for integrally colored concrete. Use color as indicated:

Altamar Mauve Red 841

B. Release Agent - Dry-shake powder to facilitate release of imprinting tools as manufactured by Brickform Rafco or Prism Pigments. Color as indicated:

Altamar Dark Gray

C. Curing Compound - Use transparent curing compound meeting subsection 903.05B of the 2012 MDOT Standard Specifications for Construction. [ASTM C 309, Type 1 or 1-D] Standard curing compounds cannot be used on colored or decorative concrete. See following section "Surface Sealer" for approved products.

D. Surface Sealer. Use a "crystal clear" Class A solvent acrylic decorative sealer in low-sheen, anti-slip finish from approved list below, or other as approved by the system manufacture and the Engineer.

1. Brickform - Safety-Seal MS-5
2. Vexcon Chemicals
    a. Certivex AC 1315 solvent vase sealer (with curing compounds)
    b. Certivex Gloss Sealer FT solvent base sealer (without curing compounds)
    c. Shur Grip - anti-slip sealer additive

To impart desired texture, use high-quality resilient mats reproduced from casting of natural materials and providing uniform control of joint depth. Use tools capable of producing the pattern(s) shown on the plans and / or as required by the Engineer. Use imprinting tool(s) from approved manufacturer and pattern list below, or present a substitute mat design, manufacturer, or pattern to the Engineer for approval:

A. Brickform - Runningbond New Brick Stamp (no texture, v joints, to be placed perpendicular to pedestrian travel).

Prior to installation of colored concrete and / or stamped concrete paving work, construct sample panels in place to verify color and texture selections and processes for qualities of appearance, materials, and construction. Build mock-ups to comply with the follow requirements.

B. Size - Cast a minimum 8 foot by 8 foot mock-up to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.

C. Acceptance - If Engineer determines that mock-up does not meet requirements, demolish and remove it from the site, and cast another until the mock-up is accepted.

D. Use - Keep accepted mockup undisturbed during construction as a standard for comparison to completed paving. Undamaged mock-up may be incorporated into the work or demolished and removed from the site when directed by the Engineer.

F. Preparation – as follows:

1. Carefully lay out the locations of forms and joints, taking into consideration the orientation of the pattern as shown on the Plans, intended aesthetics, and construction sequence.
2. Integral Color - Comply with the color manufacturer’s published recommendations and instructions for mix designs, admixtures, concrete temperature, mixing, installing, finishing and curing. Coordinate stamped colored concrete to ensure consistency in color, texture and quality.
3. Color Release - Apply powder release per manufacturer guidelines at the minimum rate required to cover the previously colored surface. "Liquid Antique" agent can be used as a substitute for the dry release. If clear liquid release is to be used, apply per manufacturer guidelines. Colored powder release can be mixed with clear liquid and sprayed on the surface only after the imprinting has been completed, to create an accent coloring.

4. Imprint Pattern - Comply with tool manufacturer's standard and MCA practices. Lay out to proper alignment and imprint constant depth while concrete is plastic. Do not allow the surface to crust over or harden before stamping. Hand-tool in the areas where imprinting tools are not practical.

5. Removal of Excess Release - Wash off excess release agent with normal water pressure prior to joints being cut. Remove a minimum of 80 percent of the release. Temperature conditions will dictate the timing of release removal. Dispose of any excess release agent in compliance with local regulations.

6. Acid washing of decorative surface may be required to achieve the desired finish, as directed by the Engineer. A minimum of 36 hours after placement, apply a solution of 1 part muriatic acid to 30 parts potable water to the surface of the pavement and lightly scrub with a straw broom. Wash the surface until proper color has been achieved and then flush thoroughly.

7. Sealing Decorative Surface - Seal the surface with approved sealer according to manufacture's recommendation. Refer to previous section of this specification for approved products and manufacturer technical data sheets for proper installation procedures, including moisture content restriction at time of application.

Stamped Concrete Sidewalk includes coloring, mixing, hauling, placement, strike off, finishing, texturing, stamping, curing, and all jointing shown in the plans.

2.00 BLOCK PAVERS

2.01 CONCRETE BLOCK PAVERS INCLUDING CONCRETE BASE: This item of work consists of furnishing and installing concrete block pavers including concrete base at locations indicated on the Plans or as directed by the Engineer, and in accordance with the details on the Plans. This item of work includes excavation, compacting granular base material, and furnishing and installing 3/8 inch thick latex mortar between the pavers and concrete base as noted and indicated on the Plans.

A. Materials - Concrete mixture for the concrete base refer to Section 12.00 within sidewalk areas and or as specified on the Plans.

Concrete block pavers shall be rectangular pavers with beveled top edges. Paver dimensions shall be 3 7/8" wide x 7 7/8" long x 2 3/8" high. Samples of the pavers shall be furnished to the Engineer for approval. Paver dimensions shall not vary more than 1/8 of an inch from approved samples. Pavers shall be manufactured by **Fendt Builders Supply** or approved equal.

Concrete block pavers shall consist of Type "A" and Type "B" pavers. Type "B" pavers shall be installed around the perimeter of each paver area. Color and estimated plan quantity for each type of paver shall be as noted on the Plans. All pavers installed shall have consistent coloring and be free of cracks and breakage.

Concrete block pavers shall be made with concrete aggregates conforming to ASTM C 33; cement shall conform to ASTM C 150 Portland Cement and ASTM C 595 for blended cements. The pavers shall have a minimum compressive strength of 8,000 P.S.I. and maximum absorption of 5% when tested in accordance with ASTM C 140.

B. Equipment and Construction Method - Perimeters of areas to receive pavers shall be formed with care to achieve the finished dimensions for the paver areas indicated on the Plans. A concrete base shall be poured for each paver area and shall be finished so that the surface of the concrete base is 0.23' (2 3/4") below the finished concrete sidewalk surface at the perimeter. Concrete block pavers shall be cut as necessary and installed in the pattern as indicated in the detail on the Plans.

Cutting shall be done with either a hydraulic or mechanical block splitter or a masonry saw so as to leave a clean edge at the finished surface. The pavers shall be set in a 3/8 inch minimum thick layer of thin-set latex mortar which shall act as a leveling course between the bottom of the pavers and the top of the concrete base. Horizontal gaps between pavers shall be minimized and no greater than 1/8 inch on any side.

Placement of brick pavers shall be centered as much as possible in the areas created or formed for placement of the pavers. When pavers are placed to create the standard patterns outlined on the plans some gaps may occur at the perimeter of the paver pattern. This area can be filled with expansion paper up to 1 inch thick, recessed 3/4 inch below the finished paver surface to allow for a 1/2 inch thick cap of silicone sealant, **Sikaflex ® - 2cNS** brand or approved equal.

After sealant for expansion joints has cured, the Contractor shall broom-sweep **polymeric** sand along all concrete block paver areas to fill all voids between the pavers. Sand to be furnished by the Contractor for this purpose shall conform to the gradation requirements of Section 902 - MDOT Fine Mason Sand.

3.00 HANDICAPPED RAMPS

3.01 SIDEWALK HANDICAPPED RAMPS: The Contractor shall comply with the requirements of Public Act No. 8 of 1973 as follows:

SIDEWALKS: HANDICAPPED PERSONS P.A. 1973, No. 8 Imd. Eff. April 12; AN ACT to provide for the construction and maintenance of sidewalks for use by handicapped persons. The People of the State of Michigan enact:

125.1361.1. *Sidewalks: Construction Requirements Sec. 1. A sidewalk hereafter constructed or reconstructed on public or private property for public use within this state, whether constructed by a public agency or a person, firm, corporation, nonprofit corporation or organization, shall be constructed in a manner that will facilitate use by physically handicapped persons. At points of intersection between pedestrian and motorized liens of travel, and at other points where necessary to avoid abrupt changes in grade, a sidewalk shall slope gradually to street level so as to provide an uninterrupted line of travel. The department of state highways shall prescribe standards of slope gradient, width, and slip-resistant qualities which will assure that a sidewalk will accommodate a person in a wheelchair or other handicapped persons.*

All agencies of state and local government including school districts and other groups aforementioned, public or private, shall comply with these standards and the provisions of this act when undertaking construction or reconstruction of affected streets, curbs, or sidewalks, except that a local unit of government may adopt ordinances which provide for standards at least equal to those provided by the department of state highways.

ADA Compliant Handicap Ramps - Handicap ramps shall be 6 inches thick (unless otherwise directed by the Engineer) from back of curb to 5 feet from back of curb, 1/8" x 2" dummy paper shall be placed at the back of curb at all ramp installations. Refer to section 1.01 for concrete mix and installation specifications for pavements and curb and gutter and see handicap ramp details on page PD-3 through PD-9.

Furnishing and installing handicap detectable warning dome pattern on all handicap ramps in accordance with the current MDOT detail R-28 (see detail sheets PD- 3 thru PD-9).

Sidewalk abutting back of curb cannot be poured within twelve (12) hours of curb installations, unless approved by the Engineer.

Sidewalk slopes and grades shall meet all current requirements of the Americans with Disabilities Act Access Guidelines (ADAAG) and MDOT handicap ramp detail R-28.

The 5 feet wide by 2 feet deep detectable warning surface shall be installed at all curb openings (drop curbs) installed for pedestrian crossings, wet mold stamped concrete handicap detectable warning dome patterns are not acceptable and will not be allowed.

The detectable warning surface shall be centered on the crosswalk at the drop curb, but in no case shall the width of the surface installed be less than 5 feet.

The detectable warning surface shall contrast visually with adjacent walking surfaces, dark-on-light, and shall consist of small domes conforming to the details as shown in MDOT Standard Plan No. R-28, (see detail sheets PD- 3 thru PD-9), or the current MDOT detail.

The detectable warning surface shall be installed according to the manufacturer's instructions and MDOT Standard Plan No. R-28.

The surface materials shall be cast-in place and installed so that the edge nearest the back of curb line is at the back of curb line or as directed by the Engineer.

The detectable warning material shall be ADA Solutions ™- Clay Red (Federal Color Code 22144), Armor-tile ™- Brick Red (Federal Color Code 22144) or approved equal.

The Contractor shall provide written certification to the Engineer that the detectable warning surface complies with all requirements of the Americans with Disabilities Act Access Guidelines (ADAAG).

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
**CONCRETE JOINT REPAIR, CASE A,
USING LATEX MODIFIED CONCRETE
(7 SACK)**

a. Description. This work consists of repairing concrete joints by partial depth milling and hand chipping to remove deteriorated and delaminated concrete; preparation, placement, finishing and curing of the latex modified concrete material; and sealing cracks and joints. Complete all joint repair work according to the Standard Specifications for Construction, except as modified by this special provision.

Repair locations will be as directed by the Engineer.

b. Materials. Use a bonding grout consisting of equal weights of Portland cement and number 2NS sand, mixed mechanically with sufficient amount of a 50-50 mixture of latex and water to form a slurry with the consistency of thick cream.

Use a concrete mixture containing the following materials per cubic yard.

Portland Cement, Type	658 lb
Mix Water, Net	168 lb
Latex Admixture	140 lb
2NS Fine Aggregate, Dry	1348 lb
26A Coarse Aggregate, Dry	1458 lb

Concrete air-entrainment and slump must be as follows:

Entrained Air	4.5 +/- 1.5 percent
Slump	1 - 6 inches

In addition to the requirements of Section 902 of the standard specifications, the 26A coarse aggregate must have a maximum absorption (24-hour soak method) of 2.50 percent according to ASTM C 127.

Hot-poured joint sealant must meet subsection 914.04.A. Backer rod for use with hot-poured joint sealant must meet subsection 914.04.B.

c. Equipment. Use a planing or milling machine equipped with a cutting drum designed for grinding concrete to close tolerances. The milling drum must be able to cut continuously, parallel to the joint and be adjustable to depths of 6 inches. The milling drum must be equipped with side cutters which cut a vertical edge for repair depths greater than 2 inches. The manufacturer of the milling drum must provide documentation form at least two sources that demonstrates compliance with the stated specifications.

d. Construction.

Temperature Limitations. Do not place concrete repairs at air temperatures below 50°F, nor above 90°F. Insulate repairs when air temperature is below 60°F or when the pavement concrete temperature is below 50°F.

Surface Preparation. Remove deteriorated concrete and patching material by milling within the limits shown in the detail for Concrete Joint Repair, Case A, including deteriorated concrete a minimum of 2 inches to a maximum of half the pavement depth, or to the top of the tie bars. Remove any mesh reinforcement within the repair areas. Use light-weight chipping hammer (15 lb) to remove all slivers of concrete less than 1 inch wide remaining along the repair area after milling. After milling and chipping, sound all exposed surfaces with a steel bar to detect delaminations. If delaminations are detected, remove the effected concrete and resound the areas. Clean exposed surfaces using high pressure water cleaning, with a minimum pressure of 3000 psi with a 15 degree tip. Re-establish transverse joints in the same configuration as the existing pavement.

Bonding Grout. The surface of the concrete must be damp, without excess water, at the time bonding grout is applied. Apply bonding grout immediately prior to concrete placement. Apply grout either by brushing or scrubbing (with a stiff bristle broom) onto the prepared concrete surface. If the grout whitens before concrete placement, it must be removed by sand blasting and the area re-grouted. Do not re-temper the grout.

Concrete Placement and Finishing. After the concrete is placed and screeded to the elevation of the surrounding pavement surface, seal all edges with mortar by working concrete outward toward existing hardened pavement concrete. Broom-finish the surface.

Joints and Crack Relief. Re-establish longitudinal and transverse joints, associated with existing pavement, through repairs. Provide crack relief at all locations where the repair is intersected by a full-depth pavement crack. Establish joints and crack relief cuts through the full depth of the repair by either sawing a minimum 1/4 inch wide cut as soon as possible after initial set without excessive raveling and before any cracking occurs, or by installing a 1/4 inch wide compressible isolation joint material into the crack prior to concrete placement. If sawing is used to isolate joints and cracks, remove the wet cure only long enough to saw and flush the joints and cracks before reestablishing the wet cure. If isolation joint material is used, it must be maintained vertical throughout the entire thickness of the repair. Thoroughly clean all joints and crack relief cuts by water flushing immediately after sawing.

Wet Cure. Cover the repair with wet burlap immediately after finishing. Use only burlap that has been soaked in water for a minimum of 12 hours prior to application. Cover and fully secure the burlap with polyethylene sheeting. The burlap and polyethylene sheeting must extend beyond the perimeter of the repair area a minimum of 6 inches. Keep the burlap fully saturated and protected with the polyethylene sheeting for a minimum 24 hours after concrete finishing.

Sealing Joints and Crack Relief. Remove isolation joint material to a depth of 2 inch below the pavement surface. Immediately prior to sealing, the joints and crack relief cuts must be clean, dry, and free of all incompressible material. Seal the joints and crack relief cuts with hot-poured sealant as specified in subsection 602.03.S of the standard specifications. The top of the sealant (after cooling) must be flush to 1/8 inch below the surface of the pavement.

Opening to Traffic. Wet cure the concrete for 24 hours and do not open to traffic until a compressive strength of 2500 psi is achieved.

e. Delayed Acceptance. Prior to final acceptance, repair all damage to any in-place pavement, roadway structure, or appurtenance resulting from the preparation, repair, or curing operation, as directed by the Engineer. All costs associated with this repair will be borne by the Contractor.

The Department will inspect all repairs for failures one month after the repairs are open to traffic. Evidence of bond loss, delamination, or spalling will be considered failure of a repair. Delaminations will be detected by sounding with a steel bar. All failed repairs must be removed and replaced, or otherwise correct to the satisfaction of the Engineer.

Submit a plan to the Engineer for the completion of this work including an acceptable completion time. All costs associated with restoring failed repairs will be borne by the Contractor.

f. Measurement and Payment. The completed work as described will be paid for at the contract unit price for the following contract item (pay item):

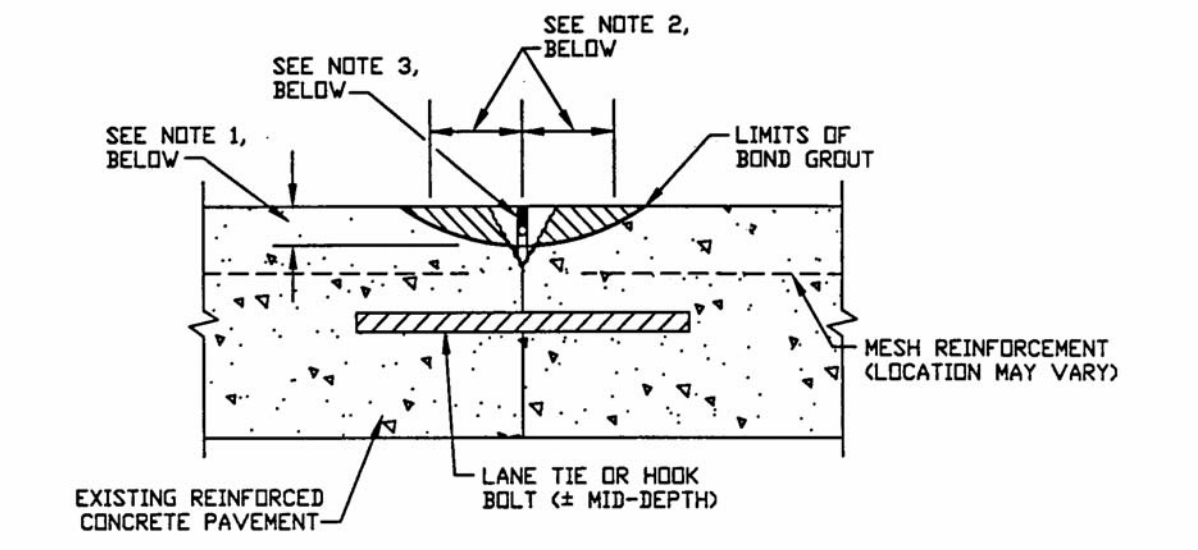
Contract Item (Pay Item)	**Pay Unit**
Conc Joint Repair, Case A, (LMC), Special	Foot
Latex Modified Conc	Cubic Yard

Payment for **Conc Joint Repair, Case A, (LMC), Special** includes all work required to prepare the area to be repaired; to consolidate, finish, and cure the repair mixture material; and to provide crack relief and seal cracks and joints, according to this special provision. This item will be measured along the repaired joint.

Latex Modified Conc includes all work required to furnish and place the latex modified concrete. **Latex Modified Conc** will be measured and paid for by the theoretical yield of the mix design and documented by the ticket printout. Deductions will be made for material wasted or rejected.

All costs associated with providing traffic control required to restore failed repairs, as described in section (e) of this special provision, will be included in the item **Conc Joint Repair, Case A, (LMC), Special**. Traffic control to perform the delayed acceptance inspection will be provided by the Department.

CONC JOINT REPAIR, CASE A



AREA TO BE REMOVED

NOTES:

1. 2 inches MIN. REMOVAL TO A MAX. OF 1/2 THE PAVEMENT DEPTH OR TO THE TOP OF THE TIE BAR, WHICHEVER IS LESS.

2. 5 inches MIN. WIDTH, MAX. TO MATCH THE WIDTH OF THE SPALL.

3. 1/4 inch SAWCUT TO EXTEND THROUGH THE DEPTH OF THE REPAIR. TOP OF 3/8 inch BACKER ROD TO BE LOCATED 1 inch BELOW PAVEMENT SURFACE.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
COLD-MILLING CONCRETE PAVEMENT

C&T:GEN 1 of 1 C&T:APPR:JFS:EMB:05-27-03

a. Description. Accurately remove the top portion of an existing concrete pavement to the depth and cross section shown on the log or plans, and as directed by the Engineer.

b. Equipment. Use cold-milling machine(s) equipped with positive depth control adjustments and a positive means for controlling the cross slope. Cold-milling equipment must be capable of removing the chips from the pavement and preventing dust from escaping into the air.

c. Construction. Cold-mill the existing concrete pavement to the depth and cross section indicated on the log or plans, and as directed by the Engineer. Collect and dispose of the excess material resulting from the operations as specified in subsections 103.07 and 204.03.B of the Standard Specifications for Construction.

Provide a final surface texture that is reasonably smooth and free of gouges, holes or large depressions. Prevent damage to the adjacent concrete. Where material is removed below the depth specified due to poor cold-milling practice, backfill and compact the resulting holes or depressions by hand patching according to subsection 502.03C.9. Repair all damage to adjacent surfaces as directed by the Engineer. All costs associated with this corrective work will be borne by the Contractor.

d. Measurement and Payment. The completed work will be paid for at the contract unit price for the following contract item (pay item).

Contract Item (Pay Item)	**Pay Unit**
Cold Milling Conc Pavt	Square Yard

Payment for **Cold Milling Conc Pavt** includes removing, loading, hauling, and disposal of the material. Material picked up by sweeping after cold-milling will not be paid for separately. This work will be measured by area in square yards regardless of the number of passes required to remove the concrete to the required depth.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
CONCRETE PAVEMENT INTERMEDIATE SURFACE REPAIR USING LATEX MODIFIED CONCRETE

a. Description. This work consists of repairing concrete pavement spalls at locations not adjacent to joints or working cracks in the surface. This work includes partial depth milling and hand chipping to remove deteriorated and delaminated concrete; and preparation, placement, finishing and curing of the latex modified concrete material. Complete all spall repair work according to the Standard Specifications for Construction, except as modified by this special provision.

Repair locations will be as directed by the Engineer.

b. Materials. Use a bonding grout consisting of equal weights of Portland cement and 2NS sand, mixed mechanically with sufficient amount of a 50-50 mixture of latex and water to form a slurry with the consistency of thick cream.

Use a concrete mixture containing the following materials per cubic yard.

Portland Cement, Type I	658 lb
Mix Water, Net	168 lb
Latex Admixture	140 lb
2NS Fine Aggregate, Dry	1348 lb
26A Coarse Aggregate, Dry	1458 lb

Concrete air-entrainment and slump must be as follows:

Entrained Air	4.5 +/- 1.5 percent
Slump	1 - 6 inches

In addition to the requirements of Section 902 of the standard specifications, the 26A coarse aggregate must have a maximum absorption (24-hour soak method) of 2.50 percent according to ASTM C 127.

c. Equipment. Use a planing or milling machine equipped with a cutting drum designed for grinding concrete to close tolerances. The milling drum must be able to cut continuously and be adjustable to depths of 6 inches. The milling drum must be equipped with side cutters which cut a vertical edge for repair depths greater than 2 inches. The manufacturer of the milling drum must provide documentation from at least two sources that demonstrates compliance with the stated specifications.

d. Construction.

Temperature Limitations. Do not place concrete repairs at air temperatures below 50 °F, nor above 90 °F. Insulate repairs when air temperature is below 60 °F or when the pavement concrete temperature is below 50 °F.

Surface Preparation. Remove deteriorated concrete and patching material by milling to a minimum of 2 inches and to a maximum of half the pavement depth. Remove any mesh reinforcement within the repair areas. Use light-weight chipping hammer (15 lb) to remove all slivers of concrete less than 1 inch wide remaining along the repair area after milling. After milling and chipping, sound all exposed surfaces with a steel bar to detect delaminations. If delaminations are detected, remove the effected concrete and resound the areas. Clean exposed surfaces using high pressure water cleaning, with a minimum pressure of 3000 psi with a 15 degree tip. Re-establish transverse joints in the same configuration as the existing pavement.

Bonding Grout. The surface of the concrete must be damp, without excess water, at the time bonding grout is applied. Apply bonding grout immediately prior to concrete placement. Apply grout either by brushing or scrubbing (with a stiff bristle broom) onto the prepared concrete surface. If the grout whitens before concrete placement, it must be removed by sand blasting and the area re-grouted. Do not re-temper the grout.

Concrete Placement and Finishing. Reform all full depth cracks in the repair area using 1/4-inch compressible material. After the concrete is placed and screeded to the elevation of the surrounding pavement surface, seal all edges with mortar by working concrete outward toward existing hardened pavement concrete.

Wet Cure. Cover the repair with wet burlap immediately after finishing. Use only burlap that has been soaked in water for a minimum of 12 hours prior to application. Cover and fully secure the burlap with polyethylene sheeting. The burlap and polyethylene sheeting must extend beyond the perimeter of the repair area a minimum of 6 inches. Keep the burlap fully saturated and protected with the polyethylene sheeting for a minimum 24 hours after concrete finishing.

Opening to Traffic. Wet cure the concrete for 24 hours and do not open to traffic until a compressive strength of 2500 psi is achieved.

e. Delayed Acceptance. Prior to final acceptance, repair all damage to any in-place pavement, roadway structure, or appurtenance resulting from the preparation, repair, or curing operation, as directed by the Engineer. All costs associated with this repair will be borne by the Contractor.

The Department will inspect all repairs for failures one month after the repairs are open to traffic. Evidence of bond loss, delamination, or spalling will be considered failure of a repair. Delaminations will be detected by sounding with a steel bar. All failed repairs must be removed and replaced, or otherwise correct to the satisfaction of the Engineer.

Submit a plan to the Engineer for the completion of this work including an acceptable completion time. All costs associated with restoring failed repairs will be borne by the Contractor.

f. Measurement and Payment. The completed work as described will be paid for at the contract unit price for the following contract items (pay items):

Contract Item (Pay Item)	**Pay Unit**
Conc Surface Patch, (LMC), Special	Square Yard
Latex Modified Conc	Cubic Yard

Payment for **Conc Surface Patch, (LMC), Special** includes all work required to prepare the area to be repaired and to consolidate, finish, and cure the patching mixture material according to this special provision. This item will be measured by the average length multiplied by the average width of the repaired areas.

Latex Modified Conc includes all work required to furnish and place the latex modified concrete. **Latex Modified Conc** will be measured and paid for by the theoretical yield of the mix design and documented by the ticket printout. Deductions will be made for material wasted or rejected.

All costs associated with providing traffic control required to restore failed repairs, as described in section (e) of this special provision, will be included in the item **Conc Surface Patch, (LMC), Special**. Traffic control to perform the delayed acceptance inspection will be provided by the Department.

GENERAL SPECIFICATIONS PAVEMENT- FOR BITUMINOUS STREET RESURFACING

1.00 **WORK INCLUDED**: The work under the Contract consists of, but is not limited to removing and replacing concrete pavement and curbing; reconstructing, adjusting and building drainage structures; grinding asphalt and concrete surfaces; and resurfacing with Hot Mix bituminous Material.

The Contractor shall provide all labor, equipment and materials as specified in these specifications and shown on the plans to complete all aspects of the Contract.

The work covered shall meet the requirements of the 2012 Michigan Department of Transportation Standard Specifications for Construction.

Contractors may obtain water for milling and cleaning operations from city hydrants at locations approved by the City. However, there **shall** be an air gap equal to or greater than the fill line diameter in the fill line hose / piping prior to water entering the water storage tank. A hydrant wrench shall be used when using a hydrant, approved for use by the Contractor, meeting backflow prevention requirements.

1.01 **GRINDING ASPHALT PAVEMENT WITH ROTO-MILL PAVEMENT PROFILER INCLUDING CHIPPING AROUND UTILITY CASTINGS & CONDITIONING**: This work consists of removing existing asphalt pavement by Roto-Mill Pavement Profiler machine. This item shall include milling asphalt pavement over gravel, asphalt or concrete up to one inch (1") into underlying concrete pavement. This work will be measured and paid by area in square yards at the contract unit price shown on the Form of Proposal. All chipping around utility castings and areas missed by the grinding machine shall be included with this work item. When milling across intersections and the lip from the milled surface to the existing surface exceeds 1 and 1/2 inches, this lip shall be ramped. This work shall be included within the item. Measurements of grinding will be done the same day as work, and agreed to by all parties in writing. Butt joints and clean up are included in this item. Clean up shall begin the same day as milling, refer to detail on page PD-15.

1.02 **GRINDING CONCRETE PAVEMENT WITH ROTO-MILL PAVEMENT PROFILER INCLUDING CHIPPING AROUND UTILITY CASTINGS & CONDITIONING**: Refer to section 1.01 above - same specifications except this section is for milling concrete pavement in place of asphalt pavement. Milling of asphalt pavement where milling extends into concrete under the existing asphalt overlay exceeding one inch (1") shall be paid as concrete milling only.

Concrete streets must be thoroughly cleaned and may require sprayed with tack / prime coat to control dust once milled. This operation is included as part of this item, refer to detail on page PD-15.

1.03 **GRINDING CONCRETE OR ASPHALT PAVEMENT WITH 12-INCH WIDE ROTO-MILL PAVEMENT PROFILER**: This item is intended to be used to mill channel through high areas along curb lines on existing pavement to correct existing drainage problems. The normal width milled would be 24 inches and maximum 2 inches depth as directed by the Engineer, refer to detail on page PD-15.

Payment shall be by the square yard. Clean up shall be done the same day as the milling.

1.04 **1-1/2 INCH MINIMUM BITUMINOUS MATERIAL NO. 36A INCLUDING 0.10 GAL/S.Y. OF SS-lh BOND COAT OR MC-70 PRIME COAT**: The bituminous material shall meet the requirements and be placed in accordance with 2012 MDOT Standard Specifications, Section 501.

General Construction Practices as follows:

A. Weather Limitations - No placement will be allowed on wet base; surface to be paved must be dry.

B. Mixture Temperature Limits - The HMA shall be heated sufficiently, but not in excess of 360°F, such that there will be separation of the asphalt form the aggregates during transportation. The mixture shall be placed at a temperature not less than 250°F.

C. Transportation of Mixtures - The time interval between placing the mixture in the hauling unit and emptying into the spreader shall not exceed two hours.

D. Compaction - After the bituminous mixture has been spread, struck off, and surface irregularities adjusted, the mixture shall be thoroughly and uniformly compacted by rolling. The bituminous mixture shall be rolled in a longitudinal direction, commencing at the outside edge and progressing towards the center, except that on super-elevated curves, the rolling shall commence of the low side and progress to the high side. Rolling shall be accomplished with a steel-sheet roller and shall be conducted in such a manner that shoving or distortion will not develop beneath the roller. The amount of rolling shall be confined to only that necessary for consolidating the bituminous mixture and bonding it to the underlying surface. Excessive rolling shall be avoided. The completed bituminous mixture shall be protected from all traffic until it has cooled sufficiently to resist abrasion.

E. Placement of Joints, Edge Trimming, and Cleanup - Placement of the bituminous mixture shall be as continuous as possible. Rollers shall not pass over the unprotected end of a freshly laid mixture unless authorized by the Engineer. Transverse joints shall be formed by cutting back of the previous run to expose the full depth of the course. When directed by the Engineer, a brush coat of bituminous material shall be used on contact surfaces of transverse joints just before additional mixture is placed against the previously rolled material. The exposed edges of the completed mat shall be cut off true to the required lines.

   Material trimmed from the edges of any other discarded bituminous mixture shall be removed from the roadway and disposed of by the Contractor at a site meeting the approval of the Engineer. Intersections are to be paved when the paver reaches that point to eliminate cold joints.

F. Method of Measurement - The asphalt mixtures will be measured by weight in tons.

G. Basis of Payment - The completed work as measured will be paid for at the Contract Unit Price.

1.05 **BITUMINOUS MATERIAL MDOT 3C INCLUDING 0.10 GAL/S.Y. OF SS-1h BOND COAT**: Refer to MDOT 2012 Standard Specifications for Construction Section 501 for mix composition and requirements.

1.06 **BITUMINOUS MATERIAL MDOT 4C INCLUDING 0.10 GAL./S.Y. OF SS-1h BOND COAT**: Refer to MDOT 2012 Standard Specifications for Construction Section 501 for mix composition and requirements.

1.07 **BITUMINOUS MATERIAL SAND ASPHALT**: This material is to be used to wedge and feather into existing driveways to insure proper drainage as well as repairing miscellaneous small ponding areas throughout the City including 0.10 Gal/S.Y. of SS-lh Bond Coat. Commercial top mix may be used also by raking the larger stone out when feathering edges.

1.08 **ASPHALT PATCHING**: This item shall consist of removal of existing asphalt pavement to solid base material or removal and replacement of up to 6 inches in base material in two (2) lifts and placement of 8 inches of 21AA Crushed Limestone or approved equal base in place compacted to proper sub-grade may be required. Placement and compaction of asphalt material to finish grade shall be as directed by the Engineer. Perimeter edges of patch areas shall be saw cut unless otherwise directed by the Engineer. The saw cutting is incidental to this item. Payment for this item shall be in square yards as measured the same day as installation. The bituminous material shall be as specified in section 1.04 or approved equal and paid at the as bid contract unit price. The roller used on this time shall be 5-10 ton minimum. This item includes hauling away and disposing of removed asphalt and concrete base material at a recognized landfill.

1.09 **MODIFIED MDOT DETAIL 7 JOINT REPAIRS**: This item shall meet the requirements of the modified MDOT Repair Detail 7 as shown on page PD-14. The bituminous material shall meet the mixture requirements for leveling as specified in section 1.04. bituminous mixtures shall be top rolled with a minimum 5-10 ton roller. Use of peanut rollers is unacceptable on this item.

1.10 **MODIFIED MDOT DETAIL 8 JOINT REPAIRS**: This item shall meet the requirements of the modified MDOT Repair Detail 8 as shown on page PD-14. Refer to section 1.04 for bituminous mixture requirements and Section 1.08 for roller requirements.

Where exceptionally large areas are encountered, the Engineer may require removal of the deteriorated section and replacement with concrete pavement. Payment for this item of work shall be by lineal foot.

GENERAL SPECIFICATIONS FOR PAVEMENT- JOINT & CRACK SEALING

1.00 **WORK INCLUDED**: The work included consists of all equipment, labor and materials for removing old joint sealer, cleaning the joints and sealing with hot poured rubber-asphalt type joint sealing compound which shall conform to the requirements under each item under the Contract.

1.01 **JOINT CLEANING EQUIPMENT**: The equipment used for cleaning and preparing the joints and cracks for sealing in existing pavement shall include the following:

A. A Tractor Mounted Plow equipped with a hydraulically operated depth control and replaceable bits shall be used to remove the bulk of old material from the joints. This equipment shall be so designed and operated as to preclude spalling or otherwise damaging the concrete.

B. Routing-Resurfacing Machine - A self-powered machine operating a rotary cutter or revolving cutting tool designed to completely remove the old joint scale and all foreign matter and to reface each side wall of the joint without spalling or otherwise damaging the edges.

C. Air Compressor - Air compressors shall be portable and capable of furnishing not less than 100 cubic feet of air per minute at a pressure not less than 90 pounds per square inch. Suitable traps shall be employed to maintain the compressed air free of oil and moisture.

D. Sand Blasting - Sand blasting equipment shall furnish a minimum of 300 cubic feet of air per minute at a pressure of not less than 90 psi. The nozzle shall be of proper size and of a long wearing type. Nozzles enlarged by wear shall be replaced as necessary.

1.02 **EQUIPMENT FOR FILLING AND SEALING JOINTS**: For Hot-Poured Rubber-Asphalt Type Compound - The heating kettle, for hot-poured rubber-asphalt type sealer, shall be indirect heating or double boiler, using oil as the heat transfer medium. It shall have a thermostatically controlled heat source, a built-in automatic agitator, and thermometers installed to indicate both the temperature of the melted sealing material and that of the oil bath. The Contractor may be required to demonstrate that the equipment proposed for use will consistently produce a joint sealer of proper pouring consistency.

When a separate pouring pot is used, it shall be of the indirect heating or double-boiler type, using oil as the heat transfer medium. It shall have a thermostatically controlled heat source, a built-in automatic agitator and thermometers installed to indicate both the temperature of the melted sealing material and that of the oil bath. The pouring pot shall be mounted on rubber-tired wheels. On projects where the material requirements for continuous operating do not exceed the capacity of the pour pot, the mechanical pour pot may be used for both melting and applying the material.

When the hot-poured sealing material is applied directly from the heating kettle, the kettle shall be equipped with a pressure pump, hose and nozzle suitable for forcing the sealing material to the bottom of the joint and completely filling the joint. The hose and nozzle shall maintain the temperature of the sealing material so that the loss in temperature is not over 10^{o}F between the nozzle and the heating tank. Heat from a direct flame on the nozzle shall maintain the temperature of the sealing material so that the loss in temperature is not over 10^{o}F between the nozzle and the heating tank.

Heat from a direct flame on the nozzle shall not be used to maintain the proper temperature of the sealing material. The heating equipment shall be mounted on rubber-tired wheels and only rubber-tired equipment shall be used to move the heating equipment on the pavement.

1.03 **CONSTRUCTION METHODS**: The following procedure shall be used in re-sealing joints and cracks in pavements:

A. Removing Old Sealer - The old joint and foreign matter shall be plowed out of the expansion joints to the existing filler or to a depth of one inch, whichever is less, and the contraction joints shall be plowed to a depth of one and one-half inches. Previously sealed open cracks shall be cleaned to new concrete by routing with a joint cleaning machine. The removal of the old joint material from transverse joints shall be done by the use of a plow blade of the proper size and shape attached to a garden tractor as described herein.

B. Joint Excavating Equipment making at least one pass each way, starting as near the curb as possible and proceeding to the centerline and then back to the edge. The vertical faces of transverse joints shall then be cleaned to the depth to which the joint material has been removed with a joint cleaning machine as herein described.

C. Routing-Refacing Machine - In addition, at least one pass shall be made on each side of transverse joints with a joint cleaning machine equipped with a scarifying head to clean the pavement surface completely to at least one inch each side of the joint groove. The vertical faces of the joint shall then be further cleaned with a wire brush, making one pass against each joint wall. When necessary, hand tools shall be used to remove any material not removed by mechanical cleaning. All old joint material and other debris removed from the joints or cracks shall be removed from the pavement immediately and disposed of by the Contractor in a manner satisfactory to the Engineer.

D. Sandblasting - Prior to the application of the sealer material, all joints or cracks will be thoroughly cleaned by sandblasting. This operation will be performed in such a manner as to result in the complete removal of all sidewalls and upper edges of the joint. The sandblasting shall continue until the entire joint space is free of dust, oil, water, old joint material and / or any other objectionable foreign matter which may prevent bonding of the sealing compound to the concrete. The sand used shall be of proper size and quality necessary for the operation.

E. Air - Following sandblasting operations, the joints and cracks will be thoroughly cleaned by means of an air jet under a pressure of not less than 90 psi. Compressed air may be used at any time during joint cleaning operations; however, to insure removal of all loose material, a jet of compressed air will be required immediately ahead of sealing operations.

F. Debris Removal - All Debris and objectionable material resulting from cleaning operations will be removed form the pavement surface prior to sealing operations and disposed of by the Contractor at a recognized disposal area.

1.04 **SEALING JOINTS WITH HOT-POURED SEALANT**: As soon as the joints are cleaned with the compressed air jet, they shall be sealed with hot-poured rubber-asphalt type compound. No joints shall be sealed until the cleaning and preparation of the joints have been inspected and approved by the Engineer.

Contraction joints, construction joints and expansion joints that have openings for the full depth of the slab shall be caulked with closed cell foam backer rod to prevent the sealing compound form flowing down to the subgrade.

For expansion joints, the closed cell foam backer rod caulking material shall not extend above the pre-molded joint filler. Contraction joints and construction joints shall have a space of one inch to one and one-half inch above the caulking material that shall be filled with the sealing compound.

Hot-poured or cold-applied joint sealant shall be applied with pressure equipment with a nozzle extending into the groove so as to completely fill the groove with sealing compound.

Immediately after the joints are cleaned, the joints shall be sealed. The surface of the concrete shall be dry at the time of sealing. The Hot-poured joint sealant shall be melted in a heating kettle. Direct heating will not be permitted. Any sealing material heated in excess of the safe heating temperature recommended by the manufacturer shall not be used in the work.

Pouring shall be done by the use of a separate pouring pot of the double-boiler type or from the melting kettle equipped with a pressure pump, hose, and nozzle. When approved by the Engineer, the hot-poured joint sealant may be poured with a hand-type pouring pot, provided a satisfactory joint is obtained. If the hand-type pouring pot does not produce a satisfactory joint, its use shall be discontinued and the equipment shall force the sealing material to the bottom of the joint and completely fill it to the surface of the pavement. Any sealant spilled on the surface of the pavements shall be removed.

The sealant shall not be placed when the temperature is less than 50^{o}F except by the approval of the Engineer. Traffic shall not be permitted over the poured joint until the sealant has hardened sufficiently to resist pickup. When joint sealing work is done during periods when the pavement is contracted, as occurs during the colder months, joints shall be filled to no more than 1/8 inch below the slab surface. When joints are sealed during hot weather periods when the pavement is expanded, they should be poured flush with the slab surface.

1.05 **MATERIAL**: The compound to be placed shall conform to Section 914.04 "Hot Poured Joint Sealant" of the MDOT 2012 Standard Specifications for Construction.

1.06 **PREPARATION OF THE SEALING COMPOUND**: Regular Joint Sealer - This type sealer shall be heated to and poured at temperatures recommended by the manufacturer. This compound shall not be heated in excess of 450^{o}F and direct heating will not be permitted at any time. Heating contrary to these conditions and limitations will be sufficient cause to reject the material so handled. If operations, including shutdown overnight, halt the pouring for extended periods, heat input into the melting kettle shall be cut off. Reheating will be permitted only once.

1.07 **FINAL CLEANUP**: The work shall not be considered as completed nor will final payment be made until the area has been restored to a neat, orderly appearance acceptable to the Engineer. Equipment, excess material, rubbish, etc., resulting from the Contractor's operation must be removed form the site. Any costs incurred for final cleanup shall be incidental to the Contract.

2.00 OPERATION

2.01 PREPARE, CLEAN & RE-SEAL LONGITUDINAL & TRANSVERSE JOINTS & CRACKS IN ASPHALT & CONCRETE RESIDENTIAL STREETS: The sealing compound shall meet all material and installation requirements specified in Sections 603 and 914.04 "Hot Poured Joint Sealant" of the MDOT 2012 Standard Specifications for Construction.

2.02 PREPARE, CLEAN & RE-SEAL JOINTS & CRACKS IN NEW CONCRETE RESIDENTIAL STREETS: The sealing compound shall meet all material and installation requirements specified in Sections 603 and 914.04 "Hot Poured Joint Sealant" of the MDOT 2012 Standard Specifications for Construction.

The Bond Breaker Rod shall be made of Polyolefin Foam - 1/2 inch diameter commonly referred to as "Backer Rod" (see PD-16). It shall be a closed cell and non-water absorbent material.

Saw-cutting the new pavement: The saw cut joint shall be of a width of 3/8 inch and a depth of 1 inch to enable installation of a 1/2 inch bond breaker - backer rod. The relief joint shall be 1/8 inch sawed to a depth of 2 and1/2 inches for 6 inch concrete pavement and 3 and 1/2 inches for 8 inch concrete pavement. For information, the preliminary basic joint layout shall be as follows for 27 foot wide concrete pavement:

Longitudinal Joints	3 - pavement centerline and quarter widths
Transverse Joints	at 15 feet on center
Expansion Joints	will be sealed without backer rod at approximately 150 feet on center, average
Concrete Pavement	Joint Layout, see detail

2.03 SEAL CONCRETE STREET PATCHES - RESIDENTIAL STREETS: CLEAN & SEAL JOINTS: The sealing compound shall meet all material and installation requirements specified in Sections 603 and 914.04 "Hot Poured Joint Sealant" of the MDOT 2012 Standard Specifications for Construction.

2.04 SEAL ASPHALT / CONCRETE MUNICIPAL PARKING LOTS: PREPARE, CLEAN & SEAL JOINTS & CRACKS: The sealing compound shall meet all material and installation requirements specified in Sections 603 and 914.04 "Hot Poured Joint Sealant" of the MDOT 2012 Standard Specifications for Construction.

2.05 METHOD OF MEASUREMENT: As follows:

A. Cleaning and Re-Sealing Longitudinal and Transverse Joints will be measured by length in linear feet, measured along the centerline of the joint.

B. Cleaning and Re-Sealing Cracks will be measured by length in lineal feet, measured in a straight line in the direction of the crack. Measurements shall be made each day by the Engineer and a foreman or representative of the Contractor. The daily measurements shall be agreed to in writing by all parties.

2.06 BASIS OF PAYMENT: Cleaning, Re-Sealing Transverse and Longitudinal Joints, and Random Cracks, Saw-cutting Joints, and Sealing New Pavement will be paid for at the contract unit price per linear foot, which price shall be payment in full for furnishing all

the materials, equipment and labor to remove the sealers, fillers and / or other foreign material, grinding, cleaning, caulking, saw-cutting, and / or sealing joints and cracks with the specified sealing compound and completing the work as specified herein. Joint details are shown on detail page PD-16.

No adjustment in unit price, regardless of the percentage of increase or decrease in quantities, will be allowed for the above described work.

GENERAL SPECIFICATIONS FOR PAVEMENT MARKINGS

1.00 THERMOPLASTIC PAVEMENT MARKINGS

1.01 **DESCRIPTION OF WORK**: This work covers the furnishing and installation of hot-applied thermoplastic pavement markings at locations as designated by the Engineer, the plans and / or the proposal.

1.02 **MATERIAL**: The material shall be specifically formulated for thermoplastic pavement markings and meet the composition requirements of Paragraph 4.2 of AASHTO M249-79I. The material shall resist discoloration during melting and subsequent exposure as pavement markings. The glass beads shall conform to the requirements of Paragraph 3.2 of AASHTO M249-79I and shall be included in the material and dropped on at the time of application.

1.03 **COLOR**: As follows:

A. White – The luminous directional reflectivity shall not be less than 80 percent relative to magnesium oxide when tested in accordance with the current ASTM E 97.

B. Yellow – Shall be within the limits of the Color Tolerance Chart for Highway Yellow, PR Color #1 of the Federal Highway Administration, except that the green tolerance limit shall have CIE coordinates of X=0.491 and Y=0.460 and except that the minimum lightness shall be 50.7 percent. Tests will be conducted in accordance with ASTM E 308, using Standard Illuminant C.

1.04 **THICKNESS**: The applied line, in the designated color, shall have a thickness of 0.099” ± 0.015”.

1.05 **APPLICATION**: Use of hot-applied thermoplastic material shall be limited to bituminous pavement surfaces. The thermoplastic material shall be extruded or sprayed by the Contractor with truck-mounted or small hand-operated pavement marking equipment approved by the Engineer. The equipment shall be capable of placing white or yellow markings of the widths and types specified, and the markings shall be in conformance with the current edition of the Michigan Manual of Uniform Traffic Control Devices. An adhesive primer (a type recommended by the supplier) shall be applied prior to application of the thermoplastic material and / or primer. The minimum air temperature shall be 50°F upon application and the material shall be applied at a minimum of 375°F.

Installation of pavement markings shall be placed over existing similar markings. If existing markings to be retraced consist of thermoplastic material, any thermoplastic material with poor adhesion to pavement surface shall be removed to the extent determined by the Engineer, and the surface cleaned prior to application of adhesive primer and new marking material.

1.06 **DRYING TIME**: Drying time shall meet the requirements of Paragraph 4.3.2 of AASHTO M249-79I.

1.07 **METHOD OF MEASUREMENT**: The method of measuring quantities for payment shall be the number of linear feet of appropriate width, and / or number of symbol and legend units, installed and accepted.

Railroad markings shall consist of “RXR” legend only. Accompanying transverse bars shall be bid separately on a linear foot basis.

1.08 **BASIS OF PAYMENT**: These items will be paid for at the contract unit price for Thermoplastic Pavement Markings, legend, and symbols, of the color, width, and type specified.

Cleaning of the road surface, sand blasting, and use of a primer of the type and quantity as specified by the supplier shall be incidental to the Contract. Removal of existing thermoplastic and / or coldplastic material shall be considered incidental to the project.

1.09 **DELAYED ACCEPTANCE OF WORK**: Acceptance of completed hot-applied thermoplastic pavement marking work will be delayed 180 days. During this 180-day period, inspections of the markings placed in accordance with the Contract will be conducted at the Engineers discretion. Markings with less than 90 percent of the original marking in place shall be replaced at the Contractor’s expense.

If the Contractor wishes to have the project accepted for final payment prior to the 180 day delay period, he must, when the balance of the Contract work has been satisfactorily completed, furnish the City / County with a maintenance bond equal in value to 90 percent of the value of the thermoplastic pavement marking work performed.

2.00 COLD PLASTIC PAVEMENT MARKINGS

2.01 **DESCRIPTION OF WORK**: This work covers the furnishing and installation of coldplastic pavement markings at locations as designated by the Engineer, the plans and / or the proposal.

2.02 **MATERIALS**: The preformed reflectorized pavement markings film shall consist of a nonporous homogeneous mixture of resins, plasticizers, fillers, pigments, and glass beads, uniformly distributed throughout the material. An added layer of reflective beads are to be bonded to the top surface. The marking material shall be capable of being affixed to bituminous and / or concrete pavement by pressure sensitive pre-coated adhesive or liquid contact cement in accordance with manufacturer’s recommendations. Material shall be required to mold itself to the pavement contours, breads, faults, etc., by the initial action of applicator and / or traffic impact. The material shall not split, crack, perforate, or shift during the delayed acceptance period. Also, the material shall be formulated so that it will have resealing characteristics and be able to fuse itself with previously applied plastic marking materials. There shall be no tearing or other failure of the protective paper, if used, during removal of the sample.

2.03 **COLOR**: The white and yellow coldplastic markings shall conform to standard highway chart colors throughout the expected life of the material, and show no dark or black areas both day and night. Color tolerance limits after one year shall be no less than 25 percent of the original using the ASTM E 308 procedure.

A. White - The luminous directional reflectivity shall not be less than 80 percent relative to magnesium oxide when tested in accordance with the current ASTM E 97.

B. Yellow: - Shall be within the limits of the Color Tolerance Chart for Highway Yellow, PR Color #1 of the Federal Highway Administration, except that the green tolerance

limit shall have C.I.E. coordinates of X=0.491 and Y=0.460 and the minimum lightness shall be 50.7 percent. Tests will be conducted in accordance with ASTM E 308, using Standard Illuminant C.

2.04 **REFLECTIVITY**: The material shall have the following initial minimum reflectance values at 0.2°and 0.5° observation angles and 86.0° entrance angle as measured in accordance with the testing procedures of Federal Test Method Standard 370. The photometric quantity measured is specific luminance (SL), and is measured as millicandelas per square foot per footcandle [(mod ft^{-2}) fc^{-1}].

	White		Yellow	
Observation angle	0.2°	0.5°	0.2°	0.5°
Specific luminance [(mod ft^{-2}) fc^{-1}].	550	380	410	250

2.05 **REFLECTIVITY RETENTION**: The glass beads must be strongly bonded and not easily removed by traffic wear.

The material shall be capable of passing the following bead retention test:

Taber Abraser Simulation Test

Using a Taber Abraser with an H-18 wheel and a 125 gram load, the sample shall be inspected at 200 cycles under a microscope to observe the extent and type of bead failure.

No more than 15 percent of the beads shall be lost due to popout, and the predominant mode of failures shall be "wear down" of the beads.

2.06 **THICKNESS**: The material shall have a film thickness of 0.060 $\pm$ 0.010 inches (excluding thickness of adhesives).

2.07 **TENSILE STRENGTH AND ELONGATION**: The film shall have a minimum tensile strength of 150 pounds per square inch of cross-section when tested according to ASTM D 638-76. A 6 inch x 1 inch sample tested at a temperature between 70°F and 80°F using jaw speeds of 10 to 12 inches per minute shall have a minimum elongation of 35 percent at break when tested by methods described in ASTM D 638-61t.

2.08 **STATIC LOAD STRENGTH**: The test specimen cut to dimensions of 6 inch x 1 inch shall be capable of supporting a dead load weight of 5 pounds for no less than 30 minutes. This test shall be conducted at a temperature of 70°F to 80°F.

2.09 **PATCHABILITY**: The pavement marking film shall be capable of use for patching work areas of any type of coldplastic material in accordance with supplier's instructions.

2.10 **SKID RESISTANCE**: The surface of the pavement marking shall provide an initial minimum skid resistance value of 45 BPN when tested according to ASTM E 303.

2.11 APPLICATION: As follows:

A. General - The color and width of line markings, and the color, type and size of symbols or legends, shall conform to the current edition of the Michigan Manual of Uniform Traffic Control Devices.

The Contractor shall apply the material to clean and dry pavement surfaces by a mechanical applicator or other types of application procedures as approved by the Engineer. Where determined by the Engineer, additional primer shall be applied to the pavement surface to ensure adequate adhesion. The material shall be applied on top of pavement surfaces (overlay application). Embedment of material in new bituminous surface applications is optional (inlay application). After application the markings shall be immediately ready for traffic.

When using the overlay application method, the Contractor shall apply a liquid primer (a type recommended by the supplier) on all pavement surfaces beneath the full extend of the marking. The Contractor shall follow manufacturer's recommendations in allowing adequate time for primer to evaporate all solvents before application of the marking. New concrete surfaces shall be lightly sandblasted to remove the curing compound prior to application of the primer. Immediately after placement the marking shall be tamped with a minimum 200 pound roller cart.

When marking by the inlay application method, the material is required to withstand the pressure of 5 to 10 ton tandem rollers used to imbed the material into the new bituminous surface. The inlay application method does not require the application of liquid primer on the pavement surface. The placed line shall not vary in width more than 1/8 inch. The inlay process shall incur no shifting, turning, twisting, or other deformation to the material. After placement, the marking shall be immediately ready for traffic.

B. Markings - Installation of symbol, legends, and lane lines may be placed over existing similar markings.

Any existing markings to be retraced, which consist of thermoplastic or coldplastic material with any following conditions, shall be removed to the extent determined by the Engineer.

1. Poor adhesion to the surface.
2. Excessive thickness as determined by the Engineer.
3. Dimensions of new marking are different than that of old marking. The Contractor has the option of installing the new marking as an exact overlay of the old marking in lieu of removal.
4. Where designated for removal in the proposal and / or the plans.

Railroad markings shall be placed over similar markings except when the location of existing markings are not in reasonable conformance with the current edition of the Michigan Manual of Uniform Traffic Control Devices. Existing plastic railroad markings which are not recovered may remain if the new marking at the appropriate "L" distance does not overlap.

2.12 TEMPERATURE: Overlay application method - the ambient temperature shall be a minimum of 50^{o}F.

Inlay application method - the ambient temperature shall be a minimum of 40°F; the bituminous surface shall be 90°F minimum to 150°F maximum.

2.13 **METHOD OF MEASUREMENT**: The method of measuring quantities for payment shall be the number of linear feet of appropriate width, and / or number of symbol and legend units, installed and accepted.

Railroad markings shall consist of "RXR" legend only. Accompanying transverse bars shall be bid separately on a linear foot basis.

2.14 **BASIS OF PAYMENT**: These items will be paid for at the contract unit price for Coldplastic Pavement Markings, legends and symbols, of the color, width, and type specified.

Cleaning of the road surface, sandblasting, and use of a primer of the type and quantity as specified by the supplier shall be incidental to the project. Removal of existing thermoplastic and / or coldplastic material shall be included as part of the pay item.

2.15 **DELAYED ACCEPTANCE**: Delayed acceptance is that period of time when the Contractor must replace all markings that have failed. Final acceptance of completed coldplastic pavement markings work will be delayed until May 1st of the following year. During this time inspection of the markings will be conducted at the Engineer's discretion. If failure occurs on any installation, the Contractor shall replace the marking at the Contractor's expense.

Markings replaced during the calendar year of initial application shall be subject to a delayed acceptance date of May 1st in the following year. Markings replaced the year following initial application must be installed by June 15th and will be subject to a 90-day delayed acceptance period.

If the Contractor wishes to have the project accepted for final payment prior to the delayed acceptance procedure described above, he must, when the balance of the contract work has been satisfactorily completed, furnish the City with a maintenance bond equal in value to 90 percent of the value of the cold plastic pavement marking work performed.

GENERAL SPECIFICATIONS FOR TRAFFIC LOOP DETECTORS

1.00 **LOOP DETECTOR INCLUDING LEAD-IN**: This item of work consists of furnishing and installing a 6 feet x 20 feet preformed polypropylene loop detector, including loop lead-in, connections, and all testing to produce a functional loop assembly. The work shall be performed at the location shown in the plans or directed by the Engineer. The work includes de-energizing, removal, and disposal of the existing loop detector and lead-in as required.

The preformed loop shall be installed in accordance with the manufacturer's instructions and shall be centered at the location indicated on the plans unless otherwise directed by the Engineer. The loop shall not enclose any ferrous metal such as manholes, handholes, and other castings.

The loop lead-in shall be brought into the existing handhole at the time the loop is placed in the pavement and shall, in any event, be protected against any physical damage. The ends shall be taped to prevent water from entering the wire.

The loop and its lead-in shall be installed in a manner to be free from kinks, abrasions, or punctures. The loop shall be unfolded in advance of installation so that it will lay down flat. Each expansion / contraction joint along the loop and lead-in shall be covered by a slide per manufacturer's instructions. The loop and lead-in shall be secured as recommended by the manufacturer so that it does not uplift during installation.

The lead-in shall be connected to existing cable at the handhole in the presence of, and as directed by, the City of Royal Oak D.P.S. Electrical Division. All voids adjacent to conduit at handhole walls shall be sealed with non-shrink grout.

Prior to energizing the loop detector, the Contractor shall check the loop for continuity and resistance to ground. The loop shall be tested for continuity at the handhole. This resistance shall not exceed 1.5 ohms, unless otherwise instructed by the manufacturer. The resistance to ground of the loop and its lead-in shall be a minimum of 1.0 mega ohms under conditions of weather or moisture, unless otherwise directed by the manufacturer. In the absence of circuit grounds, a temporary ground may be provided by a driven ground rod.

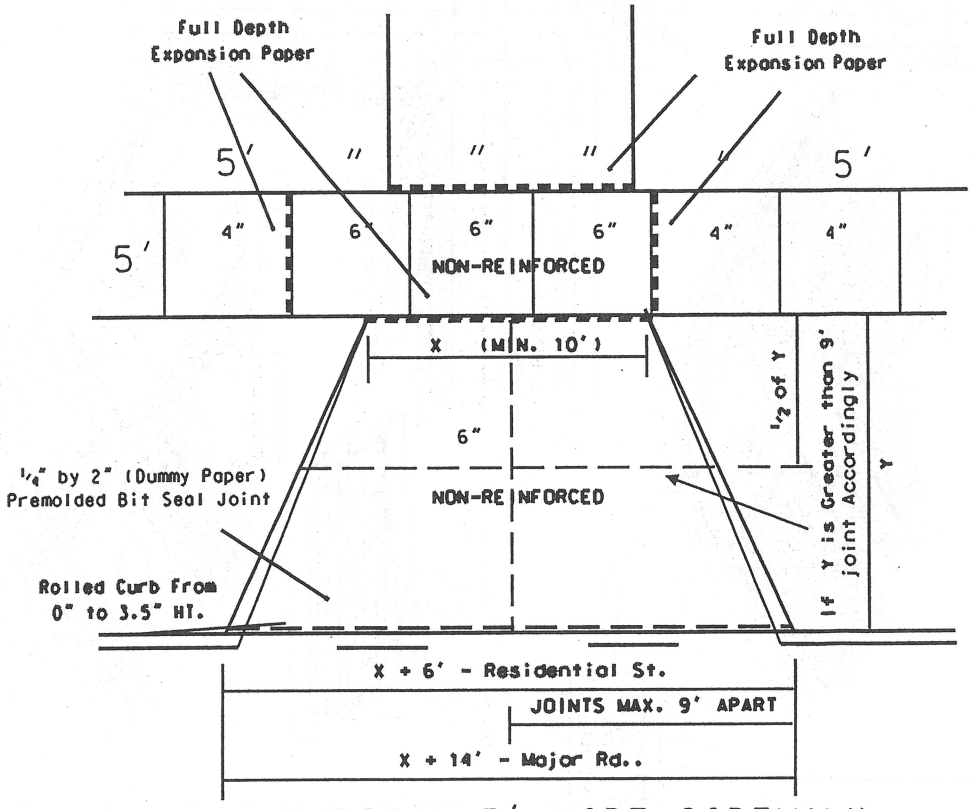
The loop detector and lead-in shall be manufactured as a preformed complete assembly that can be direct buried in fresh concrete and requiring no on-site fabrication. The assembly shall have flexible expansion / contraction joints capable of providing 1 inch of movement. Conduit for the assembly shall be 3/8 inch in diameter asphalt-rubber filled polypropylene conduit. Wire shall be #16 TFFN MTW wire. The assembly shall be Model C as manufactured by Never-Fail Loop Systems, or approved equal.

The completed work of this item will be measured in place by unit. The contract unit price will be payment in full for providing all labor, equipment, and materials for the complete installation of the loop detector in working order.

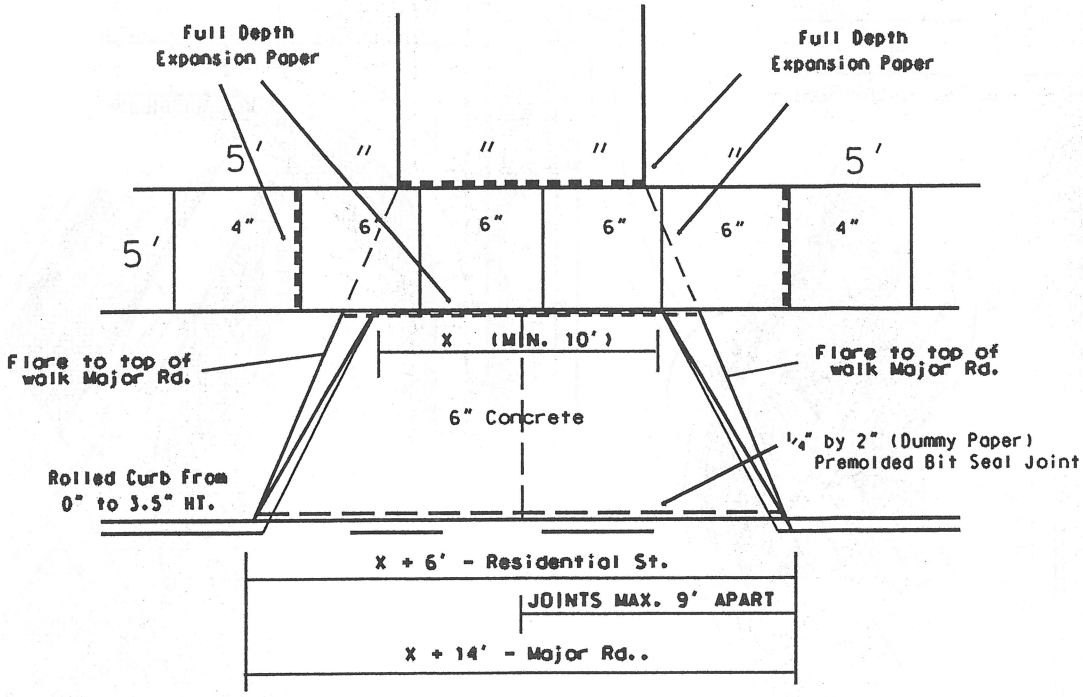
2.00 **DIGITAL LOOP DETECTORS**: This item of work consists of furnishing digital loop detectors meeting current NEMA standards. Loops detectors shall be furnished in accordance with the 2012 MDOT Standard Specifications for Construction, Section 921.09.

DRIVEWAY APPROACH & SIDEWALK

FOR NEW OR MODIFIED CURB DROP OPENINGS



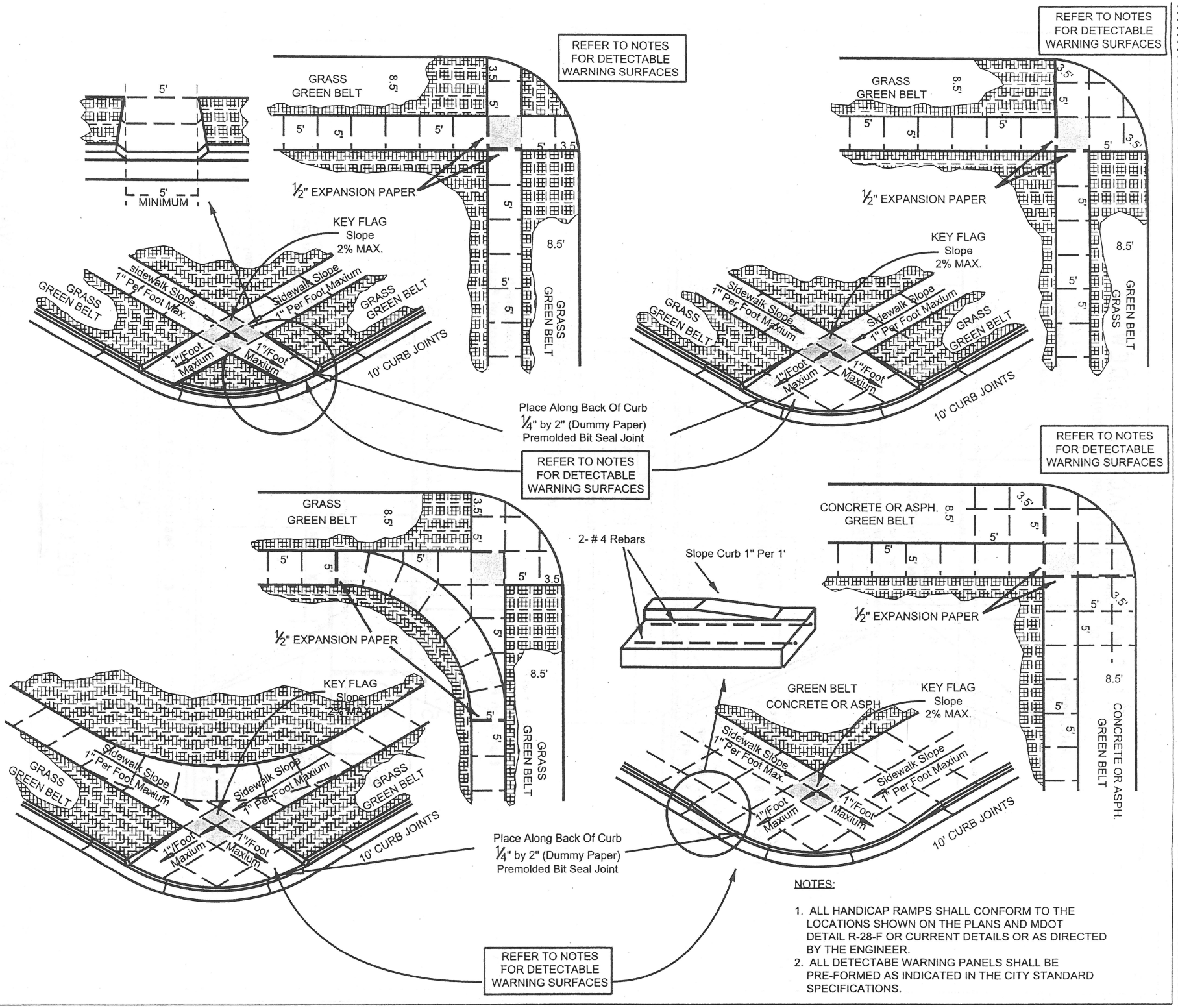
TYPICAL 5' WIDE SIDEWALK



DETAIL A

NO SCALE

DETAIL A - DRIVEWAY APPROACH CONCRETE



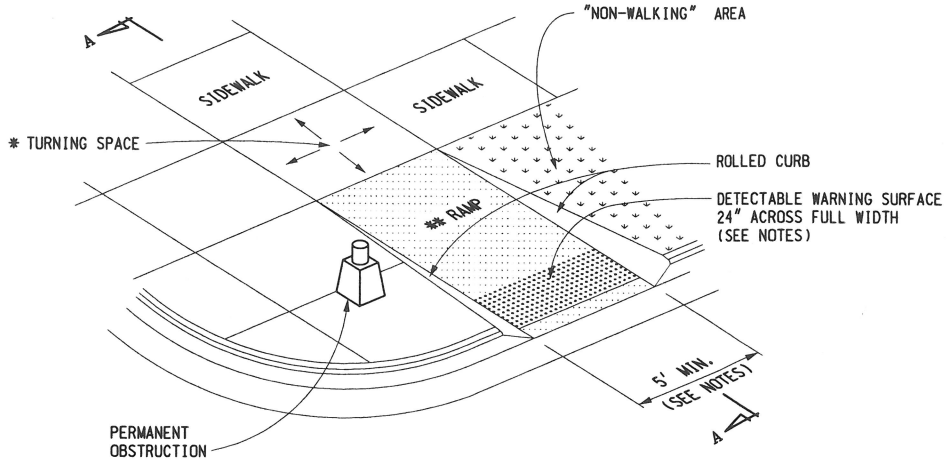
DETAIL B - SIDEWALK, RAMPS, JOINTING & EXPANSION PAPER LAYOUT

NOTES:

1. ALL HANDICAP RAMPS SHALL CONFORM TO THE LOCATIONS SHOWN ON THE PLANS AND MDOT DETAIL R-28-F OR CURRENT DETAILS OR AS DIRECTED BY THE ENGINEER.
2. ALL DETECTABE WARNING PANELS SHALL BE PRE-FORMED AS INDICATED IN THE CITY STANDARD SPECIFICATIONS.

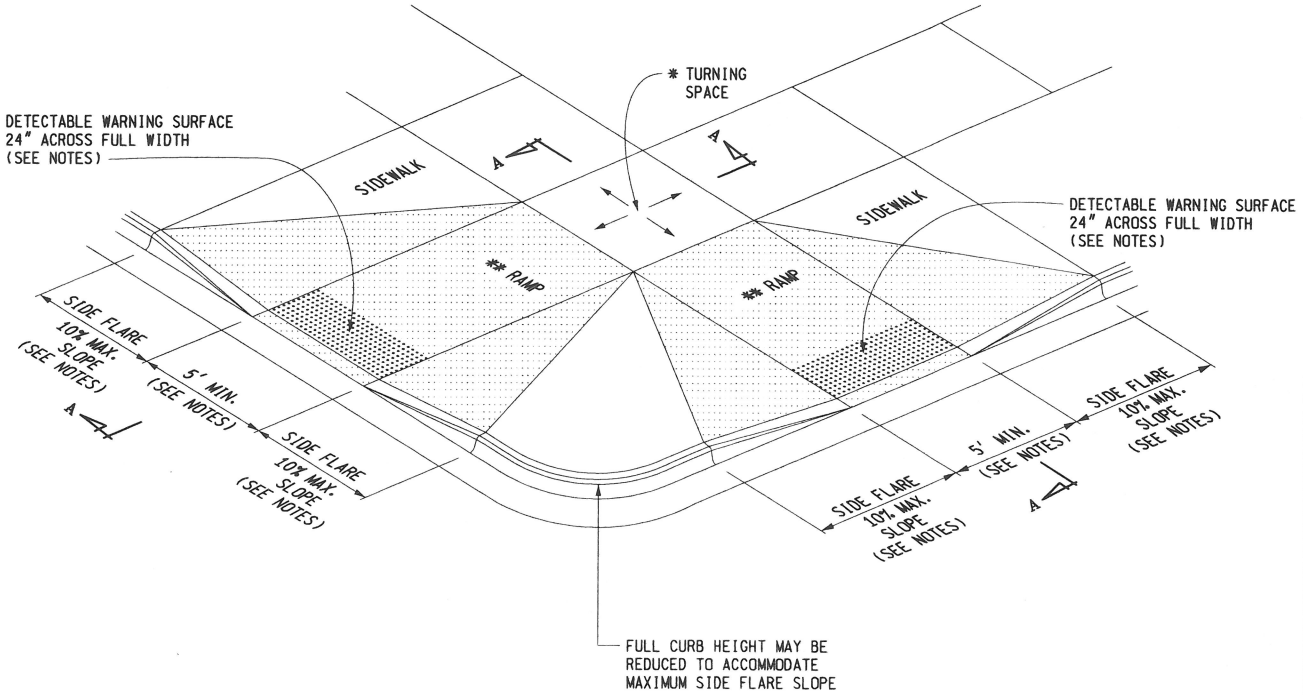
* MAXIMUM TURNING SPACE SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

** MAXIMUM RAMP CROSS SLOPE IS 2.0%, RUNNING SLOPE 5% - 7% (8.3% MAXIMUM). SEE NOTES.



SIDEWALK RAMP TYPE R

(ROLLED SIDES)



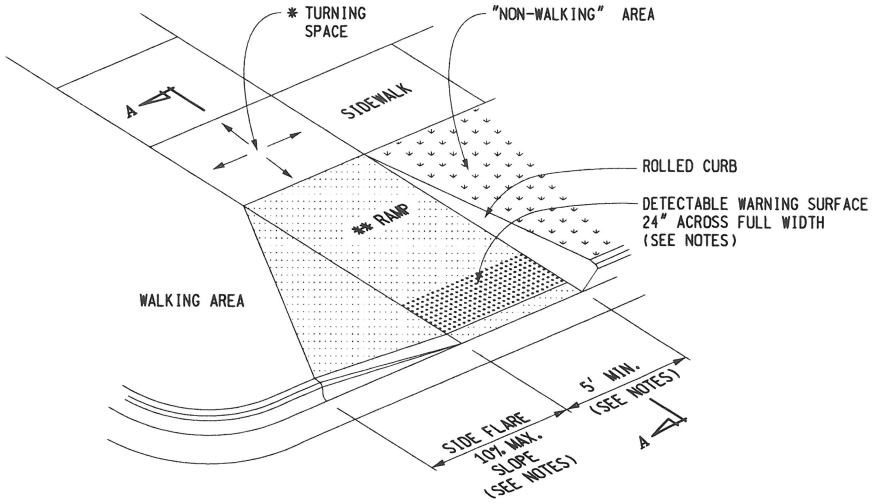
SIDEWALK RAMP TYPE F

(FLARED SIDES, TWO RAMPS SHOWN)

MDOT Michigan Department of Transportation PREPARED BY DESIGN DIVISION DRAWN BY: B.L.T. CHECKED BY: W.K.P.	DEPARTMENT DIRECTOR Kirk T. Steudle APPROVED BY: _____ DIRECTOR, BUREAU OF FIELD SERVICES APPROVED BY: _____ DIRECTOR, BUREAU OF HIGHWAY DEVELOPMENT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR SIDEWALK RAMP AND DETECTABLE WARNING DETAILS	
		9-30-2014 F.H.W.A. APPROVAL 7-1-2014 PLAN DATE	R-28-I SHEET 1 OF 7

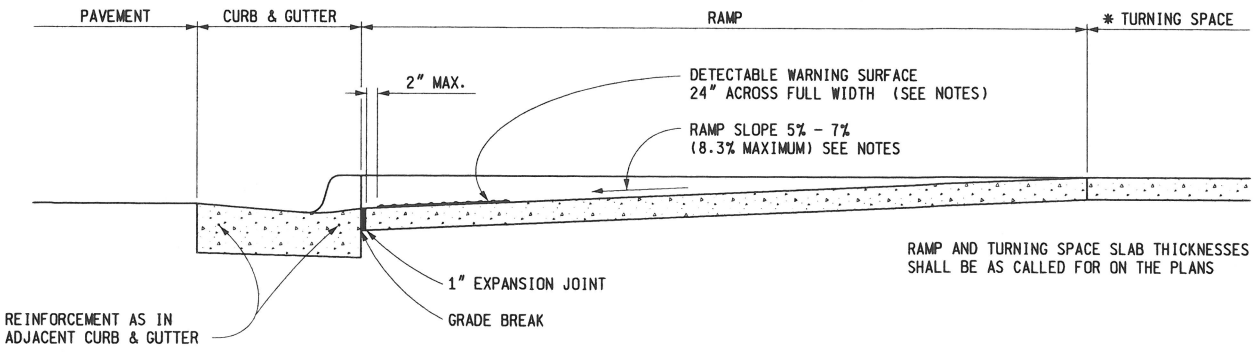
* MAXIMUM TURNING SPACE SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. MINIMUM DIMENSIONS 5′ x 5′. SEE NOTES.

** MAXIMUM RAMP CROSS SLOPE IS 2.0%, RUNNING SLOPE 5% – 7% (8.3% MAXIMUM). SEE NOTES.



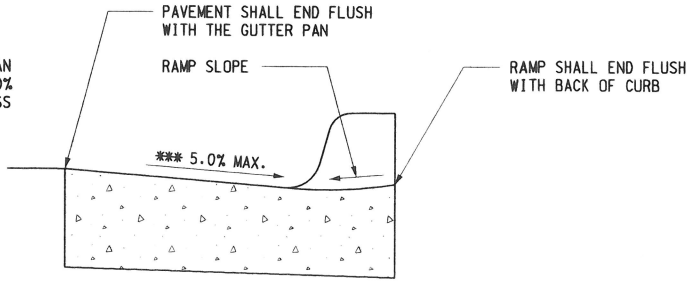
SIDEWALK RAMP TYPE RF

(ROLLED / FLARED SIDES)



SECTION A-A

*** TRANSITION ADJACENT GUTTER PAN CROSS SECTION TO PROVIDE 5.0% MAXIMUM COUNTER SLOPE ACROSS THE RAMP OPENING.



SECTION THROUGH CURB CUT

(TYPICAL ALL RAMP TYPES)

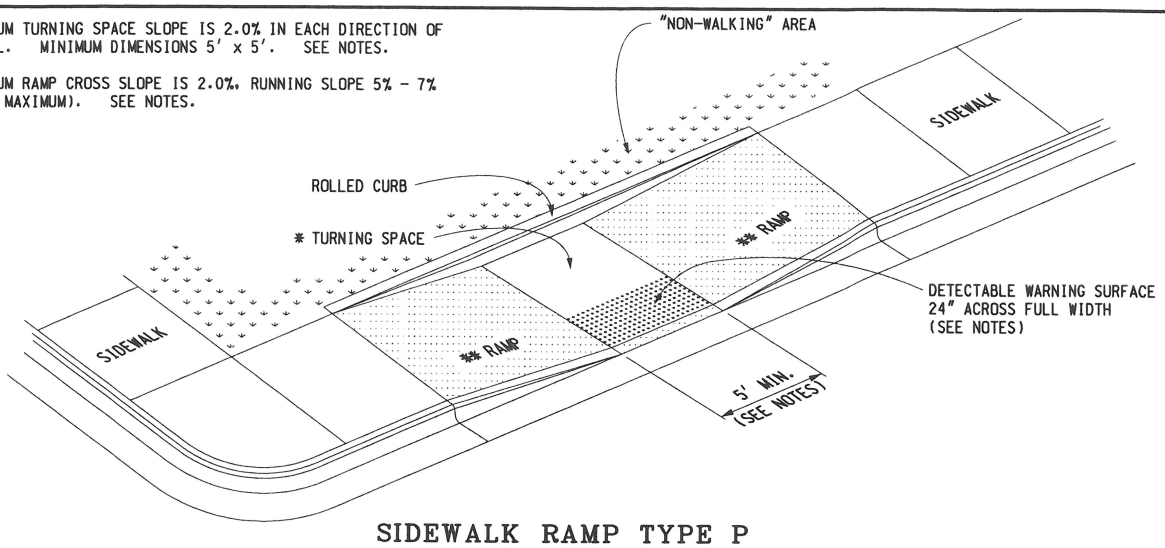
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

SIDEWALK RAMP AND DETECTABLE WARNING DETAILS

9-30-2014 F.H.W.A. APPROVAL	7-1-2014 PLAN DATE	R-28-I	SHEET 2 OF 7

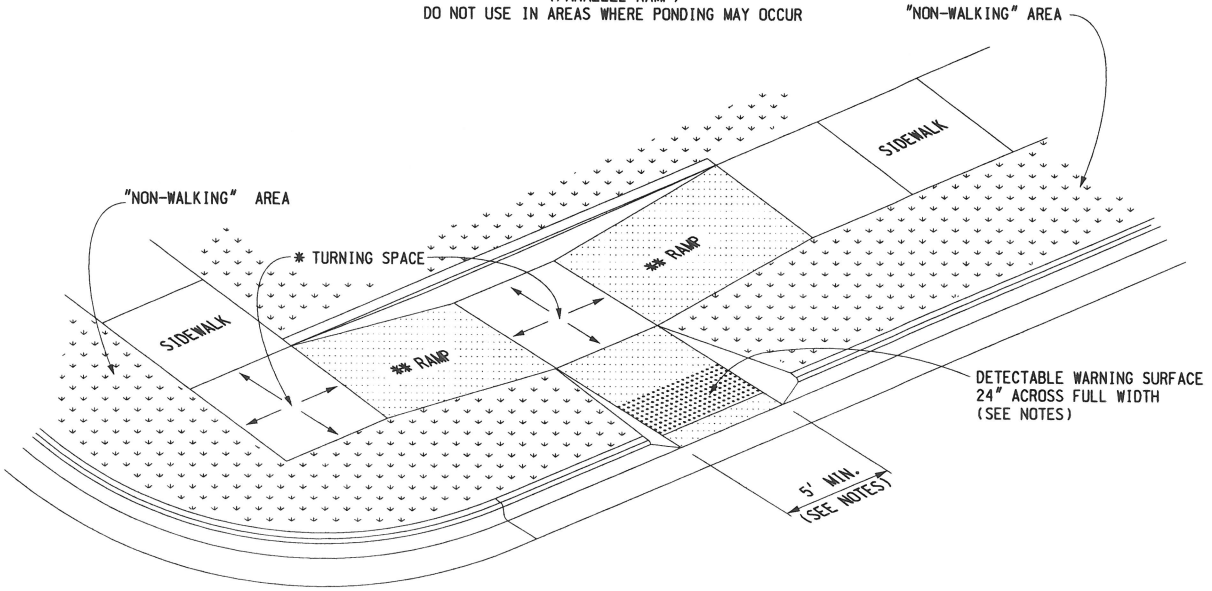
* MAXIMUM TURNING SPACE SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

** MAXIMUM RAMP CROSS SLOPE IS 2.0%, RUNNING SLOPE 5% - 7% (8.3% MAXIMUM). SEE NOTES.



SIDEWALK RAMP TYPE P

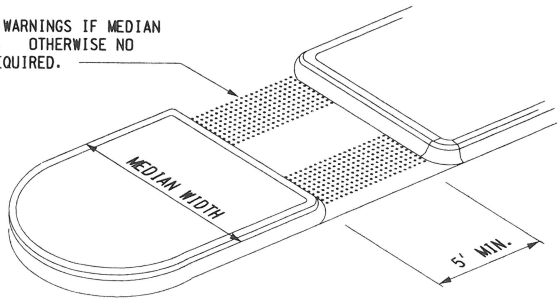
(PARALLEL RAMP)
DO NOT USE IN AREAS WHERE PONDING MAY OCCUR



SIDEWALK RAMP TYPE C

(COMBINATION RAMP)

USE 24" DEEP DETECTABLE WARNINGS IF MEDIAN WIDTH IS AT LEAST 6'-0". OTHERWISE NO DETECTABLE WARNING IS REQUIRED.



SIDEWALK RAMP TYPE M

(MEDIAN ISLAND)

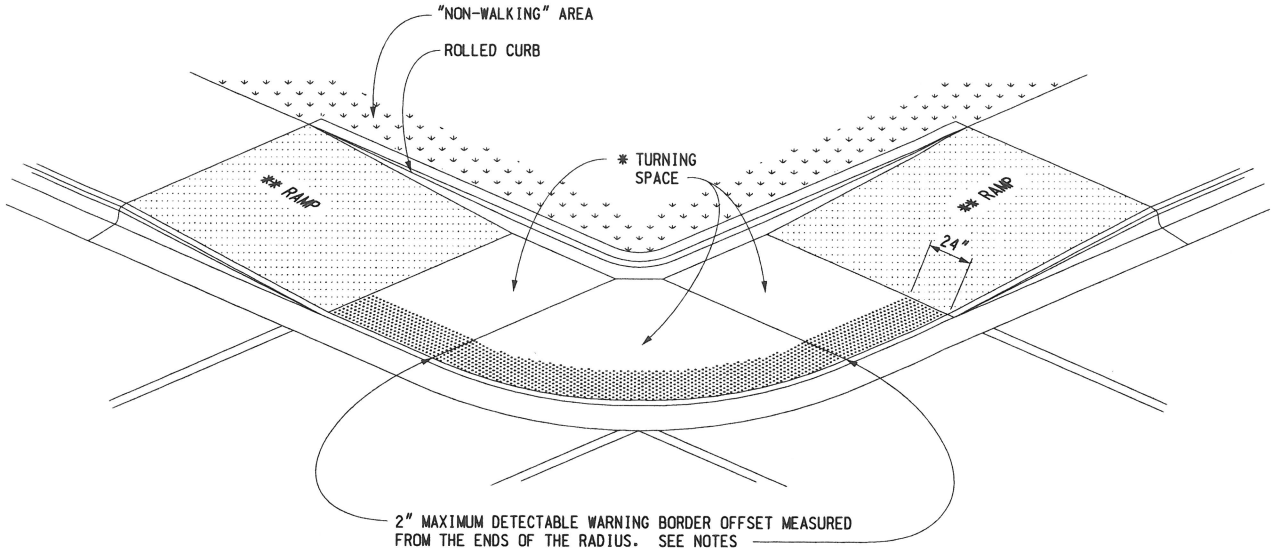
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

SIDEWALK RAMP AND DETECTABLE WARNING DETAILS

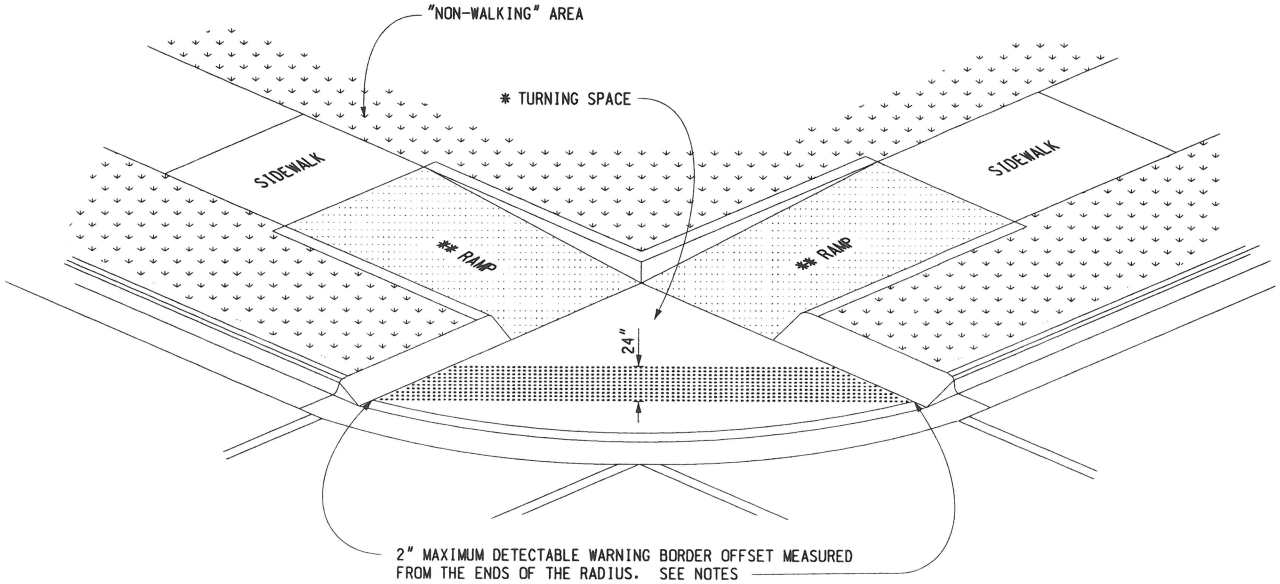
9-30-2014 F.H.W.A. APPROVAL	7-1-2014 PLAN DATE	R-28-I	SHEET 3 OF 7

* MAXIMUM TURNING SPACE SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

** MAXIMUM RAMP CROSS SLOPE IS 2.0%. RUNNING SLOPE 5% - 7% (8.3% MAXIMUM). SEE NOTES.



(RADIAL DETECTABLE WARNING SHOWN)



(TANGENT DETECTABLE WARNING SHOWN)

SIDEWALK RAMP TYPE D

(DEPRESSED CORNER)

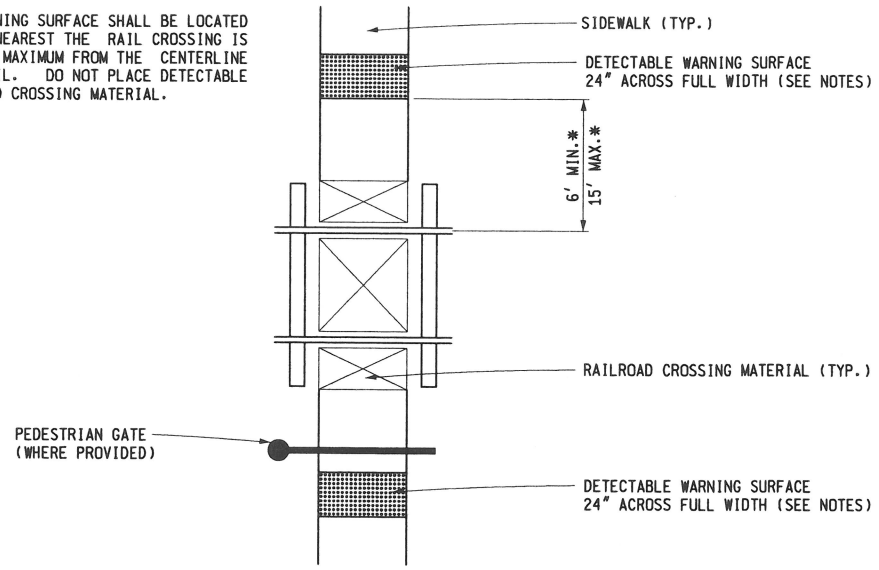
USE ONLY WHEN INDEPENDENT DIRECTIONAL RAMPS CAN NOT BE CONSTRUCTED FOR EACH CROSSING DIRECTION

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

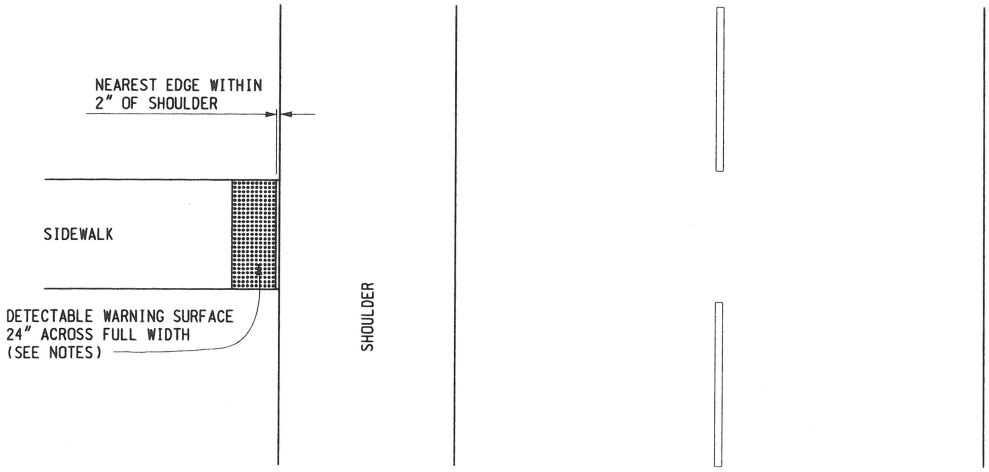
SIDEWALK RAMP AND DETECTABLE WARNING DETAILS

9-30-2014 F.H.W.A. APPROVAL	7-1-2014 PLAN DATE	R-28-I	SHEET 4 OF 7

* THE DETECTABLE WARNING SURFACE SHALL BE LOCATED SO THAT THE EDGE NEAREST THE RAIL CROSSING IS 6' MINIMUM AND 15' MAXIMUM FROM THE CENTERLINE OF THE NEAREST RAIL. DO NOT PLACE DETECTABLE WARNING ON RAILROAD CROSSING MATERIAL.



DETECTABLE WARNING AT RAILROAD CROSSING

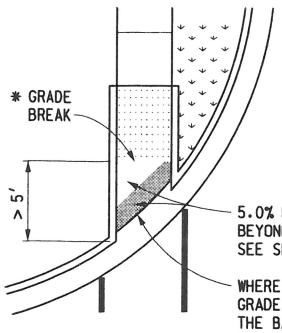


DETECTABLE WARNING AT FLUSH SHOULDER OR ROADWAY

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

SIDEWALK RAMP AND DETECTABLE WARNING DETAILS

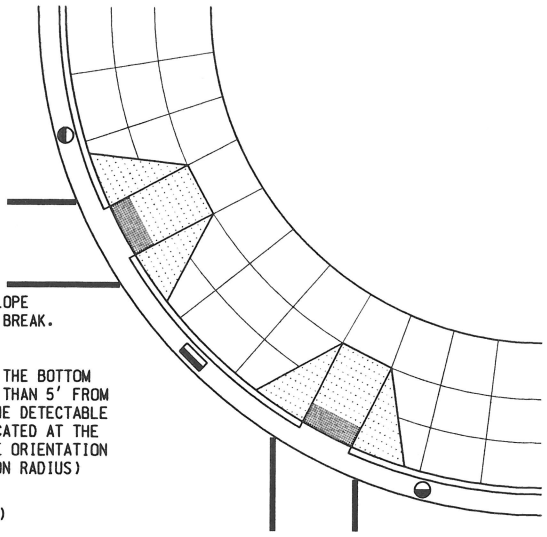
9-30-2014 F.H.W.A. APPROVAL	7-1-2014 PLAN DATE	R-28-I	SHEET 5 OF 7



5.0% MAX. RUNNING SLOPE BEYOND BOTTOM GRADE BREAK. SEE SECTION B-B

WHERE EITHER END OF THE BOTTOM GRADE BREAK IS MORE THAN 5' FROM THE BACK OF CURB, THE DETECTABLE WARNING SHALL BE LOCATED AT THE BACK OF CURB. (DOME ORIENTATION IS NOT SIGNIFICANT ON RADIUS)

SIDEWALK RAMP LOCATED IN RADIUS (TYPE R SHOWN)
(GRADE BREAK GREATER THAN 5')

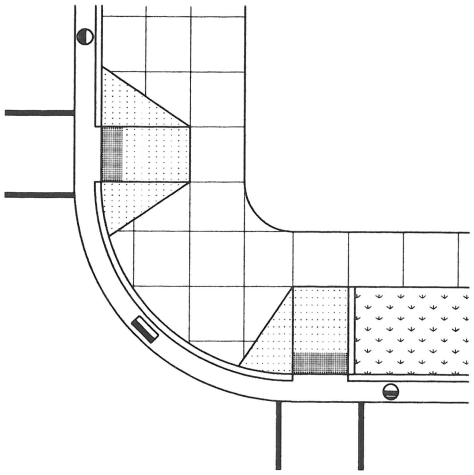


SIDEWALK RAMP PERPENDICULAR TO RADIAL CURB (TYPE F SHOWN)

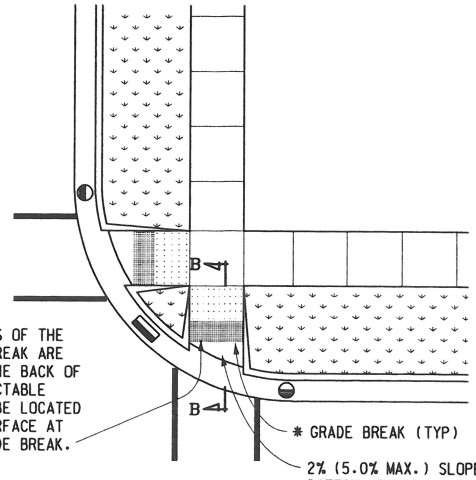
(USE WITH RADIAL CURB WHEN THE CROSSWALK AND SIDEWALK RAMP ARE NOT ALIGNED)

LEGEND

- SLOPED SURFACE
- DETECTABLE WARNING
- "NON-WALKING" AREA
- CROSSWALK MARKING
- PREFERRED LOCATION OF DRAINAGE INLET (TYP.)
- ALTERNATE LOCATION OF DRAINAGE INLET (TYP.)



SIDEWALK RAMP PERPENDICULAR TO TANGENT CURB
(TYPE F AND TYPE RF SHOWN)

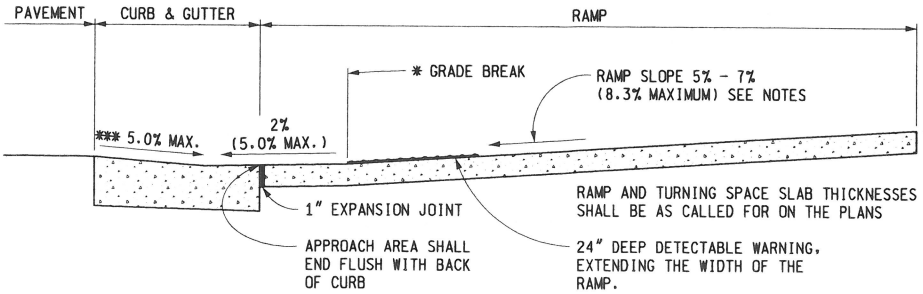


WHERE BOTH ENDS OF THE BOTTOM GRADE BREAK ARE WITHIN 5' OF THE BACK OF CURB, THE DETECTABLE WARNING SHALL BE LOCATED ON THE RAMP SURFACE AT THE BOTTOM GRADE BREAK.

* GRADE BREAK (TYP)

2% (5.0% MAX.) SLOPE BEYOND BOTTOM GRADE BREAK

SIDEWALK RAMP LOCATED IN RADIUS (TYPE R SHOWN)
(GRADE BREAK LESS THAN 5')



* GRADE BREAKS AT THE TOP AND BOTTOM OF CURB RAMPS SHALL BE PERPENDICULAR TO THE DIRECTION OF TRAVEL.

*** TRANSITION ADJACENT GUTTER PAN CROSS SECTION TO PROVIDE 5.0% MAXIMUM COUNTER SLOPE ACROSS THE RAMP OPENING.

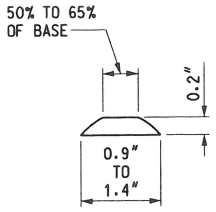
SECTION B-B

SIDEWALK RAMP ORIENTATION

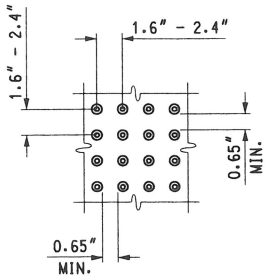
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

SIDEWALK RAMP AND DETECTABLE WARNING DETAILS

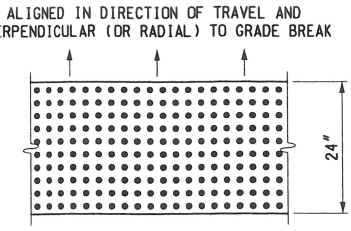
9-30-2014 F.H.W.A. APPROVAL	7-1-2014 PLAN DATE	R-28-I	SHEET 6 OF 7



DOME SECTION



DOME SPACING



DOME ALIGNMENT

DETECTABLE WARNING DETAILS

NOTES:

DETAILS SPECIFIED ON THIS PLAN APPLY TO ALL CONSTRUCTION, RECONSTRUCTION, OR ALTERATION OF STREETS, CURBS, OR SIDEWALKS IN THE PUBLIC RIGHT OF WAY.

SIDEWALK RAMPS ARE TO BE LOCATED AS SPECIFIED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.

RAMPS SHALL BE PROVIDED AT ALL CORNERS OF AN INTERSECTION WHERE THERE IS EXISTING OR PROPOSED SIDEWALK AND CURB. RAMPS SHALL ALSO BE PROVIDED AT MARKED AND/OR SIGNALIZED MID-BLOCK CROSSINGS.

SURFACE TEXTURE OF THE RAMP SHALL BE THAT OBTAINED BY A COARSE BROOMING, TRANSVERSE TO THE RUNNING SLOPE.

SIDEWALK SHALL BE RAMPED WHERE THE DRIVEWAY CURB IS EXTENDED ACROSS THE WALK.

CARE SHALL BE TAKEN TO ASSURE A UNIFORM GRADE ON THE RAMP. WHERE CONDITIONS PERMIT, IT IS DESIRABLE THAT THE SLOPE OF THE RAMP BE IN ONLY ONE DIRECTION, PARALLEL TO THE DIRECTION OF TRAVEL.

RAMP WIDTH SHALL BE INCREASED, IF NECESSARY, TO ACCOMMODATE SIDEWALK SNOW REMOVAL EQUIPMENT NORMALLY USED BY THE MUNICIPALITY.

PROVIDE TURNING SPACES WHERE PEDESTRIAN TURNING MOVEMENTS ARE REQUIRED.

WHEN 5' MINIMUM WIDTHS ARE NOT FEASIBLE, RAMP WIDTH MAY BE REDUCED TO NOT LESS THAN 4' AND TURNING SPACES TO NOT LESS THAN 4' x 4'.

DETECTABLE WARNING SURFACE COVERAGE IS 24" MINIMUM IN THE DIRECTION OF RAMP/PATH TRAVEL AND THE FULL WIDTH OF THE RAMP/PATH OPENING EXCLUDING CURBED OR FLARED CURB TRANSITION AREAS. A BORDER OFFSET NOT GREATER THAN 2" MEASURED ALONG THE EDGES OF THE DETECTABLE WARNING IS ALLOWABLE. FOR RADIAL CURB THE OFFSET IS MEASURED FROM THE ENDS OF THE RADIUS.

FOR NEW ROADWAY CONSTRUCTION, THE RAMP CROSS SLOPE MAY NOT EXCEED 2.0%. FOR ALTERATIONS TO EXISTING ROADWAYS, THE CROSS SLOPE MAY BE TRANSITIONED TO MEET AN EXISTING ROADWAY GRADE. THE CROSS SLOPE TRANSITION SHALL BE APPLIED UNIFORMLY OVER THE FULL LENGTH OF THE RAMP.

THE MAXIMUM RUNNING SLOPE OF 8.3% IS RELATIVE TO A FLAT (0%) REFERENCE. HOWEVER, IT SHALL NOT REQUIRE ANY RAMP OR SERIES OF RAMPS TO EXCEED 15 FEET IN LENGTH.

DRAINAGE STRUCTURES SHOULD NOT BE PLACED IN LINE WITH RAMPS. THE LOCATION OF THE RAMP SHOULD TAKE PRECEDENCE OVER THE LOCATION OF THE DRAINAGE STRUCTURE. WHERE EXISTING DRAINAGE STRUCTURES ARE LOCATED IN THE RAMP PATH OF TRAVEL, USE A MANUFACTURER'S ADA COMPLIANT GRATE. OPENINGS SHALL NOT BE GREATER THAN $\frac{1}{2}$". ELONGATED OPENINGS SHALL BE PLACED SO THAT THE LONG DIMENSION IS PERPENDICULAR TO THE DOMINANT DIRECTION OF TRAVEL.

TRANSITION THE GUTTER PAN CROSS SECTION SUCH THAT THE COUNTER SLOPE IN THE DIRECTION OF RAMP TRAVEL IS NOT GREATER THAN 5.0%. MAINTAIN THE NORMAL GUTTER PAN CROSS SECTION ACROSS DRAINAGE STRUCTURES.

THE TOP OF THE JOINT FILLER FOR ALL RAMP TYPES SHALL BE FLUSH WITH THE ADJACENT CONCRETE.

CROSSWALK AND STOP LINE MARKINGS, IF USED, SHALL BE SO LOCATED AS TO STOP TRAFFIC SHORT OF RAMP CROSSINGS. SPECIFIC DETAILS FOR MARKING APPLICATIONS ARE GIVEN IN THE "MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES".

FLARED SIDES WITH A SLOPE OF 10% MAXIMUM, MEASURED ALONG THE ROADSIDE CURB LINE, SHALL BE PROVIDED WHERE AN UNOBSTRUCTED CIRCULATION PATH LATERALLY CROSSES THE SIDEWALK RAMP. FLARED SIDES ARE NOT REQUIRED WHERE THE RAMP IS BORDERED BY LANDSCAPING, UNPAVED SURFACE OR PERMANENT FIXED OBJECTS. WHERE THEY ARE NOT REQUIRED, FLARED SIDES CAN BE CONSIDERED IN ORDER TO AVOID SHARP CURB RETURNS AT RAMP OPENINGS.

DETECTABLE WARNING PLATES MUST BE INSTALLED USING FABRICATED OR FIELD CUT UNITS CAST AND/OR ANCHORED IN THE PAVEMENT TO RESIST SHIFTING OR HEAVING.

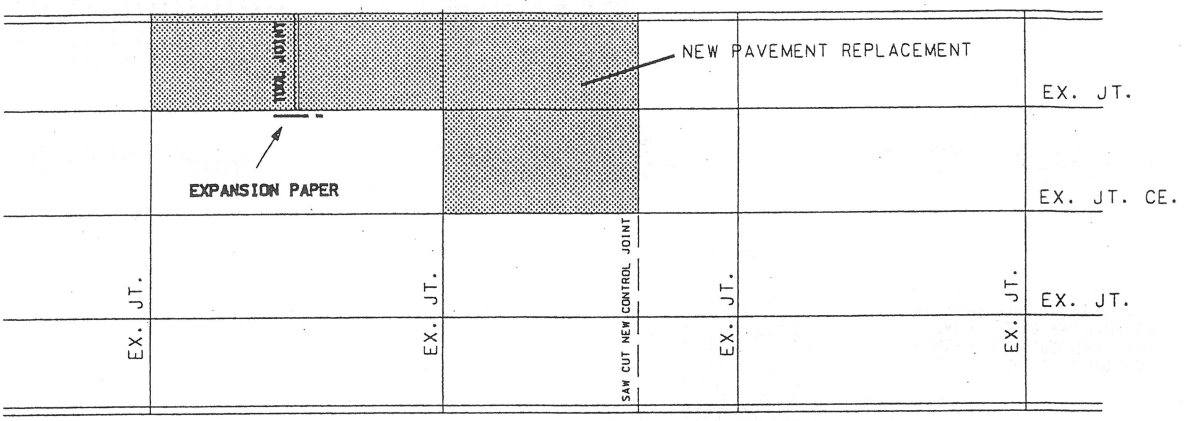
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

SIDEWALK RAMP AND DETECTABLE WARNING DETAILS

9-30-2014 F.H.W.A. APPROVAL	7-1-2014 PLAN DATE	R-28-I	SHEET 7 OF 7

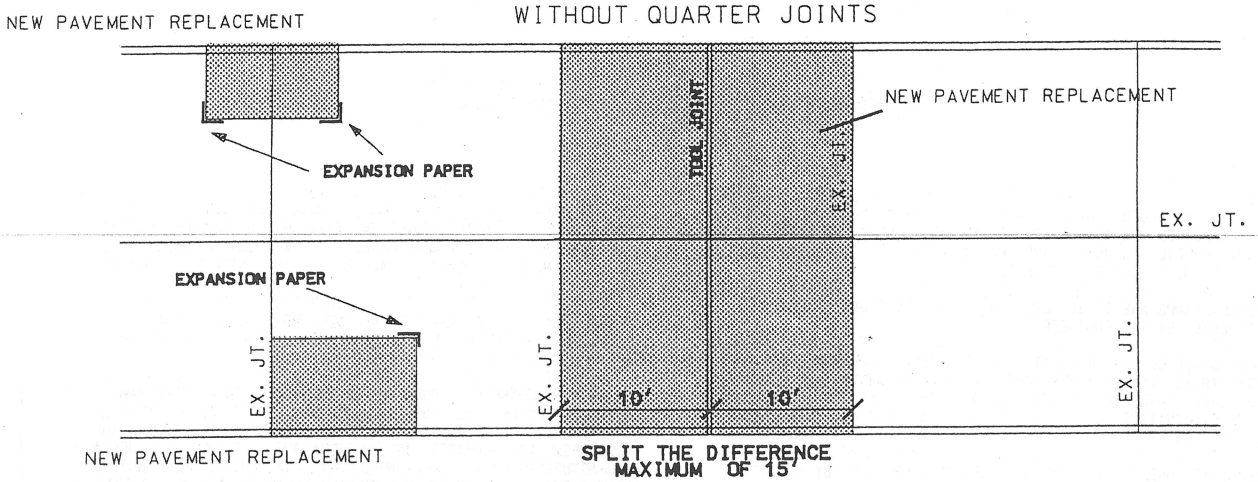
EXISITING CONCRETE PAVEMENT

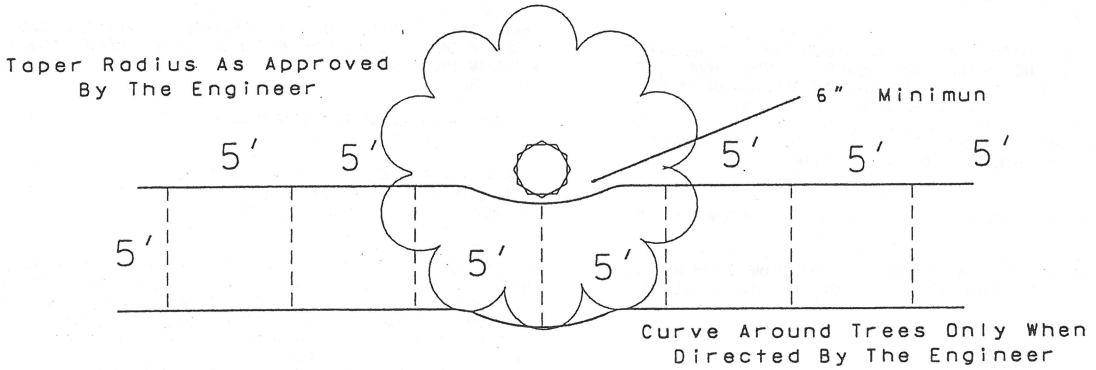
TRANSVERSE JOINTS OVER 15' APART



EXISITING CONCRETE PAVEMENT

TRANSVERSE JOINTS OVER 15' APART
WITHOUT QUARTER JOINTS



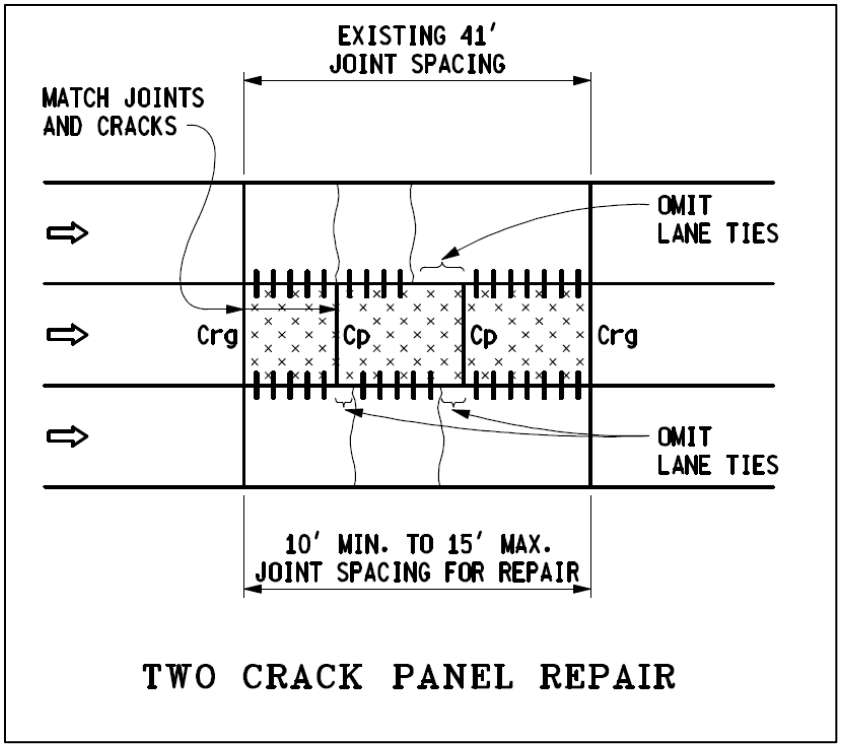


TYPICAL 5' WIDE SIDEWALK
Curve Around Tree

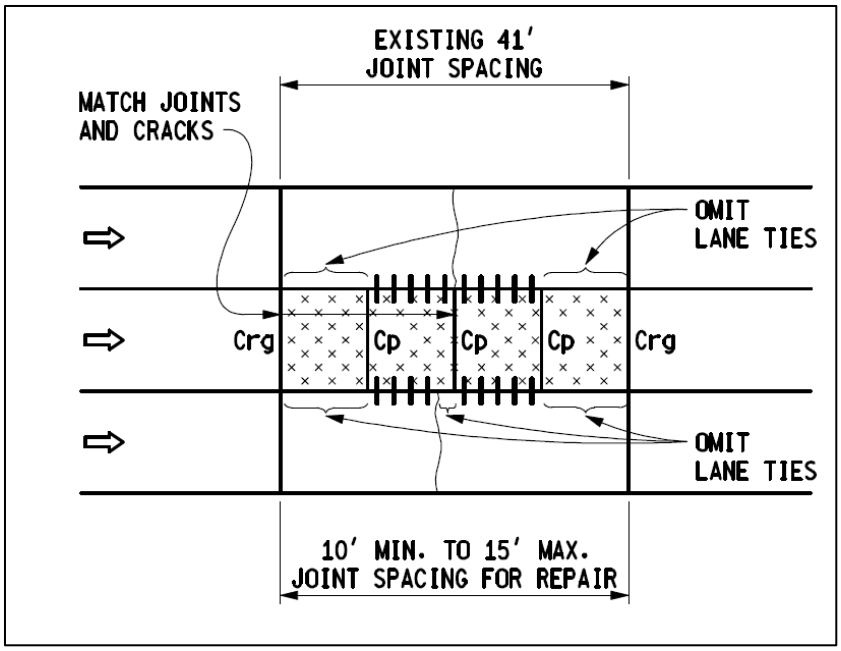
DETAIL -PAVEMENT REPLACEMENT
DETAIL -SIDEWALK AROUND TREE

Concrete Pavement Repair Details

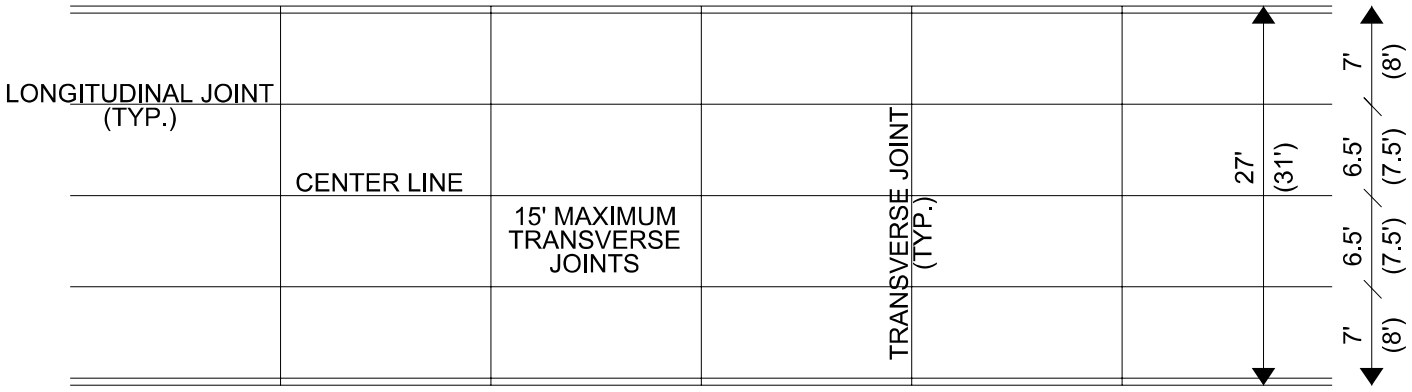
(Based on MDOT Standard Plans)

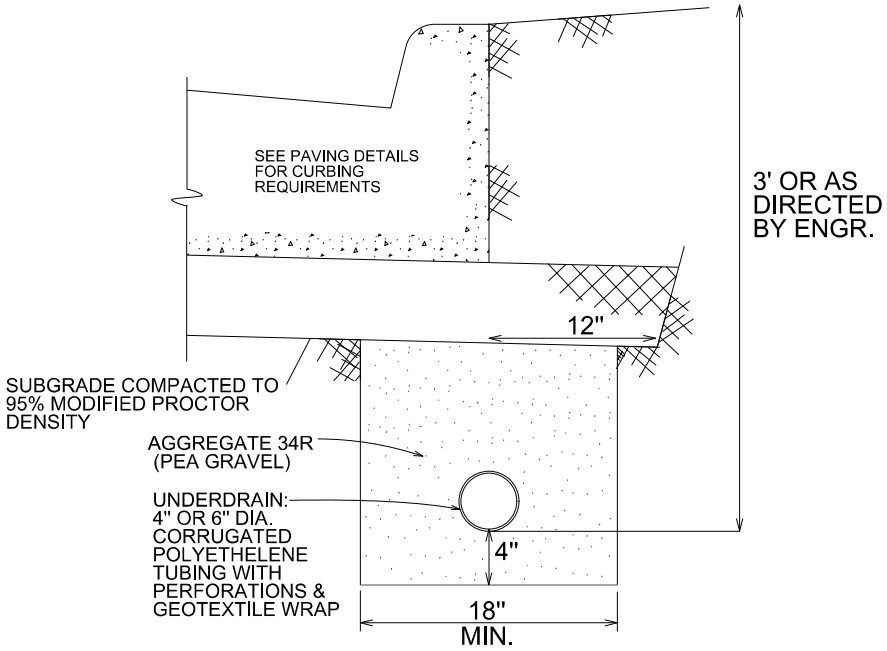


TWO CRACK PANEL REPAIR



TYPICAL JOINT LAYOUT
NEW CONCRETE PAVEMENT

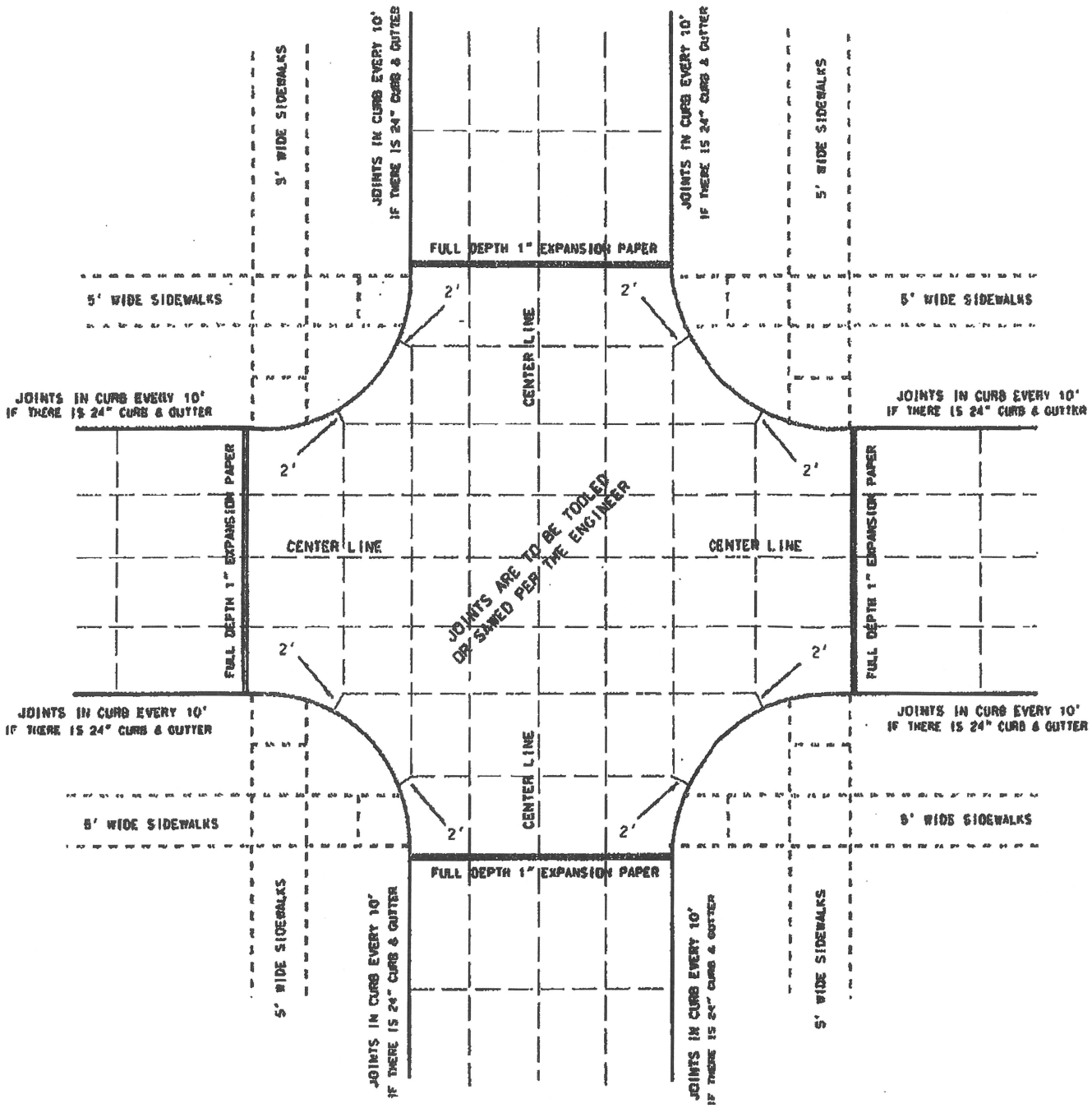




UNDERDRAIN DETAIL

NO SCALE

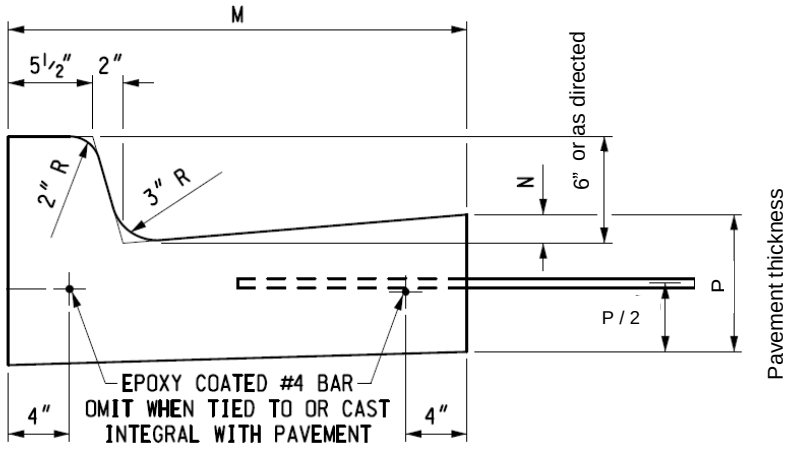
TYPICAL INTERSECTION



JOINT LAYOUT FOR A COMMON INTERSECTION

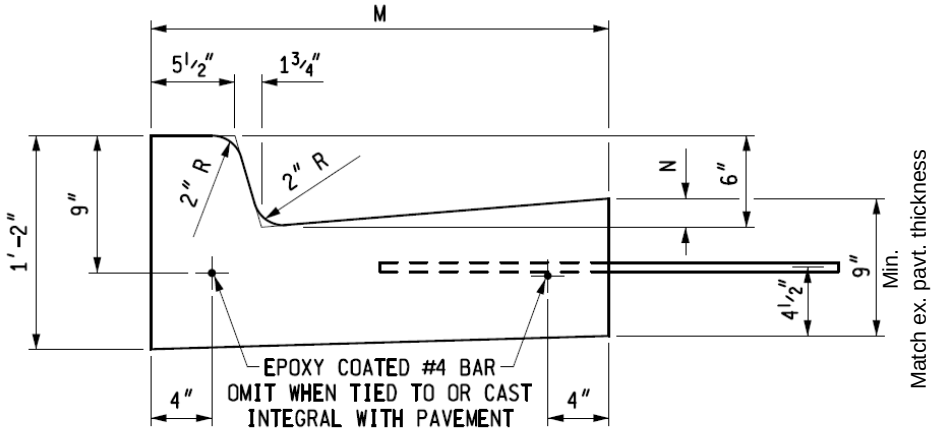
ROYAL OAK – CONCRETE CURB DETAILS

Based on MDOT Type C – Standard Plan:

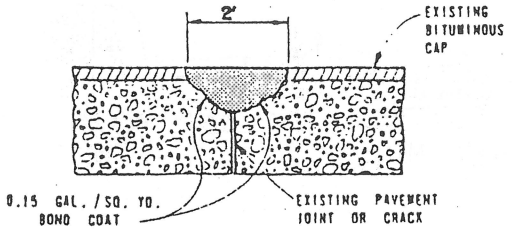


DETAIL	DIMENSION		LANE TIES	CONCRETE CYD / LFT
	M	N		
~~C1~~	~~1' 6"~~	~~⅞"~~	~~AS SHOWN~~	~~0.0506~~
~~C2~~	~~1' 6"~~	~~⅞"~~	~~OMITTED~~	~~0.0506~~
C3	2'-0"	1⅜"	AS SHOWN	0.0632
~~C4~~	~~2' 0"~~	~~1⅜"~~	~~OMITTED~~	~~0.0632~~
~~C5~~	~~2' 6"~~	~~1⅞"~~	~~AS SHOWN~~	~~0.0757~~
~~C6~~	~~2' 6"~~	~~1⅞"~~	~~OMITTED~~	~~0.0757~~

Based on MDOT Type F – Standard Plans:

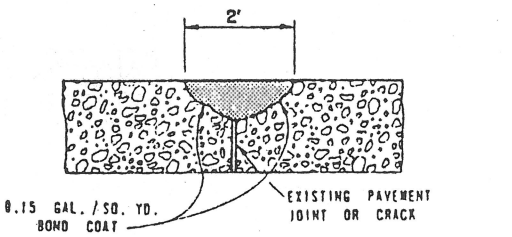


DETAIL	DIMENSION		LANE TIES	CONCRETE CYD / LFT
	M	N		
~~F1~~	~~1'-6"~~	~~⅞"~~	~~AS SHOWN~~	~~0.0484~~
~~F2~~	~~1' 6"~~	~~⅞"~~	~~OMITTED~~	~~0.0484~~
F3	2'-0"	1⅜"	AS SHOWN	0.0610
F4	2'-0"	1⅜"	OMITTED	0.0610
~~F5~~	~~2'-6"~~	~~1⅞"~~	~~AS SHOWN~~	~~0.0737~~
~~F6~~	~~2' 6"~~	~~1⅞"~~	~~OMITTED~~	~~0.0737~~



1. STRIP OFF EXISTING CAP AND REMOVE LOOSE DETERIORATED CONCRETE.
2. REPLACE BITUMINOUS CAP AND LOOSE DETERIORATED CONCRETE WITH BITUMINOUS MIXTURE NO. 1100, 1300, OR 1500 AND COMPACT WITH A MACHINE VIBRATOR OR APPROVED ROLLER. THE COMPACTED BITUMINOUS MIXTURE SHALL BE FLUSH WITH EXISTING BITUMINOUS CAP.

* FOR QUANTITY ESTIMATE PURPOSES ONLY

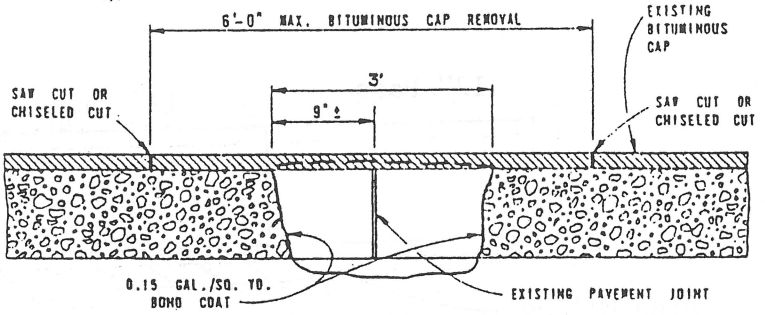


1. WHERE NO BITUMINOUS CAP EXISTS, REMOVE LOOSE DETERIORATED CONCRETE.
2. REPLACE LOOSE DETERIORATED CONCRETE WITH BITUMINOUS MIXTURE NO. 1100, 1300, OR 1500 AND COMPACT WITH A MACHINE VIBRATOR OR APPROVED ROLLER. THE COMPACTED BITUMINOUS MIXTURE SHALL BE FLUSH WITH EXISTING CONCRETE PAVEMENT.

* FOR QUANTITY ESTIMATE PURPOSES ONLY

TRANSVERSE OR LONGITUDINAL JOINT OR CRACK REPAIR

DETAIL 7

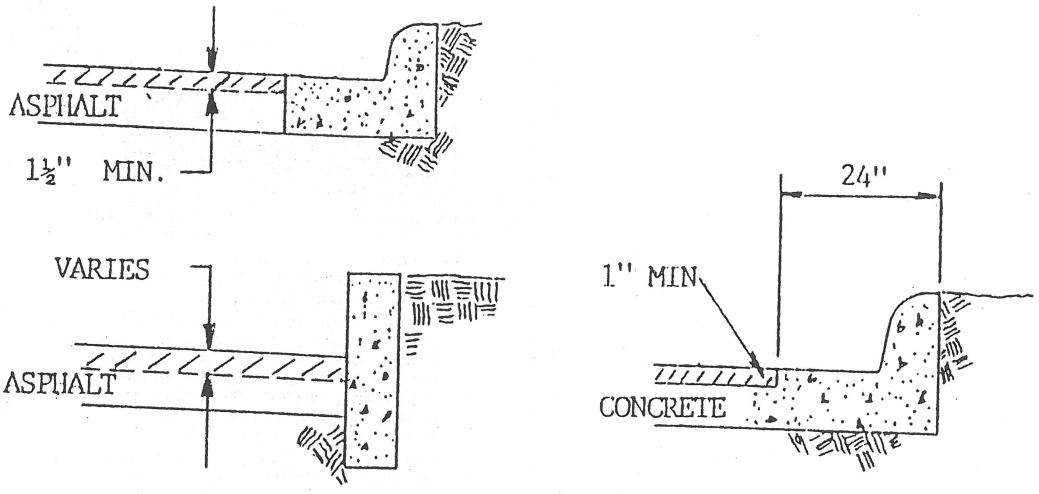


1. STRIP OFF EXISTING BITUMINOUS CAP AND BREAK OUT EXISTING CONCRETE PAVEMENT.
2. REPLACE BROKEN-OUT AREA WITH BITUMINOUS MIXTURE NO. 1100, 1300, OR 1500 AND COMPACT WITH WHEELED OR VIBRATORY EQUIPMENT.
3. REPLACE BITUMINOUS CAP WITH BITUMINOUS MIXTURE NO. 1100, 1300, OR 1500 AND COMPACT WITH APPROVED ROLLER. THE COMPACTED BITUMINOUS MIXTURE SHALL BE FLUSH WITH ADJACENT PAVEMENT SURFACE.

* FOR QUANTITY ESTIMATE PURPOSES ONLY

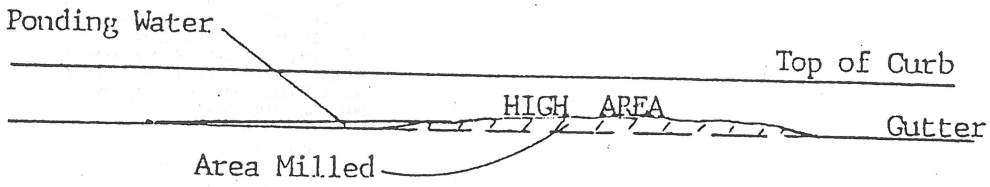
TRANSVERSE JOINT REPAIR

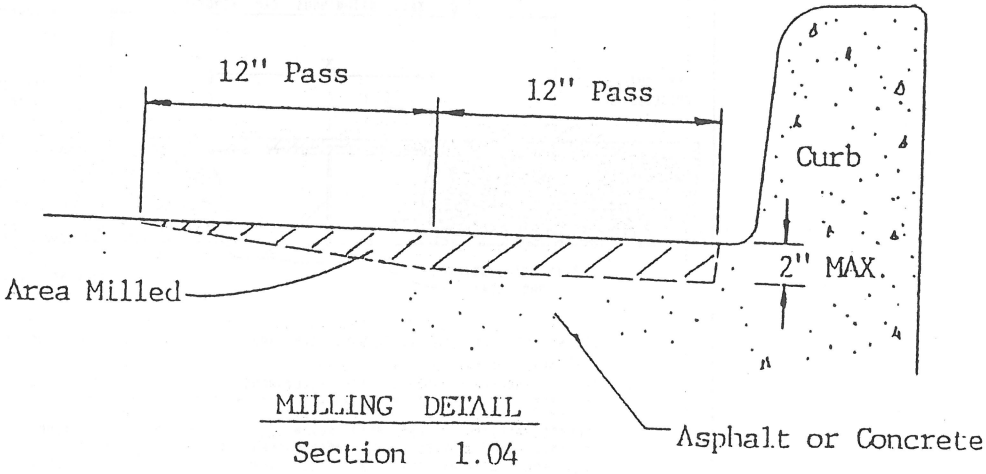
DETAIL 8



MILLING DETAILS

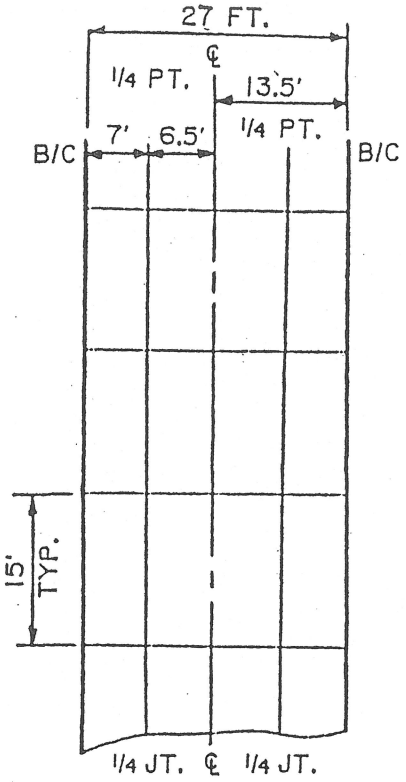
Sections 1.02 - 1.03





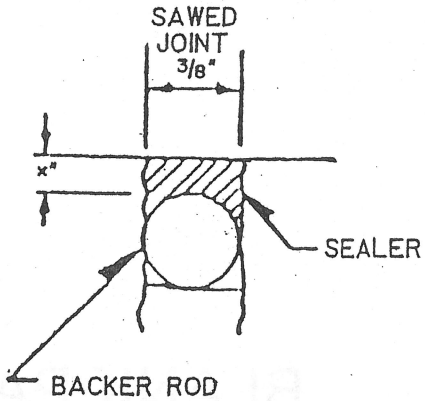
MILLING DETAIL

Section 1.04



TYPICAL SAWED JOINT LAYOUT NEW CONCRETE

NEW CONCRETE PAVEMENT SCALING DETAIL

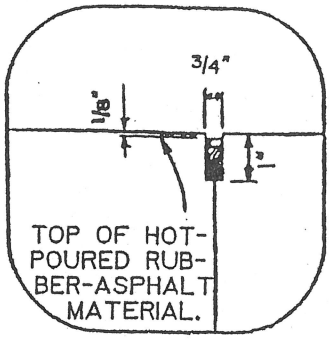


MINIMUM DIAMETER SHALL BE ONE NOMINAL SIZE LARGER THAN THE EXISTING JOINT WIDTH.

x = 1/2" MINIMUM

WORK TO BE DONE

1. CLEAN JOINT & CRACK BY SANDBLASTING AND AIRBLASTING.
2. INSTALL BACKER ROD AS SHOWN ABOVE ON DETAIL. (NEW CONCRETE PAVEMENT ONLY)
3. SEAL JOINT WITH HOT-POUR SEALER MEETING REQUIREMENTS OF THE SPECIFICATIONS.



TYPICAL JOINT DETAIL

CHECK SPECIFICATIONS FOR TYPE OF SEALANT MATERIAL TO BE USED.

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GENERAL SPECIFICATIONS FOR CONSTRUCTION SIGNING AND BARRICADING

1.00 GENERAL

1.01 **LIGHTED ARROW, TYPE A**: Each Lighted Arrow, Type A is to be furnished, maintained, installed, relocated and removed by the Contractor. Payment shall be made for the maximum number of units utilized on each part of the project on any day.

Refer to Section 812 of the MDOT 2012 Standard Specifications for Construction and current edition of the Michigan Manual of Uniform Traffic Control Devices (M.M.U.T.C.D.). The Type A panel shall be solar powered, nominal 48 inches x 96 inches, furnished flat black with lamps having an amber lens. A photoelectrically controlled circuit shall be provided to dim the lighted arrow lamps for night use. The lamps shall flash synchronously at the rate of 25 to 35 flashes per minute. The "on time" shall comprise 40 to 60 percent of each cycle. The arrow panel shall have the capability of the following modes: Left Arrow, Right Arrow, Double-Headed Arrow, and Caution. The Caution mode shall consist of four (4) or more lamps, arranged in a pattern which will not indicate a direction.

No claim for additional compensation will be allowed for units that are stolen, damaged by traffic or vandalized. Placement shall be as directed by the Engineer and per the requirements of the M.M.U.T.C.D.

1.02 **BARRICADE TYPE II, PLASTIC DRUM or CONES**: Barricades paid for this item of work shall be Type II. Payment shall be per barricade; this shall include furnishing, maintaining, installation, relocation, and removal; and shall be measured for the maximum number of units in place on each part of the project on any day. Traffic cones in accordance with Section 812 of the MDOT 2012 Standard Specifications for Construction may be used, limited to daytime hours only. Do not mix drums and cones within a traffic control signing sequence.

Refer to Section 812 of the MDOT 2012 Standard Specifications for Construction and the current edition of the M.M.U.T.C.D. Type II barricades shall be minimum 28 inch diameter plastic drums coated with reflectorized material or "snatch" cones. Weights, sand bags or base tire rings shall be provided as supplemental weight to achieve stability.

No claim for additional compensation will be allowed for barricades that are stolen, damaged by traffic or vandalized. Placement shall be as directed by the Engineer and per the requirements of the M.M.U.T.C.D.

1.03 **BARRICADE TYPE III**: Barricades paid for this item of work shall be Type III. Payment shall be per barricade; this shall include furnishing, maintaining, installation, relocation, and removal; and shall be measured for the maximum number of units in place on each part of the project on any day.

All Type III barricades shall be 8 foot wide - minimum sections furnished. Construction signing to be affixed to Type III barricades shall be paid as each. No claim for additional compensation will be allowed for barricades that are stolen, damaged by traffic, or vandalized. Type III barricades shall be placed at locations indicated on the construction signing and traffic control plan and as necessary to assure conformance with the current edition of the M.M.U.T.C.D.

1.04 **SIGN, TYPE B TEMPORARY**: Refer to Section 812 of the MDOT 2012 Standard Specifications for Construction and the current edition of the Michigan Manual of Uniform Traffic Control Devices (M.M.U.T.C.D.). This item of work consists of providing and maintaining MDOT Type B temporary signing for advance signing, detour signing, and for the protection and maintenance of traffic through and around the Construction Influence Area. The quantity and types of signing to be provided shall be per the construction signing and traffic control plan and as may be stipulated by M.M.U.T.C.D., City, and Road Commission for Oakland County requirements.

The signing shall include temporary steel posts and hardware, or portable supports. Posts for signing placed outside of hard surfaces shall be power driven into the ground and removed upon completion. Within hard surfaces, a minimum of one (1) sand bag shall be placed on each leg of the portable support to achieve stability.

All advance warning (W) signs and advance guide (G) signs may require to be furnished with a minimum of one (1) 3M Company No. 3484 Fluorescent Red Orange flag (or approved equal) during hours of daylight. All W and G signs shall be lighted with two (2) Type A warning flashers during non-daylight hours (a half hour after sunset to a half hour before sunrise).

The Contractor shall relocate or remove signing, as determined by the Engineer. The Contractor shall place an opaque covering over any signing which has a legend, which is not applicable for any period of time.

Prior to commencing construction operations, W21-1 (ROAD WORK AHEAD) signs shall be placed in advance of the work along the street to be worked on. Also, R11-2 signs (ROAD CLOSED) and R11-4 signs (ROAD CLOSED TO THRU TRAFFIC) may be required as directed by the Engineer.

Payment shall be by the square foot furnished or as addressed in project specifications, and shall include maintaining, installing, relocation, and removal. No claim for additional compensation will be allowed for temporary signs that are stolen, damaged by traffic, or vandalized.

This item of work does not include temporary no parking signs, hand-held paddle signs for flaggers, or any permanent signing work. Refer to the Special Instructions to Bidders for no parking sign and traffic regulator personnel (flagger) requirements. The City shall have the option of removing permanent signs and supports themselves or leaving them to be removed by the Contractor. All replacement of permanent signing will be performed by the City.

In the event that the City has not removed permanent signs and supports when the Contractor enters a work area, the Contractor shall remove the signs and supports in such a way as to avoid damage to either and shall carefully store them at a location outside the work area as directed by the Engineer until the material is picked up by the City.

2.00 **REMOVING PAVEMENT MARKING, LONGITUDINAL**

2.01 **REMOVING PAVEMENT MARKING**: Refer to Section 811 and 812 of the 2012 MDOT Standard Specifications for Construction and the current edition of the Michigan Manual of Uniform Traffic Control Devices (M.M.U.T.C.D.). Removal of legends, symbols,

arrows, and crosswalks, and stop bars will be paid as Removing Pavement Marking. Removal of longitudinal markings will be paid for as Removing Pavement Marking, Longitudinal. Skips in dashed lines are not included in the measurement. Removal of pavement markings 5 inches or less in width will be paid for at the bid unit price. Removal of pavement markings more than 5 inches but less than 10 inches in width will be paid for at 2 times the bid unit price. Removal of pavement markings 10 inches or more in width will be paid for at 3 times the bid unit price.

2.02 **TEMPORARY PAVEMENT MARKING, TYPE R OR NR, 4" YELLOW OR WHITE**: Refer to Section 812 of the 2012 MDOT Standard Specifications for Construction and the current edition of the M.M.U.T.C.D. Temporary pavement marking shall have a nominal width of 4 inches and shall be either yellow or white in accordance with the M.M.U.T.C.D. Temporary marking shall be placed as directed by the Engineer and may include 2-foot, 4-foot or 12.5-foot dashed pavement marking line, or solid pavement marking line.

Type R temporary pavement markings shall be tape conforming to Subsection 922.06 of the 2012 MDOT Standard Specifications for Construction. Type R markings shall be removable and shall be placed on existing or proposed pavement surfaces at locations that do not coincide with permanent pavement markings. All Type R markings shall be removed when directed by the Engineer.

Payment shall be per linear foot of temporary pavement marking applied or as addressed in a project specification.

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GENERAL SPECIFICATIONS FOR RESTORATION- SITE / RIGHT OF WAY

1.00 SPRINKLER SYSTEMS

1.01 RELOCATE OR REPLACE LAWN IRRIGATION HEADS: This item of work shall consist of all work required to relocate or replace lawn irrigation heads within the road right-of-way or private property when directed by the Engineer. Irrigation heads that are damaged by the Contractor shall be replaced in kind including any fittings, clamps, nipples, drains, protective covering, etc. Heads shall be relocated as directed by the Engineer. The Contractor shall adjust the spray pattern of each head that is relocated or replaced. Payment shall be made for each head relocated or replaced.

1.02 RELOCATE OR REPLACE LAWN IRRIGATION PIPING: This item of work shall consist of all work necessary to relocate or replace lawn irrigation piping within road right-of-way or private property. Irrigation piping that is damaged by the Contractor shall be replaced in kind including any fittings, clamps, drains, valves, etc. Piping shall be relocated as directed by the Engineer. The abutting property owner shall flush and test the relocated piping and any necessary repairs shall be made by the Contractor before payment by the City. Payment shall be made per linear foot of piping relocated or replaced.

2.00 TREES

2.01 REMOVE (size) TREE INCLUDING STUMP: At locations indicated on the plans or when directed by the Engineer “specified” caliper trees adjacent to the work shall be removed including the stump. Refer to Section 202 of the 2012 MDOT Standard Specifications for Construction. In addition, the trees, trunks, and limbs over 8 inches in diameter shall be trimmed and cut into lengths less than eight (8) feet and piled outside of the right-of-way for use by the abutting property owner if requested to do so by the Engineer. The remaining brush shall be disposed of by the Contractor at a recognized landfill. If the property owner does not desire the timber, the Contractor shall be responsible for hauling away and disposing of the removed trees at a recognized landfill.

Tree removal shall be paid at the contract unit price for each tree removed including the stump. The stump shall be removed to a depth of one (1) foot below ground surface. Where removal of the stump may result in damage to existing utilities or pavements, the stump shall be removed by chipping. Payment shall be made for each tree removal as defined by caliper in project specifications.

2.02 "(SIZE)" CALIPER ‘SKYLINE’ LOCUST TREE: This item of work consists of furnishing and planting a “specified" caliper ‘Skyline’ Locust tree (Gleditsia Triacanthos Inermis ‘Skyline’ “X”) at the locations indicated on the plans or as directed by the Engineer, and in conformance with any details which may be shown on the plans.

Planting materials shall be as specified in Section 815 of the MDOT 2012 Standard Specifications for Construction except for the following revisions and additions.

Trees shall have normal well developed branches and vigorous fibrous root systems and shall conform to the specifications of the latest edition of American Standard for Nursery Stock sponsored by the American Association of Nurserymen, Inc.

Trees shall be healthy, vigorous and free from defects; decay; disfiguring roots; sun-scale injuries; abrasions on the bark; diseases; insect pests, their eggs or larvae. Trees shall be hardy under climatic conditions similar to those in the locality of the project and shall be nursery grown.

Construction methods shall be as specified in Sections 815 of the MDOT 2012 Standard Specifications for Construction except for the following revisions and additions.

Trees shall be handled at all times in accordance with the best horticultural practices so that the roots or balls are adequately protected from the sun and drying winds. No tree shall be bound with rope or wire in a manner that would damage the bark, break the branches, or destroy its natural shape.

Trees shall be balled and burlapped trees dug with firm, natural ball of earth of sufficient diameter and depth to encompass the fibrous and feeding root systems necessary for full recovery of the tree. Balls shall be securely wrapped with burlap and bound with cord. All trees shall be delivered in closed vehicles or in open vehicles with the entire load properly covered, while in transit for protection from drying winds.

Diameter of all planting pits shall be a least one foot greater in diameter than the diameter of the ball. Depth of pits shall be enough to accommodate the ball. Earth in the bottom of the pits shall be loosened by spading or other approved means to a depth of 4 inches. Care shall be taken in machine or hand-digging so as to avoid damage to possible existing utilities, conduits, and irrigation piping located close by.

No tree shall be planted if the ball is cracked or broken. No tree balled with rot-proof material will be accepted. Wire mesh baskets holding burlap in place **shall** be removed prior to planting. Mulching shall be as indicated in the detail as shown on the plans.

The completed work of this item will be measured in place by unit and by the methods specified in the current ANSI Specification: Z 60.1. The contract unit price will be payment in full for furnishing, excavating, and pruning, planting, and wrapping the 'Skyline' Locust trees. All trees planted shall be guaranteed to grow for a period of one (1) year.

The Engineer will inspect the trees during the final inspection for the Contract to determine if any trees are unacceptable. Unacceptable trees are defined as being dead, unhealthy, or otherwise unsatisfactory at the time of final inspection, or trees that were not planted in conformance with the specifications.

The Contractor shall remove and replace any unacceptable trees identified by the Engineer at no additional cost to the Contract. Replacement trees shall be "puddled" or watered-in at time of planting and mulch shall be replaced.

2.03 ACCEPTABLE TREES; The following list of trees is acceptable for installation in the right-of-way. Product and installation requirements provided above are applicable herein:

Bradford Pear	-	*Pyrus calleryana*
Flowering Crab	-	*Malus hybrids*
Ginko	-	*Ginko Bilboa*
Little Leaf Linden	-	*Tilia cordata*

3.00 **VOLCANIC ROCK SURFACE / DECORATIVE STONE**: This item of work consists of furnishing and installing volcanic rock / decorative stone as a ground cover at locations indicated on the plans or as directed by the Engineer. The work includes any excavation, grading, and disposal of excavated materials for areas that are to receive the volcanic rock / or decorative stone.
The material shall be spread uniformly to a thickness of 3 inches or as directed by the Engineer, and the completed work shall match adjacent grades. The volcanic rock (pumice) or stone to be furnished and installed shall be a clean uniformly graded material having 3/4 to 2 inches of particle size.

The completed work of this item will be measured by volume in square yards, loose measure or as specified in project specifications. The contract unit price will be payment in full for furnishing and installing the materials.

4.00 **CHEMICAL WEED SPRAY & WEED REMOVAL**: The work of this item consists of furnishing and applying chemical weed killer to earth beds as directed by the Engineer, including removal and off-site disposal of the resulting dead vegetation. The chemical weed killer shall be labeled and applied in accordance with the Michigan Pesticide Control Act (P.A. 171 of 1976, as amended).

The chemical weed killer shall be applied no less than seven (7) days prior to topsoil installation. The application rate shall be 1/2 gallon per acre minimum, and dilution with water shall be per manufacturer's recommendations. The Contractor shall remove the resulting dead vegetation directly prior to topsoil installation.

The chemical weed killer shall be applied by a person that has a Commercial Pesticide Applicator Certification issued by the Michigan Department of Agriculture.

The chemical weed killer shall be "Roundup" or an equivalent manufactured non-volatile, broad spectrum foliage translocated herbicide to be approved by the Engineer containing Isopropylamine salt of N-(Phosphonomethyl) Glycine.

The complete work of this item will be measured by volume in gallons of chemical weed killer in the concentrated state (prior to being mixed with water). The contract unit price will be payment in full for furnishing all labor, materials, and equipment for applying the chemical weed spray, including removal and disposal of dead vegetation.

5.00 **LAWN RESTORATION**

5.01 **TOPSOIL (LOOSE MEASURE)**: This item shall consist of furnishing and grading approved screened topsoil for areas to be sod or seeded. The material and work shall conform to MDOT 2012 Standard Specifications for Construction, Section 816 except that topsoil shall be spread, graded and compacted to a depth of not less than 2 inches, but in no case greater than 3 inches. Payment shall be by the cubic yard (loose measure). Load tickets from the supplier shall indicate cubic yard, and a copy must be furnished to the City at the time of delivery.

This item of work includes grading and compacting of earth beds upon which the topsoil is to be placed and cutting, removal, and disposal of the existing turf. The limits of areas to receive topsoil shall be marked in the field by the Engineer. Where topsoil is to be placed

against existing turf, a vertical edge shall be cut through the turf using an approved sod cutter. Existing turf shall be removed from the earth bed to receive topsoil, and the turf shall be hauled away by the Contractor within 24 hours of removal.

5.02 **HYDROSEEDING INCLUDING FERTILIZER AND MULCH**: This item of work shall consist of hydroseeding and mulching areas adjacent to the back of curb for major roads or as defined by Contract. All areas to receive hydroseeding shall be free of weeds. If directed by the Engineer, the Contractor shall apply a chemical weed killer no less than seven (7) days prior to topsoil installation as described under section 4.00.

The seed, mulch, fertilizer, and water mix shall be evenly applied to properly prepared topsoil surfaces. The seed shall be applied at a rate of 250 pounds per acre and shall have the following composition:

30% ..... Fults Pucinellia
30% ..... Dawson Red Fescue
30% ..... Park Kentucky Blue
10% ..... Pennfine Perennial Rye, minimum purity 97%

The mulch shall be “Fiber-Green”, “Conweb”, or approved equal and shall be applied at a rate recommended by the manufacturer.

The chemical fertilizer shall be 12-12-12 and shall be applied at a rate of 240 pounds per acre. Payment for this Item shall be by the square yard measured in place.

Seeding - Obtain the Engineer’s approval for proposed seed mix. Obtain the Inspector’s approval of topsoil prior to placement. When specified, apply the fertilizer with or before the sowing of the seeds. Sow and re-sow as necessary the seed to provide uniform coverage (minimum of 220 pounds per acre and greater than 2 seeds per square inch). Compact the seed into the top 1/2 inch of topsoil. When specified, install the mulch within one calendar day after seeding. The end product shall be well established, weed free, growing, vigorous and contains the species required in the seeding mix.

5.03 **CLASS A SODDING, INCLUDING WATERING**: This item shall consist of furnishing and installing Class A sod in accordance with MDOT 2012 Standard Specifications for Construction, Sections 815 and 816. The furnished sod shall be a uniform thickness of not less than one (1) inch and an area of not less than 1/2 square yard. Class A Sodding will be paid for at the contract unit price per square yard measured in place. Areas adjacent to the back of curb for local side streets, and all private property, shall receive Class A sod unless otherwise indicated on the plans.

This item of work includes thoroughly watering all sod areas at such times and in amounts to **establish growth** of lawn areas for a period of 90 days after the sod is installed or reinstalled. Sod placed prior to October 1st, shall exhibit growth prior to becoming dormant for the winter. Sod placed after October 1st, shall establish growth by June 1st of the following year. The Contractor shall provide a watering truck acceptable to the Engineer. Water for lawn watering will be provided to the Contractor by the City at hydrant locations specified by the Engineer. The Contractor shall notify the Engineer to coordinate City personnel for witnessing hydrant operation when filling the truck. All trucks being filled shall have a minimum 6-inch "air gap" between the fill hose and the tank opening, or use an approved back-flow prevention device.

6.00 EXCAVATION

6.01 REMOVE & DISPOSE OF CONTAMINATED EXCAVATED MATERIAL: This item consists of removal and disposal of both Type 1 and Type 2 contaminated material if encountered during excavation. The City will be responsible for testing any suspected hazardous contaminated material. This item of work shall be paid per cubic yard, loose measure, which is removed and disposed of at a Type 1 or Type 2 approved landfill.

The contract unit price for this item shall include the cost of interruption to normal construction procedures, temporary stockpiling on plastic sheeting, placing and maintaining plastic sheeting over the stockpile, removal and disposal as directed by the City, and all related work and measures that may be required by law. Based on field screening and laboratory analysis by the City, the Contractor will be advised by the City as to the required method of disposal.

Under no circumstances shall this item include removal and disposal of contaminated material caused by or brought to the site by the Contractor.

6.02 EARTH EXCAVATION AND GRADING REMOVAL OF EXCESS MATERIAL: This item consists of removal and disposal of excavated material generated during grading for topsoil / sod and sloping along and away from new sidewalk grade ramp installations. This item of work shall cover all aspects of this item including grading, removing material, temporary stockpiling, and disposal. The thickness of material graded and removed shall be from 1 inch to 1 foot in depth, removal and hauling away of the excess material is the Contractor's responsibility. Payment shall be as specified in the Form of Proposal.

7.00 SHREDDED BARK MULCH (LOOSE MEASURE): This item of work consists of furnishing and installing a 4" thick blanket of shredded bark mulch material at landscape areas, planting beds, or at existing tree locations disturbed by the construction or as directed by the Engineer. The work for this item shall be in accordance with Subsection 917.14 of the 2012 M.D.O.T. Standard Specifications for Construction except as specified herein.

Shredded bark mulch shall consist of tree bark, which has been stripped from saw logs by means of a de-barking machine. The type and color of shredded bark mulch around existing plantings and planting beds shall match the existing type and color of mulch and shall be approved by the Engineer before it is installed. The shredded bark mulch shall be manually placed to a depth of 4" and shall include replacement or installation of new plastic edging where removed.

The completed work of this item will be measured in place by volume in cubic yards, loose measure, of shredded bark mulch placed. The contract unit price will be payment in full for furnishing and installing the shredded bark mulch blanket including any plastic edging.

8.00 TREATED LANDSCAPE TIMBERS: This item of work consists of furnishing, cutting, and installing new preservative-treated landscape timbers at locations where public sidewalk is replaced if directed by the Engineer. The timbers shall be installed directly adjacent to the public sidewalk. When the new timbers are an extension of existing timbers, the work shall include cutting, removal, and off-site disposal of portions of the

existing timbers when directed by the Engineer. When the new timbers are installed in tiers, the work shall include drilling holes, and furnishing and installing steel anchor pins (dowels).

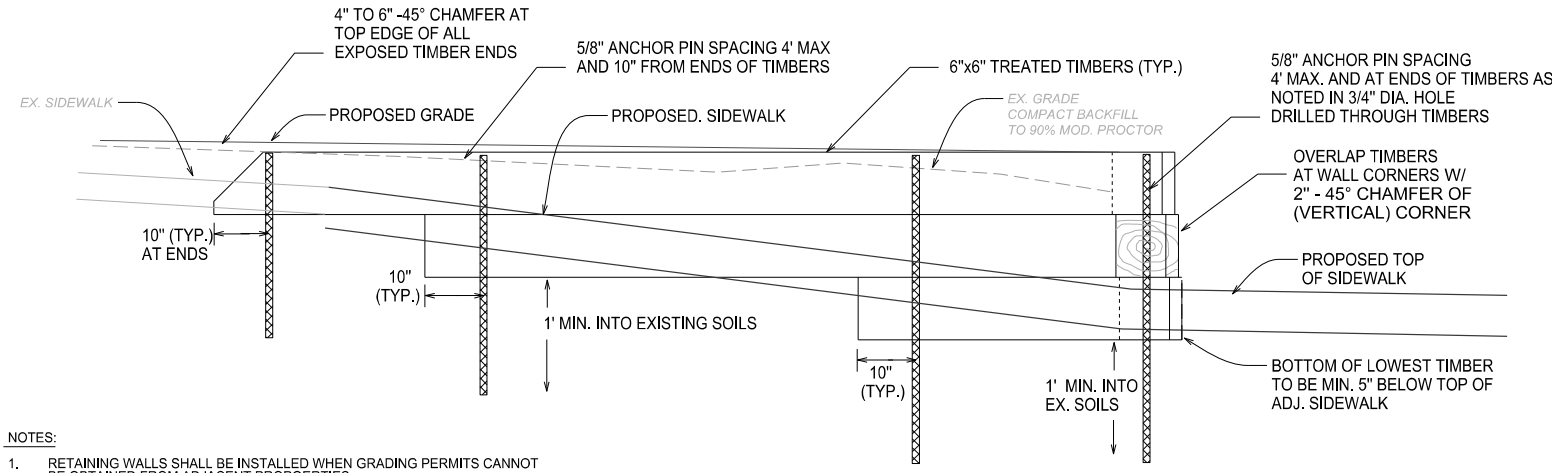
The landscape timbers shall be cut as necessary and installed on a compacted base adjacent to the sidewalk. For landscape timbers installed in tiers, 45° beveled ends shall be cut and 3/4 inch diameter holes shall be drilled for steel anchor pins along the centerline of the tier being installed. Holes shall be drilled 10 inches from the end of each timber so that a minimum of two (2) anchor pins are installed for each timber. Holes shall be drilled to extend 4 inches into the adjacent tier below. Each tier shall be recessed 1/2" towards the embankment with respect to the adjacent tier below, and the joints between timbers along each tier shall be staggered with respected to the joints in the adjacent tier below.

Landscape timbers shall meet the requirements specified in Section 912 of the 2012 M.D.O.T. Standard Specifications for Construction, except as otherwise specified herein. Landscape timbers to be furnished shall be preservative-treated No. 2 Grade timbers maximum 8 feet in length.

The landscape timbers furnished shall be nominal 6" x 6" size timbers. When the timbers to be installed are an extension of existing timbers, the nominal size of the new timbers shall equal the nominal size of the existing timbers.

Where landscape timbers are to be installed in tiers, 8 inches long x 5/8" diameter steel anchor pins (dowels) shall be furnished per Subsection 908.10 of the 2012 M.D.O.T. Standard Specifications for Construction.

The completed work of this item will be measured in place by length in feet of new landscape timber installed along each tier. The contract unit price will be payment in full for furnishing, cutting, and installing landscape timbers including steel anchors.



NOTES:

1. RETAINING WALLS SHALL BE INSTALLED WHEN GRADING PERMITS CANNOT BE OBTAINED FROM ADJACENT PROPOERTIES,
2. THIS DETAIL IS APPLICABLE FOR RETAINING EXISTING SOILS ON PRIVATE PROPERTY ADJACENT TO PUBLIC SIDEWALK. EDGE OF RETAINING WALL SHALL BE SET ADJACENT TO THE PRIVATE PROPERTY SIDE EDGE OF THE PUBLIC SIDEWALK. RIGHT OF WAY AREAS SHALL BE GRADED FLUSH TO FINAL SIDEWALK GRADES. RAMP AREAS SHALL BE GRADED FLUSH TO THE TOP OF ROLLED SIDEWALK EDGE.
3. THIS DETAIL IS APPLICABLE FOR WALLS 10" TO 18" IN HEIGHT ABOVE SIDEWALK.
4. EACH TIER SHALL BE RECESSED 1/2" INCH TOWARDS THE EMBANKMENT WITH RESPECT TO THE TIER BELOW.
5. JOINTS BETWEEN ADJACENT TIMBERS SHALL BE STAGGERED WITH RESPECT TO THE TIMBER TIERS ABOVE OR BELOW.

TYPICAL TIMBER RETAINING WALL DETAIL AT SIDEWALK INTERSECTION

NO SCALE