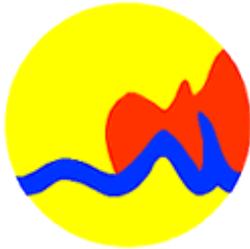


OFFICE OF  
CITY  
ENGINEER



# CITY OF GRAND RAPIDS

April 2011

TO: 1993 STANDARD CONSTRUCTION SPECIFICATION BOOK HOLDER

**RE: REVISIONS TO THE CITY OF GRAND RAPIDS STANDARD CONSTRUCTION SPECIFICATIONS**

Sections of the 1993 City of Grand Rapids Standard Construction Specifications listed below have been revised. Any and all revisions due to project specific requirements will be included in project specific proposal documents and will supersede the version provided in the Standard Construction Specifications as stated below.

Sections Revised:

- Invitation to Bid
- Information for Bidders
- Bid Form
- Bid Bond
- MBE/WBE Affidavit
- Subcontracts
- Contract Forms

The General Conditions section has not been revised unless otherwise noted or supplemented with a specific special specification in the project specific proposal documents.

Sincerely,

A handwritten signature in black ink that reads "Mark A. De Clercq". The signature is written in a cursive, flowing style.

Mark A. De Clercq, P.E.  
City Engineer

MAD/TA/bkm

T:Eng/NP/WP/Forms/1993 Standard Specifications/Revision April 2011



# CITY OF GRAND RAPIDS

March 2007

TO: 1993 STANDARD CONSTRUCTION SPECIFICATION BOOK HOLDER

RE: **REVISIONS TO THE CITY OF GRAND RAPIDS STANDARD  
CONSTRUCTION SPECIFICATIONS: DETAILS P-1, P-3, P-4,  
P-9, P-9A, W-10 (REVISED MARCH 22, 2007)**

Attached hereto are the revised Details:

P-1 Pavement Half Section for Standard Residential Street  
P-3 Combined Driveway Approach and Sidewalk  
P-4 Combined Dub-Down Alley Approach and Sidewalk Details  
P-9 Sidewalk Ramp in Paved Parkway  
P-9A Sidewalk Ramp in Unpaved Parkway  
W-10 Watermain Off-Set  
**(All Revised March 22, 2007)**

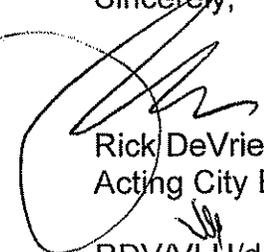
These revised details will take effect immediately and will hereby be incorporated in the City's Standard Construction Specifications 1993 Edition.

The Pavement Details (P) revisions are based on the requirement of American with Disabilities Act (ADA) Sidewalk Standards.

The Watermain revisions are based on requirements by the Michigan Department of Environmental Quality in regard to the minimum off-set between sewers and watermain.

Please contact our office if you have any questions regarding this change.

Sincerely,

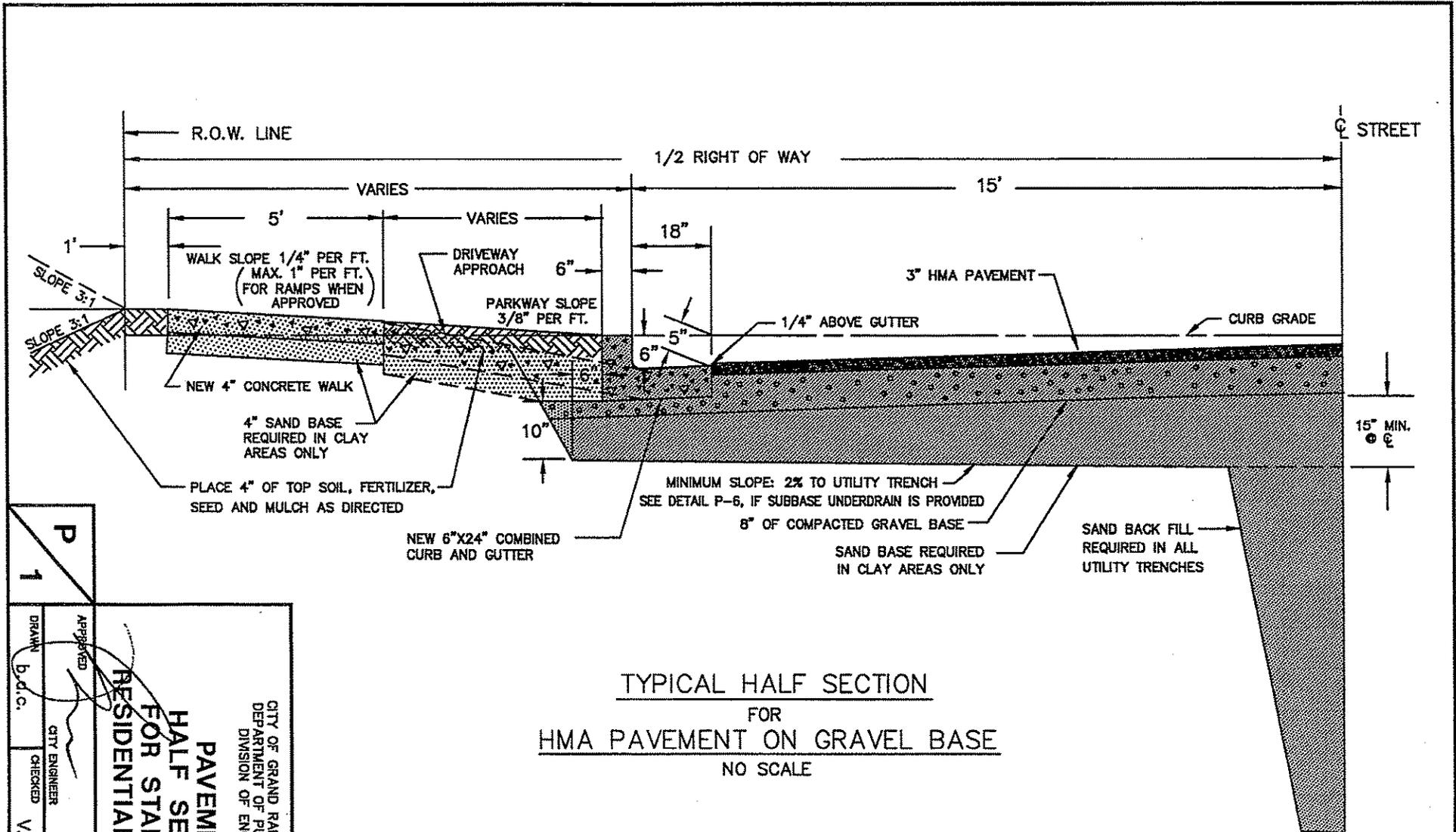


Rick DeVries, P.E.  
Acting City Engineer

RDV/MLU/dls

T:\FORMS\1993 STANDARD CONSTRUCTION SPECIFICATION ADDITIONS\032807

Attachments



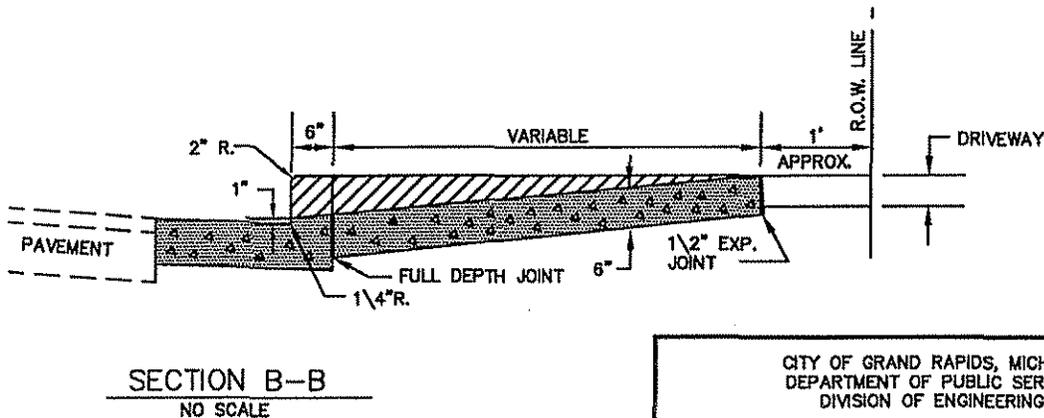
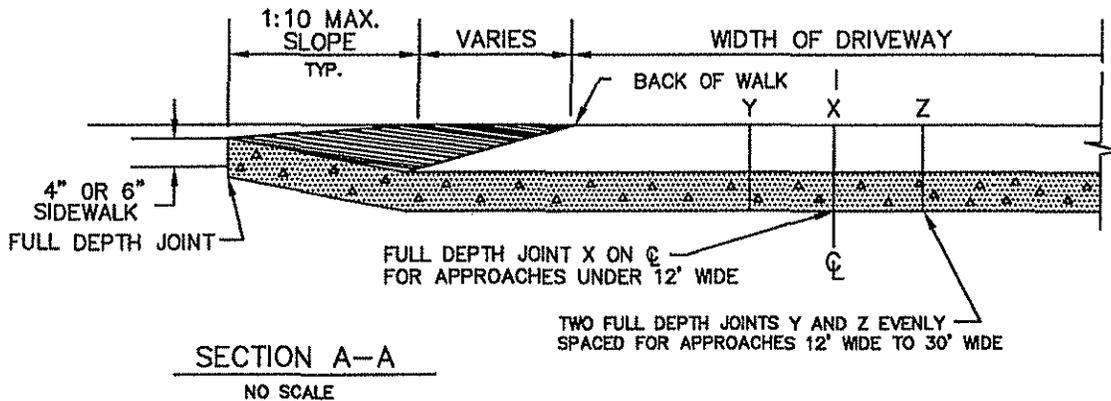
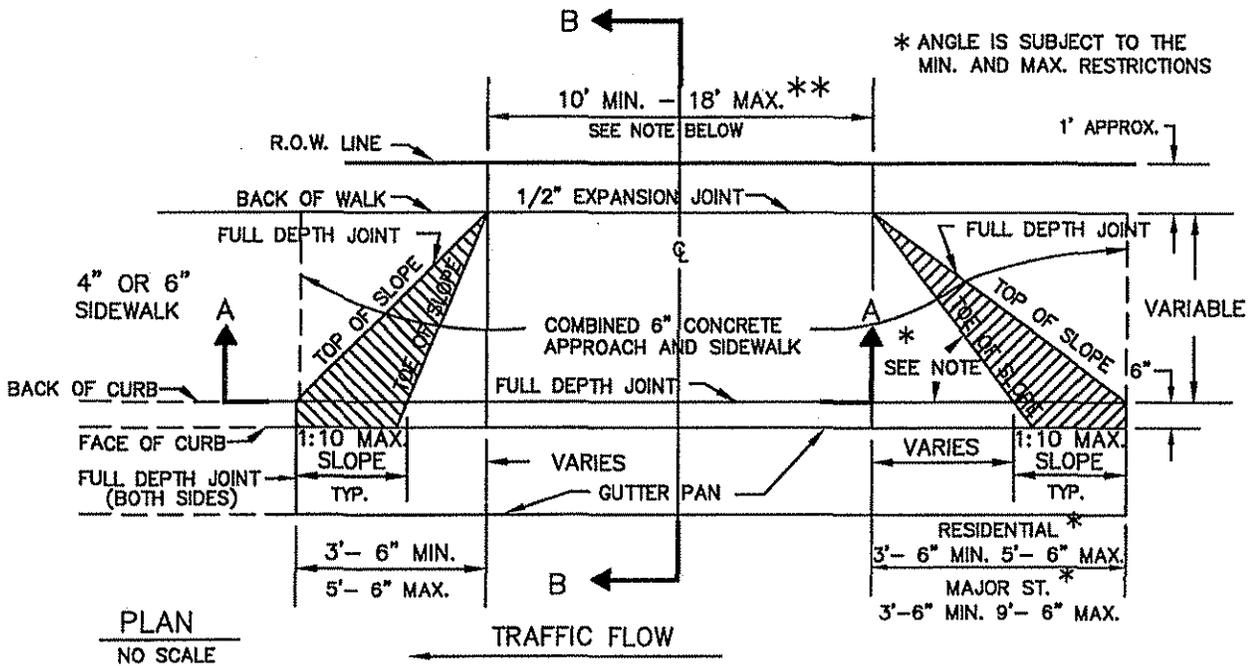
TYPICAL HALF SECTION  
 FOR  
HMA PAVEMENT ON GRAVEL BASE  
 NO SCALE

NOTE :  
 SEE CROSS SECTION ON THE IMPROVEMENT PLAN FOR PAVEMENT AND BASE REQUIREMENTS  
 ON ALL ROADWAYS OTHER THAN THE 30' STANDARD RESIDENTIAL ROADWAY

P 1	APPROVED	3/20/07
	DRAWN b.d.c.	
CITY ENGINEER	CHECKED V.U.	

PAVEMENT  
 HALF SECTION  
 FOR STANDARD  
 RESIDENTIAL STREET

CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

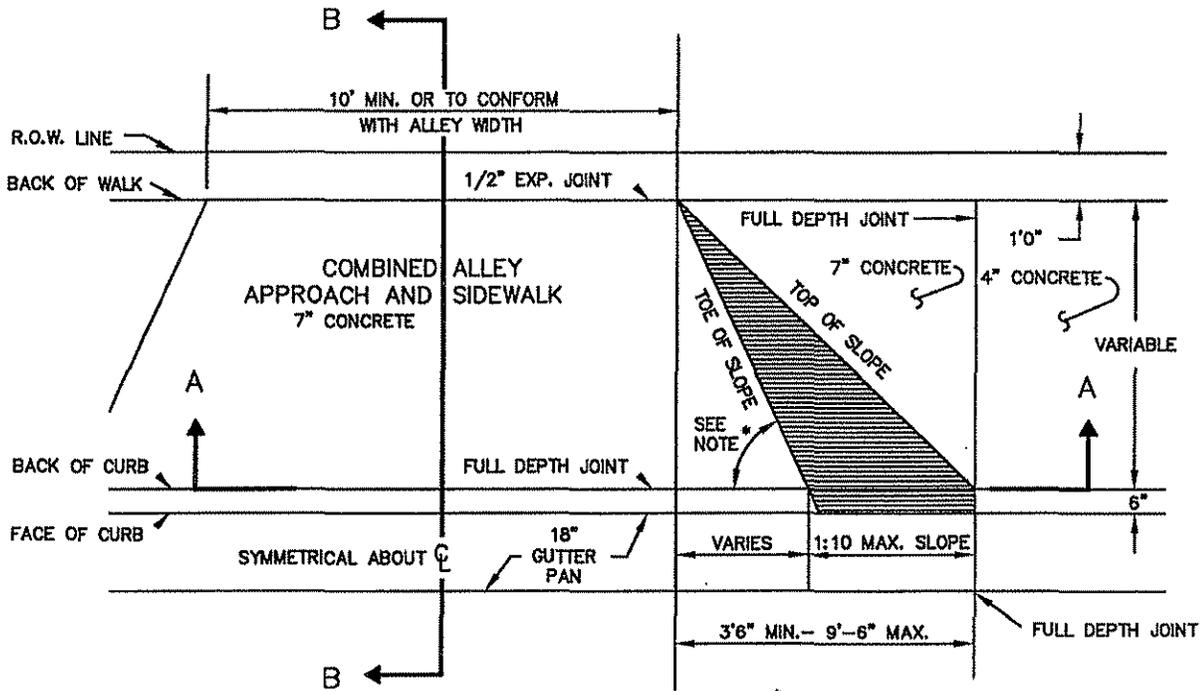


\*\* ANY DRIVEWAY OVER 18 FT. WIDE SHALL REQUIRE WRITTEN APPROVAL OF THE ENGINEER.

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

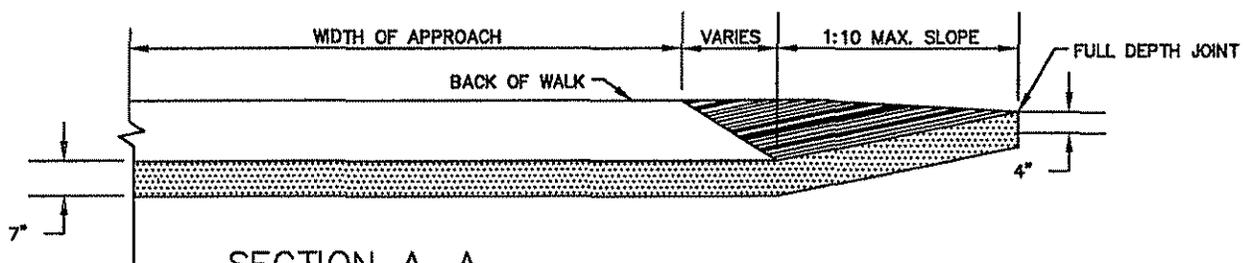
**COMBINED DRIVEWAY  
APPROACH AND SIDEWALK**

P 3	APPROVED	3/22/01
	CITY ENGINEER	DATE
	DRAWN b.a.c.	CHECKED V.U.

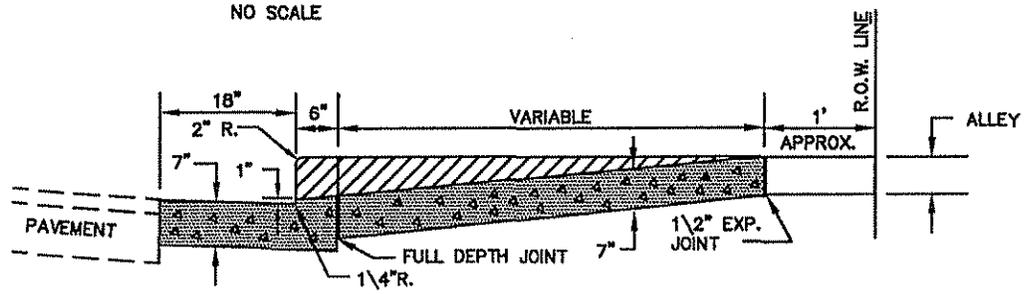


**PLAN**  
NO SCALE

NOTE:  
\*  
ANGLE IS TO BE SUBJECT TO THE ABOVE MIN. AND MAX. RESTRICTIONS



**SECTION A-A**  
NO SCALE



**SECTION B-B**  
NO SCALE

GRADE A CONCRETE TO BE USED.

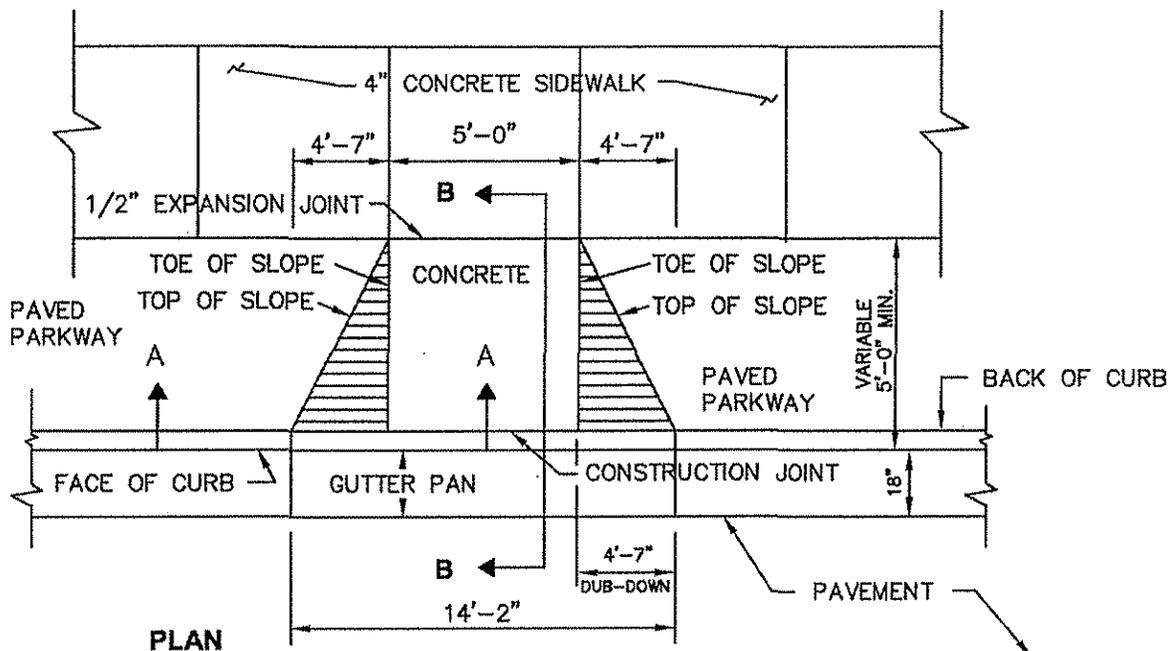
CONCRETE ALLEY APPROACHES LESS THAN 12' WIDE, FULL DEPTH JOINT AT CENTERLINE.

CONCRETE ALLEY APPROACHES 12' WIDE OR OVER ARE TO BE DIVIDED INTO THREE EQUAL SECTIONS WITH FULL DEPTH JOINTS.

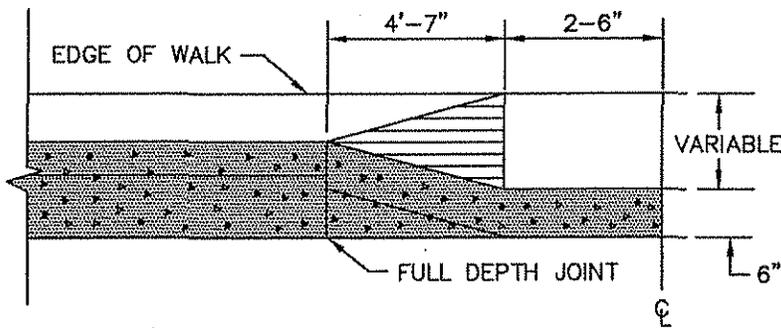
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**COMBINED DUB-DOWN ALLEY  
APPROACH AND SIDEWALK  
DETAILS**

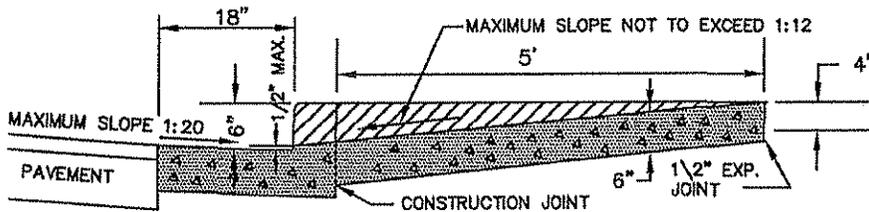
<b>P</b> <b>4</b>	APPROVED <i>[Signature]</i> CITY ENGINEER	DATE 3/22/07
	DRAWN b.a.c.	CHECKED V.U.



**PLAN**  
NO SCALE



**SECTION A-A**  
NO SCALE



**SECTION B-B**  
NO SCALE

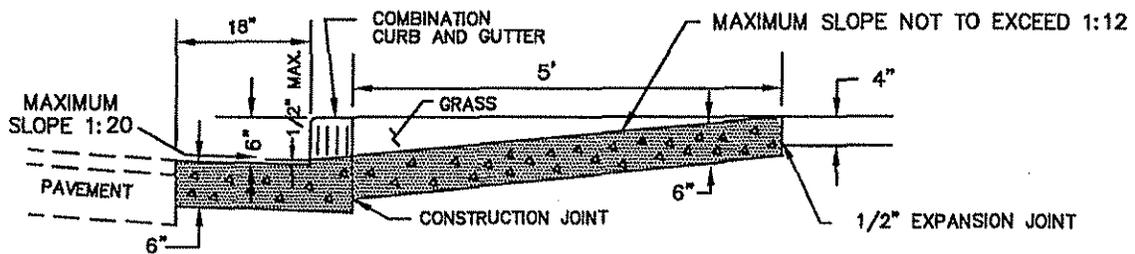
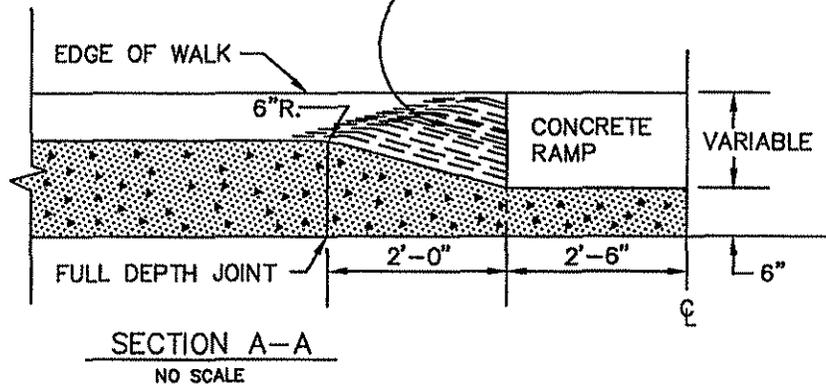
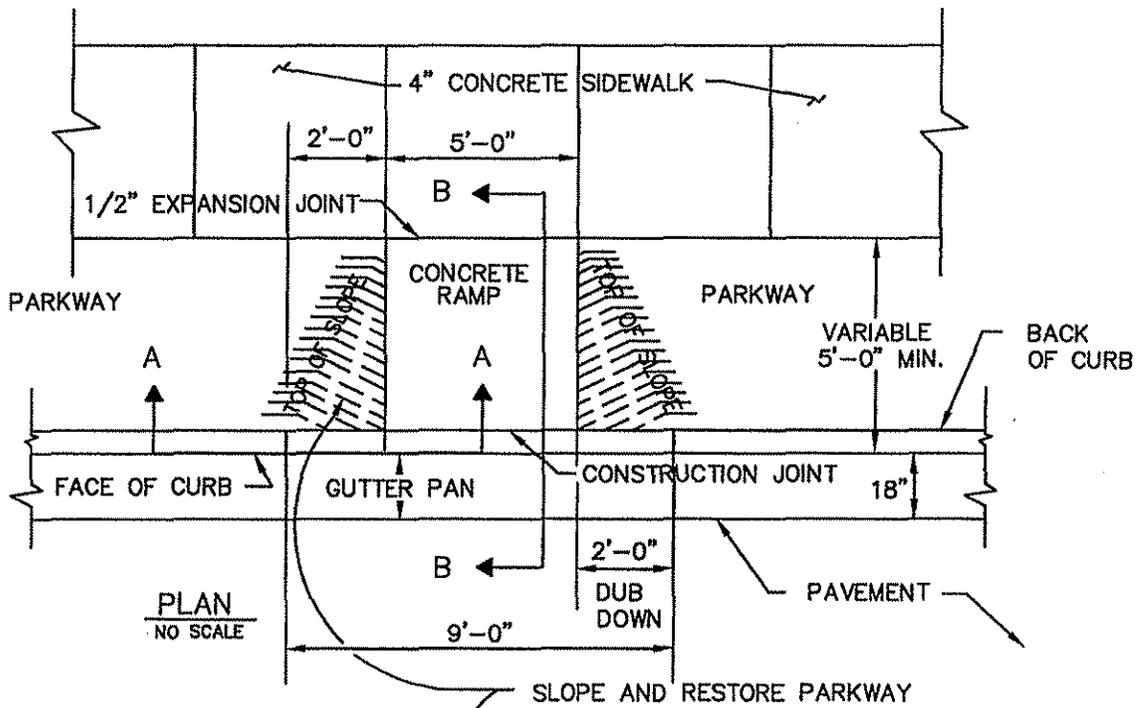
**NOTE:**

WHEN SIDEWALK RAMPS ARE TO BE INSTALLED, THE SIDEWALK SHALL BE 6" THICK FROM THE CURB TO THE FIRST JOINT (5' MINIMUM)

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**SIDEWALK RAMP  
IN  
PAVED PARKWAY**

<b>P</b> <b>9</b>	APPROVED <i>[Signature]</i>	DATE 3/22/07
	CITY ENGINEER	
DRAWN b.d.c.	CHECKED V.U.	



**NOTE:**

WHEN SIDEWALK RAMPS ARE TO BE INSTALLED, THE SIDEWALK SHALL BE 6" THICK FROM THE CURB TO THE FIRST JOINT (5' MINIMUM)

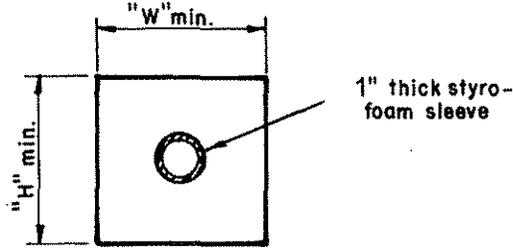
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**SIDEWALK RAMP  
IN  
UNPAVED PARKWAY**

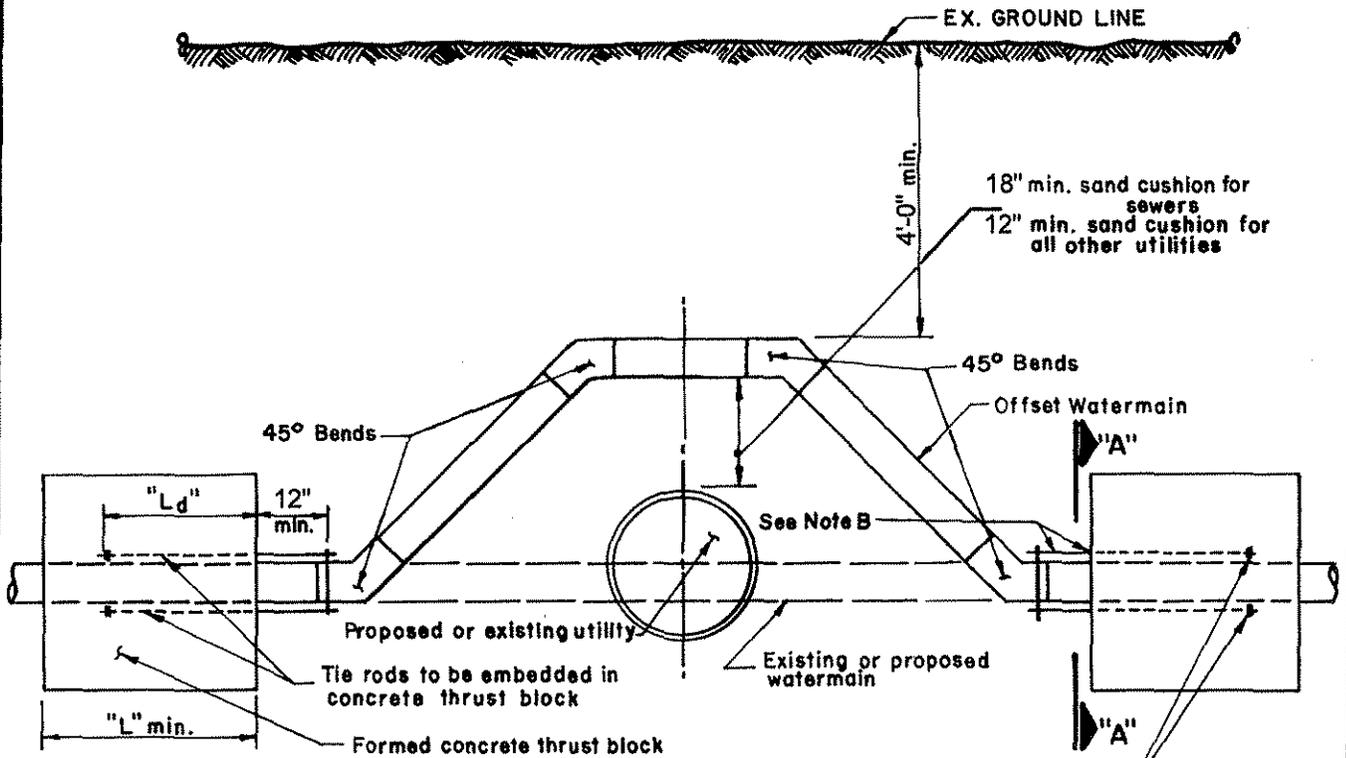
P 9A	APPROVED	DATE
	ACTING CITY ENGINEER	3/22/07
DRAWN	CHECKED	
b.a.c.	V.U.	W.

No watermain joints will be allowed inside the thrust blocks. If a joint conflicts with the thrust block placement as shown, then the joint will be restrained and the thrust block located the minimum distance beyond said joint.

THRUST BLOCK DIMENSIONS				
Pipe Dia.	L	W	H	L <sub>d</sub>
6"	1.5'	3'	3'	15"
8"	2'	3'	3'	18"
12"	4'	4'	3'	36"
16"	5'	4.5'	4'	48"



Section "A-A"



Place nuts on end of tie rods embedded in thrust block.

**Note A:**

When the minimum clearance and cover cannot be obtained, the watermain is to be relocated under the utility.

**NOTE B:**

ON EXISTING WATERMAIN, THE 45° BENDS SHALL BE RESTRAINED AS SHOWN IN THIS DETAIL, INCLUDING THRUST BLOCKS AND AS SPECIFIED IN DIVISION 19. ON NEW CONSTRUCTION, THRUST BLOCKS WILL NOT BE USED AND THE WATERMAIN SHALL BE RESTRAINED AS SPECIFIED IN DIVISION 19.

**NOTE C:**

IF TIE RODS ARE USED FOR JOINT RESTRAINT, SEE TABLE IN DIVISION 19 FOR NUMBER OF TIE RODS REQUIRED PER JOINT. ALSO, SEE TIE ROD DETAIL ON STANDARD DETAIL W/15.

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**WATERMAIN OFF-SET**

W 10	APPROVED	CITY ENGINEER	DATE
	DRAWN LAPINS		



February 2005

TO: 1993 STANDARD CONSTRUCTION SPECIFICATION BOOK  
HOLDER

RE: REVISIONS TO THE CITY OF GRAND RAPIDS STANDARD  
CONSTRUCTION SPECIFICATIONS: DETAIL S-13 26" MANHOLE  
CASTING (REVISED JANUARY 28, 2005) AND DETAIL S-14  
MANHOLE CASTING BOLT DOWN COVER (REVISED FEBRUARY  
1, 2005)

Attached hereto are the revised Details S-13 26" Manhole Casting (Revised January 28, 2005) and S-14 Manhole Casting Bolt Down Cover (Revised February 1, 2005). These revised details will take effect immediately and will hereby be incorporated in the City's Standard Construction Specifications 1993 Edition.

These revisions are based on new requirements by the Michigan Department of Environmental Quality in regard to the Ten State Standards on minimum openings for manholes.

Please contact our office if you have any questions regarding this change.

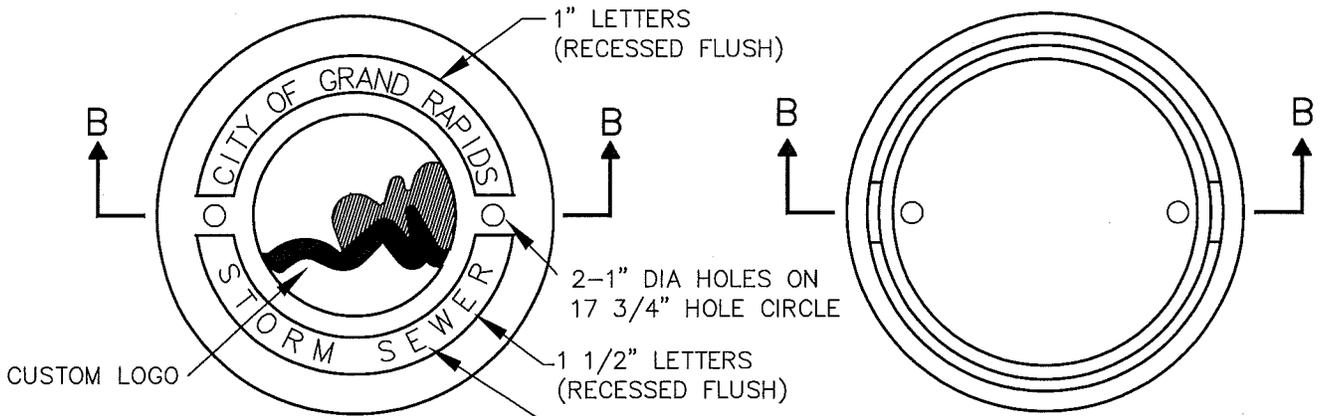
Sincerely,

Bill Cole, P.E.  
City Engineer

BC/MLU/grt

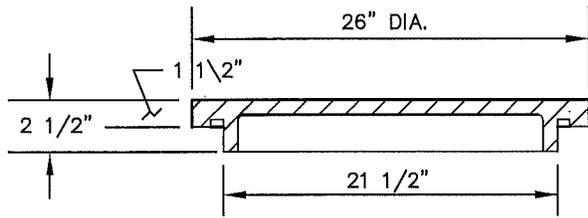
T:///FORMS/1993 STANDARD CONSTRUCTION SPECIFICATION ADDITIONS/MANHOLE CHANGES

Attachments



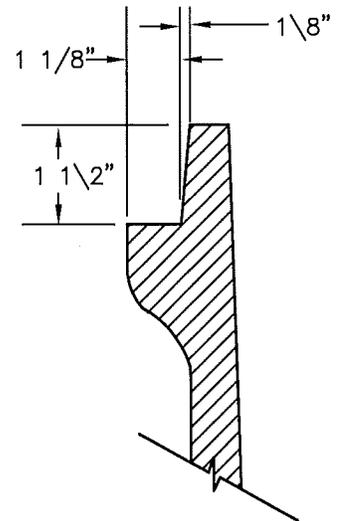
TOP COVER

BOTTOM COVER

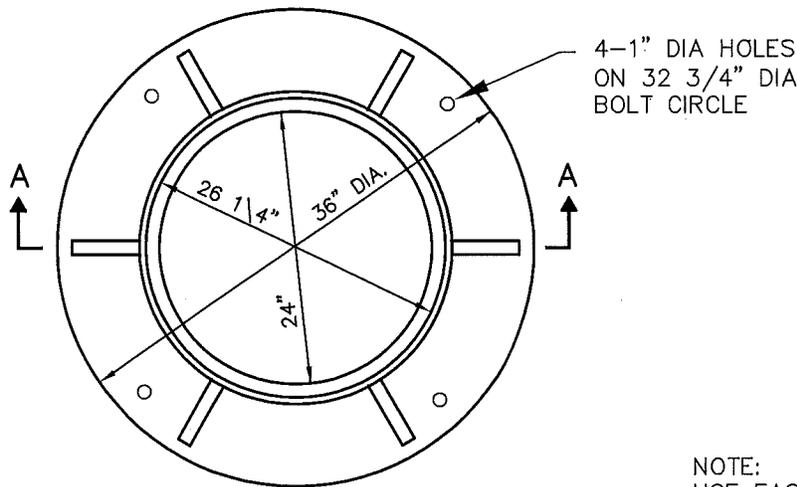


OTHER TEXT OPTIONS  
 SANITARY SEWER  
 SIGNALS & LIGHTING  
 WATER

COVER SECTION B-B

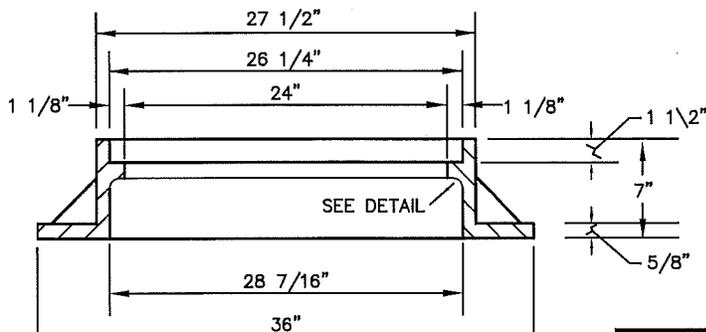


HALF SIZE SEAT DETAIL



FRAME PLAN VIEW

NOTE:  
 USE EAST JORDAN #1045Z FRAME WITH  
 SPECIAL LETTERED COVER, TYPE C OR  
 NEENAH #R-1642 OR APPROVED EQUAL

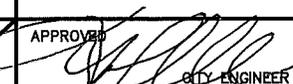


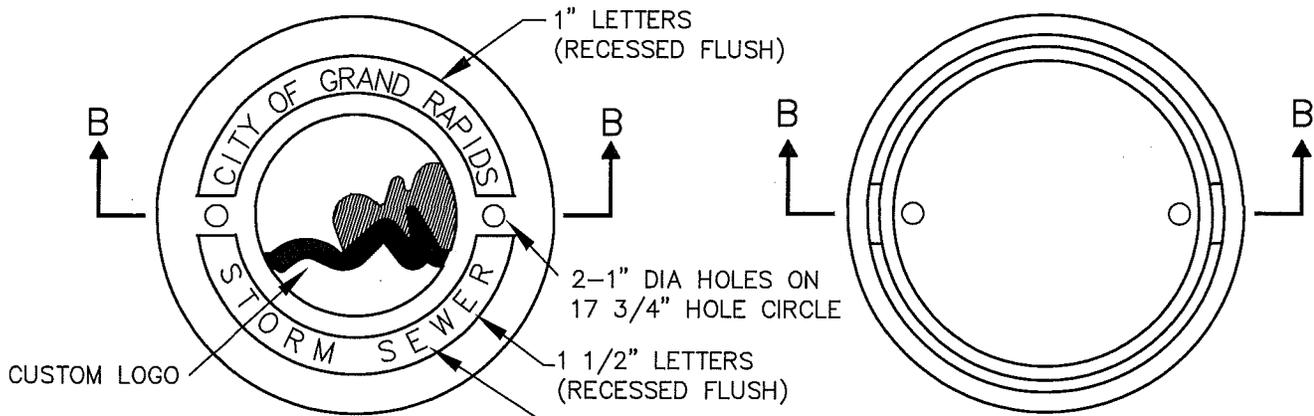
FRAME SECTION A-A

REVISED 1-28-2005

CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

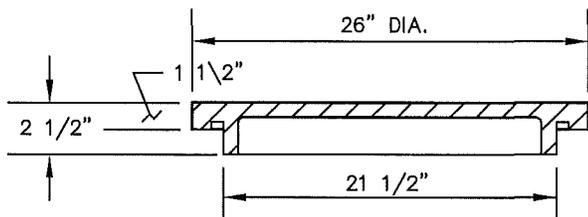
**26"**  
**MANHOLE**  
**CASTING**

<b>S</b> <b>13</b>	APPROVED  CITY ENGINEER	DATE 2/5/05
	DRAWN bap	CHECKED V.U.



TOP COVER

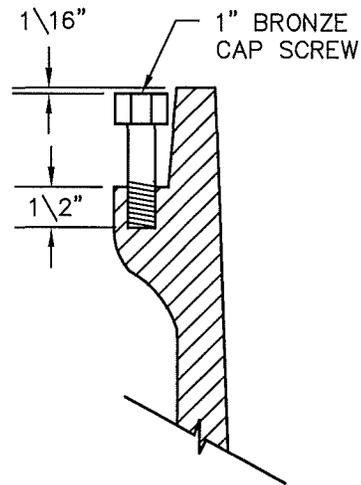
BOTTOM COVER



SECTION B-B

OTHER TEXT OPTIONS  
 SANITARY SEWER  
 SIGNALS & LIGHTING  
 WATER

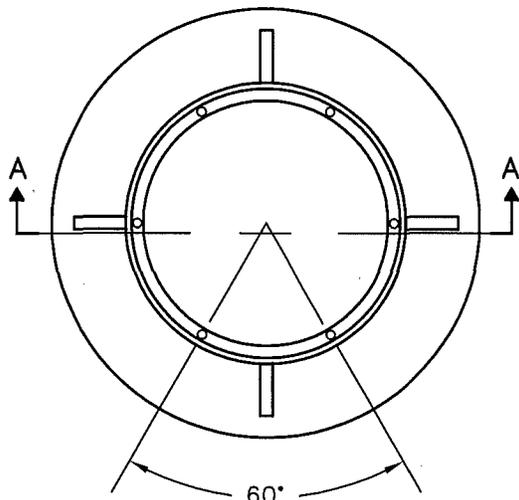
COVER TO EXTEND ONE FOOT ABOVE GRADE IN FLOOD PLAIN AREAS



HALF SIZE SEAT DETAIL

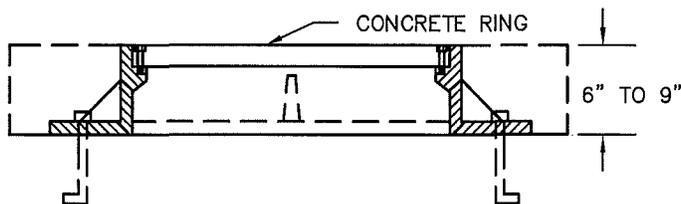
MIN. OF 2 BOLTS REQUIRED

CASTING TO BE ANCHORED TO MANHOLE WITH 3 ANCHOR BOLTS



PLAN

ALL OTHER DETAILS AND DIMENSIONS ARE SHOWN ON DRAWING FOR STANDARD 26" MANHOLE CASTINGS.



SECTION A-A

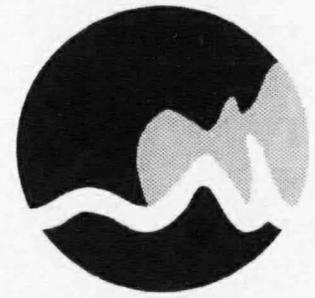
REVISED 2-1-2005

CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

**MANHOLE CASTING  
 BOLT DOWN COVER**

<b>S</b> <b>14</b>	APPROVED <i>[Signature]</i> CITY ENGINEER	DATE 2/5/05
	DRAWN bap	CHECKED V.U.

STANDARD  
CONSTRUCTION  
SPECIFICATIONS



CITY OF  
GRAND RAPIDS  
MICHIGAN

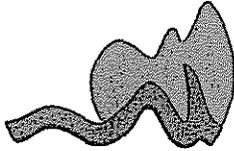
OFFICE OF  
CITY ENGINEER



1993  
EDITION

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OFFICE OF  
CITY  
ENGINEER



## CITY OF GRAND RAPIDS

March 30, 1993

### TO ALL PROSPECTIVE BIDDERS:

The Standard Construction Specifications, 1993 Edition is hereby issued by the City of Grand Rapids. The issuance of these Standard Construction Specifications is made in an effort to insure the use of uniform, adequate and acceptable construction methods and materials. Our office strives at all times to stay up to date regarding construction engineering developments.

These specifications are adopted as standard requirements to apply to work and materials advertised for bid after April 16, 1993.

JOHN L. HORNBAUGH, P.E.  
CITY ENGINEER

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**CITY OF GRAND RAPIDS**  
**STANDARD CONSTRUCTION SPECIFICATIONS**  
**1993 EDITION**

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CONTENTS (cont.)

DIVISION 21	FORCEMANS
DIVISION 22	RESTORATION
DIVISION 23	STREET RECONSTRUCTION AND RESURFACING
DIVISION 24	BORE AND JACK
DIVISION 25	STREET LIGHTING
DIVISION 26	ELECTRICAL UNDERGROUND
DIVISION 27	INSPECTION BY CONSULTING ENGINEERS
DIVISION 28	TRENCH CUTS AND RESTORATION IN PUBLIC STREETS

OFFICE OF CITY ENGINEERS  
CITY OF GRAND RAPIDS, MICHIGAN

INVITATION TO BID

The City of Grand Rapids is seeking bids for \_\_\_\_\_

Sealed Bids will be accepted at the Office of the City Engineer until 11:00 a.m., local time, on \_\_\_\_\_, \_\_\_\_\_. At that time bids will be publicly opened and read aloud.

Bids will be on the basis of unit prices as listed on the Bid Form, and must be submitted using official Bid Forms. Bids shall be sealed in an envelope plainly marked on the outside with the name of the bidder and the identification of the Project. All forms, information, and specifications may be examined and copies obtained at no cost at the Office of City Engineer, 5th Floor of City Hall, 300 Monroe Avenue, N.W., Grand Rapids, Michigan.

This work consists of \_\_\_\_\_

Bidders and subcontractors must comply with the City of Grand Rapids prequalification and precertification requirements. The successful bidder for the above project may not discriminate against any employee or job applicant in any matter related to employment because of race, creed, color, national origin, sex, handicaps, age, or marital status, and the successful bidder will be required to insert that provision in all subcontracts relating to the project.

A certified check of bid bond for a sum not less than five percent (5%) of the amount of the Bid will be required with each bid. No bid may be withdrawn for a period of 45 days after the date and time for receiving bids.

The City reserves the right to accept or reject any and all Bids, and to waive any irregularities in any Bid.

John L. Hornbach, P.E.  
City Engineer

(See REVISIONS April 2011)

## INFORMATION FOR BIDDERS

### IB-1.01 Receipt of Bids

Sealed Bids will be received at the Office of the City Engineer, Grand Rapids, Michigan, until \_\_\_\_\_ local time, at which time they will be publicly opened and read by the City Engineer or his/her duly authorized representative.

### IB-1.02 Specifications

Except as may be provided in "Special Specifications" all work shall be done in accordance with the 1993 Standard Construction Specifications of the City of Grand Rapids and supplemental specifications, which are on file in the Office of the City Engineer.

### IB-1.03 Completion Date

Unless the completion date is indicated on the Bid Form, the bidder must state the number of calendar days from date of contract within which he/she will complete the work. Space is provided for this on Sheet 1 of the Bid Form.

### IB-1.04 Unit Prices Required

Each bidder must submit a unit price for each item so indicated on the Bid Form. Unsolicited alternate bids for any item will not be considered and should not be submitted. Failure to comply with these requirements may be sufficient reason for rejecting the bid.

### IB-1.05 Sealed Bid Envelopes

Each bid must be submitted in the printed envelope supplied by the City for that purpose. The bidder shall write the name of the project and the name of the bidder in the space on the front of the envelope.

### IB-1.06 The Bid:

IB-1.06.01 Authority of the City Manager - It is provided that the City Manager or his/her duly authorized agent shall advertise for bids and that they shall be received, opened and tabulated by the Engineer, acting for and on behalf of the City Manager. After examining the bids, the Engineer shall report the same together with his/her recommendation to the City Manager. The City Manager shall then examine them, together with such report, and submit them with his/her own recommendation, to the City Commission.

IB-1.06.02 Contents of Bid Form - Bidders will be supplied with Bid Forms which will state the location and description of the work planned, the approximate quantities of the work to be performed and materials to be furnished, the amount of the Bid Security and the date, time, and place of submitting and opening bids.

IB-1.06.03 Interpretation of Estimates - The Engineer's estimate of quantities shown on the Bid Form shall be used for the comparison of bids upon which the award of the contract will be made. These

quantities are not guaranteed and the furnishing of this information creates no liability on the part of the City.

IB-1.06.04 Examination of Site by Bidder - Before submitting Bids, the bidder shall examine the site of the proposed work as well as all the Bidding Documents. The bidder hereby agrees to accept full responsibility for his/her conclusions relative to the nature and probable difficulties of the work. Information made available by the City to the bidder, regarding underground conditions, such as test borings, is offered as information, only, and shall not be construed as relieving the bidder of his/her obligations to make such supplementary or independent investigations as may be necessary or advisable.

The bidder hereby waives all claims for any damages which he/she may suffer by reason of the inadequacy or incompleteness of such underground information which the City has been able to obtain and furnish.

The bidder shall also inform himself/herself of all the requirements of Federal, State and Local laws and regulations which may affect the execution of the work.

IB-1.06.05 Bid Security - Bids on projects for which the Engineer's Estimate is \$50,000 or more may not be considered unless there is enclosed a certified check or certificate of deposit payable to the order of the City of Grand Rapids in the sum of 5% of the bid amount or a bid bond issued by an approved Surety Company on the form supplied by the City. No Bid Security will be required on projects for which the Engineer's Estimate is less than \$50,000. The Bid Security of the three lowest Bidders will be retained by the City Manager until the contract has been awarded and the checks of all other Bidders will be returned at once. In the event that the award of contract is not made within 45 days after opening of bids, the Bidder may withdraw the Bid Security without penalty.

IB-1.06.06 Delivery of Bids - The Bid shall be submitted in a sealed envelope which shall be plainly marked with the same complete project designation shown on the title sheet of the bid and with the name and address of the Bidder on the outside of the envelope. All Bids must be received by the City Engineer, acting for and on behalf of the City Manager, prior to the time and at the place indicated in the Invitation to Bid.

IB-1.06.07 Number of Bids Allowed - Each Bidder shall submit only one bid for a particular project unless alternate bids are requested.

IB-1.06.08 Public Opening of Bids - The Bids will be opened publicly and read aloud at the time and place specified in the Invitation to Bid. Only the total amount of each bid will be read. After checking all bids, the unit prices of the bids will be made available for public inspection.

IB-1.06.09 Minority/Women Business Enterprises (M/WBE) - At the time of submission of his/her Bid, each Bidder shall have attached the "Minority and Women Business Enterprise Bid Supplement" which identifies the certified Minority and Women Business Enterprises contacted, the results of the contact, whether the M/WBE subcontractor will be used on the project, and the exact dollar amount of the subcontract. Any bidder who fails to submit this Bid supplement with the bid, shall be deemed not to have exerted a good-faith effort to utilize Minority and Women Business Enterprise participation and the bid shall be deemed non-responsive.

Any bidder who does not meet the Minority and/or Women Business Enterprise goals must submit a completed Request for Waiver form at the time of submission of his/her bid or said bid shall be deemed non-responsive.

The City of Grand Rapids Equal Opportunity Department (EOD) will make available a list of local Minority/Women Business Enterprise (M/WBEs) that are approved by the City for use as sub-contractors and suppliers.

It is the responsibility of the Bidder to "cross check" the M/WBE list with the list made available of firms which are in non-compliance with affirmative action requirements and, therefore, not eligible to do business with the City. It is also the responsibility of the Contractor to make certain that any M/WBE which the Bidder proposes for use as a subcontractor is certified by the City as an M/WBE and also is not on the City's non-compliance list for affirmative action at the time of any particular bid solicitation. The City of Grand Rapids makes no guarantee as to the accuracy of the lists provided. Bids which are received which list M/WBEs who are not certified as M/WBEs with the City or are on the City's non-compliance lists may be rejected.

The City's current Commission Policy, and Administrative Guidelines for Minority and Women Business Enterprises Under City Contracts, and the current approved M/WBE list are on file at the City Engineer's Office and the City Equal Opportunity Office for reference.

IB-1.06.10 Prequalification of Bidders and Subcontractors - Bidders on projects for which the Engineer's Estimate is \$10,000 or more and subcontractors whose portion of the work is \$10,000 or more, must be prequalified with the City Engineer's Office of the City of Grand Rapids and capable of performing the various items of work on which they bid.

The current City Commission Policy, Procedures for Prequalification of Bidders and Subcontractors and list of Prequalified Bidders and Subcontractors are on file at the City Engineer's office for reference.

IB-1.06.11 Disqualification of Bidders - In accordance with the City Code of Grand Rapids, Michigan, no Bidder shall be permitted to submit a bid for any work for the City if said Bidder is in arrears to the City upon debt or contract, or who is in default upon any form of security or other obligation given to the City, or who shall in other respects be disqualified according to the provisions of this Code or the Grand Rapids City Charter.

IB-1.06.12 Affirmative Action Precertification Requirements for Bidders, Subcontractors, and Suppliers:

The City's Affirmative Action Standards for Equal Employment Opportunity require that all bidders, contractors, subcontractors, subcontractors of subcontractors, suppliers of subcontractors, suppliers, and subcontractors of suppliers shall be precertified prior to submitting a bid. The Standards further provide that bidders, contractors, subcontractors, subcontractors of subcontractors, suppliers of subcontractors, suppliers, and subcontractors of suppliers who have not received written notice of the Standards are allowed to submit bids provided that compliance with the Standards and approval thereof by the City's Equal Opportunity Office must occur within fifteen (15) days of actual written notice to the Contractor.

These Standards are applicable to bidders, contractors, subcontractors, subcontractors of subcontractors, suppliers of subcontractors, suppliers, and subcontractors of suppliers who have done a total of \$10,000 or more in business with the City of Grand Rapids within the last 12-month

period ending June 30. Said \$10,000 total shall include the amount of the work in the project being bid.

The current City Affirmative Action Standards are on file at the City Equal Opportunity Office. The current lists of Precertified contractors, subcontractors and suppliers and those in Non-Compliance are on file at both the City Engineer's Office, and the City Equal Opportunity Office.

**IB-1.07**     Preparation and Submission of Bids:

**IB-1.07.01**     Preparation of Bids - The Bid Form shall be legibly prepared with ink or typed on the form provided. The bidder shall specify a unit price for each item on the Bid Form, and shall show the products of the respective quantities and unit prices in the column provided for that purpose, and the total sum for which he/she will perform the proposed work. Any Bid which does not contain a bid price for each item may be deemed incomplete and may not be considered, except when a lump sum bid is requested. Unsolicited alternate bids for any item will not be considered and should not be submitted, and if submitted, may cause the bid to be rejected.

When there is no completion date or progress schedule incorporated in the Bid Form, each Bidder is required to write such information in the space provided on the Bid Form..

The Bid Form must be signed and the complete address of the Bidder given. If the Bidder is a corporation, the authorization for the person signing must be given unless previously on file with the City Clerk and the City Comptroller. If the Bidder is a partnership, the names of the parties must be given as well as the firm or trade name. If the Bidder is an individual, the name of the individual must be given as well as the firm or trade name. If the bid is submitted as a joint venture, the name of the individuals, corporation or partnerships which make up the joint venture must be given.

**IB-1.07.02**     Consideration of Bids - The Bidder must complete the appropriate forms in the Bid Form indicating the subcontractor(s) and supplier(s) and the Minority and Women Business Enterprise(s) that the Bidder is intending to use on the project, certifying the Bidder's compliance with the M/WBE policy and requesting a waiver of M/WBE participation when appropriate. Failure to complete all of the forms and other entries required in the Bid Form may be cause for the rejection of the Bid.

Bids received will be compared on the basis of the summation of the products of the quantities of items listed and the unit prices bid. Where a discrepancy occurs, the unit prices as written in the Bid Form shall govern, and any errors found in said products, or in addition, will be corrected.

The right is reserved to reject any or all Bids, to waive irregularities and technicalities, to advertise for new Bids, or to proceed to do the work otherwise, if in the judgment of the City Commission, it is in the best interest of the City to do so.

**IB-1.08**     Execution of Contract

**IB-1.08.01**     Execution of Contract - The Low Bidder will be determined by a tabulation of bids within one (1) business day of the bid opening. The Low Bidder, or other Bidder(s) if requested by the City (hereafter called the Bidder), shall furnish all necessary information, forms and documents

required by the bid documents to the City within seven (7) calendar days or less as stated hereafter from the bid opening to enable the City to proceed with the award of the contract. Such items shall include applicable insurance, wage forms and federal/state forms. The Minority Business Enterprise and Women Business Enterprise Affidavit Form shall be submitted within one (1) business day after the bid opening as required under the specifications for Minority and Women Business Enterprise requirements. The Bidder shall furnish all necessary sureties, in a form acceptable to the City, within twelve (12) calendar days of the bid opening. In the event the Bidder or the Bidder's proposed subcontractor(s) or supplier(s) are not precertified at the time of bid opening, the Bidder will make a request to the City's Equal Opportunity Department within two (2) business days of the bid opening for the application form(s) for said precertification, including those for the proposed subcontractor(s)/supplier(s), and comply with the time frame required for the submittal of the same.

The Contract will be transmitted to the Bidder at the address given on the Bid Form, or the Bidder will be informed that the Contract is ready and available to be picked up at the City Engineer's Office, within two (2) business days after acceptance of the Bid by the City (Award of Contract by the City Commission). The Bidder shall enter into the Contract with the City within seven (7) calendar days of the Award of Contract.

If the Bidder and the Bidder's proposed subcontractor(s) and supplier(s) are precertified at the time of bid opening and the Bidder has complied with all the bid requirements and has submitted the necessary information, forms, documents, insurance and sureties acceptable to the City within the allotted time frames noted herein, and in the event the City fails to award the Contract and to have the same ready for execution by the Bidder within fourteen (14) calendar days of the bid opening, then the total number of days by which the City fails to meet the aforesaid fourteen (14) day deadline will be added to the date of completion. However, if the Bidder or the Bidder's proposed subcontractor(s) or supplier(s) are not precertified in accordance with the requirements of this Information for Bidders at the time of bid, then the aforesaid fourteen (14) calendar day time period is hereby extended to a twenty-eight (28) calendar day time period. Failure by the Bidder to furnish the necessary information, forms, documents, insurance and sureties within the allotted time frames or to enter into the Contract with the City within the allotted time frame as noted herein, for which failure the City is not obligated to meet either the fourteen (14) or twenty-eight(28) day deadline noted above, shall not be reason to extend the date of completion of the Contract.

It is noted that on certain projects, as the City deems appropriate, it will be necessary to expedite the schedule as referenced herein in order to expedite the start of work. In such cases, the time frames for submittal of the necessary information, forms, documents, insurance, sureties, etc. and the projected date for the award of the Contract and having the same ready for execution by the Bidder will be so noted in the special specifications and such time frames will take precedent over the time frames noted herein.

IB-1.08.02      Subcontracts - All contractors will be required to provide the City with copies of executed subcontracts for all subcontracted work in excess of \$3,000. Said subcontracts shall utilize the appropriate form supplied by the City Engineer's office.

Unless specifically approved by the Engineer, the Prime Contractor shall utilize the subcontractors listed in the Bid Form.

IB-1.08.03        Contract Bond Requirements - The successful Bidder shall furnish satisfactory performance and lien bonds, each in an amount equal to the total contract price on all projects for which the contract amount is \$50,000 or more. No performance or lien bonds will be required on projects for which the contract price is less than \$50,000. Such bonds shall be on the forms provided by the City and shall conform to the regulations of the City and the requirements specified in the laws of Michigan.

IB-1.08.04        Contract Insurance Requirements - The successful Bidder shall furnish Insurance of the several types and in the amounts described in the General Conditions, and Special Specifications as applicable.

IB-1.08.05        Failure to Execute Contract - Failure on the part of the successful Bidder to execute a contract and file satisfactory bonds and insurance, as specified herein, may be considered cause for the annulment of the award and forfeiture of the Bid Security to the City.

**REVISED**  
**(See Revisions April 2011)**

Name of Bidder:

\_\_\_\_\_

BID FORM

Grand Rapids, Michigan

Bids to be received \_\_\_\_\_

at \_\_\_\_\_ Local Time

TO THE CITY OF GRAND RAPIDS:

The undersigned as bidder proposes to do all the work of

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**(See Revisions April 2011)**

and to furnish all plant, labor, materials, supplies, equipment and other facilities and things necessary and proper for and incidental to the proper performance and completion of the work specified in the Contract Documents, including the Drawings and specifications and as required by the City Manager and City Engineer to begin construction within seven (7) calendar days after a Contract is executed (unless otherwise indicated in the Special Specifications) and to complete the work by the date(s) listed below, and for the unit prices stated in the Bid Form. Addenda, if any have been issued, are to be acknowledged on the form provided at the place where bids are received, and a signed copy attached to the bid.

Completion Date: \_\_\_\_\_

Completion Date: \_\_\_\_\_



MINORITY AND WOMEN BUSINESS ENTERPRISE  
 BID FORM SUPPLEMENT

Please provide the name(s) of all MBE/WBE subcontractors from whom you solicited bids for this project and additional information requested below:

1.	MBE or WBE	SUBCONTRACTOR	CONTACT PERSON	CONTACT METHOD	DATE OF CONTACT
2.					
3.					
4.					
5.					

Of the MBE/WBE subcontractor(s) listed above, (a) please identify those who submitted quotes, (b) the amount of the quotes, (c) those who will be used on this project, and (d) those who were not used and the reason for not using them.

	MBE OR WBE	SUBCONTRACTOR	QUOTE RECEIVED	WILL SUBCONTRACTOR BE USED?		IF THE SUBCONTRACTOR IS NOT BEING USED, YOU MUST LIST REASONS(S)
				YES	NO	
1.			\$			
2.			\$			
3.			\$			
4.			\$			
5.			\$			

MBEs Used: Dollar Amount \$ \_\_\_\_\_ MBE Percentage of Total Contract \$ \_\_\_\_\_

WBES Used: Dollar Amount \$ \_\_\_\_\_ WBE Percentage of Total Contract \$ \_\_\_\_\_

If additional space is needed, please attach separate sheet(s).

See Revisions April 2011

REQUEST FOR WAIVER OF  
MINORITY AND/OR WOMEN BUSINESS ENTERPRISE PARTICIPATION

\_\_\_\_\_, being first duly sworn, says as follows:

1. That he/she is the \_\_\_\_\_ (Title) of \_\_\_\_\_ (Name of Company).
2. That \_\_\_\_\_ (Name of Company) has submitted a bid to the City of Grand Rapids to perform the following services:
3. That this bid contains less than the stated goal(s) of Minority and/or Women's Business Enterprise participation for the following reasons:
4. That the following efforts have been made to obtain Minority and/or Women's Business Enterprise participation.
5. That written documentation of the attempts referred to in number 4 are attached to this request.

**(See REVISIONS April 2011)**

\_\_\_\_\_  
Company Representative

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
Notary Public,  
Kent County, MI  
My Commission Expires: \_\_\_\_\_

**THIS REQUEST FOR WAIVER MUST BE SUBMITTED WITH THIS BID AND ALL DOCUMENTARY EVIDENCE IN SUPPORT OF THE REQUEST.**

NAME OF PROJECT:

CERTIFICATE OF COMPLIANCE WITH M/WBE POLICY

I, \_\_\_\_\_, (Owner/Officer of Prime Contractor) do hereby certify with my signature below that an owner or responsible officer of \_\_\_\_\_ (Name of Firm) company has read and understood the City of Grand Rapids requirements for "Minority/Women Business Enterprises (M/WBEs)" which includes the City of Grand Rapids Commission Policy dated April 27, 1992 and the Administrative Guidelines for Minority and Women Business Under City Contracts dated April 27, 1992 and that the firm has fully complied with these requirements in all activities and efforts to secure the contract for this project with the City of Grand Rapids.

Date: \_\_\_\_\_ Signature: \_\_\_\_\_  
(Owner/Officer of Prime Contractor)

REVISED  
(See Revisions April 2011)

proposalforms/nondisfm

Revised 05/05/92

THE UNDERSIGNED, AS BIDDER, AGREES to furnish sureties, insurance and all necessary information, forms and documents acceptable to the City in accordance with and within the time frame outlined in the Information for Bidders and to enter in to a contract within the time frames as required in the Information for Bidders and Special Specifications as applicable, and upon failure or refusal to do so agrees to forfeit the Bid Security herewith enclosed to the City as liquidated damages and not as a penalty.

THE UNDERSIGNED, AS BIDDER, AGREES to commence the work within seven (7) calendar days after signing the contract (unless otherwise indicated in the Special Specifications) and complete the same on or before the completion date(s) stated on this Bid Form. If the work is not completed on or before the date stated or time specified, the City Manager is, because of the difficulty in estimating damages, authorized to retain out of the money which may be due or become due the sum of \$\_\_\_\_\_ for each calendar day by which the bidder, as Contractor, shall fail to complete the work, said sum to constitute liquidated damages and not a penalty.

Signature of Bidder: \_\_\_\_\_

Name of Bidder: \_\_\_\_\_

Address of Bidder: \_\_\_\_\_

Daytime Telephone No.: ( ) \_\_\_\_\_

**REVISED**  
**(See Revisions April 2011)**

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we \_\_\_\_\_  
as Principal, hereinafter called the Bidder, and \_\_\_\_\_

\_\_\_\_\_ as Surety, are held and firmly bound unto the CITY OF GRAND RAPIDS, MICHIGAN, hereinafter called the Obligee, in the penal sum of \_\_\_\_\_ (\$ \_\_\_\_\_) lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

WHEREAS, the bidder has submitted the accompanying bid, dated the \_\_\_\_\_ day of \_\_\_\_\_

Now, THEREFORE, the conditions of the obligation are such that if the bid be accepted as to any or all of the items of material and workmanship proposed to be furnished thereby, or as to any portion of the same, and if the said bidder will within ten days after notice of the award of contract enter into contract with the Obligee to furnish all work and materials at the prices offered by said bid and will furnish bond with good and sufficient surety or sureties as may be required for the faithful and proper fulfillment of said contract and such other and further bonds as may be required under the ordinances of the Obligee, or statutes of the State of Michigan, then this obligation shall be void. And the surety hereby binds itself and its successors to pay the Obligee, in case the bidder fails to enter into such contract and give such bonds within ten days after such notice of award of contract to pay to the Obligee the damages which Obligee may suffer by reason of such failure not exceeding the penalty of this bond.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals this \_\_\_\_\_ day of \_\_\_\_\_, 19\_\_\_\_, the name and corporate seal of each corporate party being hereto affixed, and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

(See Revisions April 2017)

In Presence of: \_\_\_\_\_ L.S.  
\_\_\_\_\_ L.S.  
\_\_\_\_\_ Surety

MINORITY BUSINESS ENTERPRISE AND WOMEN BUSINESS ENTERPRISE

AFFIDAVIT

STATE OF MICHIGAN )

) SS

COUNTY OF KENT )

\_\_\_\_\_, being first duly sworn, deposes and says:

1. That he/she is \_\_\_\_\_ of \_\_\_\_\_  
\_\_\_\_\_  
(Name of MBE/WBE).

2. That the firm (company) named in paragraph one (1) is a Minority Business Enterprise (MBE)/Women Business Enterprise (WBE).

3. That \_\_\_\_\_ percent of the Firm (company) is owned by minorities.

4. That the primary nature of the business engaged in by the firm listed in paragraph one (1) is \_\_\_\_\_  
\_\_\_\_\_.

5. That, on \_\_\_\_\_ (date), \_\_\_\_\_  
\_\_\_\_\_ (Name of Company), submitted a bid to participate in the project known as : \_\_\_\_\_  
\_\_\_\_\_.

6. That said bid was for \_\_\_\_\_ Dollars (Amount of Bid).

7. That said bid was submitted to: \_\_\_\_\_  
\_\_\_\_\_.

8. That, the Affiant's (company's) bid was submitted to provide (perform) on the following services of work: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_.

(See REVISED Revisions April 2011)

9. That, the Affiant (company) has the knowledge and expertise to provide the services or perform the work described in paragraph eight (8).

10. That, the Affiant has been notified by the General Contractor \_\_\_\_\_  
\_\_\_\_\_ (Name of Contractor) that Affiant's bid has been accepted.

11. That, the notification referred to in paragraph ten (10) was received on \_\_\_\_\_ by \_\_\_\_\_.

12. That, the Affiant (company) proposes to actually perform the services or do the work for which he/she (it) bid.

13. That, Affiant (company) has not, or will not, subcontract or assign the work upon which he/she (it) bid without written permission from the Owner of the project or the Owner's representative.

**REVISSED**  
**(See Revisions April 2011)**

\_\_\_\_\_  
(Signature)  
\_\_\_\_\_  
(Name)  
\_\_\_\_\_  
(Title)

On this \_\_\_\_\_ day of \_\_\_\_\_, 19\_\_\_\_ before me, a Notary Public, appeared \_\_\_\_\_, to me known to be the same person described and who, being duly sworn, did execute the foregoing Affidavit, and did state that he/she was properly authorized by \_\_\_\_\_ (Name of Firm) to execute the said Affidavit, and who had acknowledged the same to be his/her free act and deed.

\_\_\_\_\_  
Notary Public, Kent County, MI  
My Commission Expires: \_\_\_\_\_

City of Grand Rapids, Michigan  
Office of City Engineer

SUBCONTRACTS

THIS AGREEMENT, made this \_\_\_\_\_ day of \_\_\_\_\_, 19\_\_\_\_, by  
and between \_\_\_\_\_  
Principal Contractor, of \_\_\_\_\_  
part of the first part, and \_\_\_\_\_  
Subcontractor, of \_\_\_\_\_  
part of the second part.

WITNESSETH, that the party of the second part, for and in consideration of the payment or payments hereinafter specified, hereby agrees to furnish all necessary machinery, tools, apparatus, and other means of construction, do all the work, furnish all the material except as herein otherwise specified, and to complete, in strict accordance with the contract between the City of Grand Rapids and the Principal Contractor, dated \_\_\_\_\_, 19\_\_\_\_, for the \_\_\_\_\_  
\_\_\_\_\_, the work as described herein.

IN CONSIDERATION WHEREOF, said party of the first part agrees to pay said party of the second part for all work done at the following prices:

Item	Unit	Quantity	Unit Price	Total

**REVISSED**  
**(See Revisions April 2011)**

The work shall be done in conformance with the Contract, including the current Grand Rapids Standard Specifications at the time the contract was awarded, the Drawings, and all of the general, supplemental and special specifications that are a part of the aforementioned contract between Grand Rapids and \_\_\_\_\_, These Specifications are hereby made a part of this Subcontract.

Particular attention is called to the following contract provisions:

- A. It is specifically understood and agreed that the party of the second part shall present satisfactory evidence to the party of the first part, prior to the beginning of the work, that Workers' Compensation Insurance has been obtained and is in full force and effect covering all employees performing work hereunder, and that the same will be kept in full force and effect until the work herein contracted to be done has been fully completed.
- B. Should the contract documents include provisions or conditions indicating that the project is funded in whole or in part by any government agencies other than the City of Grand Rapids, then the requirements of those agencies, as stipulated in the Contract, shall be binding on the parties to this Subcontract.

(See REVISIONS April 2011)

The Subcontractor hereby agrees to include all applicable parts of the above-described specifications in any lower-tier subcontracts with they may enter into together with a clause requiring this insertion in any further subcontracts that may in turn be made.

IN WITNESS WHEREOF, the parties hereto have set their hands the day and year first above written.

WITNESSED:

\_\_\_\_\_  
By: \_\_\_\_\_  
\_\_\_\_\_  
By: \_\_\_\_\_

CONTRACT NO.

THIS AGREEMENT made on the \_\_\_\_\_ day of \_\_\_\_\_, 1993  
by and between the City of Grand Rapids, Kent County, Michigan, party of the first part, hereinafter  
called the "City", and

party of the second part, hereinafter called the "Contractor."

WITNESSETH, that the City and the Contractor, for the considerations hereinafter mentioned,  
agree as follows:

ARTICLE I - THE CONTRACT

The following shall be deemed to be part of this Contract:

- (a) Information for Bidders
- (b) The Bid Form
- (c) The General Conditions and Supplementary Conditions
- (d) Performance and Payment/Lien Bonds (required)(not required)
- (e) All Provisions required by law to be inserted in  
this Contract whether actually inserted or not
- (f) The Standard Specifications
- (g) Supplemental and Special Specifications as listed below:  
(fill in specific project specs)

(h) The Drawings as listed below

(\_\_\_ Sheet/s)

## ARTICLE II - SCOPE OF THE WORK - SUBJECT MATTER

The Contractor hereby agrees to furnish all of the materials and all of the equipment and labor necessary to perform all of the work shown on the Drawings and described in the specifications for the project entitled:

all in accordance with the requirements and provisions of the Contract. The Contractor likewise agrees to do all incidental and appurtenant work in connection therewith.

## ARTICLE III - TIME OF COMPLETION

The work to be performed under this Contract shall be commenced within seven (7) calendar days after the execution of this Contract and shall be completed

\_\_\_\_\_ Should the Contractor be obstructed or delayed in the prosecution or completion of his work or by any act, neglect or default of the City then the time herein fixed for completion of the work shall be extended for a period equivalent to the time lost by reason of such delay for the causes herein mentioned. The duration of such extension shall be determined by the City Manager or his authorized representative.

ARTICLE IV - LIQUIDATED DAMAGES

Should the work under this Agreement not be finished within the time specified, the City is hereby authorized to deduct out of the money which may be due or become due to the Contractor under this Agreement, as damages for the non-completion of the work aforesaid, within the time herein before stipulated for its completion, the sum of \_\_\_\_\_ Dollars and 00/100 (\$\_\_\_\_\_) Dollars for each calendar day by which the Contractor shall fail to complete the work or any part thereof in accordance with the provisions hereof, and such liquidated damages shall not be considered as a penalty.

ARTICLE V - THE CONTRACT SUM

The City agrees to pay and the Contractor agrees to accept the sum of \_\_\_\_\_ the amount named in the Bid Form, as full compensation for all labor, supervision, equipment, materials, and incidental expense required in executing all of the work contemplated in this Contract, including also all loss of damage arising out of the nature of the work or from the action of the elements or from any unforeseen obstruction or difficulties which may be encountered in the prosecution of the same or from other causes of every description connected with the work.

It is further agreed that the sum named may be increased or decreased in accordance with the units of work actually completed at the Contract unit prices, and may be increased by the addition of items or work not included in the Bid Form.

ARTICLE VI - CITY CHARTER TO BE GOVERNING DOCUMENT

The City Charter of the City shall be the governing document in all contractual relations with the City of Grand Rapids. In the prosecution of the work under this Contract, eight (8) hours shall constitute a day's labor as provided by Section 22 of Title XVIII of the Charter of the City. The City retains the right to determine finally all questions as to the proper performance under this Contract or any unfinished portion thereof, and in case of improper, dilatory or imperfect performance thereof to suspend the work at any time and to order the partial or entire reconstruction of the same. The City likewise retains full power to determine all questions arising under this Contract according to the true intent and meaning thereof, all in accordance with Section II of Title XVIII of the City Charter.

## ARTICLE VII - COMPLIANCE WITH LAWS, ORDINANCES AND REGULATIONS

The Contractor shall keep fully informed of and shall at all times comply with all local, state and federal laws, rules and regulations applicable to this Contract and the work to be done hereunder.

## ARTICLE VIII - EQUAL EMPLOYMENT OPPORTUNITY AND AFFIRMATIVE ACTION

The Contractor shall not discriminate against any employee or applicant for employment, to be employed in the performance of this Contract, with respect to hire, tenure, terms, conditions or privileges of employment, or any matter directly or indirectly related to employment, because of race, color, religion, national origin, age, sex, height, weight or marital status (Act 453, P.A. 1976). The Contractor further agrees to require similar provisions from any subcontractors.

The Contractor agrees to take affirmative action in hiring, training, and promoting minority group persons and women to bring about reasonably representative integration of his or her employees.

For the purposes of this Contract, a "Minority" is a person who is a citizen or lawful resident of the United States who is:

- (a) Black, a person having origins in any of the black racial groups of Africa;
- (b) Hispanic, a person of Spanish or Portuguese culture, with origins in Mexico or Central America or the Caribbean Islands;
- (c) Asian American, a person having origins in any of the original people of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands;
- (d) Native American, a person having origins in any of the original peoples of North America.

The Contractor further agrees to review or examine with the City relevant employment data and other information pertaining to its hiring practices. The Contractor further agrees that he or she will require similar covenants from all subcontractors under this Contract.

## ARTICLE IX - BOND OF CONTRACTOR

The Contractor shall provide sufficient security by bond to guarantee the faithful performance of the work, including the Guarantee provided in the General Conditions, and the payment by the Contractor of all subcontractors and payment for all labor performed and materials and supplies furnished.

IN WITNESS WHEREOF, the parties hereto have set their hands thereto as of the day and year first written above.

\_\_\_\_\_(Seal)  
\_\_\_\_\_, Mayor

\_\_\_\_\_(Seal)  
\_\_\_\_\_, City Clerk

\_\_\_\_\_(Seal)  
(A Michigan Corporation/Individ Corp?)

BY: \_\_\_\_\_(Seal)

**REVISED**  
**(See Revisions April 2011)**

#3C:WP5/CITYCONT

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PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS. That \_\_\_\_\_

\_\_\_\_\_ of the \_\_\_\_\_ of \_\_\_\_\_, County of \_\_\_\_\_ and State of \_\_\_\_\_ as principal \_\_\_\_\_ and \_\_\_\_\_ as sureties are held and firmly bound unto the City of Grand Rapids, in the penal sum of \_\_\_\_\_

\_\_\_\_\_ Dollars, to be paid to the City of Grand Rapids, or its assigns, for which payment well and truly to be made, we bind ourselves, or and each of our heirs, executors and administrators, jointly and severally, firmly by these presents.

Sealed with our seals, and dated this \_\_\_\_\_ day of \_\_\_\_\_ A.D., 19\_\_\_\_\_.

The condition of the above obligation is such that if the above-named principal shall in all things stand to, abide by, and well and truly keep and perform the covenant, conditions and agreements in the foregoing contract contained, including the guarantee requirements, to be performed on \_\_\_\_\_ part, at the time, and in the manner and form therein specified, subject to the changes therein provided for, then this obligation to be void, otherwise of force and virtue.

(See Revisions April 2011)

\_\_\_\_\_(Seal)  
By: \_\_\_\_\_(Seal)  
\_\_\_\_\_(Seal)  
By: \_\_\_\_\_(Seal)  
\_\_\_\_\_(Seal)  
By: \_\_\_\_\_(Seal)

Bond, sureties, and contract approved and ordered executed by the Commission of the City of Grand Rapids at a session held \_\_\_\_\_, 19\_\_\_\_\_.

Attest: \_\_\_\_\_  
Clerk

PAYMENT/LIEN BOND

KNOW ALL MEN BY THESE PRESENT That \_\_\_\_\_

and \_\_\_\_\_, as principal \_\_\_\_\_

and \_\_\_\_\_

as sureties, all of the State of Michigan, are held and firmly bound unto the City of Grand Rapids in the sum of

\_\_\_\_\_ Dollars,

lawful money of the United States of America, to be paid to the City of Grand Rapids or to their certain attorneys, or assigns to which payment well and truly to be made, we bind ourselves, our heirs, executors and administrators, jointly and severally, firmly by these presents.

Signed with our hands, sealed with our seals and dated the \_\_\_\_\_ day of \_\_\_\_\_, A.D., 19\_\_\_\_\_.

WHEREAS, the above bounded \_\_\_\_\_

have become the Contractor with the City of Grand Rapids in the County of Kent and State of Michigan, for the

in said City.

NOW, THEREFORE, the conditions of this obligation are such, if \_\_\_\_\_

principal Contractor, shall pay any and all subcontractors and pay any and all parties performing labor or furnishing materials or supplies in the performance or construction of said work (provided that the principal Contractor shall not be required to make any payment to a subcontractor of sums due from the subcontractor to parties performing labor or furnishing materials or supplies except upon receipt of the written orders of said party to pay the sum due to them to subcontractors), then this obligation to be void, otherwise in full force and virtue.

By: \_\_\_\_\_ (Seal)  
By: \_\_\_\_\_ (Seal)  
By: \_\_\_\_\_ (Seal)  
By: \_\_\_\_\_ (Seal)  
By: \_\_\_\_\_ (Seal)

REVISED  
(See Revisions April 2011)

## GENERAL CONDITIONS

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## GENERAL CONDITIONS

- GC-1.01 Definitions: Whenever the words hereinafter defined, or any pronouns, used in their stead, occur in the Contract, they shall have the meanings herein given.
- GC-1.01.01 Addenda - Written or graphic instruments issued prior to the opening of bids which clarify, correct or change the Bidding Documents or the Contract.
- GC-1.01.02 Approved - Wherever in the Specifications or upon the Drawings the words "as ordered," "as directed," "as required," "as permitted," or words of like import are used, it shall be interpreted that the order, direction, requirement of permission of the Engineer is intended; and similarly, the words "approved," "acceptable," or "satisfactory," or words of like import shall mean approved by, or acceptable or satisfactory to the Engineer.
- GC-1.01.03 Bid - The written offer of the Bidder, on the Bid Form furnished by the City for the work proposed.
- GC-1.01.04 Bidder - The individual, partnership or corporation formally submitting a bid for the work contemplated, or any portion thereof, acting directly or through an authorized representative.
- GC-1.01.05 Bidding Documents - The Invitation to Bid, the Information for Bidders, and those items defined herein as the Contract, upon which the Bidder is to base his/her Bid for the Work under this Contract.
- GC-1.01.06 Bid Security - The security designated in the Information for Bidders and furnished by the Bidder as a guarantee of good faith to enter into a Contract for the work proposed.
- GC-1.01.07 Change Order - A document signed by Contractor and Engineer which authorizes an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the time of the Contract, issued on or after the effective date of the Contract.
- GC-1.01.08 City - The corporation of the City of Grand Rapids, Michigan.
- GC-1.01.09 City Manager - The person holding the position or acting in the capacity of the City Manager, appointed by the City Commission or his/her duly authorized representative.
- GC-1.01.10 Commission - The duly elected Commissioners of the City of Grand Rapids, acting as a corporate body, or any officer duly authorized to act for the Commission in any matter pertaining to the contract.
- GC-1.01.11 Contract - The agreement covering the performance of the Work, Addenda (which pertain to the Contract), Contractors Bid (including documentation accompanying the bid and any post bid documentation) when attached as an exhibit to the Contract, the Bonds, these General Conditions, the Supplementary Conditions, the Standard and Special Specifications, and the Drawings, together with all Change Orders.
- GC-1.01.12 Contract Bonds - The statutory bonds, executed by the Contractor and the Surety, guaranteeing performance of the Contract and the payment of all lawful indebtedness pertaining thereto.

- GC-1.01.13        Contract Price - The moneys payable to Contractor for completion of the Work in accordance with the Contract as stated on the Contract Form.
- GC-1.01.14        Contractor - The individual, partnership or corporation undertaking the execution of work under the terms of the Contract and acting directly or through agents or employees.
- GC-1.01.15        Contractor's Prequalification - The classification and rating based on the Experience and Financial Statement of the Bidder in accordance with City Commission Policy for prequalification of Contractors and Subcontractors.
- GC-1.01.16        Defective - An adjective which when modifying the word work refers to work that is unsatisfactory, faulty or deficient, in that it does not conform to the Contract, or does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract, or has been damaged prior to Engineer's recommendation of final payment.
- GC-1.01.17        Director of Public Service - The person holding the position or acting in the capacity of the Director of Public Service or his/her duly authorized representative.
- GC-1.01.18        Drawings - The Drawings which show the scope, extent and character of the Work to be furnished and performed by Contractor and which have been prepared or approved by Engineer and are referred to in the Contract. Shop drawings are not Drawings as so defined.
- GC-1.01.19        Engineer - The person holding the position or acting in the capacity of the City Engineer or his/her duly authorized representative.
- GC-1.01.20        Final Completion - The time at which the Work has been deemed to be totally completed and final payment has been authorized by the Engineer.
- GC-1.01.21        Inspector - The authorized representative of the Engineer, assigned to make detailed inspections of any or all portions of the work or the materials therefor.
- GC-1.01.22        Laboratory - The materials testing laboratory will be the laboratory which may be designated by the Engineer to inspect and determine the suitability of materials.
- GC-1.01.23        Progress Clause - That part of the Contract pertaining to the order of proceeding with the various items of the Work to be done and the rate of progress for completing said items of work.
- GC-1.01.24        Risk Manager - The person holding the position or acting in the capacity of the Risk Manager for the City of Grand Rapids, or his/her duly authorized representative.
- GC-1.01.25        Shop Drawings - All drawings, diagrams, illustrations, schedules and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
- GC-1.01.26        Special Specifications - Special requirements, regulations, or directions prepared to cover work on a particular project not satisfactorily provided by the Standard or Supplemental Specifications.

- GC-1.01.27      Standard Specifications - All requirements contained in the latest edition of the City of Grand Rapids Standard Construction Specifications, including Standard Details included therein.
- GC-1.01.28      Subcontractor - The individual, partnership or corporation undertaking the execution of part of the work under the terms of the contract, by virtue of an agreement with the Contractor.
- GC-1.01.29      Substantial Completion - The Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, it is sufficiently complete, in accordance with the Contract, so that the Work (or specified part) can be utilized for the purposes for which it is intended.
- GC-1.01.30      Supplemental Specifications - Detailed specifications which are supplemental to or which supersede any part of the Standard Specifications.
- GC-1.01.31      Supplementary Conditions - Project specific written modifications to these General Conditions.
- GC-1.01.32      Surety - The corporate body which is bound with and for the contractor for the performance of the Contract and for the payment of all lawful indebtedness pertaining thereto.
- GC-1.01.33      Traffic Safety Director - The person holding the position or acting in the capacity of the Traffic Safety Director for the City of Grand Rapids, or his/her duly authorized representative.
- GC-1.01.34      Work - The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract. Work includes and is the result of performing or furnishing labor and furnishing or incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract.
- GC-1.01.35      AASHTO - The American Association of State Highway and Transportation Officials.
- GC-1.01.36      AED - Associated Equipment Distributors.
- GC-1.01.37      ANSI - American National Standard Institute.
- GC-1.01.38      ASTM - The American Society for Testing Materials.
- GC-1.01.39      AWPA - American Wood Preservers Association.
- GC-1.01.40      AWWA - The American Water Works Association.
- GC-1.01.41      EEI - Edison Electric Institute.
- GC-1.01.42      IES - Illuminating Engineering Society.
- GC-1.01.43      MDOT - The Michigan Department of Transportation.
- GC-1.01.44      NEC - National Electric Code.
- GC-1.01.45      NEMA - National Electrical Manufacturers Association.

GC-1.02 The City Charter:

The City Charter shall be the governing document in all contractual relations with the City of Grand Rapids. Any apparent discrepancy in the text of any other Contract document, or in construction drawings, or in sketches, shall be interpreted, or construed, or set aside in favor of the specific provision or provisions of the City Charter.

GC-1.03 Insurance Requirements:

(a) Indemnity - General - Upon execution of the Contract, the Contractor shall agree to assume all liability for and protect, indemnify and save the City, its agents, officers and employees harmless from and against all actions, claims, demands, judgments, losses, expense of suits or actions and attorney fees for injuries to, or death of, any person or persons and loss or damage to the property of any person, or persons, whomsoever, including the parties thereto, and their agents, contractors, subcontractors, officers and employees, arising in connection with or as a direct or indirect result of entering into and performance of the contract, whether or not due to or arising out of the acts of any party thereto or its agents, contractor, subcontractors, officers and employees, or by or in consequence of any negligence or carelessness in connection with the same or on account of liability or obligation imposed directly or indirectly upon the City by reason of any law of the State of Michigan or the United States, now existing or which shall hereinafter be enacted, imposing any liability or obligations, or providing for compensation to any person or persons on account of or arising from the death of, or injuries to employees. Said Contractor shall pay, settle, compromise, and procure the discharge of any and all such claims and all such losses, damages, and expenses.

(b) Requirements - Prior to commencing work under the Contract, the Contractor as successful bidder shall file with the City a certificate of insurance acceptable to the City as proof that the Contractor has secured the types and amounts of insurance as stated herein or as stated in any Special Specifications applicable to the Contract. The City reserves the right, in its sole discretion, to require the Contractor to file with the City certified copies of any policies of required insurance either prior to the execution of the Contract or at any time thereafter.

The certificate, policies, or other proofs of insurance filed with the City must provide for giving the City 30 days prior written notice of any cancellation or material change in coverage prior to the expiration date of the insurance. In addition, if the stated expiration date for any of the required policies of insurance precedes the stated Contract completion date, the applicable certificate, policy, or other proof of such insurance filed with the City must provide for giving the City 30 days prior written notice of an intent not to renew any such required insurance coverage.

The furnishing by the Contractor of any insurance policies and insurance certificates required and their acceptance or approval by the City shall not release the Contractor from the obligation to provide sufficient coverage as set forth herein and shall not waive liability of the Contractor to indemnify the City against all damage as aforesaid.

For each Contract to which these Standard Specifications apply, the following types and amounts of insurance shall be provided by the Contractor, unless any Special Specifications applicable to the Contract provide for different insurance requirements. The Contractor may comply with these or any Special Specifications by providing insurance with separate limits for bodily injury and property damage and/or by providing umbrella insurance which provides substantially equivalent coverage to that required by the applicable specifications. THE CITY

RESERVES THE ABSOLUTE RIGHT TO MAKE THE FINAL DETERMINATION AS TO WHETHER ANY INSURANCE PROVIDED BY THE CONTRACTOR COMPLIES WITH THESE STANDARD SPECIFICATIONS OR ANY APPLICABLE SPECIAL SPECIFICATIONS. In addition, the City reserves the absolute right to modify or waive at any time, by mutual agreement with the Contractor, any applicable insurance requirements when, in the sole discretion of the City's Risk Manager or any other authorized representative of the City Manager, it is in the City's best interests to do so.

(b1) Contractor's General Liability Insurance - The Contractor shall secure and maintain during the life of the Contract, Commercial General Liability insurance in an amount not less than One Million Dollars (\$1,000,000) Combined Single Limits (CSL) per occurrence; Two Million Dollars (\$2,000,000) General Aggregate; Two Million Dollars (\$2,000,000) Products Completed Operations Aggregate, for both bodily injury and property damage providing the coverages equivalent or greater than those provided by Insurance Services Office (ISO) 1986 Commercial General Liability Policy, Occurrence Form, without any other than the standards exclusions contained in such ISO policy form. These coverages include but are not limited to:

- Premises Operations
- Products/Completed Operations
- Independent Contractors
- Personal Injury
- Broad Form Property Damage - including completed operations
- Contractual Liability, including coverage for the Indemnity Liability assumed pursuant to Section 1.04.04(2) above.
- Explosion, Collapse, and Underground Hazard

In addition to the foregoing, the Contractor, if required in the bid or special specifications, will be required to provide umbrella coverage in an amount of One Million Dollars (\$1,000,000) to Five Million Dollars (\$5,000,000) as determined necessary by the City's Risk Manager based on an analysis of the risks involved in the particular work to be performed.

(b2) Contractor's Motor Vehicle Insurance - The Contractor shall secure and maintain during the life of the contract, Contractor's Motor Vehicle Insurance, with required Michigan endorsements, in an amount of One Million Dollars (\$1,000,000) Combined Single Limit (CSL) per occurrence for bodily injury and property damage, such insurance to be provided through an ISO Business Auto Policy, 1986 Form, Occurrence Basis, or through another policy which provides equivalent or greater coverages than those provided as a standard feature of such ISO form, with no exclusions other than the standard exclusions for such form.

(b3) Owners and Contractors Protective Liability Insurance - The Contractor shall secure and pay the premiums for, and maintain during the entire life of the contract, Owners and Contractors Protective Liability Insurance written in the name of the City of Grand Rapids in an amount of One Million Dollars (\$1,000,000) Combined Single Limit (CSL) per occurrence for bodily injury and property damage, such insurance to be provided through an ISO Owners and Contractors Protective Liability (OCP), 1986 Occurrence Form, or through another policy which provides equivalent or greater coverages than those provided as a standard feature of such ISO form, with no exclusions other than the standard exclusions for such form. Only the City of Grand Rapids and the City's Consultant for the project shall be a named insured on such policy, except that, if there are any named additional insureds, then the policy limits shall be increased by an additional One Million Dollars (\$1,000,000) CSL for each named additional insured.

(b4) Worker's Compensation Insurance - The Contractor agrees that it and all of its Subcontractors will comply with all applicable Worker's Compensation laws and will provide proof of such insurance coverage.

(c) Builders Risk Insurance - When required in the Special Specifications, the Contractor shall purchase Builder's Risk insurance naming the City as an insured party, which provides coverage for all risks on a Completed Value form policy in the amount of the Contract price, which shall include coverage for at least the following perils: Fire, lightening, removal, wind, hail, aircraft, vehicles, explosion, riot, smoke, vandalism, malicious mischief, collapse, theft, and water damage.

(d) Notification of Cancellation - A guarantee that thirty (30) days notice to the City prior to the cancellation of, change in, or non-renewal of any such insurance shall be endorsed on each policy and shall be noted on each certificate. If any of the insurance is canceled, the Contractor shall cease operations on the date of termination and shall not resume operations until new insurance is in force.

(e) If the work is located in the City of Kentwood, City of Walker, Township of Cascade, or Township of Grand Rapids, the Contractor shall furnish to that unit of government an Owner's Protective or Contingent Liability policy written in the name of that unit of government in the amount of the Owner's and Contractor's Protective Liability Insurance limits specified in paragraph b3) Owner's and Contractor's Protective Liability Insurance.

GC-1.04 Non-Discrimination and Affirmative Action Requirements:

The Contractor shall not discriminate against any employee or applicant for employment, to be employed in the performance of his/her contract, with respect to his/her hire, tenure, terms, conditions or privileges of employment because of race, color, religion, national origin, age, sex, height, weight or marital status (Act 453, P.A. 1976.). Breach of this Contract may be regarded as material breach of Contract as provided for in Act 453, of the Public Acts of 1976. The Contractor further agrees to require similar provision from any subcontractors and suppliers.

The Contractor agrees to take affirmative action in hiring, training, and promoting minority group persons and women to achieve reasonable representative integration of their employees. For purposes of this contract, a "minority group person" is defined as Asian American, Black, Hispanic, or Native American. The Contractor further agrees to provide for review with the City relevant employment data and other information pertaining to its employment practices. The Contractor further agrees that it will require similar covenants from all subcontractors and suppliers under the contract.

GC-1.05 Preconstruction Meeting:

The Contractor shall, upon award of the Contract, arrange for a Preconstruction Meeting with the Engineer. At the Preconstruction Meeting the Contractor shall present to the Engineer a proposed work schedule for his/her approval. The meeting shall also serve to coordinate the Contractor's work with the utility companies.

GC-1.06 Time:

In the performance of the work under City Contracts, time shall be deemed to be of the essence.

GC-1.07 Permits and Licenses:

The Contractor shall procure all permits and licenses and pay all charges and fees necessary to the due and lawful prosecution of the work. Costs for these items shall be included in the price bid for other items of work.

GC-1.08 Sanitary Provisions:

The Contractor shall comply with all rules and regulations of the State and local health officials, and must take such precautions as are necessary to avoid creating unsanitary conditions.

GC-1.09 Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material:

If, during the course of construction, any asbestos, PCBs, petroleum, hazardous waste or radioactive materials are uncovered or revealed at the site which were not shown or indicated on the Drawings or in the Special Specifications to be within the scope of the Work and which may present a substantial danger to persons or property exposed thereto in connection with the Work at the site, the Contractor shall cease operations affecting the find and shall notify the Engineer, who shall notify the necessary parties. No further disturbance of the materials shall ensue until the Contractor has been notified by the Engineer that he/she may proceed.

Any additional work or contract time associated with removal and disposal of any such hazardous materials, if encountered, shall be included in a Change Order. The contract price and contract time shall be adjusted in accordance with the provisions stated in these General Requirements. City reserves the right to negotiate such additional work under a separate contract.

GC-1.10 Contractor Responsibilities:

GC-1.10.01 Safety and Protection - The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. The Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

the public and all persons on the Work site or who may be affected by the Work;

all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and

other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and underground facilities not designated for removal, relocation or replacement in the course of construction.

The Contractor shall comply with all applicable Laws and Regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. The Contractor

shall notify owners of adjacent property and of underground facilities and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in this paragraph caused, directly or indirectly, in whole or in part, by the Contractor, any Subcontractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by the Contractor. The Contractor's duties and responsibilities for safety and protection of the Work shall continue until such time as all the Work is completed and accepted.

GC-1.10.02        Safety Representative - The Contractor shall designate a qualified and experienced safety representative at the site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

CG1.10.03        Hazard Communication Programs - The Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the site in accordance with Laws or Regulations.

GC-1.10.04        Emergencies - In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the City or the Engineer, is obligated to act to prevent threatened damage, injury or loss. The Contractor shall give the Engineer prompt written notice if the Contractor believes that any significant changes in the Work or variations from the Contract have been caused thereby. If the Engineer determines that a change in the Contract is required because of the action taken by the Contractor in response to such an emergency, a Change Order will be issued to document the consequences of such action.

GC-1.10.05        Supervision and Superintendence - The Contractor shall supervise, inspect and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract. The Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. The Contractor shall be responsible to see that the complete Work complies accurately with the Contract.

The Contractor shall keep on the Work at all times during its progress a competent superintendent, who will cooperate fully with the Engineer at all times, and who shall not be replaced without written notice to the Engineer except under extraordinary circumstances. The superintendent will be the Contractor's representative at the site and shall have authority to act on behalf of the Contractor. All communications given to the superintendent shall be as binding as if given to the Contractor.

GC-1.10.06        Labor, Materials, and Equipment - The Contractor shall provide competent, suitably qualified personnel to perform the Work as required by the Contract. The Contractor shall at all times maintain good discipline and order at the site.

The Contractor shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up, and completion of the Work.

All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract. All warranties and guarantees specifically called for by the Specifications shall expressly run to the benefit of the City. If required by the Engineer, the Contractor shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise provided in the Contract.

GC-1.11 Completion/Substantial Completion:

When the Contractor considers the Work complete, he/she shall notify the Engineer. If the Engineer agrees and the Contractor has furnished the City with all required records, operating and/or maintenance manuals, guarantees, bonds and other such documents required by the Contract or applicable permits, law, etc., the Engineer will notify the Contractor that the Work is complete and accepted.

Should the Engineer not consider the Work complete, he/she shall notify the Contractor of the incomplete or defective work and the Contractor shall promptly remedy the deficiencies.

Should the Contractor consider that all or a portion of the Work is Substantially Complete as defined herein and as more fully described below, he/she shall declare so in writing and request the Engineer to concur in writing.

Within two weeks thereafter, the Engineer shall make an inspection of the Work or a portion thereof, to determine the status of completion. If the Engineer does not consider the Work or a portion thereof substantially complete, the Engineer shall notify the Contractor in writing, giving reasons therefor. If the Engineer considers the Work or a portion thereof substantially complete, the Engineer shall prepare a Notice of Substantial Completion which will fix the date of Substantial Completion and the responsibilities between the City and the Contractor for operation, utilities, and maintenance. The notice shall include a tentative list of items to be completed or corrected before final acceptance.

"Substantial Completion" includes, but is not limited to the following examples: the treated water main is completed, including testing and disinfection, and can be put into service in accordance with the City's standard operating procedures; and all valves, branch piping, distribution mains, appurtenances and connections to existing water mains have been installed and operational; the sanitary sewer system has been installed and tested for infiltration and exfiltration; the storm sewers and catch basin leads have been installed to adequately collect and transport stormwater runoff; all final grading and pavement restoration including bituminous leveling course, drive approaches, sidewalks, curbs and gutter, have been completed. Substantial Completion for equipment requires the successful start-up of said equipment or the successful start-up of the facility in which the equipment operates, and the Engineer accepts the equipment for the City's beneficial use.

GC-1.12 Guarantee:

The Contractor shall guarantee the completed work for one year, shall promptly repair, replace, restore, or rebuild, as the Engineer may determine, any finished work in which defects of materials or workmanship may appear or to which damage may occur (or has occurred) because of such defects during the one-year period following Final Completion except where other periods of

maintenance and guarantee are provided or at a point of substantial completion as agreed to in writing by the Contractor and Engineer, and as provided below.

The date of substantial completion for general construction may be upon final payment for the work performed or as otherwise agreed in writing between the Engineer and the Contractor after a written request from the Contractor to the Engineer.

The date of substantial completion for equipment may be the date of successful start-up of said equipment or the successful start-up of the facility in which the equipment operates, and the Engineer accepts the equipment for the City's beneficial use, whichever event occurs last, or as otherwise agreed in writing between the Engineer and the Contractor after a written request from the Contractor to the Engineer.

All subcontractors', manufacturers', or suppliers' warranties and guarantees, expressed or implied, with respect to any material or equipment used in or incorporated as a part of the Work shall be obtained by the Contractor as agent for the City, and all such warranties and guarantees shall inure to the benefit of the City without the necessity of separate transfer or assignment thereof; Provided: that if approved by the Engineer, the Contractor shall require such subcontractors, manufacturers, or suppliers to execute such warranties and guarantees in writing to the City.

Notice by the Engineer to the Contractor to repair, replace, rebuild or restore such defective or damaged work shall be timely if given not later than ten days subsequent to the expiration of the stipulated one-year period or other periods provided herein.

GC-1.13 Assignments:

The Contractor shall not assign, transfer, convey, or otherwise dispose of this Contract or his/her right to execute it or his/her right, title, or interest to it or any part thereof, or assign any of the moneys due or to become due under this contract, without the prior written consent of the Engineer.

GC-1.14 Estoppel: (No waiver of legal rights by City)

The City or any officer, agent or employee thereof, shall not be estopped, bound or precluded by any determination, return, decision, approval, order, letter, payment or certificate made or given by the City Manager, or other officer, employee or agent of the municipality at any time, either before or after the final completion and acceptance of the Work and payment therefor from: (1) showing the true and correct amount, classification, quality and character of the work done and materials furnished by the Contractor or any other person under this contract, or from showing at any time that any determination, return, decision, approval, order, letter, payment or certificate is untrue and incorrect, or improperly made in any particular, or that the completed Work or incorporated materials or any part thereof, do not in fact conform to the specifications, and (2) from demanding and recovering from the Contractor any overpayments made to him/her, or such damages as it may sustain by reason of his/her failure to perform each and every part of this Contract in strict accordance with its terms, or both.

GC-1.15 Unlawful Provisions:

All unlawful provisions shall be deemed stricken from the Contract and shall be of no effect. Upon the application of either party, the unlawful parts shall be considered stricken without affecting the binding force of the remainder of the Contract..

GC-1.16 Patents:

The Contractor shall pay all royalties and license fees and shall hold and save the City, its officers, agents, servants and employees harmless from liability of any nature and kind, including costs and expenses for or on account of any patented or unpatented invention, process, article or appliance manufactured or used in the performance of the Contract, including its use by the City. In this respect, the Contractor shall defend all suits or claims for infringement of any patent or license rights.

GC-1.17 Subcontracting:

GC-1.17.01 Permission - The Contractor shall not subcontract or assign any portion of the Contract without the written consent of the Engineer. Such consent shall not relieve the Contractor from full responsibility for the performance of the Work. The authority thus exercised by the Engineer shall be construed as having been delegated to him/her by the City Manager and he/she is acting on behalf of the City Manager.

GC-1.17.02 Subcontractors to Prequalify - Approval of the subcontracting of any portion of the Contract will not be granted unless and until the subcontractor is prequalified for work of the type and magnitude proposed. The current City Commission Policy and Procedures for Prequalification of Bidders and Subcontractors, and a list of prequalified Bidders and Subcontractors are on file at the City Engineer's Office for reference.

GC-1.17.03 Subcontracts - All Contractors will be required to provide the City with copies of executed Subcontracts for all subcontracted work in excess of \$3,000. Said Subcontracts shall be executed on forms supplied by the City Engineer's Office.

Unless approved by the Engineer, the Contractor shall utilize the Subcontractors listed in the Bid Form.

GC-1.18 Authority of the Engineer:

The Engineer shall decide all questions which may arise as to the quality and acceptability of materials furnished and work completed; all questions which may arise as to the interpretation of the Drawings and specifications; and all questions as to the satisfactory and acceptable fulfillment of the terms of the Contract. The City reserves the right to make minor technical changes in the Work, when such changes would provide a better completed project, in the judgment of the Engineer, and would not incur additional expense for the Contractor. The authority thus exercised by the Engineer shall be construed as having been delegated to him/her by the City Manager and that he/she is acting on behalf of the City Manager.

The Engineer shall not supervise, direct or have control of the Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto.

GC-1.19 Coordination of Parts of the Contract:

It is the intent of the Contract to describe a functionally complete Project. All Work, materials or equipment that may reasonably be inferred from the Contract or from prevailing custom or trade usage as being required to produce the intended result will be furnished and performed whether or not specifically called for.

GC-1.19.01 Pay Items - The listing of Pay Items in the Bid Form and the Contract is intended to define the complete Work for the purposes of receiving competitive bids, and for determining the amounts of partial and final payments to the Contractor. The Pay Items describe the work to be done for each unit price bid. Additional descriptions of some pay items are included in those Divisions of these Standard Specifications and in Special Specifications included with some contracts, which specify and describe the Work in detail. The cost of work which is required to provide a complete project, but which is not described either in the wording of the Pay Items or in the additional descriptions of Pay Items, shall be considered to have been included in the prices bid for the Pay Items listed in the Bid Form, and will not be paid for separately.

GC-1.20 Access:

The Engineer and his/her representatives shall be allowed access to all parts of the Work at all times and shall be furnished such information and assistance by the Contractor as may be required to make a complete and detailed inspection. Such inspection may include mill, plant or shop inspection of materials and workmanship.

Scales and weighing equipment may be inspected at any time by the City. Claims by the Contractor for delays or inconvenience due to these operations will not be considered.

GC-1.21 Authority and Duties of Inspectors:

Inspectors shall not supervise, direct, or have control of the Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto. Inspectors are not authorized to revoke, alter, enlarge or relax any of the specifications nor to change the Drawings in any particular. The Inspectors are not authorized to increase or decrease any Contract item nor to add new items to the Contract. The Inspector will inform the Engineer as to the progress of the work and the quality of the completed work, and the quality of the materials being used. No payments will be made for materials or work found to be defective by the Inspector. No additional payments will be made to the Contractor for efforts required to uncover defective work which was covered after the Inspector informed the Contractor of the defect. In no instance shall any action or omission on the part of the Inspector relieve the Contractor of the responsibility for completing the Work in accordance with the Contract .

GC-1.22 Final Inspection:

The Engineer shall make inspection of the completed Work, or such portions thereof which are eligible for acceptance upon notification by the Contractor that the Work is complete or substantially complete. If the completed Work is not acceptable to the Engineer at the time of such inspection, he/she shall inform the Contractor orally or in writing as to the particular defects to be remedied before final payment can be made.

GC-1.23 Partial Payments:

GC-1.23.01 Completed Work - Projects will fall into one of the following classifications:

- (a) Projects of less than \$30,000.
- (b) Projects which there will be a maximum of three payments.
- (c) All other projects.

a) Projects less than \$30,000 - Partial payments will be made monthly or as may be otherwise agreed by the Contractor and the Engineer. Such payments shall be made on the basis of 90% of the amount earned. Said partial payments shall be subject to the following provisions: that the Work is progressing satisfactorily, the time for completion has not expired, and that not less than \$500 has been earned during the month.

When, in the opinion of the Engineer, the project has been substantially completed, the Engineer may reduce the retained amount to an amount sufficient to pay for the Work yet to be done provided that the Contractor has filed with the City the written consent of the Surety to such reduction and, that the Contractor has furnished an affidavit that all his/her indebtedness by reason of the Contract has been paid.

b) Projects with a maximum of three payments - For certain projects the Engineer may state in the Special Specifications that a maximum of three payments will be made. The Special Specifications shall also describe how the payments will relate to the progress schedule, i.e., at which major points in work the Contractor can expect to receive payments. In these cases the first two payments will be made on a basis of 90% of the amount earned. Said partial payments will be subject to the following provisions: that the Work is progressing in accordance with the Contract, that the time for completion has not expired, and that not less than \$500 has been earned since the last payment.

When, in the opinion of the Engineer, the project has been substantially completed, the Engineer may reduce the retained amount to an amount sufficient to pay for the Work yet to be done; provided, that the Contractor has filed with the City the written consent of the Surety to such reduction and, that the Contractor has furnished an affidavit that all his/her indebtedness by reason of the Contract has been paid.

c) All other projects - For all projects not as described in paragraph a.) or b.) above, partial payments will be made monthly or as may otherwise be agreed by the Contractor and Engineer and on the basis of the amount earned. however, payments for work done, which exceed 95% of the final Contract amount, shall be made only after the Contractor has filed with the City the written consent of the Surety and has furnished an affidavit that all his/her indebtedness, by reason of the Contract, has been paid.

Said partial payments shall be subject to the following provisions: that the Work is progressing satisfactorily in accordance with the Contract, that the time for completion has not expired, and that not less than \$500 has been earned during the month.

d) Accepting Payment - By accepting payments, the Contractor declares that he/she has not, during the period of the time for which he/she is accepting payment, performed any work,

furnished any materials, sustained any loss, damage, or delay, or otherwise done anything for which the Contractor shall ask, demand, sue for, or claim compensation from the City of Grand Rapids in addition to the regular items as set forth in the Contract executed between the Contractor and the City of Grand Rapids and the extra work as agreed to in writing between the Contractor and the City of Grand Rapids except as the Contractor has filed a written claim with the Engineer prior to the Contractor's acceptance of said payment.

GC-1.23.02 Delivered Materials - Generally no allowance will be made in any payment for materials furnished and delivered until such materials have been permanently incorporated into the Work. In the case of non-perishable or indestructible materials which are properly stored and protected to the satisfaction of the Engineer, and are not scheduled to be incorporated into the Work for 30 days or more, the Engineer may make an allowance in the estimate not to exceed the invoice price of such items. However, Contractor shall be responsible for any such materials which are lost or stolen even though they have been included in progress payments.

GC-1.24 Acceptance and Final Payment:

When the Work has been completed and the Engineer has ascertained that each and every part of the Work has been performed in accordance with the Contract or such modifications thereof as have been approved, the same will be accepted and the Engineer will make a final estimate as soon as practicable, but not more than one month after acceptance, for the completed Work, and the total amount due the Contractor, less the total amount of all previous payments will be paid.

Final payment will not be made until the Contractor has filed with the City the consent of the Surety to payment of the final estimate and satisfactory evidence by affidavit or otherwise that all his/her indebtedness by reason of the Contract has been fully paid or satisfactorily secured. In case such evidence is not furnished, the Engineer may retain out of any amount due said Contractor sums sufficient to cover all lienable claims unpaid.

The acceptance by the Contractor, or by anyone claiming by or through him/her of the final payment, whether such payment be made pursuant to any judgment of any court or otherwise, shall constitute and operate as a release of the City from any and all claims of and liability to the Contractor for anything theretofore done or furnished for or relating to or arising out of the Contract, and the Work done thereunder, and for any prior act, neglect or default on the part of the City or any of its officers, agents, or employees, excepting only a claim against the City for the amount deducted or retained in accordance with the terms and provisions of this Contract.

GC-1.25 Authorized Extras and Changes in Work:

GC-1.25.01 Increased or Decreased Quantities of Contract Items - The City reserves the right under the Contract to make such changes from time to time in the character of the Work and the length of the project as may be necessary or desirable. When said changes are made in original Contract items, and if such a change amounts to Twenty-Five Percent (25%) or more in any one Contract item, or in two or more closely related items, a new unit price may be negotiated for each of the items thus increased or decreased, or as otherwise specified in the Special Specifications.

GC-1.25.02 Construction Items Not in Original Contract - The amount to be paid to the Contractor for work and materials not included in a specific Contract item shall be determined by one or more of the following methods, the City reserving the right to select the method or methods at the time the change in the Work is ordered.

(a) By an acceptable lump sum bid. All lump sum bids shall be itemized and all quantities and unit prices shall be given, as well as the total amount.

(b) By unit prices. The payment for such items(s) of work shall be made on the basis of the actual quantity completed at the unit prices(s) for such items(s) in the original Bid or fixed by subsequent agreement.

(c) By force account. The Engineer may order such work, including any required off-site work, to be done by force account. The compensation as herein provided shall be accepted by the Contractor as payment in full for extra work done by force account, and the general expense, overhead, miscellaneous costs, unforeseen costs, and the use of small tools and equipment.

For approved subcontract work, the Contractor will be paid an amount equal to six percent (6%) of the total administrative costs incurred in connection with the subcontract work. When it becomes necessary for the Contractor to hire a firm to perform a specialized type of work or a service for which the Contractor or Subcontractors are not qualified to do, payment will be made at the invoice costs. Prior approval by the Engineer is required. The Contractor will be paid an amount equal to six percent (6%) of the invoice costs, as reimbursement for administrative costs. The aforesaid six percent (6%) administrative cost shall be a one-time cost and paid by the City to the Contractor, and no additional costs therefore shall be paid to any intermediate tier of Subcontractors.

For all labor and for all craft forepersons directly engaged in the specified work, the Contractor will be paid the actual rate of wages and the number of hours paid said labor and forepersons computed to the nearest half hour, plus twenty-six percent (26%) of the sum thereof, which includes a one percent (1%) allowance for the Single Business Tax.

For materials, the Contractor will receive the actual cost of such materials and supplies delivered to the site of the work, including freight charges as shown by original receipted bills, plus twenty percent (20%) of the sum thereof. If a change in the amount or type of the force account work results in a surplus of the materials and/or supplies ordered and delivered to the project site, the City will reimburse the Contractor for the costs incurred in returning the surplus materials and/or supplies to the supplier.

For any machinery and equipment owned by the Contractor, which it may be deemed necessary or desirable to use on force account work, the Contractor shall be paid an ownership expense price as approved by the Engineer and which will be reviewed annually.

When it is necessary for the Contractor to rent equipment in the performance of the force account work, the Contractor shall be allowed the actual rental price paid, if reasonable, for each and every unit of time (i.e., hourly, daily, weekly, monthly) that such equipment is used on the work, to which the sum of twenty percent (20%) will be added. The Contractor will be required to furnish receipted bills to cover such rental costs.

Bond premium, worker's compensation insurance, personal injury public liability insurance, property damage public liability insurance, unemployment compensation, and federal social security shall be paid for at actual cost to which the sum of twenty percent (20%) will be added except that twenty-six (26%) percent will be added to the taxable fringe benefits. The Contractor

shall furnish satisfactory evidence of the amounts paid for each of these required costs as related to the force account work.

The Contractor shall furnish to the Engineer itemized reports of the costs of all force account work. The reports shall be furnished as often as required by the Engineer and shall include a certified copy of the weekly payroll and copies of the bills for the materials used and freight charge paid on the same. Discount for prompt payment or penalty for late payment will not be considered in determining the net amount of the bill. The net amount of the bill shall be charged to the force account work. When materials used are not specifically purchased for use on extra work but are taken from the Contractor's stock, the Contractor shall submit certification of the quantity, price and freight of such materials in lieu of the original bills and invoices.

The Contractor shall prepare on acceptable City forms itemized statements, including but not necessarily limited to, the following information:

Name, class, dates, number of hours worked each day, total hours computed to the nearest half hour, rate, and extension for each laborer and foreperson engaged.

Designation, number of hours computed to the nearest half hour worked each day, total hours, rental rate, and extension for each unit of equipment engaged.

Quantities of materials, prices, and extensions.

Freight on materials.

The Contractor and the Engineer shall compare records of force account work and bring them into agreement, as often as required by the Engineer.

GC-1.25.03 Deleting Items - The Engineer shall have the right at any time to delete the performance or completion of any Contract item, and shall promptly execute the standard City forms as evidence of such action. A fair and equitable amount, representing all costs incurred on such items prior to such deletion, shall be agreed upon in writing and paid to the Contractor.

GC-1.25.04 Equivalent Materials and Equipment - Whenever any material or equipment is defined by describing a proprietary product, or manufacturer's name, the term "or approved equal," if not inserted, shall be implied. The specified material or equipment shall be understood to indicate a standard of quality. The Engineer will consider alternate products upon request of the Contractor and may allow such substitution, when in the opinion of the Engineer equal products are being offered. Said approval shall be in writing.

GC-1.26 Defective Materials and Work:

All materials which do not meet the requirements of the specifications at the times they are to be used shall be rejected, unless otherwise authorized as acceptable by the Engineer.

All completed work that may be found to be defective before the final acceptance of the completed work shall be corrected and replaced immediately in conformance with the Specifications.

The Contractor shall be responsible for any and all damages that the Work may sustain prior to its acceptance, and shall rebuild, repair, restore and make good at his/her own expense, all injuries and damages to any portion of the Work by the action of the elements or from any cause whatsoever prior to its acceptance.

GC-1.27 Temporary Suspension of Work:

The Engineer shall have the authority to suspend the work wholly or in part, for such period or periods as he/she may deem necessary, due to unsuitable weather or such other conditions as are considered unfavorable. The Contractor shall not suspend the Work or remove therefrom equipment or materials without permission from the Engineer.

Upon suspension, the Work shall be put in proper and satisfactory condition, carefully covered and adequately protected. In all cases of suspension of construction operations, the Work shall not again be resumed until permitted by written order of the Engineer. In the event that the Work is temporarily suspended, no claims for additional compensation will be approved, and extensions of the contract completion date will only be allowed if approved in writing by the Engineer.

The Engineer shall not supervise, direct, control, or have authority over or be responsible for the Contractor's means, methods, techniques, and sequences of construction, or safety precautions and programs incident thereto.

GC-1.28 Extension of Time:

If the Contractor finds that it will be impossible for him to complete the Work on or before the completion date fixed by the Contract, he/she shall, at least ten days prior to said date, make written request to the Engineer for an extension of time for completion of the Work. He/she shall set forth fully therein the reasons which he/she believes would justify the Engineer in granting his/her request and shall also set forth a revised completion date which will provide sufficient additional time for the completion of the Work.

Upon receipt of such written request from the Contractor, if the Engineer finds that the Work was delayed by conditions beyond control of the Contractor, or that the quantities of work done or to be done are sufficiently in excess of the estimated quantities to warrant additional time, he/she will, with or without notice to the Surety, grant an extension of time, in writing, to such date as appears to him to be reasonable and proper. This date shall thereafter be as binding upon the Contractor and Surety as if it appeared in the Contract originally.

When such extension of time, or any part thereof, is granted for the purpose of completing the work of one or more of the original Contract items which, in the judgment of the Engineer could have been completed prior to the original completion date, and when the completion of such original Contract items required additional expense of inspection, engineering or other services, the City reserves the right to deduct such expense from any moneys to be paid the Contractor for the said original Contract items which were completed after the original completion date.

Payments due the Contractor will be paid only if the Contract completion date is not in default at the time payments are due, except for those items of work which were completed before the Contract completion date.

Immediately following the Contract Completion date, the Contractor's right to proceed with the Work under the Contract may be considered forfeited, and the City may proceed immediately to terminate the Contract as provided in the General Conditions under Termination of Contract. Under these circumstances, the City is not required to give the Contractor the ten day written notice of such forfeiture.

Permitting the Contractor or the Surety to continue and finish the Work, or any part thereof, after the time fixed for its completion, or after the date to which the time for completion may have been extended, shall in no way operate as a waiver on the part of the City of any of its rights under the Contract.

GC-1.29 Termination of Contract:

If the Contractor shall be prosecuting the Work with a work force, equipment or materials insufficient to complete the Work by the date set for completion; or shall discontinue the performance of the Work; or shall neglect or refuse to remove such materials or to replace any such work as shall have been rejected as defective and unsuitable; or shall, for any reason, not complete the Work in accordance with the Contract; the Engineer may give the Contractor and Surety written notice, specifying the delay, neglect or default, and the action to be taken by them; and if the Contractor or Surety, within a period of ten days after such notice, shall not proceed satisfactorily in accordance therewith; then the City may terminate the Contract; and may complete the Work with its own forces; may enter into another contract to finish the Work; may appropriate and use any and all materials on the site which may be suitable; or may use such other methods as in its judgment may be required for the proper completion of the Work.

If the Contractor commits any act of bankruptcy, or becomes insolvent or is declared bankrupt; if the Contractor follows any final judgment against him/her to remain unsatisfied for a period of five days; or, if the Contractor shall make an assignment for the benefit of his/her creditors; then in such case, the City shall have full power and authority to proceed in any of the ways aforesaid, forthwith upon the delivery by the Engineer to the Contractor and Surety of written notice stating the reasons for the Engineer's said action.

In case the City takes over the uncompleted work under any of the provisions of this section, all additional costs and damages, and costs and charges for completing the work shall be deducted from moneys due or to become due the Contractor; and if the total of such damages, costs and charges exceeds the balance of the Contract price which would have been payable to the Contractor had he/she completed the Work, then the Contractor and Surety shall, on demand, pay to the City the amount of such excess.

GC-1.30 Cooperation by Contractor:

The Contractor shall conduct his/her operation so as to interfere as little as possible with those of other Contractors, Utilities, or any public authority on or near the work shown on the Drawings or in the other documents comprising the Contract.

The Contractor shall adjust his/her schedule when necessary and cooperate with other Contractors to the best interest of the City, as determined by the Engineer.

No claims for extra compensation or adjustments in the Contract price will be made on account of delay or failure of others to complete work units as scheduled.

The Contractor agrees to make no claim for monetary damages for delay in the performance of the Contract occasioned by any act or omission to act of the City or any of its representatives, or because of any injunction which may be brought against the City or its representatives, and agrees that any such claim shall be fully compensated for by an extension of time to complete performance of the Work.

GC-1.31 Other Remedies:

The previous provisions outlined shall be in addition to any and all other legal remedies permissible under laws in effect.

GC-1.32 Utility Work Within the Public Right-of-Way:

Any Contractor representing a private party, or private utility company, or any private utility company working within the public right-of-way within the City of Grand Rapids, or outside the City of Grand Rapids where the City of Grand Rapids has sanitary sewers, or watermains which are an extension of the Grand Rapids system shall comply with the construction methods and materials requirements as set forth in this book or in accordance with any other requirements on file in the Grand Rapids City Engineer's Office.

## DIVISION 1

### GENERAL REQUIREMENTS

GR-1.01	General Requirements
GR-1.02	Protection and Restoration of Property
GR-1.03	Monuments
GR-1.04	City Datum
GR-1.05	Water
GR-1.06	Contractor's Office
GR-1.07	Contractor's Employees
GR-1.08	Blasting
GR-1.09	Maintaining Traffic
GR-1.10	Shop Drawings

## DIVISION 1

### GENERAL REQUIREMENTS

#### GR-1.01 General Requirements:

GR-1.01.01 The General Requirements contained in this Division 1 of these Standard Specifications apply to the Work described in the other Divisions. The costs of work specified in this Division shall be considered to have been included in the prices bid for other Pay Items listed in the Bid Form, and will not be paid for separately.

GR-1.01.02 When the description of the work is referenced to the Bid Form, it shall refer specifically to the listing of Pay Items in the Bid Form, and the Contract.

GR-1.01.03 Public Safety and Convenience - The Contractor shall at all times conduct his/her work so as to create the least possible obstruction to both vehicular and pedestrian traffic and to insure the safety and convenience of the general public including the residents along the street. Unless otherwise specified, streets shall remain open to local and emergency traffic during construction operations.

Complete protection of persons and property shall be provided by the Contractor. To this end, the Contractor shall provide and maintain adequate barricades, signs, lights, temporary pavement marking, and flags to warn and guide the public, and shall provide flag persons and watch persons as required. If no separate pay item is provided, the cost of maintaining traffic as referenced in this Division and Division 11 shall be considered to be included in the prices bid for other items of work.

#### GR-1.02 Protection and Restoration of Property:

GR-1.02.01 Contractor to Restore Property - The Contractor shall restore, at his/her own expense, any public or private property damaged or injured as a result of any act or omission on his/her part or on the part of his/her employees or agents, to a condition similar to and equal to that existing before such damage or injury was done.

GR-1.02.02 Clean-Up - Cleaning up shall be completed before final acceptance of the Work. The Contractor shall clean the street surface, walks, gutters, fences, lawns, private property, right-of-way, and structures, leaving them in as good a condition as originally found, and shall remove all machinery, tools, surplus materials, temporary buildings and other temporary structures from the site.

GR-1.02.03 Railroad Crossing Protection - Whenever a line of pipe, or any other structure shall cross any railroad or lie close to any railroad track, all of the precautionary construction measures required by the railroad officials shall be performed by the Contractor.

GR-1.02.04 Dust Control - The Contractor's attention is particularly directed to the problem of the control of dust, mud or other debris.

All dust resulting from hauling operations or construction operations shall be controlled by the application of water or other approved dust controller.

It shall be the responsibility of the Contractor to keep any street cleaned of mud or debris and free from dust resulting from his/her operations.

GR-1.02.05 Public Easement - The easements shown on the Drawings for this project have been secured by the City of Grand Rapids or other governmental units involved for the construction, maintenance or repair of the utility shown on the Drawings. When additional access rights have been acquired, they shall be described in the Special Specifications.

These easements do not grant the City or the Contractor the unrestricted use of the properties adjacent thereto nor do they grant the City or other governmental units or the Contractor the right to disturb trees or landscaping or structures outside the easement areas.

GR-1.02.06 Soil Erosion Control - The Contractor shall abide by the City of Grand Rapids' Soil Erosion Ordinance the purpose of which is to prevent soil erosion and sedimentation from non-agricultural development by requiring proper provisions for water disposal and the protection of soil surfaces during and after construction, in order to promote the safety, public health, convenience and general welfare of the community and shall include the protection of all catch basins and storm sewers within the influence of the proposed Work. All soil erosion control measures proposed for use by the Contractor must be submitted to the Engineer and approved prior to use by the Contractor.

The prevention of such erosion and sedimentation in private property as well as public right-of-way shall be the responsibility of the Contractor. The costs associated shall be included in the prices bid for other items of work being done, unless otherwise specified or shown on the Drawings. It shall be the responsibility of the Contractor to verify that a proper soil erosion permit has been issued prior to the commencement of his/her operations.

GR-1.02.07 Notification to "Miss Dig" - The Contractor shall notify the Utility Communications Systems (Miss Dig - 800-482-7171) a minimum of 3 working days hours prior to commencing any excavating, blasting, or drilling.

GR-1.03 Monuments:

United States public land survey monuments, City street monuments, and land property corner irons shall not be disturbed by construction operations except as authorized by the Engineer.

U.S. Government monuments, i.e., section corners, quarter section corners, and center section points which require removal and replacement, shall not be disturbed by the Contractor. If encountered, the County Surveyor will be notified by the Engineer, and the County Surveyor will witness, remove and replace such monuments at no cost to the Contractor.

City street monuments, if encountered, shall not be disturbed by the Contractor. The Engineer will arrange for City forces to witness, remove and replace these at no cost to the Contractor.

Property corner irons, if encountered, shall be witnessed, removed and replaced by a Registered Land Surveyor, licensed in Michigan. The cost of this work shall be born entirely by the Contractor and shall be included in the prices bid for other items of work on the project.

Any monuments of any type disturbed by the Contractor without proper notifications as required will be replaced in a manner acceptable to the Engineer at the Contractor's sole cost.

GR-1.04 City Datum:

The 0.00 (zero elevation) of City Datum is 588.79 feet above mean sea level as determined by the United States Geological Survey (USGS).

GR-1.05 Water:

If the Contractor desires to use City water for construction he/she shall obtain the required permit from the City Water Department. A hydrant connection will then be issued to him/her by the City Water Department. The Contractor must deposit the required fee as charged by the City Water Department for the use of the hydrant connection. It will be refunded to the Contractor upon the return of the connection. The use of privately owned hydrant connections is prohibited. When connections are made to hydrants, the Contractor shall promptly notify the City Fire Department.

GR-1.06 Contractor's Office:

GR-1.06.01 Place of Office - The Contractor shall maintain an office at or near the site of the Work, or at some regularly appointed place of business within the Grand Rapids metropolitan area. He/She shall keep on file in this office copies of the Contract. The date of delivery of written notices from the City left at this office shall constitute and become the date of Contractor's notification.

GR-1.06.02 Office for Engineer - The Contractor shall furnish and maintain an office for the exclusive use of the Engineer in making field tests or as a field office, for use at concrete batching plants, asphalt plants, or other large projects, if so ordered by the Engineer. The building shall be suitably heated and lighted, and where feasible, a telephone shall be installed as directed.

GR-1.07 Contractor's Employees:

The Contractor shall employ only competent and trained employees for work on the project.

GR-1.08 Blasting:

Where blasting is necessary, the Contractor shall obtain the required permits and licenses from the City Fire Department and the State Fire Marshall at his/her own expense. The work shall be done in compliance with the City Ordinance, and with due regard to the safety of workers, the public, and public and private property.

The Engineer reserves the right to reject any proposed blasting procedures. However, the Engineer will not supervise, direct, control or have authority over or be responsible for the Contractor's means, methods, techniques, sequences or procedures of construction, including blasting, or the safety precautions and programs incident thereto.

GR-1.09 Maintaining Traffic:

The Contractor shall be responsible to conduct the Work in a manner which will ensure the safety and convenience of the public, and both vehicular and pedestrian traffic in and around the

site of the project. Specific provisions and Pay Items for Maintaining Traffic are specified in Division 11.

GR-1.10 Shop Drawings:

When called for in the Standard Specifications or Special Specifications, the Contractor shall submit shop drawings for equipment and material items to be incorporated into the Work.

The Contractor shall stamp each submittal indicating that he/she accepts full responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, and that he/she has reviewed or coordinated each submittal with the requirements of the Contract.

Each submittal shall include a statement prepared by the originator of the Drawings and data, certifying compliance with the Contract, except for deviations which are specifically identified.

All deviations from the Contract shall be identified on submittals.

The Contractor shall accept full responsibility for the completeness of each submission, and, in the case of a resubmission, shall verify that all exceptions previously noted by the Engineer have been taken into account. In the event that more than one resubmission is required because of failure of the Contractor to account for exceptions previously noted, the Contractor shall reimburse the City for the charges for review of the additional resubmissions when such reimbursement is required by the Engineer.

The Engineer's review of the Drawings and data submitted by the Contractor will cover only general conformity to the Drawings and Specifications, external connections, and dimensions which affect the layout. The Engineer's review does not indicate a thorough review of all dimensions, quantities, and details of the material, equipment, device, or items shown. The Engineer's review of submittals shall not relieve the Contractor from responsibility for errors, omissions, or deviation, nor responsibility for compliance with the Contract Documents.

Four copies (or one reproducible copy) of each Drawing and necessary data shall be submitted to the Engineer. The Engineer will not accept submittals from anyone but the Contractor. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades. Resubmittals shall bear the number of the first submittal followed by a letter (A, B, etc.) to indicate the sequence of the resubmittal.

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## DIVISION 2

### CLEARING, GRUBBING, REMOVING TREES

2.01	Description
2.01.01	Clearing
2.01.02	Grubbing
2.01.03	Removing Trees and Stumps
2.02	Construction Methods
2.02.01	Clearing
2.02.02	Grubbing
2.02.03	Clean-up
2.03	Measurement and Payment

## DIVISION 2

### CLEARING, GRUBBING, REMOVING TREES

2.01 Description:

2.01.01 Clearing - This work shall consist of cutting and disposing of all trees, shrubs, and other vegetation occurring within the right-of-way or within such other limits as may be defined on the Drawings or specifications which interfere with excavation, embankment, clear vision, or are otherwise objectionable.

2.01.02 Grubbing - This work shall consist of removing from the ground and disposing of all stumps, roots, logs, and other timber more than three (3) inches in diameter, together with all brush, matted roots, and debris which occur within the right-of-way or within such other limits as may be defined on the Drawings or specifications.

2.01.03 Removing Trees and Stumps - This work shall consist of removing individual trees and stumps where called for on the Drawings or in the Bid Form or as approved by the Engineer. This item shall also include cutting such trees or stumps or trees which have been "topped," removing their stumps and roots from the ground and disposing of the resulting material.

2.02 Construction Methods:

2.02.01 Clearing -

(a) All trees, stumps, brush and other vegetation occurring within the areas affected by grading, excavation, or embankment for cuts, fills, special ditches, borrow pits, and clear vision areas which are not designated on the Drawings or by the Engineer to be saved, and all such material occurring outside these areas which is shown on the Drawings to be removed, shall be cut off at a height not more than three (3) feet above the ground; provided, however, that in any areas where clearing is required, but grubbing is not required, such material shall be cut off level with the ground.

(b) All shrubs and other vegetation within the areas affected by grading, excavation, or embankment which are designated on the Drawings or by the Engineer to be saved, and all such material occurring outside these areas which is not designated on the Drawings or by the Engineer to be removed, shall be carefully protected from damage or injury during all construction.

2.02.02 Grubbing - All stumps, roots, logs and other timber more than three (3) inches in diameter and all brush, matted roots and debris not suitable for road foundation, occurring within the limits for cuts and for fills, shall be pulled or otherwise removed to a depth of at least one foot below the ground. Blasting, when permitted, shall be done in compliance with the City Ordinance governing the use of explosives.

2.02.03 Clean-Up - All brush, limbs, tops, stumps, roots, logs, and debris resulting from clearing, grubbing, and removing trees, shall be removed from the site, or otherwise disposed of according to applicable laws and regulations.

2.03 Measurement and Payment:

The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for furnishing all labor, equipment and material, including excavation and backfilling, for performing the work complete.

<u>Pay Item</u>	<u>Pay Unit</u>
Remove Tree, 8-18 inch	each
Remove Tree, 19-36 inch	each
Remove Tree, 37 inches or larger	each
Remove Stump, 8-18 inch	each
Remove Stump, 19-36 inch	each
Remove Stump, 37 inches or larger	each

2.03.01 Clearing and Grubbing - All clearing, grubbing, removing and disposal of trees, brush, stumps, roots, logs and other vegetable matters shall be considered included in the price bid for grading, excavation and embankment.

2.03.02 Remove Trees - The size of trees will be determined by the average diameter of the tree trunk, measured to the nearest full inch, at a point 4-1/2 feet above the base of the tree at the ground line. Trees having major limbs lower than 4-1/2 feet from the ground shall be measured at the smallest diameter below such limbs.

Removing trees less than 8 inches in diameter shall be included in the work of grading, earth excavation, or other items, and will not be paid for separately.

2.03.03 Remove Stumps - Stumps which are shown on the Drawings as trees, and stumps shown on the Drawings or authorized to be removed will be measured as the average diameter of the top of the stump. Measurement will be to the nearest full inch.

Where more than one tree has grown from a common stump, each tree or stump will be measured as a separate tree or stump.

2.03.04 If the contract does not include a separate item to Remove Trees or Remove Stumps, all work specified in this section which is within the area affected by grading, excavation, or embankment, shall be included in such work. When trees or stumps outside these areas are required to be removed which are not shown on the Drawings to be removed, they will be paid for as extra work.

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## DIVISION 3

### REMOVING AND ABANDONING EXISTING STRUCTURES

3.01	Description
3.02	Construction Methods
3.02.01	Drop-Hammer Prohibited
3.02.02	Sawing Concrete
3.02.03	Blasting
3.02.04	Salvage
3.02.05	Backfilling
3.03	Removal
3.03.01(a)	Remove Pavement, Full Depth
3.03.01(b)	Remove Bituminous Pavement, Full Depth
3.03.01(c)	Remove Bituminous Pavement ____ "
3.03.01(d)	Remove Concrete Pavement Base
3.03.01(e)	Remove Reinforced Concrete Pavement
3.03.01(f)	Remove Bituminous Pavement, including Brick
3.03.01(g)	Remove Brick Pavement
3.03.02	Abandon Underground Utility
3.03.03	Clean and Remove Manhole, Valve Chamber, or Catch Basin
3.03.04	Remove Meter Pit
3.03.05	Cleaning Up
3.03.06	Removal of Areaways
3.04	Measurement and Payment

## DIVISION 3

### REMOVING AND ABANDONING EXISTING STRUCTURES

#### 3.01 Description:

This work shall consist of removing, to the extent shown on the Drawings or specified herein, bridges, retaining walls, culverts, old pavement surface and base course, areaways, sidewalk, masonry, fence poles, guard rail, manholes, catch basins, inlets, sewers, water mains, and other structures which are not suitable to be left in the roadway or are otherwise objectionable, disposing of the resulting materials and backfilling the resulting trenches, holes and pits.

All walls, piers, foundations and similar masonry structures shall be removed entirely, or to an elevation at least two feet below subgrade within the area of the roadbed, or to provide two feet clearance from proposed new structures, and elsewhere to an elevation at least one foot below the finished surface.

The removal of curb, curb and gutter, and related items not specified in this Division are specified in Division 23.

#### 3.02 Construction Methods:

3.02.01 Drop-Hammer Prohibited - The use of a drop-ball, drop-hammer, pile-driver, or any such equipment will not be permitted for the purpose of breaking up any structure in the streets or alleys unless done under controlled conditions as approved by the Engineer.

3.02.02 Sawing Concrete - When a limited portion of a concrete pavement or other concrete structure is to be removed, the boundary of such portion shall first be sawed to a depth of not less than 3 inches with an approved masonry saw. When the sawing has been completed, the concrete which is to be removed shall be broken out in such a manner as will leave the sides of the opening as nearly vertical and smooth as is feasible. When sawcutting is to be full depth, it will be paid for separately.

3.02.03 Blasting - Where blasting is necessary, it shall be done in accordance with Division 1, General Requirements.

3.02.04 Salvage - All materials resulting from the work under this Division shall be removed from the site and disposed of by the Contractor in accordance with applicable laws and regulations unless otherwise shown on the Drawings, or indicated in the Bid Form or Special Specifications.

3.02.05 Backfilling - Unless otherwise specified, all trenches, holes, and pits resulting from the breaking down or removal of any structures shall be filled with granular material Class II as specified in the current Michigan Department of Transportation Standard Specifications for Construction, unless otherwise approved by the Engineer.

#### 3.03 Removal:

3.03.01(a) Remove Pavement, Full Depth shall consist of removing all of the pavement and disposing of the resulting materials, when called for on the Drawings, listed on the Bid Form, or when

required by the Engineer, be it bituminous on concrete, bituminous on brick on concrete, brick on concrete, or concrete.

3.03.01(b) Remove Bituminous Pavement, Full Depth shall consist of completely removing bituminous pavement which was placed on aggregate base, and disposing of the resulting materials when called for on the Drawings, listed on the Bid Form, or when required by the Engineer.

3.03.01(c) Remove Bituminous Pavement \_\_\_\_\_" shall consist of removing the existing bituminous pavement to the depth shown on the Drawings, listed on the Bid Form, or as approved by the Engineer.

Prior to removal of the bituminous pavement, all of the manhole castings shall be removed, the openings plated and temporarily filled with bituminous pavement. These temporary patches in the manhole areas shall be adequately maintained for traffic by the Contractor during the construction period until the final adjustment to the manhole castings has been made. All work necessary to remove the casting and maintain the patches including all necessary bituminous materials will be considered to have been included in the price bid for other items of work for removing the existing bituminous pavement or the items for adjusting the manhole castings.

The Contractor shall use power-operated machines of the heater-planner type or the cold-milling type to remove the bituminous surface. Any equipment used shall be capable of accurately removing the bituminous surface in one or more passes to the grade shown on the Drawings or as established by the Engineer. The equipment shall also have an effective means for removing excess material from the surface and preventing any dust resulting from the operation from escaping into the air.

There may be some concrete patches under the bituminous pavement. These patches shall be removed to the same depth as the bituminous pavement. No extra compensation will be allowed for removal of such concrete.

3.03.01(d) Remove Concrete Pavement Base shall consist of removing concrete pavement base and disposing of the resulting material when called for on the Drawings, listed on the Bid Form, or when required by the Engineer. This item will be used in areas where the existing pavement is bituminous on concrete or bituminous on brick on concrete and the existing bituminous pavement or bituminous and brick pavement is removed and paid for under separate items, leaving the removal of the concrete base to be paid for separately under the item "Remove Concrete Pavement Base."

3.03.01(e) Remove Reinforced Concrete Pavement shall consist of removing reinforced concrete pavement when called for on the Drawings, listed on the Bid Form, or required by the Engineer regardless of whether it is the pavement base or riding surface course.

3.03.01(f) Remove Bituminous Pavement, including Brick shall consist of removing bituminous pavement which overlays brick pavement and the underlying brick pavement, while leaving the concrete base beneath the brick pavement intact, and disposing of the resulting materials, where shown on the Drawings, listed on the Bid Form, or required by the Engineer.

3.03.01(g) Remove Brick Pavement, including Sand Cushion shall consist of removing brick pavement and the sand cushion on which the brick was placed, and disposing of the resulting material, where

shown on the Drawings, listed on the Bid Form, or required by the Engineer. If a concrete base is present under the brick and sand cushion, it shall remain in place.

3.03.02            Abandon Underground Utility shall consist of filling the existing underground utilities (basin connections, sewers, water mains, underdrains, etc.) which are to be abandoned with a flowable fill mix as specified in Division 7. All utilities to be abandoned shall be cut at each end of the pipe and filled from one end until the fill material comes out the other end. All open ends of the pipe to be filled are to be plugged with concrete. Plugging shall be included in the unit price for abandonment. The Contractor may remove the utility in lieu of filling if approved by the Engineer. However, the Contractor will only be paid the price bid for abandoning underground utilities.

3.03.03            Clean and Remove Manhole, Valve Chamber, or Catch Basin - The Contractor shall break the existing structure down to a point at least three feet below the pavement elevation, clean out all rubble and sediment and complete the work by either of the following methods. The first method being to break up the concrete floor to allow it to drain and backfill the area with compacted MDOT granular material Class II. The second method is to backfill the structure area with pea stone and sealing the structure with a concrete cap as per the applicable standard detail. The remaining area above the concrete cap shall be filled with compacted MDOT Class II backfill. The contractor shall use a vibrator to aid in the compaction of the pea stone.

The entire structure may be removed and backfilled with compacted sand in lieu of either of the above-mentioned methods at the Contractor's option.

3.03.04            Remove Meter Pit - This item is for removing abandoned meter pits in which the meter has already been removed or for removing active meter pits in which there is a meter in use in the meter pit. In active meter pits, the meter will need to be relocated into the building it serves before the meter pit can be removed. All work necessary to relocate the meter into the building shall be performed, measured and paid for under a separate item.

The work to remove a meter pit shall consist of removing the meter pit structure in its entirety, backfilling the hole with compacted sand and restoring the surface as necessary.

Payment for the work of plugging or bulkheading abandoned pipes, conduits, or service connections encountered in excavation is considered to be included in payment for other contract items. This work shall only be done when specifically shown on the Drawings or required by the Engineer.

3.03.05            Cleaning Up - When the removed structures were in or near the right-of-way of a public street or alley, or in a right-of-way acquired across private property, the Contractor shall remove all resulting debris from the street surface, walks, gutters, fences, lawns, private property, right-of-way, and adjacent structures. When the removed structures were in or near or over a public waterway, the Contractor shall remove all resulting debris from the bed of the stream and the adjacent structures and land. All areas and structures to be cleaned as herein specified shall be left in as good a condition as originally found, and all machinery, tools, surplus materials (except salvage), temporary buildings and other temporary structures shall be removed from the site before final payment will be made.

3.03.06            Removal of Areaways - Areaways shall be removed and filled with compacted MDOT Class II backfill as specified in Division 17. The floor of the areaway shall be broken up so as to provide drainage. Any existing utilities shall be adequately protected. The opening from the

building into the areaway shall be filled in. All designs for the filling in of said openings must meet with the approval of the Engineer prior to construction. Relocation and/or protection of service utilities, and constructing the necessary closure between the areaway and the basement of the adjacent building shall be the responsibility of the building's owner.

3.04 Measurement and Payment:

The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for furnishing all labor, equipment and material for performing the work complete. The cost of removing pavement, sidewalk, or other structures for the purpose of constructing a sewer, water main, or other underground utility will not be paid for separately, but will be considered to be included in the unit prices bid for installing the underground utilities unless otherwise shown on the Drawings, or indicated in the Bid Form or Special Specifications.

Unless otherwise provided, this work will be measured in the original position of the structures to be removed. The contract unit price shall be payment in full for breaking down and removing, including sawing where required, disposing of materials, and furnishing, placing, and compacting backfill.

<u>Pay Item</u> _____	<u>Pay Unit</u>
Remove Pavement, Full Depth	sq yd
Abandon and Fill Underground Utilities, ____" Dia.	lin ft
Remove Areaway	cu yd
Remove Meter Pit	each
Concrete Sawing, Full Depth	lin ft
Clean and Remove Manhole, Valve Chamber, or Catch Basin per Detail 23B	each
Remove Concrete Pavement Base	sq yd
Remove Reinforced Concrete Pavement	sq yd
Remove Bituminous Pavement ____"	sq yd
Remove Bituminous Pavement, Full Depth, Outside Roadway	sq yd
Remove Bituminous Pavement Full Depth	sq yd
Remove Bituminous Pavement and Brick including Sand Cushion	sq yd
Remove Brick Pavement including Sand Cushion	sq yd
Bituminous Concrete Sawing, Full Depth (____")	lin ft

3.04.01 "Remove Areaway" will be measured by volume in cubic yards of backfill placed in the areaway. This price shall include the cost of removing roofs and sidewalks.

3.04.02 "Abandon and Fill Underground Utility" will be measured by length in lineal feet of the utility filled and paid for at the Contract unit price per linear foot.

3.04.03 Sawcutting - The cost of sawcutting to a depth of 3 inches, as specified, shall be included in the unit price bid for removal items. Sawcutting full depth when called for on the Drawings, stated in the Specifications, or required by the Engineer will be measured in lineal feet actually cut and paid for under the item "Concrete Sawing, Full Depth."

3.04.04

Miscellaneous structures shown on the Drawings to be removed but which are not included in the pay item quantities will not be paid for separately; payment for such work will be considered as having been included in the contract unit prices bid for other contract items. When not shown on the Drawings to be removed and there is no contract item, the work of removal will be paid for as extra work.

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## DIVISION 4

### EXCAVATION, EMBANKMENT AND GRADING

4.01	Description
4.02	Materials
4.02.01	Embankment
4.02.02	Topsoil
4.03	Construction Methods
4.03.01	Salvaging Topsoil
4.03.02	Preparing Area for Embankment
4.03.03	Constructing Embankments
4.03.04	Grading of Previously Excavated Streets
4.03.05	Pre-grading of Plats or Other Developments within the City of Grand Rapids
4.04	Subgrade Undercutting
4.05	Salvageable Material
4.06	Placing Topsoil
4.07	Rock Excavation
4.08	Measurement and Payment

## DIVISION 4

### EXCAVATION, EMBANKMENT AND GRADING

#### 4.01 Description:

Excavation, embankment and grading shall consist of all the work necessary for shaping the street to conform to the established grades and cross sections shown on the Drawings and as may be indicated on the site by stakes set by the Engineer. It shall include all the area of the pavement, curb and gutter, parkway, sidewalks, entrances to driveways and alleys, intersecting streets, and such adjacent property as may be necessary to construct needed side slopes. Clearing, grubbing, and removal of trees shall be as specified in Division 2.

#### 4.02 Materials:

4.02.01 Embankment - Material used for embankment shall be Granular Material Class II or Class III as specified in the current Michigan Department of Transportation Standards Specifications for Construction as shown in the Bid Form or approved by the Engineer. If no specific reference is made on the Drawings or in the Bid Form regarding the type of material to be used for embankment, Class II material shall be used. Class II may be substituted for Class III at the Contractor's option. Sound earth may be used for embankments when specifically shown on the Drawings or specified in the Bid Form.

4.02.02 Topsoil - Dark, organic natural surface soil, exclusive of muck or peat, suitable for the establishment of grass or other vegetable growth.

#### 4.03 Construction Methods:

4.03.01 Salvaging Topsoil - Topsoil existing within the limits of excavation and grading shall be removed to the depth and width shown on the Drawings, or as approved by the Engineer. Equipment and methods of operation shall be such as to avoid the lifting of subsoil. The topsoil shall be kept separate from other excavated materials by stockpiling in such a manner that it will be available for later use as topsoil.

4.03.02 Preparing Area for Embankment - The following shall govern the preparation of fill area:

(a) Where embankments are to be made in areas containing trees, stumps, brush, shrubs, and other vegetation, the ground shall be prepared as described in Division 2 - Clearing and Grubbing. Embankments shall not be started in such areas until the site has been inspected and approved by the Engineer.

(b) Where embankments are to be constructed on existing slopes steeper than 1 vertical to 6 horizontal, steps with a horizontal dimension of not less than 3 feet shall be formed in the slope before any of the embankment is placed.

(c) Where existing roadways are to be covered with less than 1 foot of fill, the surface shall be scarified and compacted to the same density as adjacent areas.

(d) Prior to the placing of the embankment, all existing sod and/or topsoil to a depth of 6 inches is to be removed from the area lying within a 1 on 1 projection extending down from the top of the slope.

4.03.03            Constructing Embankments - Embankments shall be constructed of MDOT Class II or Class III material as shown on the Drawings or specified in the Bid Form. Excavated sound earth materials may only be used for the embankment if specifically shown on the Drawings, specified in the Bid Form, or approved by the Engineer. Sound earth shall be any natural or other approved material which can be compacted to the required density, contains no organic materials, and shall have a maximum unit weight of at least 110 pounds per cubic foot.

Stones over three inches in diameter shall not be placed within 12 inches of the subgrade under the area of the pavement or curb or gutter.

Frozen lumps shall not be placed within the limits of assumed 1 to 1 slopes, spreading outward from the right-of-way line. During periods of continuous freezing weather when construction of the embankment in layers would result in deposits of frozen materials throughout the embankment, construction shall be postponed or modified as required by the Engineer.

Materials for embankments shall be placed in layers and uniformly compacted to 95% of the maximum unit weight using the modified Proctor T-180.

4.03.04            The Grading of Previously Excavated Streets - When a street or alley which is to be improved has been previously excavated to within 12 inches of the proposed grade as shown on the Drawings, it shall be graded to the proposed grades.

The work shall consist of shaping the surface to conform to the required cross section as shown on the Drawings, including driveways and intersections. The work shall also include the disposing of excess material or the supplying of additional material if necessary.

4.03.05            Pre-Grading of Plats or Other Developments within the City of Grand Rapids - Prior to the initiation of any plat pregrading work not under contract to the City of Grand Rapids, the Consulting Engineer will be required to submit to the Office of the City Engineer for review and approval, the grading Drawings, specifications regarding "cut" and "fill" in public rights-of-way, and method of construction of the same. Upon completion of the pre-grading work and prior to the initiation of the construction of utility and improvement work in public rights-of-way, the Consulting Engineer will be required to submit test results indicating the compliance with the work as noted above and state in writing under the signature of a Registered Professional Engineer that the work was done in such a manner that it is suitable for roadway construction and installation of various underground utilities, and that the private lots have been graded in accordance with the previously approved grading Drawings.

4.04            Subgrade Undercutting:

Should there be areas in the subgrade where the earth is unsuitable for a foundation for pavement, those areas shall be excavated to a depth determined by the Engineer, and backfilled with MDOT granular material Class II, unless otherwise required by the Engineer. The surplus earth shall be disposed of by the Contractor.

The backfill shall test at 95% of the maximum unit weight using the modified Proctor T-180.

4.05 Salvageable Material:

The Engineer reserves the right to require the Contractor to haul any surplus earth for filling any low street, alley, or sidewalk space to an established grade, provided that the location is not more than 2000 feet from the limits of the project. This shall be considered included in the price bid for excavation or grading.

4.06 Placing Topsoil:

The topsoil shall be spread on the prepared surface to uniform depth as shown on the Drawings or as approved by the Engineer. After spreading, any large clods and hard lumps shall be satisfactorily broken, and all stones and rocks over one inch in diameter, all roots and other foreign matter shall be raked up and disposed of by the Contractor. The finished surface of the topsoil shall conform to the lines, grades and cross sections shown on the Drawings or established by the Engineer.

4.07 Rock Excavation:

Rock excavation, where required, shall be done as specified in Division 17.

4.08 Measurement and Payment:

The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for furnishing all labor, equipment and material for performing the work complete.

<u>Pay Item</u>	<u>Pay Unit</u>
Grading	lin ft
Earth Excavation	cu yd
Embankment (C.I.P.)	cu yd
Sand Embankment (C.I.P.)	cu yd
Subgrade Undercutting	cu yd
Topsoil Placing Only	cu yd
Topsoil Furnishing and Placing Only	cu yd

4.08.01 Earth excavation shall be measured in cubic yards of volume in its original position, computed by the method of average end areas. It shall include the quantities measured for the necessary removal of topsoil and sod (based on a 6" depth) in the embankment areas.

4.08.02 The contract unit price per cubic yard for "Earth Excavation" shall be payment in full for excavation, disposal of material, and disposal of existing bituminous pavement and for excavating and stockpiling salvageable topsoil and all work related thereto.

4.08.03 Embankment whether paid for as "Embankment" or "Sand Embankment" will be measured in cubic yards of volume in place. The volume will be computed by the method of average end areas using cross sections taken off the original ground surface before the work is begun.

The contract unit price per cubic yard for "Embankment" and "Sand Embankment" shall be payment in full for this work including all work related thereto, regardless of whether the embankment is hauled in or is salvaged from on-site excavation.

4.08.04 Subgrade Undercutting will be measured in cubic yards in its original position, and shall include the removal and replacement of the undesirable materials with backfill.

4.08.05 The placing of topsoil will be measured in cubic yards of actual volume of topsoil in place.

4.08.06 The contract unit price for Topsoil, Furnishing and Placing, shall be payment in full for loading, hauling and placing topsoil brought in from off-site.

4.08.07 The contract unit price per linear foot for "Grading," when such work is performed on previously graded streets or alleys, shall be payment in full for furnishing all labor, equipment, and material required to complete the work as specified.

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## DIVISION 5

### SUBGRADE

- 5.01 Description
- 5.02 Shaping the Subgrade
- 5.03 Maintenance of Subgrade
- 5.04 Measurement and Payment

## DIVISION 5

### SUBGRADE

5.01 Description:

The subgrade is that portion of the road bed upon which the sub-base and surfacing materials, including curb and gutter, sidewalks and topsoil, is to be placed.

5.02 Shaping the Subgrade:

After the installation of underground utilities has been completed, the subgrade for the pavement and curb and gutter shall be scarified to a uniform depth below and for the full width of the pavement and curb and gutter sufficient to eliminate all depressions and irregularities and to permit uniform reshaping. If additional embankment as described in Division 4 is necessary to bring the subgrade to the desired elevation, this must be done before scarifying. After scarifying, the subgrade shall be shaped correctly to conform to the Drawings and be brought to a firm, unyielding surface by rolling the entire area with an approved roller. Any portion of the subgrade which is not accessible to a roller shall be compacted thoroughly with hand tampers weighing not less than 50 pounds, the face of which shall not exceed 100 square inches, or approved mechanical means.

All soft and yielding material which will not compact readily when rolled or tamped, shall be removed and replaced with suitable material as specified in Division 4 under Subgrade Undercutting or as approved by the Engineer, and compacted as above specified.

5.03 Maintenance of Subgrade:

The finished subgrade shall be maintained in a smooth and compacted condition until the pavement has been deposited thereon.

5.04 Measurement and Payment:

The work specified in this Division shall be included in the price bid for grading, excavation or embankment and no additional payment will be made therefor.

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DIVISION 6

SUB-BASE

- 6.01 Description
- 6.02 Materials
- 6.03 Construction Methods
- 6.04 Measurement and Payment

DIVISION 6

SUB-BASE

6.01 Description:

This work shall consist of constructing a sub-base of sand material, constructed to the specified depth below the pavement shown on the Drawings or required by the Engineer and stabilized when necessary.

6.02 Materials:

The sand used for sub-base shall be Granular Material Class II as specified in the current Michigan Department of Transportation Standard Specifications for Construction.

6.03 Construction Methods:

The subgrade for the sub-base shall be constructed and shaped to the required cross-section shown on the Drawings for the bottom of the sub-base. The surface of this area shall be accurately trimmed to within 1/10th foot above or below the bottom of the sub-base. The sub-base material shall be evenly spread and thoroughly compacted in layers as specified for Embankments in Division 4. The exact locations where sub-base is to be required may be determined by the Engineer after grading operations are in progress and will depend upon the characteristics of the soil encountered.

The sub-base shall test at 95% of the maximum unit weight using the modified Proctor T-180.

6.04 Measurement and Payment:

The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for furnishing all labor, equipment and material for performing the work complete.

<u>Pay Item</u>	<u>Pay Unit</u>
Sand Sub-base (CIP)	cu yd

Sub-base (CIP) will be measured by volume in cubic yards of the material in place, computed by the method of average end areas.

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DIVISION 7  
CONCRETE, GROUT, MORTAR, AND FLOWABLE FILL

7.01 Description

7.02 Materials

- 7.02.01 Portland Cement
- 7.02.02 High-Early-Strength Portland Cement
- 7.02.03 Air-Entraining Portland Cement
- 7.02.04 High-Early-Strength Air-Entraining Portland Cement
- 7.02.05 Fine Aggregate
- 7.02.06 Coarse Aggregate
- 7.02.07 Admixtures
- 7.02.08 Water
- 7.02.09 Reinforcing Steel
- 7.02.10 Flowable Fill
- 7.02.11 Masonry Sand
- 7.02.12 Mortar
- 7.02.13 Expansion Joint Material
- 7.02.14 Grout

7.03 Production

- 7.03.01 Furnishing, Storing and Handling of Aggregates
- 7.03.02 Mixing and Equipment
- 7.03.03 Consistency of Concrete
- 7.03.04 Air-Entrained Concrete
- 7.03.05 Concrete Accelerator
- 7.03.06 Water-Reducing Admixtures and Water-Reducing Retarding Admixtures

7.04 Protection and Curing

- 7.04.01 Cold Weather Protection
- 7.04.02 Hot Weather Limitations
- 7.04.03 Rain
- 7.04.04 Curing

7.05 Design

- 7.05.01 Classification and Proportioning
- 7.05.02 Proportioning of Aggregates and Cement
- 7.05.03 Testing of Concrete
- 7.05.04 High-Early-Strength Concrete
- 7.05.05 "Quick-Set" Pavement Patching Concrete

7.06 Measurement and Payment

## DIVISION 7

### CONCRETE, GROUT, MORTAR, AND FLOWABLE FILL

7.01 Description:

Concrete, grout, mortar, and flowable fill shall consist of mixtures of Air-Entraining Portland Cement, fine aggregate, coarse aggregate and water combined in the proportions specified for the various grades of concrete and other products.

7.02 Materials:

7.02.01 Portland Cement - Portland Cement when permitted by the Engineer shall conform to the requirements for Type I of the current Specifications for Portland Cement, A.S.T.M. Designation: C-150.

7.02.02 High-Early-Strength Portland Cement, when required, shall conform to the requirements for Type III of the current Specifications for Portland Cement, A.S.T.M. Designation: C-150.

7.02.03 Air-Entraining Portland Cement, shall conform to the requirements for Type I-A of the current Specifications for Air-Entraining Portland Cement, A.S.T.M. Designation: C-150.

7.02.04 High-Early-Strength Air-Entraining Portland Cement, shall conform to the requirements of the current Specifications for Type III-A for Air-Entraining Portland Cement, A.S.T.M. Designation: C-150.

7.02.05 Fine Aggregate - Fine Aggregate shall conform to the requirements for "Natural Sand 2NS," of the current Michigan Department of Transportation Standard Specifications for Construction.

7.02.06 Coarse Aggregate - Coarse Aggregate shall conform to the requirements for "Coarse Aggregate 6AA, 6A, 17A" of the current Michigan Department of Transportation Standard Specifications for Construction. The particular coarse aggregate to be used shall be 6A for reinforced concrete structures; concrete curb and gutter, gutter, or roll curb and gutter; concrete sidewalks, sidewalk ramps, driveways, and approaches, and alley pavement and approaches; or that specified under other specific work items.

7.02.07 Admixtures - Admixture shall be from the MDOT's list of approved admixtures or used with Engineer's acceptance.

7.02.07(a) Air -Entraining Admixtures - ASTM C260, certified by the manufacturer to be compatible with other required admixtures.

7.02.07(b) Water-Reducing Admixtures - ASTM C494, Type A and containing not more than 0.1 percent chloride ions.

7.02.07(c) Water Reducing, Non-Chloride Accelerator Admixture - ASTM C494, Type E and containing not more than 0.1 percent chloride ions.

- 7.02.07(d) Water-Reducing, Retarding Admixture - ASTM C494, Type D, and containing not more than 0.1 percent chloride ions.
- 7.02.07(e) Concrete Accelerator - Water Reducing, Non-Chloride Accelerator Admixture ASTM C494, Type E, containing not more than 0.1 percent chloride ions.
- 7.02.08 Water - The water to be used for mixing and curing the concrete shall be taken from the City's water mains or other source approved by the Engineer.
- 7.02.09 Reinforcing Steel - Steel reinforcement shall be deformed bars conforming to the "Specifications for Deformed and Plain Billet Steel Bars for Concrete Reinforcement" (ASTM - A615) and be Grade 60 bars.
- 7.02.10 Flowable Fill- Flowable fill concrete shall consist of a mix of Portland Cement, fly ash, water and granular material Class II of fine aggregate 2NS. Class II material shall have 100% passing a 1-inch sieve. It must have a minimum density of 130 pounds per cubic foot, a minimum compressive strength of 50 psi, and a maximum compressive strength of 100 psi. Approximate proportions are 50 lbs. cement, 500 lbs. fly ash, 2850 lbs. granular material, and 50 gallons of water.
- 7.02.11 Masonry Sand - Masonry sand for mortar shall conform to the requirements of "Masonry Sand, 2MS" of the current Michigan Department of Transportation Standard Specifications for Construction.
- 7.02.12 Mortar for brick or block masonry, for joints in precast units, for parging manholes and catch basins when required, and as a mortar bed for castings, shall consist of one part Portland Cement of Air Entraining Cement and two parts masonry sand, measured by volume. The mortar shall attain a minimum 28-day compressive strength of 3,000 p.s.i.
- Measured quantities of sand and cement shall be mixed dry in a clean tight box until a mixture of uniform color is produced, after which water shall be added until the required consistency is obtained. Mortar shall be mixed only in such quantities as needed for immediate use. The retempering of mortar will not be permitted.
- 7.02.13 Expansion Joint Material - Expansion Joint Material shall be a non-extruding and resilient type. This material shall be pre-molded and composed of fiber of cellular nature and asphalt, ground cork or other approved materials. The expansion joint material shall conform to the requirements of the current A.S.T.M. specification D-1751.
- 7.02.14 Grout - Grout shall be factory pre-mixed commercially available, non-shrink grout mixtures, Master Builders "Set Grout" or "Master Flow," Euclid Chemical Co. "Enco-NS," L and M Construction Chemicals Co. "Crystex," U.S. Grout Corp. "Five Star Grout," or approved equal.
- 7.03 Production:
- 7.03.01 Furnishing, Storing and Handling of Aggregates - shall be performed in a manner which will insure uniformity of grading at the time of batching. Fine and coarse aggregates, aggregates from different sources, and separate sizes of coarse aggregates shall be placed in separate bins or stock piles, such that they cannot become mixed before batching. The area on which stock piles are to be placed shall be firm and reasonably level and shall be cleaned of all foreign materials.

Mixing and Equipment:

(a) The Mixer shall meet the requirements as specified under Concrete Pavement as specified in the current Michigan Department of Transportation Standard Specifications for Construction. The mixing of each batch shall continue for a period not less than 1-1/2 minutes in mixers of less capacity than 18 cubic feet, not less than 1-1/4 minutes in mixers of capacity of at least 18 cubic feet and less than 38 cubic feet, and not less than one minute in mixers of capacity of 38 cubic feet and greater, capacity after the materials composing the batch are in the mixer. During this time, the drum shall revolve at the rate of not less than fourteen nor more than twenty revolutions per minute. The drum shall be entirely emptied after each batch before recharging. The volume of mixed material in each batch shall not exceed the Associated General Contractors of America rated capacity of the mixer, and as stamped on the mixer.

(b) Ready Mixed Concrete - Ready Mixed Concrete is concrete which has been mixed, and transported in a freshly mixed state, ready for placement, to the site of the work.

The mixing of concrete in truck mixers enroute from the batching plant to the site of the work will be permitted only for mixers equipped with an approved revolution counter which will either record the number of revolutions of the mixer drum at mixing speeds and the number of revolutions at agitating speeds, for each batch, or will record the revolutions of the mixer drum only when the mixer is operating at mixing speeds. Truck mixers not so equipped shall mix the concrete at the batching plant site. The mixing shall be done on a reasonably level area, sloping not more than 2 percent in any direction.

The mixer drum shall be entirely emptied after each batch before recharging. Truck mixers shall be operated in a manner that will assure discharge of water collected in the mixer drum through washing operations. Concrete or mortar which has partially hardened shall not be retempered or remixed. The mixer shall be cleaned thoroughly each time that it is out of operation for more than 30 minutes.

The concrete shall be discharged within a period of one hour after the introduction of the mixing water with the dry materials or within a period of 1-1/2 hours after the cement has been placed in contact with the aggregates. The discharged concrete shall be within the specified limits for consistency and air content and it shall not be segregated.

(c) Hand Mixing - Hand Mixing will be permitted only in case of a breakdown or other emergency or for very small units, and then only upon written permission from the Engineer or his representative. When so permitted, hand mixing shall be done on a water-tight wood or metal surface of a suitable size. The cement and aggregate shall be mixed without the addition of water until a mixture of uniform color is produced. Water shall then be added to produce the specified consistency and the whole mass should not be turned less than six times.

(d) The Quantities of Concrete mixed shall be only as required for immediate use and any which has developed initial set shall not be used. Any concrete or mortar which has partially hardened shall not be retempered or remixed. The use of a fractional sack of cement will not be permitted unless the fractional part is measured by weight. The mixer shall be cleaned thoroughly each time when out of operation for more than 30 minutes.

7.03.03            The Consistency of Concrete mixes shall be measured as described in the current specifications for "Method of Slump Test for Consistency of Portland Cement Concrete" of the A.S.T.M., Designation C-143.

The quantity of water, or the slump required, shall not exceed the limits established in each Division of the Standard Specifications for the grade of concrete specified.

The concrete shall at all times be of such consistency and workability that it can be puddled readily into corners and angles of the forms and around joints, dowels, tie bars and reinforcement without excessive spading, segregation or undue accumulation of water or laitance on the surface. The Engineer shall vary the proportions as provided in order to produce this workability, and if the aggregates have characteristics which require such changes in proportions to secure the specified workability and consistency, so that the cement factor is increased above that required for the basic proportions, no extra compensation for such increased cement factor will be allowed.

7.03.04            Air-Entrained Concrete shall be constituted so that the total entrained air content in the concrete shall be 6.5% plus or minus 1.5% and shall be obtained and controlled by one of the following methods:

(a) Air-Entraining Portland Cement - When air-entraining Portland Cement is used, and it is found that the air content of the concrete is greater than the specified maximum, the Contractor shall immediately quit its use and provide an air-entraining Portland Cement which will provide an air content within the specified limits. The Contractor may blend the air-entraining Portland cement with Portland cement, manufactured at the same mill, in a ratio which will reduce the air content to a value within the specified limits. The ratio of the two kinds of cement in the blend shall be approved by the Engineer.

When it is found that the air-entraining Portland Cement produces concrete having an air content less than the specified minimum, the Contractor shall immediately discontinue its use and provide an air-entraining Portland Cement, which will produce an air content within specified limits; or in lieu thereof, the Contractor may add to each batch, a sufficient amount of air-entraining agent (Neutralized Vinsol Resin, Darex AEA or approved equal) to bring air content within the specified limits, as directed by the Engineer.

(b) High-Early-Strength Air-Entraining Portland Cement - When high-early-strength air-entraining Portland Cement is used, the air content of the concrete shall be controlled in the same manner as specified for air-entraining Portland Cement in paragraph (a) of this section.

(c) Portland Cement and Air-Entraining Agent - When the use of Portland Cement, or high-early-strength Portland Cement is permitted, the air-entraining agent shall be Neutralized Vinsol Resin, Darex AEA, or approved equal. These agents shall be used as directed in the current Michigan Department of Transportation guidelines and subject to the approval of the Engineer.

7.03.05            Concrete Accelerator - Concrete Accelerator shall be used only when directed by the Engineer and shall be considered incidental to the concrete.

7.03.06            Water-Reducing Admixture and Water-Reducing Retarding Admixtures - The Contractor may use water-reducing admixtures and water-reducing retarding admixtures unless otherwise specified. Said admixtures shall conform to the requirements for Type A admixture and Type D admixture, respectively, as specified in ASTM C-494, except that neither Type A or Type D

admixtures shall contain calcium chloride unless otherwise specified. The admixture used shall be as approved by the Engineer. When the Contractor chooses to use an admixture, the amount used shall be based on the manufacturer's recommendation for maximum and minimum quantities. Concrete mixtures containing an admixture shall meet the same requirements for entrained air, minimum strength, maximum water/cement ratio, minimum cement content, and maximum slump as required for the respective grade of concrete without an admixture.

7.04 Protection and Curing:

7.04.01 Cold Weather Protection - When existing temperature conditions will produce concrete of less than 50°F, without heating materials, protection from freezing shall be accomplished as specified in the current Michigan Department of Transportation Standard Specifications for Construction. No concrete shall be placed unless the temperature of the air in the shade and away from artificial heat is at least 25°F and rising, unless specifically approved. The Contractor shall be responsible for the concrete placed during cold weather and any concrete injured by frost action shall be removed and replaced at the Contractor's expense.

7.04.02 Hot Weather Limitations - Casting of concrete during hot weather shall be limited by the temperature of the concrete at the time of placing. Concrete shall not be cast when the temperature of the concrete is above 90°F.

7.04.03 Rain - Newly laid concrete threatened with damage by rain shall be covered with burlap, cotton fabric, curing paper, polyethylene sheets or by other suitable means.

7.04.04 Curing - Exposed surfaces of concrete shall be covered with burlap or cotton fabric immediately after the forms are removed and shall be kept continuously wet for four days except as provided below. During this period, only such areas as are in the process of being finished may be uncovered. Footings may be cured by flooding, when permitted. Membrane curing compound may be used according to the current Michigan Department of Transportation Standard Specifications for Construction.

Curing periods specified above apply only when concrete is placed at a temperature of approximately 70°F. For lower temperatures, increase minimum curing periods to seven days.

7.05 Design:

7.05.01 Classification and Proportioning of concrete shall be on the basis of strength requirements. The proportions of fine and coarse aggregates shall be the quantities of these materials which, with the specified quantity of mixing water and cement, will produce a plastic and workable concrete free from stone pockets, honeycombing, or segregation.

There will be two grades of concrete, designated as AA and A. The following table shows, for each grade of concrete, the approximate proportions of cement, fine and coarse aggregate, the minimum compressive strength in pounds per square inch, and the minimum number of sacks of cement per cubic yard of concrete:

GRADE	APPROXIMATE PROPORTIONS BY VOLUME	MINIMUM COMPREHENSIVE STRENGTH Lbs/Sq. Inch 28 Days	ESTIMATED COMPREHENSIVE STRENGTH Lbs./Sq. Inch 7 Days	MINIMUM CEMENT Sacks/Cu. Yd. Of Concrete
AA	1:1.9:3.0	4000	2500	6.5
A	1:2.1:3.4	3500	2120	6.0

7.05.02

The Proportioning of Aggregates and Cement shall be by weight except on those projects where volume methods is specifically permitted by the Engineer. In both methods, water shall be measured in a container which will discharge the correct amount within a maximum variation of 2%. The container shall be so constructed and calibrated so that the amount of water may be observed and controlled at all times. Other accurate means may be employed if approved by the Engineer. If Ready Mixed Concrete is used, the quantities shall be shown on the delivery tickets for each batch.

(a) By Weight - When the aggregates are proportioned by weight, the proportions shall be computed by the Engineer according to the current Michigan Department of Transportation Standard Specifications for the construction of "Mortar Voids" theory of design.

(b) By Volume - When aggregates are proportioned by volume, the unit of measure shall be the cubic foot. The standard sack of cement containing 94 pounds, net weight, will be taken as the unit measure of cement and will be considered as having a volume of one cubic foot.

The volume of each aggregate to be used in the batch will be determined by the Engineer by converting to volume the predetermined weights of dry loose materials required for the batch. Aggregates shall be accurately measured in suitable carts, boxes, or bins. Shovel methods of measuring will not be permitted.

7.05.03

Testing of Concrete - During the progress of the work, standard 6-inch cylinders for compression tests of the concrete shall be prepared from each pour of walls, footings, floors, sidewalks, curb and gutter, and any other concrete work as determined by the Engineer. Concrete for test specimens and assistance for making them on the project will be furnished by the Contractor. The furnishing of molds, the actual making of the test cylinders, and all testing will be performed by the City.

The sample shall be tested in accordance with the specification of the American Society for Testing Materials, Serial Designation C-31 or the current Michigan Department of Transportation Standard Specifications for Construction. If the average results from test specimens cured at an average temperature of 70°F are below the 28-day required compressive strength, it will be sufficient reason for rejecting for further use the materials entering into the concrete.

7.05.04

High-Early-Strength Concrete, when called for on the Drawings or in the specifications, or directed by the Engineer, shall be Grade 35 HE as specified in the current Michigan Department of Transportation Standard Specifications for Construction.

7.05.05

"Quick Set" Pavement Patching Concrete - Concrete base for restoration over utility trenches (or any other place called for) in concrete base pavement, if so specified or directed by the Engineer be of the "Quick Set" type and shall conform to Type P-FS as set forth in the current

Michigan Department of Transportation Standard Specifications for Construction. In general, said "Quick Set" concrete shall consist of not less than nine sacks of cement per cubic yard of concrete. Aggregate shall be Michigan Department of Transportation 6A. Maximum slump shall be three inches.

The need or requirement for using a concrete accelerator shall be decided by the Engineer. When required, the amount of concrete accelerator shall be as recommended by the Admixture Manufacturer for the expected quantity and the ambient temperature of the placed concrete.

Said "Quick Set" concrete shall develop a 48 hour compressive strength of not less than 3200 p.s.i.

7.06

Measurement and Payment:

Concrete will be measured as provided under the section covering the structure where it is used, in the units indicated on the Bid Form. "Concrete" will be paid for as provided under the section covering the structure where it is used.

The completed Work as measured for High Early Strength Concrete shall be paid for at the unit price for the following Contract items (pay item). The price shall be payment in full for furnishing all labor, equipment, and materials, and performing the Work complete.

<u>Pay Item</u>	<u>Pay Unit</u>
Cement	ton

The additional cement for Grade 35 HE concrete, over the amount normally used, will be measured in tons of cement for the work to be constructed with High Early Strength Concrete. Extra cement used by the Contractor at his/her option will be paid for by the Contractor.

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## DIVISION 8

### REINFORCED CONCRETE STRUCTURES

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## DIVISION 8

### REINFORCED CONCRETE STRUCTURES

#### 8.01 Description:

This work shall consist of construction of all reinforced concrete structures, both above and below ground and all items directly related to the proper functioning of the completed concrete work, including foundation excavation, forming steel reinforcement, waterproofing, backfill and related items. See also Division 7, Concrete, for related specifications.

#### 8.02 Materials:

8.02.01 Concrete - Concrete for all work in this division shall be Grade A, air-entrained concrete as specified in Division 7 unless otherwise specified.

8.02.02 Form Material - All face form lumber for exposed surfaces shall be either dressed tongue and groove, dressed shiplap, or square edged lumber sized uniformly. Face form lumber shall be of uniform width and thickness, and shall be sound and free from loose or rotten knots, knot holes, check splits, or wane showing on the surface in contact with concrete.

For exposed surfaces, to be left unfinished, dressed tongue and groove or shiplap lumber not less than 3/4-inch actual thickness and not more than eight inches in width shall be used.

Instead of face form lumber, the Contractor may use plywood for structural boarding. It shall be at least 5 ply, not less than 3/4-inch in thickness, and in computing stud spacing it will be considered as 1-inch lumber.

The Contractor shall not use defective face form lumber which may produce work inferior to that resulting from new material.

Metal forms shall be of such thickness and so constructed that the forms will remain true to shape. All bolt and rivet heads occurring in the inside face of the forms shall be countersunk. Use of the metal form shall result in a plane smooth surface of the desired contour.

#### 8.03 Construction Methods:

8.03.01 Foundation Excavation - Foundation Excavation shall be made of sufficient size to permit construction of the foundation units and to provide for adequate drainage. Excavated material suitable for the purpose of backfilling shall be stored and used later.

Special care shall be taken not to disturb the bottom of the excavation. The elevations for the bottom of footings shall be subject to such changes as are necessary to insure a satisfactory foundation. The final removal of the foundation material to grade shall not be made until just before the foundation is placed. All unsound material underlying proposed structures shall be removed and replaced with bank run gravel or coarse aggregate, in layers not exceeding 6-inches in depth, and each layer shall be thoroughly compacted by tamping or by vibrating. The thickness of each layer of backfill may be increased to more than 6 inches, provided the full depth of each layer of backfill is compacted to not less than 95% of maximum weight.

Concrete shall not be placed until the depth of excavation has been checked, and the suitability of foundation material has been approved by the Engineer.

Where soil conditions allow and when approved by the Engineer, the footing forms may be omitted. Footing excavation may be trimmed to the exact size of the footing. In this case, guide forms to establish the grade for the top of the footing will be required.

8.03.02

Forms. - All forms shall be of wood or metal and shall be built mortar-tight of sound material sufficiently strong and rigid to prevent distortion during the placing and curing of concrete.

(a) Form Design - Design, erect, support, brace and maintain form work to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure.

Design form work to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only.

Provide for openings, offsets, linkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work.

(b) Form Construction - Forms shall be constructed and maintained to prevent warping and the opening of joints due to shrinkage of the lumber. Forms shall be secured to studs or uprights with true horizontal joints.

Forms shall be built true to the lines designated and shall be so maintained until the concrete has sufficiently hardened to allow their removal.

Form work shall be built to be readily removable, without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials. Forms shall be fabricated for ready removal without hammering or prying against concrete surfaces.

Crush plates or wrecking plates shall be provided where stripping may damage cast concrete surfaces.

Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

Forms shall be securely braced to prevent movement while placing concrete.

Clamps, pins or other connecting devices shall be designed to hold the forms rigidly together and to allow removal without injury to the concrete.

Form work shall be constructed so that concrete members and structures are of correct size, shape, alignment, elevation and position. Forms shall be constructed to size, shape, line and dimensions shown, to obtain accurate alignment, location, grades, level and plumb work in finished structures. The maximum deflection of form facing material between supports, and the maximum deflection of form supports such as studs and wales, shall not exceed 1/4-inch per 10 feet of span.

All face form lumber on upright studs shall be secured to the studs or uprights with true horizontal joints.

Temporary openings shall be provided at the base of wall and column forms and other interior area of form work where it is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Temporary openings shall be located on forms at inconspicuous locations.

Forms and bracing shall be retightened after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

Selected materials shall be used to obtain required finishes. Joints shall be solidly butted and provided with back-ups at joints to prevent leakage of cement paste.

Unless otherwise provided on the Drawings or by authorization, all buried corners shall be finished square without moldings. All exposed corners and edges shall be chamfered 3/4-inch minimums, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

Coordinate the installation of joint materials, perimeter insulation, and vapor retarders with placement of forms and reinforcing steel.

(c) Use of Forms -

Special care shall be exercised to keep metal forms free from ruts, grease, or other foreign materials such as will tend to discolor the concrete.

Cleaning and Tightening - Forms and adjacent surfaces to receive concrete shall be thoroughly cleaned. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed.

Metal forms which do not present a smooth surface or line up properly shall not be used.

Oiling - The inside of all forms for exposed concrete surfaces shall be oiled with a light, clear, paraffin-base oil which will not discolor or otherwise injuriously affect the concrete surface. Oiling shall be done after all necessary planning is completed.

(d) Coordination Issues- Openings in the concrete form work shall be provided when necessary to accommodate work of other trades. Size and location of openings, recesses and chases shall be determined from trades providing such items. Items built into forms shall be accurately placed and securely supported.

8.03.03

Placing of Steel Reinforcement - Materials for steel reinforcement shall be as specified in Division 7. Steel reinforcement shall be accurately placed in the position shown on the Details or Drawings. If not shown, steel reinforcement shall be placed in accordance with the current Standards of the American Concrete Institute.

Bars shall be placed with a variation between adjacent bars of not more than one-sixth of the spacing shown on the Drawings, and the clear distance from the surface of the concrete to the reinforcement shall not vary by more than one-fourth of the dimensions.

Bars shall be tied at all intersections except where spacing is less than one foot in each direction when alternate intersections shall be tied. Supports for reinforcement which are to remain in the work shall be precast concrete blocks of approved shape and dimensions.

Steel reinforcement shall be accurately secured against displacement by standard chairs, bolsters, spacers, and the like, supplemented by such additional supporting and spacing devices as may be required. Metal chairs for use in flat slabs when permitted by the Engineer shall be of sufficient strength to satisfactorily support the reinforcing.

When placed in final position, reinforcement shall be free from dirt, rust, mill scale, paint, oil or other foreign material. When there is a delay in depositing concrete, reinforcement shall be reinspected and corrected as to position and cleaning where necessary. Projecting reinforcement from prior concrete pours shall be cleaned of adhering mortar and loose rust before being incorporated in the new concrete pour.

8.03.04            Building in Work - All necessary ties, anchors, bolts, inserts, manholes and steps and other work shall be accurately set and securely held in concrete work according to details shown on the Drawings or standard practice.

Suitable sleeves shall be set in concrete for all small piping of every kind and for all large piping where shown on the Drawings where such piping passes through concrete work. Such sleeves shall be set with due regard to their position in the final surface finish. Proper allowance shall be made in concrete work, where necessary, for other installed work.

8.03.05            Placing Concrete - Concrete shall be placed in any unit of the structure only after the forms, bracing and preparations for casting have been approved. At the time concrete is placed, the forms shall be clean and all sawdust, chips and other debris shall have been removed from the interior of the forms. Struts, stays, and braces, serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their location, shall be removed when the concrete placing has reached an elevation rendering their service unnecessary.

The concrete shall be promptly placed with a minimum of handling to avoid segregation of the materials. Each pour shall be completed in a continuous operation with no interruption in excess of 45 minutes between the placing of contiguous adjacent portions of concrete. Each layer shall be placed and compacted before the preceding layer has taken an initial set.

Concrete during and immediately after depositing shall be compacted thoroughly by means of suitable tools. For thin walls or inaccessible portions of the forms where rodding or forking is impracticable, the concrete shall be assisted into place by tapping or hammering the forms opposite the freshly deposited concrete, and the concrete shall be worked thoroughly around the reinforcement, around embedded fixtures, and into the corners of the forms. Internal vibrators may be used.

To obtain clean and firm bearing surfaces, all water and softened material shall be removed from excavations immediately before concrete is deposited. Concrete shall not be deposited in water, nor shall water be allowed to rise over the concrete until the concrete has hardened sufficiently to prevent injury thereto. Any flow of water into the excavation shall be diverted through proper side-drains to a sump, or shall be removed by other approved methods which will avoid washing the freshly deposited concrete. Water vent pipes and drains shall be

filled by grouting or other means approved by the Engineer after the concrete has thoroughly hardened.

The concrete shall be deposited in the forms in horizontal layers not more than 12 inches thick unless otherwise specified by the Engineer and to as near final position as possible. When placing operations would involve dropping the concrete more than 5 feet, it shall be deposited through sheet metal or other approved pipes made in sections not to exceed 4 feet in length. The use of long troughs, chutes or pipes for conveying concrete from the mixing plant to the forms will not be permitted. Short troughs, chutes or pipes used as aids in placing concrete shall be arranged and used in such a manner that the concrete ingredients do not become separated. Where steep slopes are required, troughs and chutes shall be equipped with baffle boards or shall be arranged in short lengths that reverse the direction of movement. Troughs and chutes shall be of metal or shall be lined with metal and shall extend as nearly as possible to the point of deposit. When the discharge must be intermittent, provide a hopper or other device for regulating the discharge shall be provided.

Before depositing concrete on or against concrete which has set, the forms shall be retightened and the surface of the hardened concrete shall be roughened as required by the Engineer and thoroughly cleaned of foreign matter and laitance. The new concrete placed in contact with hardened or partly hardened concrete shall contain an excess of mortar to insure bond. To insure this excess mortar at the juncture of the hardened and the newly deposited concrete, the cleaned and saturated surfaces of the hardened concrete, including horizontal, vertical and inclined surfaces, shall first be slushed with a coating of neat cement grout or of mortar against which the new concrete shall be placed at once before the grout or mortar has attained its initial set.

The placing of concrete shall be so regulated that the pressures caused by wet concrete shall not exceed those used in the design of the forms. The consistency of the concrete shall be as in Paragraph 7.03.03. The slump shall not be less than 3 inches and not more than 4 inches unless otherwise approved by the Engineer.

Such spading as is necessary to insure smooth surfaces and dense concrete shall be done along form surfaces and in corners. After the initial set of the concrete, the forms shall not be jarred. All forms above concrete being placed, and all placing equipment, shall be kept clean and free from coatings of hardened concrete. Water used for flushing the placing equipment shall be discharged clear of the concrete and forms.

8.03.06

Construction Joints - In general, necessary construction joints are shown on the Drawings, and modifications of locations shall be subject to the approval of the Engineer.

Construction joints when called for on the Drawings between footings and walls and/or in walls below grade shall be provided with a polyvinyl chloride thermoplastic type water stop as approved by the Engineer. All water stops shall be continuous with ends lapped or spliced to make the joint watertight, and plates shall be adequately supported in accurate position and in a manner that does not interfere with the reinforcing steel. Water stops shall be placed at junctions of walls with floor slab and/or as shown on the Drawings.

The contact surface of concrete already in place, and the faces of all joints shall be thoroughly wetted before placing new concrete. The face edges of all joints shall be carefully finished true to line and elevation.

8.03.07            Patching and Finishing Concrete - Immediately following the removal of forms, all fins and other irregular projections shall be removed from exposed surfaces. On all surfaces, the cavities produced by form ties and other holes, broken corners and edges and similar defects shall be thoroughly cleaned. After being saturated with water for not less than one hour, surfaces shall be carefully pointed and trued with a mortar of cement and fine aggregate of the same proportions as the concrete being finished. Mortar used in pointing shall be not more than one hour old.

                    If, in the judgment of the Engineer, any defects present in the concrete are of such a nature as to warrant condemnation, such portion of the pour may be ordered replaced in its entirety and the Contractor shall promptly replace the same.

                    Where not specifically designated, the top surface of the concrete slabs shall be struck off at the elevations shown on the Drawings and given a smooth wood float finish. Where floors contain active drains, they shall slope uniformly to the floor drain.

8.03.08            Waterproofing - The materials and methods for waterproofing will be done according to the current Michigan Department of Transportation Standard Specifications for Construction Division 5, Waterproofing, where called for on the Drawings, specifications or otherwise authorized.

8.04                Backfill:

                    Backfill against structures shall be Granular Material Class II, in accordance with the current Michigan Department of Transportation Standard Specifications for Construction, unless otherwise approved by the Engineer. Backfill shall not be placed against any portion of the structure until the structure has been approved by the Engineer for backfilling. The backfill shall be carried up to the surface of the adjacent ground or to the elevation for the proposed earth grade, and its surface shall be neatly graded.

8.05                Measurement and Payment:

                    The completed Work as measured for reinforced concrete structures will be paid for on the basis of the contract unit prices for the bid items identified in the Bid Form. The price shall be payment in full for furnishing all labor, equipment, materials, including excavation, backfill, steel reinforcement forming, concrete, waterproofing, restoration, and performing the Work complete unless otherwise provided in the Specifications or in the Bid Form.

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## DIVISION 9

### CONCRETE CURB, CURB AND GUTTER, OR GUTTER

- 9.01 Description
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- 9.03 Construction Methods
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- 9.04 Measurement and Payment

## DIVISION 9

### CONCRETE CURB, CURB AND GUTTER, OR GUTTER

9.01 Description:

The work shall consist of constructing curb, gutter, combination curb and gutter, roll curb and gutter, radius driveway returns and radius alley returns of Grade A Concrete, with or without steel reinforcement, as provided, on the prepared subgrade. See also Division 7 for related specifications.

The construction of concrete curb, gutter, combination curb and gutter, roll curb and gutter, driveway returns or alley returns, shall precede the construction of non-rigid types of pavement or base course, but may either follow or precede, whichever is the more feasible, the construction of concrete pavement or concrete base course.

9.02 Materials:

9.02.01 Concrete - Concrete for all work in this Division shall be Grade A, air-entrained concrete as specified in Division 7, unless otherwise specified.

9.03 Construction Methods:

9.03.01 Subgrade - The subgrade shall be formed by trenching or filling to the required elevation for bottom of concrete or to the bottom of the subbase, if a subbase is specified. The subgrade shall be thoroughly tamped or otherwise compacted.

9.03.02 Subbase - Subbase for curbs, gutter, etc., shall consist of Granular Material Class II and/or aggregate base as specified in the current Michigan Department of Transportation Standard Specifications for Construction, placed under the structure, to the thickness shown on Standard Detail P-1, or the Drawings, and as specified in Division 6. For work performed under sidewalk repair contracts at individual locations of approximately 30 lineal feet in length, sub-base is not required.

9.03.03 Consistency - The Consistency of the concrete shall be as specified in Division 7. The slump shall not be less than 3 in. and not more than 4 in. unless otherwise specified by the Engineer, except for curb or curb and gutter placed with a machine where the slump shall be as required by the Contractor to allow for adequate finishing while preventing any deflection as the machine proceeds.

9.03.04 Forms - The Forms shall be metal, straight and free from distortion, and of sufficient strength to resist springing during the process of depositing and finishing the concrete. Wood forms or flexible steel forms shall be used on circular curb and on special sections and shall be subject to the approval of the Engineer. Circular curb shall be defined as any curved section of curb or curb and gutter constructed on a radius of 200 ft. or less. They shall be of an approved section with a flat surface on top. The forms shall be of the full depth of the structure and shall be well built, substantial and unyielding. They shall be securely staked, braced, and tied to the required line and grade and sufficiently tight to prevent leakage of mortar. The inside surface of the forms shall be oiled with a light, clear paraffin-base oil which will not discolor or otherwise injuriously affect the concrete. Curb machines may be used at the Contractor's discretion.

9.03.05            Placing and Finishing Concrete - No Concrete shall be placed until the subgrade and forms have been approved by the Engineer. The subgrade shall be thoroughly wetted and the concrete deposited to the proper depth. The concrete shall be spaded sufficiently to eliminate all voids and tamped to bring the mortar to the surface, after which it shall be floated smooth and even by means of a magnesium or wooden float.

The edge of the gutter and the back top edge of the curb shall be rounded with an approved finishing tool having a radius of 1/4 in. All transverse joints shall be finished with a double edging tool having a 1/4 in. radius on each side. The face of the curb, at the top and bottom, shall be rounded with approved finishing tools having the radii shown on the Drawings.

The exposed surfaces of the curb, gutter, combination curb and gutter, and roll curb and gutter, roll and curb gutter and driveway returns shall be finished smooth and even by means of a moistened steel trowel and shall not vary more than 1/8 in. in 10 ft. from the established grade. After smoothing the surfaces with a steel trowel, the surfaces shall be brushed lightly with a fine brush to remove tool marks. Neat cement shall not be used as a drier to facilitate the finishing of surfaces.

After the forms are removed, honeycomb and minor defects shall be filled with mortar composed of one part Portland Cement, and two parts of fine aggregate, applies with a wooden float.

9.03.06            Placing Steel Reinforcement - Materials for steel reinforcement shall be as specified in Division 7. When Steel Reinforcement or tie bars are called for on the Drawings, the bars shall be properly spaced and held in the correct position during the placing of concrete by the use of bar chairs or other approved devices.

9.03.07            Joints - Joints shall be constructed to provide for expansion and contraction of the concrete as follows:

(a) General - Joints shall be constructed perpendicular to the surfaces of the structure and shall not vary more than 1/4 in. from this position. The concrete at the faces of all joints shall be thoroughly spaded and compacted or vibrated to ensure satisfactory consolidation, and the surface shall be finished smooth and true to grade.

(b) Plane of Weakness Joints - Plane of Weakness Joints shall be placed throughout the structure at intervals of approximately 10 ft. The unit length divisions shall be produced by use of division templates extending the full depth of the concrete, or by placing joints in the concrete, after troweling to a depth of not less than 1/4 the thickness of the section. These joints shall not be less than 1/8 in. nor more than 1/4 in. in width, and shall be finished smooth and substantially true to line.

(c) Expansion Joints - Expansion Joints, 1/2 in. thick, extending to the full depth of the curb, shall be placed at all street returns, at intervals of no greater than 100 ft., and elsewhere as shown on the Drawings.

Expansion joint filler shall extend to the full depth of the joint, and the top shall be recessed slightly below the finished surface of the structure.

9.03.08 Backfilling - Backfilling shall be performed after the concrete has set sufficiently and the forms have been removed. The spaces on both sides of the curb, gutter, combination curb and gutter, roll curb and gutter, and driveway returns shall be backfilled to the required elevation with MDOT Class II material, which shall be properly compacted and trimmed to the cross section shown on the Drawings.

9.03.09 Positive Drainage - The Engineer will set line and grade for the curb and gutter. However, it shall be the responsibility of the Contractor to insure that positive drainage (no "Bird Baths") is achieved. In the event that the curb and gutter as constructed does not have positive drainage ("Bird Baths" are evident) the Contractor shall, at his/her own expense, remove and replace sufficient curb and gutter so as to insure that positive drainage is achieved.

9.04 Measurement and Payment:

The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for furnishing all labor, equipment and material, for furnishing and placing sand and aggregate sub-base, and for any necessary grading, excavation and backfill when not paid for separately, and for performing the work complete. The price shall include pavement and parkway restoration when indicated in the Pay Item.

Pay Item	Pay Unit
Combined curb and gutter (____" pan), per Detail P-5	lin ft
Curb, per Detail P-5	lin ft
Curb with separate gutter (____" pan), per detail P-5	lin ft
Roll curb and gutter, per Detail P-5	lin ft
Combined curb and gutter per Detail P-5, including radius driveway return per Detail P-2	lin ft
Combined curb and gutter per Detail P-5, including radius alley return per Detail P-2A	lin ft
Combined curb and gutter (____" pan), per Detail P-5, including pavement and parkway restoration	lin ft
Curb, per Detail P-5, including pavement and parkway restoration	lin ft
Curb with separate gutter (____" pan), per Detail P-5, including pavement and parkway restoration	lin ft

Pay Item	Pay Unit
Roll curb and gutter, per Detail P-5, including pavement and parkway restoration	lin ft
Combined curb and gutter per Detail P-5, including radius drive return per Detail P-2, including pavement and parkway restoration	lin ft
Combined curb and gutter per Detail P-5, including radius alley return, per Detail P-2A	lin ft

9.04.01 Concrete curb, gutter, or combined curb and gutter and roll curb and gutter will be measured in place by length in lineal feet, along the base of the curb face, or along the flow line of the gutter, with no deductions in length for catch basins, inlet castings, dub-down sidewalk ramps, dub-down drive approaches, or dub-down alley approaches as shown on the applicable Standard Details. Circular curb shall not be measured separately.

9.04.02 Concrete radius driveway returns as per Detail P-2 shall include the drive return to a line four (4) feet behind the face of the curb and will be measured in lineal feet along the flow line of the gutter from tangent point to tangent point. Any concrete necessary beyond the back of the return shall be placed under a separate item entitled "Concrete Driveway and Approach" and shall be measured in square feet.

9.04.03 Concrete radius alley returns as per Detail P-2A shall include the alley return to a line seven (7) feet behind the face of the curb and will be measured in lineal feet along the flow line of the gutter from tangent point to tangent point. Any concrete necessary beyond the back of the return shall be placed under a separate item entitled "Concrete Alley Pavement and Approach" and shall be measured in square feet.

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DIVISION 10

CONCRETE SIDEWALK, SIDEWALK RAMPS, DRIVEWAY AND APPROACHES,  
AND ALLEY PAVEMENT AND APPROACHES

- 10.01 Description
- 10.02 Materials
  - 10.02.01 Concrete
- 10.03 Construction Methods
  - 10.03.01 Subgrade
  - 10.03.02 Sand Subbase
  - 10.03.03 Consistency
  - 10.03.04 Forms
  - 10.03.05 Placing and Finishing Concrete
  - 10.03.06 Joints
  - 10.03.07 Backfilling
- 10.04 Measurement and Payment

## DIVISION 10

### CONCRETE SIDEWALK, SIDEWALK RAMPS, DRIVEWAY AND APPROACHES, AND ALLEY PAVEMENT AND APPROACHES

#### 10.01 Description:

The work shall consist of constructing concrete sidewalk, sidewalk ramps, driveways and approaches and alley pavements and approaches of the required cross section, constructed on the prepared subgrade or subbase as shown on the Drawings, and shall include grading, and any necessary parkway and pavement restoration. Concrete thicknesses shall be as shown on the Drawings, on the Standard Details, or in the Special Specifications. See also Division 7 for related specifications.

Ramps shall be constructed according to the applicable Standard Details when called out for on the Drawings and whenever new walk and curb is constructed within the crosswalk area and whenever an existing curb or curb radius is disturbed within a crosswalk area during construction of the project. A crosswalk area is the area lying within the projections of the two intersecting right-of-way.

Concrete driveway and alley approaches and alley pavements shall be constructed according to the applicable Standard Details.

This specification shall not apply to the sidewalks constructed as an integral part of a bridge, grade separation, culvert, nor as an independent structure over an areaway.

#### 10.02 Materials:

10.02.01 Concrete - Concrete for all work in this Division shall be Grade A, air-entrained concrete as specified in Division 7, unless otherwise specified.

#### 10.03 Construction Methods:

10.03.01 Subgrade - The subgrade shall be formed by trenching or filling to the required elevation for bottom of concrete or to the bottom of the subbase, if a subbase is specified. The subgrade shall be thoroughly tamped or otherwise compacted.

10.03.02 Sand Subbase - Subbase for items specified in this Division shall consist of Granular Material Class II as specified in the current Michigan Department of Transportation Specifications for Construction, and shall be placed under the structure, to a thickness of 4 inches, except for alleys and alley approaches where the thickness shall be 8 inches, and as specified in Division 6. For work performed under sidewalk repair contracts at individual locations of approximately 200 square feet, sand subbase is not required.

10.03.03 Consistency - The consistency of concrete shall be as specified in Division 7. The concrete for concrete driveways and approaches, sidewalks, and alleys and approaches shall be made with High Early Strength Cement. The slump shall be 1/2" - 2-1/2" unless otherwise approved by the Engineer.

10.03.04        Forms - The forms shall be of metal, straight and free from warp, and of sufficient strength to resist springing during the process of depositing and finishing the concrete. The forms shall be the full depth of the concrete. Forms shall be set firmly on the subgrade, true to the required line and grade, and be held in place by adequate stakes. Approved flexible steel or wood forms shall be used for sharp curves or special sections, when building the walk on a radius of 200 feet or less.

10.03.05        Placing and Finishing Concrete - The subgrade shall be thoroughly wetted and the concrete shall be deposited thereon to the proper depth. The concrete shall be thoroughly spaded along the forms and joints before finishing operations are started. The concrete shall be alternately tamped and struck off with a proper strike board until all the voids are removed and the surface has the required grade and cross section. The surface shall be floated with a wood float just enough to produce a smooth surface free from irregularities.

The edges on all concrete shall be rounded to a radius of 1/4 inch with an approved finishing tool. All joints shall be rounded with an approved double edging tool having a radius of 1/4-inch on each side. The surface shall then be brushed lightly to produce a slightly roughened surface and remove the finishing tool marks.

10.03.06        Joints - Joints shall be constructed to provide for expansion and contraction of the concrete as follows:

(a) General - Joints shall be constructed true to line, with their faces perpendicular to the surface of the concrete. Transverse joints shall be constructed at right angles to the centerline of a sidewalk, and longitudinal joints shall be constructed parallel to the centerline, unless otherwise required. When a sidewalk is constructed in partial-width slabs, transverse joints in the succeeding slab shall be placed in line with like joints in the adjacent slab. When widening an existing sidewalk, transverse joints shall be placed in line with the like joints in the existing sidewalk. All standard lineal sidewalk shall have transverse joints located at 5-foot intervals.

(b) Expansion Joints - Expansion joints, 1/2-inch thick, extending to the full depth of the concrete, shall be placed between the concrete and the back of the abutting curb or gutter at intersections and at those locations where the concrete extends from a building or other rigid structure to the curb, and at intervals of no greater than 50 feet. Expansion joint material shall extend to the full depth of the joint and the top shall be slightly below the finished surface.

(c) Plane of Weakness Joints - Plane of Weakness Joints shall be placed throughout the structure at intervals of 5 feet for standard lineal sidewalk and where necessary to insure that any sidewalk is divided into areas of approximately 36 square feet. Drive approaches and alley approaches shall be divided up into areas as shown on the applicable Standard Details, or as shown on the Drawings.

Joints in sidewalk and sidewalk ramps may be made by slab division templates extending the full depth of the concrete or, by placing joints in the concrete (after floating) to a depth of not less than 1/4 the thickness of the walk (dummy joints). These joints shall not be less than 1/8-inch nor more than 1/4-inch in width and shall be finished smooth and substantially true to line.

Joints in concrete driveway and alley approaches shall be full depth joints. No "Construction Joints" shall be allowed except for the 45° angle joint in the driveway or alley return.

10.03.07 Backfilling - Backfilling shall be performed after the concrete has set sufficiently and the side forms have been removed. The space on both sides of the walk shall be backfilled with MDOT Class II material which shall be properly compacted and trimmed to conform to the cross section shown on the Drawings.

10.04 Measurement and Payment:

The completed work as measured for concrete sidewalk including ramps, concrete driveway and approaches, and concrete alley pavement and approaches, will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for furnishing all labor, equipment and materials, for furnishing and placing sand subbase, for any necessary grading, excavation and backfill, and performing the work complete. The price shall include parkway restoration when indicated in the Pay Item.

Pay Item	Pay Unit
4" Concrete Sidewalk, including ramps	sq ft
6" Concrete sidewalk, including ramps	sq ft
7" Concrete sidewalk	sq ft
4" Concrete Sidewalk, including ramps and restoration	sq ft
6" Concrete Sidewalk, including ramps and restoration	sq ft
7" Concrete sidewalk, including restoration	sq ft
6" Concrete driveway and approach	sq ft
6" Concrete driveway and approach, including restoration	sq ft
7" Concrete alley pavement and approach	sq ft

10.04.01 Concrete sidewalk ramps shall be measured in place by area in square feet and included in the item for sidewalk of the same thickness.

10.04.02 Concrete driveway and alley approaches constructed according to Details P-2 and P-2A shall include the approach from the end of the return to the face of the walk and shall be measured in place by area in square feet.

10.04.03 Concrete driveway and alley approaches constructed according to the applicable Standard Details shall include the approach from the back of the curb to the face of the walk and shall be measured in place by area in square feet.

10.04.04 Concrete driveway and alley approaches constructed according to the applicable Standard Details shall include the combination walk and approach from the back of the curb to the back of the walk and shall be measured in place by area in square feet.

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## DIVISION 11

### MAINTAINING TRAFFIC, PAVEMENT MARKING AND DETECTOR LOOPS

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## DIVISION 11

### MAINTAINING TRAFFIC, PAVEMENT MARKING AND DETECTOR LOOPS

11.01 Description:

This work shall consist of the necessary provisions for Maintaining Traffic in and around the Work, furnishing and installing reflectorized pavement markings for new and reconstructed pavement surfaces, and furnishing and installing pre-wired traffic count and traffic detector loops with lead-in conduits and handholes in new and existing pavements, as shown on the Drawings, listed in the Bid Form and specified in this Division.

11.02 Maintaining Traffic:

11.02.01 Public Safety and Convenience - The Contractor shall at all times conduct his/her work so as to create the least possible obstruction to both vehicular and pedestrian traffic and to insure the safety and convenience of the general public including the residents along the street. Unless otherwise specified, streets shall remain open to local and emergency traffic during construction operations.

Complete protection of persons and property shall be provided by the Contractor. To this end, the Contractor shall provide and maintain adequate barricades, signs, lights, temporary pavement marking, and flags to warn and guide the public, and shall provide flag persons and watch persons as required. The Contractor shall contact the City Traffic Safety Director at least two business days prior to commencement of work on any street where traffic will be maintained, and at least 10 business days prior to the closing of any street, or implementation of the required detour.

11.02.02 Existing Traffic Signs - Unless otherwise specified, removal and replacement of existing signs pertaining to traffic, either moving or parked, shall be accomplished by the City Streets and Sanitation Department at no cost to the Contractor. However, any traffic sign damaged or destroyed by the Contractor shall be repaired or replaced by the City Streets and Sanitation Department, and the cost deducted from payments to the Contractor. Under no circumstances shall the Contractor remove, obstruct, relocate, or tamper with any traffic regulatory sign. In the event a conflict is foreseen or encountered, the Contractor shall notify the City Traffic Safety Director for a resolution.

11.02.03 Detours - Unless otherwise specified, the Contractor shall furnish, place, and maintain all necessary signs, barricades, and other appurtenances necessary for detouring traffic, including placing and maintaining signs, lights, barricades, temporary pavement markings, flag persons, etc., for the entire duration of the project. Detour signing shall be as shown on the Drawings, or if not shown, in accordance with the current edition of the Michigan Manual of Uniform Traffic Control Devices.

11.02.04 Temporary Facilities - All traffic control devices, and their installation, provided under this section shall conform to the Michigan Manual of Uniform Traffic Control Devices. All signs and barricades used for traffic control devices shall be reflectorized, and shall be new or in like new condition. Items damaged during construction shall be replaced immediately.

Installation of temporary parking restrictions (i.e. "No Parking" signs) must be approved by the City Traffic and Safety Department prior to installation.

Any time that traffic will be operating over the new leveling course, or the new wearing course prior to the installation of the permanent pavement markings, on streets where pavement markings are required, the Contractor must temporarily mark the pavement. The temporary tabs to be placed shall be 4' x 4" at 50' intervals for both centerline and lane lines. Removable pavement markings shall be used on existing or new pavement areas for traffic control during construction stages. Painted pavement markings may be used on temporary roadway surfaces that will eventually be removed. All temporary marking work will be considered to be included with the paving items.

11.03 Pavement Marking:

This work shall consist of furnishing and applying specified reflectorized pavement markings at locations shown on the Drawings, listed in the Bid Form, or as required by the Engineer in accordance with the Michigan Manual of Uniform Traffic Control Devices and as specified herein.

All markings, shapes, and dimensions shall conform with the current Michigan Department of Transportation (MDOT) typical Drawings for pavement markings, Special Specifications, or applicable Standard Details.

11.03.01 Materials, General

The specified paint and thermoplastic marking materials shall be selected from the MDOT's Qualified Products List (QPL) - See current MDOT Materials Sampling Guide.

Each container shall be plainly marked, both on the head and side, with a durable, weather-resistant marking, showing the name and address of the manufacturer, description of the material, batch number, date of manufacture, and volume and weight of contents.

The Engineer retains the right to test any product at his/her discretion. Samples will be provided by the Contractor when requested by the Engineer.

The Contractor shall provide the Engineer with material Safety Data Sheets (MSDS) for all materials and supplies used for this contract. The Contractor shall properly dispose of unused material and containers in accordance with the Federal Resource Conservation Recovery Act (RCRA) of 1987 and the Michigan Hazardous Waste Management Act (ACT 64), and any modifications or revisions thereto.

The City will not provide buildings or space to store Contractor's materials and/or equipment.

11.03.01(a) Materials, Thermoplastic Pavement Marking

The Contractor will provide a copy of a data sheet for the material which shows the allowable temperature range for applying the material.

Glass Beads used with thermoplastic pavement marking materials shall meet the requirements of AASHTO M 247 and be applied at the recommended rate. All glass beads shall have moisture proof coating. The glass beads will be sampled and/or certified in accordance with the requirements in the Materials Sampling Guide.

The hot-applied thermoplastic material shall be packaged in suitable containers to which it will not adhere during shipment and storage. The label on the material shall warn the user that the material shall be heated to a temperature range recommended by the manufacturer.

11.03.01(b)      Materials, Painted (Regular Dry) Pavement Markings

Glass beads for regular dry payment markings shall meet the requirements of the current MDOT Standard Specifications for Construction.

11.03.02      Equipment for Pavement Marking

The pavement marking equipment shall be self-propelled when used to apply longitudinal lines of the specified marking material. Where the configuration or location of a pavement marking is such that the use of a self-propelled pavement marker is unsuitable, the specified material and glass beads may be applied by other methods and equipment if approved by the Engineer. The Engineer will determine if other equipment is suitable for a particular use such as special marking, etc.

All self-propelled equipment must be certified by MDOT prior to use. A valid certificate will be presented to the Engineer prior to the start of work.

All pressurized air lines shall have water and oil traps installed and operating at all times. In general, the equipment shall be that necessary to accomplish the marking in a safe and efficient manner.

The self-propelled pavement marker used to apply centerlines shall be capable of applying three yellow, four-inch minimum width lines on a two-lane road, in one pass of the equipment. The equipment shall have sufficient material capacity to enable sustained pavement marking operations and shall be equipped so as to ensure uniform application of the paint and beads. The equipment shall have pressurized bead dispensers.

The Contractor shall use a dashing mechanism, capable of being easily adjusted, to retrace existing lane or centerline markings as shown on the Drawings or in the Bid Form or as required by the Engineer. The pavement marking machine shall be equipped with a method of measuring the flow rate of the material to the applied line. A flow meter, graduated tanks, or other method approved by the Engineer is acceptable for measuring flow rate.

The self-propelled pavement marker shall allow pavement marking to be applied in either direction on a given roadway and the skip cycle shall be continuous. The cycle control unit shall not zero or return to the beginning or start of a new cycle even though the skip line markings are interrupted by intersections, dual line no passing zones, school/pedestrian crossing, railroad grade crossings, etc.

It is also necessary to maintain the cycle through No Passing Zones where the centerline skip marking is omitted in double yellow markings. In most cases, this will allow for more accurate retracing and maintaining the cycle of the center skip line.

The Contractor's equipment shall include a linear footage meter to measure the length of each applied line.

The Engineer shall check the calibration of any metering device prior to the start of work and may check calibration of any metering device at his/her discretion during the duration of the contract. The accuracy and reliability of the equipment being used shall be satisfactory to the Engineer. When the equipment is unsatisfactory, other methods determined to be acceptable by the Engineer shall be used. No work shall progress until this determination has been made.

All equipment for applying hot-applied thermoplastic material shall have the capability of maintaining the material heated in accordance with the manufacturer's requirements.

The equipment shall be capable of applying the material to the required length and width. The equipment used to apply thermoplastic material shall be capable of ensuring uniform application of the materials.

11.03.03

Construction Methods, General

The pavement marking shall be applied according to the dimension and line shown on the Drawings and applicable Standard Details, and as established by the Engineer or his/her representative. Where centerline parallel solid yellow lines are required, the lines shall be separated by a space of 6 inches

Prior to the application of pavement marking, the pavement surfaces shall be clean, dry, and free of foreign materials. The Contractor shall be responsible for removing all foreign materials which can be removed by air-blasting. The Contractor shall also be responsible for removing occasional debris from the line track. The location of areas requiring special cleaning shall be determined by the Contractor. The Contractor shall be responsible for notifying the Engineer about these areas at least 48 hours in advance of the pavement marking operations. The Engineer shall require either normal cleaning, arrange cleaning by others, or order special cleaning by the Contractor. When shown on the Drawings or in the Bid Form, or when required by the Engineer, curing compound on new concrete shall be removed by light sandblasting.

Pavement markings shall be applied uniformly to the surface following manufacturer's recommendations. All materials shall be thoroughly mixed at all times during application. Thinning of liquid materials will be not be permitted. Longitudinal lines applied on concrete surfaces shall be offset approximately two inches from construction joints, as shown on the Drawings, or on the applicable Standard Details.

Lines, as shown on the Drawings or Standard Details, shall be between the width shown and that width plus 1/2-inch. The markings shall be white or yellow, and solid, broken, or dotted as shown on the Drawings, in the Bid Form, or as required by the Engineer. A solid line of the color and width specified shall have no gaps or spaces of unapplied material. An edge line shall be a solid line. A double line of the color and width specified shall be applied as either two solid lines or one solid line and one broken line. Both lines shall have equal width.

The lateral deviation of the new (not re-traced) lines shall not exceed 1/2-inch from the proposed location alignment, as specified in the Drawings and/or required by the Engineer.

When applying centerline and lane lines on new construction, the existing adjacent cycle shall be used (measured) to determine cycle length. This is done to ensure continuity of the existing cycle and aids in the retracing of the pavement markings in subsequent applications.

The cycle for retracing dotted lines shall not vary by more than a foot longitudinally.

Existing pavement markings are to be retraced with lines of equal length.

All pavement marking materials shall be loaded on the pavement marking machine in a manner that will not interfere with or delay traffic.

If markings are applied when the roadway is open to traffic, traffic shall be maintained by the Contractor at no additional cost. The striping equipment shall be operated in a manner that will make it unnecessary for traffic to cross the uncured markings.

Applied markings shall be sharp and well defined and shall provide uniform application of beads. Bead guns shall be positioned so all beads are directed into the line material. The markings shall be free of uneven edges, overspray, or other readily visible defects which, in the opinion of the Engineer, detract from the appearance or function of the pavement markings. Appropriate care shall be taken to prevent motorists from being sprayed. Shields or other devices may be used for this purpose.

Pavement marking lines shall be straight or of uniform curvature and shall conform with the tangents, curves, and transitions shown on the Drawings or Standard Details, or as required by the Engineer.

Improperly located markings shall be removed at the Contractor's expense and shall be reapplied in the correct locations at no cost to the City.

Pavement markings damaged by traffic, that were not properly applied and/or protected, shall be traced at the Contractor's expense as required by the Engineer. Tracked lines shall be removed at the Contractor's expense when required by the Engineer.

11.03.04

Construction Methods, Thermoplastic Pavement Marking

Thermoplastic material and glass beads shall be applied uniformly at the rate shown in the following table. Application rates will be determined by dividing the quantity used by the length of line painted.

Pavement Marking Material Application Rates Per Mile

Thermoplastic

1 lb. of glass bead/10.34 lbs of material

<u>Line Type</u>	<u>Material (lbs) Rate</u>	<u>Glass Beads (lbs) Rate</u>
Solid 4"	1,820	176
Broken 4"	455	44
4" Double		
2 solid	3,640	352
1 solid, 1 broken	2,275	220

All pavement should be more than visibly dry, since subsurface moisture can be present in amounts sufficient to affect proper bonding of the hot-applied thermoplastic material. The

minimum ambient air temperature shall be 49°F and rising at the start of marking operations. If work is started and the air temperature falls below 45°F, and continual cooling is indicated, all work shall be stopped, as required by the Engineer.

The thermoplastic material shall be heated to and applied at the temperature range recommended by the manufacturer.

11.03.05 Construction Methods, Painted (Regular Dry) Pavement Markings

Regular dry paint and glass beads shall be applied uniformly at the rate shown in the following table. Application rates will be determined by dividing the quantity used by the length of the line painted.

Pavement Marking Material Application Rates Per Mile

Regular-dry Paint

6 lb. of glass beads/gal. of marking material

<u>Line Type</u>	<u>Paint (Gal.) Rate</u>	<u>Glass Beads (lbs) Rate</u>
Solid 4"	16	96
Solid 8"	32	192
Broken 4"	4	24
Broken 8"	8	48
4" Double		
2 solid	32	192
1 solid, 1 broken	20	120
Dotted 4"	3.2	19.2
Dotted 8"	6.4	38.4

The Contractor shall apply the paint at a minimum temperature of 150° or higher as necessary to achieve a 30-to-50 second, no-track time. If necessary, the Contractor will protect the line from tracing for a period of no less than 45 seconds using backup vehicles properly equipped with safety devices.

New Bituminous Pavement - No pavement markings shall be placed prior to a minimum 14-day cure time on the new bituminous top surface, unless approved by the Engineer. Temporary striping of the roadway in the meantime will be considered as included in the price bid for other items of work and will not be paid for separately.

Temperature - This marking material shall be applied when the surface temperature of the pavement is 41°F or higher.

11.04 Traffic Loops:

11.04.01 Materials for Detector Loops

1. Loop Wire: Wire shall be 14-gauge THHN stranded or as shown on the Drawings.

2. PVC lead-in and detector loop conduit and fittings: The PVC conduit shall be schedule 80, 3/4" nominal inside diameter. Fittings shall be plastic for use with PVC conduit. Type "T" and pulling elbows shall have rubber gaskets and screw covers in order to protect the wire from moisture infiltration. Glue used for connections shall be PVC cement or similar to endure durable and waterproof connections.

3. Handholes: Handholes shall be City of Grand Rapids type as shown on the Drawings or the applicable Standard Details.

11.04.02

Construction Methods

Detector Loop Assembly - The PVC Conduit must be cut to dimensions shown on the Drawings or as required by the Engineer. All parts shall be assembled to form a rigid frame. The Conduit may be preheated and bent as required. The angle of bending shall not exceed 45 degrees (see the detector loop assembly detail on the Drawings). The wire to be threaded into the detector loop and the lead-in conduit to the handhole shall be in one piece. Splices will NOT be permitted.

The total length of wire to be used shall be determined according to perimeter of the detector loop, number of turns or times around the detector loop and length of lead-in wire. A minimum of 4' of both wires is to be left in the handhole or cabinet. The following table shows the number of turns or times that the wire is to be threaded around each detector loop.

<u>Detector Loop Perimeter (feet)</u>	<u>Number of Turns or Times Around Each Detector Loop</u>
12 - 20	4
20 - 45	3

All loops shall be wired in a clockwise direction and tagged to indicate start and finish. Loops shall also be numbered in the handhole or cabinet to facilitate splicing with alternate polarity connections. The color of the wire for each detector loop shall be different from the color for the other detector loops in order to be recognizable when all the wires are pulled into the handhole. The Contractor shall notify the Engineer prior to installation of the prewired loops to have them tested and approved by the City of Grand Rapids Traffic Safety Department. The Contractor will be responsible for delivering the loops to the Traffic Safety Department for testing and for picking them up again afterwards. The detector loops shall not be installed until they have been approved.

Installation of Prewired Detector Loops

The assembled prewired detector loops shall be installed as shown on the Drawings.

The lead-in wire from each pair of loops shall be threaded through a single conduit to the handhole or as shown on the Drawings. After wire has been pulled to the handhole or cabinet, there shall be 4 feet of wire left to make necessary arrangements for traffic equipment connection. The lead-in conduit shall be placed perpendicular to centerline of the road. The loops shall be installed in the gravel base as shown on the "Detector Loop Installation Detail" on the Drawings. The sand cushion shall be considered incidental. The handholes shall be placed where shown on the Drawings or as required by the Engineer and shall be adjusted to the final grade of parkway or sidewalk. The ends of lead-in conduit in the handhole shall be carefully sealed with duct seal or

silicone rubber to prevent water from entering the conduit. After the detector loops and lead-in conduit are in place, they must be tested and approved again by the City of Grand Rapids Traffic Safety Department prior to the placing of any backfill or paving.

Care shall be taken by the Contractor when pulling the wire through the conduit so as not to damage the wire in any way such as by excessive pulling tension or scoring of the sheath on conduit's edges. Any defective wire shall be replaced by the Contractor, at his own expense.

#### Acceptance Tests

1. The resistance to ground of the detector loop and its lead-in shall be a minimum of 1.0 Meg. OHMS under condition of weather or moisture. In the absence of circuit grounds, a temporary ground may be provided by a driven ground rod.

2. Each detector loop shall be tested for continuity at the handhole. This resistance shall not exceed 1.5 OHMS.

#### 11.05 Measurement and Payment:

The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for furnishing all labor, equipment and material for performing the work complete.

Pay Item	Pay Unit
Maintaining traffic, (estimated ____ days)	lump sum
Detour Signing (estimated ____ days)	lump sum
4" Yellow or white thermoplastic pavement marking	lin ft
6" White thermoplastic pavement marking (crosswalk)	lin ft
12" White thermoplastic pavement marking (stop bar)	lin ft
18" Yellow or white thermoplastic pavement marking	lin ft
24" White thermoplastic pavement marking (stop bar)	lin ft
White thermoplastic pavement marking legend (left or right turn arrow)	each
White thermoplastic pavement marking legend "ONLY"	each
White thermoplastic pavement marking, railroad symbol "RxR"	each
4" Yellow or white painted pavement marking	lin ft
6" White painted pavement marking (cross walk)	lin ft
12" White painted pavement marking (stop bar)	lin ft
18" Yellow or white painted payment marking	lin ft
24" White painted pavement marking (stop bar)	lin ft
White painted pavement marking legend (left or right turn arrow)	each
White painted pavement marking legend "ONLY"	each
White painted pavement marking, railroad symbol "RxR"	each
Count detector loop installation	lump sum
Traffic detector loop installation	Lump Sum

11.05.01

Maintaining Traffic

Maintaining traffic will be paid for on the basis of a lump sum price, which shall include furnishing and maintaining lights, barricades, signs, flags, flag persons, temporary pavement marking and other items of work as identified in this section for the duration of the project.

Detour signing will be paid on the basis of a lump sum price, which shall include payment in full for furnishing and placing signs, barricades, and other devices, maintaining them throughout the life of the project, and removing them at project completion.

In the event that the Contractor fails to adequately place and/or maintain traffic control devices for Maintaining Traffic or Detour Signing, a specified sum will be deducted from the amount due under each of these items for each day the traffic control devices are inadequate. This specified sum is herein defined as the Lump Sum Price Bid in the Bid Form divided by the estimated number of days said traffic devices will be necessary, as set forth in the Bid Form. Under no circumstances shall the daily specified sum deduction be less than \$100. The estimated number of days set forth in the Bid Form is only for the purpose of calculating any daily specified sums to be deducted as set forth above and does not reflect the actual number of days said traffic devices are necessary. The Contractor shall be required to maintain traffic and detours as set forth herein for the entire duration of the project, regardless of the estimated number of days noted in the Bid Form and shall be paid the Lump Sum Price Bid for the same, less any deduction(s) for the number of days said traffic control devices were not adequately placed or maintained.

11.05.02

#### Pavement Marking

Linear pavement markings will be measured in linear feet complete and in place for the type, color, and width specified. Symbol and legend pavement markings will be measured in units as each for the type and color specified. Payment shall include all traffic control, protective devices, or pavement marking convoy necessary to perform the work. The skips in dashed lines are not included in the measurements for both painted and thermoplastic markings.

#### Material Deficiency

Material shortages will not be permissible without contract unit price reductions. Any determination of pay deduction resulting from shortages in marking materials shall be based on measurements obtained and the required application rate shown in the application rate table. If material shortages exist the contract unit price will be reduced in direct proportion to the deficiency, up to 15 percent maximum. If the daily deficiency of either pavement marking material or beads is more than 15 percent, the day's work shall be considered unsatisfactory and the day's markings shall be reapplied at no cost to the City. Any reapplied markings shall be applied as described under Construction Methods.

Delayed Acceptance of Hot Applied Thermoplastic Material - Delayed acceptance is that period of time when the Contractor must replace markings that have failed. Final acceptance of completed pavement marking work will be delayed 180 days or as otherwise approved by the Engineer. During this 180-day period, inspections of the markings placed in accordance with the contract will be conducted at the Engineer's discretion. Markings with less than 90 percent of the original markings in place shall be replaced immediately at the Contractor's expense. Pavement markings that have been damaged by snowplowing operations will not be considered as having failed.

If the Contractor wishes to have the project accepted for final payment prior to the 180-day period, the Contractor 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 pavement marking work performed.

11.05.03

Count Detector and Traffic Loop Installation

"Count Detector Loop Installation" and Traffic Detector Loop Installation" which includes assembling and installing the pre-wired detector loops and lead-in conduits and installing the conduits for the detector loops as shown on the Drawings will be measured as a unit and paid for at the contract lump sum unit price each. The cost for handhole(s) will be measured and paid for separately under the appropriate item in the Bid Form.

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DIVISION 12  
CONCRETE PAVEMENTS

- 12.01 Description
- 12.02 Measurement and Payment

DIVISION 12

CONCRETE PAVEMENTS

12.01 Description:

This work shall consist of constructing a jointed Portland cement concrete pavement, base course, or shoulder, with or without reinforcement, as specified.

The classification, materials, equipment, construction methods, and method of measurement and payment shall be as specified under Division 4 of the current Michigan Department of Transportation Standard Specifications for Construction, or any special specifications prepared by the City.

12.02 Measurement and Payment:

The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for furnishing all labor, equipment and material, and for any necessary grading, excavation and backfill. when not paid for separately, and for performing the work complete.

<u>Pay Item</u>	<u>Pay Unit</u>
Concrete Base Course - Reinforced ____ "	sq yd
Concrete Base Course - Nonreinforced ____ "	sq yd
Concrete Pavement - Reinforced ____ "	sq yd
Concrete Pavement - Nonreinforced ____ "	sq yd
Contraction Joint C	lin ft
Contraction Joint C3	lin ft
Contraction Joint W	lin ft
Contraction Joint C2	lin ft
Contraction Joint C4	lin ft
Contraction Joint E2	lin ft
Contraction Joint E3	lin ft
Contraction Joint E4	lin ft
Plane-of-Weakness Joint D1	lin ft
Plane-of-Weakness Joint D2	lin ft

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DIVISION 13

RESERVED

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DIVISION 14

AGGREGATE BASE AND SURFACE COURSES

14.01 Description

14.02 Measurement and Payment

DIVISION 14

AGGREGATE BASE AND SURFACE COURSES

14.01 Description

This work shall consist of an aggregate roadway or aggregate base constructed on an existing aggregate surface or on a prepared subbase or subgrade.

The materials, equipment, construction methods, and measurement and payment shall be as specified under Division 3 of the current Michigan Department of Transportation Standard Specifications for Construction, or any special specifications. Crushed, recycled concrete pavement meeting the gradation requirements of the specified aggregate may be used at the Contractor's option.

14.02 Measurement and Payment

The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for furnishing all labor, equipment and material, and for any necessary grading, excavation and backfill when not paid for separately, and for performing the work complete.

<u>Pay Item</u>	<u>Pay Unit</u>
Aggregate Base Under Bituminous, ____" (C.I.P.)	sq yd
Aggregate Base Under Concrete, ____" (C.I.P.)	sq yd
Aggregate Base Under Bituminous (C.I.P.)	cu yd
Aggregate Base Under Concrete (C.I.P.)	cu yd
Aggregate Surface Course (C.I.P.)	sq yd, cu yd

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## DIVISION 15

### BITUMINOUS MIXTURES

- 15.01 Description
- 15.02 Materials
  - 15.02.01 Bituminous Mixtures
  - 15.02.02 Bituminous Bond Coat
- 15.03 Equipment
- 15.04 Construction Methods
  - 15.04.01 Placing Top Course Mixture
  - 15.04.02 Preparation of Foundation
- 15.05 Measurement and Payment

## DIVISION 15

### BITUMINOUS MIXTURES

15.01 Description:

The work shall consist of conditioning the foundation and constructing thereon one or more courses of the bituminous mixture (s) specified. The courses may include various combinations of bituminous base, leveling, and top (wearing) courses requiring various gradations of aggregate, percentages of bituminous material and crushed aggregate content, and a minimum aggregate wear index.

15.02 Materials:

15.02.01 Bituminous Mixtures shall conform to the requirements of the Special Specifications issued for each project.

The bituminous material for base mixtures shall have a 120-150 penetration, and the bituminous material for surface mixtures for wedging, leveling, and top courses shall have a penetration of 85-100.

Bituminous Mixtures shall be prepared in a bituminous mixing plant which has been prequalified by the Michigan Department of Transportation or as approved by the Engineer and shall be in accordance with the current Michigan Department of Transportation's Standard Specifications for Construction.

Reclaimed Asphalt Pavement (RAP) shall not be used in the top course of pavement.

The Contractor shall be required to submit a job-mix formula for the bituminous mixtures to be used on the project to the Engineer for his/her approval at least 30 days prior to the production of any bituminous mixtures. Should lack of a mix design delay completion of the project beyond the stipulated completion date, the Contractor shall be charged for liquidated damages in accordance with Contract. The mix design must either be an approved design from the Michigan Department of Transportation or a certified design from an approved testing laboratory. The source of all materials is to be identified in the mix design by pit name, location, and Michigan Department of Transportation pit number. All related costs to obtain an approved mix design will be at the Contractor's expense.

The aggregate wear index (AWI) number applies to the aggregate used in the top (wearing) course bituminous mixtures and will be a minimum of 290 or as called for on the Drawings or in the Bid Form or Special Specifications.

The Contractor shall be required to submit to the Engineer a certification that the asphalt cement in the bituminous mixtures used on a project is in accordance with the current Michigan Department of Transportation Standard Specifications for Construction pertaining to asphalt cement.

15.02.02 Bituminous Bond Coat - when specified, shall conform to the current requirements of the Michigan Department of Transportation's Standard Specifications for Construction. Bond coat will be SS-1H unless otherwise specified.

15.03 Equipment:

Equipment to be used for placing bituminous pavements shall conform to the requirements of the current Michigan Department of Transportation's Standard Specifications for Construction, except as noted herein.

15.04 Construction Methods:

Construction methods to be used for placing bituminous mixtures shall conform to the requirements of the current Michigan Department of Transportation's Standard Specifications for Construction except as noted herein.

The Contractor shall give 24 hours notice to the Engineer prior to beginning the paving operation in order that the Engineer may make arrangements for inspectors and testing personnel to be on hand during the paving operation.

When a wedging course is specified, it shall be placed before the top course or leveling course is applied in order to eliminate the uneven street surface. The thickness will vary from zero on the high spots to the thickness necessary to eliminate the uneven surface.

15.04.01 Placing Top Course Mixture as specified in the current Michigan Department of Transportation Standard Specifications for Construction shall be changed or modified in part to the following:

All construction and transverse joints in the top course shall be close knit, conforming to the required crown and grade, and without an excess of coarse aggregate exposed. Each day's run of top course shall cover the entire width of the street unless otherwise permitted by the Engineer. All longitudinal joints left open to traffic shall be painted with bond coat when work is resumed at such joints. All transverse joints shall be trimmed to a straight line and painted with bond coat before work is resumed.

When the mixture is to be spread by hand at intersections and other places inaccessible to a machine, the resulting pavement shall have the same appearance as the adjoining pavement which was machine laid. It shall conform to the crown and grade required without an excess of coarse aggregate on the surface.

All materials shall be shoveled and not dumped from the truck when hand work is required and shall be placed to grade with a minimum of raking or luting. Use of the lute for final shaping is required. Shovelers shall not distribute the material any faster than it can be properly handled by the rakers. The rakers will not be permitted to stand in the hot mixture while raking, except to correct an error.

15.04.02 Preparation of Foundation in the above mentioned Michigan Department of Transportation Standard Specifications for Construction shall be changed or modified in part by the following:

For the purpose of making joints at intersections, sections of the existing bituminous pavement varying in width from six to eight feet adjacent to the proposed joint shall be removed as approved by the Engineer, unsuitable or defective bituminous surfaces shall be removed. The work shall be paid for at the contract unit price bid per square yard on the Bid Form under the item

"Remove Pavement," which price shall be payment in full for the removal and disposal of the bituminous pavement and shall include all costs in connection therewith and incidental thereto.

15.05 Measurement and Payment:

The completed work as measured for Bituminous Mixtures will be paid for at the contract unit prices for the following contract items (pay items) or for those Contract items (pay items) listed in the Bid Form or Special Specifications. The price shall be payment in full for furnishing all labor, equipment and material and for any necessary grading, excavation and backfill when not paid for separately, and for performing the work complete.

<u>Pay Item</u>	<u>Pay Unit</u>
Bituminous Bond Coat	gallon
Bituminous Base Mixture No. 700, 20C (120-150) at ____ lbs/SY (____")	ton
Bituminous Mixture No. 1300L, 20AAA (85-100) at ____ lbs/SY (____")	ton
Bituminous Mixture No. 1300T, 20AAA (85-100) at ____ lbs/SY (____")	ton
Bituminous Mixture No. 20AAA (85-100), including wedging as required by the Engineer	ton

Bituminous Mixtures shall be measured in tons of pavement constructed at the weight per square yard noted in the Bid Form item, unless otherwise specified.

Bituminous mixtures to be used for wedging shall be measured in tons of wedging material placed.

Various tests will be performed on the bituminous material and price adjustments will be made to the affected materials according to those described in the current Michigan Department of Transportation's Standard Specifications for Construction.

For the leveling and top courses when measured and paid for in tons, the Contractor will not be paid for any tonnage of material placed that exceeds the number of tons of material authorized to be placed by more than 5%. The number of tons authorized to be placed will be computed by measuring the number of square yards of material actually placed by the Contractor and accepted by the Engineer and multiplying that number by the weight per squared yard specified in the Bid Form, on the Drawings, or as approved by the Engineer. Any material placed in excess of this 5% tolerance will be at the Contractor's expense unless approved by the Engineer based on specific justification provided by the Contractor.

Bond coat shall be measured by volume in gallons of material placed at a temperature of 60°F unless otherwise specified.

The changes and modifications noted herein were made to adapt to the current Michigan Department of Transportation Standard Specifications for Construction, to meet local conditions and not to downgrade or produce a finished job of lesser quality and stability than would be produced otherwise. Any overlapping or conflict between Michigan Department of Transportation Standard Specifications for Construction and the changes and modifications noted in these

specifications shall be so construed as to work to the advantage of the City so that the completed work is of the highest quality.

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DIVISION 16  
BRICK PAVEMENT

16.01	Description
16.02	Materials
16.02.01	Paving Brick
16.02.02	Grout Filler
16.02.03	Sand for Bituminous Mastic Cushion
16.02.04	Bituminous Materials
16.03	Construction Methods
16.03.01	Preliminary Work
16.03.02	Grout-Filled Brick Pavement
16.03.03	Asphalt-Filled Brick Pavement
16.03.04	Final Clean-Up
16.04	Measurement and Payment

DIVISION 16  
BRICK PAVEMENT

16.01 Description:

This work shall consist of a wearing surface of new or salvaged brick, laid on a sand cushion and with Portland Cement grout filler, or laid on a bituminous mastic cushion and with bituminous filler, and constructed on the prepared foundation.

16.02 Materials:

16.02.01 Paving Brick - Paving brick shall conform to the requirements of the Special Specifications for Brick Pavement issued for projects where such materials are to be used. Paving brick may be purchased from the City's supply, when available, upon written authorization from the Engineer, or provided by the City at no cost to the Contractor if specifically stated in the Bid Form or Special Specifications.

16.02.02 Grout Filler - Cement, water, and sand materials used to make grout filler for the work under this Division shall be as specified in Division 7. The grout filler shall be prepared as described in this Division.

16.02.03 Sand for Bituminous Mastic Cushion - Bituminous mastic cushion shall be prepared as described in this Division, the brick manufacturer's recommendations, and Special Specifications as applicable.

16.02.04 Bituminous Materials - The bituminous materials shall be as specified in Division 15 and/or a Special Specification issued for each project where such materials will be used.

16.03 Construction Methods:

16.03.01 Preliminary Work

(a) Removing and Salvaging Brick - On those areas where the brick is to be relaid, they shall be carefully removed to avoid damage, and all sound and satisfactory brick shall be salvaged for relaying. All mortar and other foreign matter adhering to the brick shall be entirely removed, and all the work of cleaning and handling the brick shall be done in such a manner that the brick will not be broken or otherwise damaged so as to make them unfit for relaying.

(b) Repairing Existing Foundation - After the brick wearing course has been removed, all of the existing sand cushion or mastic cushion shall be removed together with all other foreign matter, so that the condition of the existing base course may be examined by the Engineer. If the concrete base course is defective, it shall be removed to the extent required by the Engineer. In the event that the defective base course was caused by unstable subgrade, the subgrade shall be removed to the extent required by the Engineer and replaced with sand-gravel or other suitable material and compacted as required to the original elevation of the subgrade. The concrete base course shall then be replaced as specified in Division 12 of these specifications.

(c) Changing Crown or Grade - When the crown or grade elevation is to be raised, the sand cushion or mastic cushion shall be removed, the existing concrete foundation shall be swept clean, and the crown or grade shall be built up by placing concrete or mortar on the existing concrete

foundation to conform to the Drawings or required by the Engineer. On those areas where the elevation is to be raised two inches (2") or more, Grade "A" concrete shall be used, and on those areas where the elevation is raised less than two inches (2"), mortar shall be used. The Grade "A" concrete and mortar shall be as specified in Division 7 and this Division.

#### 16.03.02 Grout-Filled Brick Pavement

(a) Placing Sand Cushion - When the concrete base course has been repaired, or the crown or grade has been changed, as above specified, the sand cushion shall be spread over the prepared concrete base to a uniform thickness which will not exceed one inch when the brick surface is rolled. (It is estimated that 1-1/2 inch loose will compact to the required one-inch after rolling.)

The sand cushion shall be carefully shaped to a true cross section parallel with the surface of the finished pavement by means of an approved template so designed as to be easily drawn on the edge of the adjacent brick pavement or on other approved guides.

(b) Handling Brick - Brick must be delivered from the piles to the brick-layers by hand, or mechanically on conveyors. No throwing, dumping or other rough handling of the brick will be permitted.

(c) Laying Brick - When the area to be paved is one or more City blocks in length and extends from curb to curb, the brick shall be laid upon the prepared sand cushion in straight courses at right angles to the curb between street intersections. The brick courses in intersections shall be laid in the directions shown on the Drawings. The brick shall be laid carefully with lugs in the same direction and with the better face up and so that the lugs of the brick in one course will touch the brick in the adjoining course. The ends of the brick shall be as close together as possible without wedging or bridging. The spaces between the brick shall be kept clean and open to the bottom until the grout filler is applied. Joints shall be broken by starting each alternate course with a half brick. Bats or broken brick shall not be used except at headers, and they shall not be less than 3 inches in length. The course shall not deviate from a true line more than 1 inch in 50 feet.

When the area to be paved is less than one City block in length, and is less in width than the full width of the street, the brick used shall be of the same size and color as in the adjacent pavement. The end bricks in the existing pavement adjacent to the area to be paved shall be whole bricks only, so that the new work may be neatly "toothed" into the old and produce a firm and neat surface.

Immediately after laying, the brick surface shall be swept and inspected. All brick which is soft, cracked, spalled, off-color, underburned, overburned or otherwise undesirable will be marked by the Inspector. The Contractor shall at once remove such brick from the pavement with flatnosed tongs, without disturbing the sand cushion and replace them with approved brick. Slightly chipped brick, if not otherwise defective, may be turned over and if the reverse side is satisfactory, may be replaced in the pavement.

(d) Rolling Brick - After the bricks have been laid, and after all objectionable bricks have been removed, they shall be brought to a true surface by means of rolling with a power-driven tandem roller weighing not less than 5 nor more than 8 tons. The pavement shall be rolled in longitudinal and diagonal directions. The longitudinal rolling shall begin at the curb and progress toward the center of the pavement. The pavement shall then be thoroughly rolled at an angle of 45 degrees with the curb. When this rolling has been completed, the brick shall again be inspected and

all that are broken or damaged shall be removed from the pavement and replaced with approved brick. If necessary to secure a uniform surface, the brick shall again be rolled diagonally across the pavement at right angles to the first diagonal rolling. To prevent the brick from being left careened, the roller shall in all cases cover exactly the same area in making its backward trip as was covered in its forward trip and shall proceed at a very slow rate of speed until the entire pavement has been rolled. Portions of the pavement inaccessible to the roller shall be tamped to grade by the use of hand tampers applied upon a 2-inch board.

After final rolling, the pavement shall be tested with a 10-foot straight edge laid parallel with the centerline of the pavement, and any depression exceeding 1/8 inch shall be corrected, and if necessary, the entire surrounding area shall be again rolled.

(e) Grout-Filler - The grout for filling the joints in the brick shall consist of one (1) part of Portland Cement and one (1) part of sand. As soon as the pavement is rolled and before the grout filler is applied, the pavement shall be thoroughly wetted.

The cement and sand shall be thoroughly mixed dry until the mass assumes a uniform color. Water shall then be added slowly, while the mixing operation is continued, until the mixture is of such a consistency that it will flow readily into the joints without separation. The application should be repeated until the joints are full. Any surplus material remaining on the bricks shall then be removed.

After the first treatment has had time to settle into the joints, and before initial set has developed, a second treatment shall be applied in a similar manner with a somewhat thicker grout. After this application has had time to settle and before the initial set takes place, the pavement shall be finished to a smooth surface with a squeegee having a rubber edge which shall be worked over the brick at an angle with the joints leaving them entirely filled and leaving the surface of the bricks clean.

(f) Curing - The curing of grout-filled pavement shall be carefully and systematically carried out, by covering the pavement with sand, straw, burlap, cotton mats or other approved material and keeping the covering material thoroughly saturated for a period of 72 hours from the time applied.

(g) Opening to Traffic - All grout-filled pavement shall be kept closed to traffic during the curing period. After the completion of the curing period, the curing materials shall be removed, the pavement shall be swept clean, and all construction equipment removed.

16.03.03

Asphalt-Filled Brick Pavement -

(a) Bond Coat - On those areas where mastic cushion and bituminous filler are to be used, the prepared foundation shall be surface treated with bonding material applied in a continuous uniform film by means of a pressure sprayer at the rate of approximately 0.2 gallons per square yard as approved by the Engineer. Under no circumstances shall pools of bonding material be allowed to remain on the surface. The entire cost of furnishing and applying Bond Coat shall be included in the price bid for Brick Pavement.

(b) Preparing and Placing Bituminous Mastic Cushion - The bituminous mixture shall be composed of clean, dry sand and bituminous material as specified. It shall contain bituminous material in the amount between 4 and 7 percent, by weight, determined by the Engineer, such that

the mixture will spread and compact readily but will not shift or squeeze up between the bricks more than 3/8 inch during rolling of the brick surface.

Unless otherwise specified or permitted by the Engineer, the materials shall be mixed in an approved plant meeting the requirements for Sheet Asphalt Surface. The sand shall be thoroughly dry and at a temperature of not more than 150°F at the time of mixing.

When the surface of the foundation has been thoroughly cleaned, and treated with bond coat as above specified, a layer of bituminous mastic mixture shall be spread upon the prepared foundation to such depth that it will have a uniform thickness of 1/2 inch after being compacted and shall not vary more than 1/8 inch from that thickness. Measurements shall be made to the surface of the base.

The bituminous mastic cushion shall be carefully shaped to a true cross-section parallel with the surface of the finished pavement by means of an approved template so designed as to be easily drawn on approved guide forms. After the cushion is shaped, it shall be rolled with a hand roller until well compacted. The roller shall be not less than 36 inches in diameter and 24 inches in width and shall weigh not less than 10 pounds per inch of width. Any depressions formed by rolling shall be corrected by placing additional mixture, leveling with the template and rolling. This operation shall be repeated until a uniformly compacted cushion of the required depth and surface is obtained. The surface of the roller shall be kept wet to avoid picking up the cushion. Rolling may be omitted upon approval of the Engineer if a smooth, uniform surface can be obtained by placing the brick directly upon the uncompacted bituminous mastic cushion.

The bituminous mastic cushion shall be prepared at least 25 feet in advance of laying brick, except, that at the end of each working day, all prepared mastic cushion shall be covered by brick, and any that is not covered shall be removed and discarded. The bituminous mastic cushion shall be kept dry until the brick are laid thereon. Any areas that are injured or displaced before the brick surface is laid, shall be replaced in a satisfactory manner at the expense of the Contractor.

(c) Handling, Laying and Rolling Brick - This work shall be done in the same manner as specified for grout-filled brick pavement in this Division.

(d) Treating Brick Surface - Immediately prior to the application of asphalt filler, the brick shall be treated with a separating agent consisting of a solution of calcium chloride or other approved agents. Adjacent curb surfaces or other structures which may be discolored by application of filler material shall be treated with the separating agent to facilitate removal of any filler lodging on them and causing discoloration of the surface.

The calcium chloride solution shall have the following composition by weight:

CALCIUM CHLORIDE (100 lb. - 1 sack)	32%
LAUNDRY STARCH ( 3 lb.)	1%
WATER (25 gal.)	67%

In extremely hot weather, the quantities of starch and calcium chloride may be increased to produce satisfactory results, as approved by the Engineer.

The separating agent shall be applied with sprayers or other equally effective devices capable of producing a fine mist or fog. Brooms shall not be used for applying the separating

agent. When calcium chloride is used, only air pressure methods will be permitted; other agents shall be applied by means of air pressure methods, barrel spray pumps or other types of pressure pumps, whichever, in the opinion of the Engineer, gives the best results.

The method of application, type of angle fog nozzle used, amount of pressure applied and all other incidental equipment and methods shall be such that the separating agent will be applied vertically in the form of a fine fog or mist which is permitted to settle onto the brick surface. Whenever the nozzle opening wears or the equipment no longer produces satisfactory results, it shall be so applied, that the material is confined to the exposed surface of the brick and will not penetrate onto the side and ends.

The application of the separating agents must be carefully coordinated with the application of filler in order to insure satisfactory removal. In general, this application shall be from 10 to 25 feet in advance of the application of filler, but in any case shall be so timed as to give satisfactory separation with a minimum of foaming.

Other agent, methods and equipment which have demonstrated their ability to produce results equivalent to those described herein will be permitted upon approval by the Engineer.

(e) Applying Asphalt Filler - The asphalt filler shall be heated in a kettle having a capacity of not less than 500 gallons, unless otherwise authorized, to a temperature between 400°F and 450°F before it is applied, and maintained at this temperature during application. The kettle shall be of approved design and shall be equipped with a stationary thermometer for accurately indicating the temperature of the asphalt at all times. The filler shall be stirred in the melting kettles to prevent injury by burning. While the filler is at the specified temperature, it shall be poured or flushed into the joints, so as to penetrate fully to the bottom of the joint with a surplus retained on the brick surface. Filler shall be emptied directly onto the brick from buckets or containers without the use of squeegees, buggies, nozzles or similar devices. There shall be no manipulation of filler by squeegees or lutes. Partially filled areas or patches where foaming occurs shall receive a second application of hot filler. Lutes will be permitted only for the prevention of waste over the curb or adjacent structures.

For the protection of pavement, the kettles for heating bituminous filler shall be provided with a drip pan under the valves and a swinging pan so interposed between kettle and pavement as to provide a minimum of 2 inches of air-space between pan and pavement at all times. If necessary to secure satisfactory penetration of the filler and when the temperature of the brick laid in the pavement is below 50°F, such temperature shall be raised to not less than 80°F, immediately before applying the filler, by the use of surface heaters or other devices of approved design, and shall be maintained at that temperature until the filler is applied.

All brick shall be treated with separating agent and filled on the day of laying. If the mastic cushion becomes saturated with water after the bricks have been laid, the filler shall not be applied until the mastic cushion has thoroughly dried. When necessary to accomplish this purpose, the brick shall be taken up, the mastic cushion reconditioned and the brick relaid as approved by the Engineer.

(f) Removing Surplus Filler - When the filler has partially cooled, the surplus mat or carpet of filler shall be cut clean from the brick in strips not more than four bricks wide, by means of hand sidewalk cleaners, spading tools, or similar devices. The entire operation, especially the handling of the bituminous mat after being cut loose, shall be such as will have no tendency to pull or loosen

the asphalt in the joints. Rolling the mat in a tight roll and thus exerting a direct pull will not be permitted. Any joints found to be unfilled after the above operation shall be refilled flush with a hand pot. The final result shall be a clean brick surface with joints completely filled and with all surplus filler completely removed from brick curbs and adjacent structures.

New and salvaged asphalt filler shall be placed on board platforms or old drum metal and will not be permitted to lie on brick surface or base. Asphalt which has been removed from the brick surface as above described may be reheated and re-used, but the proportion of reheated asphalt in the kettle shall not exceed 40 percent.

16.03.04 Final Clean-Up - Before final acceptance of the work, the Contractor shall clean the street surface, walks, gutter, fences, lawns, private property and structures, leaving them in as good a condition as originally found, and shall remove all machinery, tools, surplus and waste materials, temporary buildings and other temporary structures from the site.

16.04 Measurement and Payment:

16.04.01 The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for furnishing all labor, equipment and material, and for any necessary grading, excavation and backfill when not paid for separately, and for performing the work complete.

<u>Pay Item</u>	<u>Pay Unit</u>
Grout-Filled Brick Pavement	sq yd
Asphalt-Filled Brick Pavement	sq yd
Remove and Replace Concrete Foundation, _____"	sq yd
Concrete or Mortar Shim	cu yd

16.04.02 Brick pavement will be paid for at the contract unit price per square yard, which price shall be payment in full for furnishing all labor, equipment and materials for performing the work complete, ready for use. Sand cushion or bituminous mastic cushion will not be measured separately, but shall be considered as included in the price bid for the item Brick Pavement. Concrete pavement base, where called for on the Drawings or in the Bid Form, will be paid for separately.

16.04.03 Removing and replacing concrete foundation will be paid for at the contract unit price per square yard, which price shall be payment in full for furnishing all labor, equipment and materials for constructing the foundation complete, ready for application of cushion.

16.04.04 Concrete or mortar shim will be paid for at the contract unit price per cubic yard, which price shall be payment in full for furnishing all labor, equipment and materials, and performing the work complete, ready for application of cushion.

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## DIVISION 17

### EXCAVATION AND BACKFILL FOR UNDERGROUND UTILITIES

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  - 17.03.03 Extent of Open Trench
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  - 17.03.05 Existing Underground Structures
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  - 17.03.09 PVC Solid Wall and Truss Pipe Installation
  - 17.03.10 Disposal of Excess Excavated Material
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  - 17.03.16 Cleaning-Up
- 17.04 Measurement and Payment

DIVISION 17

EXCAVATION AND BACKFILL FOR UNDERGROUND UTILITIES

17.01 Description:

The work shall consist of excavating and backfilling for storm sewers, sanitary sewers, water mains, conduits, and all other underground utilities.

17.02 Materials:

17.02.01 Backfill and Bedding -

(a) Backfill shall meet the requirements for Granular Materials Class II as specified in the current Michigan Department of Transportation Standard Specifications for Construction.

(b) Bedding shall meet the requirements for MDOT Class II except that 100% of the materials shall pass a 3/8" sieve.

(c) Gravel shall only be used for bedding when shown on the Drawings, listed in the Bid Form, specified in the Special Specifications, or when approved by the Engineer. Gravel for bedding shall be either pea gravel or one-inch gravel, as directed, and shall conform to the following grading requirements:

Pea Gravel	MDOT 28B
1-inch Gravel	MDOT 17A

17.02.02 Water - The water used to obtain the desired moisture content of backfill material shall be taken from the City's water mains, as specified in Division 7, unless otherwise specified.

17.03 Construction Methods:

17.03.01 Excavation -

(a) Excavation of the trench shall normally begin at the outlet end for sewers unless otherwise permitted by the Engineer and as may be agreed upon for other utilities. The excavation shall be true to line and grade as is required and shall be of sufficient width to provide ample working space and to permit ramming and compacting of bedding backfill around the utility, including also sufficient space for bracing and supporting sides of trenches and for pumping and draining of ground water and/or sewage.

(b) Width of Trench - In addition to the provisions of the preceding paragraph, the maximum bottom width of trench shall be 36 inches for pipe, 8 inches to 12 inches inclusive in diameter. For larger sizes of pipe, the maximum width of trench shall be not more than two (2) feet greater than the inside diameter of the pipe, except as otherwise specified or directed. The above limiting restrictions on trench width apply from outside bottom of pipe to 12 inches above outside top of pipe.

(c) Unstable Foundation - When the bottom uncovered at the proposed grade is soft and in the opinion of the Engineer cannot support the pipe or utility, a further depth shall be excavated and

refilled to the proposed grade with approved materials compacted in 12-inch layers as specified in this Division, or other approved means shall be employed to assure a firm foundation for the utility, with extra compensation allowed therefore. The volume of unstable foundation removed and replaced with approved materials for which payment will be allowed shall be determined in cubic yards unless otherwise specified on the Drawing or in the Bid Form, said volume to be computed by assuming that the cross section area of the unstable foundation takes the form of a trapezoid as shown on Standard Detail S-15.

- 17.03.02            Tunneling - shall be done only where shown in Drawings, or as approved by the Engineer.
- 17.03.03            Extent of Open Trench - The excavation shall at all times be finished to grade for a safe distance in advance of the completed structures, but unless otherwise specifically approved or permitted by the Engineer, not more than fifty (50) feet of trench shall be open at one time. The excavated earth along the line of the trench shall be controlled by the use made of the street or right-of-way by the public, and shall always be confined to approved limits. Pedestrian crossings shall be erected and maintained by the Contractor where designated by the Engineer. Excavation or use of land outside the street right-of-way or easement shown on the Drawing will not be permitted, unless approval is granted by the Engineer, or, as specified on the Drawing or in the Special Specifications, and unless specific approval is given by the Engineer.
- 17.03.04            Fire Hydrants and Water Main Valves - shall be kept accessible for immediate use at all times, unless otherwise approved by the Engineer. Upon approval, the Contractor shall notify the Grand Rapids Water Department and Fire Department of any hydrants or valves to be taken out of service.
- 17.03.05            Existing Underground Structures - The Contractor shall provide and install adequate supports and protection for all sewer and water pipes or other underground structures extending into or crossing the trench. Where gas mains or electric cable or conduits extend into or across the trench, the Contractor shall notify the owner of the utility at once and provide such supports and protection as may be required by the them.

Should any such gas main or electric cable or conduit require raising or lowering or moving to another location, such changes will be made by the owner without additional expense to the Contractor.

Where sewers, water mains, cables or conduits and all other underground structures are parallel to the Contractor's trench opening, the Contractor shall so carry on his/her work at all times as not to cause damage to the paralleling structure or structures.

Where gas, electrical, or telephone, water or sewage service connections to occupied buildings must be temporarily disconnected, the Contractor shall give at least 24 hours notice to the affected building occupants of the time and duration of the anticipated cut-off.

When pipes, conduits or sewers are removed from the trench leaving "dead" ends in the ground, such ends shall be fully plugged or bulkheaded with brick and mortar by the Contractor without additional compensation.

Removal and replacement of existing street lighting, storm, sanitary or water main structures, necessary for the proposed utility construction, shall be included in the unit cost of

installing the utility, and no extra compensation will be allowed unless an item is shown on the Bid Form for said removal and replacement.

The Contractor shall not abandon any unidentified pipes, conduit, mains, etc. without the approval of the Engineer. If approval is not given, the Contractor shall restore such pipes, conduits, water mains, etc., to service. The cost of restoration shall be the responsibility of the Contractor.

The removal of abandoned underground utilities, both public and private (such as street lighting, telephone or electrical conduits; gas mains, water mains, sewer, etc.) necessary to install new utilities shall be considered to be part of installing the new utility and will not be paid for separately, unless called out specifically on the Bid Form.

17.03.06      Disposal of Water and Sewage - The Contractor shall remove, by pumping, bailing or otherwise, any water which may accumulate or be intercepted or be found in the trenches and in any other excavations made under this contract. He/She shall provide all temporary construction necessary to keep the trenches entirely clear of water and sewage while the structures and their appurtenances are being constructed. The Contractor shall at all times have sufficient pumping equipment on the job ready for immediate use.

The Contractor shall discharge water from dewatering operations to separate storm sewer whenever possible. The Contractor shall provide the Engineer prior notification of proposed dewatering operations. The Engineer will be responsible to provide any necessary notification to the MDNR of proposed discharge to the storm sewer system. The Contractor shall obtain prior approval from the Engineer if discharge to a combined sewer or sanitary sewer is required. The Contractor shall also obtain, at no cost, a prior discharge authorization approval from the Grand Rapids Wastewater Treatment Plant Superintendent for discharge of dewatering water to combined sewers or sanitary sewers. Dewatering flow rates shall not result in a total flow rate which exceeds 50% of the capacity of the receiving sewer, or which will cause backups of the receiving sewer, including separate storm sewers, combined sewers and sanitary sewers. The Contractor shall pay special attention to the water quality of the discharge and incorporate necessary measures to reduce suspended solids (i.e., stone, straw, or geotextile filters). The pumping operation shall be controlled to avoid unnecessary discharge to combined sewers and sanitary sewers. The Contractor shall temporarily suspend the discharge of dewatering water to storm sewers, sanitary sewers or combined sewers if necessary to prevent basement backups, local flooding or combined sewer overflows.

Dewatering methods used by the Contractor shall provide adequate protection against damage to properties in the area. The potential for settlement of structures located in the area shall be assessed prior to initiating the dewatering operation and specific measures shall be incorporated to avoid settlement where necessary. The Contractor shall be solely responsible for any damages to public or private property resulting from his/her dewatering activities.

No additional payment will be made to the Contractor for this work. It will be considered as included in the prices bid for other items of work. However, if the groundwater is found to be contaminated, and if pretreatment is required prior to discharge, then the pretreatment will be considered as extra work and paid for separately.

17.03.07      Bracing, Sheet piling, and Shelving - The Contractor shall brace or slope back the sides of all excavations in accordance with current MIOSHA and OSHA regulations. The Contractor shall be responsible for the design, installation and maintenance of all excavation safety measures.

Unless otherwise specified in the Bid Form, the costs incurred in the installation of bracing, sheeting, and shelving shall be included in the unit price bid for the work being performed.

17.03.08

Bedding and Backfill

(a) General Requirements - Bedding and backfill shall not be placed until the material has been approved by the Engineer. Bedding material shall be placed under and around the utility to a minimum depth of at least one foot above the top of the utility. Bedding shall be placed in layers not more than 6 inches in thickness and each layer thoroughly compacted without damaging or displacing the utility. Unless otherwise specified on the Drawings, on the Bid Form, or in the Special Specifications, backfill shall be of material as specified in this Division. The backfill shall be placed in layers not more than 12 inches thick, each layer being fully compacted using vibrators or other mechanical means as approved by the Engineer. Flooding of trenches as a method of compaction will not be permitted. However, additional water may be required to reach desired moisture content of the backfill material. The backfill shall test at 95 percent of maximum unit weight as measured by the current Modified Proctor Test, ASTM Specification D1557.

(b) Clay or other Hard Bottom - When the soil encountered at sewer grade is clay or other hard material, the Contractor shall excavate such hard material to a depth of 6 inches below the bottom of the pipe or conduit and replace such material with material as specified in this Division. Cost of such work shall be included in the price for the utility unless payment is specifically provided for in a contract item prior to bidding.

(c) Special Requirements - In certain instances the Engineer may choose to use the existing material excavated from the trench as backfill for the area of the trench above one foot above the top of the utility. When the conditions allowing this choice are known prior to bidding, the Drawings, Bid Form or Special Specifications shall so note that the general requirements in Paragraph (a) above relative to the area above one foot above the top of the utility do not apply. When the conditions are not known prior to bidding and the decision is made by the Engineer in the field, a suitable reduction in price for eliminating the required granular backfill as specified in Paragraph (a) above shall be negotiated. Material shall be placed as specified in Paragraph (a), above.

Excavated rock, boulders of more than one cubic foot, broken concrete, masonry, frozen material, tree roots or other vegetable or organic matter, debris, and refuse shall not be used for backfill.

17.03.09

PVC Solid Wall and Truss Pipe Installation - The construction methods used for PVC solid wall and truss pipe shall be as specified in ASTM D2321, Underground Installation of Flexible Thermoplastic Sewer Pipe, the applicable sections of this Division, and the Manufacturer's recommendations.

17.03.10

Disposal of Excess Excavated Material - All excavated material in excess of that needed for backfill shall be disposed of by the Contractor at the Contractor's cost. The Engineer reserves the right to direct the Contractor to haul any excess material for filling any low street, alley, or sidewalk space to an established grade, provided that such haul shall not be more than 2000 feet outside this project.

17.03.11

Rock Excavation -

(a) Definition - Rock excavation shall include all ledge rock in place that cannot be excavated by hand except by blasting or, in the opinion of the Engineer, by the continuous use of air tools, or by the exceptional use of excavating equipment, and all boulders whose individual volume is 1/2 cubic yard or more.

(b) Pipe Clearance in Rock - When rock is encountered in the excavation, it shall be removed to the depth shown on the Drawings or 6 inches below the bottom of the utility when no underdrain is required. If an underdrain is required, additional excavation shall be made to the depth and width required for the underdrain. The width of rock excavation shall be two (2) feet greater than the inside diameter of the utility unless otherwise specified.

(c) Blasting - Where blasting is necessary, the Contractor shall do the work as specified in the General Requirements.

17.03.12

Removal of Surface Features - The costs of removing pavement, curb and gutter, sidewalk, trees, brush, or other structures necessitated by the excavation for placing utilities shall be included in the unit price bid for the utilities unless otherwise shown on the Drawings or indicated in the Bid Form or Special Specifications.

17.03.13

Prolonged Trench Maintenance - When conditions are such that the final restoration has to be prolonged, the Contractor shall maintain all roadways, driveways and sidewalks in condition suitable for their convenient and safe use until such time as they are permanently restored.

This will include the use of such bituminous material as may be necessary and approved by the Engineer as a temporary surface in areas which ultimately receive either a bituminous or concrete surface. The costs of such temporary materials shall be included in the unit prices bid for installing the utilities unless otherwise shown on the Drawings or indicated in the Special Specifications.

17.03.14

Removing Abandoned Utilities - The cost of removal of all abandoned underground utilities (such as street light conduits, gas mains, water mains, etc.) necessary to install new underground utility lines shall be included in the unit price bid for installation of the utility.

17.03.15

Holding Utility and Street Lighting Poles - The Contractor shall be responsible for holding any utility or street lighting pole which are locate adjacent to the proposed underground utility or utilities that the Contractor is constructing and he/she shall provide all necessary materials, labor, and equipment necessary for holding the pole, for adequate compaction of backfill near the pole, and for any temporary or permanent guys and anchors. Any damage to underground and/or overhead utilities shall be the responsibility of the Contractor and shall be repaired or replaced by the Contractor at his/her expense All work associated with holding these poles shall be considered to be included in the major items of work for placing the utility or utilities.

17.03.16

Cleaning-Up - The Contractor shall remove surplus excavated materials and materials for construction as the work progresses, and shall render the street suitable, safe, and convenient for traffic. Before final acceptance of the work, the Contractor shall clean the street surface, walks, gutters, fences, lawns, private property, right-of-way, and structures, leaving them in as good condition as originally found or better, and shall remove all machinery, tools, surplus materials, temporary buildings and other temporary structures from the site of the work. Furthermore, the

sewers, manholes, inlets, etc. shall be cleared of all scaffolding, centering, rubbish, dirt, dams or other obstructions.

17.04 Measurement and Payment:

Payment for the work covered in this section shall be included in the unit price of the utility work being accomplished, except for rock excavation and removal of unsuitable soil. The completed work as measured for "Rock Excavation" and "Remove Unsuitable Soil and Replace with \_\_\_\_\_" will be paid for at the unit price for the following Contract Items (pay items). The price for these items shall be payment in full for furnishing all labor, equipment and materials, and for performing the work complete.

<u>Bid Item</u>	<u>Bid Unit</u>
Rock Excavation	cu yd
Remove Unsuitable Soil and Replace with _____	cu yd

17.04.01 "Rock Excavation" shall be paid for at the Bid price per cubic yard, which shall be payment in full for all work as specified in this Division.

Only boulders of one-half (1/2) cubic yard or greater in volume or rock defined herein will be measured for payment. Measurements of rock will be made by the Engineer after rock is removed from the excavation by measuring the trench before the pipe is installed.

The cross sectional area will be measured at 25-foot intervals or closer if required to accurately measure the trench. The maximum depth which will be measured for payment shall be from the top of the rock formation to the specified subgrade for the pipe embedment material. The maximum width of trench to be considered for payment shall be as follows:

Below outside top of pipe, maximum width shall be the inside diameter of the pipe plus 2 feet, but not less than 30 inches.

From outside top of pipe to top of rock formation, maximum width shall be computed based on a 5 on 1 slope vertically for the sides of the trench.

The volume will be computed by the Engineer using the method of average end areas based on measurements of rock actually removed subject to the maximum limits specified.

If a unit price has not been established in the Bid Form, payment for rock excavation will be based on the contract Provisions for extra work.

17.04.02 "Remove Unsuitable Soil and Replace with \_\_\_\_\_" will be measured in cubic yards as specified in this Division for "Unstable Foundation," and paid for at the unit price listed in the Bid Form.

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## DIVISION 18

### SEWERS

18.01 Description

18.02 Materials

18.02.01 (a) Sewer Pipe

(b) Sanitary and Storm Sewer Lateral Pipe

18.02.02 Joints for Sanitary and Storm Sewer Pipes; and for Sewer Laterals and  
Catch Basin Connections

18.02.03 Pipe Test Certification

18.02.04 Cement, Mortar

18.03 Construction Methods

18.03.01 Excavation and Backfill

18.03.02 Laying Sewer Pipe

18.03.03 Concrete Cradle

18.03.04 Testing and Inspection of Sewers

18.03.05 Sewer Reconstruction

18.04 Measurement and Payment

## DIVISION 18

### SEWERS

18.01 Description:

The work shall consist of constructing sanitary or storm sewer pipe of the specified sizes placed in a trench, and shall include furnishing and installing the pipe, excavation and backfill. The work also shall include connections to the sewer, sewer laterals to the abutting property when specified in the case of a sanitary sewer, and basin connections which connect catch basins to manholes or the storm sewers.

18.02 Materials:

18.02.01 (a) Sewer Pipe - Sanitary and storm sewer pipe and pipe used for basin connections, shall conform to one or all of the following current ASTM or other specifications as designated on the Drawings or in the Bid Form. Pipe furnished for a particular project shall be of the materials shown on the Drawings or specified in the Bid Form for that project. No changes in pipe material or size will be allowed between manholes.

(1) Concrete Pipe conforming to the current ASTM specification C-14 Class 1 through 3, or ASTM Specification C-76 Class I through V, as shown in the Drawings or specified in the Bid Form. (Sanitary sewers, storm sewers, or basin connections 10 inches and larger)

(2) Vitrified Clay Pipe conforming to the current ASTM Specification C-700 or for either standard or extra-strength pipe or to the current National Clay Pipe Institute's Specification ER 4-67, as shown in the Drawings or specified in the Bid Form. (Sanitary sewers only)

(3) PVC Truss (Polyvinyl Chloride Composite) Pipe shall conform to current ASTM Specification D-2680 as shown on the Drawings or specified in the Bid Form. (Sanitary sewers only)

(4) PVC (Polyvinyl Chloride) Solid-Wall Pipe where approved, shall conform to current ASTM specification D-3034, including appendixes, with a standard dimension ratio of 35 (SDR-35). The use of PVC Solid Wall Pipe shall only be permitted on a project by project basis and said approval shall be prior to bids being received and the Drawings or Special Specification shall so state. (Sanitary sewers only)

(5) Ductile Iron Pipe shall conform to the current ANSI Standard A 21.50, thickness Class 53. Ductile Iron Pipe shall be cement mortar lined in accordance with the current ANSI Standard A 21.51 as shown on the Drawings or specified in the Bid Form. (Sanitary sewers, storm sewers, or basin connections)

(b) Sanitary and Storm Sewer Lateral Pipe for houses shall be vitrified clay, PVC Truss, PVC Solid-Wall, or Ductile Iron Pipe, unless otherwise specified.

(1) Vitrified Clay Pipe for depths up to ten (10) feet shall be standard strength pipe conforming to current ASTM specification C-700X. Depths over ten (10) feet shall be as shown on the Drawings or listed in the Bid Form.

(2) PVC Truss Pipe (Composite Sewer Pipe) shall conform to the current Specification ASTM D-2680.

(3) Concrete Pipe shall conform to the requirements of the current ASTM Specification C-14 Class 3, or C-76 Class III for depths up to ten (10) feet. For depths over ten (10) feet, the pipe shall be as shown on the Drawings or listed on the Bid Form. (Laterals 10 inches or larger)

(4) PVC (Polyvinyl Chloride) Solid-Wall Pipe shall conform to the current ASTM Specification D-3034 with a standard dimension ratio of 35 (SDR-35).

(5) Ductile Iron Pipe shall conform to the current ANSI Standard A 21.50, thickness Class 53. Ductile Iron Pipe shall be cement mortar lined in accordance with the current ANSI Standard A 21.51.

18.02.02

(a) Joints for Sanitary and Storm Sewer Pipes, and for Sewer Laterals and Catch Basin Connections shall conform to the following specifications.

(1) Concrete Pipe - Joints for concrete Sanitary Sewer Pipe of 10-inch diameter and larger shall be of the round rubber gasket type, or Glipp Type, using a modified bell and spigot design. The spigot shall have an external groove accurately sized to receive the gasket, so that when the pipe is laid and the joint completed, the gasket shall be enclosed on all surfaces. Joints and gaskets shall conform to the current ASTM Specifications C443 except the taper on the conic surfaces of the inside of the bell and the outer surface of the spigot shall not be more than two (2) degrees with respect to the longitudinal axis of the pipe. The durometer hardness of rubber gaskets shall be 45, plus or minus 5, and the gaskets shall have a circular cross section or be the Glipp Type. The Contractor shall furnish to the Engineer a detailed drawing showing the pipe and joint proposed to be furnished under these specifications.

(2) Vitrified Clay Pipe joints shall conform to the current ASTM specification C-425 Types I, II or III.

(3) PVC Truss Pipe and PVC Solid-Wall Pipe Joints shall be chemically welded or shall be of the elastomeric gasket seal (O-Ring) type as specified in the current ASTM Specification D-3212. Care shall be taken to insure that all joints are pushed to the full "home" position and held tightly in the "home" position during any grade or line adjustments. If solvent is used, pipe shall be rotated during joint insertion to insure a complete spread of joining cement. Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers and adhesives shall be used as recommended by the pipe manufacturer. Installations of solvent weld joint pipe shall be installed in accordance with current ASTM specification F-402, and all required precautions shall be taken to assure adequate trench ventilation and protection for workers installing the pipe. Swab-type applicators shall be used to apply primer and cement. Opened containers in the trench shall be protected from dirt, water and other contaminants.

(4) Ductile Iron Pipe - Joints shall be push-on type coupled in accordance with ANSI/AWWA C-111/A 21.11

(b) Mortar Joints for Storm Sewers - Only when specifically shown on the Drawings, listed in the Bid Form, or approved by the Engineer, pipe joints on storm sewers can be made with mortar in lieu of the O-rings specified.

Mortar joints shall be made as follows: After each section of pipe is laid, the lower portion of the bell shall be filled with mortar and the succeeding section shall be laid in place so that the inner surfaces of the abutting sections are flush. The remainder of the joint shall then be filled with mortar and sufficient additional mortar used to form a bead around the joint, which shall be flush with the outside diameter of the bell. The inside of the joint shall be wiped clean and smooth. The joints of concrete pipe shall be thoroughly wet before the mortar is placed. The use of a bituminous or similar type mastic will not be permitted.

18.02.03 Pipe Test Certification - Contractor shall make arrangements to furnish the Engineer with a satisfactory test report by an approved independent Testing Consultant to be hired by the City covering all pipe delivered to the site. It shall, as a minimum, include the following information as may be applicable: ASTM specifications, breaking test data, absorption test data, test cylinder data and other information as may be required by the Engineer.

The Testing Consultant shall stamp all pipe covered by his/her test report and delivered to the job site.

The cost of the above-described testing shall be paid for by the City. Any testing charges resulting from unsatisfactory pipe having been furnished shall be the responsibility of the Contractor.

The Engineer may, in cases where in his/her opinion the work is of such small quantity as to make the above requirement unnecessary, waive or alter these test requirements if so requested prior to delivery of pipe to a job site.

The Engineer also may, in cases where the pipe manufacturer has an approved testing facility, accept certification test reports of tests performed by the manufacturer.

18.02.04 Cement, Mortar - Cement and mortar used for the work under this Division shall be as specified under Division 7.

18.03 Construction Methods:

18.03.01 Excavation and Backfill - Excavation and backfill for sewers shall be done in accordance with Division 17.

18.03.02 Laying Sewer Pipe

(a) General - Alignment and depth of the pipe shall be as shown on the Drawings, unless otherwise approved by the Engineer. The construction shall begin at the outlet end and proceed toward the upper end. The pipe shall be carefully laid in the prepared trench to the line and grade as shown on the Drawings or as approved by the Engineer, with the spigot end downstream. The bottom of the trench shall be so shaped to permit a firm and even bearing along the barrel of the pipe. A sufficient sand cushion shall be provided in clay soil as specified in Division 17, where approved by the Engineer. The pipe shall be fitted close and tight and with smooth inverts. All

connections to existing manholes or catch basins shall be of the flexible type (Rubber Boot) as specified in Division 20.

Whenever a force or pressure main is to be constructed in which sewage will be pumped under pressure, it shall be installed according to the Construction Methods as specified in Division 21.

(b) Laser - The Contractor shall use the laser beam method of maintaining line and grade for sewer construction. The Contractor shall submit evidence to the Engineer that a qualified operator will handle the laser beam equipment during the course of construction.

The Engineer shall place the line and grade stakes at each manhole, or more often, as he/she determines is appropriate. The Contractor shall check the line and grade at every point at which a stake has been placed.

(c) Laterals - In sanitary sewers, the openings for house connections shall be tees or wyes (unless otherwise noted) placed at the locations shown on the Drawings or as approved by the Engineer, and the pipe shall be laid from the tee to the property line. These laterals 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. Lateral shall be constructed at a minimum 1% grade from the main to the right-of-way or easement line. The depth of the lateral, below grade, at the right-of-way or easement line shall be no greater than nine and one half feet (9.5'), unless otherwise shown on the Drawings, or approved by the Engineer. The upper end of the lateral shall be closed with a stopper sealed in place by the same joint and material as used for the lateral. The location of the end of each lateral and of each stoppered opening in the sewer shall be marked by a 2 in. x 2 in. wooden stake which shall extend vertically from the sewer pipe to just below the ground, and which shall have at its lower end, a piece of lumber 1 in. x 2 in. x 6 in. securely nailed horizontally, and shall have at its upper end a securely fastened, heavy ferro-magnetic washer.

In the event that the lateral being constructed is to be constructed all the way to the structure which it will serve, the final connection is to be made by a licensed plumber in possession of a valid connection permit. No lateral is to be constructed any closer than five feet to the structure it is to serve without the above requirements being met.

No sewer lateral may be connected into any newly constructed sanitary sewer until such time as said sewer has been approved and an "In-Service" letter has been written by the Engineer.

Approved premanufactured pipe-to-pipe adapters shall be utilized on all laterals where more than one type of pipe is used.

(d) Extra Strength Laterals - Where the sanitary sewer main is at an excessive depth below the established street grade, an extra strength lateral as per Detail S-17 shall be constructed at the location shown on the Drawings or profile, of the diameter and height specified, or as approved by the Engineer, for the purpose of providing a connection at the top of such riser for a house lateral.

(e) Other Connections - All other connections, including catch basin connections, shall be made in tee or wye openings at the locations shown on the Drawings or as approved by the Engineer.

(f) Cut-Ins - When cutting into a larger sewer, the opening in the larger sewer shall be no larger than is necessary to admit the new sewer or lateral. Openings shall be circular. All broken or surplus material shall be removed from both sewers.

When the larger sewer is of reinforced concrete construction, the reinforcing steel shall be carefully cut off to the proper distance to avoid spalling the concrete. For connecting clay or concrete sewers greater than 24 inches, the sewer shall be neatly grouted into the receiving sewer as approved by the Engineer. For connecting clay or concrete sewers, 12 inches through 24 inches, the hole shall be cored in, and the connection between the new sewer and the sewer which was cut into shall be made with a flexible rubber boot as specified in Division 20. Cut-ins for clay or concrete pipe 12 inches in diameter and less shall be made with a sewer saddle as shown in Detail S-20, unless otherwise approved by the Engineer.

For PVC pipe, the connection shall be made using a saddle, solvent welded onto the cut pipe. The saddle shall be anchored with two stainless steel clamps in addition to the solvent weld. The saddle shall cover at least one half the outside diameter of the pipe.

(g) Cutting PVC, Truss and PVC Solid-Wall Pipe - The cutting of PVC truss pipe and PVC solid-wall pipe lengths, where required, shall be performed by the use of tools or equipment that will provide a neat, perpendicular cut without damage to the plastic or filler material. Bowing or warping of PVC pipe can occur with temperature fluctuations. The Contractor shall store and protect from sunlight the pipe to minimize bowing. Nominal 12-foot 6-inch pipe lengths having deviations from straight greater than one inch shall not be used.

18.03.03 Concrete Cradle - Where a concrete cradle is required, it shall be built of Grade A concrete, as specified in Division 7, and to conform to the details and at the locations shown on the Drawings or as approved by the Engineer.

18.03.04 Testing and Inspection of Sewers - All sanitary sewer pipes and their service laterals shall be tested and inspected for infiltration and exfiltration by the Contractor. Storm sewer pipes and basin connections shall be tested for infiltration by the Contractor. Any construction which fails the requirements of this section will be sealed and retested at the expense of the Contractor. Any construction which cannot be sealed to bring the sewer within the requirement of this section will be reconstructed and retested at the Contractor's expense. The cost of the initial test and inspection will be included in the unit cost of the Construction of the sewer.

PVC solid wall and PVC truss pipe shall be inspected to ensure that the pipe has not deformed. The complete installation shall at no point have out-of-round deflections greater than 5%. The Engineer shall have the option of requiring deflectometer or go/no go gauging tests run prior to acceptance of pipe on pipelines where high deflections are suspected. Pipe with deflections greater than 5% will be considered unacceptable and shall be relaid by the Contractor. The cost of such testing will be considered to have been included in the price bid for the sewer.

Exfiltration test shall be conducted by a water test or a low pressure air test. When the sewers are to be tested with water, the Contractor shall isolate a section or sections of the sewers between manholes by means of approved temporary type of watertight bulkheads. The isolated section of sewer shall then be filled with water to a level which is two and one-half (2-1/2) feet above the existing water table, but not less than two and one-half (2-1/2) feet above the end of the highest lateral or crown of the sewer pipe at the high end of the isolated section under test. The length of the section shall be such that, where possible, the water level at its lower end will not be

more than five (5) feet above the crown of the pipe except as may be required by a high water table. The length of time of the exfiltration test period shall be at the discretion of the Engineer. Determination of the amount of exfiltration shall be made by measurement of the loss of volume of water in the manholes. The amount of exfiltration over a 24-hour period will then be calculated from the measured loss of volume and time period.

Infiltration shall be measured by the temporary placement of weirs in manholes capable of accurately measuring the infiltration which occurs.

Rates of infiltration or exfiltration for sewers will not exceed 100 gallons per day, per inch of diameter, per mile of sewer.

Tabulation of this requirement for various diameters per lineal foot is as follows:

Diameter of Sewer <u>in Inches</u>	Infiltration or Exfiltration in Gallons per day <u>per lineal foot</u>	Diameter of Sewer <u>in Inches</u>	Infiltration or Exfiltration in Gallons per day <u>per lineal foot</u>
6"	.113	30"	.568
8"	.151	36"	.681
10"	.198	42"	.795
12"	.227	48"	.909
15"	.284	54"	1.022
18"	.341	60"	1.136
21"	.397	66"	1.250
24"	.454	72"	1.363
27"	.511		

Exceeding these amounts will be considered as failure for the tested lengths of sewer. Lengths of sewer to be tested will be approved by the Engineer.

Visual Inspection by sight and television will be provided by the City for all new sewers. Any infiltration which is observed shall be sealed by the Contractor.

On any section of sewer that the Engineer shall deem it impractical to test by means of the water exfiltration test specified in this Division, the following air test shall be used. 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. The average back pressure is determined by inserting a pipe probe by boring or jetting, into the backfill material adjacent to the center of the pipe, and determine the pressure in the probe when air passes slowly through it. All gauge pressures in the test should be increased by this amount. 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 pressure drop from 3.5 psi to 2.5 psi is not less than the holding time listed in the table which follows.

LOW PRESSURE AIR TEST TABLES  
 TIME REQUIRED FOR 1.0 PSIG PRESSURE DROP  
 WHEN TESTING ONE PIPE DIAMETER ONLY FOR SIZE AND LENGTH OF PIPE INDICATED.

TABLE FOR PVC AND DI PIPE

1 Pipe Diameter (in.)	2 Minimum Time (min:sec)	3 Length for Minimum Time (ft.)	4 Time for Longer Length (sec.)	Test Time for Length (L) Shown (min:sec)							
				100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

TABLE FOR VCP AND CONCRETE PIPE

1 Pipe Diameter (in.)	2 Minimum Time (min:sec)	3 Length for Minimum Time (ft.)	4 Time for Longer Length (sec.)	Test Time for Length (L) Shown (min:sec)							
				100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
4	1:53	597	.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:48	11:24	12:50
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23
42	19:50	57	20.939L	34:54	52:21	69:48	87:15	104:42	122:09	139:36	157:03

Note: When testing two sizes of pipe simultaneously, time shall computed by ratio of lengths involved.

Example: 400 feet of 8-inch PVC pipe and 150 feet of 6-inch VCP pipe.

$$\begin{aligned}
 \text{Time} &= \frac{\text{Time} = \text{Length}_1 \times \text{Time}_1 + \text{Length}_2 \times \text{Time}_2}{\text{Length}_1 + \text{Length}_2} \\
 &= \frac{400 \times 10:08 + 150 \times 2:50}{400 + 150} = \frac{400 \times 608 + 150 \times 170}{400 + 150} \\
 &= 489 \text{ seconds} = 8:09 \text{ (min:sec)}.
 \end{aligned}$$

18.03.05 Sewer Reconstruction

(a) Removal of Existing Sewer - When so noted on the Drawings, the work under this section shall include the removal of all existing sewers and laterals, which are to be replaced by the reconstructed sewer system. No extra compensation will be paid for said removal or for any necessary plugs.

(b) Maintaining Existing Services - The Contractor shall make every reasonable effort to maintain uninterrupted water and sewer service to all property owners adjoining the project. In the event that such interruption of service is unavoidable it shall be done only with prior approval of the Engineer. Any necessary pumping of sewage for any reason whatever shall be the responsibility of the Contractor. This responsibility shall commence at the time the Contractor commences reconstruction operations, or 48 hours after the award of the contract, whichever occurs first, unless otherwise required in the Special Specifications.

(c) Reconnection of Laterals - The Contractor shall carefully uncover the existing sanitary sewer and locate all connections thereto. It shall be the Contractor's responsibility to reconnect all live laterals. Where the property is vacant, one lateral per lot shall be reconnected. The Contractor shall place tees or wyes in the reconstructed sewer as close to the existing laterals as is possible. No tee or wye shall be placed upstream from the lateral. Tees and wyes shall be shop fabricated. No field connections into the reconstructed sewer line will be allowed, unless approved by the Engineer. Any necessary additional lateral alignment may be accomplished by using premium jointed bends, provided that no bends shall be sharper than 45 degrees.

During the process of construction the Contractor shall "Dye" all existing sanitary laterals for the purpose of making certain that all existing sanitary laterals have been reconnected. The dyeing process shall consist of pouring a sufficient quantity of an approved dye into each lateral (toilet, drain, etc.) of each structure adjacent to the sewer being reconstructed. The Contractor shall make the arrangements necessary to gain access to buildings adjoining the project. This work shall be considered incidental to the other items and no extra compensation will be paid therefore.

The Contractor shall clean and inspect the lateral to the property line, and advise the Engineer of the condition of the lateral prior to making the connection.

The necessary field connection between the new lateral pipe and the existing lateral pipe shall be made by cutting the new lateral pipe to the proper length, inserting a prefabricated pipe to pipe adapter, and pouring a concrete collar not less than six (6) inches thick by twelve (12) inches wide around the joint. In the event the lateral is constructed of truss pipe no concrete collar is to be placed. No misalignment or angle point will be allowed at the field connection.

18.04 Measurement and Payment:

The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The prices shall be payment in full for furnishing all labor, equipment and material and shall include all clearing, tree removal, tree root protection, removal of pavement, excavation, trenching, cofferdams, dewatering, cut-ins, furnishing and placing the pipe, fittings and plugs, bedding, all backfilling, disposal of excess material, temporary sheeting and bracing, removal of abandoned utilities and services, temporary support, removal and replacement of existing utilities and services, and the repair and replacement thereof if damaged, connection of existing sewers, testing, and all other work required for a complete job.

Pay Item	Pay Unit
____ " Sanitary Sewer C-700X	lin ft
____ " Sanitary Sewer D-2680	lin ft
____ " Sanitary Sewer C-76 Cl. _____	lin ft
____ " Sanitary Sewer _____	lin ft
6" tee/wye on ____ " Sanitary sewer	each
____ " Sanitary Sewer Lateral	lin ft
Adjust Existing Sanitary Lateral	lin ft
____ " Extra Strength Sanitary Sewer Lateral, per Detail S-17	lin ft
Reconnect Existing Sanitary Sewer Lateral	each
Saddle for ____ " Lateral on ____ " Diameter or Less Sanitary Sewer, per Detail S-20	each
Drop Connection, per Detail S-1A, on ____ " Sanitary Sewer	each
Drop Connection, per Detail S-1A, on ____ " Sanitary Sewer, Over 15' Deep	each
____ " Storm Sewer C14 Cl. _____	lin ft
____ " Storm Sewer C76 Cl. _____	lin ft
____ " Tee on ____ " Storm Sewer	each
____ " Basin Connection C14 Cl. _____	lin ft
____ " Basin Connection C76 CL. _____	lin ft

18.04.01 Sewers of the size(s) shown in the Bid Form shall be measured in lineal feet along the centerline of the pipe, without reductions in length for manholes or other structures.

18.04.02 Sewer Laterals of the size(s) shown in the Bid Form shall be measured in lineal feet along the centerline of the pipe from the center of the main line sewer to the other end of the pipe.

18.04.03 Tees and Wyes shall be measured as units furnished. Payment for laying tees or wyes shall be included in the price for furnishing and laying the sanitary sewer.

- 18.04.04            Adjust Existing Sanitary Lateral shall include relaying the existing sanitary sewer lateral to clear any proposed sanitary sewer, storm sewer, or large water main and shall be measured in lineal feet along the centerline of the sanitary sewer lateral, so adjusted and accepted by the Engineer.
- 18.04.05            Basin Connections of the size(s) shown in the Bid Form shall be measured in lineal feet along the centerline of the pipe from the center of the manhole or receiving sewer to the center of the catch basin.
- 18.04.06            Reconnect Existing Sewer Lateral shall be measured on the basis of a unit price for each connection, including furnishing and placing all necessary bends, any necessary sewer lateral pipe, the pipe-to-pipe adapter, the concrete collar, surface restoration (unless separate pay items are provided therefor) and all else necessary and incidental thereto. The Contractor will be compensated for the tee or wye under the appropriate item.

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DIVISION 19  
WATER MAINS

19.01 Description

19.02 Materials

- 19.02.01 Ductile Iron Pipe
  - 19.02.02 Concrete Water Pipe
  - 19.02.03 Ductile Iron Restrained Joint Pipe
  - 19.02.04 Water Main Fittings
  - 19.02.05 Mechanical Joint Anchoring Fittings for Hydrants
  - 19.02.06 Joint Restraining Glands
  - 19.02.07 Tie Rods, Clamps, Nuts, Eye-Bolts and Appurtenances
  - 19.02.08 Gate Valves and Tapping Valves
  - 19.02.09 Butterfly Valves
  - 19.02.10 Compression Type Fire Hydrants
  - 19.02.11 Copper Water Service Pipe
  - 19.02.12 Copper to Copper Connections
  - 19.02.13 Lead Corporation Stop to Copper Connection
  - 19.02.14 Tapping Saddles
  - 19.02.15 Smith-Type Tapping Sleeves
  - 19.02.16 Corporation Stops
  - 19.02.17 Curb Stops
  - 19.02.18 Curb Boxes
  - 19.02.19 Valve Boxes
  - 19.02.20 Rust Preventive Coating
- 19.03 Construction Methods
- 19.03.01 Excavation
  - 19.03.02 Horizontal and Vertical Changes
  - 19.03.03 Interruption of Water Service
  - 19.03.04 Continuity of Service for Reconstructing an Existing Water Main
  - 19.03.05 Pipe Installation
  - 19.03.06 Assembling Mechanical Joint Pipe
  - 19.03.07 Assembling Slip Joint Pipe
  - 19.03.08 Jointing Concrete Water Pipe

- 19.03.09 Plastic Wrap for Pipe
- 19.03.10 Setting Valves, Valve Boxes and Specials
- 19.03.11 Setting Hydrants
- 19.03.12 Laying Water Services
- 19.03.13 Tapping for Water Services
- 19.03.14 Reconnect Existing \_\_\_\_" Copper Water Services
- 19.03.15 Replace Lead Water Service with \_\_\_\_" Copper Water Service
- 19.03.16 Anchorage of Bends, Valves, Tees and Plugs
- 19.03.17 Hydrostatic Testing, Chlorination and Bacteriological Testing
- 19.04 Measurement and Payment

## DIVISION 19

### WATER MAINS

19.01 Description:

The work shall consist of constructing water mains of specified sizes and appurtenances as specified in the Bid Form and as shown on the Drawings, including the furnishing of all labor, equipment, and materials. The placement of water mains, water service connections, and appurtenances shall also include the excavation and backfilling of the trench as necessary.

All reference to American Water Works Association (ANSI/AWWA) standards shall be to the latest revision thereof.

19.02 Materials:

Materials to be furnished by the Contractor shall meet the following requirements:

The Contractor will furnish certification by the Manufacturer stating that the pipe, specials, valves, hydrants or other materials as required by the Engineer conform to the required specifications.

In addition, all valves and hydrants are to be tagged or stamped by the Manufacturer stating that they conform to the Standard Specifications. The tag or stamp shall be permanently attached to valves and the barrel of hydrants.

All stainless steel materials used in this Division shall conform to ASTM F-593 or F-594.

19.02.01 Ductile Iron Pipe - Ductile iron pipe shall meet or surpass ANSI/AWWA C151/A21.50-816 (R86) and be in accordance with the specifications noted herein. All pipe shall be centrifugally cast. Also, all pipe shall be lined with cement mortar on the inside in accordance with ANSI/AWWA C-104/A21.4.

Unless otherwise specified, the pipe joints will be push-on type coupled in accordance with ANSI/AWWA C-111/A21.11.

Unless otherwise specified, all pipe shall be Class 53.

19.02.02 Concrete Water Pipe - Concrete water pipe shall be in accordance with ANSI/AWWA C-301 with a working pressure of 175 P.S.I.

19.02.03 Ductile Iron Restrained Joint Pipe - All ductile iron restrained joint pipe shall be Clow Corporation "Super-Lock" or "Ball and Socket"; American Ductile Iron Pipe "Lok-Ring Joint", "Flex-Ring Joint", or "Molox Ball Joint"; Griffin Pipe Products Co. "Snap-Lok"; or approved equal. All components of the restrained joint shall be as manufactured, supplied, or recommended by the manufacturer of the restrained joint pipe system actually installed.

19.02.04 Water Main Fittings - All fittings shall be ductile iron in accordance with ANSI/AWWA C-153/A21.10 and with a minimum pressure rating of 350 P.S.I.

Nominal thickness of ductile fittings shall be equal to Class 53 Ductile Iron Pipe Thickness. Fittings shall be cement lined in accordance with ANSI/AWWA C-104/A21.4 and shall have mechanical joints in accordance with ANSI/AWWA C-110/A21.10.

19.02.05        Mechanical Joint Anchoring Fittings for Hydrants - Mechanical joint anchoring fittings furnished as an alternate to restrained joint pipe as noted in this Division for restraint of joints on hydrant laterals shall be Clow F-1215, F-1216, F-1217, F-1218, or approved equal.

19.02.06        Joint Restraining Glands - Joint restraining glands shall be Megalug as manufactured by EBAA Iron, Inc. or approved equal.

19.02.07        Tie Rods, Clamps, Nuts, Eye-Bolts and Appurtenances - All tie rods and nuts furnished as an alternative to restrained joint pipe as noted in this Division shall be stainless steel, ASTM F-593 and F-594. 3/4" Diameter eye-bolts and nuts required and as shown in the Standard Details will be "corten" steel or stainless steel. Clamps and other appurtenances which are not ductile iron, cast iron or stainless steel, shall be coated as specified herein.

19.02.08        Gate Valves and Tapping Valves - This specification covers cast or ductile iron body, bronze mounted gate valves for use in the water distribution system in sizes from 4 inches through 12 inches nominal diameter designed for direct bury and operated through a standard valve box. Gate valves shall be East Jordan, Traverse City, Waterous, Clow or approved equal. Valves are to be furnished in accordance with ANSI/AWWA C500 and in accordance with the following supplementary specifications:

(a) These valves are for ordinary water distribution system service in approximately level setting on buried pipelines. Unless otherwise noted on the Drawings, these valves shall be the same nominal size as the water main. They will be double disc gate valves with non-rising stems.

(b) Four copies of certified shop drawings shall be furnished as requested by the Engineer for each valve size and type including all repair parts ordering data.

(c) The valve shall have mechanical or restrained joint ends in accordance with ANSI/AWWA C500. Valves with mechanical joint ends will be furnished with accessories, including glands, gaskets, and "corten" steel or stainless steel tee-head bolts and nuts.

(d) The valves will be installed vertically in a horizontal line.

(e) The stems shall be made of Grade D or E bronze as listed in ANSI/AWWA C500.

(f) The stuffing box shall be the O-ring type as listed in ANSI/AWWA C500.

(g) Gland bolts shall be of Class B, C, D, or E bronze, "corten" steel, or stainless steel as listed in ANSI/AWWA C500.

(h) All valves shall rotate clockwise to open, wrench nut to be painted red, and be 1-15/16 inches square at the top, 2 inches square at the base and 1-3/4 inches high. The nut or cap screw for the wrench nut shall be bronze or stainless steel per ASTM F-593 and F-594.

(i) Bonnet bolts shall be rust-proofed by cadmium or zinc coating.

(j) The minimum number of turns to operate the valve from fully open to fully closed shall be in accordance with ANSI/AWWA/C500 using stems with single lead threads:

<u>SIZE</u>	<u>MINIMUM NUMBER OF FULL TURNS</u>
4 inches	12
6 inches	18
8 inches	24
12 inches	36

19.02.09

Butterfly Valves - This specification covers tight shut off butterfly valves for water system distribution valves, 24" and less, shall be designed for direct bury and operated through a standard valve box. Butterfly valves shall be Pratt Ground-Hog or approved equal.

Valves furnished under this specification shall conform to ANSI/AWWA C504, except as herein modified. Unless otherwise noted on the Drawings, these valves shall be the same nominal size as the water main.

Valves shall be Class 150-B and have mechanical or restrained joint ends in accordance with ANSI/AWWA C110.

(a) Four copies of certified shop drawings shall be furnished as requested by the Engineer for each valve size and type including all repair parts ordering data.

(b) Valves will be furnished with "corten" steel or stainless steel nuts and bolts.

(c) Manual operators shall be of the traveling nut slotted lever or link-lever type, sealed and gasketed, and lubricated to withstand submersion in water.

(d) The minimum number of turns to operate the manual valve from fully open to fully closed shall be the same as for gate valves using a single-lead stem in accordance with ANSI/AWWA C500.

(e) The operator or wrench nut shall be painted red and 1-15/16 inches square at the top, 2 inches square at the base and 1-3/4 inches high.

(f) The operator shall rotate clockwise to open and shall have the input shaft vertical.

(g) The body of the valve will be of the short pattern design unless specified otherwise.

(h) The maximum non-shock shutoff pressure rating shall be 150 P.S.I.

(i) Shaft seals shall be of the O-ring type and replaceable without removing the valve from service.

19.02.10

Compression Type Fire Hydrants - Compression type fire hydrants shall be in strict conformity with the ANSI/AWWA C502 and the following specifications:

(a) Four copies of certified shop drawings shall be furnished as requested by the Engineer for each hydrant including all repair parts ordering data.

(b) The main valve stem operating and supporting mechanism shall not restrict the flow of water through the nozzles. Loss of head due to friction, within the hydrant, corrected for inlet and outlet velocity head, shall not exceed the maximum permissible head loss as given in the following table:

No. of Outlet Nozzles	Nominal Diam. of Outlet Nozzles Inch.	Total Flow from Outlet Nozzles GPM	Max. Permissible Head Loss PSI
1	2-1/2	250	1.0
2	2-1/2	500*	2.0
1	4	1000	5.0

\* 250 gpm approximately, from each outlet nozzle.

(c) If the operating mechanism is under the main valve, it shall be bronze to bronze mounted. The hydrant top shall be of the dry type bonnet design (free-draining) and contain no oil.

(d) The hydrant valve shall be compression type and 5-1/4 inches in diameter.

(e) The inlet at the hydrant butt shall be mechanical joint ANSI A21.11 standard 6 inch.

(f) The delivery or head of the hydrant shall have two 2-1/2 inch and one 4-inch National Standard hose coupling male screw thread outlets with caps.

(g) The hydrant shall have a bury length of six feet from the invert of the connecting pipe to the ground line. The distance from the center line of the connecting pipe to the center line of the outlet nozzles shall not be less than seven feet six inches.

(h) Each nozzle cap shall have a suitable rubber or synthetic rubber gasket and chains with "S" hooks attached to the barrel.

(i) The hydrant shall be opened by turning the operating nut clockwise. A clearly visible arrow and the word "OPEN" shall be cast in relief on the top of the hydrant to designate the direction of opening.

(j) The hydrant shall be painted with a zinc chromate primer and finish coat of Rust-Oleum #944 chrome yellow above grade and with two coats of asphalt varnish below grade. Painting shall be in strict accordance with ANSI/AWWA C502.

(k) The hydrant operating nut and nozzle caps shall have a 1-3/4 inch square portion one inch high.

(l) O-ring seals shall be installed in the hydrant top. Stuffing box seals may not be used.

(m) The hydrant shall be capable of withstanding a minimum of 200 foot-pounds of torque in both the opening and closing directions without causing permanent deformation of metal parts.

(n) Barrel and stem extensions shall be made at or above the ground line and without digging.

(o) The hydrant mechanism shall be so designed that the valve may be easily removed and the valve seat, if required to be removed, shall have bronze to bronze mounting for easy removal.

(p) Outlet nozzles shall be threaded into the barrel and pinned.

(q) The hydrant shall be supplied with a tapped drain. The drain shall be plugged.

(r) Compression type fire hydrants shall be Clow-Eddy F-2641, Traverse City TVC-5 or East Jordan BR-5. If required by the Engineer, the Contractor shall submit a shop drawing of the proposed hydrant for review.

(s) The Contractor will be required to present an affidavit from the Fire Underwriter Laboratory that the maximum permissible loss of head is not exceeded if so requested by the Engineer.

19.02.11 Copper Water Service Pipe - Copper water service pipe two (2) inches and smaller in diameter shall be Type K, annealed seamless soft copper tubing in accordance with the current ASTM Specifications.

19.02.12 Copper to Copper Connections - Copper to copper connections shall be Mueller H-15400, H-15403, H-15406; McDonald 4756, 4758; Hayes 5610, 5615, 5615C.F.; Ford C-22, CS-22, C-44; Jones J-1528, J-1529, J-2609 or approved equal.

19.02.13 Lead Corporation Stop to Copper Connection - Lead corporation stop to copper connection shall be made with tapping adapter Mueller H-154-80 or approved equal.

19.02.14 Tapping Saddles - Tapping saddles shall have stainless steel straps and be Ford FC202 Series; Rockwell 317 and 393 Series; Romac 202N Series or approved equal. Threads shall be as per ANSI/AWWA C-800 (Standard Mueller Thread). NOTE: 1-1/2" and 2" taps require saddles on 4" through 16" water mains.

19.02.15 Smith-Type Tapping Sleeves - Smith-type tapping sleeves are to be all stainless steel sleeves with stainless steel flange, Ford FAST; Romac SST; Rockwell #663; JCM #432, or approved equal.

19.02.16 Corporation Stops - Corporation stops shall be Mueller H-15000, H-15008, H-15013; McDonald 4701, 4701B, 4701BT, 4701T; Hayes 4400, 4400C.F., 5200, 5200C.F.; Ford F-600, FB-600, F-1000, FB-1000; Jones J-3401, J-1500, J-1930, J-1937, or approved equal. Threads shall be as per ANSI/AWWA C-800 (standard Mueller thread).

19.02.17 Curb Stops - Curb stops shall be Mueller H-1502-2, H-1504-2, H-15200 or H-15204; McDonald 4713, 4713T, 6100 or 6100T; Hayes 4008, 4304, 4304C.F. or 5045; Ford B-22 or B-44; or Jones J-1949 or approved equal.

19.02.18 Curb Boxes - Curb boxes shall be the Buffalo type, Mueller No. H-10350 (with H-10349 base for 2" curb cock), Tyler No. 6500 "D" screw type, or approved equal.

19.02.19            Valve Boxes - Valve boxes (three piece) shall be Tyler 6860 series, or approved equal.

19.02.20            Rust Preventive Coating - Fittings, clamps, bolts, nuts, appurtenances, etc., which are not ductile iron, cast iron, stainless steel or corten steel, and are buried in the ground shall be coated with a coal tar protective coating in accordance with ANSI/AWWA C203. Also, existing steel water main encountered during construction shall be coated as noted above.

The material shall be Tnemec 46A-413 manufactured by Tnemec or Kop-Coat 300-M as manufactured by Kop-Coat Company or an approved equal.

The application of the material shall be according to the specifications or instructions of the Manufacturer.

The cost of furnishing and applying such material shall be included in the unit price bid for water main of the sizes shown.

19.03            Construction Methods:

19.03.01            Excavation - Excavation shall be done in accordance with Division 17 and the following conditions:

(a) Alignment - Alignment of the trench shall be as shown on the Drawings unless otherwise required by the Engineer.

(b) Depth - Depth of the water main shall be 5 feet 9 inches from grade to center line of pipe or have a minimum 5'-0" of cover to the top of the pipe, unless otherwise specified on the Drawings or required by the Engineer.

19.03.02            Horizontal and Vertical Changes - The data shown on the Drawings is indicative of adjacent and/or interfering structures and features, but is not guaranteed to be complete or exact in location and detail. Small adjustments can be made by deflecting joints as per manufacturers recommendation and not exceeding Table I and Table II as follows.

TABLE I

Maximum Deflection Full Length Pipe - Mechanical Joint Pipe					
Size of Pipe In	Deflection Angle Deg. - Min.	Maximum Deflection Inches		Approx. Radius of Curve Produced By Succession of Joints Feet	
		18-ft Length	20 ft. Length	18-ft. Length	20-ft. Length
4	8-18	31	35	125	140
6	8-07	27	30	145	160
8	5-21	20	22	195	220
10	5-21	20	22	195	220
12	5-21	20	22	195	220
14	3-35	13-1/2	15	285	320
16	3-35	13-1/2	15	285	320
18	3-00	11	12	340	380
20	3-00	11	12	340	380
24	2-23	9	10	450	500
30	2-23	9	10	450	500
36	2-05	8	9	500	550

TABLE II

Maximum Deflection Full Length Pipe - Slip Joint Pipe					
Size of Pipe In	Deflection Angle Deg	Maximum Deflection In		Approx. Radius of Curve Produced By Succession of Joints Ft	
		18-ft Length	20 ft. Length	18-ft. Length	20-ft. Length
4	5	19	21	205	230
6	5	19	21	205	230
8	5	19	21	205	230
10	5	19	21	205	230
12	5	19	21	205	230
14	3	11	12	340	380
16	3	11	12	340	380
18	3	11	12	340	380
20	3	11	12	340	380
24	3	11	12	340	380
30	3	11	12	340	380
36	3	11	12	340	380

Insofar as possible, the Contractor shall do the work in the locations shown on the Drawings, with minor adjustments allowable if approved by the Engineer. Deflections in pipes and fittings shall be made with sufficient number of joints being deflected to allow for clearance of underground structures. The maximum deflection permissible shall be limited to that allowed in the deflection tables. For approved vertical changes only, the depth from centerline of main to

grade shall not exceed 8 feet and the minimum distance from top of pipe to ground line is 4 feet provided said vertical change can be accomplished within 40 linear feet each side of the conflicting utility. When using concrete pipe or restrained joint pipe, laying schedules will be required and followed unless adjustments are approved by the Engineer.

19.03.03            Interruption of Water Service - The Contractor shall not operate any valve on any water main in service, except in case of emergency. In such emergency, the Contractor shall, with the approval of the Engineer, operate such valves consistent with normal valve operating procedures in order to relieve the emergency. The Contractor shall immediately notify the Fire Department, Grand Rapids Water System and consumers affected regarding the time and probable duration of each shut-off.

In other cases for which the Grand Rapids Water System personnel operate the valves, the Contractor shall notify the Fire Department, Grand Rapids Water System and consumers affected at least one day in advance of the shut-off. The Grand Rapids Water System will then open and close valves on mains in service where necessary, in conjunction with the Contractor's work, subject to such limitation as to time and place as requirements of the Grand Rapids Water System shall impose.

19.03.04            Continuity of Service for Reconstructing an Existing Water Main - Where the Contractor is replacing an existing water main, it shall be the Contractor's responsibility to schedule his/her work in such a manner so as to ensure that the time period during which water service is shut down is kept to a minimum. To this end, the Contractor shall construct the new water main while the existing water main remains in service. The following general procedure shall be employed to ensure minimum service interruptions:

(a) The Contractor shall lay the entire new main.

(b) The new main shall be tested and chlorinated.

(c) After the testing and chlorination has been approved, the Contractor shall connect one end of the new water main to the water system and plug the open end of the existing water main that is to be abandoned.

(d) While the Contractor is proceeding with the reconnection of existing water services, both the old and the new water mains shall be in service. each main being connected to the water system at one end only.

(e) Upon completion of the water service reconnections, the Contractor shall then remove the temporary plug from the "dead end" of the new water main and connect that end of the main to the water system to complete the loop and thereby disconnect permanently the old main from the water system.

(f) All work necessary to maintain service as described above shall be coordinated with the Engineer and the Grand Rapids Water System, and shall be considered as included in other items of the contract.

19.03.05

Pipe Installation -

(a) Manner of Handling Pipe, Etc. - Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and expedient completion of the work. All pipe, fittings, valves and hydrants shall be carefully lowered into the trench by means of derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to pipe or pipe coating. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

(b) Grade - The Contractor shall always check the lines and grades of the pipe as constructed from the stakes furnished by the Engineer. Any variation therefrom shall be corrected as approved by the Engineer before continuing with the work.

(c) Pipe Kept Clean - All dirt or other foreign material shall be removed from the inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying.

Whenever work is stopped for the day, a standard plug shall be securely placed in the end of the pipe. No tools or other articles shall be stored in the pipe at any time.

(d) Cutting Pipe - The Contractor shall cut the pipe in a neat, straight and uniform manner wherever necessary for placing valves, hydrants, special castings, or closure pieces without damage to the pipe and without extra cost to the City. The area adjacent to cuts made on pipe shall be beveled before assembly of the joint.

The method of cutting pipe shall be subject to the approval of the Engineer.

(e) Bell Ends to Face Direction of Laying - Unless otherwise approved, pipe shall be laid with bell ends facing the direction of laying; and for lines on an appreciable slope, bells shall, at the direction of the Engineer - face up-grade.

(f) Railroad Crossing - Whenever the line of the pipe shall cross any railroad or lie within the railroad right-of-way, all of the precautionary construction measures required by the railroad officials shall be followed by the Contractor.

(g) Spacers in Ductile/Cast Iron Sleeves - In connecting ductile/cast iron pipe together with a ductile/cast iron sleeve, the space between the adjoining ductile/cast iron pipes shall not exceed one inch. Where the space between adjoining ductile/cast iron pipe exceeds one inch, a spacer shall be placed to fill the space. The spacer shall be a piece of ductile iron pipe of the same diameter and class as the adjoining pipes and shall be cut straight and uniform and be free of defects and damage.

19.03.06

Assembling Mechanical Joint Pipe -

(a) Preparation of Pipe Ends - The last exterior 8 in. of the plain end and inside of the bell of mechanical joint pipe shall be thoroughly cleaned to remove oil, grit, tar (other than standard coating), or any other foreign matter and then painted with a non-toxic, tasteless, odorless vegetable soap product recommended and/or supplied by the Manufacturer. The retaining gland shall then be slipped on the plain end of the pipe with the lip extension of the gland toward the bell end of the pipe to be joined. The rubber gasket shall be cleaned and painted with the vegetable soap product and placed on the plain end with the thick edge toward the gland.

(b) Alignment of Pipe in Bell - The plain end shall be centered in the bell, the pipe forced "home", and brought into alignment; it shall be secured there with sand carefully tamped under and around it, excepting at the bell holes. Care shall be taken to prevent dirt from entering into the joint space.

(c) Bolting of Joint - The entire section of the pipe shall be pushed forward to seat the plain end in the bell. The gasket shall then be pressed into place within the bell, being careful to have the gasket evenly located around the entire joint. The retaining gland shall be moved along the pipe into position for bolting, all of the bolts inserted, and the nuts screwed up tightly with the fingers. All nuts shall be tightened with a torque limit wrench. The torque limits for various sizes of bolts shall be as follows:

Size	Range of Torque
<u>In.</u>	<u>Ft - Lb.</u>
5/8	45-60
3/4	75-90
1	100-120
1-1/4	120-150

Nuts spaced 180 degrees apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This may be done by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, and last, the remaining bolts. Repeat this cycle until all bolts are within the above range of torques. If effective sealing is not attained at the maximum torque indicated above, the joint should be disassembled and reassembled after thorough cleaning. Overstressing of bolts to compensate for poor installation practice is not allowed.

19.03.07

Assembling Slip Joint Pipe -

(a) Preparation of Pipe Ends - After the pipe is lowered in the trench and positioned for jointing, the inside of the bell and the outside of the plain end of the jointing pipe must be wiped clean to the guide line stripe. The gasket is then inserted in the groove in the bell by flexing so that it is in the proper position. A liberal coating of the vegetable soap product, as specified in this Division, shall be applied to the outside of the plain end from the plain end to the guide line.

The condition of the trench bottom must be such that correct position and location of the pipe results in a joint of maximum tightness and a permanent seal is assured.

(b) Restrained Joint Pipe - Restrained joint pipe will be assembled in the same manner as slip joint pipe and as outlined in the Manufacturer's recommendations.

(c) Permissible Deflection of Joints - Permissible deflection of joints in slip joint pipe shall be in accordance with Table II. Permissible deflection for restrained joint pipe shall be in accordance with the Manufacturer's recommendation.

19.03.08

Jointing Concrete Water Pipe -

(a) Preparation of Pipe Ends - The joint rings and rubber gasket shall be cleaned and liberally lubricated with an approved type of vegetable oil soap.

(b) Alignment of Pipe in Bell - The plain end, with the gasket placed in the groove, shall be centered into the bell of the pipe already laid, making sure that both pipes are properly aligned. The pipe is then forced "home". After the plain end ring is well centered into the joint ring, so that the gasket shall be fully compressed and brought to its final shape, and just before the pipe is brought fully home, each gasket shall be carefully checked with a suitable feeler gauge supplied by the pipe manufacturer for being in proper position around the full circumference of the joint. If the gasket is found not to be in proper position, the pipes shall be separated and the damaged gasket replaced.

(c) Pouring Cement Grout in Diaper - When the pipe has been joined, a band at least five and one-half inches (5-1/2) wide shall be placed around the outside of the pipe at the joint as recommended and available from the pipe manufacturer. The band shall serve as a form for placing a 1:2 cement mortar grout in the external recess formed by the face of the bell and the shoulder of the plain end.

The cement mortar grout materials and preparation shall meet the requirements of ANSI/AWWA C300.

If a reinforced paper joint band is used, it shall be drawn up tight around the pipe and the backfill tamped against it up to the spring line before pouring the grout. If a cloth band is used, it shall be wired around the outside of the pipe and the grout poured before backfilling. On pipes of 24-inch diameter or larger, the joint space remaining on the inside of the pipe shall be filled with a stiff mix of 1:2 cement mortar which shall be troweled in place so as to produce a continuous smooth flush surface across the joint.

(d) Permissible Deflection in Joints of Concrete Water Pipe - Wherever necessary to deflect pipe from a straight line, either in a vertical or horizontal plane, to avoid obstructions, to plumb stems, or for any other reason, the degree of deflection shall be such so that the joint opening in the inside of the pipe shall not exceed 3/8 in. or the allowance as recommended by the pipe Manufacturer, whichever is the least.

19.03.09

Plastic Wrap for Pipe - Where indicated on the Drawings, the pipe shall be encased in a seamless polyethylene tube, in accordance with ANSI/AWWA C105/A21.5. The use of plastic wrap does not preclude the need for the rust preventive coating as referenced in this Division.

19.03.10

Setting Valves, Valve Boxes and Specials -

(a) General - Valves and specials shall be set and jointed to new pipe in the manner heretofore specified for cleaning, laying and jointing pipe. All valves and specials shall be anchored in accordance with this Division.

(b) Valve Boxes - Valve boxes shall be firmly supported and maintained plumb over the operating nut of the valve, with box cover flush with the grade line or at such level as may be directed. All other valves, as may be designated on the Drawings, shall be set in valve chambers

with the operating nuts readily accessible for operation through the valve chamber opening or through a valve box top section let into the chamber top centered over the operating nut.

(c) Valve Chambers - Valve chambers when shown on the Drawings, or called for in the Bid Form or Special Specifications shall be constructed in accordance with the Drawings or the applicable Standard Details and shall conform to the requirements of Division 20.

19.03.11            Setting Hydrants -

(a) Location - Hydrants shall be set at the locations shown on the Drawings or as approved by the Engineer. All hydrants set within the street right-of-way shall have their grade line mark located (6) six inches above the proposed centerline grade. All hydrants not located within a street right-of-way shall have their grade line mark set at the grade line shown on the Drawings, in the specifications or as in the applicable Standard Detail.

All necessary hydrant extensions shall be furnished and placed by the Contractor. When hydrant extensions are required because the water main is deeper than the standard as shown on the Drawings, or as required by the Engineer, or if the grade at the hydrant location is substantially different from the grade above the water main, then hydrant extensions shall be paid for separately. If a hydrant extension is required for any other reasons, it shall be provided by the Contractor at no additional cost as part of the work of installing the hydrant. All extensions shall be painted as noted in this Division.

(b) Position of Nozzles - All hydrants shall stand plumb and shall have their hose or 2-1/2" nozzles parallel with the curb, with the pumper nozzle pointing normal to the curb. The 4" nozzle shall be a minimum of 18" above the ground.

(c) Anchorage for Hydrants, Hydrant Valves, and Hydrant Laterals - Each hydrant will be restrained to the hydrant lateral valve and the valve shall be restrained to the water main or tee with restrained joint pipe, mechanical joint anchoring fittings or stainless steel tie rods as specified in this Division. Thrust blocks will not be used for restraint on hydrants or hydrant laterals. The entire hydrant lateral shall be restrained as provided for herein.

(d) Pumping Hydrant - All fire hydrants shall be pumped completely dry when the water main is placed in service.

19.03.12            Laying Water Services - Water services shall be laid perpendicular to the water main unless otherwise approved by the Engineer. The curb stop shall normally be one (1) foot from the sidewalk, toward the street. The curb stop shall be installed on an approved block or brick support so that the valve can be operated normally after backfilling.

The service shall be sealed shut by using a copper to copper connection or cast iron or ductile iron plug. Under no circumstances is the water service laid by the Contractor to extend closer than five (5) feet to the structure to be served unless said last five (5) feet is laid under the supervision of a licensed plumber in possession of a valid connection permit.

19.03.13            Tapping for Water Services - Taps one-inch in diameter and less shall be made either by the City or the Contractor, but no taps shall be made until a permit has been issued, the water main has passed hydrostatic and bacteriological testing and approval has been granted by the Engineer. The corporation stop shall be installed using a tapping machine approved by the Engineer and shall

be installed along the horizontal axis of the pipe. Acceptable tapping machines are those manufactured by Hayes, Mueller, Ford, A.P. Smith or an approved equal. The flow arrow shall point away from the main.

All taps over one inch in diameter shall be made by the City and charged to the Contractor with material (including the corporation stop, any necessary saddle or tapping sleeves, etc.) to be furnished by the Contractor. Taps one-inch in diameter and less which are made by the City shall be similarly charged to the Contractor as noted above. All service tees installed as part of the water main construction shall have a permit issued before construction commences.

19.03.14            Reconnect Existing \_\_\_\_\_" Copper Water Service - This work consists of all that is necessary to reconnect existing copper water services to the new water main including all copper water pipe, connections, fittings, sand backfill, and all else necessary to reconnect the water service, complete, in accordance with the Drawings and applicable Standard Details. The tap will be paid for under a separate item.

19.03.15            Replace Lead Water Service with \_\_\_\_\_" Copper Water Service - The work consists of removing all lead water services and replacing them with copper water services of the sizes shown on the Drawings from the new water main to the existing curb stop including reconnection to the existing lead water services one foot behind the curb stops with the appropriate adapters and backfilling the trench with sand in accordance with the Drawings and applicable Standard Details.

The Contractor shall be required to obtain tapping permits prior to commencement of such work; however, said permit will be issued at no charge to the Contractor. The taps including the corporation stop and collar shall be paid for separately. The curb stop shall also be replaced but will be paid for separately.

19.03.16            Anchorage of Bends, Valves, Tees and Plugs

(a) General Requirements - On water main work, all bends, tees, plugs, reducers and other fittings shall be securely anchored. Anchorage can be accomplished through the use of the following methods: Joint Restraint, Thrust Blocks and Encasements. However, thrust blocks will only be permitted at such locations where the Drawings specifically indicate that they will be allowed, or as approved by the Engineer. When using concrete pipe or restrained joint pipe, laying schedules will be required and followed unless adjustments are approved by the Engineer.

The cost of providing anchorage and for all work in connection therewith and incidental thereto shall be included in the price bid for the water main and no extra payment will be made.

For concrete pipe, the restraining element shall be of the type recommended by the Manufacturer and approved by the Engineer. Welded type restrained joint water pipe shall be assembled according to the Manufacturer's recommendations.

(b) Joint Restraint - refers to mechanical devices such as restrained joint pipe, stainless steel tie rods, joint restraining glands or mechanical joint anchoring fittings.

(1) Restrained joint pipe and restrained joints for any necessary closure pieces at specials shall be as specified in this Division unless an alternate method is given prior approval by the Engineer.

(2) Stainless steel tie rods shall be as specified in this Division. The number of rods to be provided is listed below in Table III.

Table III  
Number of Rods Per Joints

<u>Pipe Size</u>	<u>No. of Rods</u>
6"	2
8"	2
10"	4
12"	6
16"	8

(3) Joint restraining glands shall be as specified in this Division and may be used as an alternative to restrained joint pipe or stainless steel tie rods on 16" diameter pipe and less. Approved joint restraining glands will be permitted on hydrants, hydrant laterals and hydrant valves.

(4) Mechanical joint anchoring fittings shall be as specified in this Division and are approved for use for anchorage of hydrants, hydrant valves and hydrant laterals only.

When joints are to be restrained with mechanical devices as noted above, all joints shall be restrained for a minimum distance from the fitting as required in Table IV.

TABLE IV  
PIPE RESTRAINT LENGTH REQUIRED, FEET

<u>Pipe Diameter</u>	<u>Tees, 90° Bends</u>	<u>45° Bends</u>	<u>22-1/2° Bends</u>	<u>11-1/4° Bends</u>	<u>Dead Ends</u>	<u>Reducers (one size)</u>	<u>**</u>
4"	23	9	5	2	57		
6"	32	13	6	3	82	43	63
8"	41	17	8	4	104	43	55
12"	58	24	12	6	149	80	120
16"	74	31	15	7	192	82	110
20"	89	37	18	9	233	82	104
24"	104	43	21	10	272	82	99
30"	123	51	25	12	328	115	148
36"	141	58	28	14	379	115	140

\*\* If straight run of pipe on small side of reducer exceeds this value, then no restrained joints are necessary.

NOTE: The length of restrained pipe required as shown in Table IV is based on trench backfill being compacted to 95% of the maximum unit weight as measured by the modified Proctor, AASHTO T-180. If the pipe is to be wrapped in polyethylene, the length of restrained pipe required will be as shown on the Drawings or in the special specifications. Table IV does not consider polyethylene wrapped pipe.

(5) Special fittings and anchoring requirements: All joints lying within the above minimum distances from the fitting must be restrained as noted herein and as referenced in the applicable Standard Details.

Tees: Tees shall be restrained in the branch direction as required in Table IV. Also, to augment the above, in the straight through direction, the minimum length of the first pipe on either side of the tee shall be 10 feet. In those cases where a valve is placed at the tee, the valve shall be restrained to the tee as noted below and the next pipe shall be a minimum length of 10 feet.

Plugs: All dead ends on water mains shall be capped or plugged with standard plugs or caps. The water main, including the plug or cap, shall be restrained back from the plug or cap as required in Table IV.

Bends: Bends shall be restrained in both directions as required in Table IV.

Valves: Valves used in conjunction with restrained joint pipe shall be restrained in accordance with the recommendations of the manufacturer of the restrained joint pipe. All valves at crosses or tees will be restrained to the tee by use of restrained joint pipe or stainless steel tie rods. Anchorage of hydrant valves is shown in the Standard Details.

(c) Thrust Blocks - Thrust blocks shall be allowed only at the specific locations shown on the Drawings, or as specifically approved by the Engineer. At such locations, all fittings which have not been restrained through the use of restrained joint pipe or stainless steel tie rods shall be securely blocked against the trench bottom and walls through the use of concrete thrust blocks. Thrust blocks shall be formed as shown on the applicable Standard Detail or as approved by the Engineer according to the laying conditions encountered.

Forms for thrust blocks shall be of industry standard materials (i.e., steel, plywood, wood etc.) as necessary to ensure they are constructed to the dimensions shown. The concrete shall be separated from the water main by a layer of visqueen or other approved wrap to ensure that there is no bonding between pipe and concrete. Any jointing of thrust blocks required by the Drawings and specifications shall be included in the bid price for the water main and no extra payment will be made. If such jointing of thrust blocks is required by the Engineer during construction, the additional cost shall be due the Contractor.

(d) Encasements - For water main greater than 16 inches in diameter, joint restraint may include encasements and shall be as required on the Drawings, in the Special Specifications, or on the applicable Standard Details.

19.03.17

Hydrostatic Testing, Chlorination and Bacteriological Testing -

(a) General Requirements: All newly constructed water mains and water services 4 inches and greater in diameter must be hydrostatically tested, chlorinated, and bacteriologically tested. Hydrostatic testing and chlorination may be performed by the contractor or performed by the Grand Rapids Water System, at the Contractor's option. Bacteriological Testing will be performed by the Grand Rapids Water System personnel. The Contractor shall provide a minimum of 48 hours advance notice to the Grand Rapids Water System to either schedule the testing crews or to schedule the observation of the testing in the event the Contractor elects to perform the same.

Contractors are encouraged to give as much advance notice as possible, particularly during the busy portion of the construction season.

The Contractor shall make every effort to schedule well in advance of the anticipated time for testing and chlorinating. The Contractor shall ensure that all trenches are open, that riser pipes are easily accessible without use of ladders and that provisions have been made for the removal of ground water so that testing and chlorinating can begin immediately upon arrival of Grand Rapids Water System personnel.

The Contractor will supply all of the necessary plugs, caps and two inch galvanized riser pipes with two inch gate valves. The main plugs or caps placed at the end of the water main and/or the end of the stub services for future main extensions for testing, flushing, and chlorinating, shall have an opening extension or connection of not less than 2 inches in diameter, so that filling, flushing and chlorinating can take place at a sufficient velocity to clean the main and reduce the time required for these operations. The Contractor shall also provide a clean city water supply to within 50 lin. ft. of the test site as shown on the applicable Standard Detail.

The water main must be flushed to ensure the removal of all foreign material prior to testing. The Contractor shall provide restraints adequate for the testing pressures. Provisions for flushing the mains without damage to surrounding property shall be made in advance by the Contractor. Such flushing may include the use of a polyethylene swab ("Poly Pig") or the injection of compressed air into the main as approved by the Engineer. The Contractor shall be responsible for providing a suitable and approved means for discharge of flushing, testing and chlorinating water. This includes disposing of heavily chlorinated water.

The Contractor shall maintain the equipment and set up for testing (riser pipes, gate valves, etc.) in good and workable condition and shall make all necessary repairs prior to testing and chlorination.

The Contractor will protect all exposed piping from freezing during the winter construction season. In the event it becomes necessary to thaw frozen piping and/or valves, the Contractor shall be responsible for damages caused by either the Contractor or the Grand Rapids Water System while attempting to thaw said frozen piping and valves. The Grand Rapids Water System will attempt to notify the Contractor of any such damages of which it is aware.

(b) Hydrostatic Tests: If the Contractor elects to perform the hydrostatic testing, said testing will be observed by Grand Rapids Water System personnel using a water meter supplied by the Grand Rapids Water System. Existing valves as necessary to flush and fill the main may be operated by the Contractor as approved by the Engineer and the Grand Rapids Water System.

The length of water main to be tested shall be as approved by the Engineer. Large test sections will not proportionally increase the leakage allowance, but will be rounded off to the next higher 100 joint increment. Only when permission from the Engineer has been received, shall a test be made against an existing valve. The new facility shall be tested separate from existing water mains unless a connection is approved by the Engineer and the Grand Rapids Water System.

(1) Test Pressure: The test pressure shall be 160 PSI. The pipe shall be filled with water slowly, and all air pockets removed by bleeding off at hydrants or standpipes. All valves and hydrants and the pipe will be pressurized to the specified pressure by a pressure pump.

(2) Acceptance: Acceptance shall be determined on the basis of allowable leakage. If any test discloses a leakage greater than that specified in the table, the Contractor will be required to locate and repair the defects until the leakage is within the specified allowance.

Allowable leakage per 100 joint of pipeline in gallons per hour will be as follows and based on a test pressure of 160 psi:

<u>PIPE SIZE IN INCHES</u>	<u>ALLOWABLE LOSS (GALLONS PER HOUR PER 100 JOINTS)</u>
4	1/2 gallon
6	1 gallon
8	1-1/2 gallon
10	2 gallon
12	2 gallon
16	2-1/2 gallon
24	3 gallon
30	4 gallon
36	5 gallon

The test shall be repeated as necessary to maintain the test pressure for one hour. In all cases, the pressure shall be restored to 160 pounds at the end of the one hour period. The loss shall not exceed the allowance in the table for the size of pipe and number of joints.

(3) Defects, Cracks or Leakage: Any defects, cracks or leakage that develop or may be discovered, either in the pipe or in the castings or due to the negligence of the Contractor, shall be promptly corrected by the Contractor at his/her expense to the satisfaction of the Engineer.

(4) Leakage: Leakage is defined as the quantity of water to be supplied into the newly laid pipe necessary to maintain the specified leakage test pressure after the pipe has been filled with water and air expelled.

(c) Chlorination - After the hydrostatic test has been satisfactorily completed the water main shall be chlorinated. This may be done by either the Contractor or the Grand Rapids Water System personnel at the Contractors option. If the Contractor elects to perform the work necessary to chlorinate the water main, the same shall be accomplished by use of an approved liquid chlorinator in accordance with the requirements of the Grand Rapids Water System and under the observation of Grand Rapids Water System personnel. Approved liquid chlorinators are Chem-O-Feeder as manufactured by BIF Corporation, Wallace Tiernan Series 44-747 as manufactured by Wallace Tiernan or an approved equal. Following the injection of the required chlorine solution, the water main shall be left for a period of at least 12 hours after which the water main shall be flushed again with City water to remove the chlorine solution.

The Contractor shall not place or inject any chlorine tablets or powder into the pipe during construction or prior to the testing and chlorination of the main.

In certain situations, small sections of the new water main may, with the approval of the Engineer and the Grand Rapids Water System, be excluded from the overall chlorination. When this is the case, all pipe, fittings, or offsets must be cleaned of all dust, dirt or other deposits and

then carefully swabbed with a chlorine solution containing 50,000 parts per million (5% bleach - Clorox, etc.) of chlorine immediately before installation.

(d) Bacteriological Testing - Once the hydrostatic testing and chlorination have been completed and the water main filled with City water, Grand Rapids Water System personnel will initiate sampling for bacteriological testing with the assistance of the Contractor.

In accordance with State Health Department requirements, two (2) consecutive, bacteriologically safe samples must be taken at twenty-four (24) hour intervals before the new water main may be connected to the existing water system.

(e) Responsibility for Testing Costs - All work performed by the Grand Rapids Water System in connection with initial testing and chlorinating the water main will be done at the expense of the City. However, if it is necessary to test or chlorinate more than once, all additional costs beyond the first test shall be borne by the Contractor. The cost for all work performed by the Contractor and materials supplied by the Contractor in connection with testing and chlorinating the water main shall be included in the unit price bid for furnishing and laying the water main and no extra payment will be made therefore.

19.04 Measurement and Payment:

The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for furnishing all labor, equipment and material and shall include all clearing, tree removal, tree root protection, removal of pavement, excavation, trenching, cofferdams, dewatering, furnishing and placing the pipe, fittings and plugs, anchorage, bedding, all backfilling, disposal of excess materials, temporary sheeting and bracing, temporary support, removal of abandoned utilities and services, removal and replacement of existing utilities and services, and the replacement and repair thereof if damaged, connections to existing water mains, testing, disinfection, and all other work required for a complete job.

Pay Item	Pay Unit
____ " Water Main	lin ft
____ " Water Service	lin ft
Reconnect existing ____" Copper Water Service	each
Replace lead water service with ____" copper water service	lin ft
Curb Stop and box on ____" water service	each
Curb box on ____" water service	each
Tap for ____" water service, including corporation stop	each

(cont.)

Pay Item	Pay Unit
Tap for ____ " water service, including corporation stop and collar	each
____ " Valve and box	each
____ " x ____ " x ____ " Tapping sleeve, valve and box	each
5" Hydrant	each
____ " x ____ " Four-way cross	each
____ " x ____ " x ____ " x Tee	each
____ " x ____ " x ____ " x Hydrant Tee	each
____ " x ____ " Reducer	each
____ " Sleeve	each
____ " ____ Degree Bend	each
____ " Plug	each
____ " Water main offset, per Detail W-10	each
Adjust existing ____ " water service	each
Hydrant Extension	vert ft

19.04.01 Water main of the size(s) shown in the Bid Form shall be measured in linear feet along the centerline of the water pipe in place from end to end of the line of pipe including the lengths of specials and valves.

19.04.02 Water Services of the size(s) shown in the Bid Form shall be measured along the centerline of the pipe from the center of the water main to the end of the pipe.

19.04.03 Curb Stops and Boxes, Valves and Boxes, Valves and Valve Chambers, Hydrants, Taps and Specials shall be measured in units as shown in the Bid Form and includes furnishing and installing curb stops and boxes, valves and valve boxes, valves and valve chambers including casting rings and covers, taps including corporation stops and appurtenances, 5" hydrants, and specials.

19.04.04 Adjust Existing Water Service shall be paid for at the contract unit price for each service adjusted and approved by the Engineer.

19.04.05 Water Main Offset of the size(s) shown shall be paid for at the Contract unit price for each offset.

- 19.04.06 Hydrant Extensions shall be paid for at the unit price bid per vertical foot of extension in those locations where extensions are indicated on the Drawings or as approved by the Engineer.
- 19.04.07 Reconnect Existing \_\_\_\_" Copper Water Service shall be paid for at the contract unit price for each service reconnected.
- 19.04.08 Replace Lead Water Service with \_\_\_\_" Copper Water Service shall be measured along the centerline of the pipe, and paid for at the contract unit price per linear foot.
- 19.04.09 Specials as listed in the Bid Form shall be measured as a unit including furnishing and placing the Special. The cost of related work shall be included in the price bid for the water main.
- 19.04.10 Anchorage - The cost of providing anchorage shall be included in the price bid for the laying of the pipe and no extra payment will be made.

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DIVISION 20

MANHOLES, CATCH BASINS, VALVE CHAMBERS, METER PITS, HANDHOLES,  
VAULTS AND SIMILAR STRUCTURES

20.01	Description
20.02	Materials
20.02.01	Iron Castings
20.02.02	Precast Reinforced Concrete Manholes and Catch Basins
20.02.03	Adjusting Rings
20.02.04	Brick or Block Masonry
20.02.05	Plastic Coated Steel Steps
20.02.06	Flexible Connections
20.02.07	Precast Reinforced Concrete Structures, Concrete Mortar, and Steel Reinforcement
20.03	Construction Methods
20.03.01	The Excavation
20.03.02	Infiltration
20.03.03	Brick or Block Units
20.03.04	Manholes, Catch Basins and Alley Basins
20.03.05	Drop Inlet to Catch Basin
20.03.06	Valve Chambers and Meter Pits
20.03.07	Handholes
20.03.08	Transformer Vaults
20.03.09	Rebuilding Tops of Existing Structures
20.03.10	Curb Boxes
20.03.11	Bleeders
20.03.12	Backfill for Structures
20.04	Measurement and Payment

DIVISION 20

MANHOLES, CATCH BASINS, VALVE CHAMBERS, METER PITS, HANDHOLES,  
VAULTS AND SIMILAR STRUCTURES

20.01 Description:

The work shall consist of: (1) Constructing manholes, catch basins, valve chambers, meter pits, handholes, vaults, and similar structures, according to the Standard Details or Drawings pertaining thereto; and (2) Rebuilding the top portion of existing manholes, catch basins, valve chambers, meter pits, vaults, and similar structures, and (3) Adjusting existing castings, including curb boxes and other valve boxes, to fit the new grade.

20.02 Materials:

20.02.01 Iron Castings, including manhole steps, shall be made of soft gray iron as specified below and shall be whole and free from sand holes, blow holes, cut scabs, washes, cold shuts, and other defects, and shall have a smooth surface without lumps or rough areas.

The manhole cover and frame, valve chamber cover and frame, catch basin grate and frame, and other similar combinations of castings shall be machined to fit and to the dimensions shown on the appropriate Standard Detail so that there will be an even bearing.

The chemical composition of the gray iron shall conform to the following limitations:

Silicone	not less than	1.75%
Sulfur	not more than	0.125%
Manganese	not less than	0.40%
Phosphorus	not more than	0.90%

20.02.02 Precast Reinforced Concrete Manholes and Catch Basins - All manholes and catch basins, including their cone sections shall be Reinforced Concrete Sewer Pipe, ASTM, Designation C-478 with premium rubber gasketed joints or O-ring butyl rubber gasketed joints conforming to the current ASTM Specification C443. Gaskets shall be Rubber Neck, Kent Seal, Easy Stick, Forsheda type, or approved equal, unless otherwise allowed by the Engineer.

20.02.03 Adjusting Rings - Castings for structures specified in this Division shall be adjusted to finished grades using precast concrete rings, or concrete bricks as shown on the Standard Details.

20.02.04 Brick or Block Masonry units and precast concrete sections shall conform to the ASTM Specifications as follows:

(a) Concrete Brick shall conform to the requirements for Grade A of the current Specifications for Concrete Building Brick, ASTM, Designation C-55.

(b) Concrete Blocks shall conform to the requirements of the current Specifications for Concrete Masonry Units for Construction of Catch Basins and Manholes, ASTM, Designation C-139.

20.02.05 Plastic Coated Steel Steps

(a) Plastic shall conform to the requirements for Type II, Grade 49108 or Grade 16906 of the current Specifications for Propylene Plastic Molding and Extrusion Materials, ASTM, Designation D 2146-69.

(b) Steel shall conform to the requirements for Grade 60 of the current Specifications for Deformed Billet-Steel Bars for Concrete Reinforcement, ASTM, Designation A-615.

20.02.06 Flexible Connections

Flexible manhole connections (also called rubber boots) shall be "Kor-N-Seal" by National Pollution Control Systems Inc., "P.S.X." or "Press Wedge II" by Press Seal Gasket Corporation, "Lock Joint Flexible Manhole Sleeve" by Inter Pace Corporation, "A-lok" by A-lok Products Inc. or approved equal. Flexible manhole connections shall conform to ASTM Standard C923, Resilient Connectors.

20.02.07 Precast Reinforced Concrete Structures, Concrete Mortar, and Steel Reinforcement - Precast reinforced concrete structures, mortar, grout and steel reinforcement shall be as specified in Divisions 7 and 8.

20.03 Construction Methods:

20.03.01 The Excavation shall be of sufficient dimensions to provide ample space for sheeting and bracing where sheeting and bracing are required, and ample space to perform the work in a satisfactory manner.

When the earth at the normal depth of the structure is unsuitable for a foundation for the structure, such unsuitable material shall be removed as required by the Engineer and replaced with MDOT Class II material, and shall be paid for separately as specified for Subgrade Undercutting in Division 4.

20.03.02 Infiltration - All structures and manholes to be built under this section shall be made water-tight. Any infiltration which is detected shall be eliminated by the Contractor.

20.03.03 Brick or Block Units shall be laid in such a manner that the courses will be true to line and with the joints fully bonded.

In a structure of cylindrical design, radius blocks shall be used.

In a structure of rectangular design, the bricks shall be laid in alternate courses of headers and stretchers.

20.03.04 Manholes, Catch Basins and Alley Basins. All manholes, catch basins, and alley basins shall be constructed of precast reinforced concrete sections, as shown on the Standard Details or Drawings. Masonry and cast-in-place manholes, catch basins, and alley basins will not be allowed unless specified, or approved by the Engineer

Openings shall be provided in the manholes, catch basins, and alley basins for connections, including future connections, as shown on the Drawings of such size and at such elevation as

required and shall be included in the cost of the construction of the manholes, catch basins, and alley basins. All openings in manholes, catch basins, and alley basins for the purpose of receiving pipes up to and including 24-inch diameter (including openings for future pipes) shall be fitted with a connection of the flexible type connector. Flexible connectors on manholes shall be factory installed. Openings for future connections shall be sealed by an approved prefabricated cap.

The outside surface of Brick or Block manholes shall be parged one-half inch thick with mortar. The mortar shall be as specified in Division 7.

The Manhole Castings shall be set in a full bed of mortar made with high early strength cement with the top at the required elevation. Chimneys, including castings, shall be no more than twenty (20) inches high.

All catch basins shall be fitted with a standard cast iron hood as shown on the applicable Standard Details.

The inside surface of all brick or block catch basins shall be parged with mortar one-half inch thick from the bottom to the corbel.

20.03.05 Drop Inlet to Catch Basin shall be constructed to conform to the Standard Details or Drawings governing the work. When an inlet of this design is to be used for a direct connection to a manhole, and is so specified on the Drawings, the work shall be done in the same manner as when the connection discharges into a catch basin.

The castings to be used on this type of structure shall be a basin casting of the Grand Rapids Standard Design and shall be set in a full bed of mortar made of high early strength cement on top of the masonry, with the top at the required elevation.

20.03.06 Valve Chambers and Meter Pits shall be constructed to conform to the Standard Details or Drawings governing the work. They shall be precast reinforced concrete structures as shown on the Standard Details, unless otherwise shown on the Drawings or approved by the Engineer.

Valve Chamber and Meter Pit Castings shall be as shown on the Standard Details, set in a full bed of mortar made with high early strength cement on top of the masonry, with the top at the required elevation.

20.03.07 Handholes shall be constructed as shown in the Standard Details. All openings in handholes for the purpose of receiving conduits shall be fitted with a flexible connector.

20.03.08 Transformer Vaults shall be constructed in accordance with the Standard Details or the Drawings.

Steps shall be conveniently located under the hatch frame door.

20.03.09 Rebuilding Tops of Existing Structures - Whenever existing manholes, catch basins, valve chambers, or similar structures occur on a street improvement project, the tops of such structures shall be adjusted or rebuilt so that the top of the casting will fit the crown and grade of the finished surface. "Chimneys" shall be as specified for new structures

(a) When it is required that the top of a structure be rebuilt, the work shall be done according to the Standard Specifications and the rebuilt structure shall conform to the appropriate Standard Detail for such structure.

(b) When the top of the structure is raised or lowered one foot or more, payment will be made at the contract unit price per vertical foot of new masonry completed in excess of the first vertical foot, which will be payment in full for furnishing all labor, material, and equipment for removing old and placing new masonry complete, and setting the casting to the required grade.

(c) When the top of the structure is raised or lowered less than one foot, the cost of such work shall be included in the contract unit price for pavement, base or excavation, and no further payment will be made, unless otherwise specified.

20.03.10 Curb Boxes on water services, and other existing valve boxes, shall be adjusted by the Contractor to fit the finished surface. Valve boxes in paved areas shall be adjusted according to the Standard Details.

20.03.11 Bleeders are required for all Storm Manholes and Catch Basins as shown on the applicable Standard Details. These installations shall not be allowed on sanitary manholes.

Such bleeders shall be installed in accordance with the Standard Details unless otherwise shown on the Drawings.

20.03.12 Backfill for Structures specified in this Division shall be granular material Class II in accordance with the current Michigan Department of Transportation Standard Specifications for Construction, unless otherwise shown on the Drawings or approved by the Engineer, and placed in accordance with Division 17.

20.04 Measurement and Payment:

The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The prices shall be payment in full for furnishing all labor, equipment and material and shall include all clearing, tree removal, tree root protection, removal of pavement, excavation, trenching, cofferdams, dewatering, furnishing and placing the structures, all backfilling, disposal of excess material, temporary sheeting and bracing, removal of abandoned utilities and services, temporary support, removal and replacement of existing utilities and services, and the repair and replacement thereof if damaged, connection of existing sewers, testing, and all other work required for a complete job.

Pay Item	Pay Unit
Storm manhole, per Detail ____	each
Storm manhole, per Detail ____ over 15' deep	each
Catch basin, per Detail ____	each
Drop inlet, per Detail S-6	each
Drop inlet, per Detail S-6A	each
Alley basin, per Detail S-7	each
Ditch basin, per Detail S-8	each
Sanitary manhole, per Detail ____	each
Sanitary manhole, per Detail ____ over 15' deep	each
Electrical manhole, per Detail E-25	each
Cable handhole and cover, per Detail E-4	each
Cable handhole and cover, per Detail E-4A	each
Transformer Vault, per Detail E-3	each

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DIVISION 21

FORCEMAINS

21.01	Description
21.02	Materials
21.02.01	Ductile Iron Pipe
21.02.02	Fittings
21.02.03	Plug and Gate Valves
21.02.04	Air Relief Valves
21.03	Construction Methods
21.03.01	Excavation and Backfill
21.03.02	Pipe Laying
21.03.03	Anchorage of Bends, Tees and Plugs
21.03.04	Pressure Test
21.04	Measurement and Payment

## DIVISION 21

### FORCEMAINS

#### 21.01 Description:

The work shall consist of constructing a forcemain of the type and size and at the depths as shown on the Drawings, including execution, backfill, and the furnishing of all labor, equipment, and materials.

#### 21.02 Materials:

Materials to be furnished by the Contractor shall meet the following requirements:

##### 21.02.01 Ductile Iron Pipe

Ductile iron pipe shall meet or surpass ANSI/AWWA C104/A21.4.

All pipe shall be centrifugally cast and enameled with cement mortar on the inside. The exterior and interior shall also be coated with a bituminous seal coat. The pipe, unless otherwise specified, shall be "Tyton," "Belltite" or "Super Belltite" slip type coupled (ANSI/AWWA C111/A21.11).

Unless otherwise specified, pipe shall be furnished as thickness Class 53.

##### 21.02.02 Fittings

All fittings shall be ductile or cast iron watermain fittings and shall be mechanical joint and conform to ANSI/AWWA C110/A21.10.

##### 21.02.03 Plug and Gate Valves

Valves on force mains shall be plug valve for sizes up to and including 12 inches, and gate valves for sizes larger than 12 inches.

Plug valves shall be nonlubricated, eccentric type with resilient faced plugs as called for in the Valve Schedule. End connections shall be mechanical joint unless otherwise shown on the Drawings or applicable Standard Details. Port areas shall be equal to at least 80 percent of the nominal size pipe area. Valve bodies shall be suitably marked to indicate whether the valve is open or closed.

The seating surface of the rotating element shall be nitrile butadiene (hycar), or other material recommended by the manufacturer for sewage service. Bearings at the top and bottom supporting the rotating element shall be self-lubricating, corrosion-resistant type, suitable for sewage plant service. The valve shall be of the bolted bonnet design. Packing shall be visible for inspection without dismantling valve or removing operator. The packing shall be adjustable and replaceable without disassembling of the valve.

All plug valves shall be of adequate design to operate with a pressure of 50 psi on both sides or on either side of the valve without leakage.

Plug valves shall be Clow, DeZurik, Homestead, Pratt, or approved equal.

Gate valves shall be double disk type as specified in Division 19.

21.02.04 Air Relief Valves

Air relief valves for force mains shall be combination air and vacuum relief type, designed for 100 psig working pressure, provided with all the accessories shown on Standard Detail S-18. Accessories shall be provided by the valve manufacturer. Valve bodies shall be ductile or cast iron. Float and internal hardware shall be stainless steel. Valves shall be APCO Bulletin 400, Val-matic, or approved equal.

21.03 Construction Methods:

21.03.01 Excavation and Backfill - Excavation and backfill shall be performed according to Division 17, and the following.

21.03.02 Pipe Laying

(a) General - Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, and valves shall be carefully lowered into the trench piece by piece by means of derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to pipe or pipe coating. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

(b) Alignment - Alignment of the trench shall be as shown on the Drawings unless otherwise approved by the Engineer.

(c) Depth - The depth shall be 5 feet - 9 inches from finished grade to the centerline of pipe unless shown otherwise on the Drawings or approved by the Engineer.

(d) Pipe Kept Clean - All dirt or other foreign matter shall be removed from the inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying.

Whenever work is stopped for the day, a standard plug shall be securely placed in the end of the pipe. No tools or other articles shall be stored in the pipe at any time.

(e) Cutting Pipe - the Contractor shall cut the pipe in a neat and workmanlike manner wherever necessary for placing valves, special castings, or closure pieces without damage to the pipe and without extra cost to the City. The area adjacent to cuts made on slip joint pipe shall be beveled before assembly of the joint.

Pipe shall not be cut with a hardy, chisels, or any tool or machine that will cause damage to the pipe or the cement lining. The method of cutting pipe shall be subject to the approval of the Engineer.

21.03.03 Anchorage of Bends, Tees and Plugs

On all forcemain work, wherever necessary, all bends, tees, plugs and other fittings shall be restrained as specified for watermains in Division 19.

21.03.04 Pressure Test

Pressure tests for forcemains shall be performed in accordance with the requirements for pressure testing watermains found in Division 19.

21.04 Measurement and Payment:

The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for furnishing all labor, equipment and material, and shall include all clearing, tree removal, tree root protection, removal of pavement, excavation, trenching, cofferdams, dewatering, furnishing and placing the pipe, fittings and plugs, anchorage, bedding, all backfilling, disposal of excess materials, temporary sheeting and bracing, temporary support, removal of abandoned utilities and services, removal and replacement of existing utilities and services, and the replacement and repair thereof if damaged, testing, and all other work required for a complete job.

Pay Item	Pay Unit
____ " Forcemain	lin ft
____ " blowoff tee with plug, on ____ " forcemain	each
Air relief valve and chamber on ____ " forcemain, per Detail S-18	each
Cleanout on ____ " forcemain, per Detail S-19	each
____ " Valve and box	each
____ " x ____ " x ____ " Tee	each
____ " x ____ " Reducer	each
____ " ____ Degree Bend	each
____ " Sleeve	each
____ " Plug	each

21.04.01 Forcemain of the size and class as shown shall be measured in lineal feet along the centerline of the pipe in place, including the lengths of valves and specials.

21.04.02 Air Relief Valve and Chamber shall be measured as a unit and shall include the costs of all of the equipment and materials including chamber, valves and couplings shown Detail S-18.

- 21.04.03           Specials as listed in the Bid Form shall be measured as a unit including furnishing and placing the special. The cost of related work shall be included in the price bid for the forcemain.
- 21.04.04           Anchorage - The cost of providing anchorage shall be included in the price bid for the laying of the pipe and no extra payment will be made.

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## DIVISION 22

### RESTORATION

22.01	Description
22.02	Materials
22.02.01	Aggregate
22.02.02	Concrete
22.02.03	Bituminous
22.02.04	Top Soil
22.02.05	Seed, Fertilizer and Mulch
22.02.06	Sod
22.02.07	Miscellaneous
22.03	Restoration
22.03.01	Restoration of Lawns over Trenches
22.03.02	Restoration of Ditches
22.03.03	Restoration of Banks and Side Slopes Steeper than 1 on 3
22.03.04	Gravel Shoulder
22.03.05	Pavement Trimming
22.03.06	Restoration of Surface - Type I
22.03.07	Restoration of Surface - Type I-A
22.03.08	Restoration of Surface - Type II
22.03.08	Restoration of Surface - Type III
22.03.10	Restoration of Surface - Type IV
22.03.11	Restoration of Surface - Type V
22.03.12	Restoration of Surface - Type VI
22.03.13	Restoration of Surface - Type VII
22.04	Measurement and Payment

## DIVISION 22

### RESTORATION

22.01 Description:

The work shall consist of surface restoration over backfill, as specified, for sanitary sewer, sewer lateral, water main, water service, storm sewer, or basin connection trench construction or adjacent to sidewalk, curb and gutter, straight curb, or pavement so that the restoration is equal to or better than the conditions existing prior to the construction. It shall include the furnishing of all labor, equipment and material necessary to complete the work.

22.02 Materials:

22.02.01 Aggregate shall conform to the requirements as specified in Division 14.

22.02.02 Concrete shall conform to the requirements as specified in Division 7 as applicable.

22.02.03 Bituminous materials shall conform to the requirements as specified in Division 15.

22.02.04 Top Soil shall be dark, organic natural surface soil, exclusive of muck or peat, suitable for the establishment of grass or other vegetable growth.

22.02.05 Seed, Fertilizer and Mulch shall conform to the requirements as specified in the Current Michigan Department of Transportation Standard Specifications for Highway Construction.

22.02.06 Sod shall conform to the requirements as specified in the current Michigan Department of Transportation Standard Specifications for Construction.

The type of sod used shall depend upon the area disturbed - Class A for lawns and field sod when applicable.

22.02.07 Miscellaneous materials such as shrubs, sprinklers, sprinkler pipe, fence, etc. shall be equal to or better than the material being replaced and shall be approved by the Engineer.

22.03 Restoration:

22.03.01 Restoration of Lawns over Trenches -The work shall consist of the furnishing, placing and grading of four (4) inches of top soil over the trench to conform to the grade prior to construction, and the furnishing and placing of seed, fertilizer, mulch and additional top soil as required on all disturbed lawn areas. At the option of the Contractor, or if called for in the Bid Form, sod shall be used.

Hydro Mulch application will be allowed on slopes less steep than 1 on 3 and shall be placed at a minimum rate of 1500 pounds per acre. The hydro mulch shall contain a minimum of 150 lbs. of Class A Seed and 84 lbs. of each of the three nutrients (12-12-12) per acre. The mulch shall consist of virgin wood fibers or an approved equal material. Wood fiber shall have a moisture content of not less than 7% or more than 13%, shall be no less than 98.4% organic matter, shall have a pH not less than 4.3 nor more than 5.3, shall be dyed green to aid in visual metering during application, and shall be mixed and applied in accordance with standard accepted procedures.

It shall be the responsibility of the Contractor to produce a good catch of weed-free grass. In the event that the grass contains weeds, the Contractor shall apply, or arrange to have applied, weed killer no sooner than after the third mowing of the grass. The Contractor shall also issue an informative instruction sheet or booklet to each adjacent property owner outlining the need for water, weed killer, etc., and the Contractor shall take proper time to apply the same. Once a good catch of weed-free grass has been achieved, the Contractor's responsibility in this matter shall have ended. However, it is to be clearly understood that any failure on the part of the property owner to properly care for the restored lawn area prior to achieving a good catch of weed-free grass shall in no way relieve the Contractor of his/her responsibility as set forth above.

Construction methods and material quantities used shall be as specified in the current Michigan Department of Transportation Standard Specifications for Construction.

22.03.02        Restoration of Ditches -Where work is located beside a ditch and/or where an existing ditch is filled or disturbed in the Contractor's operations, the Contractor shall clean, repair or replace the ditch with properly pitched bottom and side slopes and of sections and capacity not less than the original section. The sides and bottom of the restored ditch shall be completely sodded with an approved sod to the satisfaction of the Engineer. The Contractor may, if approved by the Engineer, use top soil, seed, fertilizer and mulch as described herein with the understanding that if he/she is unsuccessful in getting a satisfactory catch or growth of grass, he/she may be required to sod the ditch at the discretion of the Engineer, and no additional compensation will be paid for the sod.

22.03.03        Restoration of Banks and Side Slopes Steeper than 1 on 3 -When a restoration item appears on the Bid Form and the work disturbs an existing lawn or other established ground cover on a bank or side slope greater than 1 on 3, the lawn or other established ground cover shall be restored as in Paragraph 22.03.02.

22.03.04        Gravel Shoulder -The work shall consist of furnishing and placing six (6) inches of compacted gravel for at least the full width of the shoulder disturbed. The restored shoulder shall be a minimum of four (4) feet wide.

22.03.05        Pavement Trimming - When existing pavement has been removed and prior to restoration, the pavement shall be neatly trimmed to a minimum depth of 3 inches. Bituminous pavements may be trimmed by sawcutting or other approved methods. Concrete pavement trimming shall be done by sawcutting. If trim lines are not neat, additional trimming must be done, and the Contractor shall do so at no additional cost. Full depth sawcutting, where called for, will be paid for as a separate item, as specified in Division 3.

Any areas of pavement which are undermined during excavation shall be removed and replaced at the Contractor's cost.

22.03.06        Restoration of Surface - Type I - shall be complete restoration of surface; over a backfilled trench in a concrete, bituminous, or brick pavement. Restoration shall include any aggregate shoulder, curb, gutter, sidewalk, lawns, ditches, shrubs, drive, etc., disturbed by the construction. Restoration of pavement shall be as specified below unless otherwise noted on the Drawings or in the Special Specifications.

If the existing pavement is concrete, or bituminous on concrete, or bituminous on brick on concrete, a 7-inch minimum concrete pavement or concrete base shall be restored unless the

existing pavement or base is of greater depth, in which case, the greater depth shall be used in restoration. All concrete base course must be covered with a minimum of 3 inches of bituminous concrete.

When the existing pavement is bituminous on aggregate base, the restoration shall include a minimum of 5.25 inches of bituminous base course or 8-inch compacted aggregate base, 3 inches of bituminous concrete pavement consisting of 1-1/2 inch leveling and 1-1/2 inch top courses. In the event the existing pavement structure consists of greater depths than the above, the restoration shall conform to said greater depths.

Bituminous base may be substituted in place of concrete base or aggregate base on all pavements where the finish top course will be bituminous, unless otherwise required by the Engineer. For the purposes of this specification, 1 inch of aggregate base shall be considered equal to 0.65 inches of bituminous base and 1 inch of concrete or brick shall be considered equal to 1.25 inches of bituminous base.

22.03.07 Restoration of Surface - Type I-A shall be specified when the road is to be completely resurfaced and shall be the same as Restoration Type I including the furnishing and placing of all materials necessary to bring the roadway up to the existing surrounding pavement surface or the elevation as required by the Engineer. The complete full width resurfacing will be done under a separate Division 15 item as set forth in the Bid Form.

When the existing pavement is restored with concrete base, the restored concrete base shall be placed so that the final roadway surface will have a minimum three (3) inch of bituminous top course over the new base.

When the existing pavement is restored with aggregate or bituminous base, the new restored base shall be placed so that the final roadway surface will have a minimum of three (3) inches of bituminous top course over the new base.

22.03.08 Restoration of Surface - Type II shall be complete restoration of the surface over a backfilled trench in a bituminous seal coat pavement, and shall include 6-inch aggregate base and bituminous prime and a single tar seal over trench, an additional tar seal over full width of pavement, and the replacement of any aggregate shoulder, curb, gutter, lawns, ditches, shrubs, drives, sidewalk, etc., disturbed by the construction. If pavement replacement is to be done after September 1, "Restoration of Surface - Type V" shall be constructed in lieu of "Restoration of Surface - Type II."

22.03.09 Restoration of Surface - Type III shall be complete restoration of surface over a backfilled trench in a bituminous pavement, and shall include scarifying existing pavement, replacement of gravel to make 6-inch compacted aggregate base, bituminous prime and double tar seal for full width of pavement and replacement of any aggregate shoulder, curb, gutter, lawns, ditches, shrubs, drives, sidewalk, etc., disturbed by the construction. If pavement replacement is to be done after September 1, "Restoration of Surface - Type V" shall be constructed in lieu of "Restoration of Surface - Type III."

22.03.10 Restoration of Surface - Type IV shall be complete restoration of surface over a backfilled trench in a gravel roadway and shall include 8-inch compacted aggregate base, any aggregate shoulder, curb, gutter, lawns, ditches, shrubs, drives, etc., disturbed by the construction.

22.03.11 Restoration of Surface - Type V - shall be complete restoration of surface over a backfilled trench in a bituminous pavement, and shall include replacement of aggregate in the trench to make 8-inch compacted aggregate base, placement of a 1-1/2-inch bituminous top course for full width of pavement, and replacement of any aggregate shoulder, curb, gutter, bituminous valley gutter, lawns, ditches, shrubs, drives, etc., disturbed by the construction.

22.03.12 Restoration of Surface - Type VI shall be complete restoration of surface over a backfilled trench not in pavement, and shall include any aggregate shoulder, lawns, ditches, shrubs, drives, pavement, curb, sidewalk, gutter, parkway, fences, etc., disturbed by the construction. Any pavement disturbed shall be restored as specified under Restoration of Surface -Type I.

22.03.13 Restoration of Surface - Type VII shall be complete restoration of surface over a backfilled trench in an unimproved area; i.e., not in pavement, lawn, shoulder, ditches, drives, parking lots, etc., disturbed by the construction. It shall include field grass, pasture land, rye grass, fences, etc. All disturbed areas shall, as a minimum, be seeded and sufficiently fertilized so as to generate the necessary "catch of grass" as required under the current soil erosion ordinance.

22.04 Measurement and Payment:

22.04.01 The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for furnishing all labor, equipment and material including pavement trimming as specified for performing the work complete.

Measurement shall be by linear feet along the centerline of each type of pipe over which such restoration is actually accomplished. Where the water service and sewer lateral are in the same trench, measurement and payment shall be on the basis of one trench.

Pay Item	Pay Unit
Restoration of Surface, Type _____	lin ft

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## DIVISION 23

### STREET RECONSTRUCTION AND RESURFACING

- 23.01 Description
- 23.02 Materials
- 23.03 Bituminous Pavements and Wedgings
- 23.04 Construction Methods
  - 23.04.01 Adjusting Castings to Grade
  - 23.04.02 Adjust Oversize Manhole to Grade
  - 23.04.03 Furnish Manhole Castings and Oversize Manhole Castings
  - 23.04.04 Rebuild Existing Manhole, Valve Chambers or Catch Basin
  - 23.04.05 Remove Existing Catch Basin and Build New Basin, per Detail \_\_\_\_\_
  - 23.04.06 Relocate Fire Hydrant
  - 23.04.07 Relocate Meter Pit
  - 23.04.08 Relocate Curb Stop and Box
  - 23.04.09 Abandon Valve Chamber and Place Valve Box Per Detail P-23A
  - 23.04.10 Sidewalk and Sidewalk Ramps, Concrete
  - 23.04.11 Concrete Sidewalk and Driveway Approach - Additional Repair Work
  - 23.04.12 Remove Concrete Curb or Concrete Curb with Separate Gutter, including Driveway and Alley Returns and Remove Concrete curb and Gutter, including Driveway and Alley Returns
  - 23.04.13 Remove Concrete Curb Constructed Integral with Concrete Pavement or Concrete Pavement Base
  - 23.04.14 Remove Concrete Driveway and Approach, Remove Concrete Alley and Approach
  - 23.04.15 Joint Repair
  - 23.04.16 Hand Patching
  - 23.04.17 Subbase Underdrain
  - 23.04.18 Removing of Existing Pavement
  - 23.04.19 Remove Concrete Sidewalk
  - 23.04.20 Restoration of Parkway
  - 23.04.21 Salvage Stone Curb
  - 23.04.22 Tree and Stump Removal
  - 23.04.23 Clean and Remove Manhole, Valve Chamber or Catch Basin, Per Detail P-23B
- 23.05 Measurement and Payment

DIVISION 23

STREET RECONSTRUCTION AND RESURFACING

23.01 Description:

The work shall consist of the removal of existing pavement, pavement base, curb and gutter, driveway returns, straight curb, sidewalk, catch basins; the construction of pavement, pavement base, curb and gutter, driveway returns, straight curb, sidewalk, catch basins, basin connections, parkways; the relocation of existing fire hydrants, adjusting of existing castings; the furnishing and placing of new castings; the rebuilding of existing manholes, catch basins, and valve chambers; and the necessary removal of existing trees if called for on the Drawings or Bid Form and all other work necessary and incidental thereto. It shall include the furnishing of all necessary labor, equipment, material, excavation and backfill necessary to complete the work.

23.02 Materials:

The materials shall conform to the requirements as specified in the applicable division of the Standard Specifications unless noted otherwise on the Bid Form.

The materials for subbase underdrain shall be in accordance with the current Michigan Department of Transportation Standard Specifications for Construction, except as noted in this Division.

The material for backfill shall be MDOT granular material, Class II unless noted otherwise on the Drawings or the Bid Form.

23.03 Bituminous Pavements and Wedging:

The work shall consist of preparing the foundation upon which will be placed a bituminous base course, leveling course and top course, all of varying thicknesses and composition as specified on the Drawings and in the specifications.

The materials and equipment to be used and the construction requirements and specifications shall be those specified for this work in Division 15 and the current Michigan Department of Transportation Specifications for Construction except as modified herein in these Standard Specifications.

23.04 Construction Methods:

23.04.01 Adjusting Castings to Grade -

In the prosecution of the work, the Contractor shall be required to adjust manhole, valve chamber, catch basin and flat grate castings to the grade of the new work or as required by the Engineer. At locations where the existing castings are not suitable as determined by the Engineer, the Contractor shall furnish new castings. Old castings not suitable for reuse shall be disposed of by the Contractor, unless the Drawings, Special Specifications, or Bid Form items specifically call for them to be delivered to the City. The work of adjusting shall include the removal of or building up of the top vertical foot of new masonry on the existing masonry or a combination of each. The following work shall be included:

1. The excavation or removal of existing unclassified materials, such as pavement, pavement base, earth, etc. so that the work of adjusting the casting can be done.

2. The breaking out or removal of the existing casting from the manhole, valve chamber, catch basin or other structures.

3. The tearing down or the building up of the top one foot of masonry, where necessary, or a combination of each.

4. The setting of the existing casting or new casting in a full bed of mortar on top of the masonry so that the surface of the manhole or valve chamber shall be 1/8 inch below the adjacent finished pavement surface, or that the surface of the catch basin or flat grate castings shall be two inches below the finished gutter grade.

5. The furnishing, placing and consolidating of sand backfill around the structure to within nine inches of the casting surface. Furnishing and placing of concrete pavement base not less than seven inches in thickness around the masonry and newly set casting and two inches below the top of the casting.

6. The furnishing and placing of one inch of bituminous concrete binder course and bond coat on the concrete base.

It shall be the responsibility of the Contractor to insure that casting elevations fit the existing or proposed street pavement as noted in paragraph 4. The City will provide centerline grade as per normal procedure, but the final fine adjustment of castings prior to final paving shall be the sole responsibility of the Contractor. Failure on the part of the Contractor to properly adjust said castings and the resulting inconvenience to the Engineer and the public shall be considered sufficient cause to assess the Contractor for liquidated damages in the amount of Three Hundred Dollars (\$300) for each casting requiring readjustment.

23.04.02      Adjust Oversize Manhole to Grade

This item is for furnishing and adjusting oversize manhole casting to grade. The adjustment of these oversize castings will be the same as described in the Standard Specifications and Standard Details for the regular size castings.

23.04.03      Furnish Manhole Castings and Oversize Manhole Castings

This item is for furnishing manhole castings and oversize manhole castings. The castings shall be as shown on the applicable Standard Details, S-13, S-13A and S-14 for water and sewer structures and E-24 for signal and lighting structures.

23.04.04      Rebuild Existing Manhole, Valve Chambers or Catch Basin -

In the prosecution of the work, certain manholes, valve chambers and catch basins, because of structural or other conditions, may require the tearing down or building up of more than one vertical foot of masonry, in which case the structure shall be considered as being rebuilt. The portion of the work which involves the tearing down or building up of the top vertical one foot of masonry shall be paid for as described under Adjusting Castings to Grade.

23.04.05            Remove Existing Catch Basin and Build New Basin, per Detail \_\_\_\_\_ -

The Bid Form item, "Remove Catch Basin, and Build New Basin per Detail \_\_\_\_\_," shall include the complete removal of the existing catch basin, and building a new catch basin in close proximity to the existing catch basin using a new casting.

23.04.06            Relocate Fire Hydrant -

The work under this item, including hydrant extensions, shall be done in accordance with Division 19. This item shall consist of furnishing all materials, labor, equipment and incidentals necessary to relocate existing fire hydrants to new locations as shown on the Drawings or as approved by the Engineer. It shall include all necessary excavation and MDOT Class II backfill.

The Contractor shall excavate around, and carefully disconnect each fire hydrant from the existing pipe and shall wire brush and thoroughly clean the joint. The Contractor shall remove and salvage for re-use the existing hydrant pipe and fittings, and plug the existing tee, if necessary, and install the hydrant to the proper grade and alignment in the new location.

Each hydrant shall stand plumb and have its nozzles parallel with or at right angles to the curb, with the pumper nozzle pointing normal to the curb.

23.04.07            Relocate Meter Pit -

The Bid Form item "Relocate Meter Pit" shall consist of the complete removal of the existing meter pit, building a new meter pit of proper size including the meter setting, piping, valves, fittings, adaptors, etc., to replace the existing pit in a new location, reconnecting the water service in the existing meter pit with the appropriate pipe, fittings and adaptors, backfilling the existing pit area and restoring the surface as necessary.

The City of Grand Rapids Water System will remove the meter from the existing meter pit and reinstall the meter in the meter setting in the new meter pit. They will also control the turning off or on of all valves necessary for the Contractor to relocate the meter pit as described above.

23.04.08            Relocate Curb Stop and Box -

The Bid Form item "Relocate Curb Stop and Box" shall include the removal of the existing box, furnishing and placing a new curb stop and box.

23.04.09            Abandon Valve Chamber and Place Valve Box Per Detail P-23A - In certain locations, the Engineer will require that an existing manhole or valve chamber be removed and a new valve box be placed and adjusted to grade. The contractor shall break the existing structure down to a point at least three feet below the pavement elevation, clean out all rubble and sediment, and complete the work by either of the following methods. The first method being to break the floor of the structure, place a new valve box, adjust it to grade and backfill the area with compacted MDOT Class II material. The second method is to place a new valve box, adjust it to grade, backfill the structure with pea stone and seal the structure with a concrete cap as per Standard Detail P-23A, and then backfill the remaining area above the concrete cap with compacted MDOT Class II material. The Contractor will be required to use a vibrator to aid in the compaction of the pea stone.

23.04.10 Sidewalk and Sidewalk Ramps, Concrete -

All sidewalk and ramp work under this section shall be performed in accordance with Division 10

23.04.11 Concrete Sidewalk and Driveway Approach - Additional Repair Work

For certain projects, included in the quantities for items for 4-inch and 6-inch sidewalk and 6-inch driveway approach, when applicable, is an estimated amount of work which is the adjacent property owner's responsibility to replace. It is anticipated that the City will enter into an agreement with the property owners for the contractor to perform this additional repair work. The additional repair work which the Contractor will perform will be marked out by the Engineer. The Contractor will be paid for only the amounts of said additional repair work completed at the unit price bid regardless of final quantities. No adjustment in price will be allowed for this additional repair work.

23.04.12 Remove Concrete Curb or Concrete Curb with Separate Gutter, including Driveway and Alley Returns and Remove Concrete curb and Gutter, including Driveway and Alley Returns

For purposes of this specification, the concrete radius driveway return is defined as the section of driveway abutting the street pavement and extending in from the face of the curb a distance of four (4) feet measured in the transverse direction perpendicular to the sidewalk. Detail P-2 shows a typical radius driveway return. Also for purposes of this specification, the concrete radius alley return is defined as the section of alley abutting the street pavement and extending in from the face of the curb a distance of seven (7) feet measured in the transverse direction perpendicular to the sidewalk. Detail P-2A shows a typical radius alley return. Please note that any portion of the drive return or alley return other than that defined herein is not included in this item but will be included under the item "Remove Concrete Driveway and Approache," or "Remove Concrete Alley and Approach."

The removal of straight curb, the removal of straight curb with a separate gutter pan, or the removal of curb and gutter will include removal of all pavement necessary to set forms including all pavement necessary to place a new curb, a new gutter pan, or new curb and gutter as specified on the Drawings or in the Bid Form. Concrete base to be removed will be saw cut prior to removal. Saw cutting in this case will be considered to have been included in the price bid for curb removal items and will not be paid for separately.

The removal of any bituminous pavement over the concrete gutter pan will be considered to have been included in the price bid for curb and gutter removal or curb and separate gutter pan removal and will not be paid for separately.

Where sidewalk is immediately adjacent to curb or curb and gutter that is to be removed and replaced, the Contractor will be paid separately for removal and replacement of sidewalk as required by the Engineer under the appropriate sidewalk items. If the sidewalk is saw cut at the request of the Engineer to save on removal and replacement, then the Contractor will be paid for saw cutting separately under the appropriate item. If the sidewalk is removed and not replaced, the Contractor will place topsoil, fertilizer and seed in these areas. Topsoil, seed, fertilizer and mulch in these cases will be considered as having been included in the price bid for other items of work.

23.04.13            Remove Concrete Curb Constructed Integral with Concrete Pavement or Concrete Pavement Base

The work to be done shall consist of removing the curb section constructed integral with concrete pavement or concrete pavement base by making a vertical cut in the gutter section or pavement section or pavement base section at the bottom face of the curb. The curb shall be broken away in such a manner so that the portions of pavement or base remaining shall be in suitable condition to be used as required by the conditions of the work.

23.04.14            Remove Concrete Driveway and Approach, Remove Concrete Alley and Approach

Removal of driveway approaches which are in combination with the walk as referenced in Detail P-3 shall include removing the combination walk and driveway approach from the back of the walk to the back of the curb. Removal of driveway approaches where there is parkway between the curb and walk as referenced in Detail P-3A shall include removing the approach from the front of the walk to the back of the curb.

Removal of alley approaches which are in combination with the walk as referenced in Detail P-4 shall include removing the combination walk and alley approach from the back of the walk to the back of the curb. Removal of alley approaches where there is parkway between the curb and walk as referenced in Detail P-4A shall include removing the approach from the front of the walk to the back of the curb.

The removal of these items shall include the complete removal and disposal of the existing concrete. If the concrete driveway or alley approach has been surfaced or capped with another material, the entire structure shall be considered for the purpose of these specifications as being a concrete approach. In addition to the above work, the work to be done shall include all necessary unclassified excavation and refilling and preparation of subbase and subgrade for the new aggregate pavement base or concrete pavement base, all necessary excavation and refilling and preparation of subgrade for the new work specified, all necessary work so that existing top soil can be removed, salvaged or stored and replacement of the salvaged top soil between the line of cutting and the back of the new combined curb and gutter or curb. All of the above work shall be included in the price bid and no additional payments will be made.

23.04.15            Joint Repair

Joint repair shall consist of repairing pavement joints, as shown in the applicable Standard Details for the Bid Form items specified. The work shall consist of all necessary pavement removal, including any saw cutting or chipping. The joints to be repaired will be marked in the field by the Engineer.

The placement of the bond coat and bituminous leveling course or bituminous top course materials to fill the joint shall be paid for under the item "Hand Patching."

23.04.16            Hand Patching

Hand patching shall consist of preparing the cleaned joints for resurfacing by placing a bituminous bond coat on the cleaned surface and then filling the joint with bituminous concrete leveling course or bituminous concrete top course material and compacting with a machine vibrator or approved roller.

23.04.17            Subbase Underdrain

Subbase underdrain shall be constructed according to the current Michigan Department of Transportation's Standard Specifications for Construction except as modified herein.

This work shall consist of furnishing and installing geotextile wrapped subbase underdrain and fittings, including excavation and backfilling as described herein. Underdrains shall not be plowed in place unless shown on the Drawings or specified in the Bid Form or Special Specifications.

The trench for a subbase underdrain shall be constructed as shown on the Standard Details or Drawings. The trench shall be constructed after the subbase has been placed and compacted.

Metallic-coated pipe on which the zinc or aluminum coating has been damaged in transporting, handling, or installing shall be repaired by thoroughly cleaning by wire brushing and painting with 2 coats of zinc-rich paint.

Plastic pipe or geotextile wrapping which has deteriorated in storage or has been damaged in placing will be rejected and shall be replaced.

Backfill materials shall be placed on sections of underdrain only after that section has been approved by the Engineer for backfilling.

Subbase underdrain shall be backfilled with MDOT granular material Class II as shown on the Drawings to several inches above the top of the subbase and compacted such that the upper 6 inches of backfill shall be compacted to 95 percent of maximum unit weight.

All backfilling operations shall be carried on with such care that the underdrain is not displaced from reasonably close conformity with the lines and grades required.

23.04.18            Removing of Existing Pavement -

Removing existing pavements shall be completed, measured, and paid for in accordance with Division 3.

23.04.19            Remove Concrete Sidewalk

Remove existing sidewalk shall consist of removing concrete sidewalks when called for on the Drawings, listed in the Bid Form, or when required by the Engineer. Where sidewalks are not to be replaced, the Contractor shall place topsoil, seed, fertilizer, and mulch, which will be paid separately under the appropriate item.

23.04.20            Restoration of Parkway

In the performance of the work some of the parkways will have to be regraded to conform to the new line or grade. The Contractor shall be required to remove and salvage all top soil to four inches below a line drawn from the top of the sidewalk to four inches below the top of the curb and regrade the section as required and replace the salvaged top soil so that the completed condition

will be comparable to Standard Detail on Sheet P-1A. The Contractor shall also be required under this item to seed, fertilize and mulch those areas of the parkway in which he has placed topsoil.

Payment for this work shall be included in the price bid for other items on the Bid Form unless otherwise specified. The price bid for the other items shall be payment in full for all parkway restoration, including all necessary excavation and refilling, salvaging of top soil as directed and spreading or replacing of the salvaged top soil as required, furnishing and placing of seed, fertilizer and mulch, disposing of all waste and surplus materials and all else required therefore and incidental thereto.

23.04.21 Salvage Stone Curb

Where existing curbs are Medina or other stone, and the Drawings or Bid Form requires that they be salvaged by the City, the Contractor shall notify the City Parks and Recreation Department at least 24 hours in advance of the removal of such curb by the Contractor so that the Park Department may arrange to pick up the curb stones. The removal, salvage and loading the salvaged curb onto City trucks will not be paid for separately but will be included in the item for removing existing curb or combined curb and gutter.

23.04.22 Tree and Stump Removal

Trees and stumps will be removed, measured and paid for in accordance with Division 2.

23.04.23 Clean and Remove Manhole, Valve Chamber or Catch Basin, per Detail P-23B -

This work shall be completed, measured, and paid for as specified under Division 3.

23.05 Measurement and Payment:

23.05.01 The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for furnishing all labor, equipment, material, grading, excavation, backfill, surface restoration when not paid for separately, disposal of the resulting materials, and for performing the work complete.

Pay Item	Pay Unit
Remove concrete curb and gutter, including driveway and alley returns	lin ft
Remove concrete curb, including driveway and alley returns	lin ft
Remove concrete curb constructed integral with concrete pavement or concrete pavement base	lin ft
Remove concrete alley and approach	sq ft

Pay Item	Pay Unit
Remove concrete driveway and approach	sq ft
Remove bituminous driveway	sq ft
Remove concrete sidewalk, driveway, and approach	sq ft
Remove concrete sidewalk	sq ft
Remove catch basin and build new basin per Detail ____	each
Abandon valve chamber and place valve box, per Detail P-23A	each
Adjust manhole or valve chamber casting to grade	each
Furnish manhole or valve chamber casting	each
Adjust oversize manhole casting to grade	each
Furnish oversize manhole casting	each
Adjust catch basin casting to grade	each
Adjust catch basin casting to grade, including restoration of curb and parkway	each
Furnish catch basin casting per Detail ____	each
Adjust valve box to grade	each
Furnish Valve Box	each
Adjust curb stop and box to grade	each
Furnish Curb Box	each
Relocate curb stop and box	each
Rebuild existing manhole, valve chamber or catch basin	vert ft
Relocate Meter Pit	each
Relocate fire hydrant	each

Pay Item	Pay Unit
Relocate fire hydrant, remove existing and place new 5" fire hydrant	each
Remove fire hydrant, place new 5" hydrant	each
Remove fire hydrant	each
____" Subbase Underdrain	lin ft
Joint repair, Detail A, per Detail P-21	lin ft
Joint repair, Detail B, per Detail P-21	lin ft
Joint repair, Detail C, per Detail P-21	lin ft
Hand Patching	ton

23.05.02 "Remove Concrete Curb, and Concrete Curb and Gutter, including Driveway and Alley Returns" will be measured in lineal feet and paid for at the Contract unit price per lineal foot, including preparation of subbase and subgrade.

The units to be paid for shall be as specified in the proposal and shall be based on a straight measurement along the face of the curb line with the measurement carried across the driveway and alley returns included in the straight measurement. No extra measurement or allowance will be made for the reason that the driveway and alley returns extend in from the face of the curb.

23.05.03 "Remove Concrete Curb and Separate Gutter" will be paid for under the item "Remove Curb and Gutter, including Driveways and Alley Return."

23.05.04 "Remove Concrete Alley and Approach," "Remove Concrete Driveway and Approach," and "Remove Concrete Sidewalk, Driveway and Approach" will be measured in area by square foot and paid for at the contract unit price per square foot.

23.05.05 "Remove Catch Basin and Build New Basin per Detail \_\_\_\_" will be measured as units and will be paid for at the contract unit price each, including tearing down or breaking down of the existing catch basin, and for building new catch basin including castings at the new location.

23.05.06 "Adjust Manhole or Valve Chamber Casting to Grade," and "Adjust Catch Basin Casting to Grade" will be measured as units and will be paid for at the contract unit price each, including removal of existing casting, pavement and pavement bases and the removal of old masonry, and placing of new masonry so that the existing casting, or new casting can be set to the new grade, using one vertical foot of new masonry or less, and the pavement around the castings.

23.05.07 "Relocate Curb Stop and Box" will be measured as units, and will be paid for at the contract unit price each, including furnishing and placing a new curb stop.

- 23.05.08 "Relocate Meter Pit" will be measured as units and paid for at the contract unit price each, including removing the existing meter pit, building a new meter pit, meter setting, piping, valves, fittings, adaptors, and all else necessary and incidental thereto.
- 23.05.09 "Relocate Fire Hydrant, Remove Existing and Place New 5" Fire Hydrant" will be measured as units and will be paid for at the contract unit price each. Necessary elevation adjustment will be measured and paid for as specified under "Hydrant Extension" in Division 19.
- 23.05.10 "Remove Fire Hydrant, Place New 5" Fire Hydrant" will be measured as units and will be paid for at the contract unit price each. Necessary elevation adjustment will be measured and paid for as specified under the item "Hydrant Extension" in Division 19.
- 23.05.11 "Subbase Underdrain" of the size or sizes shown will be measured in linear feet and paid for at the contract unit price per linear foot. The exact locations and amounts of underdrains may be adjusted by the Engineer and may be deleted in part or in its entirety if so determined by the Engineer without adjustment to other unit prices.
- 23.05.12 "Joint Repair" will be measured by length in linear feet and paid for at the contract unit price per linear foot according to Detail A, B, or C as noted on Detail P-21.
- 23.05.13 "Hand Patching" will be measured by weight in tons of materials actually placed and paid for at the contract unit price per ton.

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DIVISION 24  
BORE AND JACK

24.01	Description
24.02	Materials
24.02.01	Steel Casing Pipe
24.02.02	Carrier Pipe
24.03	Construction Methods
24.04	Measurement and Payment

DIVISION 24

BORE AND JACK

24.01 Description:

The work shall consist of boring and jacking a casing pipe, or carrier pipe, as specified in the Bid Form, and shall include the furnishing of all labor, materials and equipment necessary to complete the work as specified herein.

24.02 Materials:

24.02.01 Steel Casing Pipe shall be 35,000 psi minimum yield strength and shall conform to ASTM Designation A-139, Grade B or as indicated on the Drawings.

24.02.02 Carrier Pipe shall be as called for on the Bid Form.

24.03 Construction Methods:

Joints between adjacent sections of steel casing pipe shall be field welded.

Casing pipe shall be placed on an elevation so that the carrier pipe will be at the proper elevation. Wood blocking shall be used as necessary to install the carrier pipe at the proper elevation inside the casing pipe. Said blocking shall be securely fastened to the carrier pipe.

The carrier pipe shall be joined to form a continuous run through the casing.

The space between the carrier pipe and the casing pipe shall be completely filled with dry sand, pea stone, or flowable fill.

Both ends of the casing pipe shall be sealed with Grade 35S concrete (MDOT) or as indicated on the Drawings.

In constructing the jacking pit, the Contractor will be required to tight-sheet the front and all sides of the pit as necessary to protect his operation and the adjacent property.

24.04 Measurement and Payment:

The completed work as measured for items in this Division will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for furnishing all labor, equipment and material including excavation and backfill, necessary jacking pits, connections to pipes on both ends of the boring and jacking, restoration, and all other work necessary and incidental thereto for performing the work complete.

<u>Pay Item</u>	<u>Pay Unit</u>
Bore and Jack ____" Diameter Steel Casing Pipe, Wall Thickness ____", including _____" ( <u>carrier pipe</u> )	lin ft

Bore and Jack \_\_\_\_" Diameter Casing Pipe, Wall Thickness \_\_\_\_" including \_\_\_\_" (carrier pipe) shall be measured in linear feet of the actual length of pipe bored and jacked into place. This length shall not exceed that shown on the Bid Form except if additional length is specifically authorized by the Engineer. No additional payment shall be made for the length beyond the Bid Form amount except as authorized by the Engineer.

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DIVISION 25  
STREET LIGHTING

25.01	Description
25.02	Materials
25.02.01	Light Poles, Concrete
25.02.02	Light Poles, Wood
25.02.03	Cross Arms, Wood
25.02.04	Light Poles, Fiberglass
25.02.05	Bolt-Down Base
25.02.06	Bracket Arm and Options
25.02.07	Luminaire
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25.02.09	Overhead Line Hardware
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25.03.01	Light Poles
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25.03.03	Overhead Line
25.03.04	Wood Cross Arms
25.03.05	Luminaires
25.03.06	Controls
25.04	Measurement and Payment

## DIVISION 25

### STREET LIGHTING

25.01 Description:

This work shall consist of furnishing and/or installing the items described below and includes, but is not limited to, all the necessary labor, materials, tools and equipment necessary to give a finished installation.

25.02 Materials:

25.02.01 Light Poles, Concrete - Poles shall be prestressed concrete of the design and dimensions shown on the Drawings, and shall be machine made in steel molds by the centrifugal process to ensure maximum density, a smooth finish, proper embedment of the reinforcing steel and provide that flexural cracking shall not occur during handling or under designed loads. The cross section of the pole shall contain a raceway for cables, having a minimum opening of one and one-half inches, and not more than two inches at the top of the pole. This raceway shall be produced by the centrifugal process and shall extend throughout the length of the pole. (In the case of bolt-down type of base, the raceway shall be enlarged to five and one-half inches at the base for each entrance of the electrical wiring.) Cored holes for handholes or bracket openings shall be in accordance with the location and sizes shown on the Drawings, and be free from sharp edges for passage of the electrical wiring.

The material used in the manufacturer of these poles shall be as follows: All aggregates shall be graded from three-eighth inch to #100 sieve, with not more than 5% passing the #100 sieve, unless otherwise specified. Aggregates shall be sound, durable and free from chert. A minimum of 20% of the total aggregate shall be crushed black granite. At the request of the Engineer, the Contractor may be required to furnish samples of the aggregate for approval of color and texture.

The high early strength cement used in the manufacture of these standards shall conform to current American Society for Testing Materials Specification C-150.

The water used shall be free from acids, alkalis, oil, or vegetable matter. The maximum quantity of gallons of water per sack of cement shall be in the proportion required to produce a concrete with a minimum 24-hour compressive strength of 3,500 psi, under steam curing as specified, before prestressing is released.

The high tensile prestressing steel used shall have an ultimate strength of at least 250,000 psi, and shall be prestressed to not more than 70% of the ultimate strength. The primary reinforcing shall be in accordance with ASTM Designation A416-57T or A421-58T. Spacer rings with non-ferrous studs shall be securely attached to the reinforcement to ensure a minimum coverage of one-half inch of concrete. Where the minimum coverage cannot be maintained next to a cable entrance, handhole, or wire inlet, the reinforcing shall be protected by means of a non-corrosive sleeve. Spiral wrapping of a diameter not less than .105 inches shall be spaced on two and one-half inch pitch from the top of the pole for a distance of not less than five feet, and be securely tied to the reinforcement by an approved method.

Following the casting operation, the concrete shall be cured with low temperature steam. Following the steam curing, the standards shall be kept moist during the early days of curing and shall not be subject to severe temperature changes during the curing period.

The poles shall be furnished with their original cement finish and all burrs and rough edges shall be removed by grinding.

Bolt-down type poles shall have a cast steel anchor base of ASTM designation A27 Grade 70-36 which shall be secured to the primary reinforcement of the pole in such a manner as to develop sufficient strength to transmit the required loads to the anchor bolts. The connection between the bolt-down base and primary pole reinforcement shall be entirely embedded within the concrete pole. The anchor base plate shall be hot-dipped galvanized.

Poles of the type to be set directly in the earth shall have a precast butt cast as an integral part of the pole in the spinning process. Dimensions shall be in accordance with the Standard Details.

25.02.02            Light Poles, Wood - Wood poles shall be of the height, class and type specified in the Bid Form and shall meet the requirements of Edison Electric Institute Specification TD-100. Preservative shall meet AWWA Specification P-8.

25.02.03            Cross Arms, Wood - Cross arms for use with wood poles shall be the type and size specified in the Bid Form and shall meet the requirements of Edison Electric Institute Specifications. Preservation shall meet AWWA specifications P-8.

25.02.04            Light Poles, Fiberglass

Fiberglass direct embedded street lighting poles shall be round and hollow with a uniform taper of .15 in. per ft. The butt end of the pole shall be enlarged and square. Wiring access and entrance holes shall be reinforced. The color of the pole shall be contained in the resin and shall be throughout the thickness of the pole.

The inner core of the pole shall be formed by wrapping glass filaments treated in a bonding resin at a relatively wide angle (65° - 85°) to the longitudinal axis of the pole to form a number of layers with alternate layers crossing one another in opposite directions. An outer core section of greater weight than the inner section shall be formed by wrapping a number of relatively narrow bands of filaments treated in a bonding resin at a relatively slight angle (3° - 15°) to the longitudinal axis, with alternating bands of filaments crossing each other in opposite directions. The pole shall be cured in an oven. The fiberglass and resin ratio of the pole shall contain at least 65% glass and the balance polyester resin.

A finish coating of pigmented urethane capable of withstanding exposure to ultraviolet, chemicals, and extreme weather conditions shall be applied to a minimum dry film thickness of one and one-half mils.

Poles shall be rated for 110 mph 30% gust factor AASHTO wind load areas.

This pole shall have no more than 5% deflection with a 200 lb. top horizontal load and shall withstand a 1200 lb. top vertical load without failure.

The manufacturer shall warranty the pole against structural failure from natural causes, within the criteria of these specifications, for a period of 20 years.

Fiberglass pole to be or have the following:

Handhole with cover and wire entrance hole to be 2 in. by 5 in.

Handhole location to be 2 ft. above the ground line.

Two wire entrances to be opposite and located 18 in. below the ground line.

Finish to be smooth.

(a) Fiberglass Poles for Post Top Luminaire

Poles to be or have the following:

Total length - 18 ft.

14 ft. above ground, 4 ft. butt base

Total weight - 42 lbs.

Pole top tenon to be 3 in. diameter x 2-1/2 in. long

Color to be black

(b) Fiberglass Pole for 28 ft. Mounting Height and 8 ft. Mast Arm

Fiberglass pole with mast arm to be or have the following:

Luminaire mounting height - 28 ft.

Mast Arm to be aluminum, 8 ft. span, 39 in. rise, 2 in. slip fitter and capable of supporting a luminaire weighing 59 lbs. with an effective projected area of 1.2 sq. ft.

Total length of pole to be 31 ft. including a 5 ft. butt base.

Color to be gray.

(c) Fiberglass Pole for 35 ft. Mounting Height and 10 ft. Mast Arm

Fiberglass pole with mast arm to be or have the following:

Luminaire mounting height - 35 ft.

Mast Arm to be aluminum, 10 ft. span, 39 in. rise, 2 in. slip fitter and capable of supporting a luminaire weighing 59 lbs. with an effective projected area of 1.2 sq. ft.

Total length of pole to be 37 ft. 6 in. including a 5 ft. butt base.

Color to be gray.

(d) Fiberglass Pole for 35 ft. Mounting Height, 10 ft. Mast Arm, and Reinforced or Walk-Wait Signal

Reinforced Fiberglass pole with mast arm to be or have the following:

Luminaire mounting Height - 35 ft.

Mast arm to be aluminum, 10 ft. span, 39 in. rise, 2 in. slip fitter and capable of supporting a luminaire weighing 59 lbs. with an effective projected area of 1.2 sq. ft.

Total length of pole to be 37 ft. 6 in. including a 5 ft. butt base.

Color to be gray.

Special reinforcing for installation of walk-wait pedestrian signal as follows:

48 in. of reinforced area centered 15 ft. 8 in. from the butt end.

Center point of this reinforced area shall be marked.

25.02.05 Bolt-Down Base - A Bolt-Down Base meeting the requirement of the Standard Details shall be furnished as a part of the light pole for all bolt-down type poles.

25.02.06 Bracket Arm and Options - Bracket arms and other options for fiberglass and concrete poles shall be as shown on the Standard Details unless otherwise called for on the Bid Form, the Drawings or in the Special Specifications.

Bracket arms for wood pole installation shall be as indicated on the Drawings and shall be the following:

(a) 30 inches long, General Electric #C622-G002, or approved equal.

(b) 8 feet long, General Electric #C623-G005, Fabricated Metals Corp. #P200S080, or approved equal.

(c) 12 feet long, Fabricated Metals Corporation #D200S120, or approved equal.

(d) 20 feet long, Fabricated Metals Corporation #D200S200, or approved equal.

25.02.07 Luminaire - The luminaire shall be internally ballasted for high pressure sodium lamps. There shall be no opening in the top of the housing except that to accept a photo-control receptacle only if specified.

The optical system shall produce the IES Type Distribution and classification specified on the Drawings.

The ballast shall be the regulator (constant wattage) type with high power factor (greater than 90%) and shall be specially designed for use with the lamp of the type and wattage specified on the Drawings from a 120 or 240 volt single phase 60 Hz. supply. Ballast shall be complete with

600V fuse clip and 5A fuse. The starting aid shall be readily accessible. Ballast shall be multi-tapped type. Ballast for lamps of 150 watts or less shall be for the 55 volt lamp.

The reflector shall be highly polished anodized specular aluminum.

The refractor shall be a prismatic heat-resistant borosilicate glass, unless otherwise specified.

The Drawings shall indicate the type of luminaire (roadway or post top), the voltage, the wattage, and the IES light distribution.

The luminaire shall be General Electric, Crouse-Hinds, McGraw Edison, American Electric, ITT, or approved equal.

25.02.08      Secondary Circuit Controls - Secondary Circuit Control relays for street lighting control shall be of the following as indicated on the Drawings:

- (a)      RCOC relays to be 240/480 volts, 100 amperes, two poles, with 120 volts, 60 Hz coil, 480/120V control transformer, AUTO-OFF-HAND control switch, 100 amperes 600 volts dual element fuses, lightning arrestors, and 120 volt photoelectric control socket mounted on the enclosure. Enclosure shall be cast aluminum with hinged gasketed cover. Brackets shall be included for direct pole mounting. All internal wiring shall be included. Contacts shall be normally open. Relays shall be South Bend Current Controls, Inc. Type MR-DHE, Spec 6465, or approved equal.
- (b)      RCOC relays to be 240/480 volts, 60 amperes, two poles, with 120 volts, 60 Hz coil, 480/120V control transformer, AUTO-OFF-HAND control switch, 60 amperes 600 volts dual element fuses, lightning arrestors, and 120 volt photoelectric control socket mounted on the enclosure. Enclosure shall be cast aluminum with hinged gasketed cover. Bracket shall be included for direct pole mounting. All internal wiring shall be included. Contacts shall be normally open. Relays shall be South Bend Current Controls, Inc. Type MR-ZH, Spec 6406, or approved equal.

25.02.09      Overhead Line Hardware - Material used in the construction of overhead lines shall be the following:

- (a)      Machine bolts, Double Arming Bolts, and Steel Cross Arm Pins shall meet "American National Standards for Galvanized Steel Bolts and Nuts for Overhead Line Construction" (ANSI C135.1), and galvanized according to ASTM Specification A153.

<u>Size</u> <u>(inches)</u>	<u>Minimum Tensile</u> <u>Load (pounds)</u>
3/8	4,250
1/2	7,800
5/8	12,400
3/4	18,350
7/8	25,400

Steel insulator pins shall be 5/8" with square washer, nut, and lock nut, with 1" lead thread to accept insulator.

- (b) Lag Screws to be hot-dip galvanized, 1/2" x 4" with fetter-drive and pilot point.
- (c) Washers - Hot-dip galvanized in the following sizes

<u>Washer Size</u>	<u>Hole Dia.</u>	<u>Bolt Size</u>
3" x 3" x 1/4" Curved Square	11/16"	5/8"
3" x 3" x 1/4" Square	13/16"	3/4"
1-3/4" O.D. x 10 Ga. Round	11/16"	5/8"
2" O.D. x 9 Ga. Round	13/16"	3/4"

- (d) One Wire Rack (Clevis), hot-dip galvanized shall have curved sides, 3-1/4" opening for spool insulator, 4-inch clearance from back plate to center of spool insulator. Spool insulator shall be 3" high, 3-1/8" wide, single groove of 11/16" radius, with sky gray glaze, ANSI Class 53-2.
- (e) Cross Arm Braces shall be hot-dip galvanized 1-1/4" wide and 1/4" thick, with a 9/16" hole at one end and a 7/16" hole at the opposite end. Distance between the centers of the holes shall be 26 inches.
- (f) Extension strap shall be hot-dip galvanized, 1-1/4" wide and 5/16" thick, with 11/16" holes at each end. Distance between the holes shall be 20".
- (g) Guying attachment shall be ductile iron grade 654512, ASTM 536, hot-dip galvanized per ASTM 123, minimum ultimate strength 21,000 pounds, for two 3/4-inch machine bolts, for a maximum of 1/2" cable installation, for use on flat or curved surfaces, for use with standard fiberglass insulators, and for use with insulated or uninsulated guy strand. Continental Electric Co. #UGA-66-4.
- (h) Guy strand shall be utilities grade, zinc coating as listed in ASTM A363, of the following sizes:
  - 5/16-inch, 3-wire at .145-inch diameter 6500 lb., Grade 3.
  - 3/8-inch, 7 wire at .120-inch diameter, 11,500 lb., Grade 4.

A 20,000 lb. capacity guy consists of 3/8" strand (11,500 lb.) installed in a loop configuration.

25.02.10 Overhead Line Insulators - Insulators shall be of the following type:

- (a) Pin type shall be the following:
  1. Porcelain ANSI Class 55-4
  2. Threaded for 1" diameter pin.
  3. Radio-free interference type
  4. Two-skirt construction
  5. Leakage distance: 9"
  6. Dry leakage distance: 5"
  7. Cantilever Strength: 3,000 lb.
  8. Sky blue glaze: ANSI 70

- (b) Suspension - Dead end type shall be the following:
1. 6-inch disk - porcelain
  2. Clevis-tongue type
  3. Ferrous cap and stud
  4. ANSI Class: 52.1
  5. Mechanical and Electrical Rating: 10,000 lb.
  6. Proof Test: 5,000 lb.
  7. Sky blue glaze: ANSI 70

Two suspension insulators are required for dead-ending on wood structures. Three suspension insulators are required for dead-ending on steel structures.

- (c) Spool for one wire rack shall be porcelain, ANSI Class 53-2, with sky blue glaze, ANSI 70.
- (d) Guy strain shall be porcelain ANSI Class 54-3 with sky blue glaze, ANSI 70. Length = 5-1/2", Diameter = 3-3/8", for up to 5/8" strand.
- (e) Fiberglass guy strain shall have 54 inches of fiberglass rod, hot-dip galvanized malleable iron fittings at each end, one of which shall have a roller. Minimum breaking strength shall be 30,000 pounds. Joslyn #703-54, or approved equal.
- (f) Secondary cable spreader shall be designed to handle up to 4 conductors and shall be made from gray, high density polyethylene and shall be made for rigid installation or for mid-span tap. Hendrix #S-604, or approved equal.

25.02.11

Overhead Line Conductors - Conductors shall be as indicated on the Drawings and shall be of the following:

- (a) #4 Triplex (#4Tx) code word "Welk."
1. Consisting of 2 - #4 solid aluminum phase conductors. Polyethylene insulated (one of which shall have an identification such as a ridge on the insulation) and 1 - #4 ACSR (6/1) bare neutral messenger (Stranding: 6 aluminum, 1 steel).
  2. Lay of the assembled conductors shall be 90 times the diameter of one insulated conductor.
  3. Common designation on Drawings can be "#4Tx" or "4-4(6/1)-4".
- (b) #1/0 Triplex [#1/0 TX] [#1/0(7) - #1/0(6/1) - #1/0(7)]. Code word "Neritina".
1. Consisting of 2 - #1/0 aluminum conductors, 7 strands each, phase conductors, polyethylene insulated (one of which shall have an identification such as a ridge on the insulation), and 1 - #1/0 ACSR (6/1) bare neutral messenger (stranding: 6 aluminum, 1 steel) bare conductor.
  2. Lay of the assembled conductors shall be 90 times the diameter of one insulated conductor.

3. Common designation on the Drawings can be "#1/0Tx" or "#1/0(7) - #1/0(6/1) - #1/0(7)".
- (c) #4(6/1) ACSR code word "Swanate", ultimate strength 2245 lb. Steel core to have Class B zinc coating.
  - (d) #2(7/1) ACSR code word "Sparate", ultimate strength 3385 lb. Steel core to have Class B zinc coating.
  - (e) #1/0(6/1) ACSR code word "Raven", ultimate strength 4140 lb. Steel core to have Class B zinc coating.
  - (f) 3/0 (6/1) ACSR code word "Pigeon", ultimate strength 6135 lbs. Steel core to have Class B coating.
  - (g) #2(7/1) ACSR code word "Beech", ultimate strength 3350 lb., consisting of 7 strands of aluminum, 1 strand of steel, and overall covering of polyethylene.  
  
This conductor to be used for the primary neutral on 12470 volt "Y" where secondary does not exist.
  - (h) Insulated snap-on covers for insulating crimp splices and taps from or to the insulated conductor of Triplex:
    1. Burndy #CCD, for "D" die compression connectors, 2-3/4 inches long.
    2. Burndy #CCO, for "O" die compression connectors, 2-1/2 inches long, used for #4 tap and #1/0 lamp lead taps.
    3. Blackburn #C2 for 5/8" dies compression connectors, 2 inches long used for #4 butt and #4 lamp lead taps.
  - (i) Lamp lead conductors shall be 2 conductor, "Figure 8," #10 copper 7 strands, PVC insulated with a rib on the insulation of one conductor for conductor identification. IPCEA Specification No. S-61-402. To be Cyprus Wire & Cable Co. or approved equal.

25.02.12 Lightning Arrestor - Arrestors shall be of the following type:

- (a) 3 kV (for 2.4 kV Delta System) surge type
  1. Distribution Class
  2. Meet or exceed all requirements of ANSI Standard C62.1 - 1975
  3. Non-external gap
  4. With disconnect on ground lead
  5. Supplied with EEI-NEMA cross arm mounting bracket
  6. Standard sky blue glaze, ANSI 70
  7. McGraw Edison Type ES #AVS 101M003, or approved equal.
- (b) 8 kV (for 15 kV "Y" system) surge type
  1. Distribution Class
  2. Meet or exceed all requirements of ANSI Standard C62.1 - 1975

3. Non-external gap
4. With disconnecter on ground lead
5. Supplied with EEI-NEMA cross arm mounting bracket
6. Standard sky blue glaze, ANSI 70
7. McGraw Edison Type ES #AVS 101M010, or approved equal.

- (c) 9 kV (for 15 kV "Y" system) surge type
1. Intermediate Class
  2. Metal-Oxide Varistor utilization
  3. Non-external gap
  4. Meet or exceed the following performance standards: ANSI/IEEE C62.1, IEC 99-1 including pressure relief
  5. Porcelain top with connector
  6. With cross arm mounting bracket
  7. Standard sky blue glaze, ANSI 70
  8. McGraw Edison Type AZF#AZF2A10, or approved equal.

25.02.13 Metal Enclosure, Pad and Electrical Equipment - The metal enclosure shall be of the modular size and have the number of modules with the number of doors as shown on the Drawings. The pad shall be reinforced concrete (Class A) of the size and have the number of openings shown on the Drawings. Electrical equipment shall include all the electrical devices shown on the Drawings for the proposed metal enclosure. It shall also include all the mounting rails, transformers, conduit, wire, switches, controls and miscellaneous materials required to give a finished installation.

25.02.14 Transformer Vault Electrical Equipment - Transformer vault electrical equipment shall include all the electrical devices and utilization equipment specified for the existing or proposed transformer vault. It shall also include all the conduit, wire and miscellaneous materials required to give a finished installation.

25.03 Construction Methods -

Construction of items in this Division shall conform to these specifications, applicable Standard Details, all applicable codes and regulations, and accepted industry standards and practices.

25.03.01 Light Poles - Light poles of all types shall be installed plumb with the bracket arms at right angles to the curb lines. The work shall include the excavation, furnishing and placing sand backfill and disposal of surplus excavated material.

25.03.02 Bolt-Down Base - Bolt-down bases shall be constructed when and where shown on the Drawings. Concrete shall be cast in place with the reinforcing steel, conduit elbows, and anchor bolts accurately located and securely tied.

25.03.03 Overhead Line - Overhead line shall be installed as shown on the Drawings. Overhead line construction shall not impose undue stress on the poles. Pole line shall remain parallel with the right-of-way and poles shall not be bent or lean due to cable or guy tension. Exposed metal materials shall be protected from corrosion by painting with a zinc-rich paint.

25.03.04

Wood Cross Arms -

(a) All holes shall be drilled through the centerline of the faces, and shall not vary by more than 1/32-inch from the diameters specified herein.

(b) Size 3-1/2" x 4-1/2" x 8 ft. (6 pin arm, double dead end to 1370#)

(1) Holes drilled in the 4-1/2" face shall be 11/16" diameter located at the center, and 42" each way from center, and 7/16" diameter located 19" each way from center (5 holes total).

(2) Holes drilled in the 3-1/2" face shall be 11/16" diameter, located 15", 29-1/2", and 44" each way from the center (6 holes total).

(c) Size 3-1/2" x 4-1/2" x 10 ft. (3 phase switch arm)

(1) Holes drilled in the 4-1/2" face shall be 11/16" diameter located at the center, and 54" each way from center, and 7/16" diameter located 19" each way from center (5 holes total).

(2) Holes drilled in the 3-1/2" face shall be 11/16" diameter, located 15" and 56" each way from the center (4 holes total).

(d) Size 5-1/2" x 7-1/2" x 8 ft. (Single - Dead end to 2550#, double dead end to 4800#)

(1) Holes drilled in the 5-1/2" face shall be 11/16" diameter located at the center, and 42" each way from center, and 7/16" diameter located 19" each way from center (5 holes total).

(2) Holes drilled in the 7-1/2" faces shall be 11/16" diameter, located 15", 29-1/2" and 44" each way from the center (6 holes total).

25.03.05

Luminaires - Luminaires shall be installed on the light pole bracket arm combination furnished and installed under another item and shall include all the necessary wiring and connections to produce a balanced load with the existing or proposed single-phase three wire circuit with ground in accordance with the manufacturer's recommendations, to give a finished installation.

25.03.06

Controls - The controls, including enclosure and photocell, shall be securely mounted in location shown on the Drawings.

25.04

Measurement and Payment:

The completed work as measured for work in this Division will be paid for at the contract unit prices for the following contract items (pay items). The prices shall be payment in full for furnishing all labor, equipment, and material, for any necessary grading, excavation, and backfill, for restoration when not paid for separately, and for performing the work complete. In some instances the City will provide all or part of the materials for work under this Division. In those instances, the Bid Form will so indicate.

Pay Item	Pay Unit
____' concrete light pole with ____' butt base per Detail E-5, including ____ type bracket arm ____' long per Detail E-6	each
____' Fiberglass light pole per Detail E-8, including bracket arm ____' long, per Detail E-9	each
____' Fiberglass Light pole with pedestrian signal reinforcing per Detail E-8, including bracket arm ____' long per Detail E-9	each
____' Wood pole, Class ____, ( <u>material</u> ), set per Detail E-15 including bracket arm ____' per Detail E-18	each
____' Wood pole, Class ____, ( <u>material</u> ), set per Detail E-15	each
Bracket arm on wood pole, ____' per Detail E-18	each
Cross arm, single, 3-1/2" x 4-1/2" x ____'	each
Cross arm, double, 3-1/2" x 4-1/2" x ____'	each
Cross arm, double, one 3-1/2" x 4-1/2" x 10' and one 3-1/2" x 4-1/2" x 8'	each
Cross arm, single, 5-1/2" x 7-1/2" x 8'	each
Cross arm, double, 5-1/2" x 7-1/2" x 8'	each
One wire rack, bolted	each
One wire rack, lagged	each
Thimble eye-nut, bolted	each
Steel pin and insulator	each
Suspension, dead end, with two 6" disc insulators	each
Suspension, dead end, with 20" extension strap and two 6" disc insulators	each
Secondary cable spreader bolted to pole	each
____ KV lightning arrestor, ____ Class	each

Pay Item	Pay Unit
Fused cutout, ____ amperes	each
Overhead line conductor, #4 triplex	lin ft
Overhead line conductor, #1/0 triplex	lin ft
Overhead line conductor, _____ ACSR	lin ft
Secondary Circuit Control Relay ____ amperes	each
18' Fiberglass street light pole, per Detail E-10	each
Luminaire, HPS, ____ W, 120/240V, cobra head, with ____/____/____, IES light pattern	each
Luminaire, HPS, ____ W, 120/240V, post top, per Detail E-10, with ____/____/____ IES light pattern	each
Cable secondary pedestal per Detail E-4B	each
Guy installation for wood pole, per Detail E-16, ____ K rating	each
Guy installation for wood pole, per Detail E-16, ____ K rating, including fiberglass guy strain insulation	each
Sidewalk guy installation for wood pole per Detail E-17, ____ K rating	each
Sidewalk guy installation for wood pole per Detail E-17, ____ K rating, including fiberglass guy strain insulation	each
Guy installation pole to pole, ____ K rating	each
Guy installation pole to pole, ____ K rating, including fiberglass guy strain insulation	each
Ground Assembly for Wood Pole, per Detail E-19	each

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DIVISION 26  
ELECTRICAL UNDERGROUND

26.01	Description
26.02	Material
26.02.01	Cable Duct
26.02.02	Direct Buried Conduit
26.02.03	Concrete Encased Conduit
26.02.04	Primary Riser Conduit, Cable and Terminators
26.02.05	Primary Cable Installed in Conduit
26.02.06	Secondary Riser Conduit and Cable
26.03	Construction Methods
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26.03.04	Primary Cables Installed in Conduit
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## DIVISION 26

### ELECTRICAL - UNDERGROUND

26.01 Description:

This work shall consist of furnishing all labor, materials, tools and equipment necessary to construct an underground electrical system as specified. All work shall meet State, Local and National Codes.

26.02 Material:

26.02.01 Cable Duct - Cable duct is an assembly consisting of three (3) seven-strand, insulated, copper conductors of the sizes specified, covered with Type USE, 600V insulation or as otherwise specified, and one bare (uninsulated) seven-strand #6 A.W.G. copper USE green grounding conductor. The conductors shall be in a flexible plastic (polyethylene) conduit of the size specified in such a manner as to permit the ready replacement or addition of conductors should it become desirable or necessary. Insulated conductors are to be color coded to provide reference for connection of street lights to alternate conductors yielding a single-phase three-wire balanced load.

Polyethylene water pipe (ASTM B2837, D2104, 1.25 inches diameter, 100 psi) with properly sized conductors may be used in lieu of cable duct when approved by the Engineer.

26.02.02 Direct Buried Conduit - Direct buried conduit shall be PVC pipe, thickness as listed in the Bid Form.

26.02.03 Concrete Encased Conduit - Conduit for concrete encasement shall be PVC pipe, thickness as listed in the Bid Form.

All concrete for duct encasement shall be Grade A as specified in Division 7.

Steel Reinforcement shall be as specified in Division 7.

26.02.04 Primary Riser Conduit, Cable and Terminators - The Primary Riser Conduit shall be rigid, galvanized steel conduit as listed in the Bid Form and shown on the Standard Details. Cable and terminators shall be of an approved type as specified.

26.02.05 Primary Cable Installed in Conduit - Primary cable installed in conduit shall be an approved medium voltage shielded primary copper conductor of the following size and type:

- (a) 15 kV with 133% EPR Insulation
  - 1. Conductors shall be copper stranded.
    - a) Size shall be as specified (#2 - 7 strand, #2/0 - 19 strand)
  - 2. Conductor shall have extruded shielding or a stress control layer.
  - 3. EPR insulation shall be 220 mils, shall not contain any polyethylene, and shall only contain up to a maximum of 72% ethylene.
  - 4. Semi-conductive layer over insulation.
  - 5. Copper tape shielding, over semi-conductive layer, with at least 20% overlap.
  - 6. Jacket shall be 80 mils of chlorosulfonated polyethylene (cable tray rated).

- (b) 5 kV with 133% EPR insulation or 8 kV with 100% EPR Insulation
  - 1. Conductors shall be copper stranded
    - a) Size shall be as specified (#2 - 7 strand, #2/0 - 19 strand)
  - 2. Conductor shall have extruded shielding or a stress control layer.
  - 3. EPR insulation shall be 115 mils, shall not contain any polyethylene, and shall only contain up to a maximum of 72% ethylene.
  - 4. Semi-conductive layer over insulation.
  - 5. Copper tape shielding, over semi-conductive layer, with at least 20% overlap.
  - 6. Jacket shall be 80 mils of chlorosulfonated polyethylene (cable tray rated).

Primary cable materials shall be as manufactured by Kerite, Okonite, or approved equal.

26.02.06 Secondary Riser Conduit and Cable - The secondary riser conduit shall be rigid, galvanized steel conduit as listed in the Bid Form and shown on the Standard Details. Cable shall be an approved type as specified.

26.03 Construction Methods:

26.03.01 General - The location of underground utilities and other obstructions, if shown on the Drawings, although plotted from the best information available may not be completely accurate. Also underground obstructions may be encountered which are not shown on the Drawings or are unknown at this time. Locations of conduit and/or cable duct runs shown on the Drawings may have to be adjusted for the above conditions. Abandoned structures which may be encountered and which would interfere with the conduit or cable duct run shall be removed sufficiently to permit the installation or construction of the conduit or cable duct run. The cost of such removals shall be considered as included in the price bid for the conduit.

Fire Hydrants shall be kept accessible for immediate use at all times.

26.03.02 Cable Duct - Cable duct shall be installed at the locations indicated on the Drawings in continuous unspliced lengths, placed 24 in. below the finished grade.

The cable duct shall be laid as nearly as possible in a straight line between light poles or other structures and shall be brought up into the light pole to the wiring handhole located approximately 18 in. above the ground line. The Contractor shall furnish and install 5/8 in. x 8 ft. sectional type Copperweld ground rods or approved equal at the end of each "leg" of cable duct and make connection to the street lighting grounding conductor in the above grade wiring handhole of the concrete pole with a non-ferrous bolting type clamp. Resistance to ground at such points shall be not greater than 25 ohms.

26.03.03 Direct Buried Conduit and Concrete Encased Conduit

(a) General - Conduit for electric use may be either direct buried or concrete encased. Such conduit shall be, insofar as possible, continuous with joints only as necessary and staggered both horizontally and vertically in multiple conduit rows. The conduit shall be laid in a straight line if possible and if bends are necessary, they shall be "long sweep" type. All conduits shall be graded so as to drain into handholes or manholes with no low spots between structures.

Before acceptance of conduit by the Engineer the Contractor shall pull a cleaning device through the conduit to remove any foreign material from the conduit.

Should any conduit be installed with "dead ends," i.e., not connected to structures at either end, such "dead ends" shall be carefully plugged.

If available, standard bell sections shall be installed at all duct entrances to handholes, manholes, etc.

(b) Direct Buried Conduit - Single or double conduits may be installed as direct bury. They shall be installed with minimum cover of 36 inches in a roadway section and may be installed with 24" cover if outside the roadway and if they are to be use with circuits rated for less than 600V.

(c) Concrete Encased Conduit - Such conduits shall have a minimum 24" cover over the top of the encasement. The earth walls of the trench may be used to serve as forms for the concrete encasement except at open excavation around manholes or other structures where special concrete forms are necessary. All forms shall be securely braced to prevent spreading and shall be constructed of structurally sound lumber placed to provide a 3" concrete envelope on all sides.

The duct shall be placed on base-type spacers and shimmed to get 3" of concrete below the formation. Spacers are to be placed every 6 feet. Once the first layer or tier of ducts is laid, intermediate spacers shall be used for succeeding tiers of duct until formation is complete. All spacers are to be interlocked both horizontally and vertically with the spacer adjacent. Once duct formation is complete, the entire assembly shall be securely tied together with wire anchored by 5/8" reinforcing rods to avoid movement during concrete pour.

The concrete shall be fluid enough to allow it to flow between the ducts to eliminate all possible voids. Vibrate the concrete as it is poured. Neatly finish off and square the top of the concrete at the proper grade making sure there is 3" of concrete over the top of the ducts.

In instances where obstructions are found which will interfere with the duct construction, the Engineer may allow the formation of ducts to be modified to circumvent the obstruction by installing ducts above, below or around the obstruction with a 1" separation between the concrete encasement and the obstruction.

26.03.04

#### Primary Cables Installed in Conduit

Preparing Conduits and Manholes - A short time before the cable is to be installed, the conduits shall be tested and cleaned of any obstructions or foreign matter unless the conduits were installed very recently and it is definitely known that they were properly cleaned and inspected on completion of installation. Where no end bells are provided, the ends of the conduits shall be reamed to prevent damage to the cable during or after installation. Upon completion of inspection, a pulling wire shall be left in each conduit in which a cable is to be installed, for later drawing-in of the wire rope which will be used to pull in the cable.

Installation of cable involves considerable work in manholes where space is limited and working conditions are imperfect at best. To provide suitable working conditions, especially for the making up of cable joints which requires the utmost in cleanliness on the part of the workman,

any accumulated water shall be pumped out, mud and litter should be removed and the manhole made as clean as reasonably possible.

Care shall be taken by the Contractor when pulling the cable through the conduit so as not to damage the cable in any way such as by excessive pulling tension or scoring of the sheath on irregularities in the conduit. The Contractor will be permitted to lubricate the cable with a suitable lubricant if he so desires.

If the cable is found to be defective while being installed or being energized, the defective section of cable shall be removed and replaced by the Contractor, at his own expense.

26.04 Measurement and Payment:

The complete work as measured for work in this Division will be paid for at the contract unit prices for the following contract items (pay items). The price shall be payment in full for all labor, equipment, and material, for grading, excavation, and backfill, and for restoration when not paid for separately, all duct, conduit, wire, cable, cable lubricant, ground rods, grounding, removing underground obstructions, and other work necessary to provide a complete installation.

Pay Item	Pay Unit
1-1/4" cable duct, ____#____ Cu with 600V USE insulation and 1#6 Cu USE insul.	lin ft
1-1/4" cable duct, ____#____ Cu with 600V USE insulation and 1#6 Cu USE insul., ____ per trench	lin ft
1-1/4" cable duct, ____#____ Cu with 600V USE insulation and 1#6 Cu USE insul., and 1-1/4" empty polyethylene conduit	lin ft
____" Direct buried conduit, PVC Schedule ____	lin ft
____-____", ____-____", and ____-____" Direct buried conduit, PVC Schedule 40	lin ft
____-____", ____-____", and ____-____" Direct buried conduit, PVC Schedule ____	lin ft
____-____" Concrete encased conduit, PVC Schedule ____	lin ft
____-____", ____-____", and ____-____" concrete encased conduit, PVC Schedule ____	lin ft
Conductors, ____#____ Cu with 600V USE insulation and 1#____ Cu USE insul. in existing or new conduit	lin ft

Pay Item	Pay Unit
1 ____" rigid galvanized steel primary riser, per Detail E-22	lump sum
1 ____" rigid galvanized steel secondary riser, per Detail E-23	lump sum
____-____", ____-____", and ____-____" rigid galvanized steel riser, per Detail ____	lump sum
Conductors, ____#____ Cu with 600V THW insulation and 1#____ Cu USE insul. in riser conduit	lump sum
____ single conductor(s) #____ Cu stranded, w____ KV 133% EPR insulation, shld & 1-#____ Cu USE 600V insul. in riser conduit	lump sum
Primary cable, ____ single conductor(s) #____ Cu stranded, w____ KV 133% EPR insulation, shld & 1-#____ Cu USE 600V insul. in new/existing conduit	lump sum
Primary cable termination for 1 #2/0 Cu 15 KV rating, _____ manufacturer, Catalog #_____	each
Primary cable termination for 1 #2 Cu 15 KV rating, _____ manufacturer, Catalog #_____	each
Primary cable termination for 1 #____ Cu 15 KV rating, _____ manufacturer, Catalog #_____	each

- 26.04.01 Cable Duct of number and sizes specified will be paid for at the contract unit price bid per lineal foot.
- 26.04.02 Direct Buried Conduit and Concrete Encased Conduit of the numbers and size specified, will be paid for at the contract unit price bid per lineal foot.
- 26.04.03 Primary Riser will be paid for at the contract unit price bid for each riser.
- 26.04.04 Primary Cable Installed in Conduit of numbers and sizes specified will be paid for at the contract unit price bid per lineal foot.
- 26.04.05 Secondary Riser will be paid for at the contract unit price bid for each riser.
- 26.04.06 Conductors of the numbers and sizes specified will be paid for at the contract unit price bid per lineal foot.

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DIVISION 27  
INSPECTION BY CONSULTING ENGINEERS

- 27.01 Description
- 27.02 Requirements Prior to Construction
- 27.03 Service Connections Prior to Final Acceptance
- 27.04 Requirements for Final Acceptance

DIVISION 27  
INSPECTION BY CONSULTING ENGINEERS

27.01 Description:

From time to time, as may be approved by the City Manager, when constructing sanitary sewer or water main facilities for inclusion into the Grand Rapids System outside the City of Grand Rapids the construction engineering may be done by private consulting firms rather than the Grand Rapids City Engineer. This specification is written to define the conditions and procedures under which said construction engineering is to be done.

27.02 Requirements Prior to Construction:

Prior to commencing construction under this specification, the other governmental unit shall furnish the following:

a. A statement agreeing that the project will be constructed according to the Drawings and specifications approved by the City Engineer and the Standard Specifications and that should any revisions be found to be necessary during construction, that they will be approved by the City Engineer prior to installation.

b. The name of the registered engineer or firm who will undertake the construction engineering.

c. A list of key employees of said firm who will be assigned to the project and their respective duties.

d. A statement holding the City harmless from any and all claims resulting from incorrect as-built measurements and other consultant or contractor errors. This requirement is separate from the one year warranty required of the contractor by the Standard Specifications for defects in materials and workmanship.

e. Upon completion of the project, provide a final total cost of all water main work and a final total cost of all sanitary sewer work.

27.03 Service Connections Prior to Final Acceptance:

On certain projects, the City Engineer may allow service connections to water mains and sanitary sewers prior to final acceptance of the utility. When such early service connections are desired, the other community shall furnish the City Engineer with the following:

a. Water Main

1. Evidence of satisfactory pressure and chlorination tests performed by the City of Grand Rapids Water System or other qualified persons or firms which may be approved by the City Engineer on a project-by-project basis.

2. Preliminary as-built measurements, i.e., those recorded by the on-site inspector or project engineer.

3. Manufacturer's certification for all water pipe, fire hydrants, and valves stating that these materials have been manufactured in accordance with all applicable specifications.

4. Properly issued and recorded tap permits when applicable.

5. A certification by the responsible registered engineer that the water main is adequate for service and that the construction will be completed in accordance with the approved Drawings and specifications.

b. Sanitary Sewer

1. Evidence of satisfactory infiltration or exfiltration tests.

2. Evidence of a satisfactory television inspection by the City of Grand Rapids Sewer Maintenance Division or other persons or firms as may be approved by the City Engineer on a project-by-project basis.

3. Test results signed by a qualified testing engineer showing that sewer pipe has been manufactured and tested in accordance with all applicable specifications and in accordance with Division 18 of these specifications, but at no cost to the City. All sewer pipe delivered to the project shall be clearly marked by the Manufacturer or consulting firm undertaking the testing prior to installation.

4. A certification by the responsible registered engineer that the sanitary sewer is adequate for service and that the construction will be completed in accordance with the approved Drawings and specifications.

27.04 Requirements for Final Acceptance:

Prior to the final acceptance by the City of Grand Rapids for incorporation in its sanitary or water systems, the other governmental unit shall furnish the City Engineer with the following no later than six months after service connections had been allowed:

a. As-built Drawings in accordance with the Grand Rapids normal procedures, i.e., utilize the Standard Grand Rapids format, inspectors measurements recorded during the construction and final survey party pick-up measurements taken upon completion of the project.

b. A statement by the responsible registered professional engineer that the project has been constructed in accordance with the Drawings as approved by the City Engineer and the Standard Specifications.

c. A statement agreeing that prior to the expiration of the one year warranty period required under the General Conditions of these Standard Specifications that their consultant will once again inspect all structures included in the project. Said inspection will be done at such a time as to insure that adequate notice can be given to the Contractor to make any necessary repairs under the warranty. Further, that the responsibility for said repairs shall rest with the other governmental unit. Said inspection shall include a television inspection check if so requested by the City Engineer.

d. A final total cost of all watermain work and a final total cost of all sanitary sewer work.

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## DIVISION 28

### TRENCH CUTS AND RESTORATION IN PUBLIC STREETS

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DIVISION 28

TRENCH CUTS AND RESTORATION IN PUBLIC STREETS

28.01 Description:

This specification applies to the work of all parties who cut utility trenches in streets within the City of Grand Rapids. It shall include City Departments and contractors employed by City Departments, public utilities, contractors, and any other entities or individuals who excavate in public rights-of-way. The term "Contractor" used in this Division refers to those engaged in these activities. The main focus of this Division is the temporary and permanent repair of said trenches.

28.02 Materials and Construction Methods:

28.02.01 Backfill and Sub-Base - Backfill shall conform to Division 17, and sub-base shall conform to Division 6.

28.02.02 Aggregate Base - Aggregate base shall conform to Division 14.

28.02.03 Concrete - Concrete used under this specification shall conform to Divisions 7 and 12.

28.02.04 Bituminous - Materials and placement of bituminous pavement, base courses and temporary patches shall conform to Division 15, except as specified herein.

28.02.05 Cold Patch - Cold patch materials shall be CP-3 or CP-5 as specified in the current Michigan Department of Transportation Standard Specifications for Construction.

28.03 Preparation of Trench Area Prior to Restoration:

When existing pavement has been removed and prior to restoration, the pavement shall be neatly trimmed to a minimum depth of 3 inches. Bituminous pavements may be trimmed by sawcutting or other approved methods. Concrete pavement trimming shall be done by sawcutting. If trim lines are not neat, additional trimming must be done and the Contractor shall do so at no additional cost. Full depth sawcutting, where called for, will be paid for as a separate item, as specified in Division 3.

Any areas of pavement which are undermined during excavation shall be removed and replaced at the Contractor's cost.

If it is impractical at the time of excavation to place hot bituminous material, the backfill must be placed as specified and temporary pavement placed as described in this Division.

28.04 Restoration:

28.04.01 Restoration shall be as specified below. However, temporary repairs utilizing cold patch of a thickness as required by the Engineer over a 6-inch aggregate base may be used if approved by the Engineer for periods of up to 72 hours, prior to the placement of the permanent trench repair.

28.04.02            State Trunklines - Restoration of pavement areas, where there is an existing bituminous surface with a concrete base, shall consist of eight inches of concrete pavement and 1-1/2 inches of bituminous leveling course and 1-1/2 inches of bituminous top course.

Restoration of pavement areas, where there is an existing bituminous surface with a gravel base or bituminous base, shall consist of seven inches of bituminous base course and 1-1/2 inches of bituminous leveling course and 1-1/2 inches of top course.

Restoration of pavement areas, where there is an existing concrete surface, shall consist of 9 inches of concrete pavement.

28.04.03            Major Streets - Restoration of pavement areas, where there is an existing bituminous surface on the street, shall consist of 7 inches of bituminous base course, 1-1/2 inches of bituminous leveling course and 1-1/2 inches of bituminous top course.

Restoration of pavement areas, where there is an existing concrete surface, shall consist of eight inches of concrete pavement.

28.04.04            Local Streets - Restoration of pavement areas, where there is an existing bituminous surface on a concrete base or black base, shall consist of 5 inches of bituminous base course and 1-1/2 inches of bituminous leveling course and 1-1/2 inches of bituminous top course.

Restoration of pavement areas, where there is an existing bituminous surface on a aggregate base, shall consist of 8 inches of aggregate base and 1-1/2 inches of bituminous leveling course and 1-1/2 inches of bituminous top course. The Contractor may substitute 5 inches of bituminous base for eight inches of aggregate base if he/she chooses.

Restoration of pavement areas, where there is an existing concrete surface, shall consist of six inches of concrete pavement.

28.04.05            Brick Streets - There is a list of streets where, due to historical significance, the bricks must be replaced. Where the brick is to be replaced, the restoration shall consist of six inches of concrete base, one inch of sand and Portland cement grouted brick pavement in accordance with Division 16. The Contractor shall salvage and reuse any bricks available to make the repair. If additional bricks are required, Contractor shall furnish them at no additional cost. Should the street not require the replacement of brick as approved by the Engineer, the Contractor shall remove the loose brick and make repairs as specified previously.

28.05            Correction of Deficiencies:

The permanent patch placed by the Contractor shall be guaranteed for a period of 18 months. During this period should deficiencies appear the Contractor shall be responsible to make repairs as outlined. Such deficiencies shall include, but not be limited to, settled or raised pavement, deterioration of material, or separation of joints. The Contractor shall meet with the Engineer to decide upon a corrective method of repair. This method may be: 1) a total removal and replacement of the patched area and recompaction of the backfill, sub-base and base, if necessary; 2) providing additional material and use of an infra-red method to reheat the whole patch and recompact the area; or 3) use of the infra-red method, or other method approved by the Engineer, to mend joints with the adjacent pavement. The Contractor shall make repairs in a timely manner. Should weather limitations be in force at the time, the Contractor shall make temporary

repairs and be expected to make permanent repairs when weather permits, regardless of whether the 18-month guarantee period has expired at that point.

28.06 Weather Limitations:

Should the Contractor desire to cut a trench between November 15 and April 15, he/she will be required to make temporary repairs to the pavement as follows, unless otherwise approved by the Engineer:

28.06.01 Major Streets and Trunklines - On major streets and State trunklines, the Contractor shall prepare sub-base as outlined and in lieu of the base and surface courses place a temporary section consisting of 8 inches aggregate and 6 inches concrete with the concrete placed flush with the adjacent pavement. This section shall then be removed and a permanent patch installed by June 1, or earlier if weather permits.

28.06.02 Local Streets - On local streets, the Contractor shall prepare the subbase and in lieu of the base and surface courses, the Contractor may place a temporary section consisting of 6 inches of aggregate base and 6 inches of concrete with the concrete placed flush with the adjacent pavement. This temporary section shall then be removed and a permanent patch installed by June 1, or earlier if weather permits. If approved by the Engineer, temporary repairs consisting of 6 inches aggregate base and 3 inches of cold patch may be used on local streets.

The Contractor shall periodically inspect and maintain the temporary repairs.

28.07 Other Requirements:

The following items shall be provided as required in the Standard Specifications.

- Insurance
- Performance and Lien Bonds
- Prequalification of Contractor
- Notification and Coordination with City Engineer prior to Start of Work
- Soil Erosion Control
- Inspection by the City Engineer
- Public Safety, Convenience, and Maintaining Traffic
- Protection of Existing Utilities

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**CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
OFFICE OF CITY ENGINEER**

**STANDARD DETAILS**

# STANDARD DETAILS

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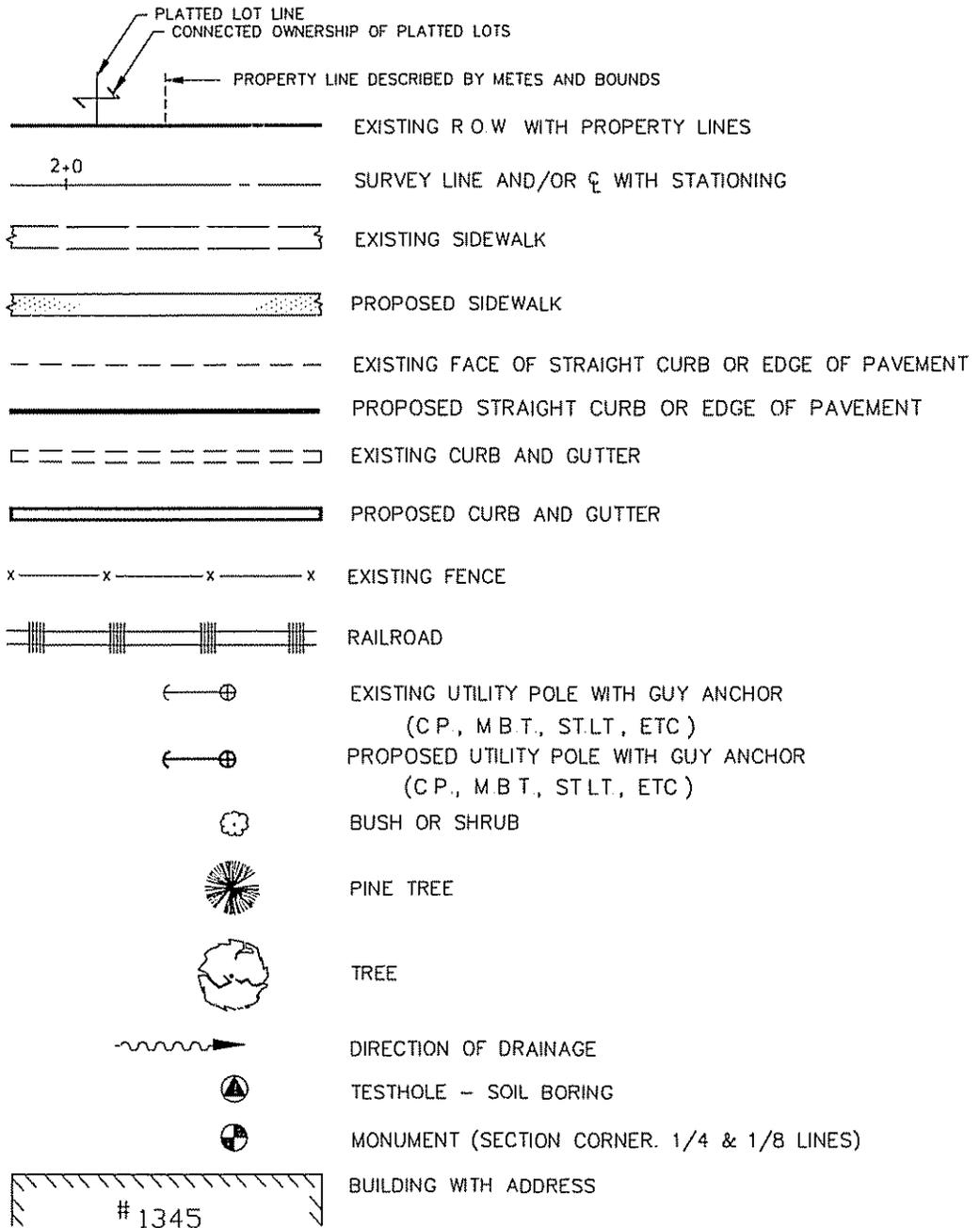
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CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

# LEGEND

<b>L</b>  <b>1</b>	<small>APPROVED</small>  <small>CITY ENGINEER</small>	<small>DATE</small> 3/23/93
	<small>DRAWN</small> P.M.H.	<small>CHECKED</small> R.J.B.

\* NOTE:

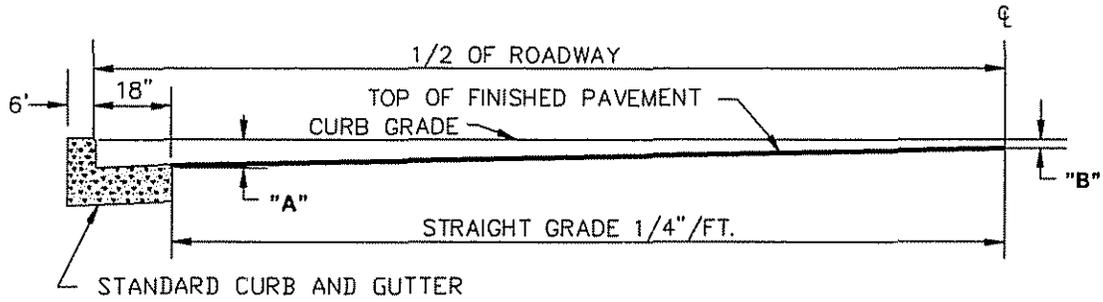
EXISTING AND PROPOSED UTILITIES OF UP TO 42" WIDE ON 40 SCALE DRAWINGS SHALL BE SHOWN WITH A SINGLE LINE UTILITIES LARGER THAN 42" SHALL BE DRAWN WITH A DOUBLE LINE SPACED THE SCALED WIDTH OF THE UTILITY

*		EXISTING SANITARY OR COMBINED SEWER WITH MANHOLE
*		PROPOSED SANITARY OR COMBINED SEWER WITH MANHOLE
*		EXISTING STORM SEWER WITH MANHOLE
*		PROPOSED STORM SEWER WITH MANHOLE
		EXISTING G.R. BASIN
		PROPOSED G.R. BASIN
		EXISTING BEEHIVE BASIN
		EXISTING FLAT GRATE BASIN
		PROPOSED FLAT GRATE BASIN
*		EXISTING WATERMAIN
*		PROPOSED WATERMAIN
*		EXISTING WATER SERVICE WITH CURB BOX
*		PROPOSED WATER SERVICE WITH CURB BOX
		EXISTING WATERMAIN VALVE AND BOX
		PROPOSED WATERMAIN VALVE AND BOX
		EXISTING WATERMAIN VALVE IN CHAMBER
		PROPOSED WATERMAIN VALVE IN CHAMBER
		EXISTING FIRE HYDRANT
		PROPOSED FIRE HYDRANT
*		UTILITY CONDUIT - OWNERSHIP AS INDICATED (C.P., M.B.T., K.C. STEAM, ETC)
*		EXISTING GAS MAIN
		EXISTING ELECTRICAL HANDHOLE (C.P., ST.LT)
		PROPOSED ELECTRICAL HANDHOLE (C.P., ST.LT)
		EXISTING M.B.T. PEDESTAL
		PROPOSED TAPERED FIBERGLASS POLE AND MAST ARM ST.LT. (E/8) (E/9)
		PROPOSED ST LIGHT (E-8)
		PROPOSED FIBERGLASS POST ST.LT. (E-10)
		PROPOSED CONDUIT RISER

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

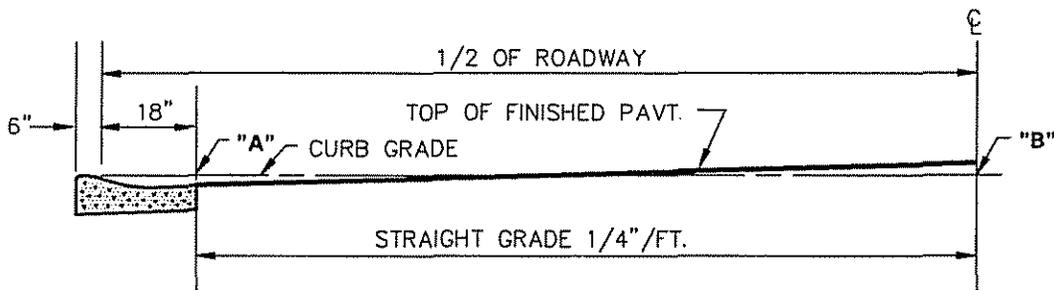
**LEGEND**

L 2	APPROVED	3/23/93
	CITY ENGINEER	DATE
DRAWN P.M.H.	CHECKED R.J.B.	



ROADWAY WIDTH (FT.)	PAVED WIDTH (FT.)	"A" PAVEMENT AT EDGE OF GUTTER		"B" AT CENTERLINE	
		FT.	IN.	FT.	IN.
30	27	-.42	-5	-.14	-1 5/8
36	33	-.42	-5	-.07	-7/8
40	37	-.42	-5	-.03	-3/8
44	41	-.42	-5	+.01	+1/8
47	44	-.42	-5	+.04	+1/2
48	45	-.42	-5	+.05	+5/8
52	49	-.42	-5	+.09	+1 1/8
54	51	-.42	-5	+.11	+1 3/8
56	53	-.42	-5	+.13	+1 5/8
57	54	-.42	-5	+.16	+1 7/8

**TOP OF FINISHED PAVEMENT MEASUREMENT FROM STANDARD CURB GRADE**



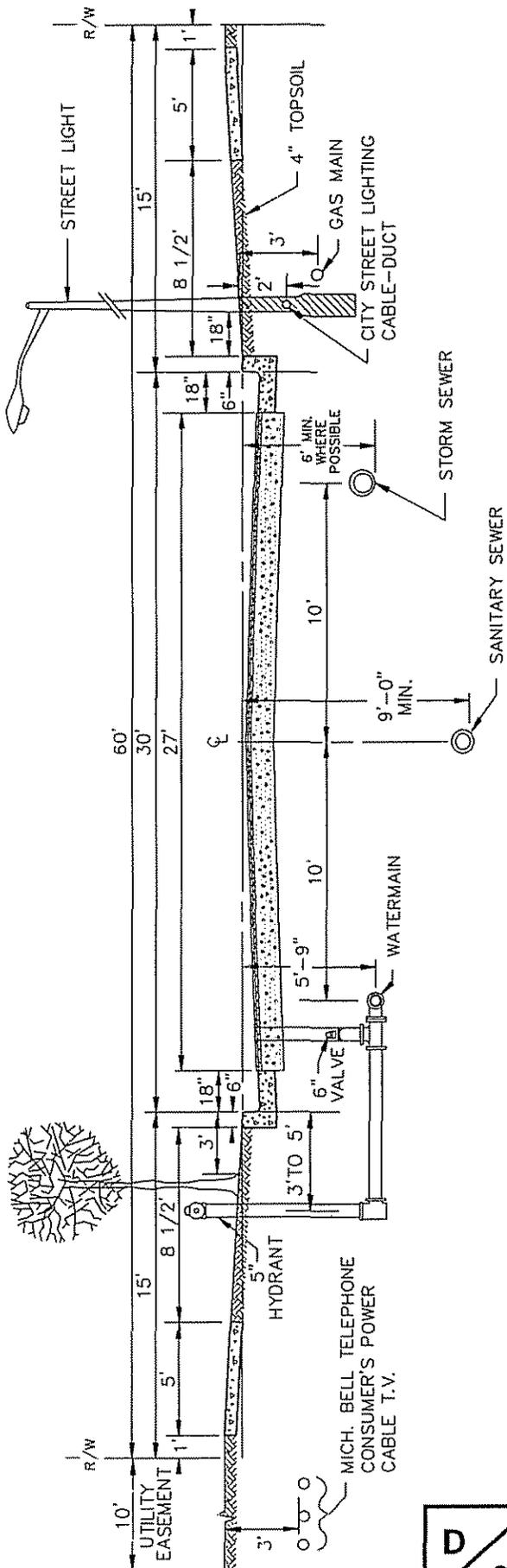
**TOP OF FINISHED PAVEMENT MEASUREMENT FROM ROLL CURB GRADE**

ROADWAY WIDTH (FT)	PAVED WIDTH (FT.)	PAVEMENT "A" @ EDGE OF GUTTER		"B" @ CENTERLINE	
		FT.	IN.	FT.	IN.
30	27	-.19	-2 1/4	+.09	+1 1/8
36	33	-.19	-2 1/4	+.16	+1 7/8

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**TYPICAL CROWN FOR VARIOUS WIDTH ROADWAYS**

<b>D</b> <b>1</b>	APPROVED <i>John L. Tomback</i> 3/23/93	CITY ENGINEER	DATE
	DRAWN P.M.H.	CHECKED V.U.	



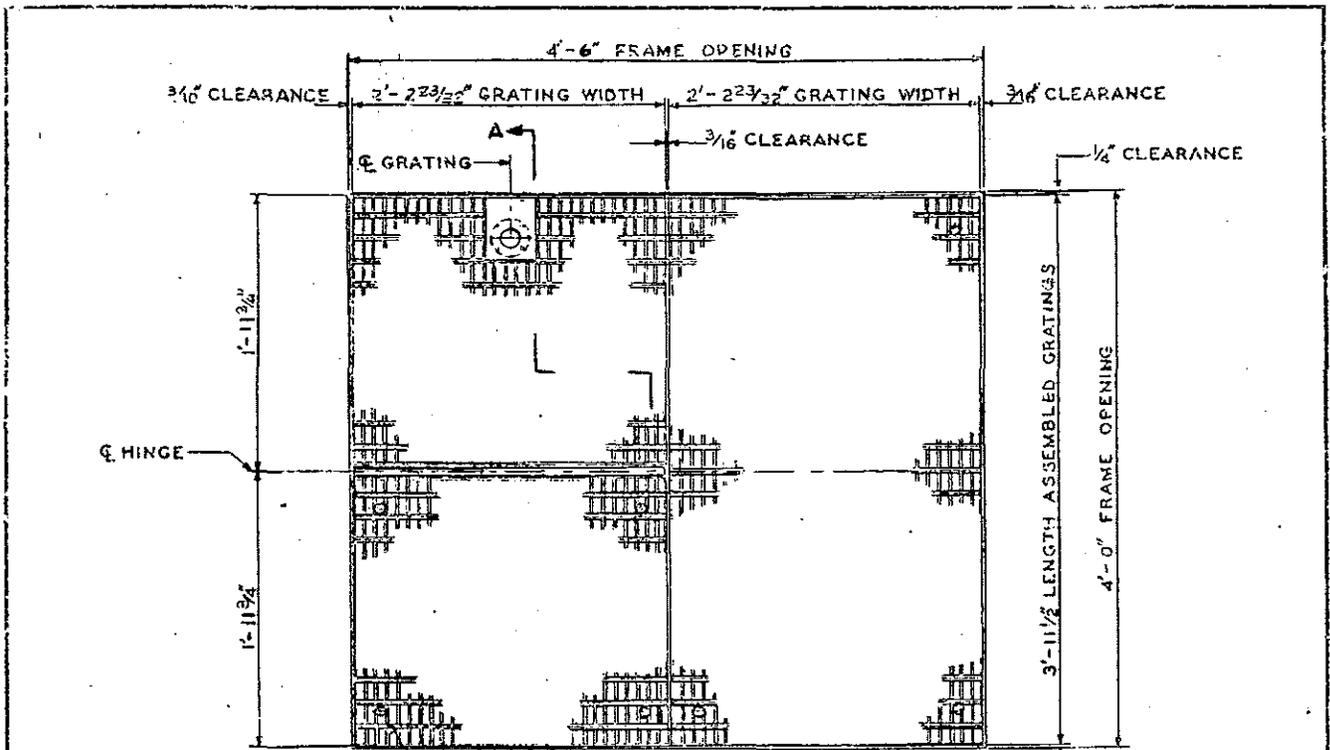
**NORTH OR EAST VIEW**

NO SCALE

CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

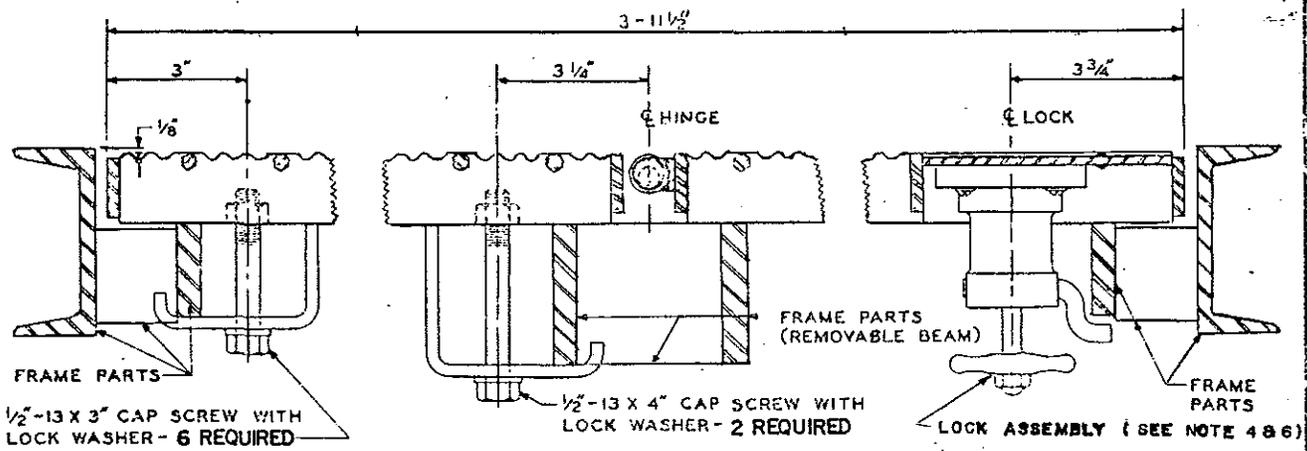
**SCHEMATIC UTILITY  
 CROSS SECTION  
 FOR  
 NEW STREET**

<b>D</b> 2	APPROVED	<i>Jim C. Tomback</i> 3/23/93	
		CITY ENGINEER	DATE
	DRAWN	P.M.H.	CHECKED
			V.U.



1/2"-13 NUT-WELDED TO GRATING  
8 REQUIRED-LOCATED AS SHOWN

ASSEMBLY - TOP VIEW



SECTION A-A  
SHOWING FASTENINGS TO FRAME

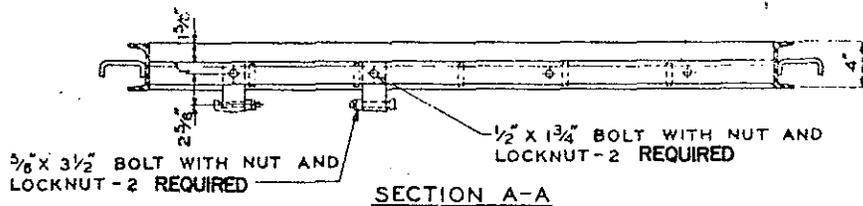
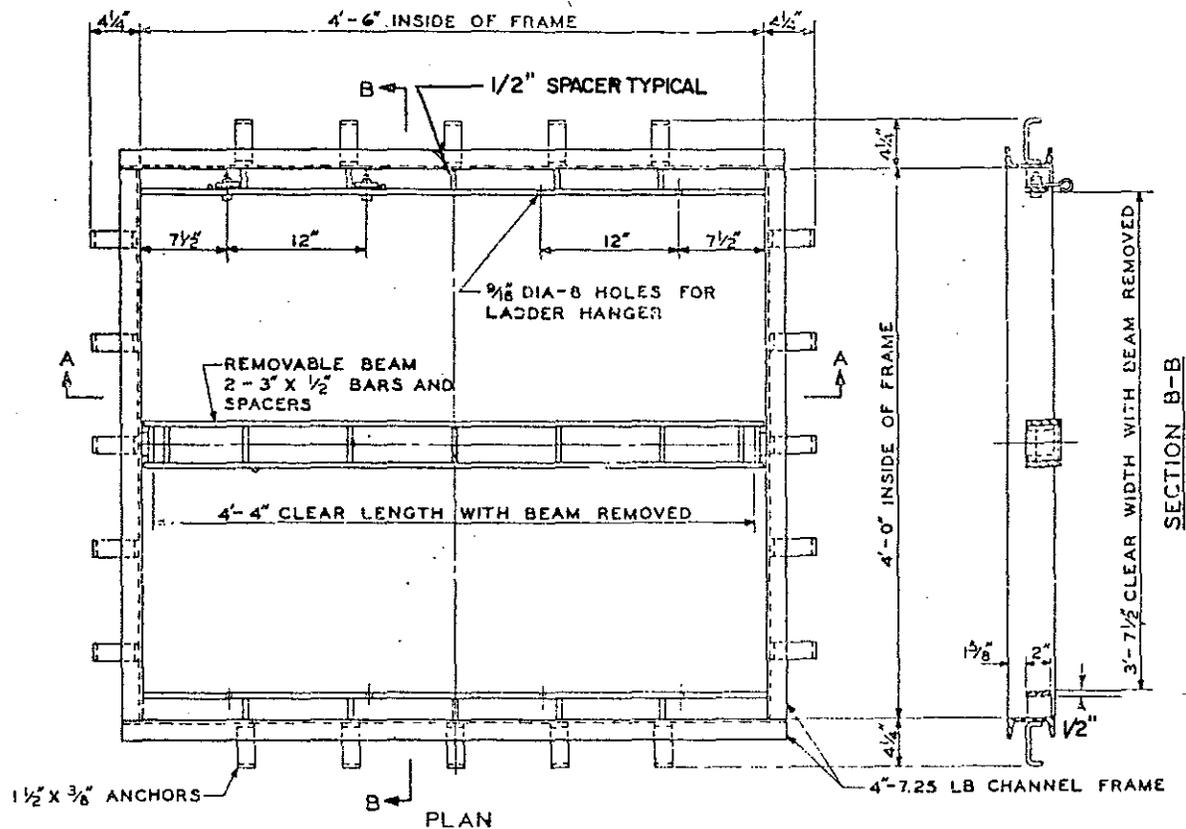
- NOTES
- 1- GRATING-WELDED STEEL, GARY TYPE SGW-150-25. SERRATED, 1 1/2" x 3/16"  
MAIN BARS AT 0.915" CENTERS, 5/16" HEXAGON CROSS BARS AT 2" CENTERS.
  - 2- EDGING-STEEL BARS, 1 1/4" x 1/4", WELDED TO GRATING.
  - 3- FINISH-HOT DIP GALVANIZED AFTER FABRICATION AND WELDING.
  - 4- LOCK MUST BE OPERABLE BY USE OF STANDARD CITY STREET LIGHTING VAULT KEY.(SEE NOTE 6)
  - 5- AVAILABLE FROM LEITELT IRON WORKS, GRAND RAPIDS, MICHIGAN
  - 6- LOCK & KEY MANUFACTURER:

LEV-L-LOK SALES  
LOVETT & RADCLIFFE  
937 E. 26TH ST.  
PATTERSON, NEW JERSEY  
07513

TYPE B COMBINATION R  
CAT. #MS-F3219

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING  
STREET LIGHTING  
**TRANSFORMER VAULT  
SIDEWALK GRATING**

<b>E</b>	APPROVED		DATE 3/8/77
	<i>Robert Ford</i> 17551 CITY ENGINEER		
<b>I</b>	DRAWN	D.D.H.	CHECKED
			<i>JK</i> K.C.D.

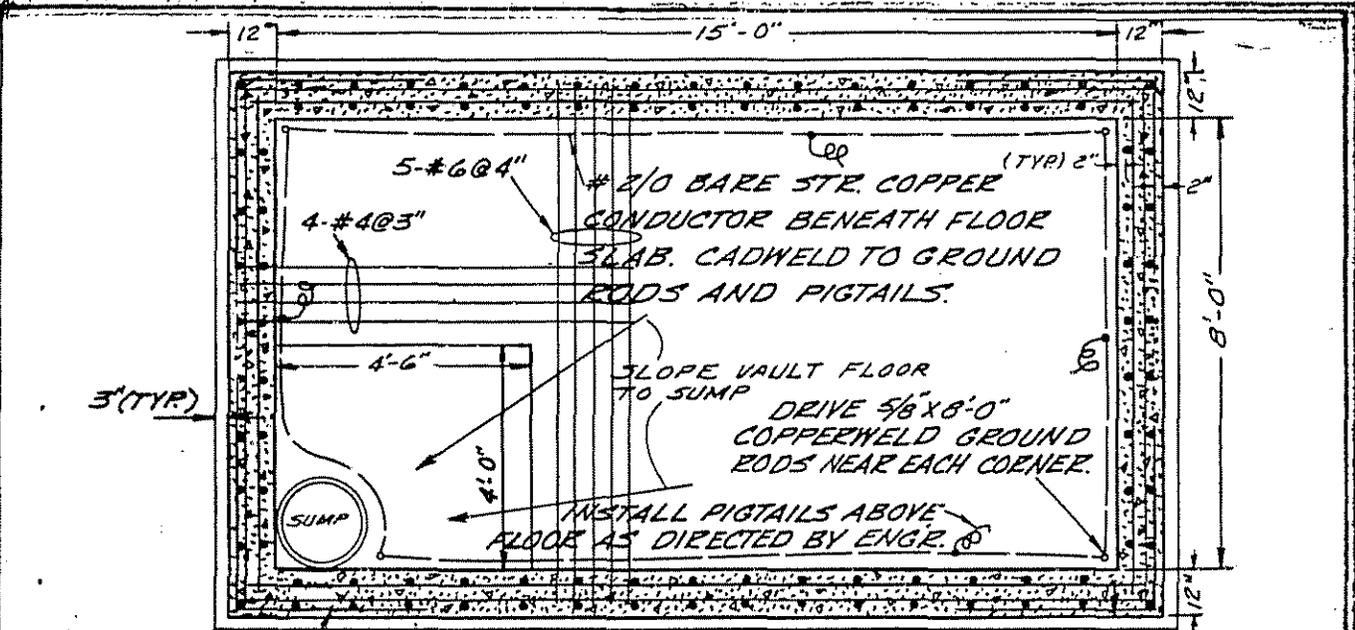


**NOTES**

- 1-MATERIAL-STRUCTURAL STEEL PER ASTM A7-58T.
- 2-ASSEMBLY-WELDED, EXCEPT AS INDICATED TO BE BOLTED OR REMOVABLE.
- 3-FINISH-HOT DIP GALVANIZED AFTER FABRICATION AND WELDING PER ASTM A123-53.
- 4-AVAILABLE FROM LEITELT IRON WORKS, GRAND RAPIDS, MICHIGAN

CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING  
 STREET LIGHTING  
**TRANSFORMER VAULT  
 HATCH FRAME**

<b>E</b> <b>2</b>	APPROVED		DATE 2/8/77
	<i>Robert J. [Signature]</i> H357 CITY ENGINEER		
	DRAWN	CHECKED	
	D.D.H.	[Signature]	K.C.D.



CORNER BARS  
#5 @ 11" BY 31"  
EACH LEG (TYPICAL)

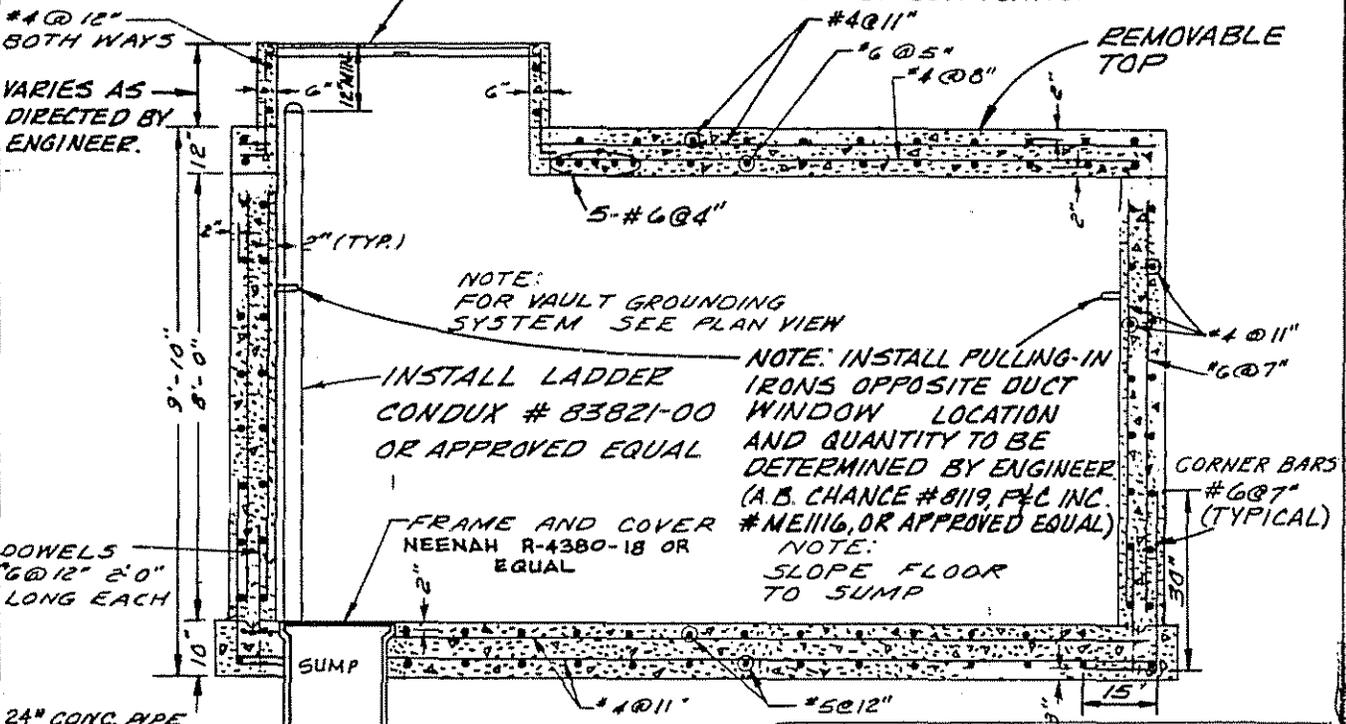
**TRANSFORMER VAULT**

PLAN VIEW

NOTE: VAULT ENTRANCE (OUT OF ROADWAY) FRAME & GRATING (STD. DETAILS E/1/E/2) TO BE 1/4" ABOVE PROPOSED SIDEWALK

NOTE: BITUMINOUS SEAL REQUIRED PER SPECIFICATION

#4 @ 12" BOTH WAYS  
VARIES AS DIRECTED BY ENGINEER.



NOTE: FOR VAULT GROUNDING SYSTEM SEE PLAN VIEW

INSTALL LADDER CONDUX # 83821-00 OR APPROVED EQUAL

NOTE: INSTALL PULLING-IN IRONS OPPOSITE DUCT WINDOW LOCATION AND QUANTITY TO BE DETERMINED BY ENGINEER (A.B. CHANCE #8119, F&L INC. #ME116, OR APPROVED EQUAL)

FRAME AND COVER NEENAH R-4380-18 OR EQUAL

NOTE: SLOPE FLOOR TO SUMP

DOWELS #6 @ 12" 2'-0" LONG EACH

24" CONC. PIPE AND BOTTOM FILLED WITH 4" OF CONCRETE (AS SHOWN)

NOTE: GRADE A CONCRETE TO BE USED. (3500 PSI)

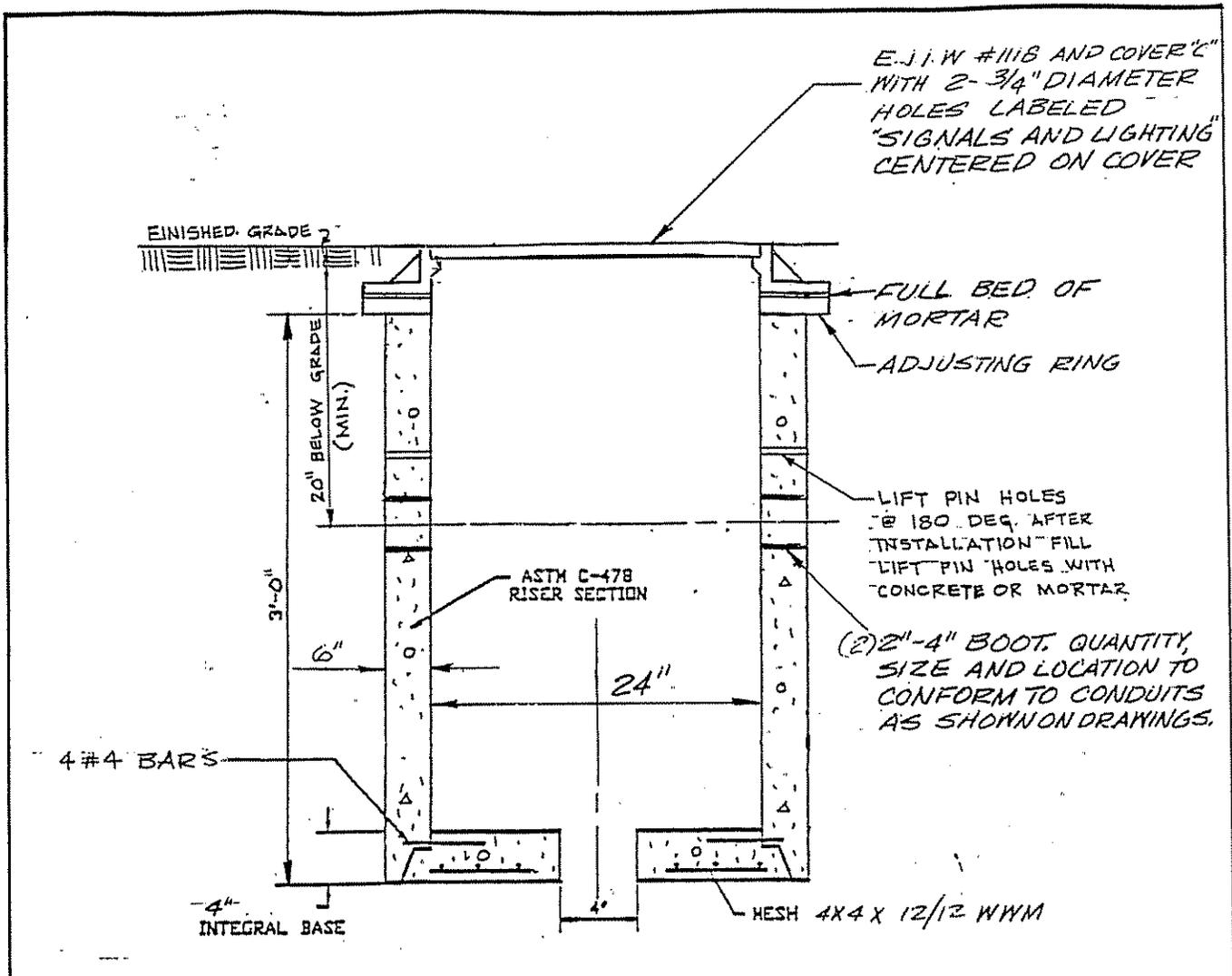
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**TRANSFORMER VAULT**

**NOTES:**

1. CONSTRUCT VAULT SO AS TO AVOID CONFLICT WITH LOCATION OF DUCTS AND VAULT OPENING.
2. COST FOR DUCT WINDOW INCLUDED IN COST FOR VAULT.

E 3	APPROVED <i>Jim L. Hambeck</i> 4/11/73 CITY ENGINEER DATE
	DRAWN R.A. CHECKED <i>J.L.</i>



NOTES:

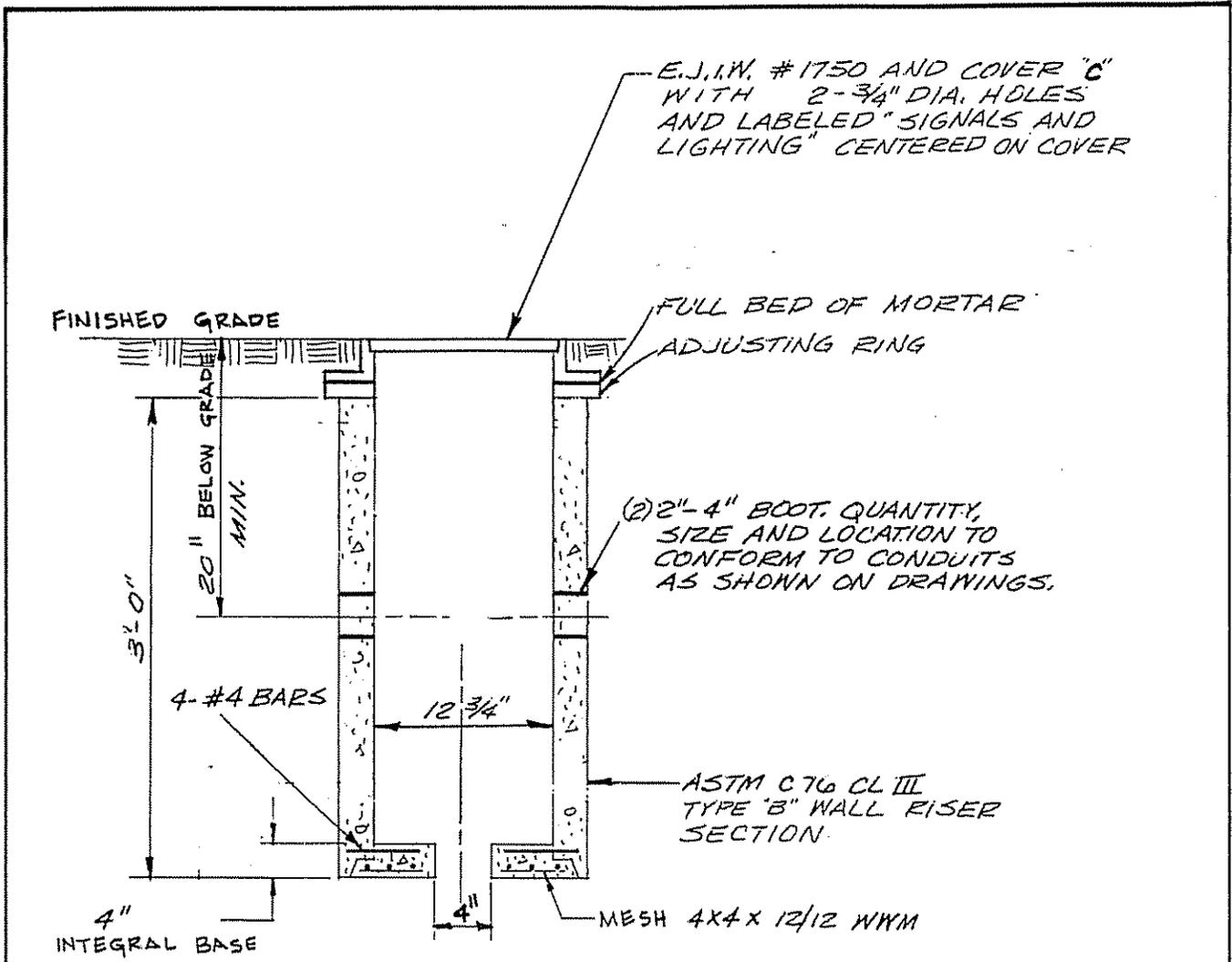
1. PROVIDE 48" OF 1-#6 CU BARE GROUNDING CONDUCTOR CONNECTED TO GROUND ROD.
2. ALL WIRING IN HANDHOLES (CONNECTIONS, TAPING AND CONDUCTOR LENGTHS) SHALL BE PER DETAIL E/13.
3. GROUND RODS AS SHOWN ON DRAWINGS OR AS REQUIRED BY ENGINEER (SEE DETAIL E/13)

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

## CABLE HANDHOLE AND COVER

(NOT IN ROADWAY)

<p style="font-size: 2em; margin: 0;">E 4</p>	<p>APPROVED <i>Tom L. Tomback</i> 3/23/93 CITY ENGINEER      DATE</p>
<p>DRAWN CWK II</p>	<p>CHECKED VU</p>



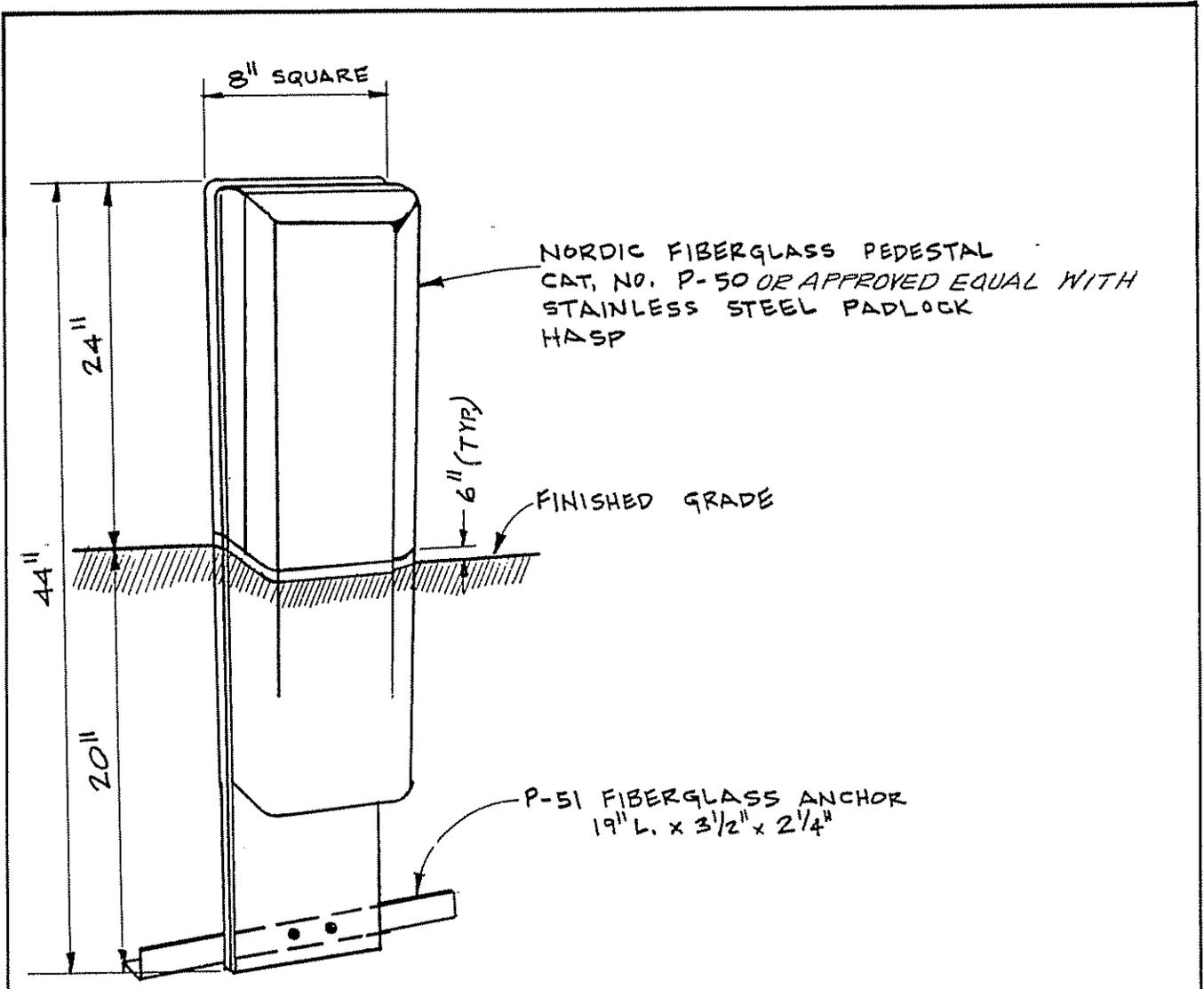
NOTES:

1. PROVIDE 48" OF 1-#6 CU BARE GROUNDING CONDUCTOR CONNECTED TO GROUND ROD.
2. ALL WIRING IN HANDHOLES (CONNECTIONS, TAPING AND CONDUCTOR LENGTHS) SHALL BE PER DETAIL E/13.
3. GROUND RIGIDS AS SHOWN ON DRAWINGS OR AS REQUIRED BY ENGINEER (SEE DETAIL E/13).

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**CABLE HANDHOLE  
AND COVER**  
(NOT IN ROADWAY)

<b>E</b> <b>4A</b>	APPROVED <i>[Signature]</i> 3/23/93 CITY ENGINEER DATE
	DRAWN CWK II CHECKED VU



**NOTES:**

1. ALL WIRING IN PEDESTAL (CONNECTIONS, TAPING AND CONDUCTOR LENGTHS) SHALL BE PER DETAIL E/13
2. IDENTIFICATION TAG FURNISHED BY CITY OF GRAND RAPIDS SIGNALS AND LIGHTING DIVISION AND INSTALLED BY CONTRACTOR.
3. USED IN LIEU OF HANDHOLE IN CLAY AREAS.
4. GROUND RODS AS SHOWN ON DRAWINGS OR AS REQUIRED BY ENGINEER (SEE DETAIL E/13).

CAT. NO.	INSIDE DIMENSIONS		TYPICAL INSTALLATION DIMENSIONS		COVER LENGTH	WEIGHT EACH
	WIDTH DEPTH	HEIGHT	ABOVE GROUND	BELOW GROUND		
P-50	8"	44"	24"	20"	19"	11.5 lbs.

CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

**SECONDARY WIRING PEDESTAL**

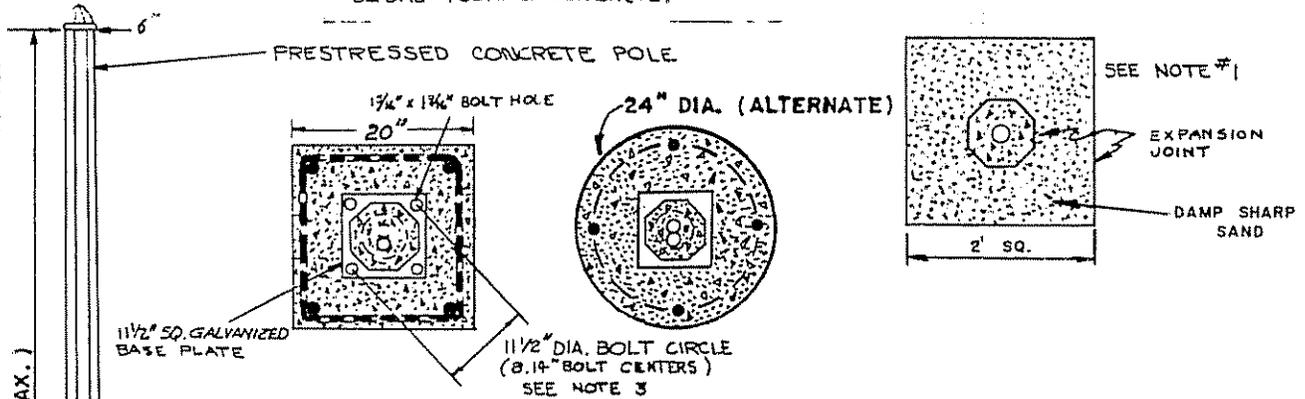
NOTE: COLOR SHALL BE (NORDIC) OLIVE GREEN NO. P-614-06

<b>E 4B</b>	APPROVED <i>[Signature]</i> CITY ENGINEER	3/23/93 DATE
	DRAWN CWK II	CHECKED VU

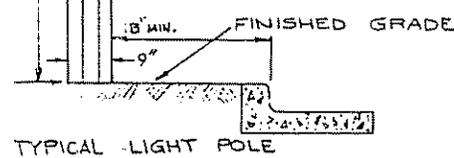
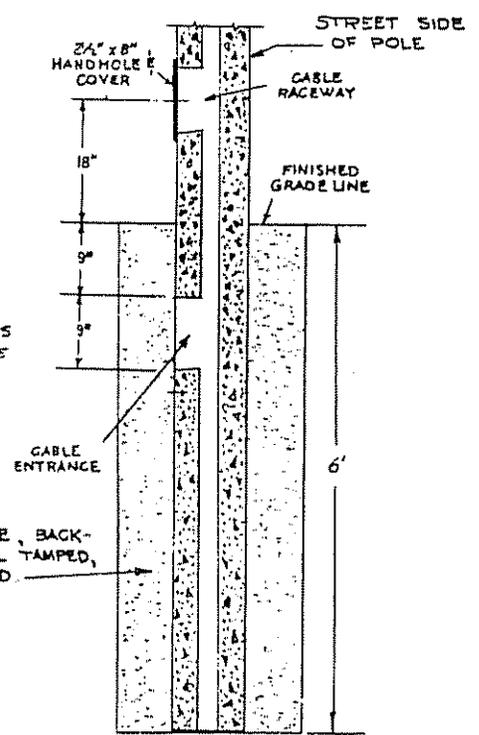
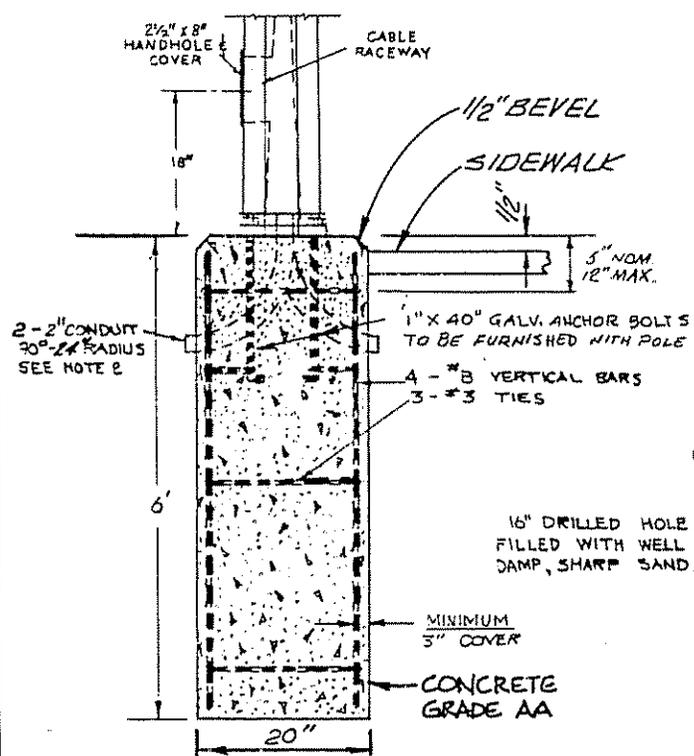
- NOTES.
- 1) IF POLE IS SET IN SIDEWALK OR OTHER CONCRETE PROVIDE 2' SQ. OF 2" CONCRETE WITH EXPANSION JOINT AT POLE AND PERIMETER ALUMINUM BOLT COVERS SHALL BE FURNISHED INCIDENTAL TO POLE.
  - 2) EXTEND CONDUIT 2" ABOVE FINISHED GRADE TO PREVENT WATER FROM DRAINING INTO CONDUIT.

3) CHECK BOLT CENTERS OF POLE BEFORE CONSTRUCTING BASE AS SOME VARIATION MAY EXIST BETWEEN MANUFACTURERS AND SIZES OF POLES. SECURE EACH ANCHOR BOLT AT TOP AND BOTTOM WITH TIE WIRES BEFORE POURING CONCRETE.

STANDARD OR SINGLE PIN POLE CAP AS NECESSARY



(31 FT. MAX.)  
POLE HEIGHT ABOVE FINISHED GRADE

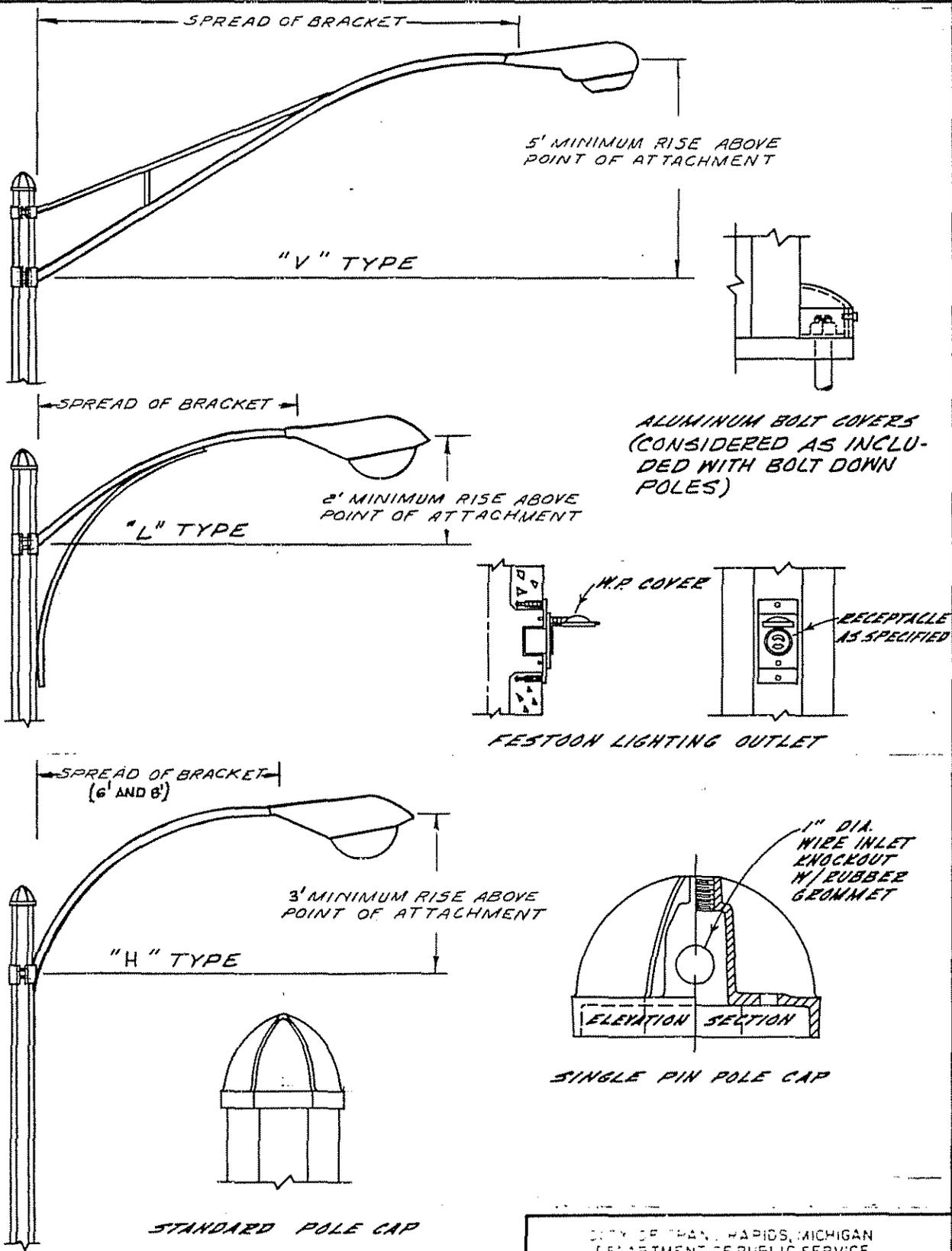


FOR INFORMATION ONLY: NOT FOR CONSTRUCTION UNLESS SPECIFICALLY CALLED FOR ON DRAWINGS OR SPECIFICATIONS.

CITY OF FRANKLIN, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

CONCRETE POLE AND BASE

E	5	DESIGNED BY	DATE
		G.C.	9/11/73
		CHECKED BY	
		VU	



NOTE:  
ON THE PLANS THE BRACKET SPREAD (IN FEET) FOLLOWS THE BRACKET LETTER

FOR INFORMATION ONLY: NOT FOR CONSTRUCTION UNLESS SPECIFICALLY CALLED FOR ON DRAWINGS OR SPECIFICATIONS.

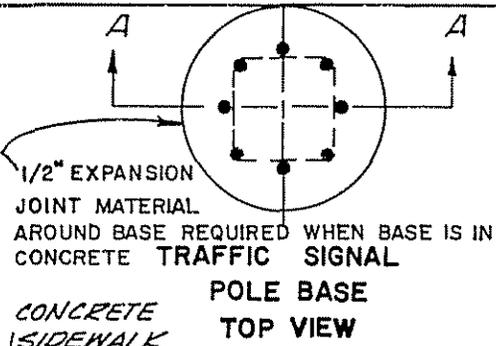
CITY OF TRAVEL RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**BRACKET ARMS AND OPTIONS**

*John L. Fornwald* 4/13/76  
CITY ENGINEER DATE

DRAWN R.A. CHECKED DAF

E / 6

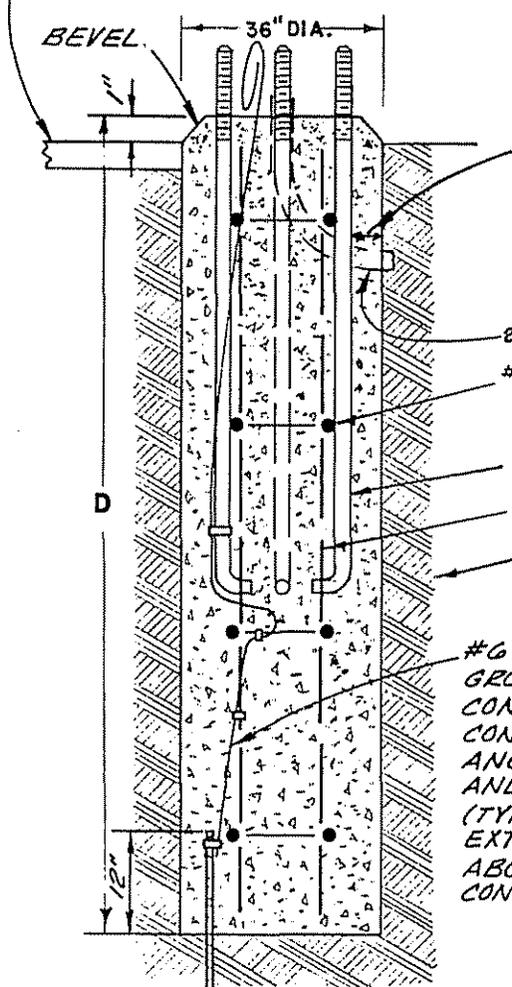


NOTE:  
Orientation of bolts relative to *Cable Stress* is critical.  
*CONSULT MANUFACTURER'S TEMPLATE FOR BOLT CIRCLE DIAMETER.*

Concrete shall be Grade AA. Foundation sizes from table below should be checked by an Engineer for the specific soil conditions.

Minimum concrete outside anchor bolt and/or reinforcing steel is *three (3) inches*.

*CONCRETE BASE MUST CURE A MINIMUM OF 7 DAYS PRIOR TO POLE INSTALLATION. SEE CONCRETE SPECIFICATIONS, DIVISION #7 OF THE STANDARD CONSTRUCTION SPECIFICATIONS.*



MINIMUM FOUNDATION SIZES FOR GIVEN POLE DIAMETER AND WALL THICKNESS

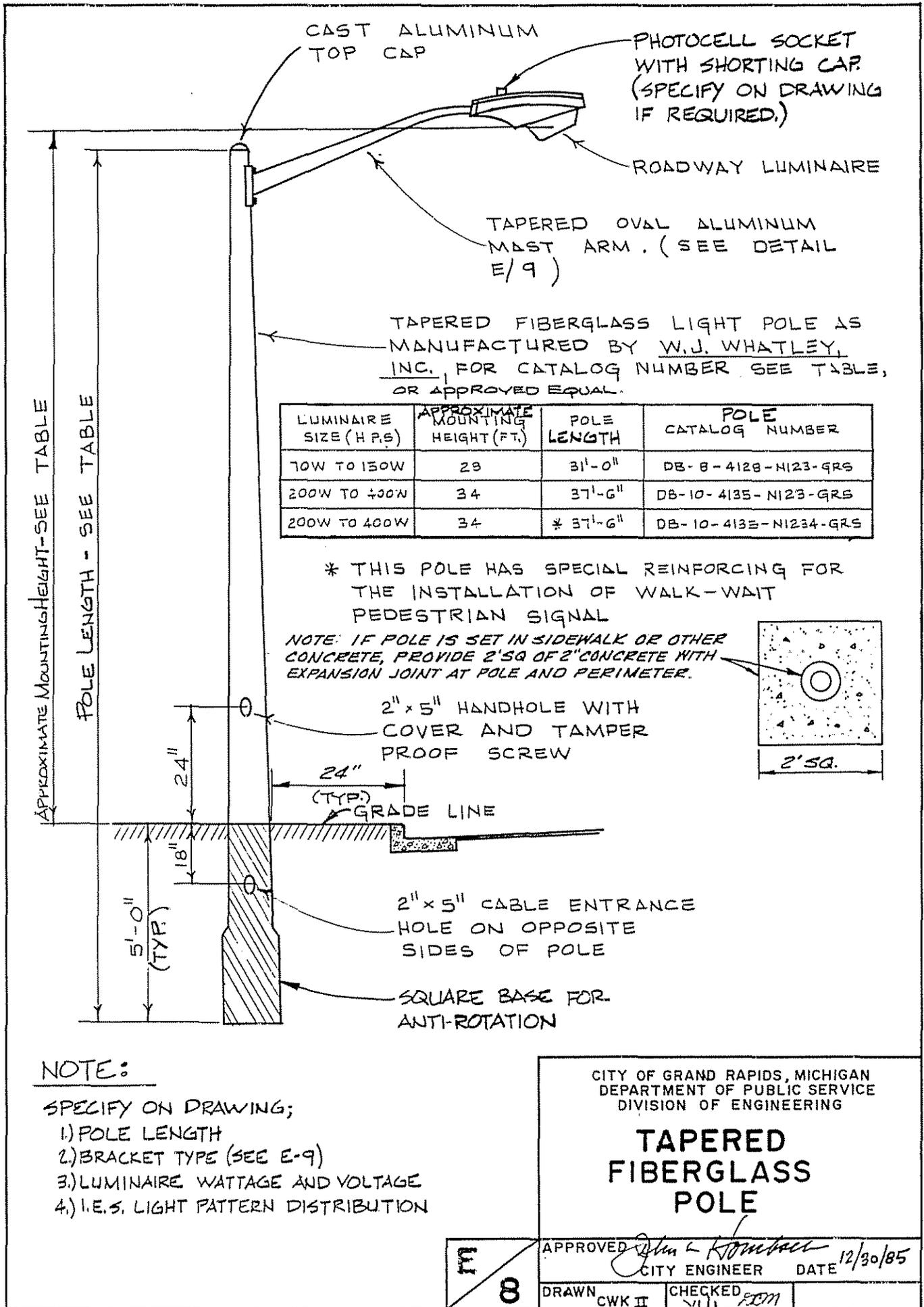
WALL	0.250"		0.3125"		0.3586"		0.500"	
	D	V	D	V	D	V	D	V
POLE BOTT. DIA.	ft. in.	cu. yd.						
11.0"	8-0	2.1	8-6	2.2	9-0	2.4	10-0	2.6
12.0"	8-6	2.2	9-0	2.4	9-6	2.5	10-6	2.8
13.0"	9-0	2.4	9-6	2.5	10-0	2.6	11-0	2.9
14.0"	9-6	2.5	10-0	2.6	10-6	2.8	11-6	3.0
15.0"	10-0	2.6	10-6	2.8	11-0	2.9	12-0	3.1

3/4" DIAMETER BY 10' LONG COPPERWELD GROUND ROD.

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

TRAFFIC SIGNAL  
BASE

E 7	APPROVED	DATE	
	<i>Tom L. Tomback</i> CITY ENGINEER	6/7/76	
	DRAWN E.W.	CHECKED	
		<i>JKD</i>	



CAST ALUMINUM TOP CAP

PHOTOCELL SOCKET WITH SHORTING CAP (SPECIFY ON DRAWING IF REQUIRED.)

ROADWAY LUMINAIRE

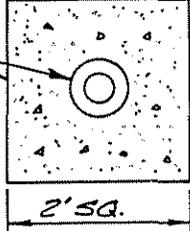
TAPERED OVAL ALUMINUM MAST ARM. (SEE DETAIL E/9)

TAPERED FIBERGLASS LIGHT POLE AS MANUFACTURED BY W.J. WHATLEY, INC. FOR CATALOG NUMBER SEE TABLE, OR APPROVED EQUAL.

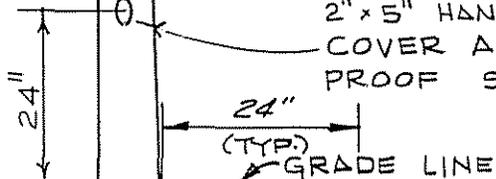
LUMINAIRE SIZE (H.P.S)	APPROXIMATE MOUNTING HEIGHT (FT.)	POLE LENGTH	POLE CATALOG NUMBER
70W TO 150W	29	31'-0"	DB-8-4128-N123-GRS
200W TO 400W	34	37'-6"	DB-10-4135-N123-GRS
200W TO 400W	34	* 37'-6"	DB-10-4135-N1234-GRS

\* THIS POLE HAS SPECIAL REINFORCING FOR THE INSTALLATION OF WALK-WAIT PEDESTRIAN SIGNAL

NOTE: IF POLE IS SET IN SIDEWALK OR OTHER CONCRETE, PROVIDE 2'SQ OF 2" CONCRETE WITH EXPANSION JOINT AT POLE AND PERIMETER.

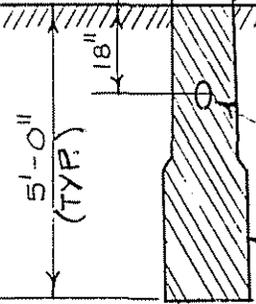


2" x 5" HANDHOLE WITH COVER AND TAMPER PROOF SCREW



24" (TYP.) GRADE LINE

2" x 5" CABLE ENTRANCE HOLE ON OPPOSITE SIDES OF POLE



SQUARE BASE FOR ANTI-ROTATION

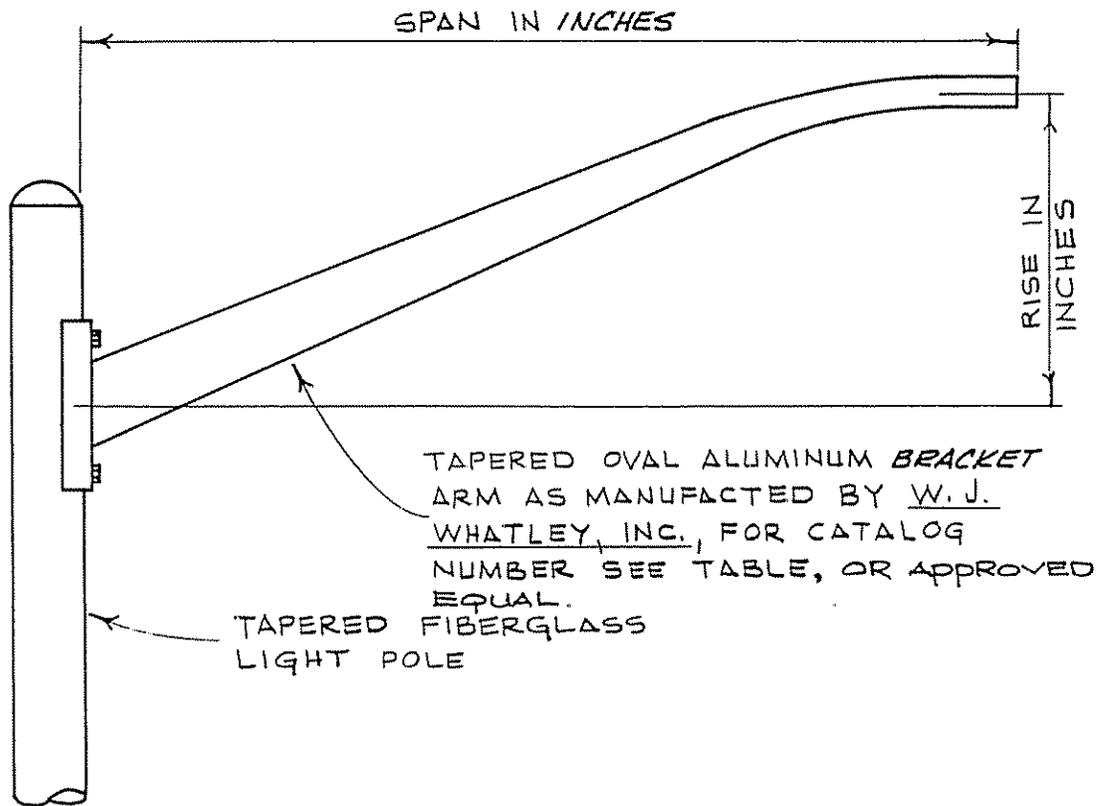
**NOTE:**

- SPECIFY ON DRAWING;
- 1) POLE LENGTH
  - 2) BRACKET TYPE (SEE E-9)
  - 3) LUMINAIRE WATTAGE AND VOLTAGE
  - 4) I.E.S. LIGHT PATTERN DISTRIBUTION

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**TAPERED FIBERGLASS POLE**

<b>E</b> <b>8</b>	APPROVED <i>John L. Kowalski</i> 12/30/85 CITY ENGINEER DATE
	DRAWN CWK II CHECKED <i>EDM</i>



Catalog No.	Type	Span	Rise	Weight (Lbs)
TO4-2	4 FL	45"	15"	6
TO6-2	6 FL	68"	24"	10
TO8-2	8 FL	90"	32"	15
TO10-2	10 FL	114"	39"	19
TO12-2	12 FL	138"	46"	22

\*  
\*\*

\* TYPICAL FOR RESIDENTIAL  
\*\* TYPICAL FOR MAJOR STREET

NOTE:  
SPECIFY "TYPE" ON DRAWING

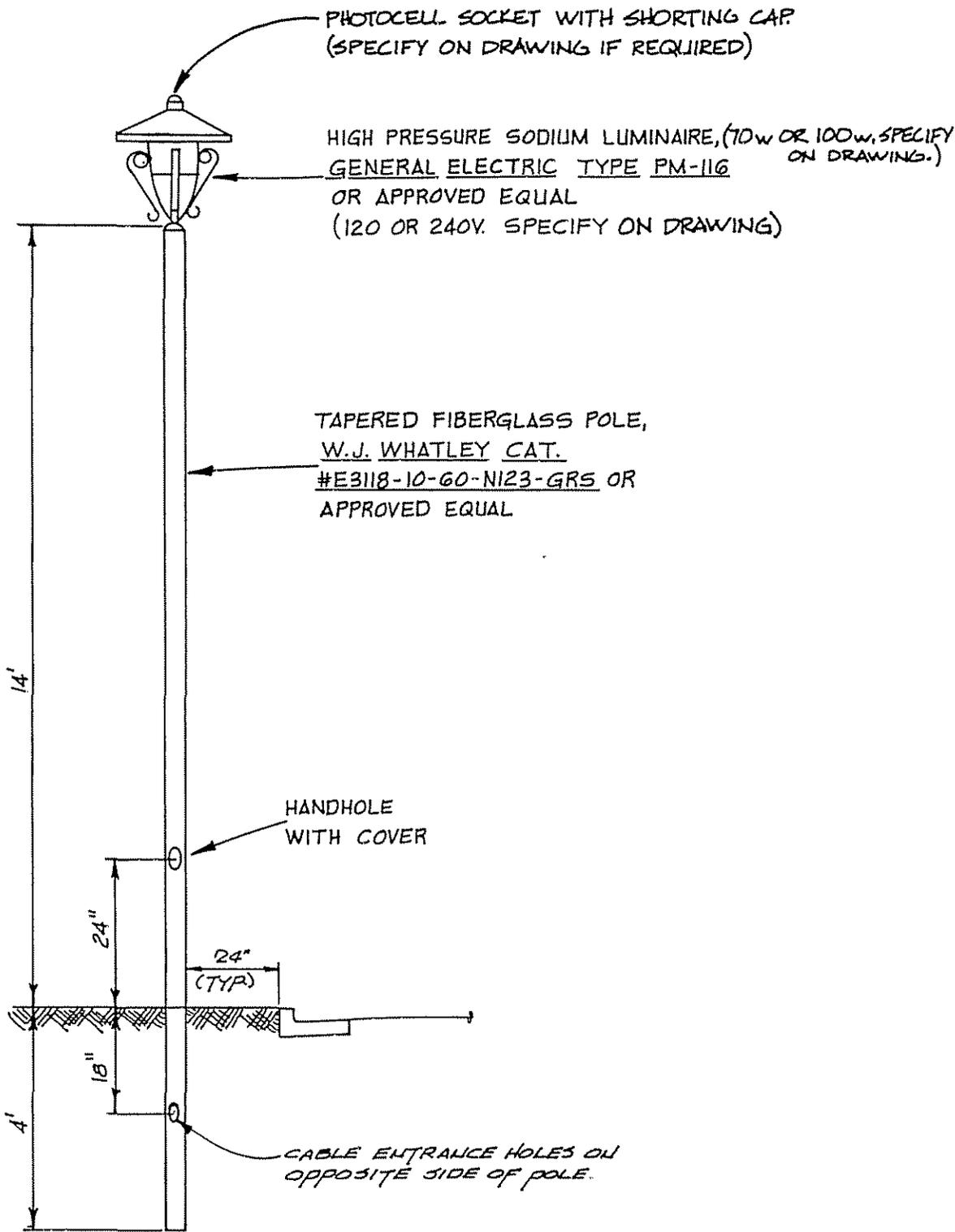
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**TAPERED OVAL  
ALUMINUM  
BRACKET ARM**

APPROVED *John C. Hornbach*  
CITY ENGINEER DATE 12/30/85

DRAWN CWK II CHECKED *WJ*

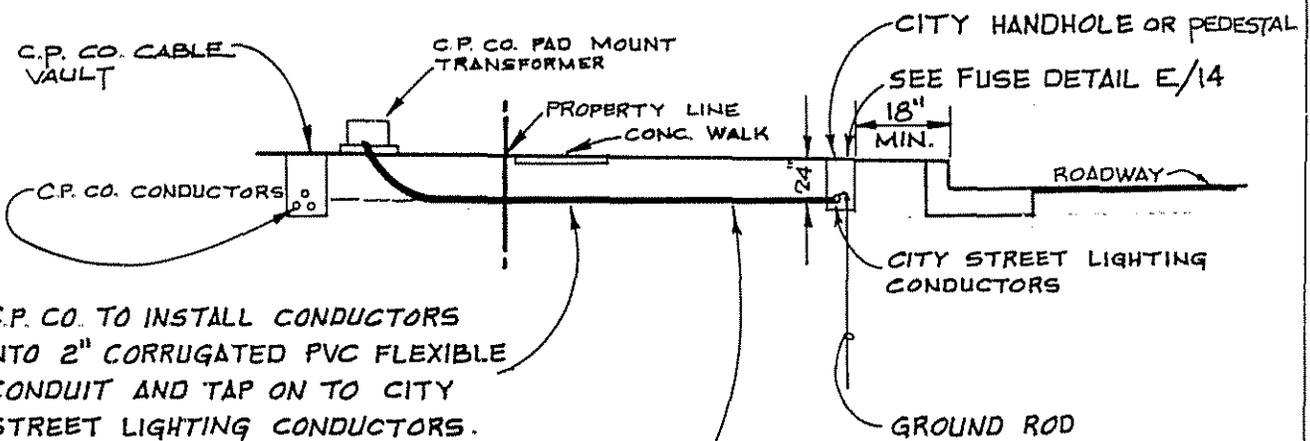
E  
9



CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**POST TOP LUMINAIRE  
AND  
FIBERGLASS POST**

E 10	APPROVED	<i>John H. Hornbait</i> CITY ENGINEER	DATE 7/10/85
	DRAWN	CWK II	CHECKED <i>YU</i>



C.P. CO. TO INSTALL CONDUCTORS INTO 2" CORRUGATED PVC FLEXIBLE CONDUIT AND TAP ON TO CITY STREET LIGHTING CONDUCTORS.

INSTALL 2" CORRUGATED PVC FLEXIBLE CONDUIT FROM CITY HANDHOLE TO WITHIN 2' OF THE C.P. CO. TRANSFORMER OR CABLE VAULT AND LEAVE SPARE SO THAT C.P. CO. CAN CONNECT TO THE TRANSFORMER WIRE WAY, OR CABLE VAULT.

ELEVATION VIEW

**NOTE:** C.P. CO. WILL ALWAYS BRING IN THREE (3) CONDUCTORS: HOT, NEUTRAL, HOT. FUSE EACH ENERGIZED HOT CONDUCTOR.

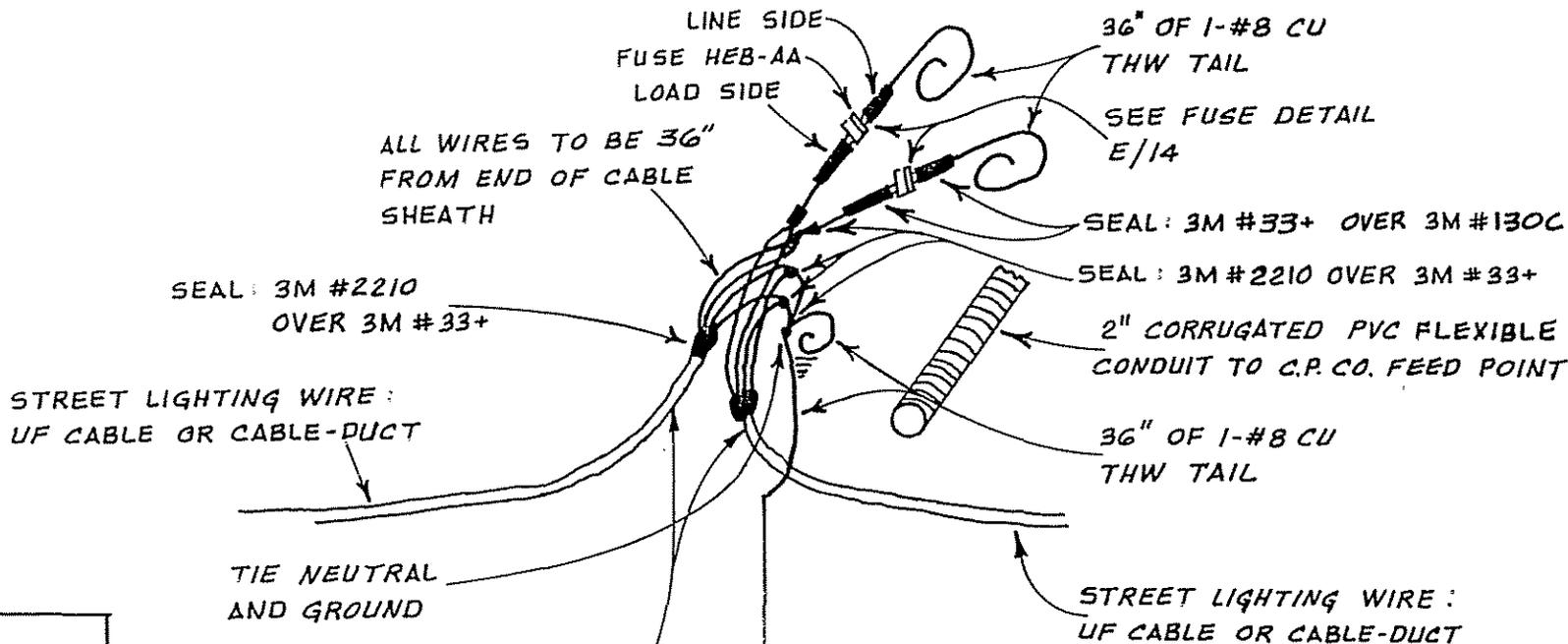
CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING  
**STREET LIGHTING UNDERGROUND FEED FROM C.P. CO.**  
**(PLAT LIGHTING)**

E II	APPROVED <i>John Hombach</i> CITY ENGINEER	DATE 7/10/85
	DRAWN CWK II	CHECKED <i>VU</i> <i>EDM</i>

**RESERVED**

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

<b>E</b> <b>12</b>	APPROVED		
	CITY ENGINEER	DATE	
	DRAWN	CHECKED	



ALL WIRING TO BE IN A HAND-HOLE OR PEDESTAL WITH A MINIMUM OF 48" OF COVERED CABLE.

NOTE:

1. ALL CONNECTORS TO BE OF COPPER ALLOY AND BE THE BOLTING TYPE.
2. WHEN USING 3M#2210 MASTIC BACKED TAPE FOR WATERPROOFING CONNECTIONS, 3M#33+ TAPE SHALL BE APPLIED FIRST TO THE CONNECTOR AREA.

<b>E</b>	APPROVED <i>[Signature]</i> CITY ENGINEER	DATE 12/30/85
<b>13</b>		
DRAWN CWK II	CHECKED <i>[Signature]</i>	

**TYPICAL**

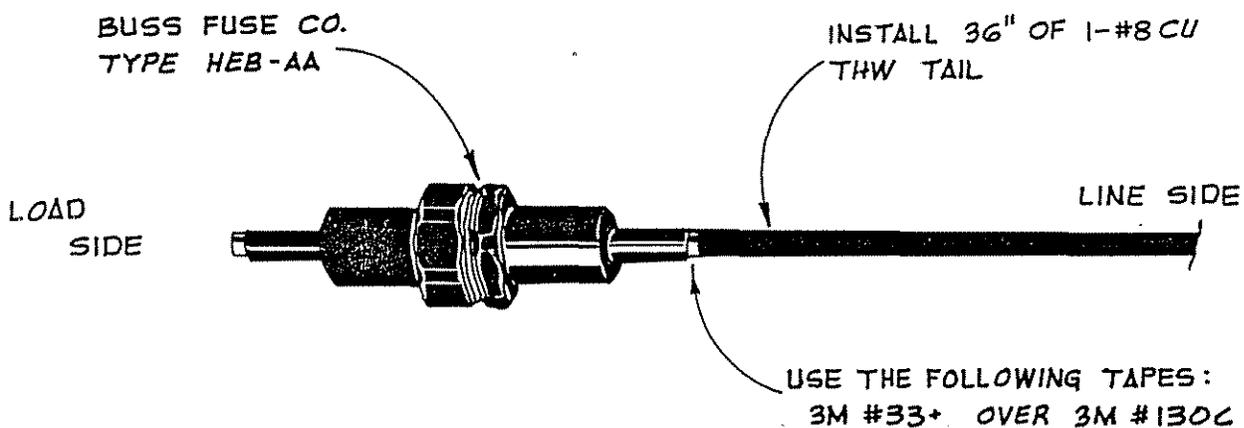
**FEED POINT**

**CONNECTIONS**

**(PLAT LIGHTING)**

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**WATERPROOF FUSEHOLER  
(30 AMPERE)**



**NOTE: FUSE EACH ENERGIZED  
FEED CONDUCTORS**

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING  
**SECONDARY FUSE  
DETAIL FOR  
UNDERGROUND**

E 14	APPROVED <i>John C. Hombeck</i> CITY ENGINEER	DATE 7/10/85
	DRAWN CWK II	CHECKED <i>[Signature]</i>

SYMBOL OF PRODUCER.

PLANT LOCATION AND YEAR MANUFACTURED.

SPECIES AND PRESERVATIVE USED.

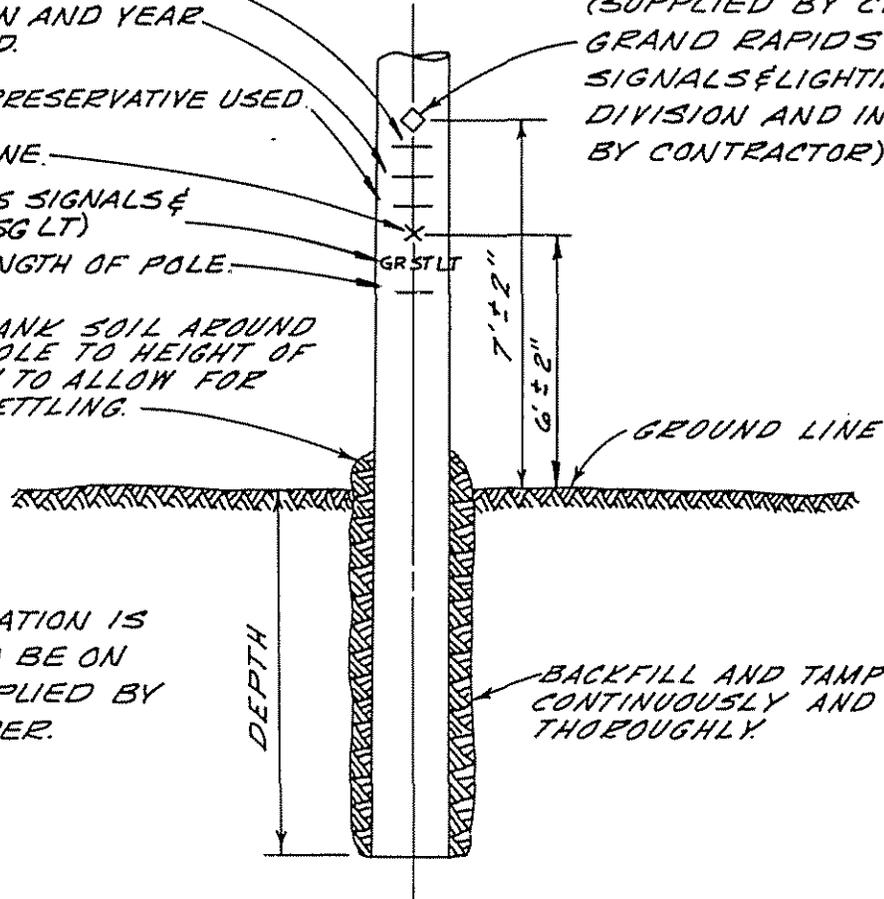
REFERENCE LINE.

GRAND RAPIDS SIGNALS & LIGHTING (GR SG LT)

CLASS AND LENGTH OF POLE.

CITY OWNERSHIP PLATE (SUPPLIED BY CITY OF GRAND RAPIDS SIGNALS & LIGHTING DIVISION AND INSTALLED BY CONTRACTOR)

BANK SOIL AROUND POLE TO HEIGHT OF 6" TO ALLOW FOR SETTLING.



NOTE:

THIS INFORMATION IS REQUIRED TO BE ON POLE AS SUPPLIED BY MANUFACTURER.

BACKFILL AND TAMP CONTINUOUSLY AND THOROUGHLY.

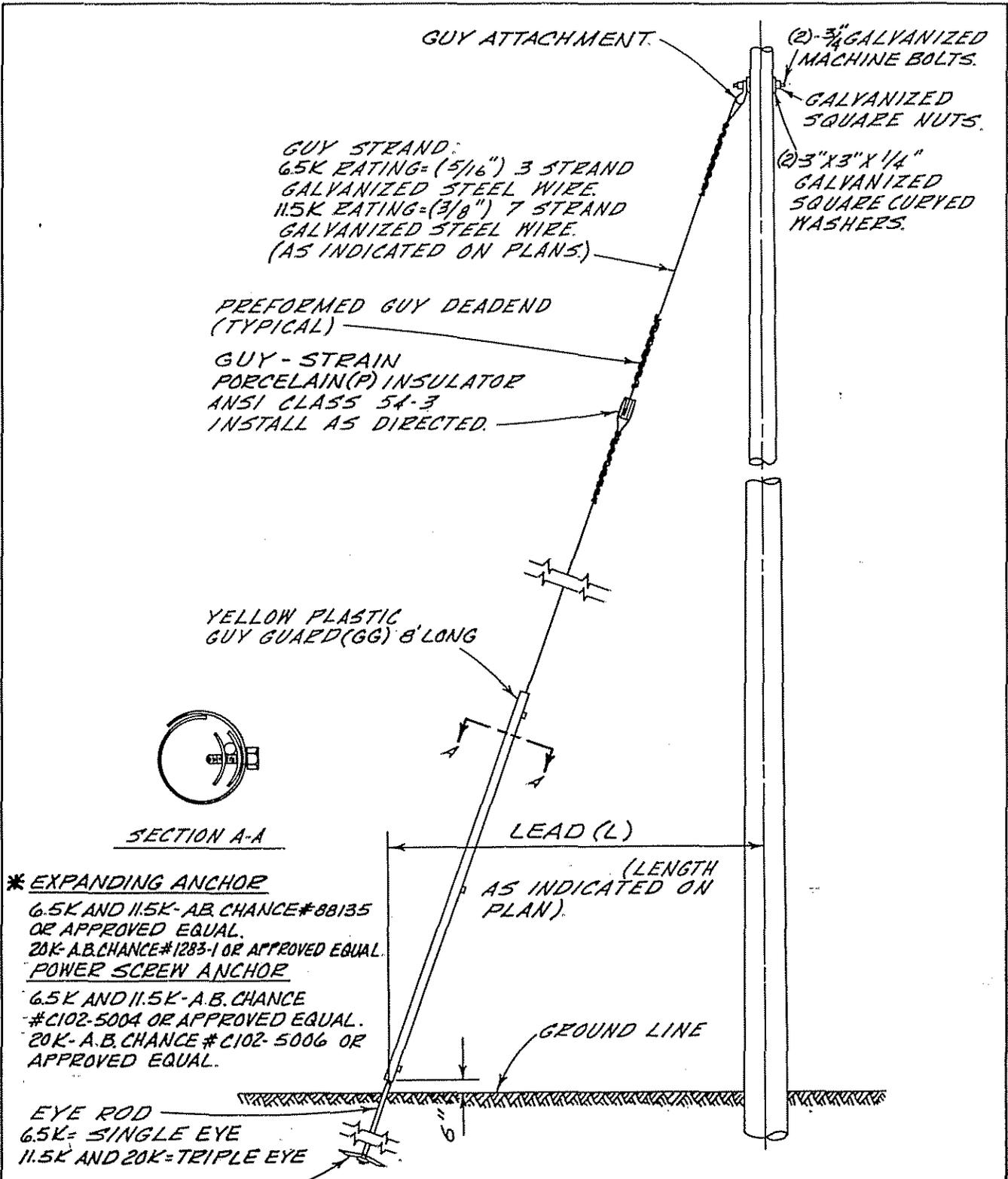
WOOD POLE SETTING DEPTH

LENGTH OF POLE IN FEET	DEPTH IN FEET	LENGTH OF POLE IN FEET	DEPTH IN FEET
30	5.5	60	8.0
35	6.0	65	8.5
40	6.0	70	9.0
45	6.5	75	9.5
50	7.0	80	10.0
55	7.5	85	10.5

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

TYPICAL  
POLE SETTING

E 15	APPROVED <i>[Signature]</i> 4/27/52 CITY ENGINEER DATE
	DRAWN <i>[Signature]</i> CHECKED <i>[Signature]</i>



- \* EXPANDING ANCHOR  
6.5K AND 11.5K - A.B. CHANCE #88135 OR APPROVED EQUAL.  
20K - A.B. CHANCE #1283-1 OR APPROVED EQUAL.
- \* POWER SCREW ANCHOR  
6.5K AND 11.5K - A.B. CHANCE #C102-5004 OR APPROVED EQUAL.  
20K - A.B. CHANCE #C102-5006 OR APPROVED EQUAL.

EYE ROD  
6.5K = SINGLE EYE  
11.5K AND 20K = TRIPLE EYE

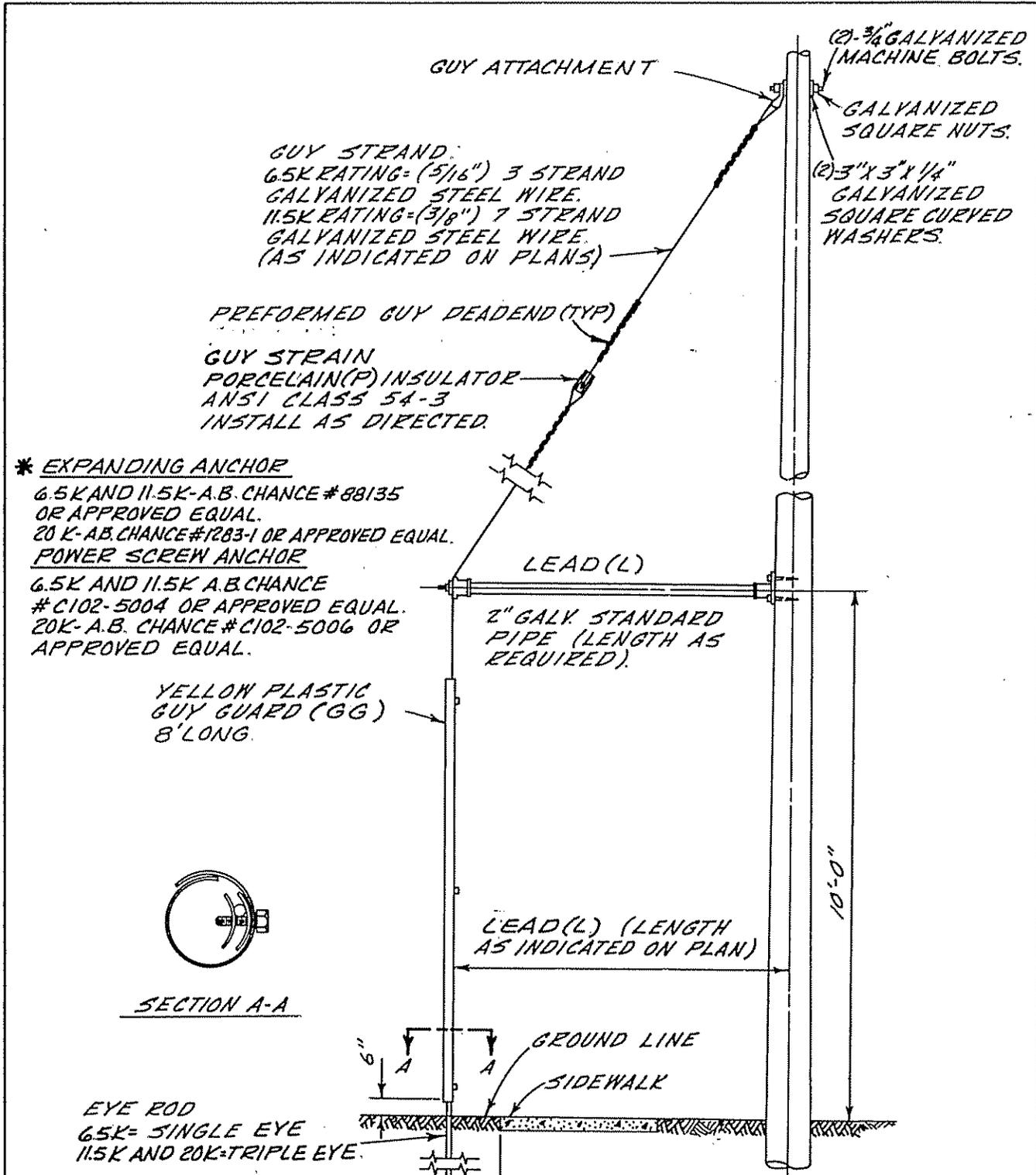
\* EXPANDING ANCHOR OR POWER SCREW ANCHOR  
(MEETING OR EXCEEDING THE KIP RATING AS SHOWN ON THE DRAWINGS)

EXAMPLE OF GUY NOTATION ON DRAWING  
6.5K-12'(FT.)L-1P-GG  
(STRAND RATING-LEAD-NUMBER OF PORCELAIN INSULATORS-GUY GUARD)

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

TYPICAL GUY  
INSTALLATION

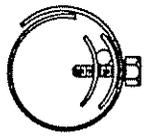
E  16	APPROVED <i>[Signature]</i> 4/27/82 CITY ENGINEER      DATE
	DRAWN S.J.D.      CHECKED <i>[Signature]</i>



**\* EXPANDING ANCHOR**  
 6.5K AND 11.5K - A.B. CHANCE #88135  
 OR APPROVED EQUAL.  
 20K - A.B. CHANCE #1283-1 OR APPROVED EQUAL.

**POWER SCREW ANCHOR**  
 6.5K AND 11.5K A.B. CHANCE  
 #C102-5004 OR APPROVED EQUAL.  
 20K - A.B. CHANCE #C102-5006 OR  
 APPROVED EQUAL.

YELLOW PLASTIC  
 GUY GUARD (GG)  
 8' LONG.



SECTION A-A

EYE ROD  
 6.5K = SINGLE EYE  
 11.5K AND 20K = TRIPLE EYE.

**\* EXPANDING ANCHOR OR POWER  
 SCREW ANCHOR (MEETING  
 OR EXCEEDING THE KIP  
 RATING AS SHOWN ON THE  
 DRAWINGS)**

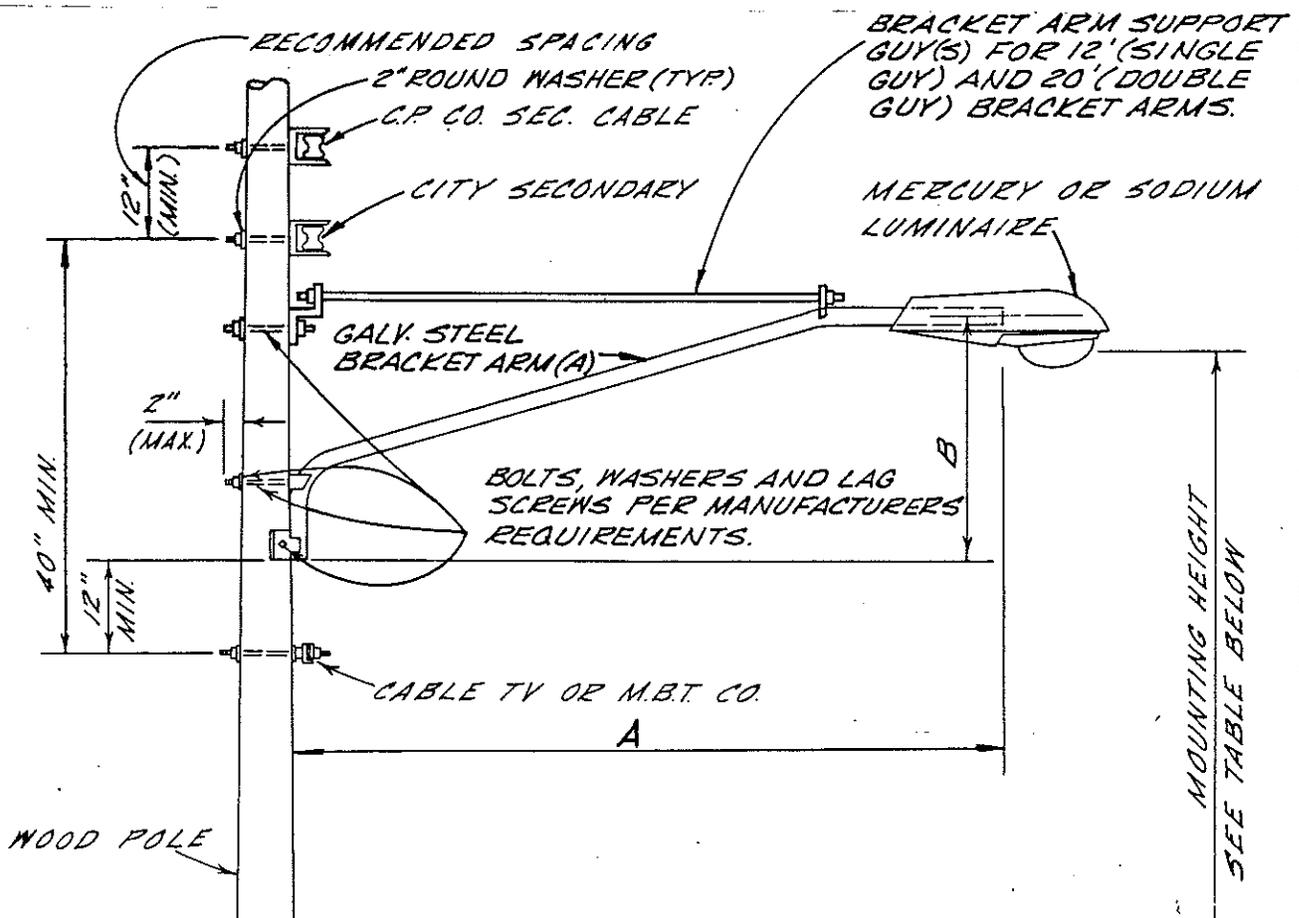
EXAMPLE OF GUY NOTATION  
 ON DRAWING.

SIDEWALK GUY  
 6.5K-12'(FT)-1P-GG  
 (STRAND RATING - LEAD - NUMBER  
 OF PORCELAIN INSULATORS - GUY  
 GUARD)

CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

**TYPICAL SIDEWALK  
 GUY  
 INSTALLATION**

E 17	APPROVED <i>[Signature]</i> 4/21/82 CITY ENGINEER DATE
	DRAWN S.J.D. CHECKED <i>[Signature]</i>



LUMINAIRE SIZE	PREFERRED MOUNTING HEIGHT (FEET) <small>UNLESS OTHERWISE NOTED ON DRAWING</small>
100 W. MERCURY	2 6
175 W. MERCURY	2 6
250 W. MERCURY	2 8
400 W. MERCURY	3 4
70 W. H.P.S.	2 6
100 W. H.P.S.	2 6
150 W. H.P.S.	2 8
200 W. THRU 400 W. H.P.S.	3 4

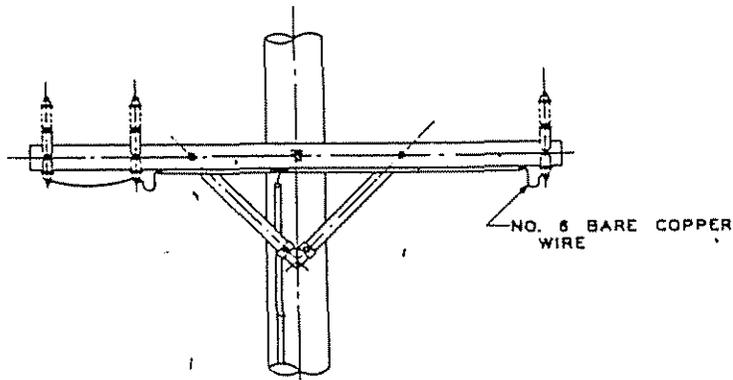
LENGTH "A" (FEET)	ARM DIA. (INCHES)	RISE "B" (INCHES)
2.5	1 1/4	15 1/4
8	2	29 5/8
12	2	40 3/8
20	2	64

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

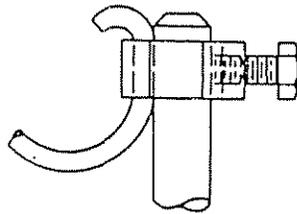
**TYPICAL  
STREET LIGHT  
INSTALLATION**

APPROVED: *[Signature]* CITY ENGINEER DATE: 4/27/62

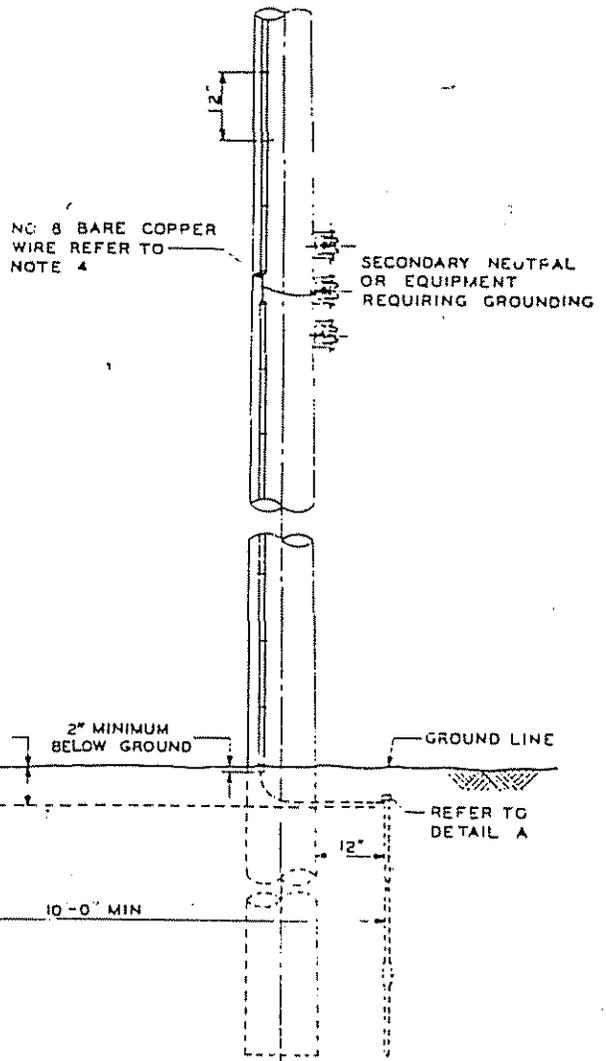
18 DRAWN: *[Signature]* CHECKED: *[Signature]*



TYPICAL GROUNDING OF LIGHTNING ARRESTERS



DETAIL A



NOTES

- 1-RECOMMENDED RESISTANCE OF GROUND- 25 OHMS OR LESS
- 2-PARALLEL GROUND(S) SHALL BE LOCATED, PREFERABLY ALONG THE CENTER LINE OF THE POLE LEAD, OR IN ANY OTHER POSITION REQUIRED BY FIELD CONDITIONS.
- 3-OVER-LAP JOINTS BETWEEN SECTIONS OF MOLDING
- 4-SALVAGED #6 HARD DRAWN COPPER MAY BE USED FOR DOWN GROUNDS. EXTRA CARE IN CLEANING CONNECTION POINTS WILL BE NECESSARY
- 5-GROUND ROD SHALL BE  $\frac{5}{8}$ " COPPERWELD. LENGTH SHALL BE AS NOTED.
  - a) 8' RODS SHALL BE OF THE SCREW CONNECTOR TYPE.
  - b) TRANSFORMER GROUND ROD INSTALLATION SHALL CONSIST OF NOT LESS THAN 2-8' RODS COUPLED TOGETHER AND DRIVEN INTO THE GROUND.
- 6-GROUND ROD CLAMP SHALL BE OF AN ALL BRONZE MATERIAL.

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

GROUND ASSEMBLY  
FOR WOOD POLE

E	APPROVED <i>[Signature]</i> 4/27/82 CITY ENGINEER DATE
	DRAWN <i>[Signature]</i> CHECKED <i>[Signature]</i>

4 - 4 (6/1) - 4 ALUM. TRIPLEX  
SPAN LENGTH IN FEET

TEMP °F	<u>75'</u>		<u>100'</u>		<u>125'</u>	
	SAG	TENSION POUNDS	SAG	TENSION POUNDS	SAG	TENSION POUNDS
90	0'-7"	250	0'-10"	310	1'-8"	235
60	0'-5"	345	0'-7"	405	1'-4"	295
30	0'-4"	450	0'-6"	505	1'-0"	380
0	0'-3"	550	0'-5"	600	0'-10"	470

TEMP °F	<u>150'</u>		<u>175'</u>		<u>200'</u>	
	SAG	TENSION POUNDS	SAG	TENSION POUNDS	SAG	TENSION POUNDS
90	2'-11"	190	4'-4"	160	5'-10"	155
60	2'-6"	215	4'-0"	180	5'-6"	165
30	2'-1"	255	3'-6"	200	5'-1"	175
0	1'-9"	320	3'-1"	240	4'-8"	195

1/0-1/0 (6/1) - 1/0 ALUM. TRIPLEX  
SPAN LENGTH IN FEET

TEMP °F	<u>75'</u>		<u>100'</u>		<u>125'</u>	
	SAG	TENSION POUNDS	SAG	TENSION POUNDS	SAG	TENSION POUNDS
90	0'-8"	450	1'-0"	540	1'-4"	620
60	0'-6"	650	0'-9"	740	1'-0"	820
30	0'-4"	910	0'-7"	990	0'-9"	1050
0	0'-3"	1200	0'-6"	1260	0'-8"	1320

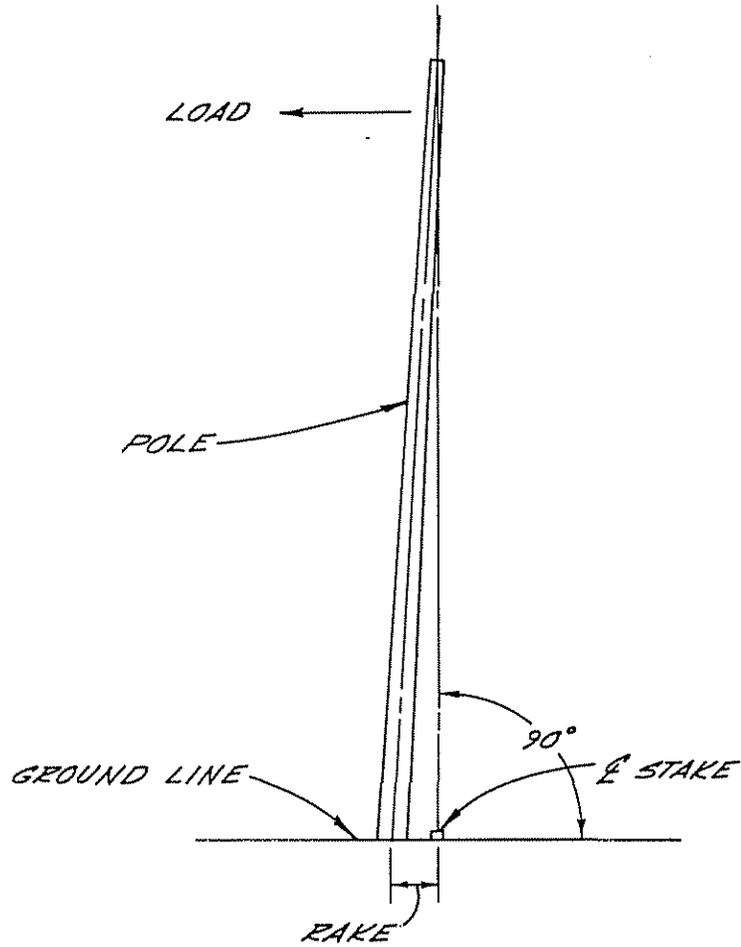
  

TEMP °F	<u>150'</u>		<u>175'</u>		<u>200'</u>	
	SAG	TENSION POUNDS	SAG	TENSION POUNDS	SAG	TENSION POUNDS
90	1'-9"	700	2'-2"	780	2'-9"	820
60	1'-5"	890	1'-10"	960	2'-3"	990
30	1'-1"	1115	1'-5"	1180	1'-10"	1200
0	0'-11"	1375	1'-2"	1425	1'-7"	1430

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**STRINGING SAGS  
AND TENSIONS**

<b>E</b> <b>20</b>	APPROVED <i>[Signature]</i> 4/27/82 CITY ENGINEER	DATE
	DRAWN <i>[Signature]</i>	CHECKED <i>[Signature]</i>



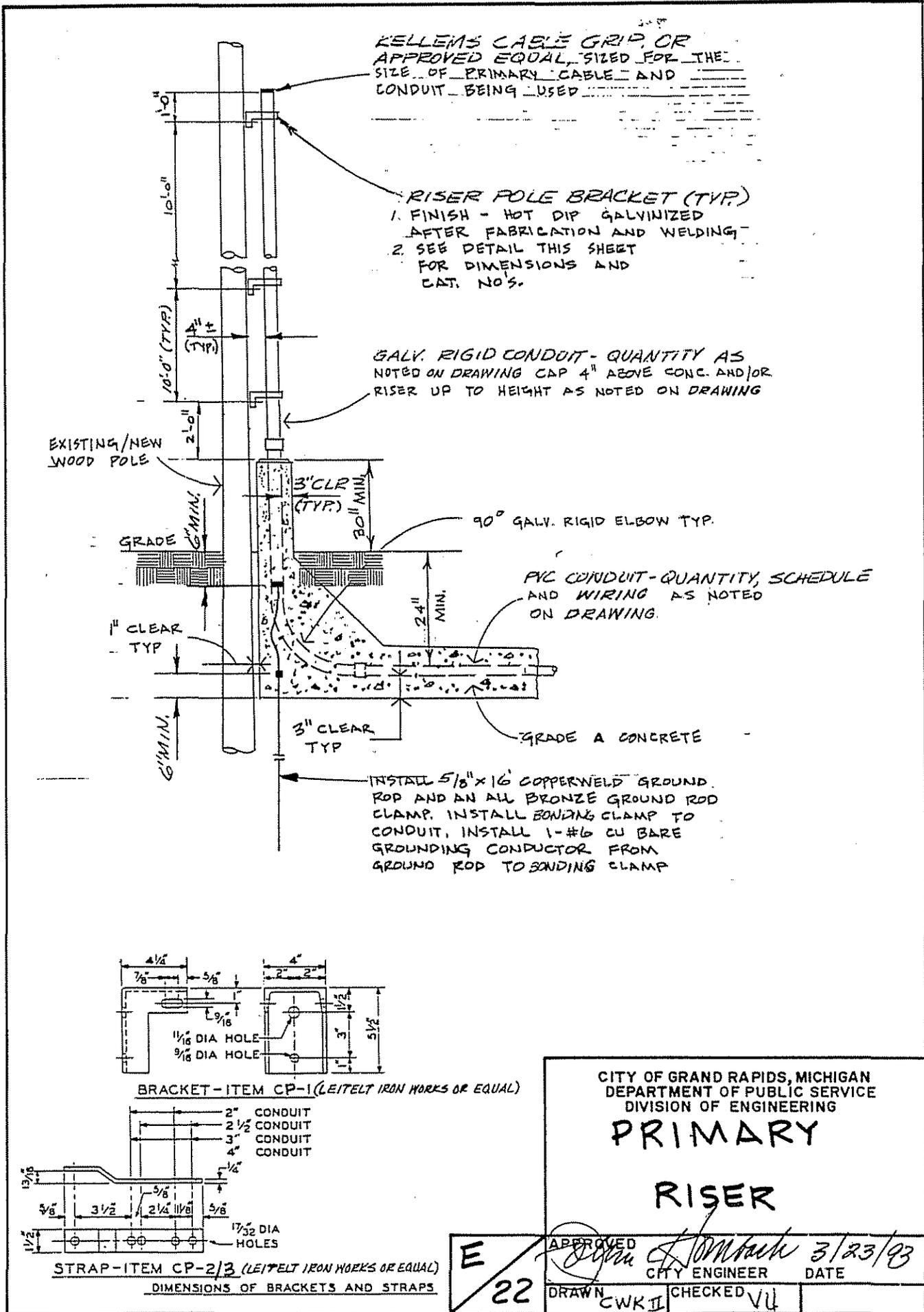
TABLE

RAKE VALUES FOR LINE ANGLES AND DEAD ENDS	
LENGTH OF POLE IN FEET	RAKE IN FEET
25	1.5
30	1.5
35	1.5
40	2.0
45	2.0

CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

POLE RAKE  
 DETAIL

E 21	APPROVED <i>Charles J. [Signature]</i> 4/27/82 CITY ENGINEER DATE
	DRAWN S.J.D. CHECKED DHM <i>[Signature]</i>



KELLEMS CABLE GRIP, OR APPROVED EQUAL, SIZED FOR THE SIZE OF PRIMARY CABLE AND CONDUIT BEING USED

RISER POLE BRACKET (TYP.)  
 1. FINISH - HOT DIP GALVANIZED AFTER FABRICATION AND WELDING  
 2. SEE DETAIL THIS SHEET FOR DIMENSIONS AND CAT. NOS.

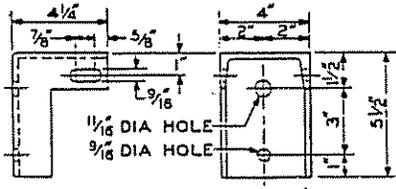
GALV. RIGID CONDUIT - QUANTITY AS NOTED ON DRAWING CAP 4" ABOVE CONC. AND/OR RISER UP TO HEIGHT AS NOTED ON DRAWING

EXISTING/NEW WOOD POLE

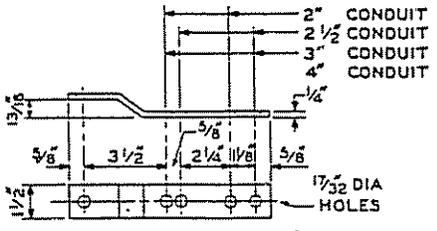
90° GALV. RIGID ELBOW TYP.

PVC CONDUIT - QUANTITY, SCHEDULE AND WIRING AS NOTED ON DRAWING

INSTALL 5/8" x 1/6" COPPERWELD GROUND ROD AND AN ALL BRONZE GROUND ROD CLAMP. INSTALL BONDING CLAMP TO CONDUIT. INSTALL 1-#6 CU BARE GROUNDING CONDUCTOR FROM GROUND ROD TO BONDING CLAMP



BRACKET - ITEM CP-1 (LEITZELT IRON WORKS OR EQUAL)

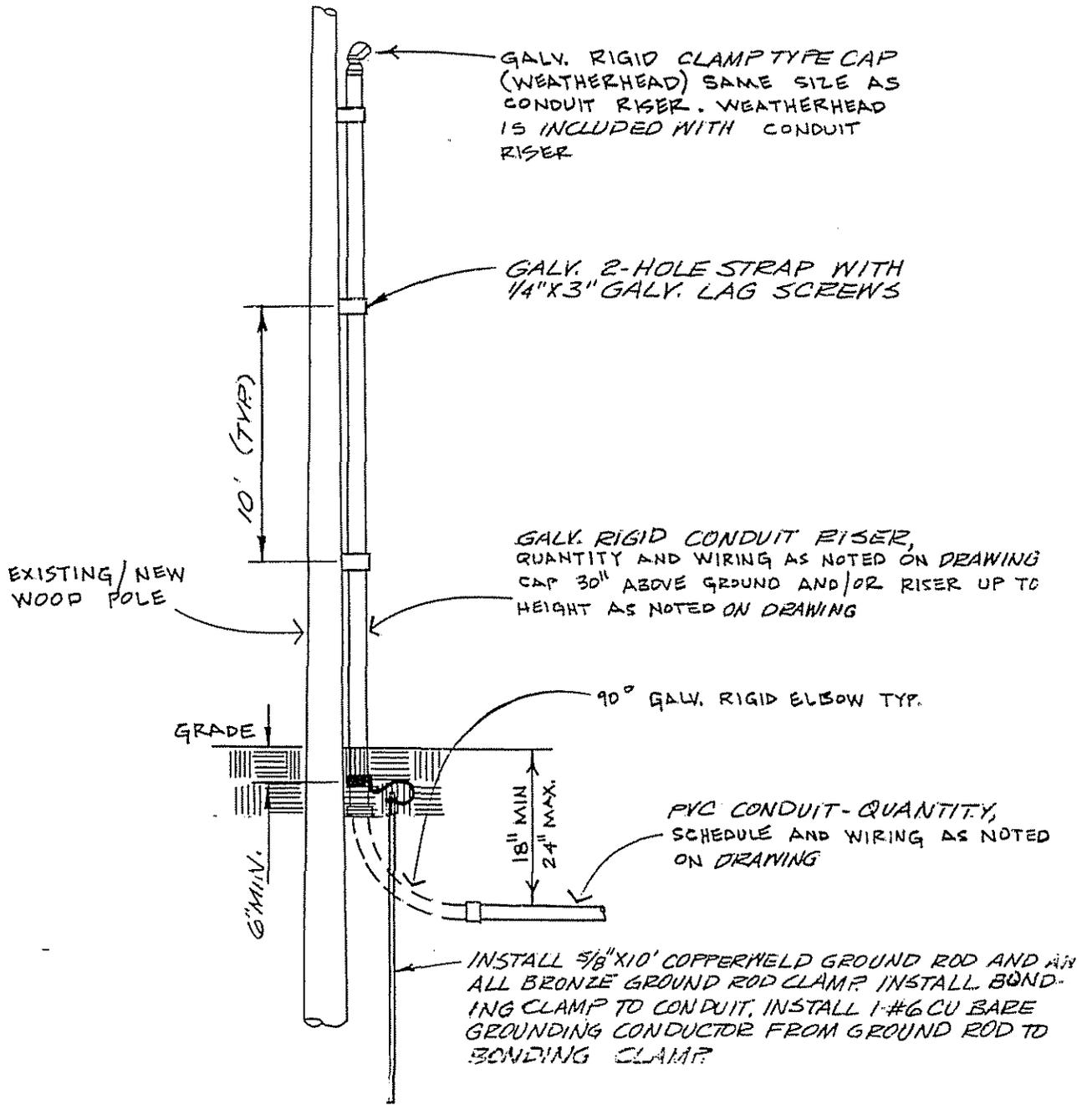


STRAP - ITEM CP-2/3 (LEITZELT IRON WORKS OR EQUAL)  
 DIMENSIONS OF BRACKETS AND STRAPS

CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

# PRIMARY RISER

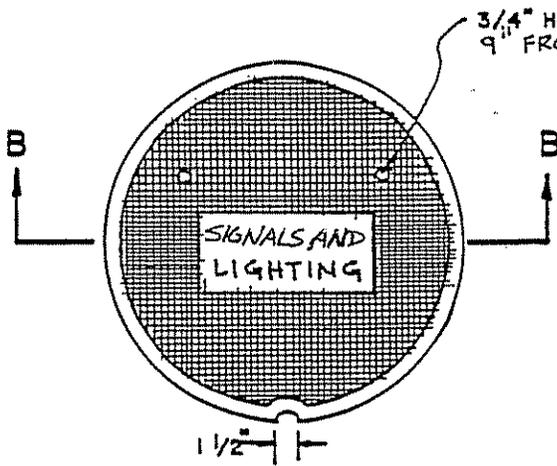
E 22	APPROVED <i>[Signature]</i> CITY ENGINEER	3/23/93 DATE
	DRAWN CWK/IL	CHECKED VU



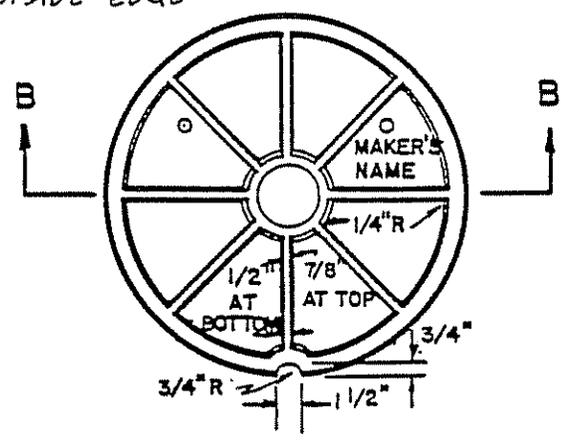
NOTES:

1. INSTALL 30A KTK WEATHER-PROOF FUSEHOLDER(S) WITH FUSE AS NOTED ON DRAWING
2. PROVIDE 36" TAILS BEYOND WEATHERHEAD, WIRING TO BE SAME AS IN CONDUIT.

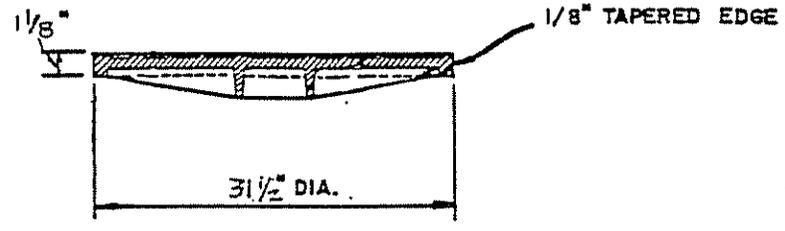
CITY OF GRAND RAPIDS, MICHIGAN DEPARTMENT OF PUBLIC SERVICE DIVISION OF ENGINEERING							
<b>SECONDARY RISER</b>							
<table border="1"> <tr> <td style="text-align: center; font-size: 2em;">E</td> <td style="font-size: 0.8em;">APPROVED <i>[Signature]</i> CITY ENGINEER</td> <td style="font-size: 0.8em;">DATE 3/23/93</td> </tr> <tr> <td style="text-align: center; font-size: 2em;">23</td> <td style="font-size: 0.8em;">DRAWN CNK-II</td> <td style="font-size: 0.8em;">CHECKED VU</td> </tr> </table>	E	APPROVED <i>[Signature]</i> CITY ENGINEER	DATE 3/23/93	23	DRAWN CNK-II	CHECKED VU	
E	APPROVED <i>[Signature]</i> CITY ENGINEER	DATE 3/23/93					
23	DRAWN CNK-II	CHECKED VU					



TOP COVER

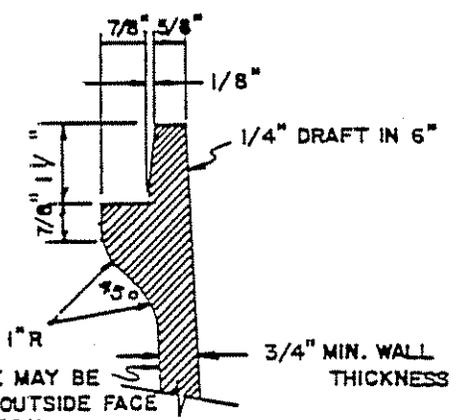


BOTTOM COVER



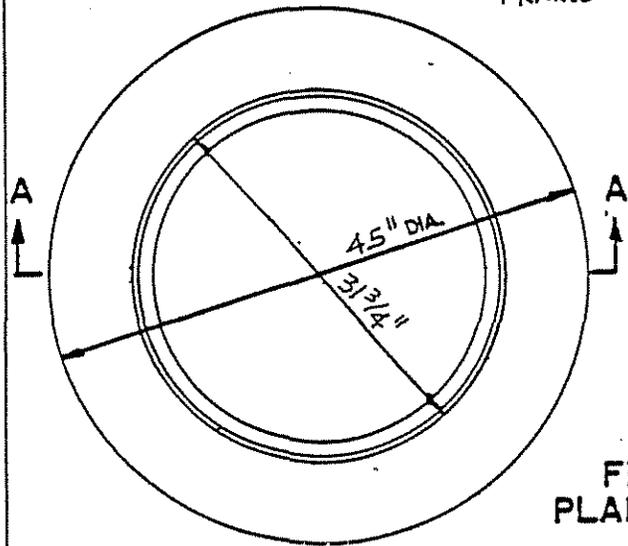
COVER SECTION B-B

NOTE:  
USE EAST JORDAN # 1220  
TYPE C WITH 1225Z  
FRAME

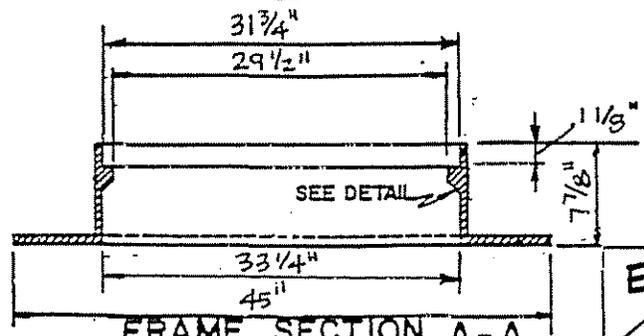


INSIDE FACE MAY BE  
PARALLEL TO OUTSIDE FACE  
OR MORE VERTICAL

HALF SIZE SEAT DETAIL



FRAME  
PLAN VIEW



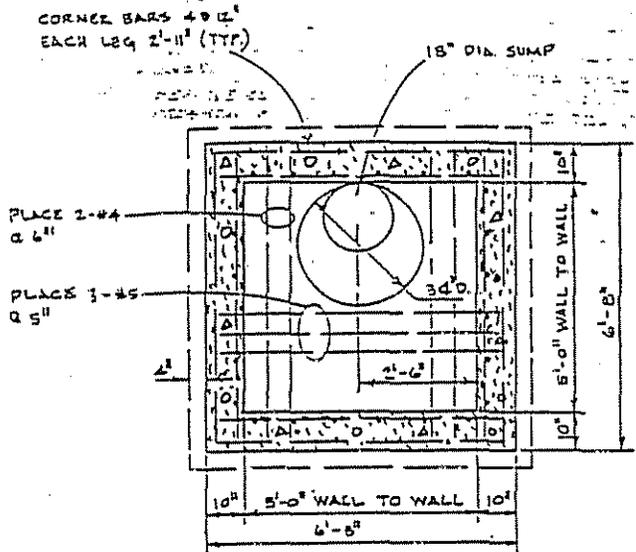
FRAME SECTION A-A

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

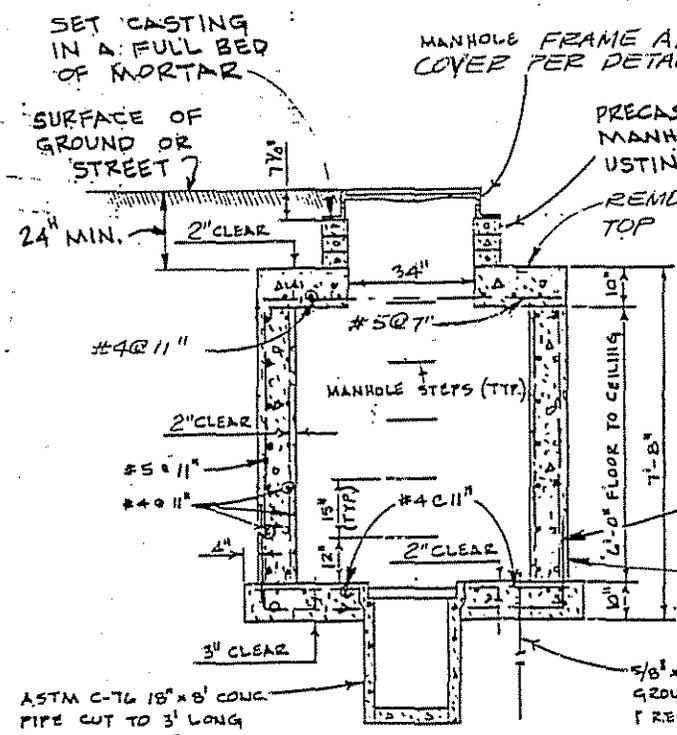
**MANHOLE  
CASTING**

E  
24

APPROVED: *[Signature]*  
CITY ENGINEER DATE 5/7/72  
DRAWN: JEM. CHECKED: VU



PLAN VIEW



ELEVATION

SCALE: 1/2" = 1'-0"

NOTES:

1. ALL CONCRETE SHALL BE GRADE A
2. MANHOLE STEPS SHALL BE P & C, INC. #MET 121 OR CONDUX, INTNL., INC. #08381800 OR APPROVED EQUAL.
3. PULLING-IN IRONS SHALL BE A.B. CHANCE #8119 OR P & C, INC. #MET 116 OR APPROVED EQUAL. PULLING-IN IRONS SHALL BE PLACED OPPOSITE WHERE DUCTS ENTER THE MANHOLE.
4. DUCT WINDOWS NOT SHOWN. EXACT LOCATIONS TO BE DETERMINED BY ENGINEER. COST FOR DUCT WINDOWS INCLUDED IN COST FOR MANHOLE. DUCT WINDOWS SHALL BE CONSTRUCTED PER DETAIL E/26.

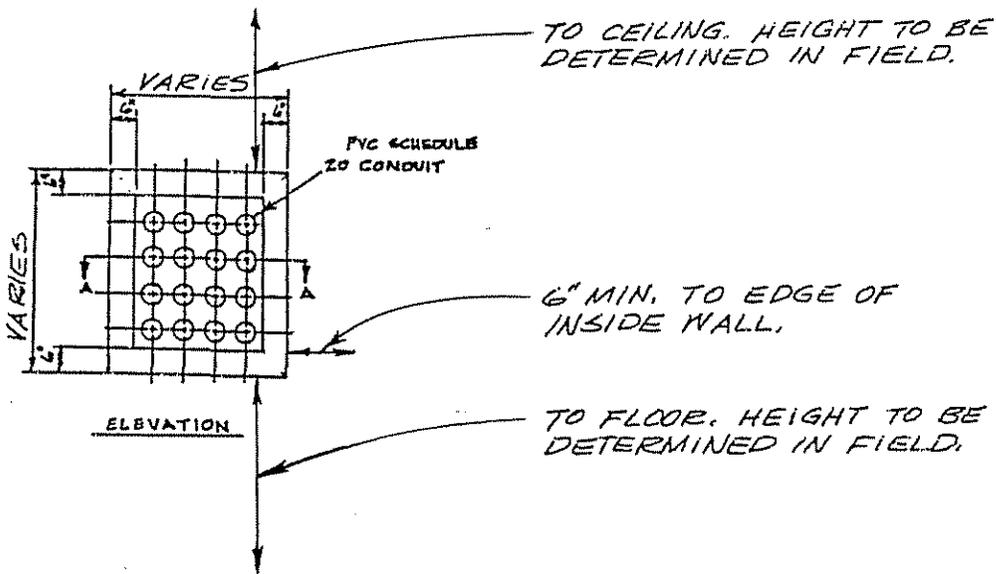
NOTE: BITUMINOUS SEAL REQUIRED PER SPECIFICATION B.03.04 AND 20.03.04

PRECAST ALLOWED, SHOP DRAWING REQUIRED PRIOR TO CONSTRUCTION.

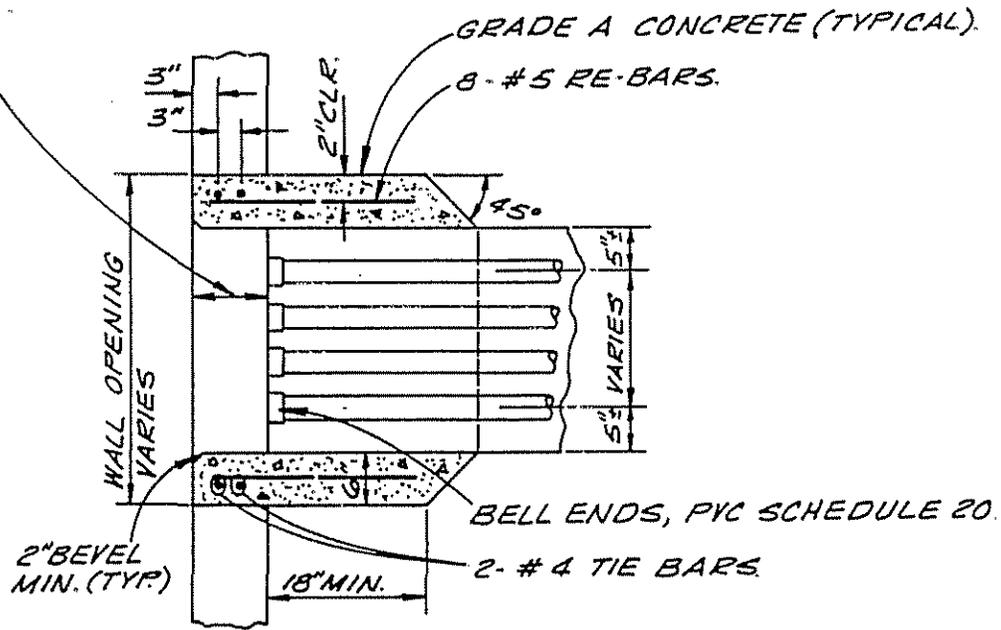
CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

# STANDARD ELECTRICAL MANHOLE

E 25	APPROVED <i>[Signature]</i> CITY ENGINEER	DATE 3/23/93
	DRAWN CWK/II	CHECKED VU



10" FOR MANHOLES AND  
112" FOR VAULTS.



SECTION A-A

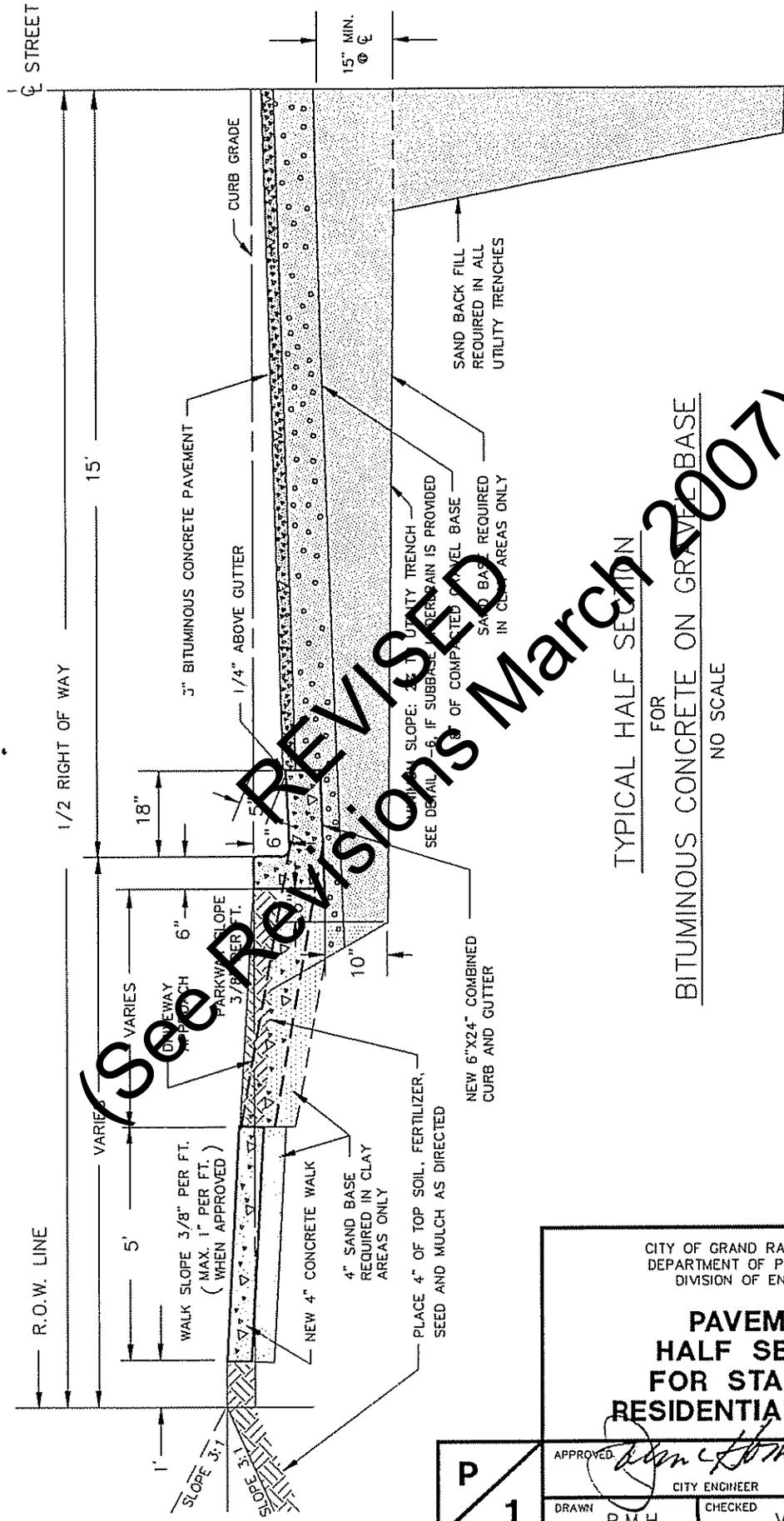
NOTE:  
COST FOR DUCT WINDOW INCLUDED  
IN COST FOR MANHOLE OR  
VAULT.

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

## DUCT WINDOW FOR MANHOLES & VAULTS

APPROVED  CITY ENGINEER	3/23/93 DATE
DRAWN CWK II	CHECKED YU

E  
26



(SEE REVISIONS March 2007)

TYPICAL HALF SECTION  
FOR  
BITUMINOUS CONCRETE ON GRAVEL BASE  
NO SCALE

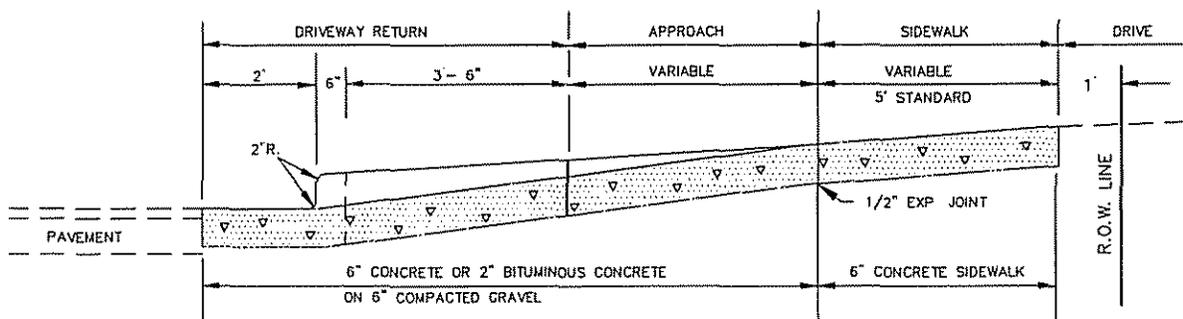
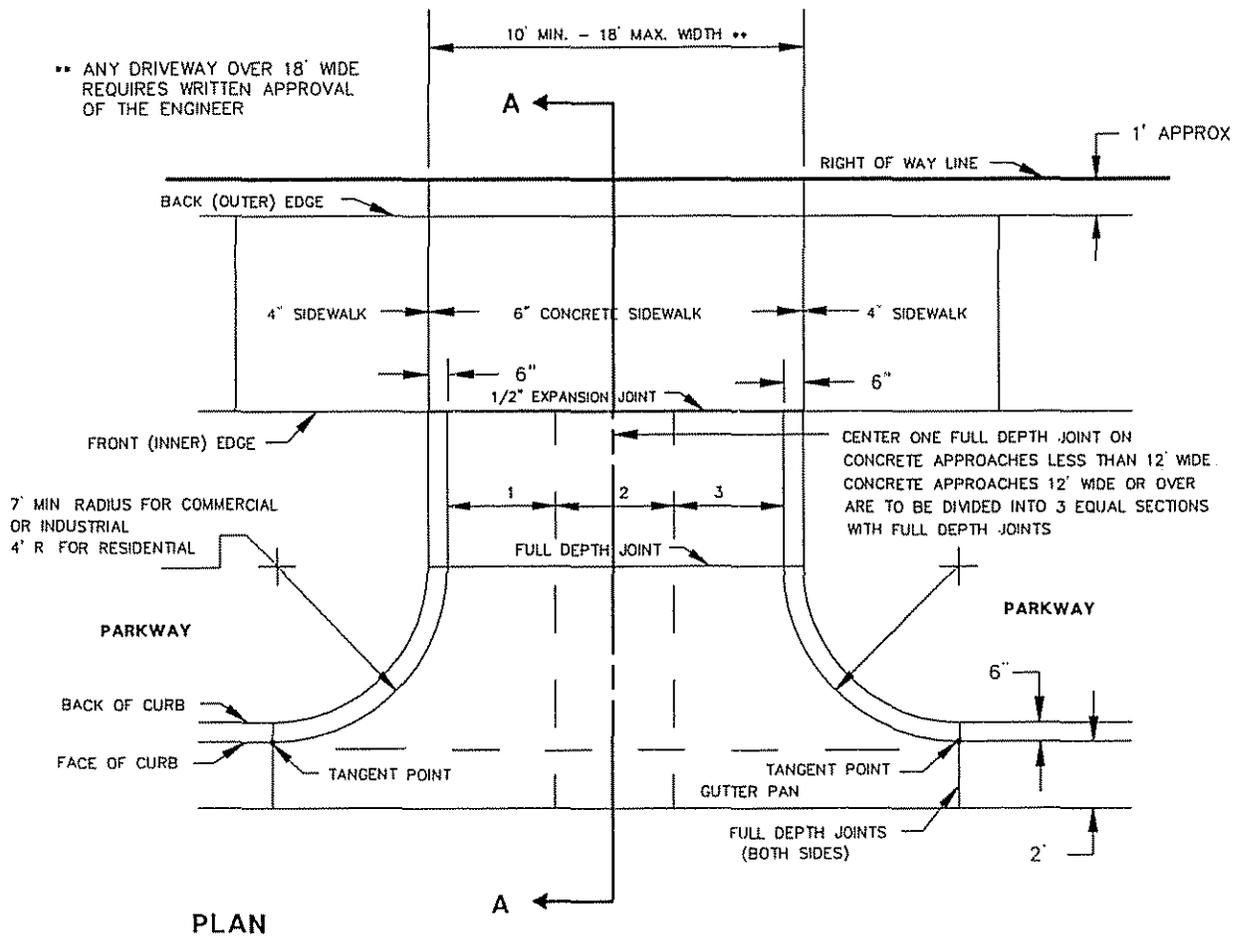
NOTE:  
SEE CROSS SECTION ON THE IMPROVEMENT PLAN FOR PAVEMENT AND BASE REQUIREMENTS  
ON ALL ROADWAYS OTHER THAN THE 30' STANDARD RESIDENTIAL ROADWAY.

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**PAVEMENT  
HALF SECTION  
FOR STANDARD  
RESIDENTIAL STREET**

<b>P</b> <b>1</b>	APPROVED <i>Dean J. ...</i> 3/23/93	DATE
	CITY ENGINEER	
DRAWN P.M.H.	CHECKED V.U.	

•• ANY DRIVEWAY OVER 18' WIDE  
REQUIRES WRITTEN APPROVAL  
OF THE ENGINEER



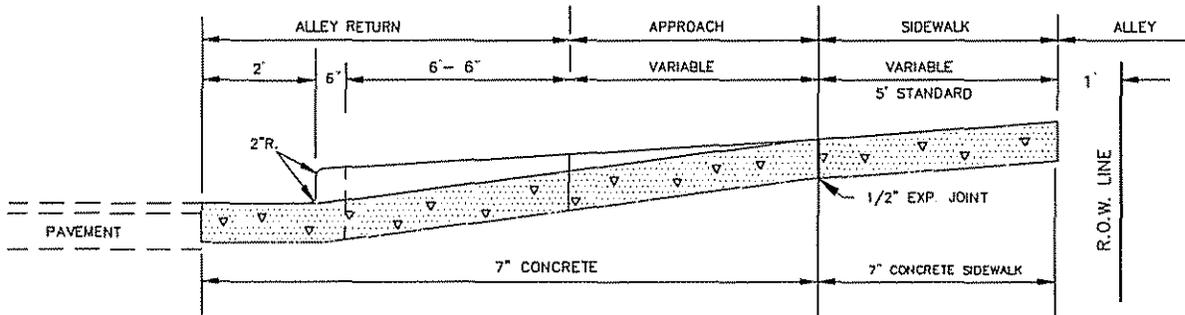
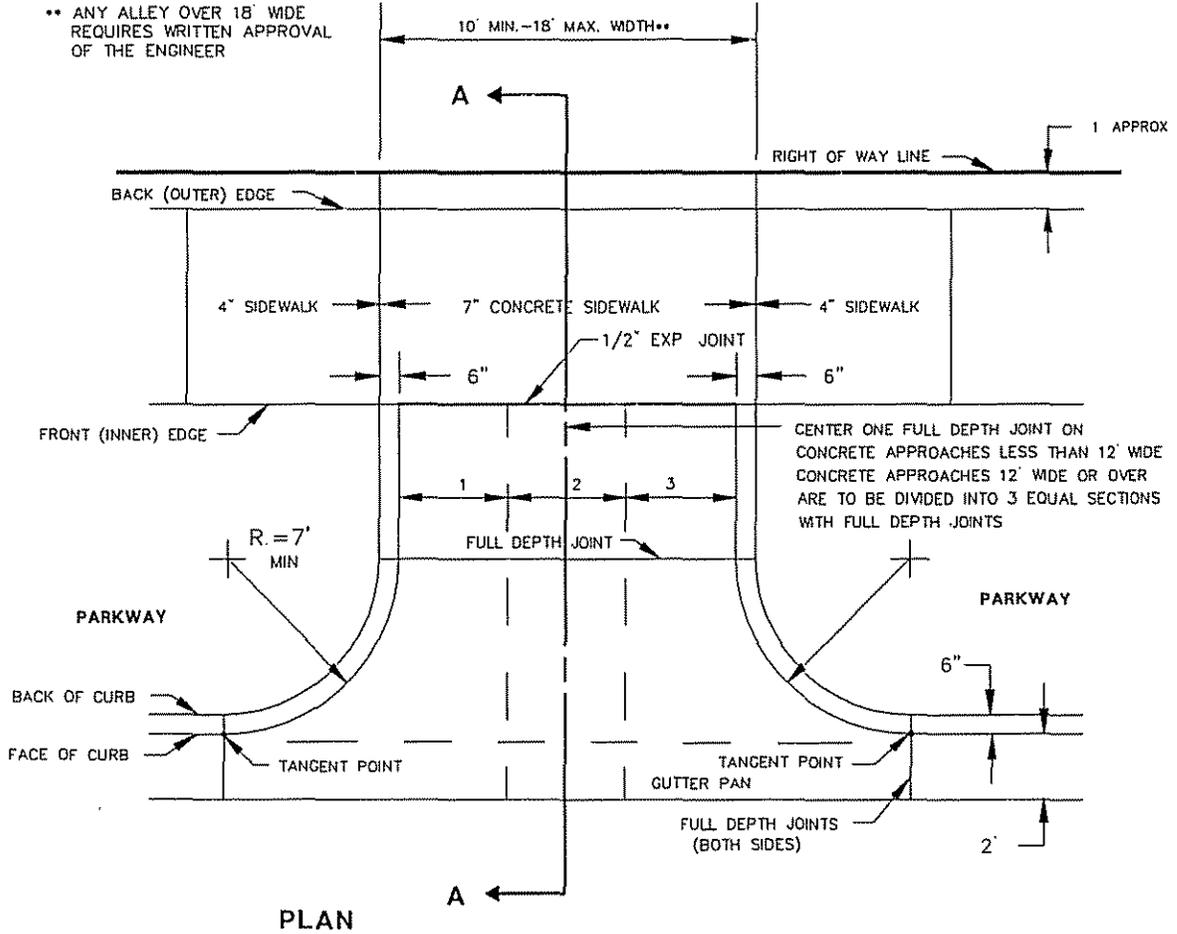
NOTE:  
THIS DETAIL SHOWS THE OLD STANDARD FOR DRIVEWAYS  
AND IS NOT TO BE USED FOR CONSTRUCTION UNLESS  
SPECIFICALLY CALLED FOR ON THE DRAWING. IN THE ITEMS  
OR AS DIRECTED BY THE ENGINEER

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**RADIUS DRIVEWAY RETURN  
AND  
APPROACH DETAILS  
AND  
SIDEWALK DETAILS**

<b>P</b> <b>2</b>	APPROVED <i>Don J. Smith</i> 3/23/93	CITY ENGINEER	DATE
	DRAWN P.M.H.	CHECKED	

•• ANY ALLEY OVER 18' WIDE  
REQUIRES WRITTEN APPROVAL  
OF THE ENGINEER

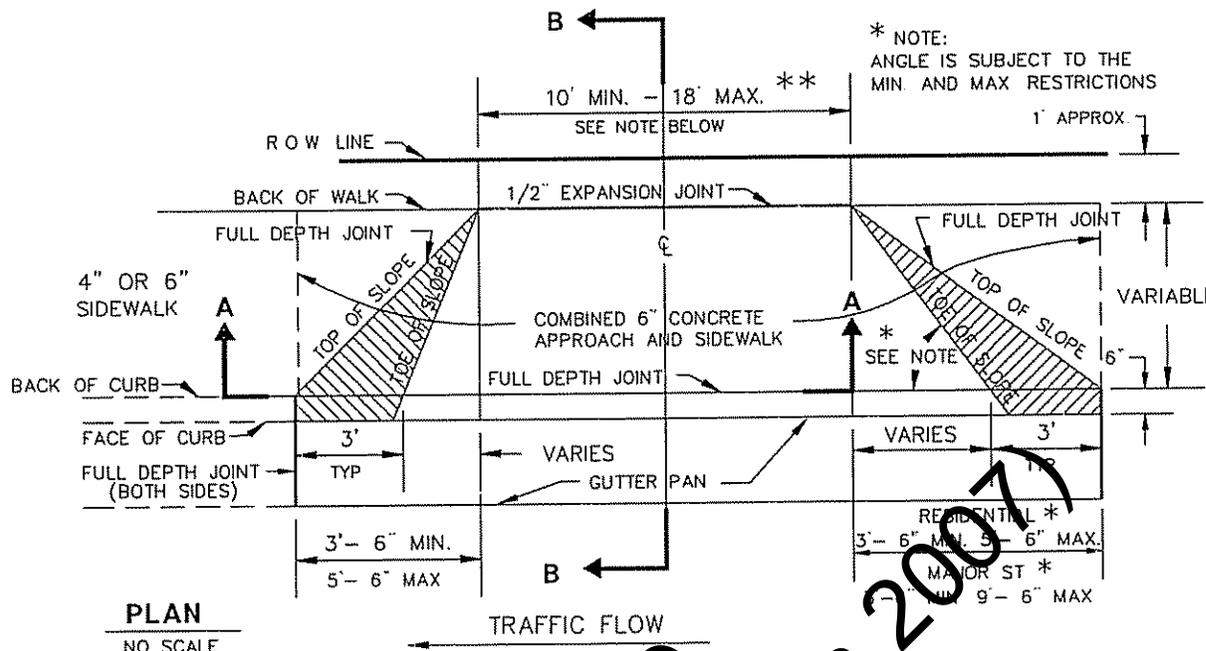


NOTE:  
THIS DETAIL SHOWS THE OLD STANDARD FOR ALLEYS  
AND IS NOT TO BE USED FOR CONSTRUCTION UNLESS  
SPECIFICALLY CALLED FOR ON THE DRAWING, IN THE ITEMS  
OR AS DIRECTED BY THE ENGINEER.

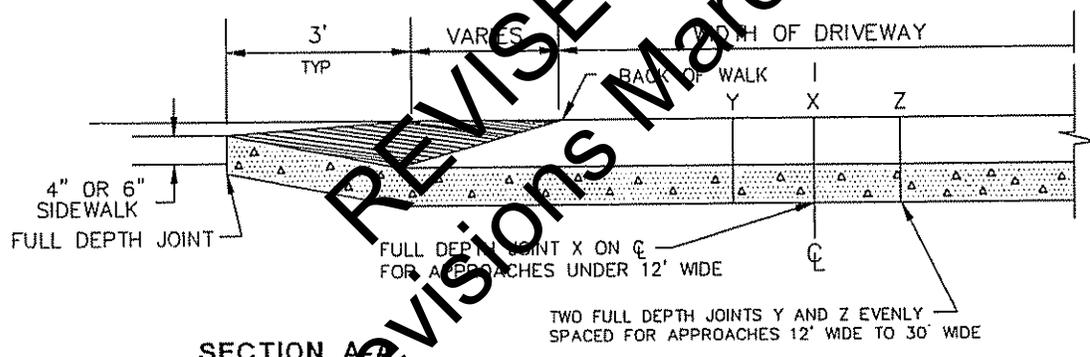
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**RADIUS ALLEY RETURN  
AND  
APPROACH DETAILS  
AND  
SIDEWALK DETAILS**

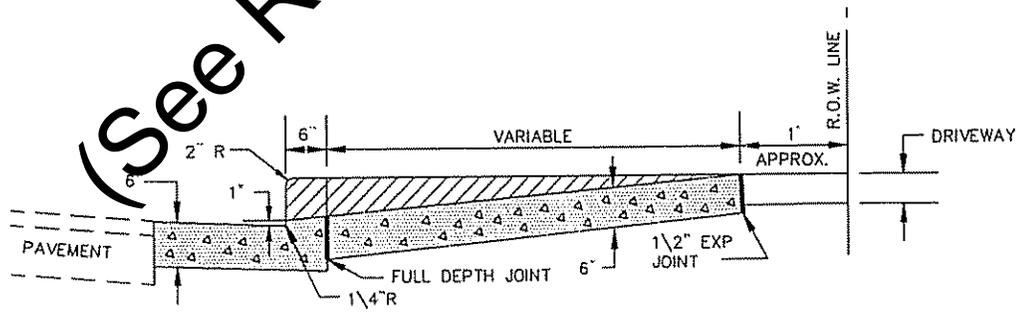
P 2A	APPROVED <i>[Signature]</i> 3/23/93	
	CITY ENGINEER	DATE
DRAWN	P.M.H.	CHECKED



**PLAN**  
NO SCALE



**SECTION A-A**  
NO SCALE



**SECTION B-B**  
NO SCALE

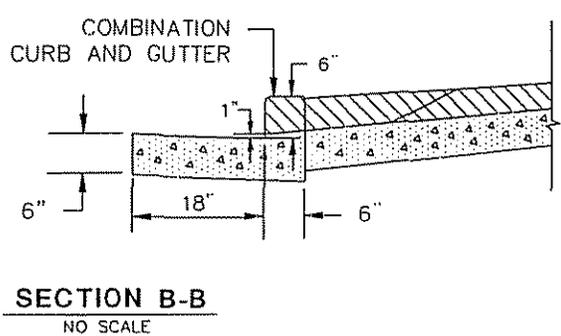
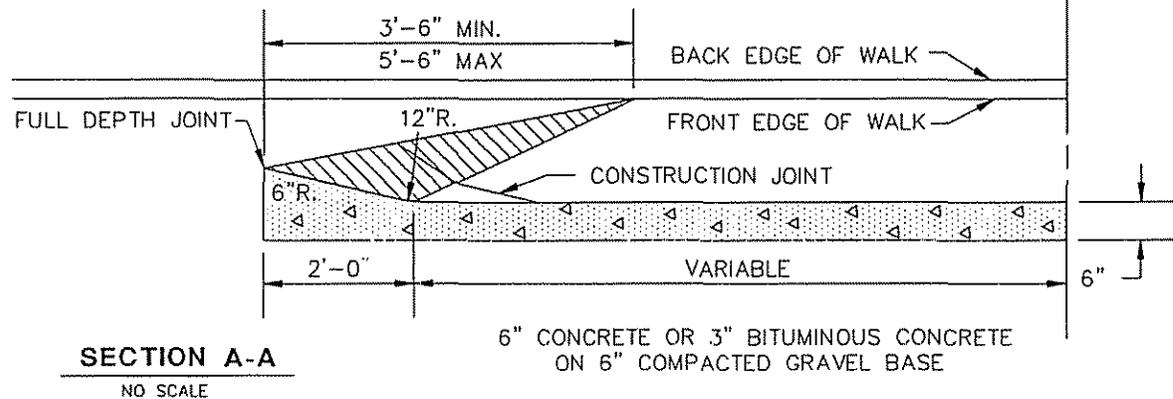
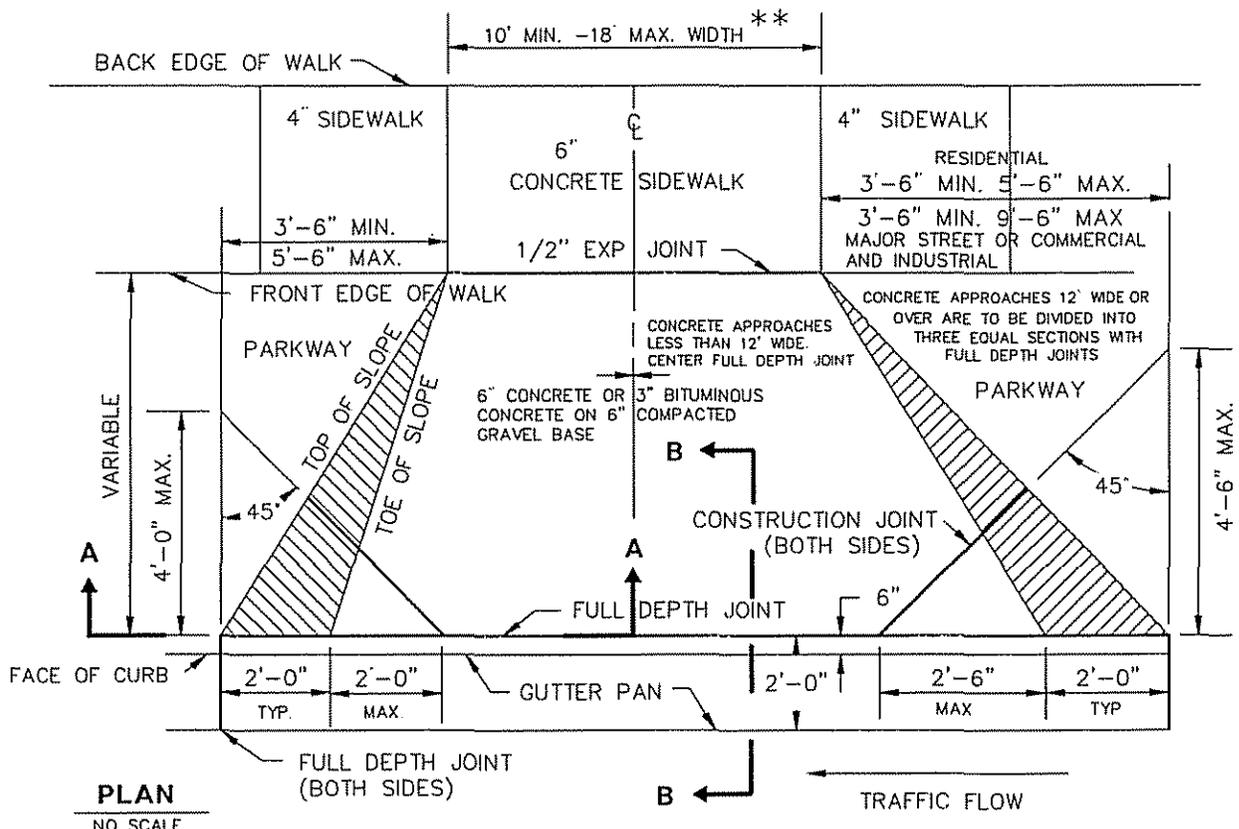
\* NOTE:  
ANGLE IS SUBJECT TO THE  
MIN. AND MAX. RESTRICTIONS

\*\* NOTE:  
ANY DRIVEWAY OVER 18 FT. WIDE  
SHALL REQUIRE WRITTEN APPROVAL  
OF THE ENGINEER

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**COMBINED DRIVEWAY  
APPROACH AND SIDEWALK**

P 3	APPROVED <i>[Signature]</i> CITY ENGINEER	3/25/93 DATE
	DRAWN P.M.H.	CHECKED V.U.

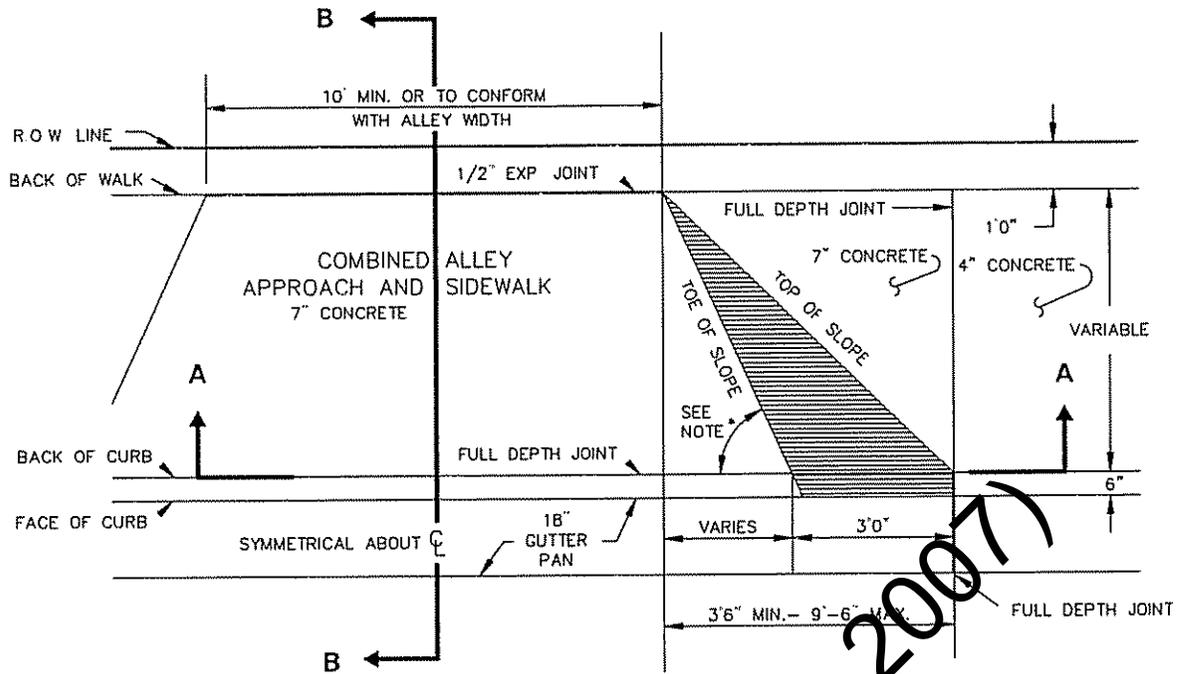


\*\*NOTE:  
ANY DRIVEWAY OVER 18 FT. WIDE  
REQUIRES WRITTEN APPROVAL  
OF THE ENGINEER.

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

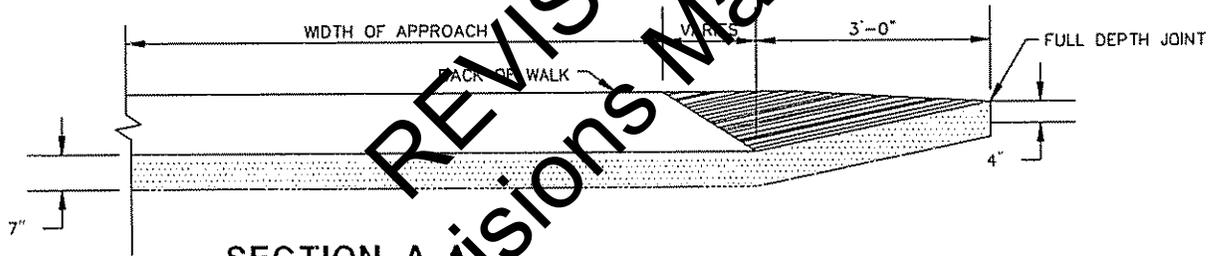
**DUB-DOWN DRIVEWAY  
APPROACH DETAILS**

<b>P</b> <b>3A</b>	APPROVED	<i>[Signature]</i> 3/23/93	
	DRAWN	CITY ENGINEER	DATE
	P.M.H.	CHECKED	V.U.

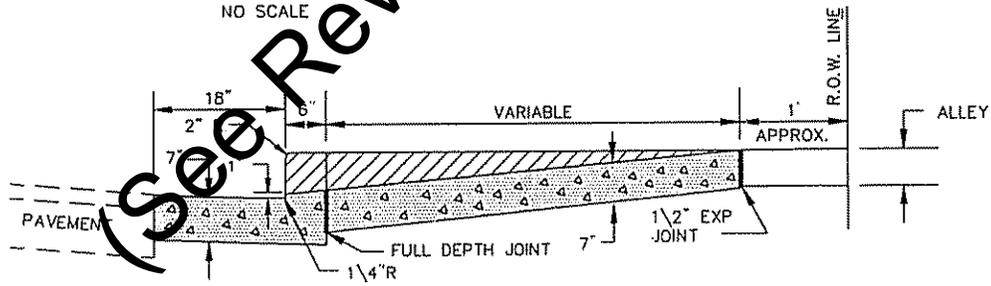


**PLAN**  
NO SCALE

NOTE: \* ANGLE IS TO BE SUBJECT TO THE ABOVE MIN AND MAX RESTRICTIONS



**SECTION A-A**  
NO SCALE



**SECTION B-B**  
NO SCALE

GRADE A CONCRETE TO BE USED.

CONCRETE ALLEY APPROACHES LESS THAN 12' WIDE, FULL DEPTH JOINT AT CENTERLINE

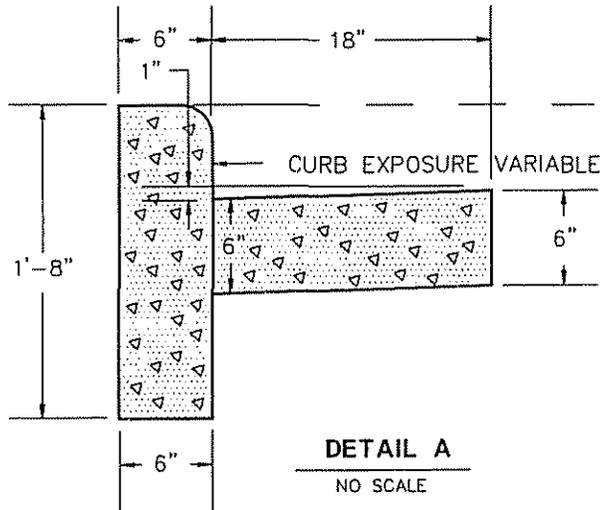
CONCRETE ALLEY APPROACHES 12' WIDE OR OVER ARE TO BE DIVIDED INTO THREE EQUAL SECTIONS WITH FULL DEPTH JOINTS

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DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

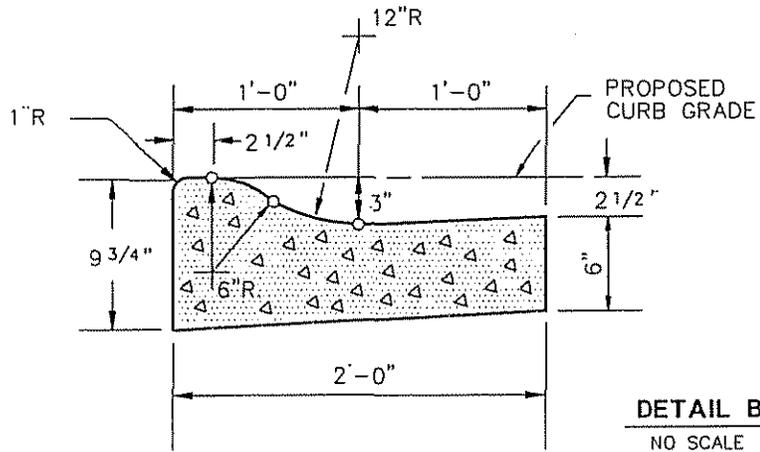
**COMBINED DUB-DOWN ALLEY  
APPROACH AND SIDEWALK  
DETAILS**

<b>P</b> <b>4</b>	APPROVED <i>[Signature]</i> CITY ENGINEER	3/23/93 DATE
	DRAWN P.M.H.	CHECKED R J B

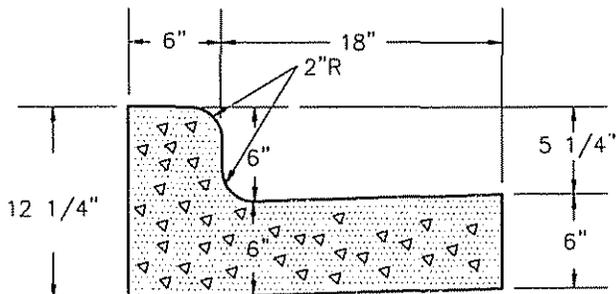




6" X 20" CURB AND SEPARATE GUTTER



ROLL CURB AND GUTTER

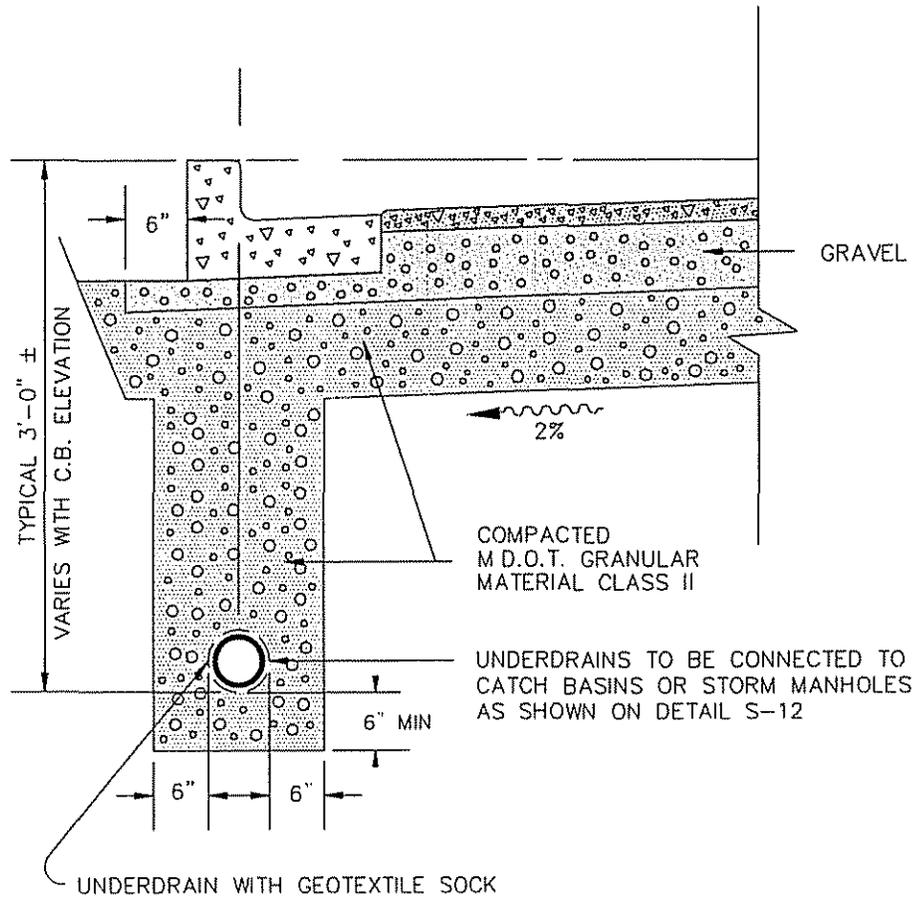


COMBINED CURB AND GUTTER

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**CURB AND SEPARATE GUTTER,  
ROLL CURB AND GUTTER,  
COMBINED CURB AND GUTTER  
DETAILS**

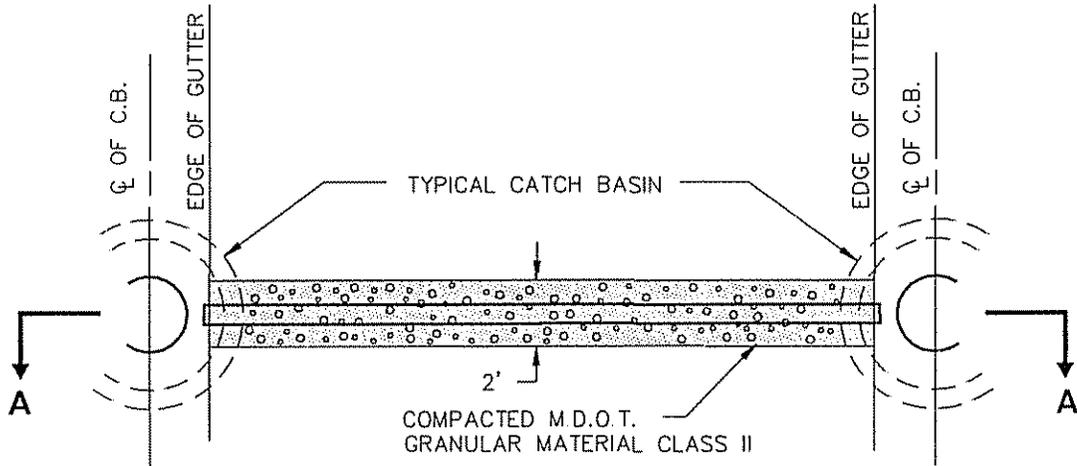
<b>P</b> <b>5</b>	APPROVED	<i>John Hombach</i> 3/23/93	
	DRAWN	CITY ENGINEER	DATE
	P.M.H.	CHECKED	V.U.



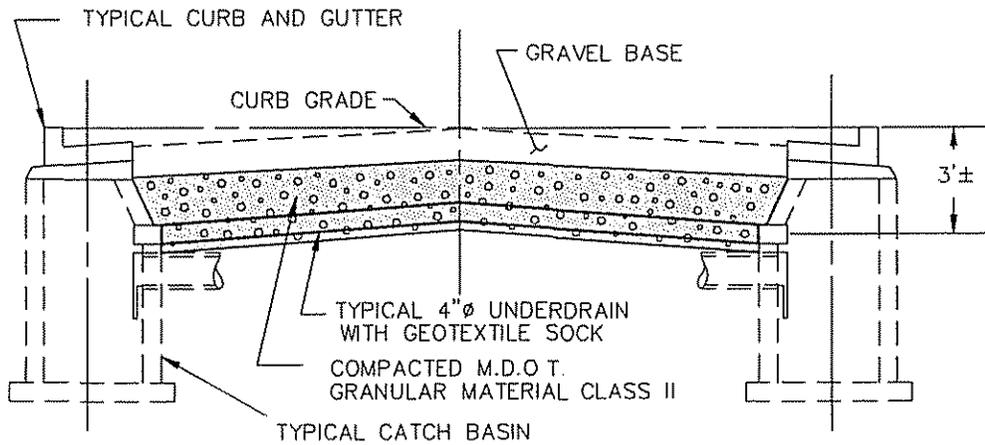
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

## SUBBASE UNDERDRAIN

<b>P</b> <b>6</b>	APPROVED	<i>[Signature]</i> 3/23/93	
	DRAWN	CITY ENGINEER	DATE
	P.M.H.	CHECKED	R.J.B.



**PLAN VIEW OF SPECIAL UNDERDRAIN**



**SECTION A-A**

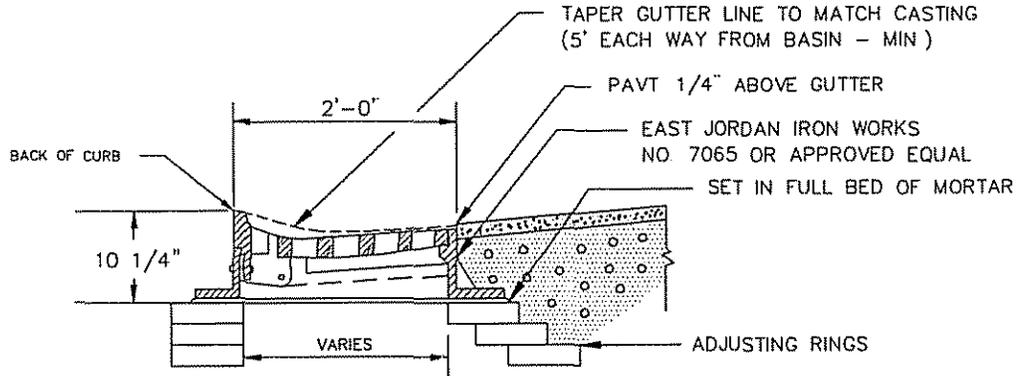
NOTES:

1. THIS SPECIAL UNDERDRAIN IS DESIGNED FOR USE IN CLAY SOIL AT LOW POINT IN GRADE LINE OF STREET
2. UNTIL THE BASE COURSE HAS BEEN PLACED THE CONTRACTOR SHALL MAINTAIN THE SPECIAL UNDERDRAIN BY KEEPING THE SURFACE REASONABLY FREE OF CLAY AND SILT.
3. UNDERDRAINS TO BE CONNECTED TO CATCH BASINS OR STORM MANHOLES AS SHOWN ON DETAIL S-12

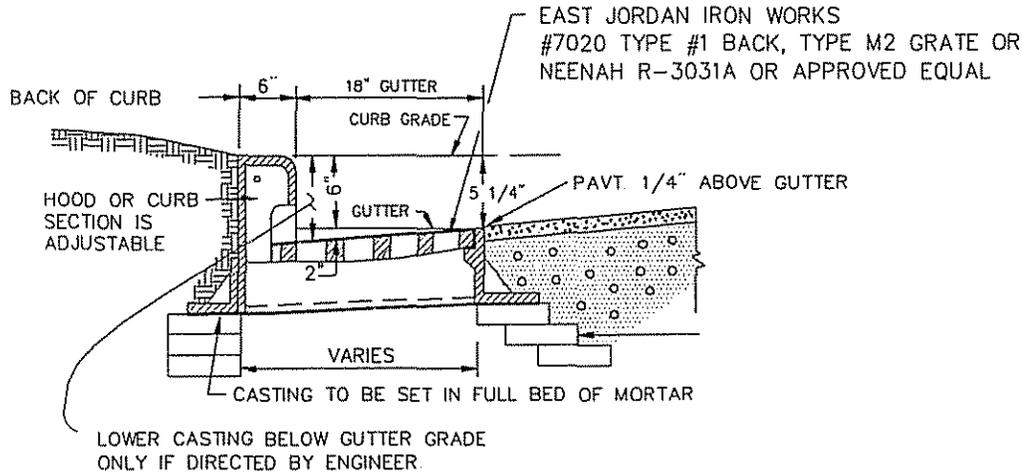
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**SPECIAL  
UNDERDRAIN**

<b>P</b>	APPROVED <i>[Signature]</i>	DATE 3/23/93
7	DRAWN P.M.H.	CHECKED R.J.B.



**CATCH BASIN CASTING SET IN PLACE IN ROLL CURB & GUTTER**

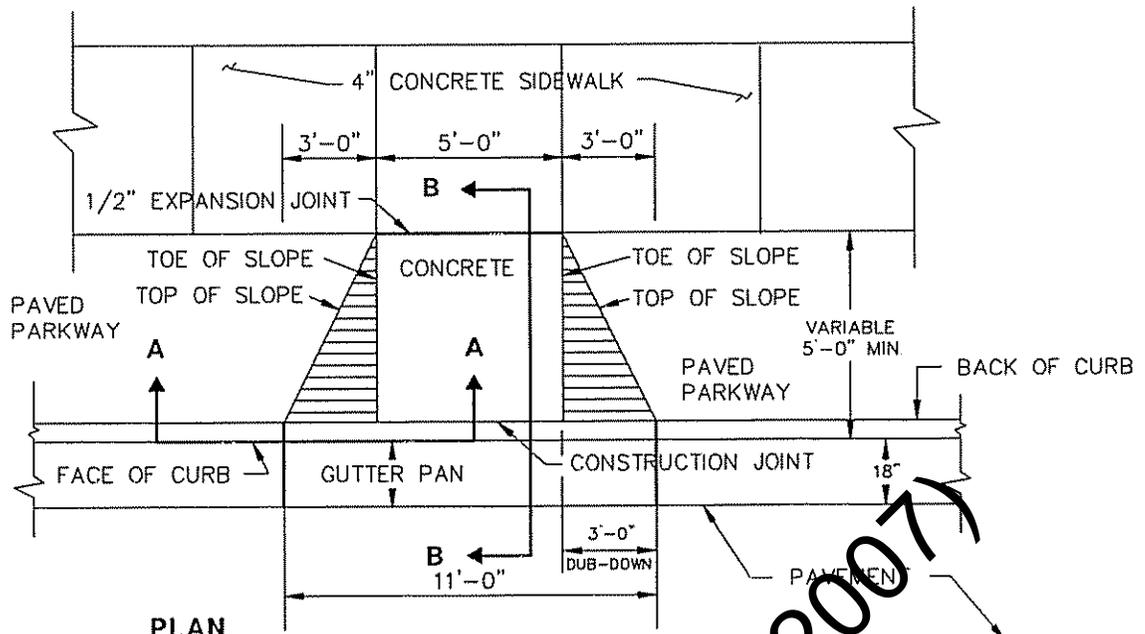


**CATCH BASIN CASTING  
SET IN PLACE IN STANDARD  
CURB AND GUTTER**

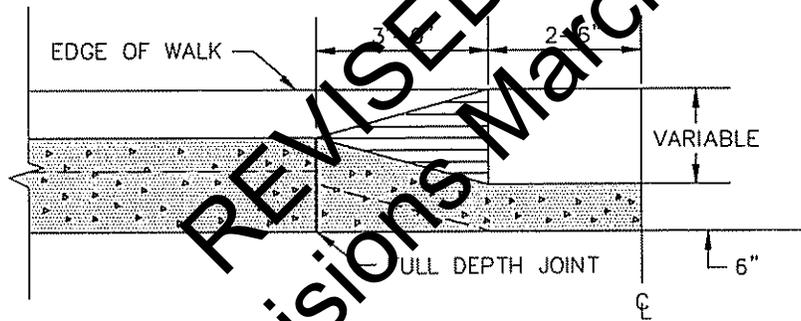
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**CATCH BASIN DETAILS**

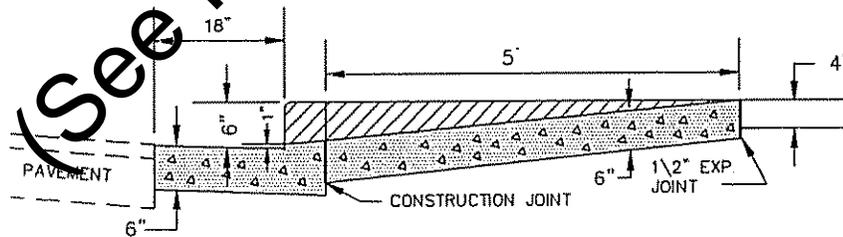
<b>P</b> <b>8</b>	APPROVED <i>[Signature]</i> 3/23/93	
	CITY ENGINEER	DATE
DRAWN P.M.H.	CHECKED V.U.	



**PLAN**  
NO SCALE



**SECTION A-A**  
NO SCALE



**SECTION B-B**  
NO SCALE

**NOTE:**

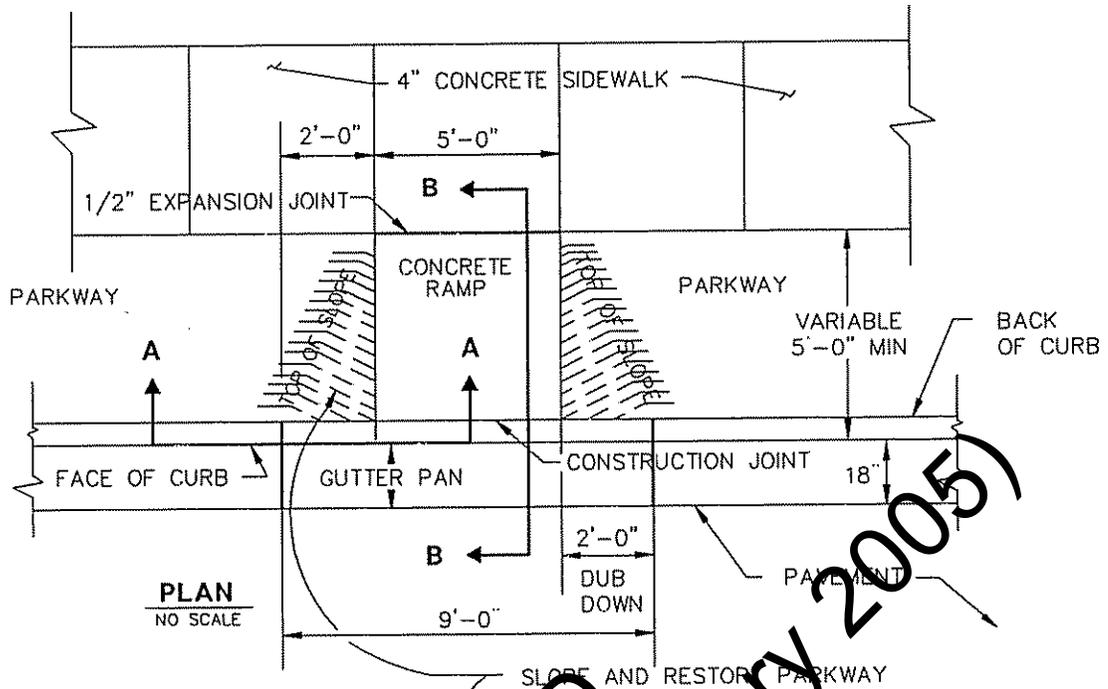
WHEN SIDEWALK RAMPS ARE TO BE INSTALLED, THE SIDEWALK SHALL BE 6" THICK FROM THE CURB TO THE FIRST JOINT (5' MINIMUM)

CITY OF GRAND RAPIDS, MICHIGAN  
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DIVISION OF ENGINEERING

**SIDEWALK RAMP  
IN  
PAVED PARKWAY**

<b>P</b> <b>9</b>	APPROVED <i>John Hombach</i> 3/23/93	DATE
	CITY ENGINEER	
DRAWN P.M.H.	CHECKED R.J.B.	

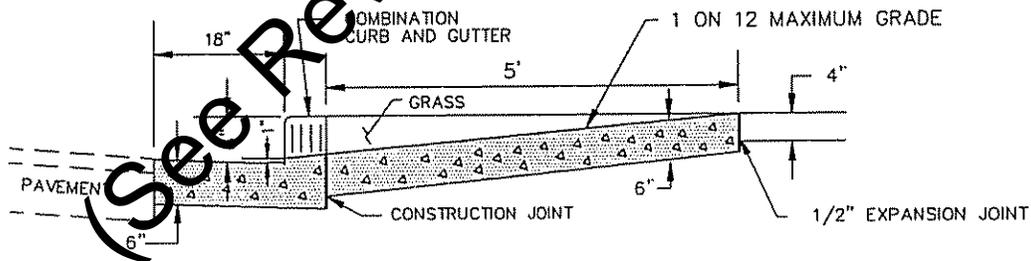




**PLAN**  
NO SCALE



**SECTION A-A**  
NO SCALE



**SECTION B-B**  
NO SCALE

NOTE:

WHEN SIDEWALK RAMPS ARE TO BE INSTALLED, THE SIDEWALK SHALL BE 6" THICK FROM THE CURB TO THE FIRST JOINT (5' MINIMUM)

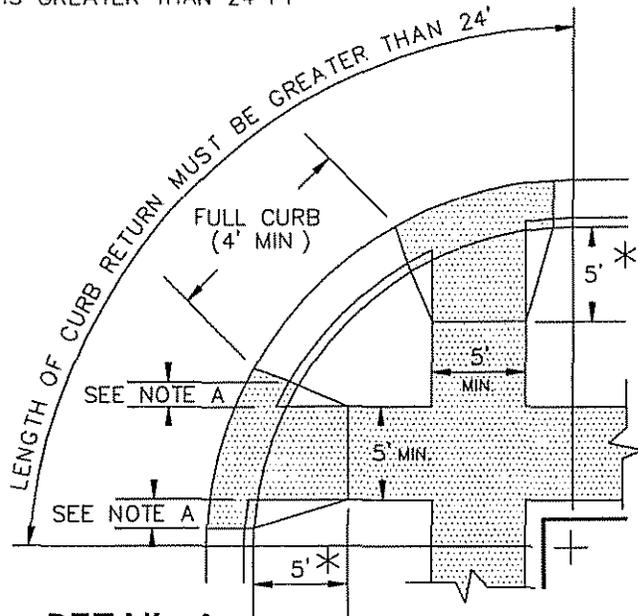
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**SIDEWALK RAMP  
IN  
UNPAVED PARKWAY**

<b>P</b>	APPROVED <i>[Signature]</i> CITY ENGINEER	DATE 3/23/93
	DRAWN P.M.H.	CHECKED R.J.B.

See Revisions February 2005

**DETAIL A - TWO RAMPS**  
 USE IF LENGTH OF CURB RETURN  
 IS GREATER THAN 24 FT



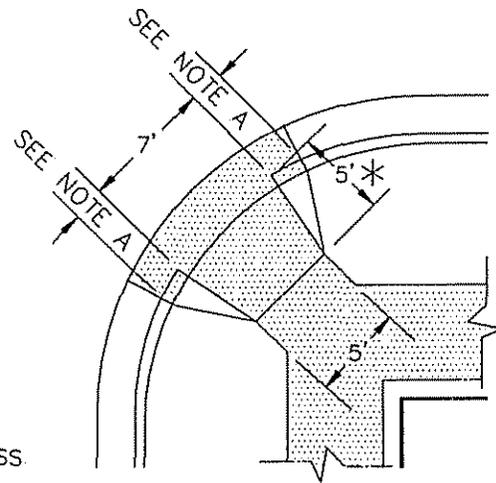
**DETAIL A**

SCALE: 1"=10'

**NOTE A:**

FOR UNPAVED PARKWAYS, SLOPE-DOWNS  
 ARE 24" WIDE AT CURB, AND ARE UNPAVED  
 FOR PAVED PARKWAYS, SLOPE-DOWNS  
 ARE 36" WIDE AT CURB, AND ARE PAVED

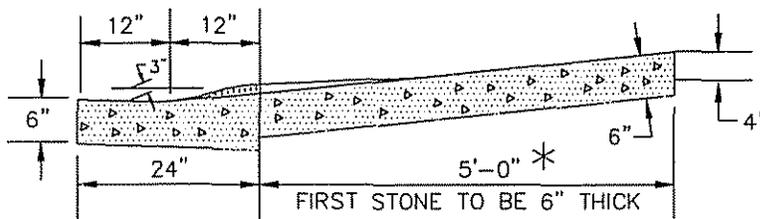
\* RAMPS TO BE 5' LONG, OR  
 AS NEEDED, SO AS NOT TO  
 EXCEED MAX. 1 ON 12 SLOPE



**DETAIL B**

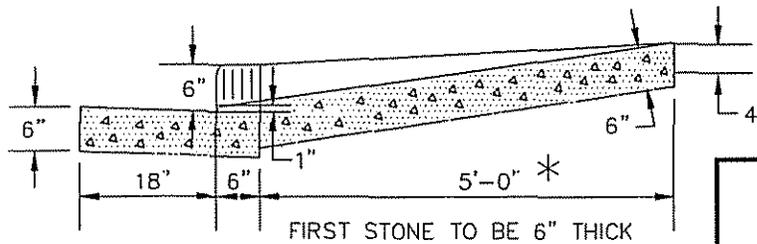
SCALE: 1"=10'

**DETAIL B - ONE RAMP**  
 USE IF UNABLE TO MAINTAIN A 4'  
 FULL-CURB SECTION BETWEEN A  
 TWO-RAMP LAYOUT, AND/OR IF  
 CURB RETURN LENGTH IS 24' OR LESS



**ROLL CURB SECTION**

NO SCALE



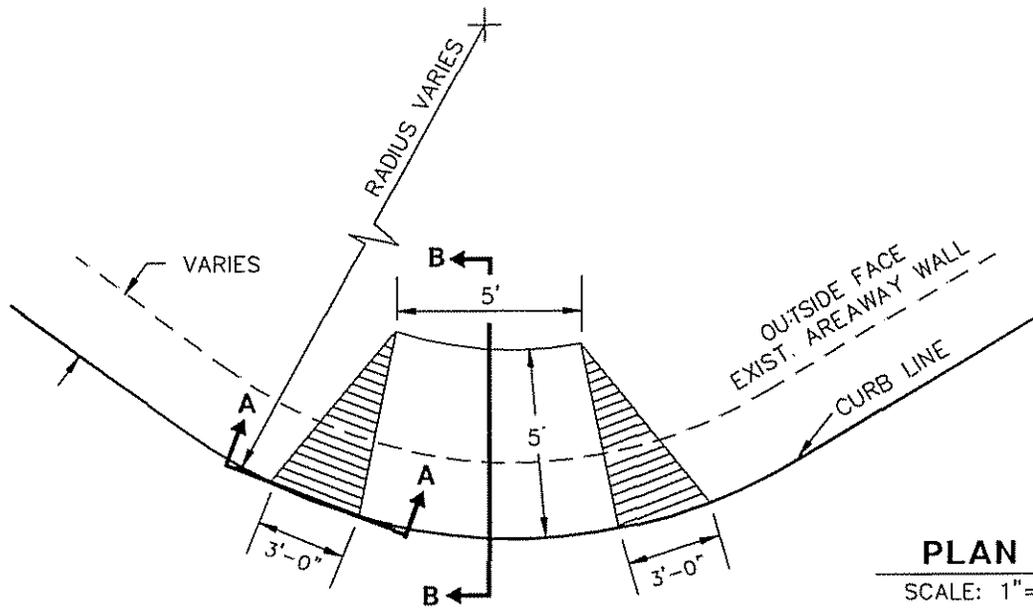
**STANDARD CURB SECTION**

NO SCALE

CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

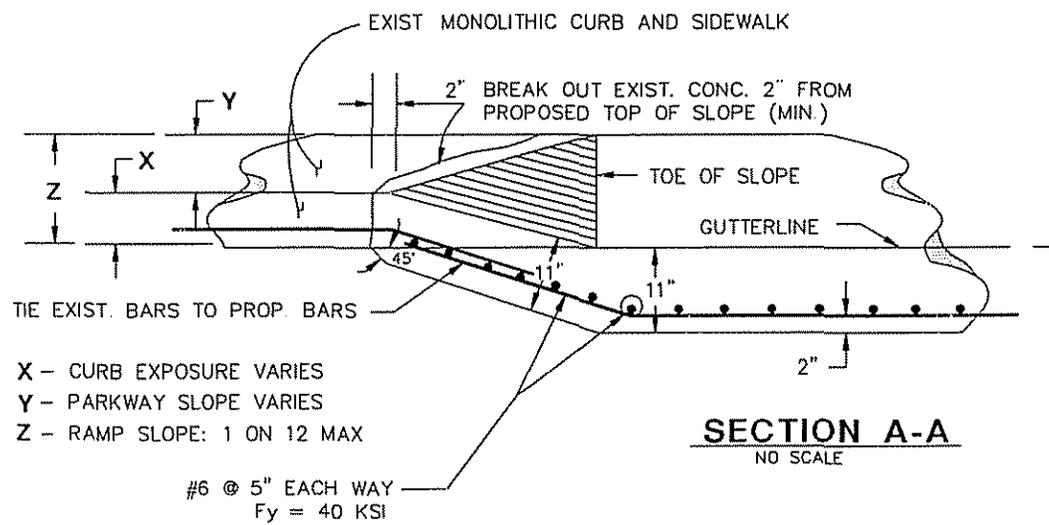
**LOCATION  
 OF  
 SIDEWALK RAMPS  
 AT  
 INTERSECTIONS**

<b>P</b>	APPROVED <i>Jim Lombach</i> 3/23/93	
	CITY ENGINEER	DATE
<b>9B</b>	DRAWN P.M.H.	CHECKED V.U.



**PLAN**

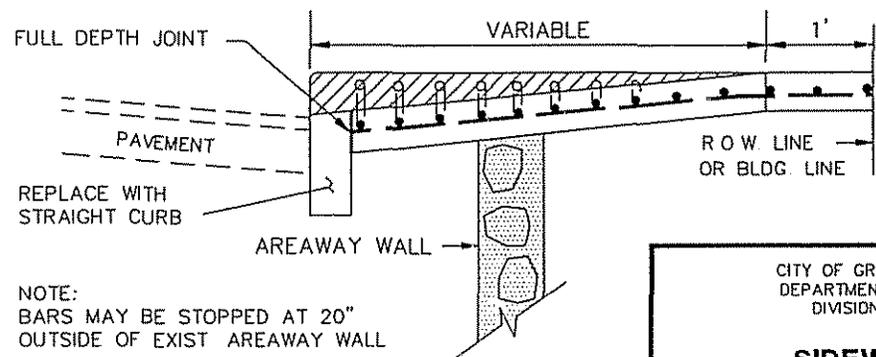
SCALE: 1"=5'



**SECTION A-A**

NO SCALE

- X - CURB EXPOSURE VARIES
- Y - PARKWAY SLOPE VARIES
- Z - RAMP SLOPE: 1 ON 12 MAX



**SECTION B-B**

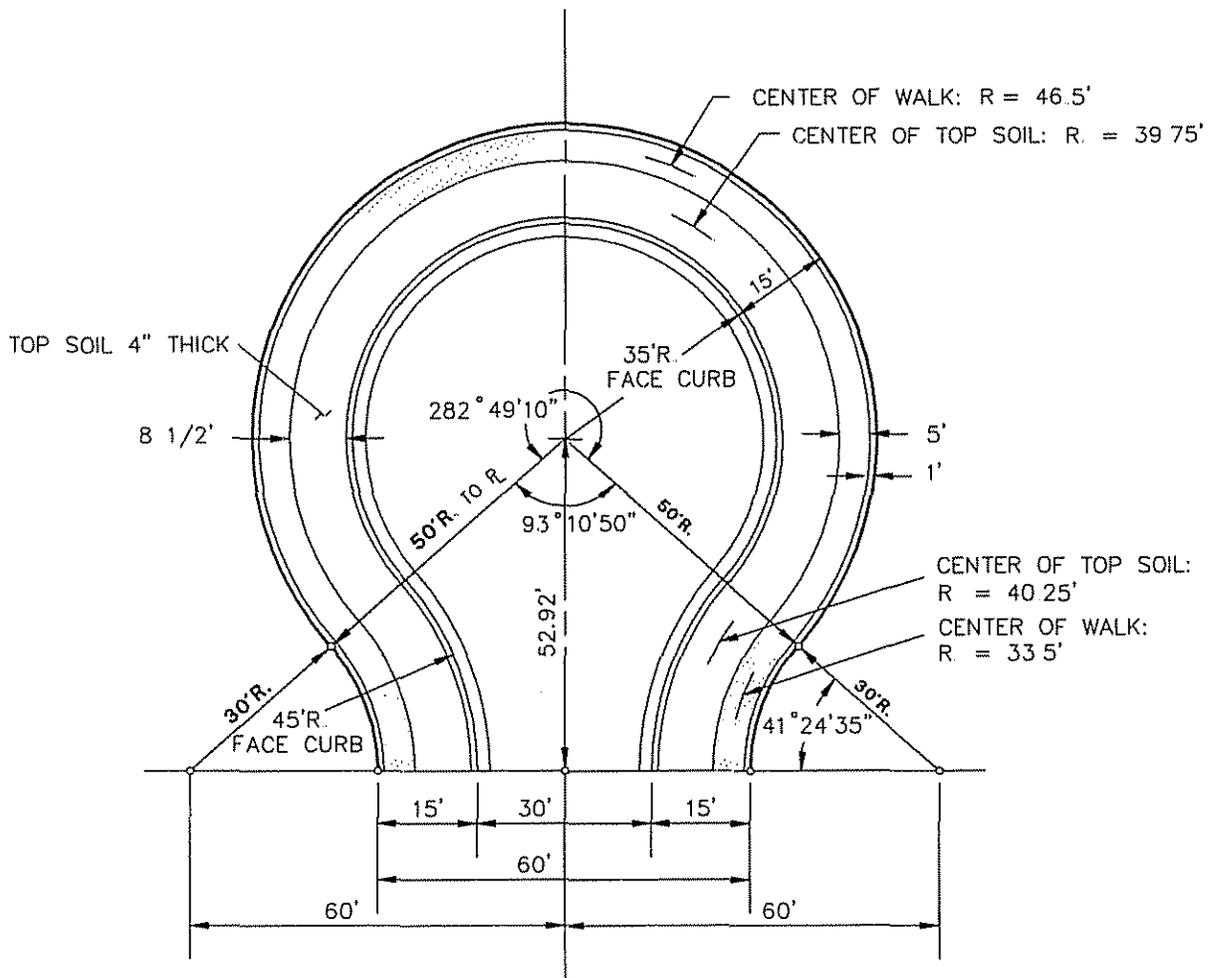
NO SCALE

NOTE:  
BARS MAY BE STOPPED AT 20"  
OUTSIDE OF EXIST AREAWAY WALL

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**SIDEWALK RAMP  
IN  
REINFORCED CONCRETE  
OVER AREAWAYS**

<b>P 9C</b>	APPROVED <i>James Tomback</i> 3/23/93		DATE
	DRAWN P.M.H.	CHECKED R.J.B.	CITY ENGINEER



**CONSTRUCTION ITEMS**

- 237.8 L.FT. COMBINED CURB AND GUTTER INCLUDING DRIVEWAY RETURNS.
- 474.1 S.YDS. PAVEMENT.
- 154.4 S. YDS. CONCRETE WALK 4" AND 6" THICK, 5' WIDE
- 33.4 C.YDS. TOP SOIL, 4" THICK, INCLUDING 25% FOR SHRINKAGE, NO DEDUCTION FOR DRIVEWAY RETURNS

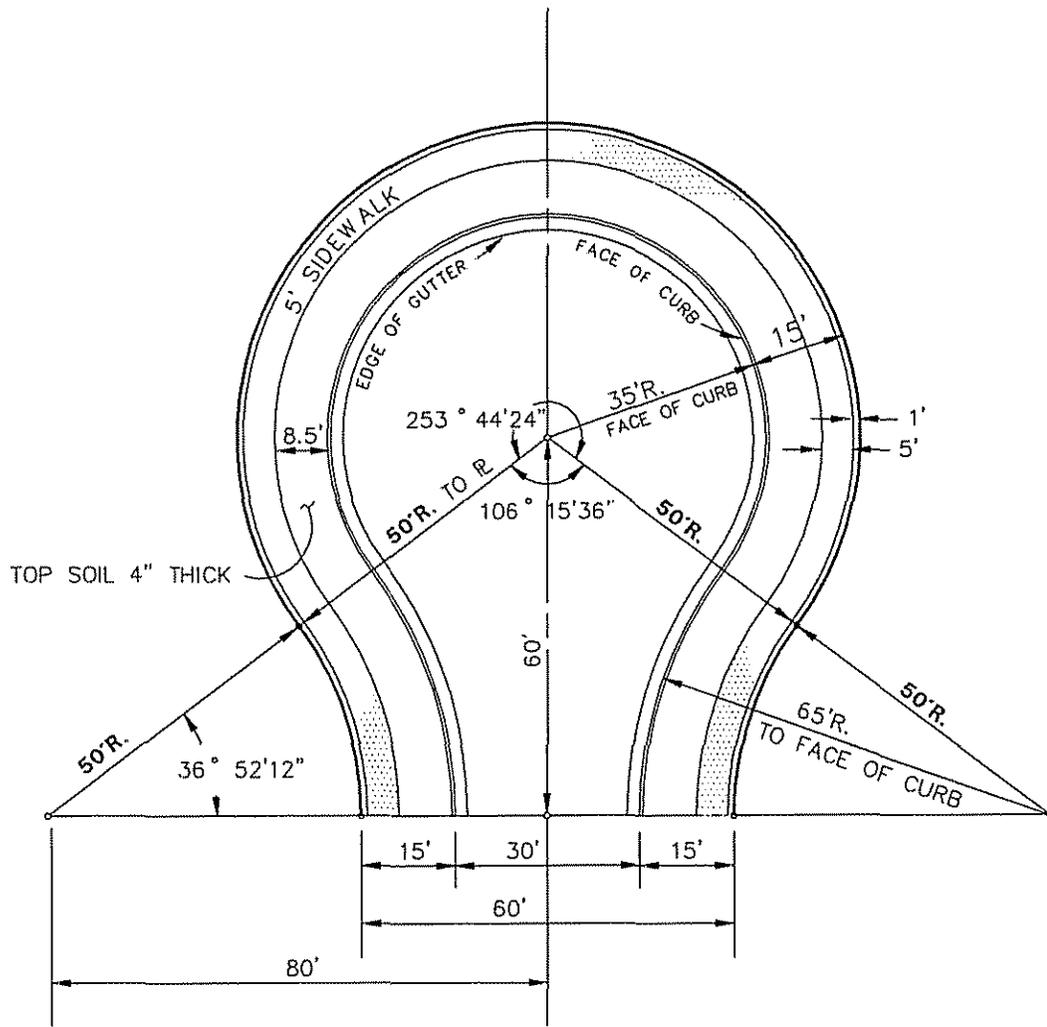
CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

**CUL-DE-SAC  
 FOR  
 60' R.O.W. - 30' & 50' RADII**

APPROVED: *[Signature]* 3/23/93  
 CITY ENGINEER DATE

DRAWN: P.M.H. CHECKED: R.J.B.

P  
 10



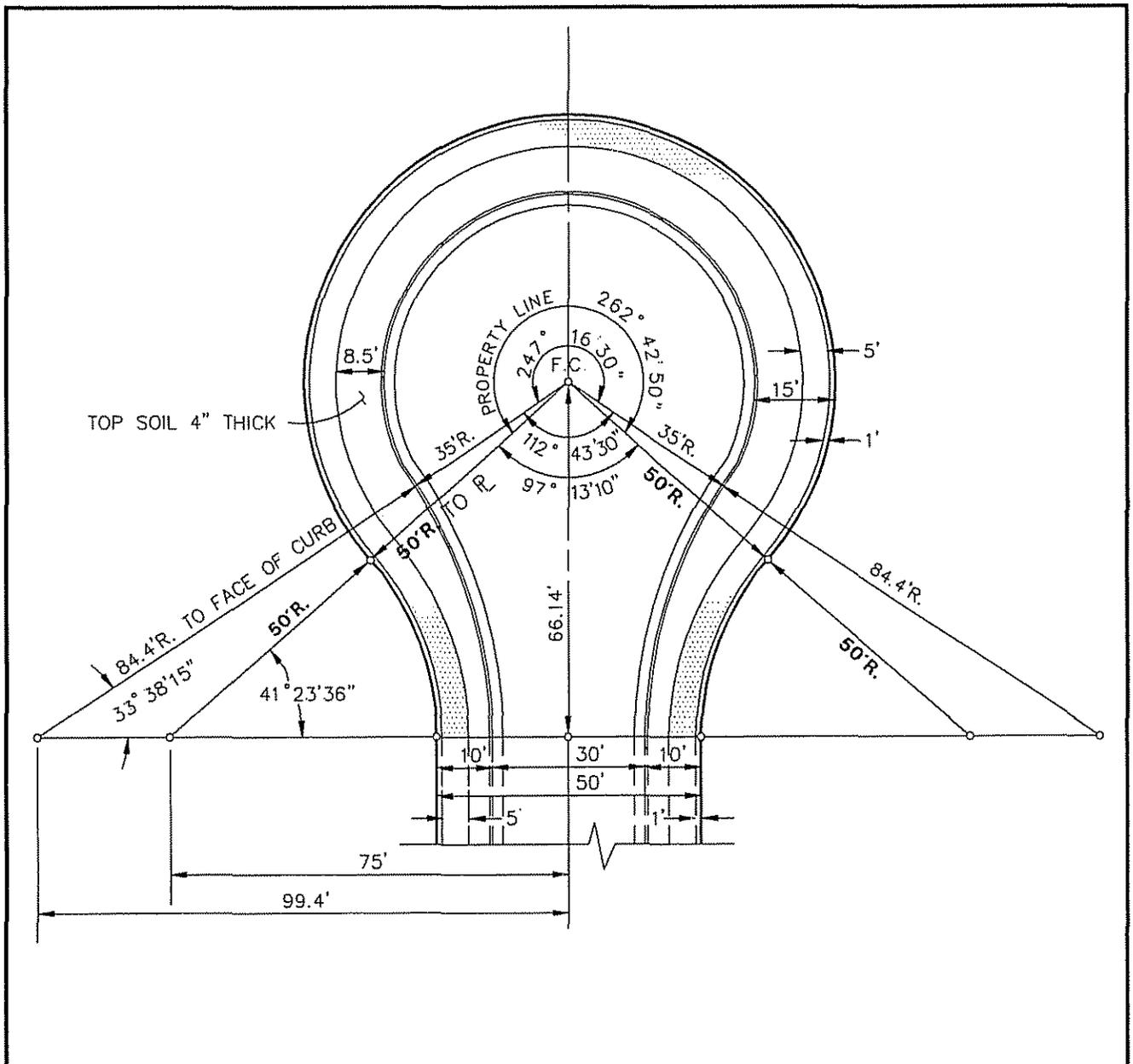
**CONSTRUCTION ITEMS**

- 248.7 L.F.T. COMBINED CURB AND GUTTER INCLUDING DRIVEWAY RETURNS.
- 480.3 SQ. YDS. PAVEMENT
- 152.7 SQ. YDS. CONCRETE WALK, 4" AND 6" THICK, 5' WIDE
- 33.2 CU. YDS. TOP SOIL, 4" THICK INCLUDING 25% FOR SHRINKAGE, NO DEDUCTION FOR DRIVEWAY RETURNS

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**CUL-DE-SAC  
FOR  
60' R.O.W. - 50' & 50' RADII**

<b>P</b>	 <small>APPROVED</small> <small>CITY ENGINEER</small>	3/23/93 <small>DATE</small>
<b>11</b>	<small>DRAWN</small> P.M.H.	<small>CHECKED</small> R.J.B.



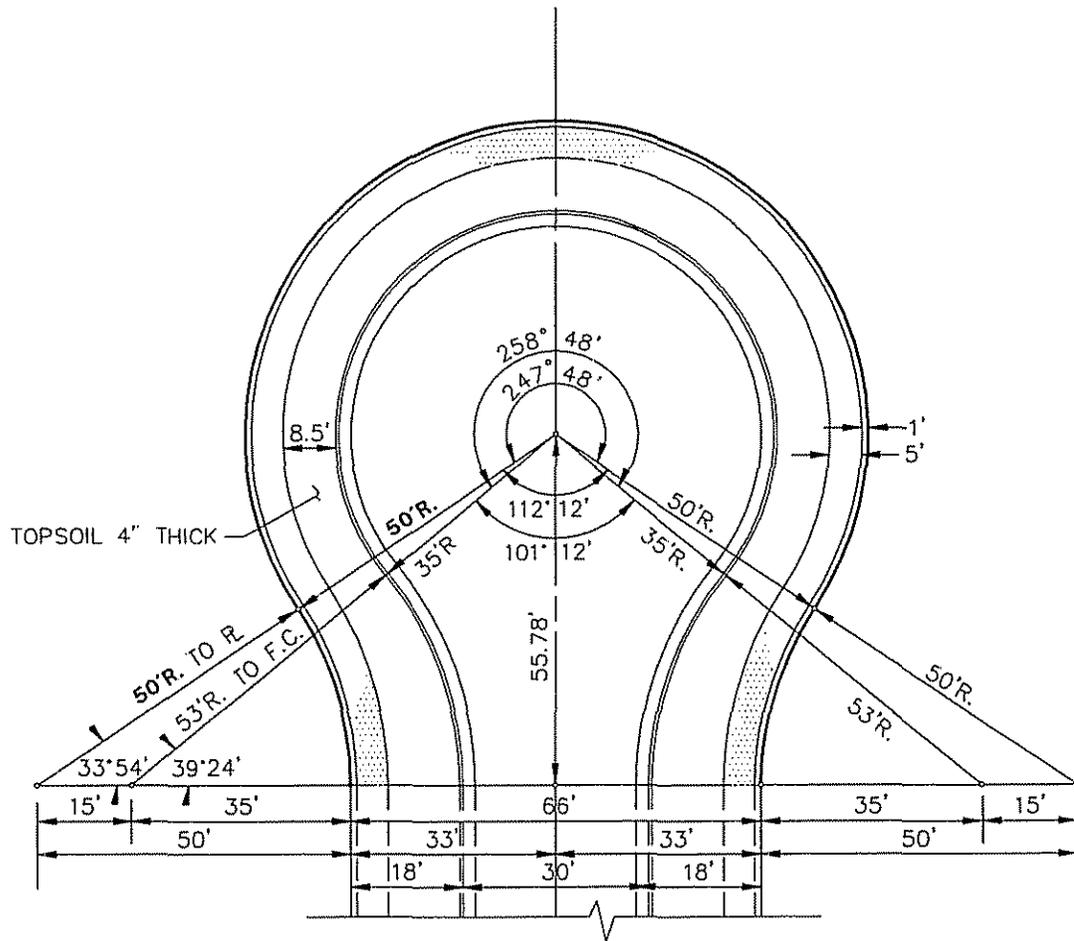
**CONSTRUCTION ITEMS**

- 250.2 L.F.T. COMBINED CURB AND GUTTER INCLUDING DRIVEWAY RETURNS.
- 504.6 SQ. YDS. PAVEMENT
- 161.4 SQ. YDS. CONCRETE WALK, 4" AND 6" THICK, 5' WIDE
- 33.1 CU. YDS. TOP SOIL, 4" THICK INCLUDING 25% FOR SHRINKAGE, NO DEDUCTION FOR DRIVEWAY RETURNS.

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**CUL-DE-SAC  
FOR  
50' R.O.W. - 50' & 50' RADII**

<b>P</b> <b>12</b>	APPROVED <i>[Signature]</i> 3/23/93	
	CITY ENGINEER	DATE
DRAWN P.M.H.	CHECKED R.J.B.	



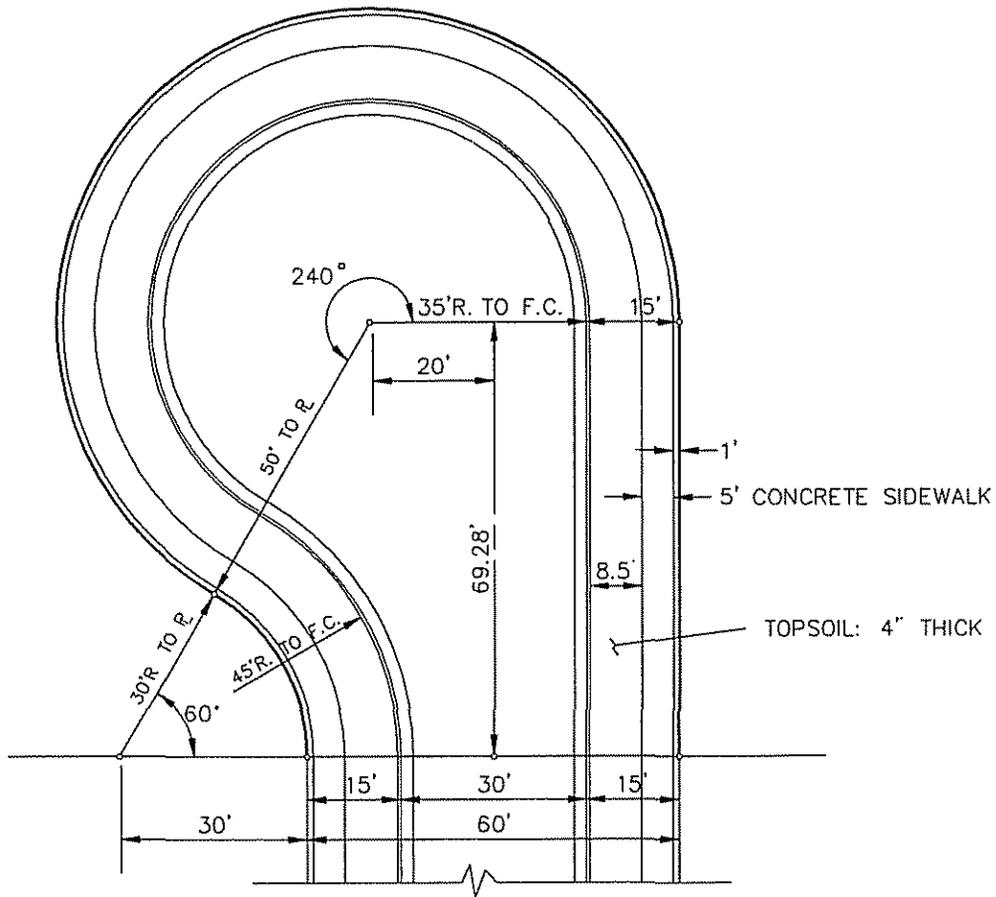
**CONSRUCTION ITEMS**

- 230.7 L FT COMBINED CURB AND GUTTER INCLUDING DRIVEWAY RETURNS.
- 463.5 SQ. YDS PAVEMENT
- 146.8 SQ. YDS. CONCRETE WALK, 4" AND 6" THICK, 5' WIDE
- 33.7 CU. YDS. TOP SOIL, 4" THICK INCLUDING 25% FOR SHRINKAGE, NO DEDUCTION FOR DRIVEWAY RETURNS.

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**CUL-DE-SAC  
FOR  
66' R.O.W. - 50' & 50' RADII**

<p><b>P</b> <b>13</b></p>	<p>APPROVED <i>[Signature]</i> 3/23/43</p> <p>CITY ENGINEER</p>	<p>DATE</p>
<p>DRAWN P.M.H.</p>	<p>CHECKED R.J.B.</p>	



**CONSTRUCTION ITEMS**

- 263 0 L.FT. COMBINED CURB AND GUTTER INCLUDING DRIVEWAY RETURNS
- 533 1 SQ. YDS. PAVEMENT
- 166 1 SQ. YDS. CONCRETE WALK, 4" AND 6" THICK, 5' WIDE
- 36 3 CU. YDS TOP SOIL, 4" THICK INCLUDING 25% FOR SHRINKAGE, NO DEDUCTION FOR DRIVEWAY RETURNS

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**UNSYMMETRICAL  
CUL-DE-SAC  
FOR  
60' R.O.W. - 30' & 50' RADII**

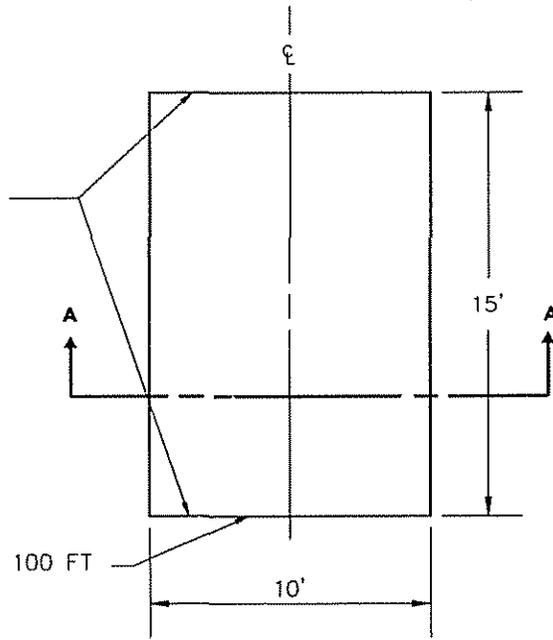
APPROVED	
P 14	CITY ENGINEER <span style="float: right;">DATE</span>
DRAWN	CHECKED
P.M.H.	R.J.B.



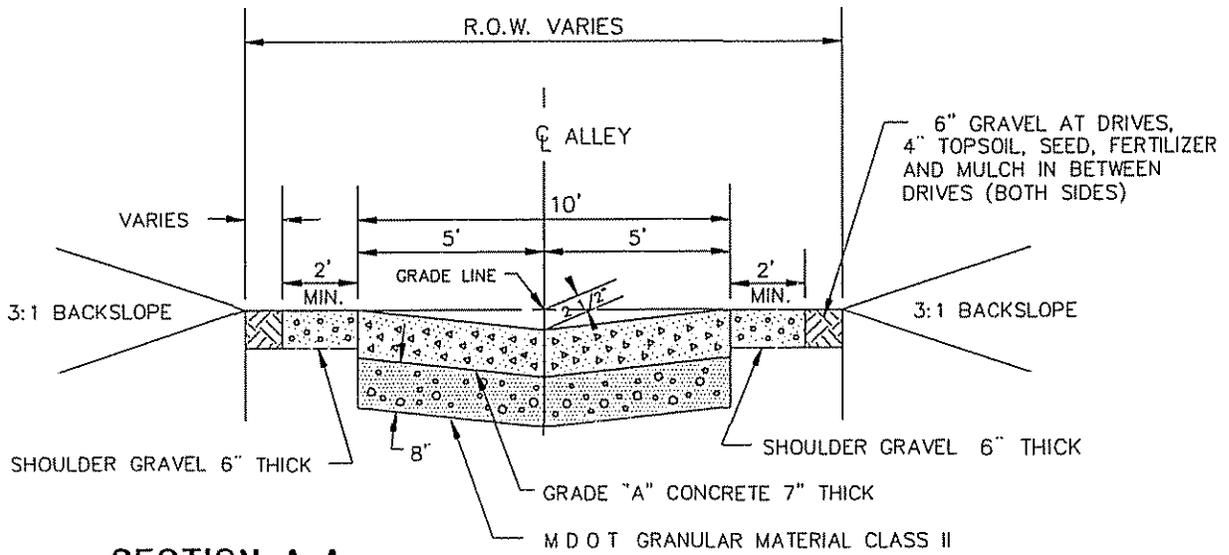


PLANE OF WEAKNESS JOINTS TO BE 15 FEET APART, AND THEY SHALL BE SET AT A DEPTH OF 1/3 OF THE THICKNESS OF THE PAVEMENT

1/2" EXPANSION JOINTS EVERY 100 FT



**PLAN**



**SECTION A-A**  
NO SCALE

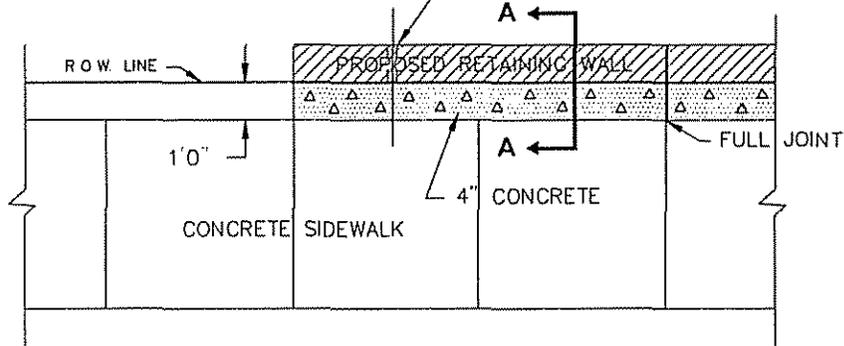
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**ALLEY PAVEMENT**

<b>P</b> <b>17</b>	APPROVED <i>[Signature]</i> <b>3/23/93</b>
	CITY ENGINEER DATE
DRAWN P.M.H.	CHECKED R.J.B.

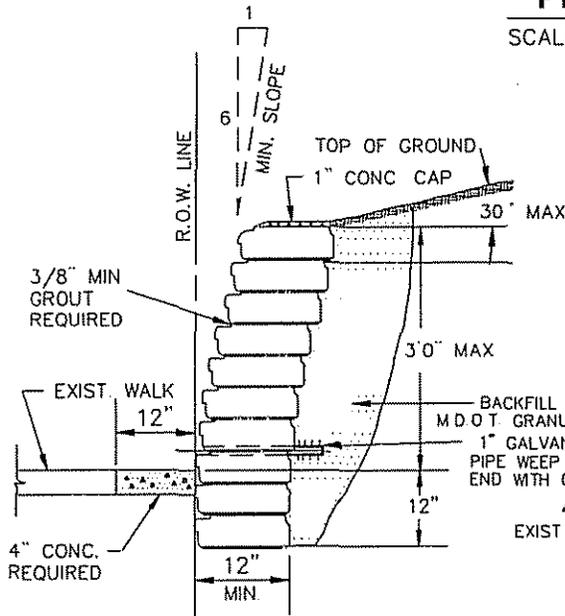
1" GALVANIZED OR PLASTIC PIPE WEEP HOLES  
ON 15' CENTERS OR AS REQUIRED BY THE ENGINEER

PLANE-OF-WEAKNESS JOINTS  
EVERY 20 FT. WITH 1/2"  
EXPANSION JOINTS EVERY 60 FT.

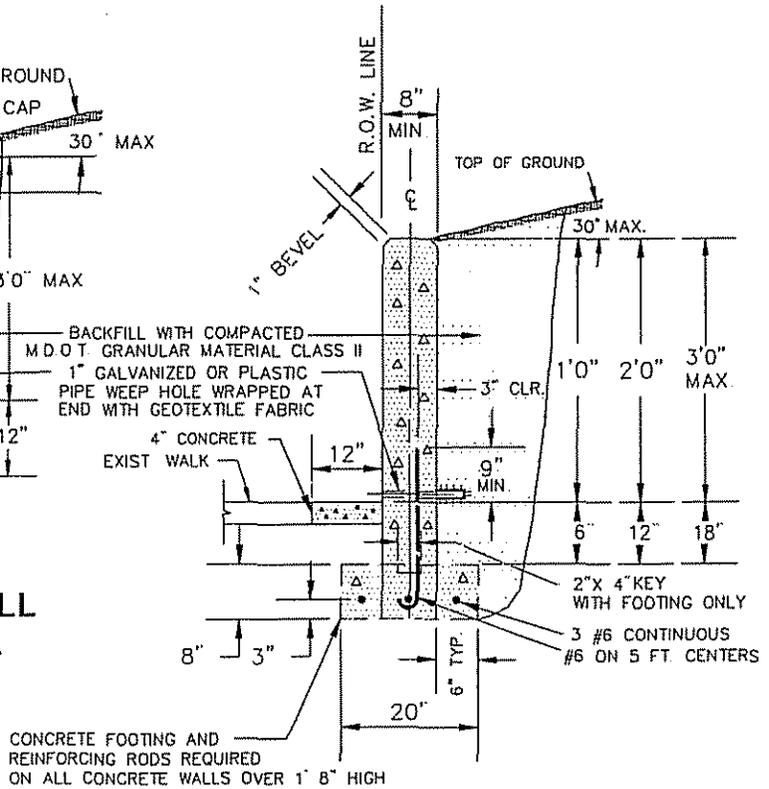


**PLAN**

SCALE: 1"=5'



**GROUTED RIP-RAP WALL  
TYPICAL SECTION A-A**



**POURED CONCRETE WALL  
TYPICAL SECTION A-A**

NOTES:

1. THIS SPECIFICATION GOVERNS THE CONSTRUCTION OF RETAINING WALLS UP TO 3 FT HIGH. MEASURED FROM THE TOP OF SIDEWALK TO CONSTRUCT WALLS HIGHER THAN 3 FT. A DRAWING MUST BE SUBMITTED TO CITY ENGINEER FOR APPROVAL.
2. ALL NEW RETAINING WALLS SHALL BE BUILT ON PRIVATE PROPERTY. REPAIR OF EXISTING WALLS DOES NOT REQUIRE RELOCATION.
3. ALL CONCRETE TO BE GRADE A CONCRETE

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**TYPICAL  
RETAINING WALLS  
(MAXIMUM 3'0" HIGH)**

<b>P 18</b>	APPROVED <i>[Signature]</i> CITY ENGINEER	DATE 3/23/93	
	DRAWN P.M.H.	CHECKED R.J.B.	

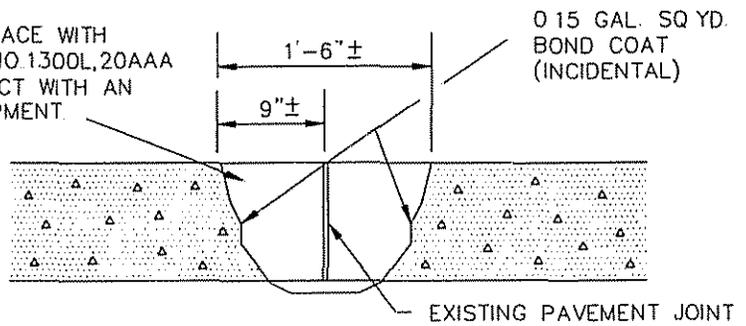


**RESERVED**

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

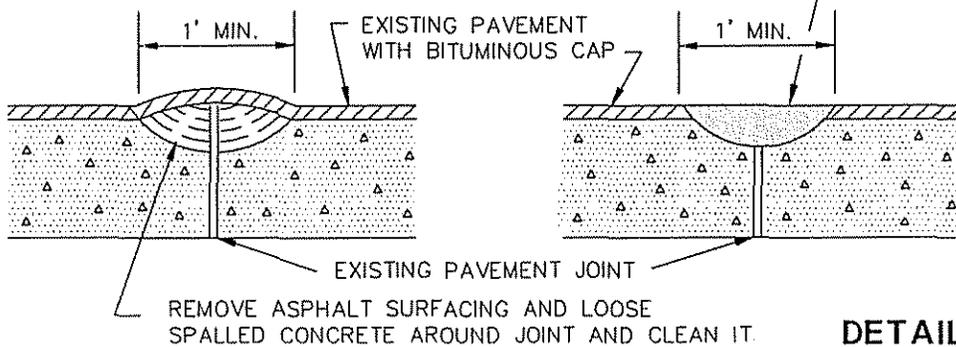
<b>P</b> <b>20</b>	APPROVED		
	CITY ENGINEER		DATE
	DRAWN	CHECKED	

BREAKOUT EXIST. CONC PAVEMENT. REPLACE WITH BIT. MIX NO.1300T,20AAA, OR BIT. MIX. NO.1300L,20AAA COMPLETELY FILL AS SHOWN AND COMPACT WITH AN APPROVED WHEELED OR VIBRATORY EQUIPMENT.

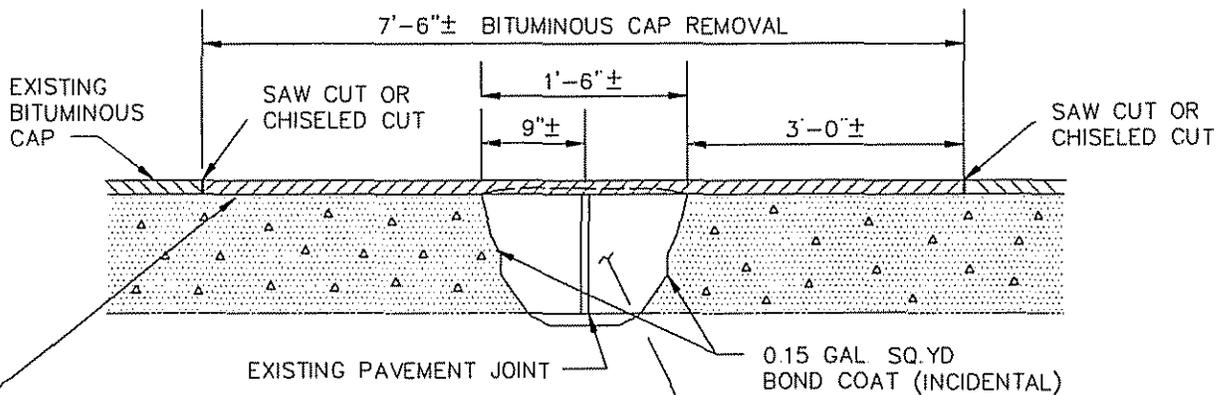


**DETAIL A**

PREPARE JOINT FOR RESURFACING BY PLACING BITUMINOUS BOND COAT ON CLEANED SURFACE AND FILL WITH BITUMINOUS MATERIAL OF THE SAME TYPE AS USED IN THE RESURFACING COURSE OR USE BIT. MIX NO. 1300T,20AAA IF APPROVED BY THE ENGINEER THE BITUMINOUS MATERIAL SHALL BE COMPACTED WITH A MACHINE VIBRATOR OR APPROVED ROLLER.



**DETAIL B**



STRIP OFF EXIST. BIT. CAP AND REPLACE WITH BIT. MIX. NO.1300T,20AAA, OR BIT. MIX. NO.1300L,20AAA AND COMPACT WITH AN APPROVED ROLLER

BREAKOUT EXIST. CONC PAVEMENT REPLACE WITH BIT. MIX. NO.1300T,20AAA, OR BIT. MIX. NO.1300L,20AAA COMPLETELY FILL AS SHOWN AND COMPACT WITH AN APPROVED WHEELED OR VIBRATORY EQUIPMENT

**DETAIL C**

CITY OF GRAND RAPIDS, MICHIGAN  
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DIVISION OF ENGINEERING

**JOINT AND CRACK REPAIR**

<b>P</b> <b>21</b>	APPROVED <i>Dean C. Hombach</i> CITY ENGINEER	DATE <i>3/23/93</i>
	DRAWN P.M.H.	CHECKED R.J.B.

BIT. MIXTURE (TOP COURSE)  
 1 1/2" MIN. FOR MAJOR AND LOCAL STREETS  
 BIT. MIXTURE (LEVELING COURSE)  
 1 1/2" MIN. FOR MAJOR AND LOCAL STREETS

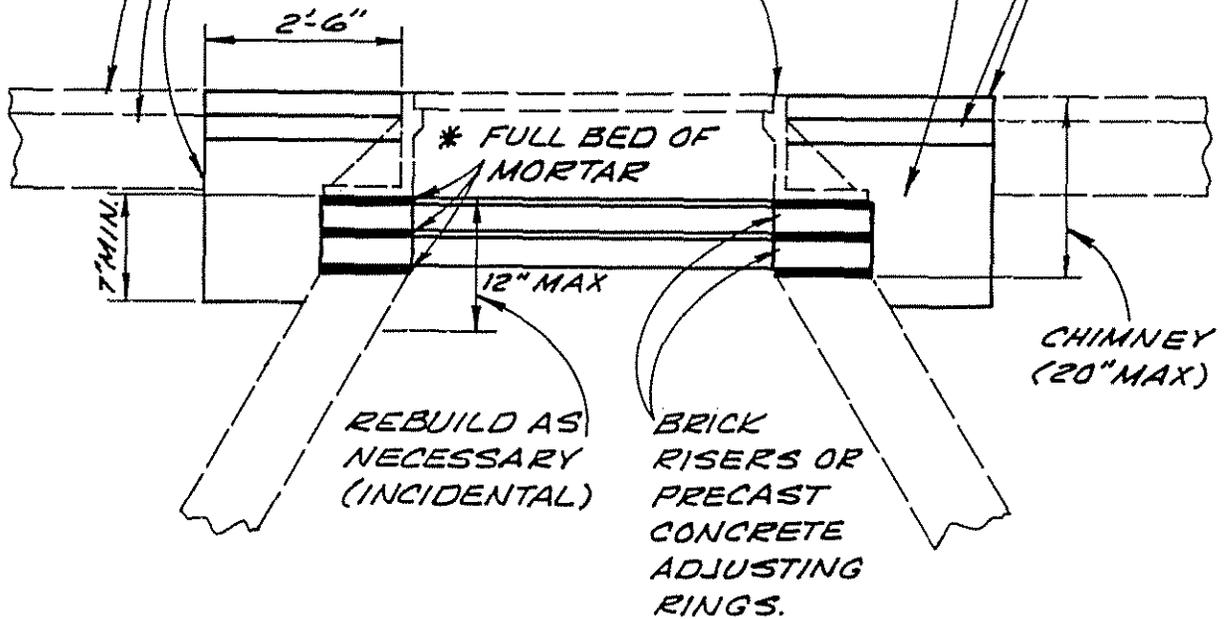
BIT. BASE MIXTURE 7" MIN.  
 GRAVEL (MAJOR STREET) 12" MIN.  
 GRAVEL (LOCAL STREET) 8" MIN.

EXIST. PAVEMENT.

EXIST. BASE.

SAW CUT OR NEATLY TRIM EDGE.

EXIST. MANHOLE CASTING.



REBUILD AS  
 NECESSARY  
 (INCIDENTAL)

BRICK  
 RISERS OR  
 PRECAST  
 CONCRETE  
 ADJUSTING  
 RINGS.

\* CONTRACTOR TO USE HIGH EARLY  
 STRENGTH MORTAR AT HIS/HER  
 COST WHEN REQUIRED BY  
 CONSTRUCTION SCHEDULE.

CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

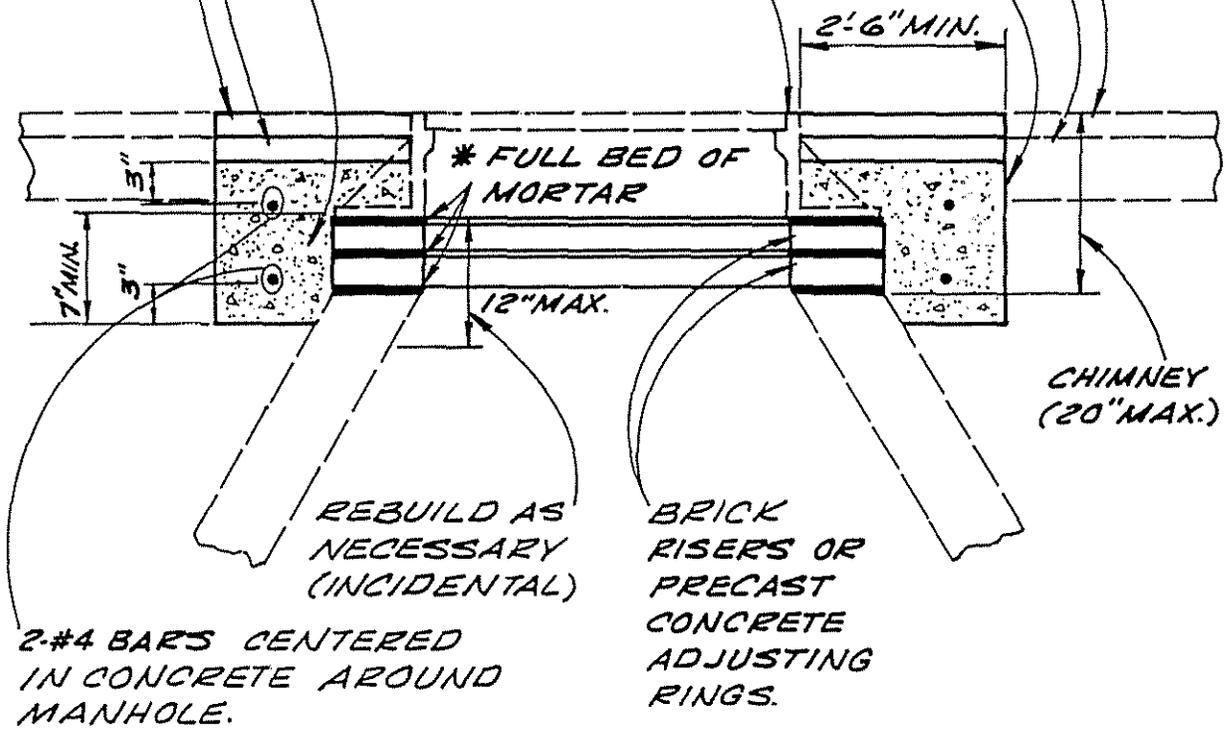
**ADJUSTMENT  
 OF  
 MANHOLE CASTING**

(WITH BIT. BASE AND TOP COURSE)

P 22	APPROVED <i>[Signature]</i> CITY ENGINEER	DATE 3/23/93
	DRAWN S.J.D.	CHECKED

BIT. MIXTURE (TOP COURSE)  
 1 1/2" MIN. FOR MAJOR AND LOCAL STREETS.  
 BIT. MIXTURE (LEVELING COURSE)  
 1 1/2" MIN. FOR MAJOR AND LOCAL STREETS.

EXIST. PAVEMENT.  
 EXIST. BASE.  
 SAW CUT OR NEATLY  
 TRIM EDGE.  
 EXIST. MANHOLE CASTING.  
 CONCRETE (GRADE A)



2-#4 BARS CENTERED  
 IN CONCRETE AROUND  
 MANHOLE.

REBUILD AS  
 NECESSARY  
 (INCIDENTAL)

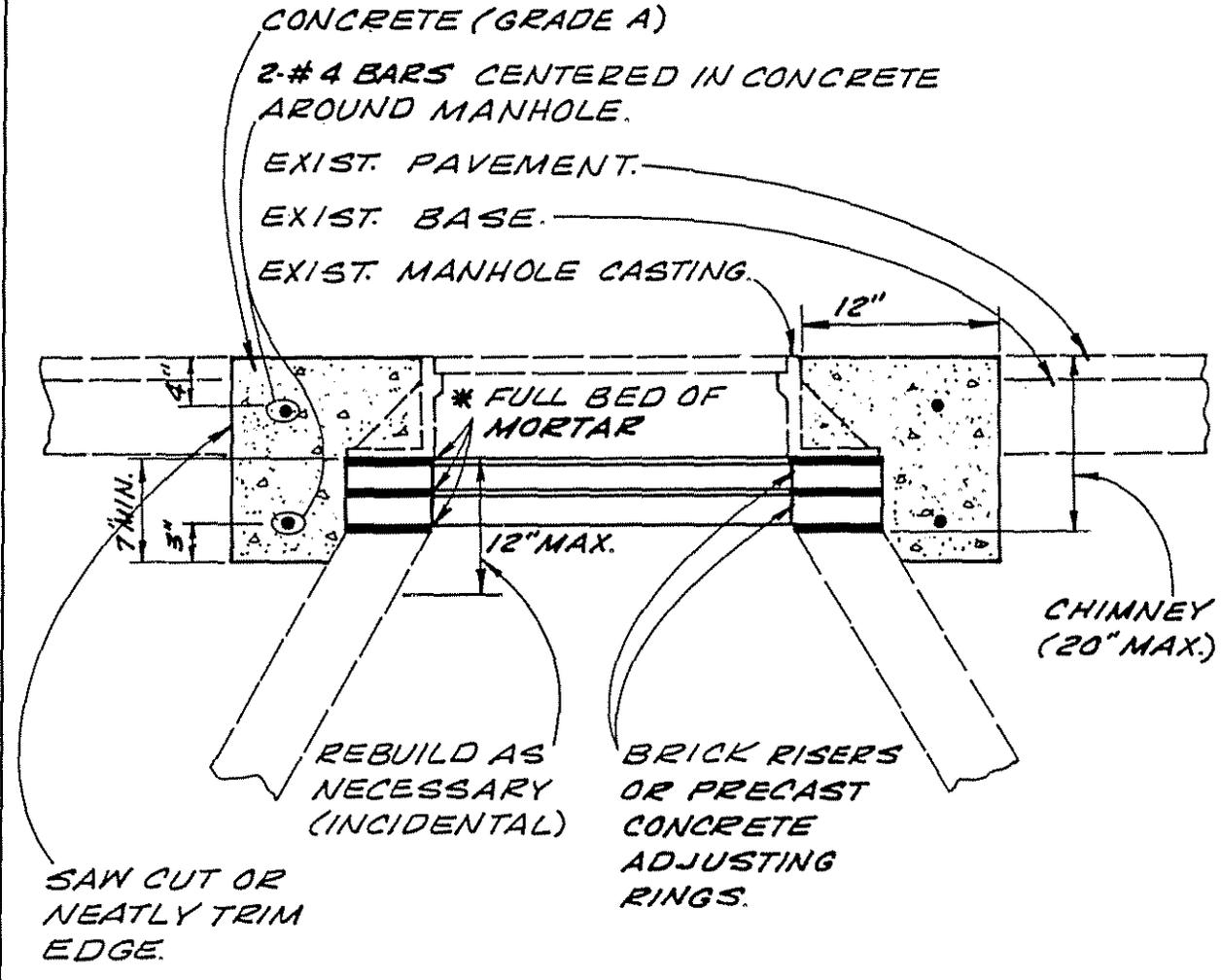
BRICK  
 RISERS OR  
 PRECAST  
 CONCRETE  
 ADJUSTING  
 RINGS.

\* CONTRACTOR TO USE HIGH EARLY  
 STRENGTH MORTAR AT HIS/HER  
 COST WHEN REQUIRED BY  
 CONSTRUCTION SCHEDULE.

CITY OF GRAND RAPIDS, MICHIGAN  
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### ADJUSTMENT OF MANHOLE CASTING (WITH CONC. BASE AND BIT. TOP COURSE)

P 22A	APPROVED <i>[Signature]</i>	DATE 3/23/93
	CITY ENGINEER	
	DRAWN S.J.D.	CHECKED



\* CONTRACTOR TO USE HIGH EARLY STRENGTH MORTAR AT HIS/HER COST WHEN REQUIRED BY CONSTRUCTION SCHEDULE.

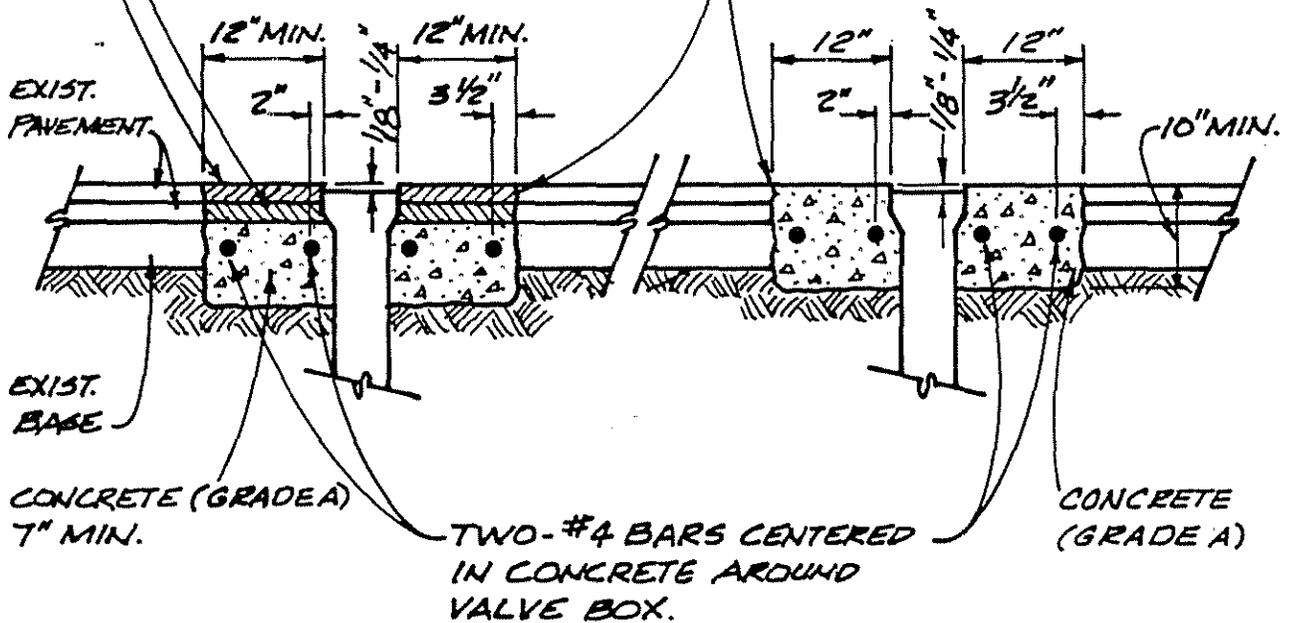
CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING  
**ADJUSTMENT  
 OF  
 MANHOLE CASTING**  
 (WITH FULL DEPTH CONC. PAVEMENT)

P	APPROVED	DATE
	<i>John L. Hombach</i>	3/23/93
22B	DRAWN S.J.D.	CHECKED

BITUM. MIXTURE (TOP COURSE)  
1 1/2" MIN. FOR MAJOR & LOCAL STREETS.

BITUM. MIXTURE (LEVELING COURSE)  
1 1/2" MIN. FOR MAJOR & LOCAL STREETS.

SAW OR NEATLY TRIM EDGE  
WITH AIR HAMMER IN A  
CIRCLE AROUND VALVE BOX.



CITY OF GRAND RAPIDS, MICHIGAN  
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DIVISION OF ENGINEERING

### ADJUSTMENT OF VALVE & BOX

P 23	APPROVED <i>[Signature]</i> 3/23/93	DATE
	CITY ENGINEER	
DRAWN P.T.P.	CHECKED	

BIT MIXTURE (WEARING COURSE)  
 1 1/2" MIN. FOR MAJOR AND LOCAL STREETS.  
 BIT MIXTURE (LEVELING COURSE)  
 1 1/2" MIN. FOR MAJOR AND LOCAL STREETS.  
 BIT. BASE MIXTURE 7" MIN.  
 GRAVEL FOR LOCAL STREETS 8" MIN.  
 GRAVEL FOR MAJOR STREETS 12" MIN.  
 CONCRETE 7" MIN.

SAW OR NEATLY TRIM EDGE.

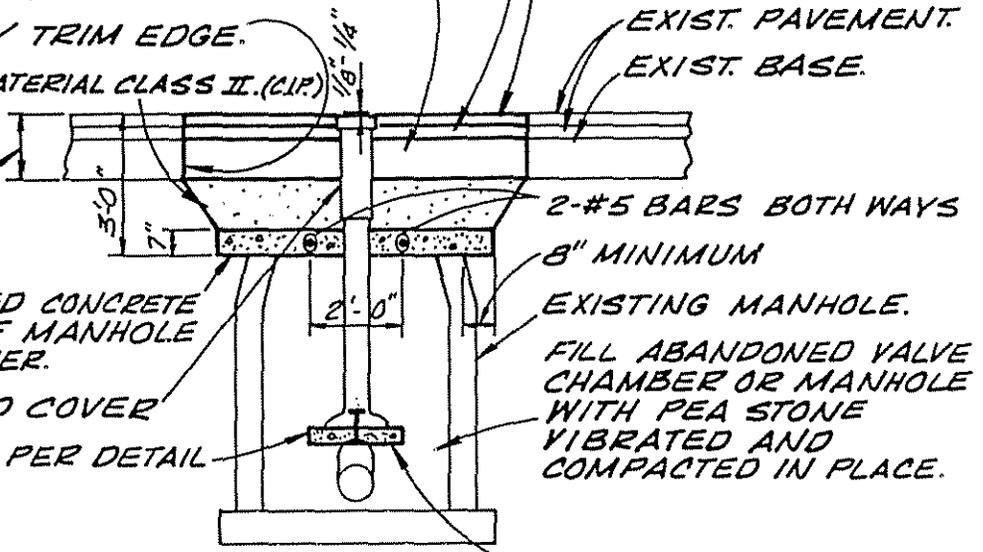
M.D.O.T. GRANULAR MATERIAL CLASS II. (C.I.P.)

SEE DETAIL A IF PAVEMENT IS RESTORED WITH CONCRETE FULL DEPTH.

PLACE REINFORCED CONCRETE CAP TO SEAL OFF MANHOLE OR VALVE CHAMBER.

VALVE & BOX AND COVER

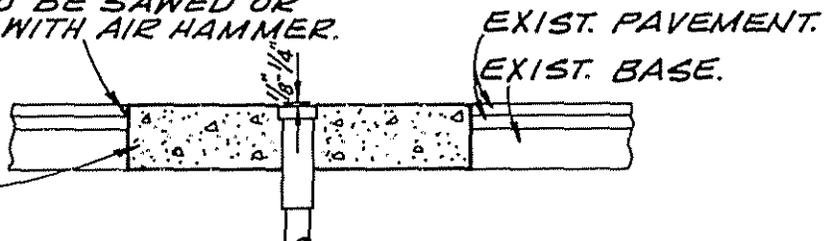
CONCRETE RING PER DETAIL THIS SHEET.



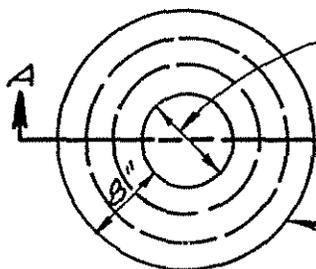
FOR PLACEMENT OF CONCRETE RING SEE DETAIL W/6

HOLE AROUND MANHOLE TO BE CUT MECHANICALLY TO A TRUE CIRCLE AT LEAST THRU THE ASPHALT PAVEMENT. CONCRETE BASE TO BE SAWED OR NEATLY TRIMMED WITH AIR HAMMER.

CONCRETE (FULL DEPTH) DEPTH SAME THICKNESS AS EXIST. PAVEMENT (10" MIN.)

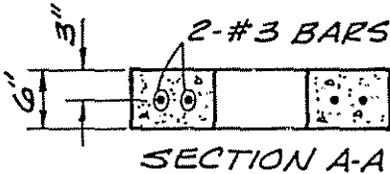


**DETAIL A (FOR FULL DEPTH CONCRETE)**



DIAMETER TO BE AS NEEDED FOR SIZE OF VALVE  
 BOX BASE USED (9 1/4" FOR TYLER 6860 SERIES # 6 BASE)  
 VALVE BOX BASE TO BE CENTERED ON CONCRETE RING.

NOTE:  
 MANHOLE OR VALVE CHAMBER MAY BE BROKEN DOWN 3' BELOW GRADE AND BACKFILLED WITH COMPACTED M.D.O.T. GRANULAR MATERIAL CLASS II IN LIEU OF BACKFILLING WITH PEA STONE AND SEALING WITH THE REINFORCED CONCRETE CAP.



**CONCRETE RING DETAIL**

CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

**ABANDON  
 VALVE CHAMBER  
 AND PLACE VALVE BOX**

P 23A	APPROVED	DATE
	<i>[Signature]</i> CITY ENGINEER	3/23/93
	DRAWN	CHECKED
	S.J.D.	

BITUM. MIXTURE (WEARING COURSE)  
1" MIN. FOR LOCAL STREETS.  
1" MIN. FOR MAJOR STREETS.

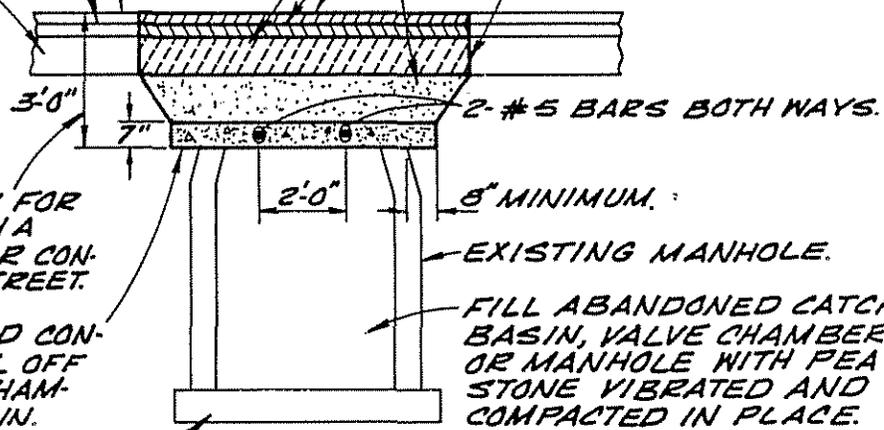
BITUM. MIXTURE (LEVELING COURSE)  
1" MIN. FOR LOCAL STREETS.  
1 1/2" MIN. FOR MAJOR STREETS.

BITUM. BASE MIXTURE 7" MIN.  
GRAVEL FOR LOCAL STREETS 8" MIN.  
GRAVEL FOR MAJOR STREETS 12" MIN.

EXIST. PAVEMENT.  
EXIST. WEDGING.  
EXIST. BASE.

COMPACTED  
M.DOT. GRANULAR  
MATERIAL CLASS II.

SAW OR NEATLY  
TRIM EDGE.



SEE NOTE 1. BELOW FOR  
THIS PORTION IF IN A  
CONCRETE BASE OR CON-  
CRETE SURFACE STREET.

PLACE REINFORCED CON-  
CRETE CAP TO SEAL OFF  
MANHOLE, VALVE CHAM-  
BER OR CATCH BASIN.

BREAK CONCRETE FLOOR  
TO ALLOW DRAINAGE.

**NOTES:**

1. IF EXIST. PAVEMENT IS CONCRETE,  
DELETE BITUMINOUS  
AND GRAVEL AND PLACE  
CONCRETE AT SAME THICKNESS AS  
THE EXISTING PAVEMENT (7" MIN.).  
IF EXIST. BASE IS CONCRETE,  
DELETE BITUMINOUS  
AND PLACE CONCRETE BASE AT  
SAME THICKNESS AS THE EXISTING  
BASE (7" MIN.) LEAVE BASE DOWN  
2 1/2" (MIN.) BELOW EXISTING SURFACE.

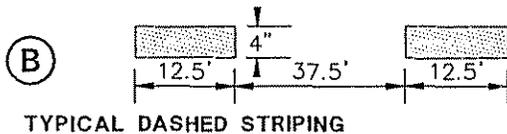
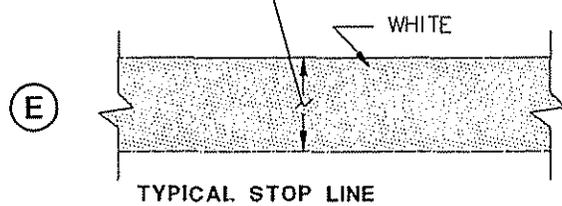
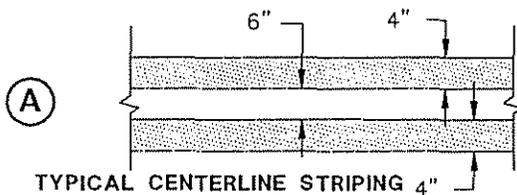
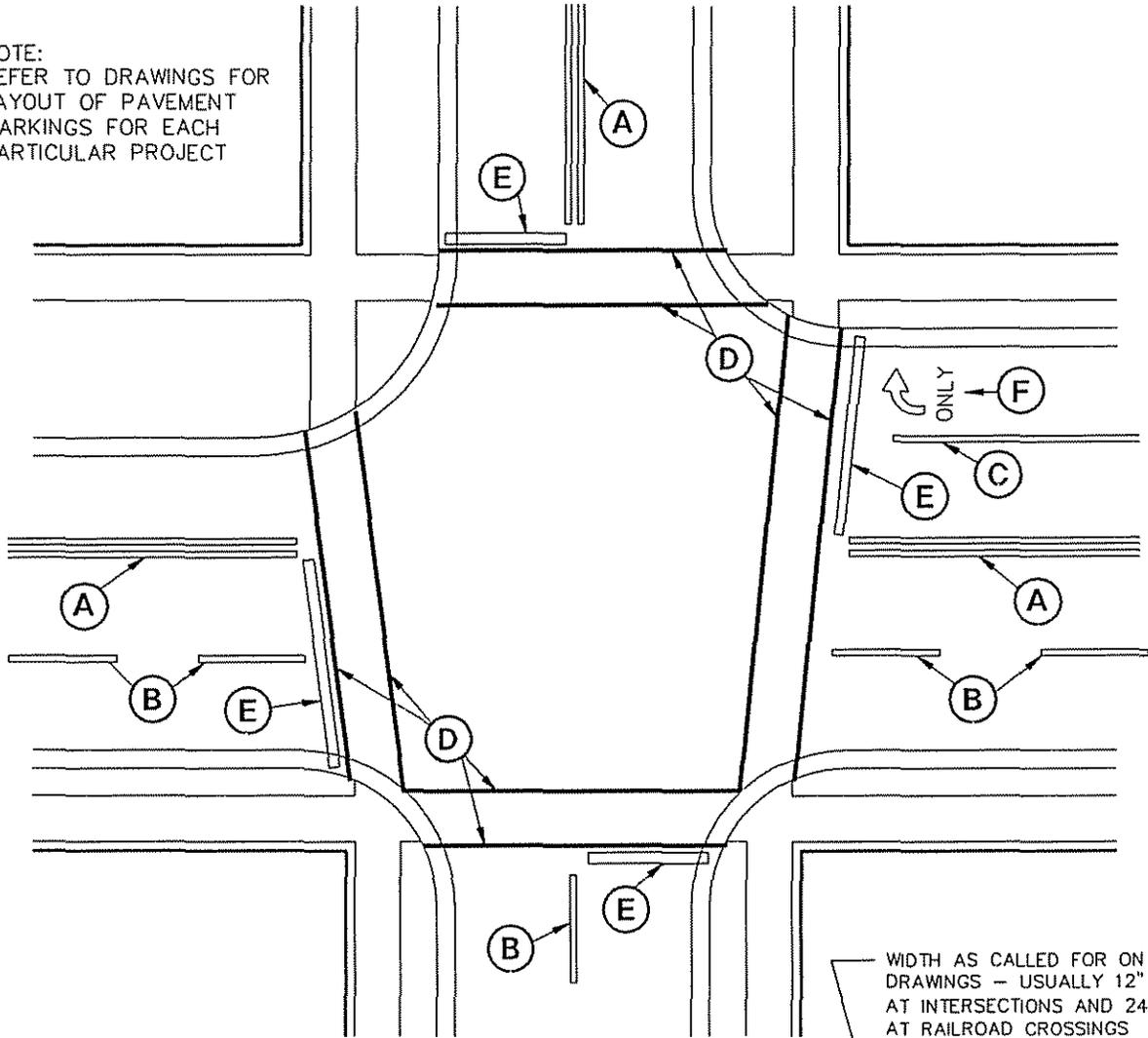
2. MANHOLE, CATCH BASIN OR VALVE  
CHAMBER MAY BE BROKEN DOWN 3'  
BELOW GRADE AND BACKFILLED  
WITH COMPACTED M.DOT. GRANULAR  
MATERIAL CLASS II. OR THESE  
STRUCTURES MAY BE REMOVED  
ENTIRELY AND BACKFILLED WITH  
COMPACTED M.DOT. GRANULAR  
MATERIAL CLASS II. IN LIEU OF  
BACKFILLING WITH PEA STONE AND  
SEALING WITH THE REINFORCED  
CONCRETE CAP

CITY OF GRAND RAPIDS, MICHIGAN  
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**CLEAN AND REMOVE  
MANHOLE, VALVE CHAMBER  
OR CATCH BASIN**

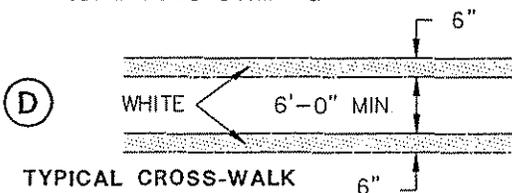
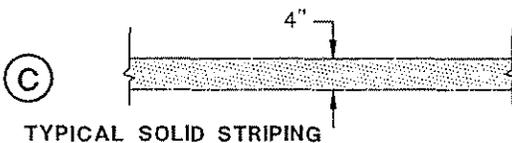
P 23B	APPROVED <i>Tom Lombach</i> 3/23/03 CITY ENGINEER	DATE
	DRAWN S.J.D.	CHECKED

NOTE:  
REFER TO DRAWINGS FOR  
LAYOUT OF PAVEMENT  
MARKINGS FOR EACH  
PARTICULAR PROJECT



**F** (FOR PAVEMENT WORD AND SYMBOL MARKINGS REFER TO M.D.O.T. MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES - SEC 3B-17)

ARROWS AND LETTERS



CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

## TYPICAL PAVEMENT MARKING DIMENSIONS

<b>P</b> <b>24</b>	APPROVED <i>[Signature]</i> 3/23/93	DATE
	CITY ENGINEER	DATE
DRAWN P.M.H.	CHECKED R J B	

TYPE	HEIGHT IN FT.
CONE (C)	2,3,4 & 5
BARREL (L)	MIN. 1'4", MAX. 8'0" AT INCREMENTS OF 1'4"

**SECTION DIMENSION**

STANDARD GRAND RAPIDS MANHOLE CASTING AND COVER S-13; USE S-13A AND S-14 WHEN SPECIFIED OR SHOWN ON DRAWINGS; WHEN S-13A IS REQUIRED, ADJUST CONE ACCORDINGLY

SET IN A FULL BED OF MORTAR

MANHOLE STEPS TO BE HERCULES #PS-1, M.A INDUSTRIES #PS-1 - PF, OR APPROVED EQUAL

ALL JOINTS BETWEEN SECTIONS SHALL BE OF THE "O"-RING, BUTYL RUBBER GASKETS CONFORMING TO ASTM C-443 SUCH AS: RUBBER NECK, KENT SEAL, EASY STICK, FORSHEDA, OR APPROVED EQUAL TYPE JOINT

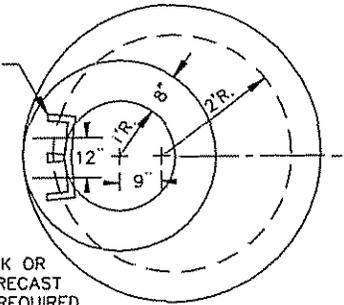
PORTLAND CEMENT MORTAR OR GRADE "A" CONCRETE

PRECAST GRADE "A" CONCRETE BASE

**NOTES:**

- 1 MANHOLES MAY BE CONSTRUCTED OF ANY COMBINATION OF THE ABOVE NOTED SECTIONS, PROVIDED HOWEVER, THAT THE TOTAL NUMBER OF SECTIONS ARE KEPT TO A MINIMUM.
- 2 L<sub>1</sub>, L<sub>2</sub> AND C SECTION TO BE USED IN COMBINATION SO THAT 20" IS THE MAXIMUM DIMENSION BETWEEN THE TOP OF CONE AND FINISHED GRADE.

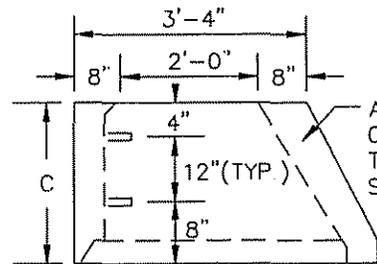
STEPS MAY BE STAGGERED OR STRAIGHT



**TOP VIEW**

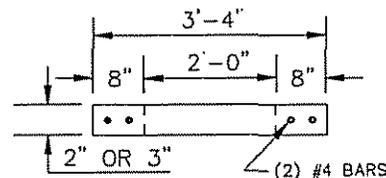
PORTLAND CEMENT BRICK OR BLOCK OR CONCRETE PRECAST ADJUSTING RING(S) AS REQUIRED

ASTM C-478 RISER SECTION WITH 5" WALL



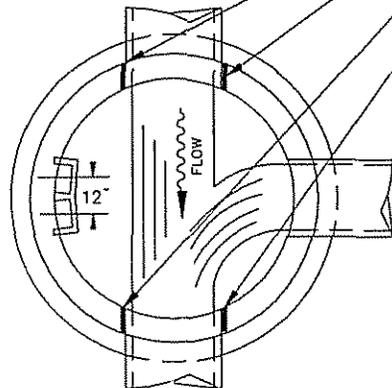
**TYPICAL CONE**

(FOR S-13 AND S-14 CASTING AND COVER)



**TYPICAL ADJUSTING RING**

ALL OPENINGS FOR PIPE UP TO AND INCLUDING 24" DIAMETER SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS: (KOR-N-SEAL BY NATIONAL POLLUTION CONTROL SYSTEMS INC; PSX OR PRESS WEDGE II BY PRESS SEAL GASKET CORPORATION; LOCK JOINT FLEXIBLE MANHOLE SLEEVE BY INTERPACE CORP OR A-LOK, OR APPROVED EQUAL). ON PVC TRUSS AND SOLID WALL SEWERS OR LATERALS, ALL OPENINGS (REGARDLESS OF SIZE) SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS.

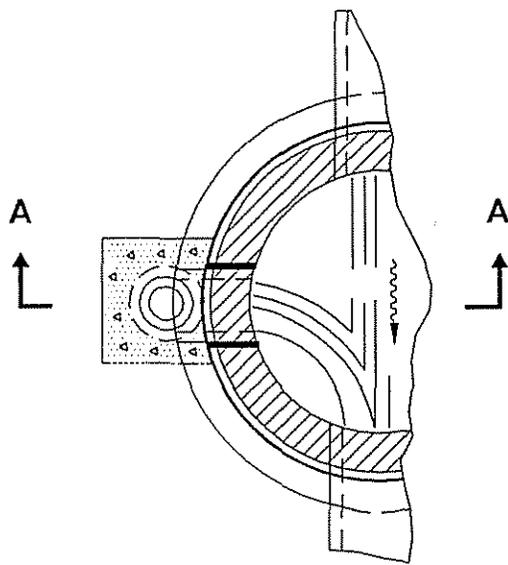


**TYPICAL CHANNEL PLAN**

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**STANDARD  
PRECAST MANHOLE**

<b>S</b>	APPROVED <i>Diane Hornbach</i> 3/23/93	
	CITY ENGINEER	DATE
<b>1</b>	DRAWN P.M.H.	CHECKED V.U.

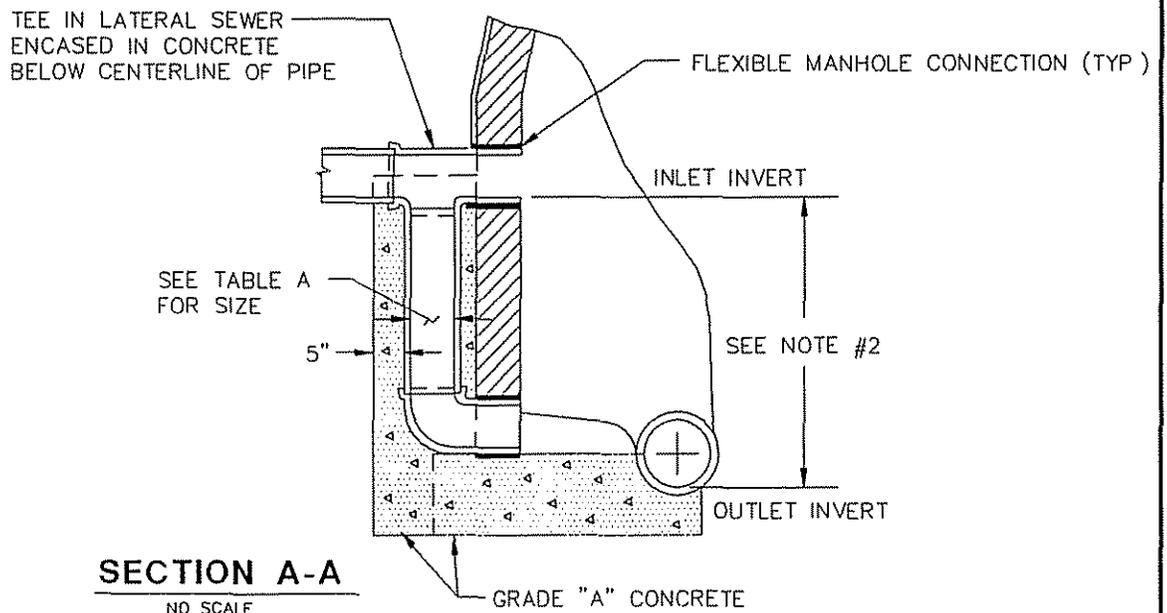


**SECTIONAL PLAN**

NOTES

1. DROP CONNECTIONS ON PVC TRUSS PIPE OR PVC SOLID WALL PIPE SHALL NOT BE ENCASED IN CONCRETE
2. ALL INLET INVERTS GREATER THAN 2'-0" ABOVE THE OUTLET INVERT WILL REQUIRE A DROP CONNECTION CONSTRUCTED PER THIS DETAIL.
3. ON PVC TRUSS AND SOLID WALL SEWERS OR LATERALS, ALL OPENINGS (REGARDLESS OF SIZE) SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE).

OPENINGS FOR CONCRETE AND CLAY SEWERS OR LATERALS UP TO AND INCLUDING 24" SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE)



**SECTION A-A**  
NO SCALE

**TABLE A**

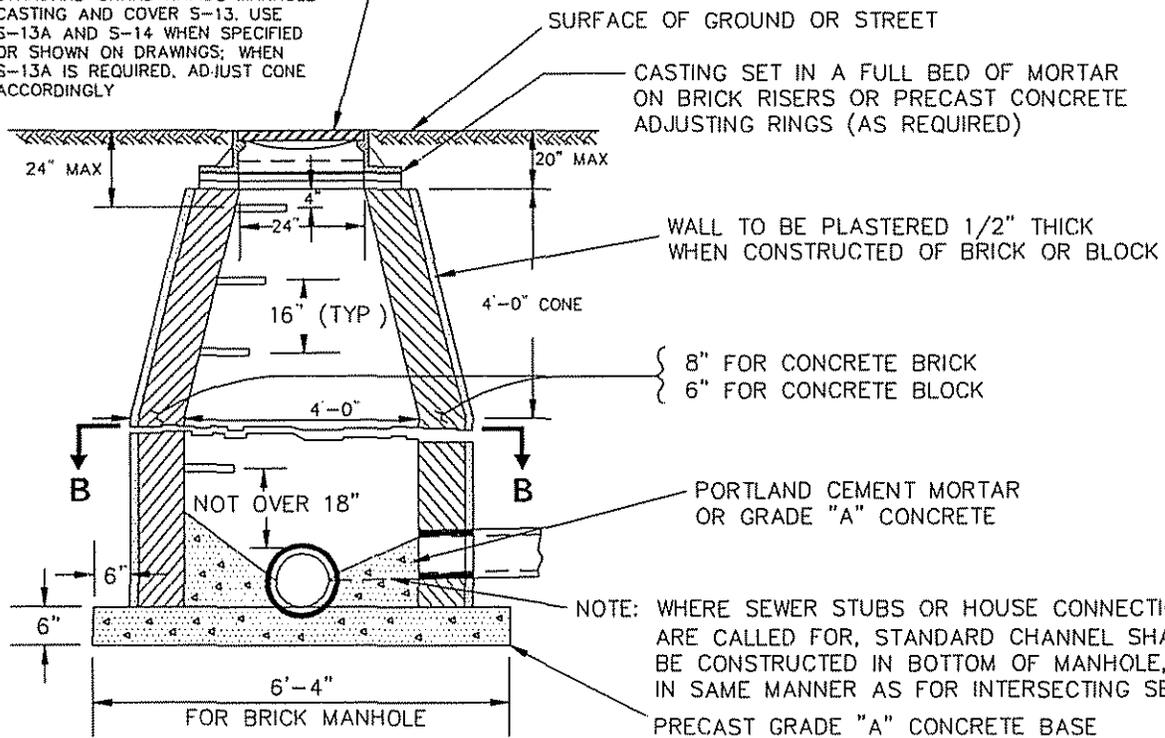
SIZE OF SEWER	DROP CONNECTION
8"	8"
10"	8"
12"	8"
15"	10"
18"	10"
21"	12"
24"	12"
27"	12"
30"	15"
36"	15"

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**DROP CONNECTION**

<b>S</b> <b>1A</b>	APPROVED <i>[Signature]</i> CITY ENGINEER	DATE 3/23/93
	DRAWN P.M.H.	CHECKED V.U.

STANDARD GRAND RAPIDS MANHOLE CASTING AND COVER S-13. USE S-13A AND S-14 WHEN SPECIFIED OR SHOWN ON DRAWINGS; WHEN S-13A IS REQUIRED, ADJUST CONE ACCORDINGLY



**SECTION AA**

NO SCALE

SURFACE OF GROUND OR STREET

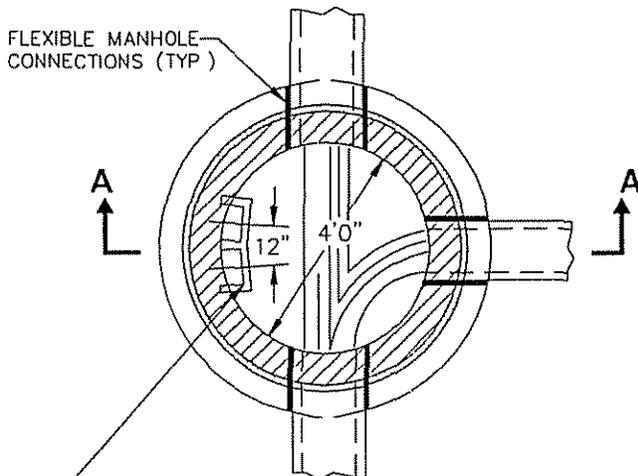
CASTING SET IN A FULL BED OF MORTAR ON BRICK RISERS OR PRECAST CONCRETE ADJUSTING RINGS (AS REQUIRED)

WALL TO BE PLASTERED 1/2" THICK WHEN CONSTRUCTED OF BRICK OR BLOCK

8" FOR CONCRETE BRICK  
6" FOR CONCRETE BLOCK

PORTLAND CEMENT MORTAR OR GRADE "A" CONCRETE

NOTE: WHERE SEWER STUBS OR HOUSE CONNECTIONS ARE CALLED FOR, STANDARD CHANNEL SHALL BE CONSTRUCTED IN BOTTOM OF MANHOLE, IN SAME MANNER AS FOR INTERSECTING SEWER PRECAST GRADE "A" CONCRETE BASE



**SECTION BB**

MANHOLE STEPS (SEE DETAIL S-1 FOR LOCATION AND TYPE)

**NOTES**

1. BELOW 15' DEPTH, MEASURED FROM PROPOSED GROUND SURFACE, MANHOLE WALLS SHALL BE 12" THICK AND DIAMETER OF BASE SHALL BE 7'-4"
2. OPENINGS FOR CONCRETE AND CLAY SEWERS OR LATERALS UP TO AND INCLUDING 24" DIAMETER SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE)
3. ON PVC TRUSS AND SOLID WALL SEWERS OR LATERALS, ALL OPENINGS (REGARDLESS OF SIZE) SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE)

BRICK OR BLOCK MANHOLES WILL ONLY BE CONSTRUCTED WHEN SPECIFICALLY CALLED FOR ON THE DRAWING OR WHEN APPROVED BY THE ENGINEER.

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

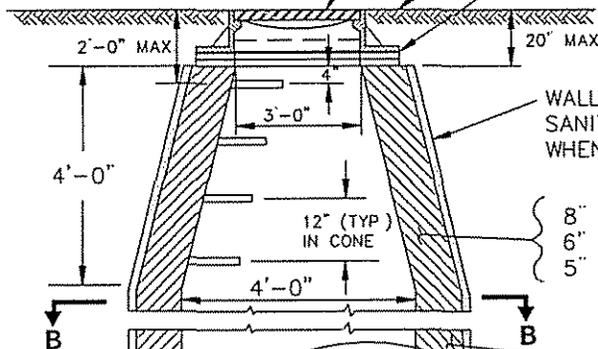
**BRICK OR BLOCK  
MANHOLE**

S 2	APPROVED <i>[Signature]</i> 3/23/93 CITY ENGINEER	DATE 3/23/93
	DRAWN P.M.H.	CHECKED V.U.

STANDARD GRAND RAPIDS  
MANHOLE FRAME AND COVER  
SEE DETAIL S-13A

SURFACE OF GROUND OR STREET

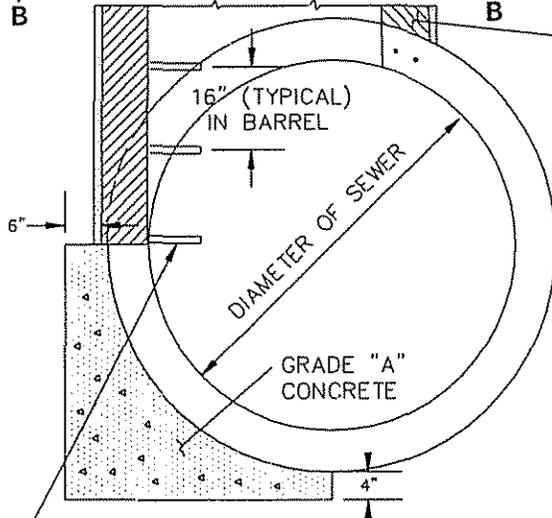
CASTING SET IN A FULL BED OF MORTAR ON  
BRICK RISERS OR PRECAST CONCRETE ADJUSTING  
RINGS (AS REQUIRED)



WALL TO BE PLASTERED 1/2" THICK ON  
SANITARY OR COMBINED SEWER MANHOLES  
WHEN CONSTRUCTED OF BRICK OR BLOCK

8" FOR BRICK  
6" FOR CONCRETE BLOCK  
5" FOR PRECAST REINFORCED CONC. PIPE

GRADE "A" CONCRETE, CONCRETE  
BRICK, CONCRETE BLOCK OR PRECAST  
REINFORCED CONCRETE PIPE AT OPTION  
OF CONTRACTOR



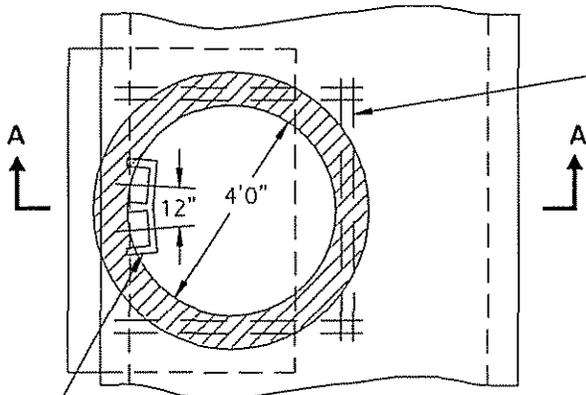
MANHOLE STEPS (SEE DETAIL S-1 FOR LOCATION AND TYPE)

NOTES

- 1 BELOW 15' DEPTH. MEASURED FROM PROPOSED GROUND SURFACE, MANHOLE WALLS SHALL BE 12" THICK FOR BRICK AND BLOCK WALL AND THE DIAMETER OF THE BASE SHALL BE 7'-4"
- 2 OPENINGS FOR CONCRETE AND CLAY SEWERS OR LATERALS UP TO AND INCLUDING 24" DIAMETER SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE)
- 3 ON PVC TRUSS AND SOLID WALL SEWERS OR LATERALS, ALL OPENINGS (REGARDLESS OF SIZE) SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE)

**SECTION A-A**

NO SCALE



EXTRA REINFORCING IN PIPE  
AROUND OPENING. #4 BARS

FOR INFORMATION ONLY: NOT FOR CONSTRUCTION  
UNLESS SPECIFICALLY CALLED FOR ON DRAWINGS  
OR SPECIFICATIONS

MANHOLE STEPS MAY BE  
STAGGERED OR STRAIGHT

**SECTION B-B**

NO SCALE

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**MANHOLE  
FOR LARGE  
DIAMETER SEWER**

<b>S</b> <b>2A</b>	APPROVED <i>[Signature]</i> CITY ENGINEER	DATE 3/23/93
	DRAWN P.M.H.	CHECKED V.U.

STANDARD GRAND RAPIDS MANHOLE  
CASTING AND COVER S-13; USE  
S-13A AND S-14 WHEN SPECIFIED  
OR SHOWN ON DRAWINGS; WHEN  
S-13A IS REQUIRED, ADJUST  
CONE ACCORDINGLY

SURFACE OF GROUND OR STREET

CASTING SET IN A FULL BED OF MORTAR  
ON BRICK RISERS OR PRECAST CONCRETE  
ADJUSTING RINGS (AS REQUIRED)

WALL TO BE PLASTERED 1/2" THICK ON  
SANITARY OR COMBINED SEWER MANHOLES  
WHEN CONSTRUCTED OF BRICK OR BLOCK

8" FOR CONCRETE BRICK  
6" FOR CONCRETE BLOCK  
5" FOR PRECAST REINFORCED CONC PIPE

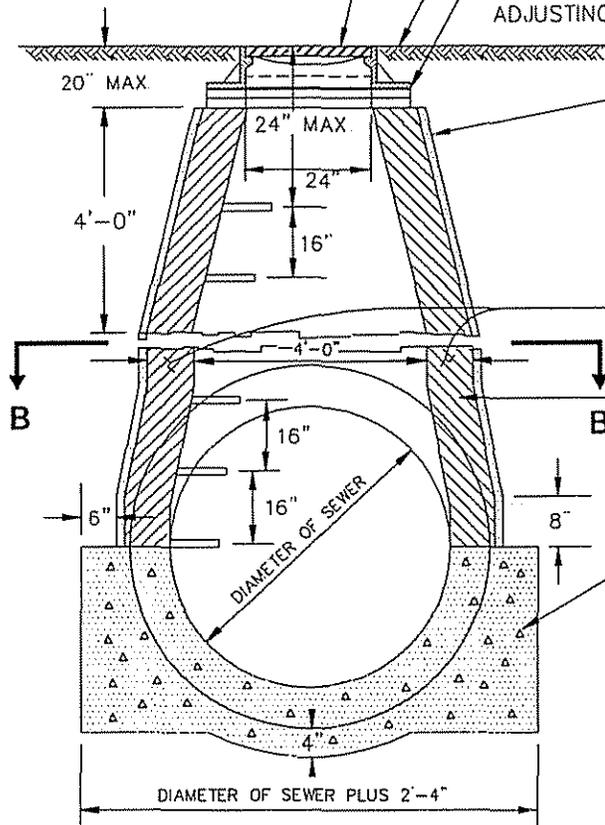
GRADE "A" CONCRETE, CONCRETE  
BRICK, CONCRETE BLOCK OR PRECAST  
REINFORCED CONCRETE PIPE AT OPTION  
OF CONTRACTOR.

GRADE "A" CONCRETE

NOTES

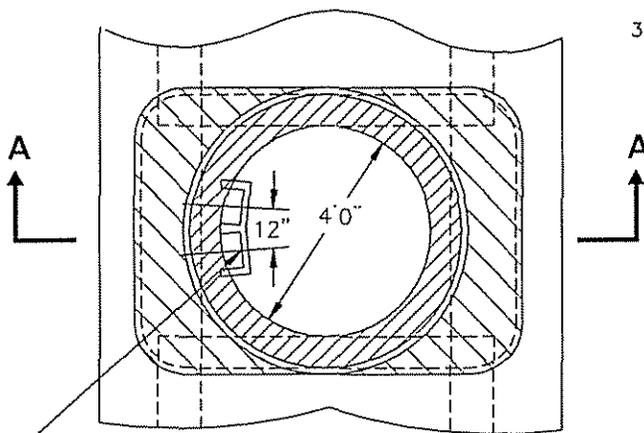
- 1 BELOW 15' DEPTH, MEASURED FROM PROPOSED GROUND SURFACE, MANHOLE WALLS SHALL BE 12" THICK FOR BRICK AND BLOCK WALL AND THE DIAMETER OF THE BASE SHALL BE 7'-4"
- 2 OPENINGS FOR CONCRETE AND CLAY SEWERS OR LATERALS UP TO AND INCLUDING 24" DIAMETER SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE)
- 3 ON PVC TRUSS AND SOLID WALL SEWERS OR LATERALS, ALL OPENINGS (REGARDLESS OF SIZE) SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE).

FOR INFORMATION ONLY; NOT FOR CONSTRUCTION  
UNLESS SPECIFICALLY CALLED FOR ON DRAWINGS  
OR SPECIFICATIONS



**SECTION AA**

NO SCALE



**SECTION BB**

MANHOLE STEPS (SEE DETAIL S-1  
FOR LOCATION AND TYPE)

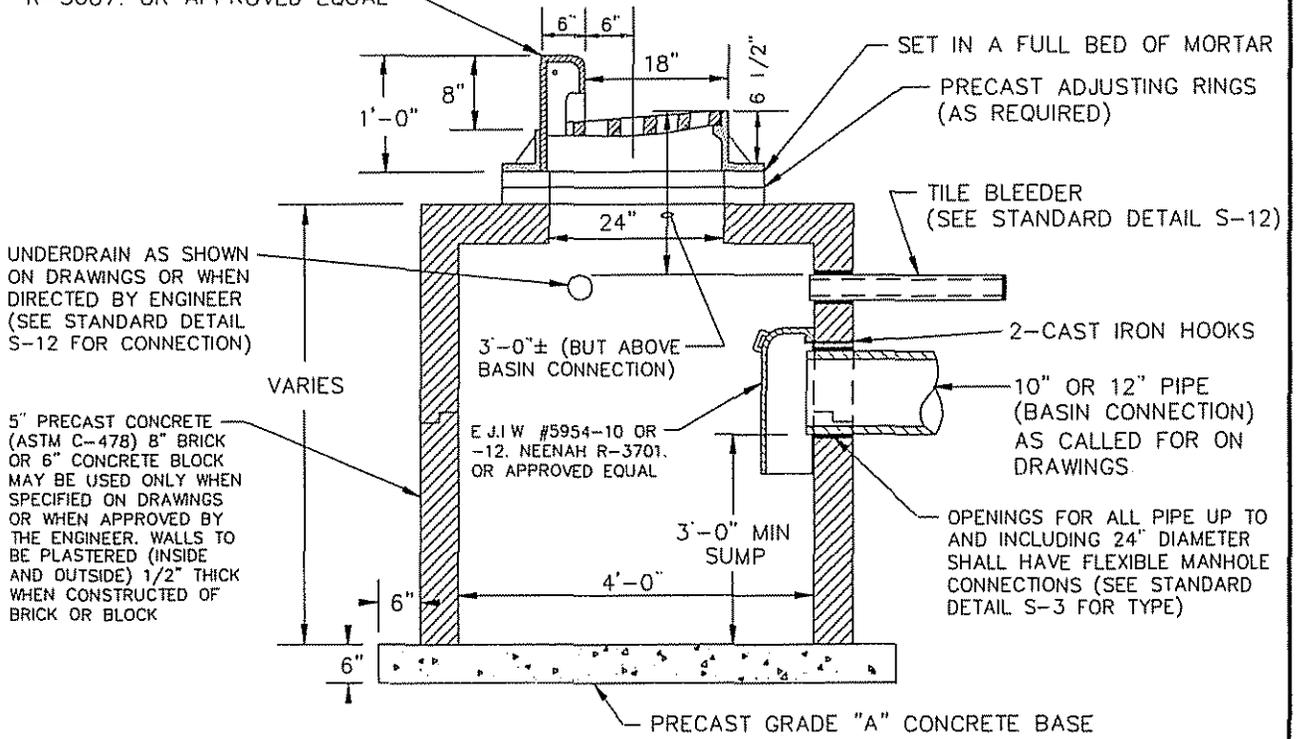
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**STANDARD MANHOLE  
ON  
EXISTING SEWER**

<b>S</b> <b>2B</b>	APPROVED <i>Wm. C. Hornbach</i> 3/23/93	CITY ENGINEER	DATE
	DRAWN P.M.H.	CHECKED V.U.	

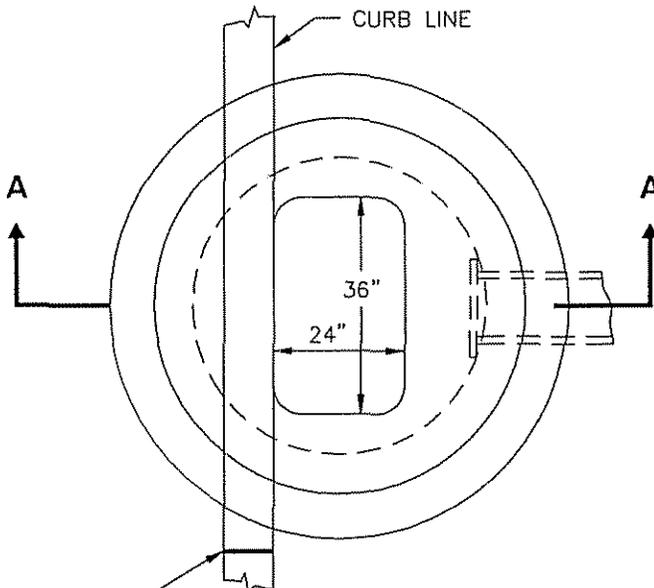


FOR CATCH BASIN CASTING IN STANDARD CURB, USE E.J.I.W #7030-M3, NEENAH R-3067. OR APPROVED EQUAL



**SECTION A-A**

NO SCALE



1/2" EXPANSION JOINT TO BE INSTALLED AT CLOSEST JOINT ON EITHER SIDE OF BASIN CLOSEST JOINT NOT TO EXCEED 10" MAX.

**SECTION B-B**

NO SCALE

**NOTES:**

1. ON PRECAST CATCH BASINS, ALL JOINTS BETWEEN SECTIONS SHALL BE "O"-RING, BUTYL RUBBER GASKETS CONFORMING TO ASTM C-443, SUCH AS: RUBBER NECK, KENT SEAL, EASY STICK, FORSHEDA, OR APPROVED EQUAL TYPE JOINT.
2. THIS FLAT-TOP CATCH BASIN CAN BE USED WITH S-3 CASTINGS WHEN SPECIFIED OR APPROVED BY THE ENGINEER

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**STANDARD PRECAST  
DOUBLE  
CATCH BASIN**

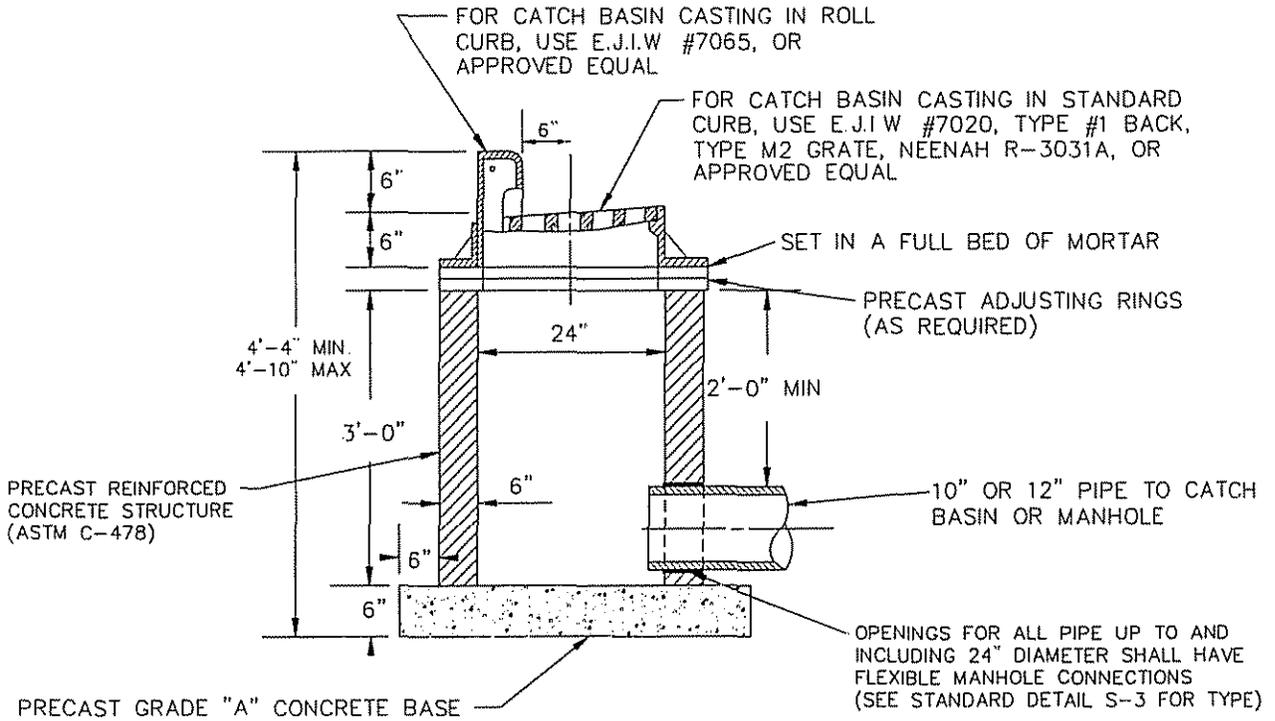
<b>S</b> <b>4</b>	APPROVED <i>[Signature]</i> 3/23/93 CITY ENGINEER	DATE
	DRAWN P.M.H.	CHECKED V.U.

**RESERVED**

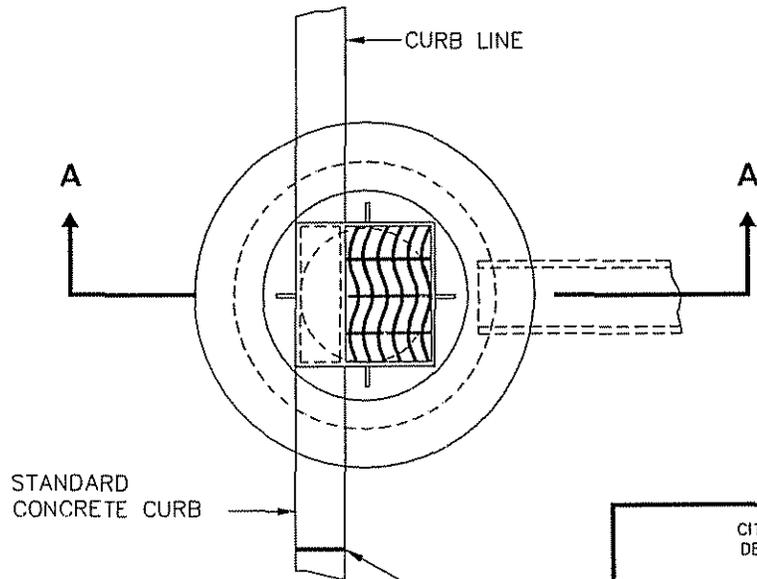
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

<b>S</b> <b>5</b>	APPROVED		
	CITY ENGINEER		DATE
	DRAWN	CHECKED	





**SECTION A-A**  
NO SCALE



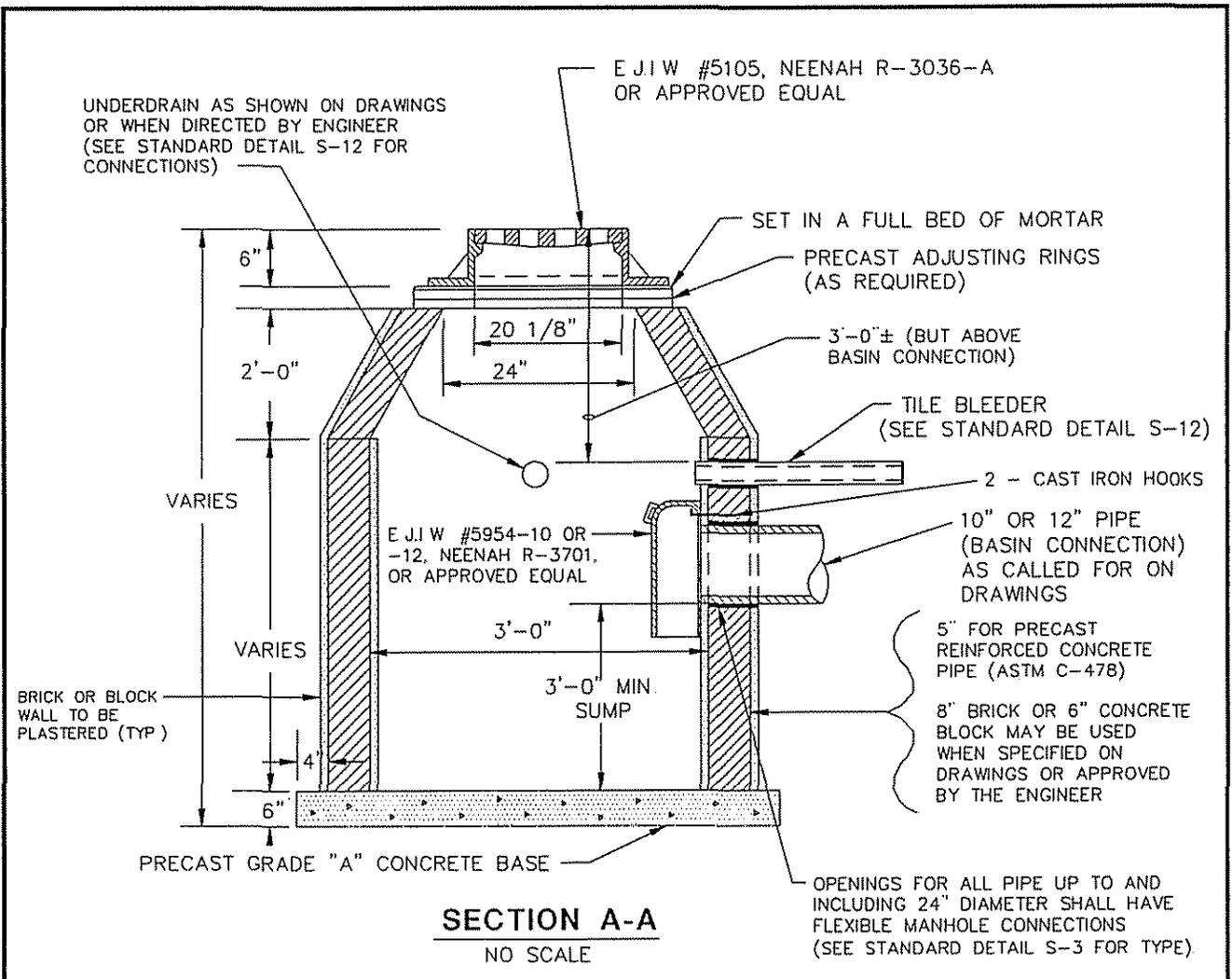
1/2" EXPANSION JOINT TO BE INSTALLED AT CLOSEST JOINT ON EITHER SIDE OF BASIN  
CLOSEST JOINT NOT TO EXCEED 10' MAX

**PLAN**  
NO SCALE

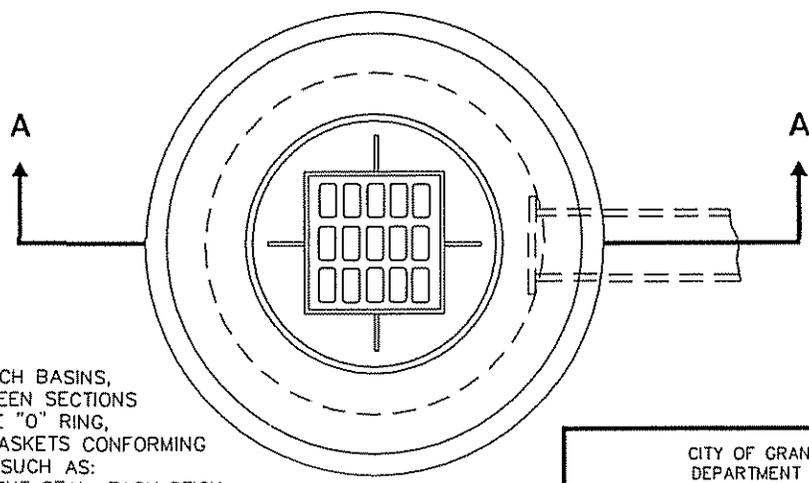
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**STANDARD DROP  
INLET TO CATCH  
BASIN OR MANHOLE**

<b>S</b>	APPROVED	<i>John J. Hombach</i> 3/23/93	
	DRAWN	CITY ENGINEER	DATE
<b>6A</b>	P.M.H.	CHECKED	V.U.



**SECTION A-A**  
NO SCALE



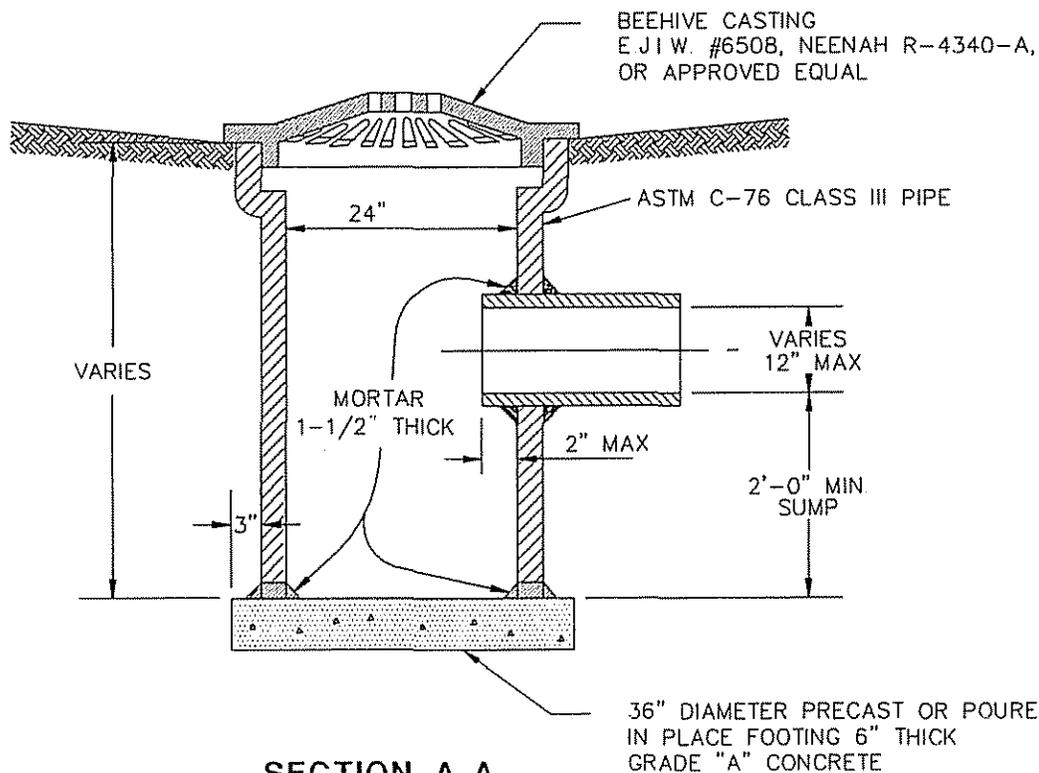
**PLAN**  
NO SCALE

NOTE:  
ON PRECAST CATCH BASINS,  
ALL JOINTS BETWEEN SECTIONS  
SHALL BE OF THE "O" RING,  
BUTYL RUBBER GASKETS CONFORMING  
TO ASTM C-443 SUCH AS:  
RUBBER NECK, KENT SEAL, EASY STICK,  
FORSHEDA, OR APPROVED EQUAL  
TYPE JOINT

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

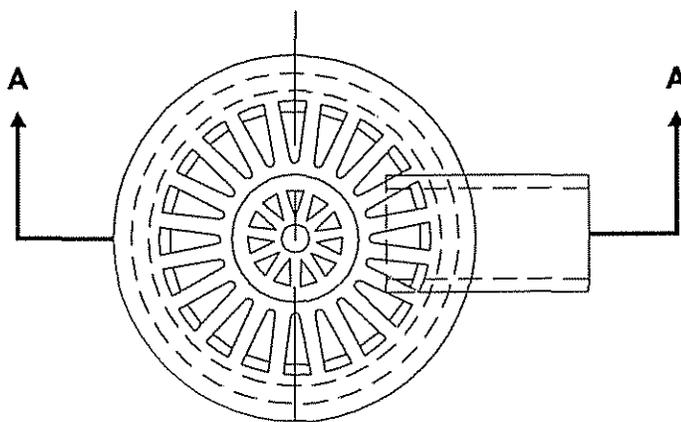
**STANDARD PRECAST  
ALLEY BASIN**

S 7	APPROVED <i>[Signature]</i> CITY ENGINEER	DATE 3/23/93
	DRAWN P.M.H.	CHECKED V.U.



**SECTION A-A**

NO SCALE



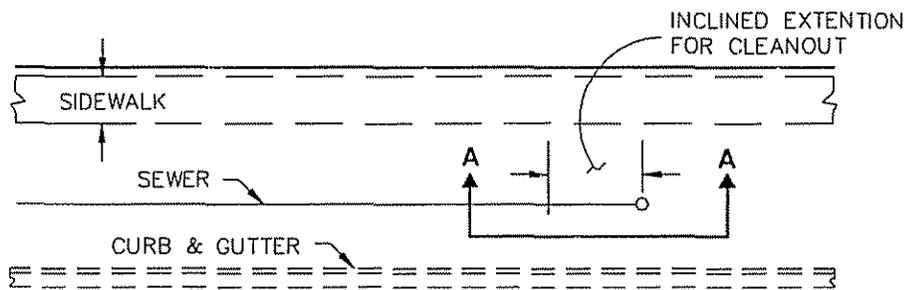
**PLAN**

NO SCALE

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

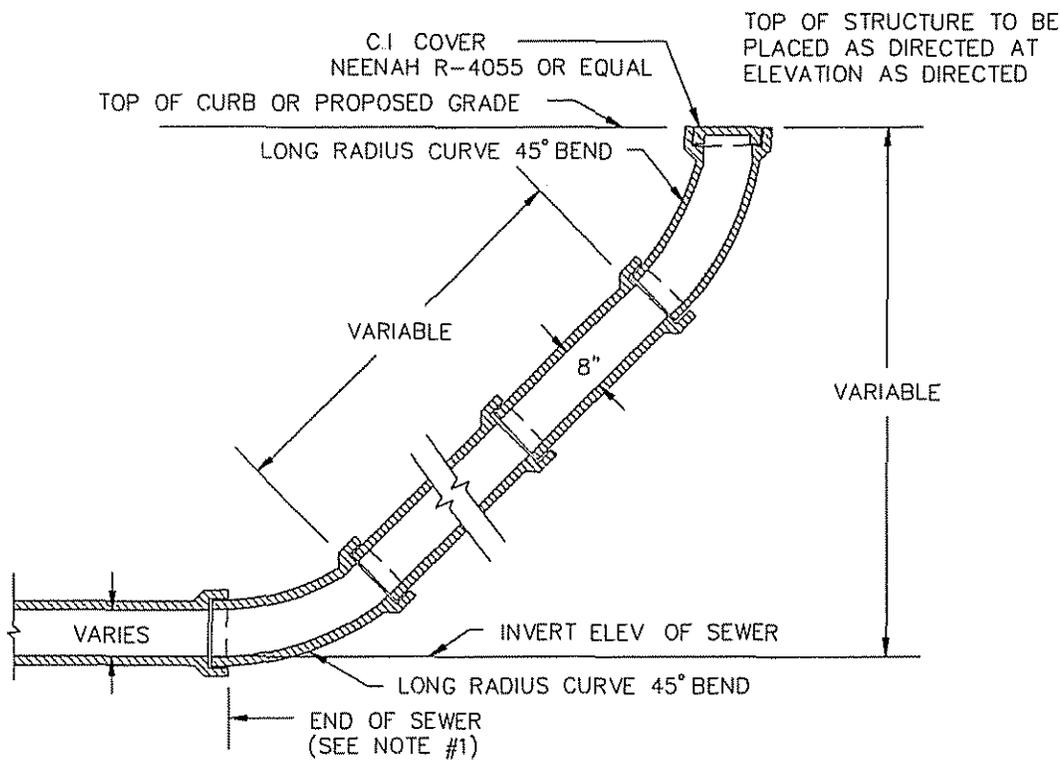
**DITCH BASIN**

S 8	APPROVED <i>P. M. H.</i> 3/23/93	DATE
	CITY ENGINEER	
DRAWN P.M.H.	CHECKED V.U.	



**PLAN**

SCALE: 1"=20'



**VERTICAL SECTION A-A**

NO SCALE

NOTES

- 1 THE TILE OR PIPE FOR THE INCLINED EXTENSION FOR CLEANOUT SHALL BE 8" DIAMETER. IF THE SEWER IS LARGER THAN 8" A REDUCER SHALL BE INSTALLED BETWEEN THE END OF SEWER AND THE LONG RADIUS CURVE.
- 2 JOINTS SHALL BE THE SAME AS SPECIFIED FOR SEWER CONSTRUCTION IN DIVISION 18
- 3 CLEANOUT COVER MUST BE METAL EVEN IF PVC PIPE IS USED IN ORDER TO LOCATE WITH A METAL DETECTOR

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DIVISION OF ENGINEERING

**SEWER CLEANOUT**

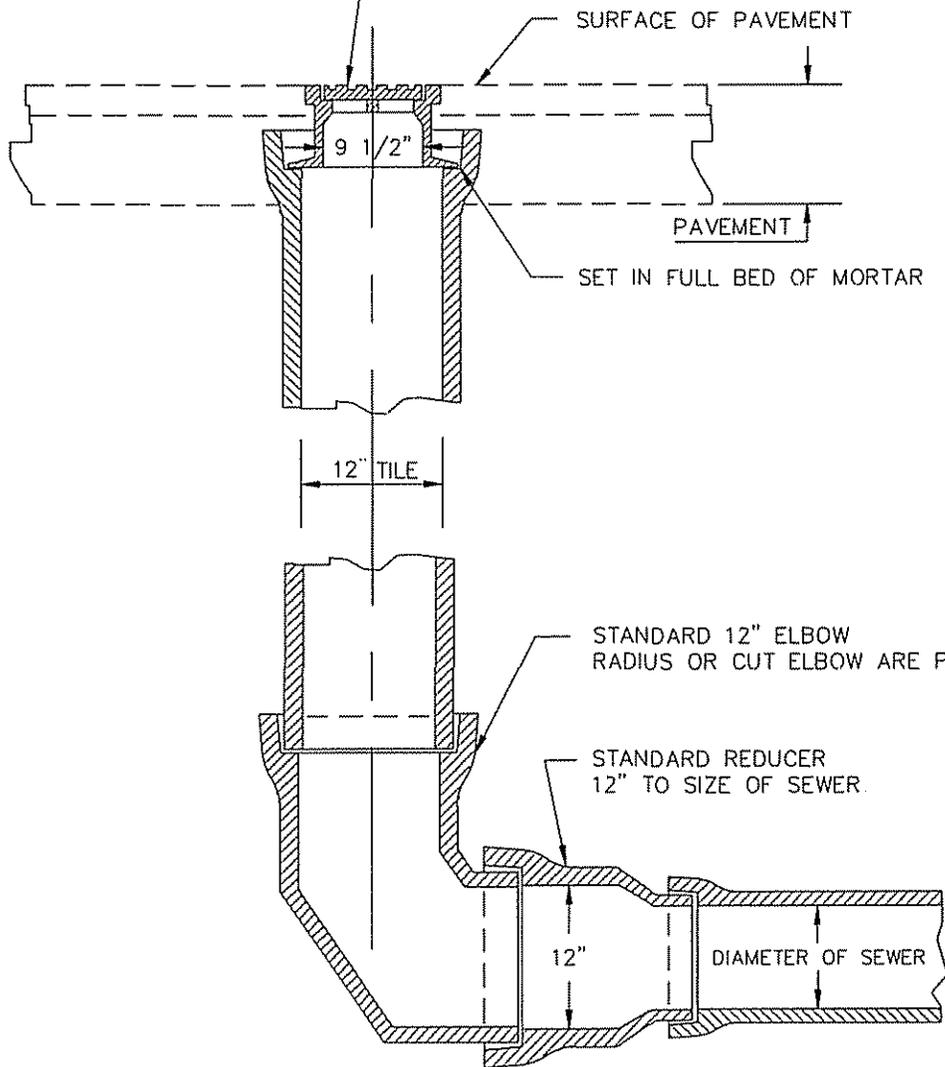
S 9	APPROVED <i>[Signature]</i> 3/23/93	CITY ENGINEER	DATE
	DRYER P.M.H.	CHECKED R.J.B.	

**RESERVED**

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

<b>S</b> <b>10</b>	APPROVED	
	CITY ENGINEER	DATE
	DRAWN	CHECKED

STANDARD CAST IRON  
LAMP HOLE RING AND COVER



STANDARD 12" ELBOW  
RADIUS OR CUT ELBOW ARE PERMITTED.

STANDARD REDUCER  
12" TO SIZE OF SEWER.

12"

DIAMETER OF SEWER

NOTES

- 1 EITHER CLAY TILE OR CONCRETE PIPE WAS PERMITTED IN THIS STRUCTURE
- 2 CAST IRON LAMP HOLE RING AND COVER SHALL BE NEENAH #R-1973-1, U.S. CAST IRON PIPE AND FOUNDRY CO. NO. 301, OR APPROVED EQUAL
- 3 ALL JOINTS SHALL BE MADE AS SPECIFIED FOR SEWER JOINTS THE PIPE BELL CONTAINING THE CAST IRON RING SHALL BE COMPLETELY FILLED WITH THE JOINTING MATERIALS AS SHOWN IN DRAWING.
- 4 WHEN EXISTING LAMP HOLES ARE FOUND, THE DESIRED METHOD OF ABANDONMENT IS TO PLACE A STANDARD MANHOLE AS A REPLACEMENT

**NOTE:**

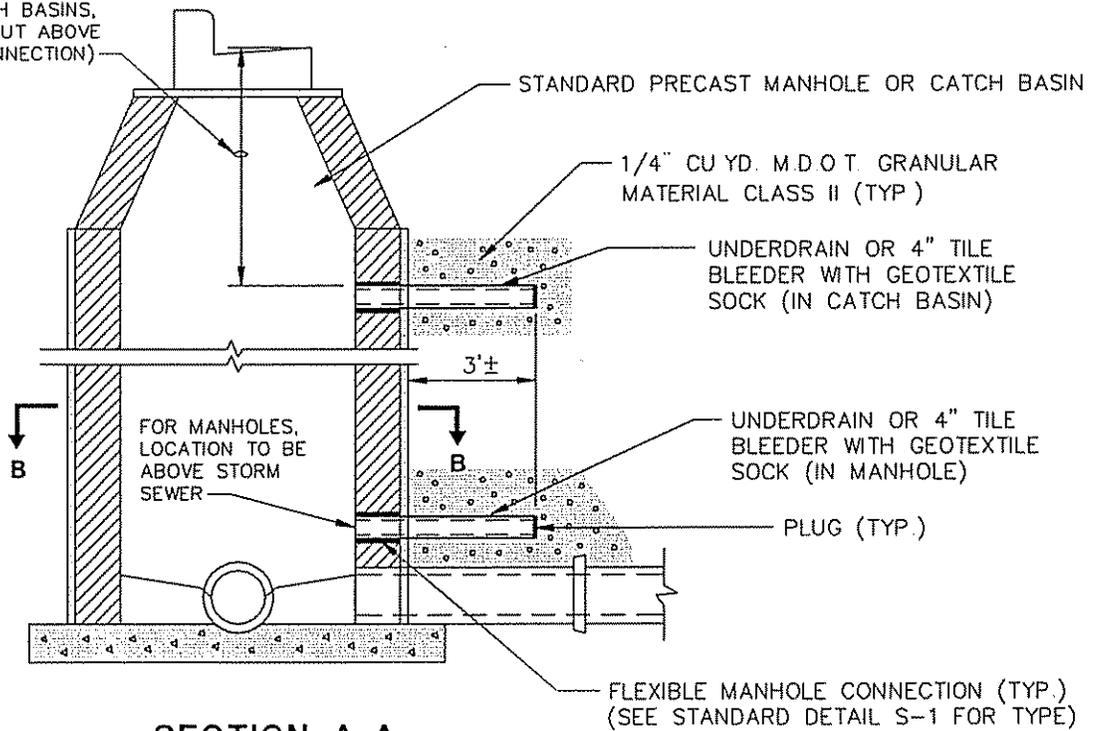
**FOR INFORMATION ONLY:  
NOT FOR CONSTRUCTION UNLESS  
SPECIFICALLY CALLED FOR ON  
DRAWING OR SPECIFICATIONS.**

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**LAMP HOLE**

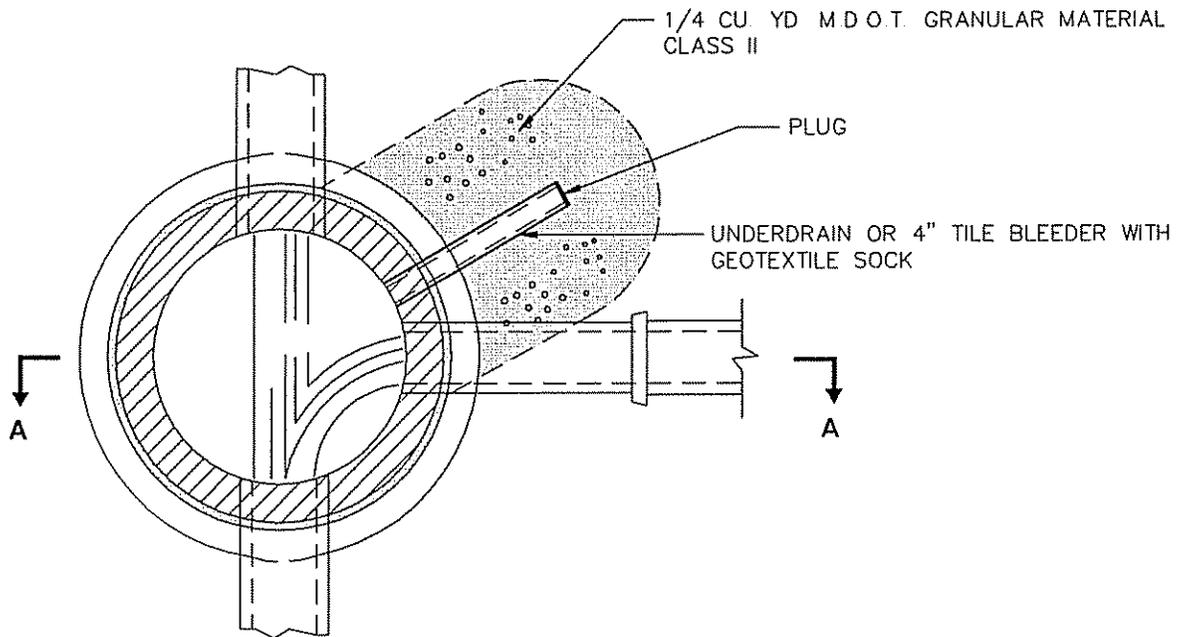
<b>S</b> <b>11</b>	APPROVED <i>[Signature]</i> CITY ENGINEER	DATE 3/23/93
	DRAWN P.M.H.	CHECKED R.J.B.

FOR CATCH BASINS,  
3'-0"± (BUT ABOVE  
BASIN CONNECTION)



**SECTION A-A**

NO SCALE



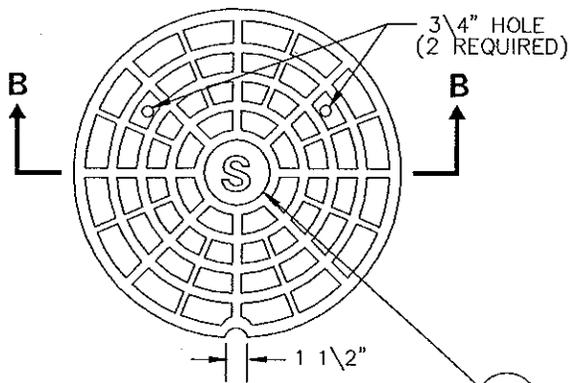
**SECTION B-B**

NOTE:  
TILE BLEEDERS ARE REQUIRED FOR ALL  
CATCH BASINS AND STORM MANHOLES  
UNLESS UNDERDRAIN IS PROVIDED PER  
STANDARD DETAIL P-6

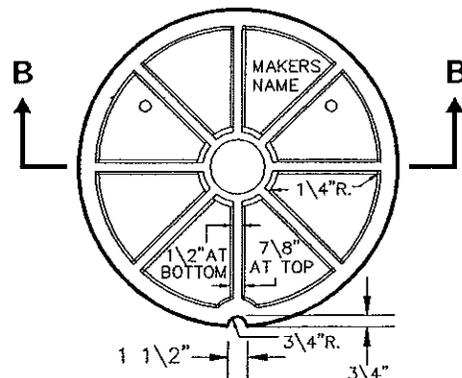
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**TILE BLEEDER  
IN  
STORM MANHOLE  
OR  
CATCH BASIN**

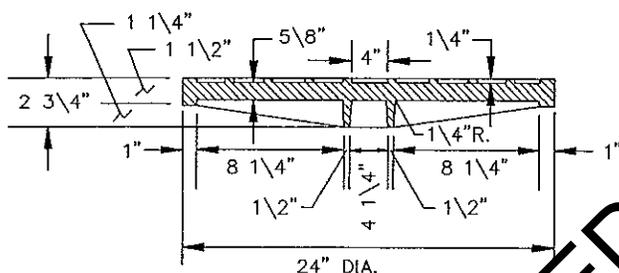
S 12	APPROVED <i>James Homtack</i> 3/23/93 CITY ENGINEER	DATE
	DRAWN P.M.H.	CHECKED R.J.B.



TOP COVER

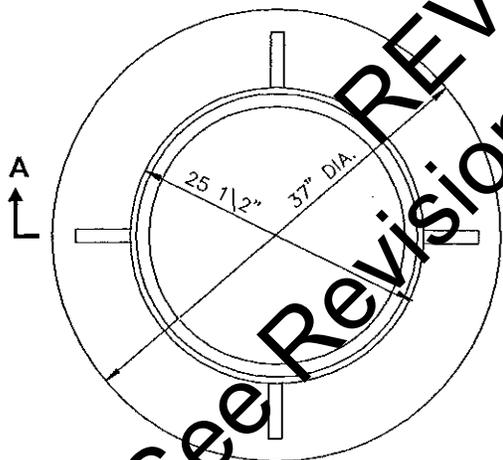


BOTTOM COVER

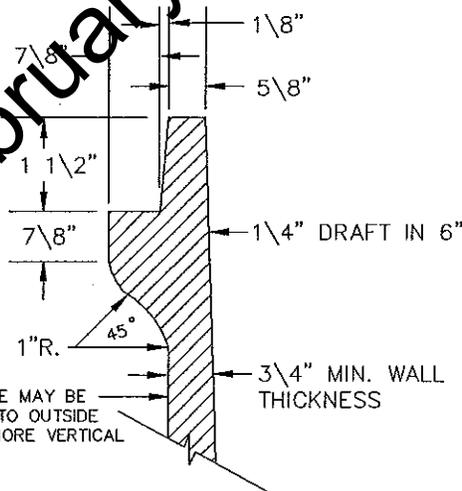


COVER SECTION B-B

"S" IS FOR SEWER AND  
"W" IS FOR WATER MH

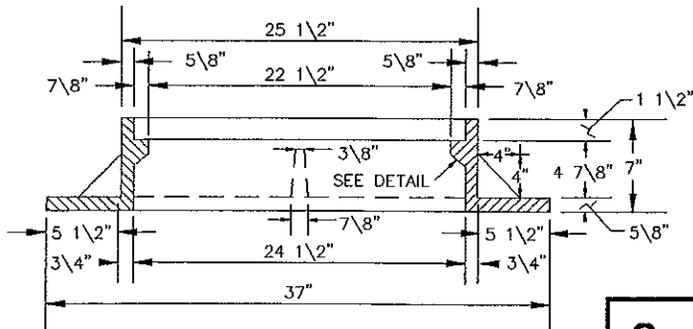


FRAME PLAN VIEW



HALF SIZE SEAT DETAIL

NOTE:  
USE EAST JORDAN #1120 TYPE C  
OR NEENAH #R 1764 OR APPROVED EQUAL

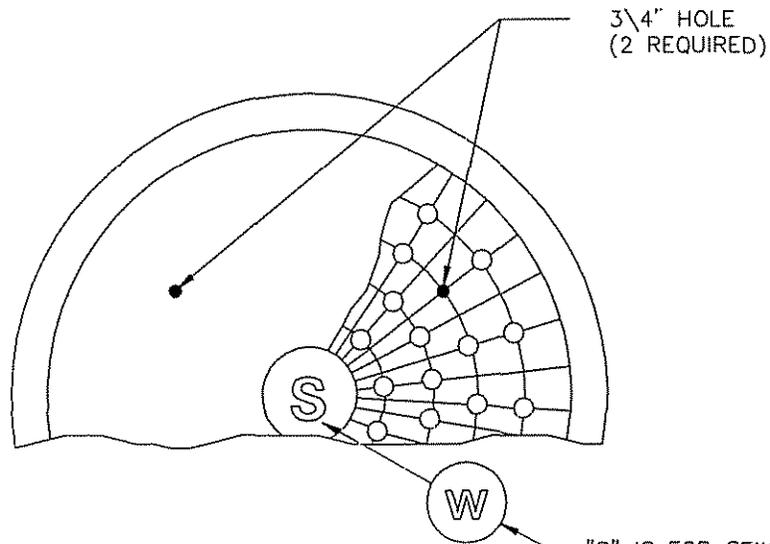


FRAME SECTION A-A

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

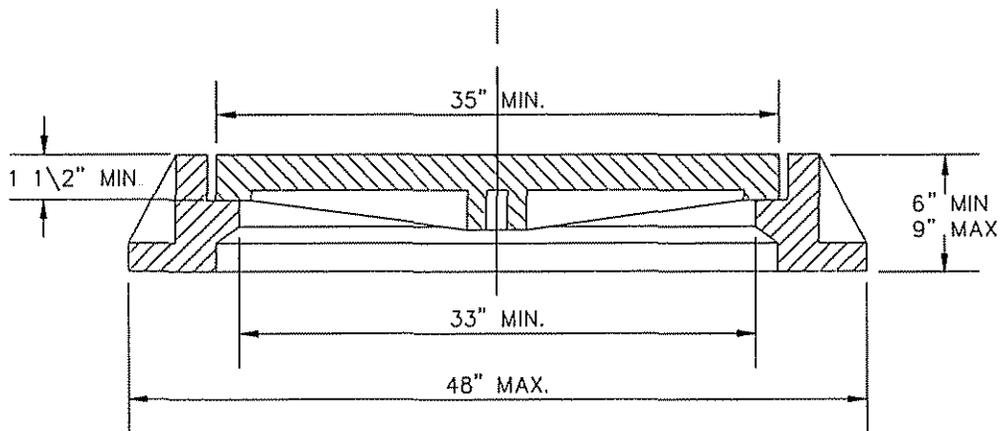
**24"**  
**MANHOLE**  
**CASTING**

<b>S</b> <b>13</b>	APPROVED <i>[Signature]</i> 3/23/93	CITY ENGINEER	DATE
	DRAWN P.M.H.	CHECKED V.U.	



TOP COVER

"S" IS FOR SEWER AND  
"W" IS FOR WATER MH



COVER SECTION

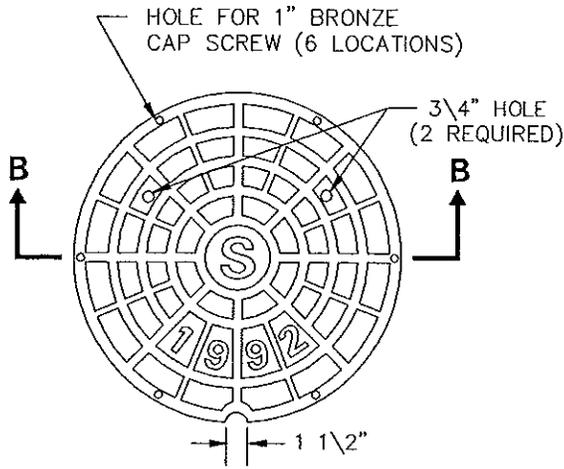
NOTES:

- 1 EAST JORDAN #1330A, NEENAH #R-1251 OR APPROVED EQUAL
2. PLACE MANUFACTURER'S NAME ON BACK SIDE OF COVER

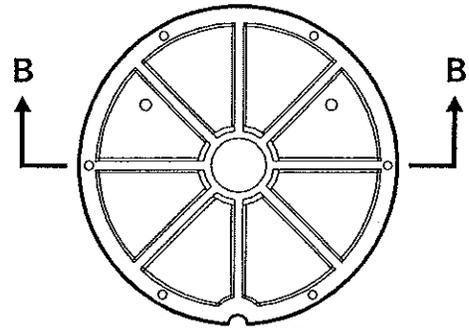
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**35"  
MANHOLE  
CASTING**

<b>S</b> <b>13A</b>	APPROVED <i>[Signature]</i> CITY ENGINEER	DATE 3/23/93
	DRAWN P.M.H.	CHECKED V.U.

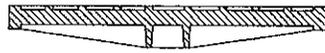


TOP



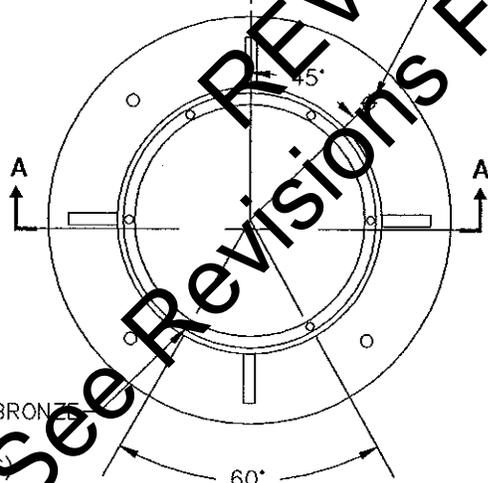
BOTTOM

COVER TO EXTEND ONE FOOT ABOVE GRADE IN FLOOD PLAIN AREAS

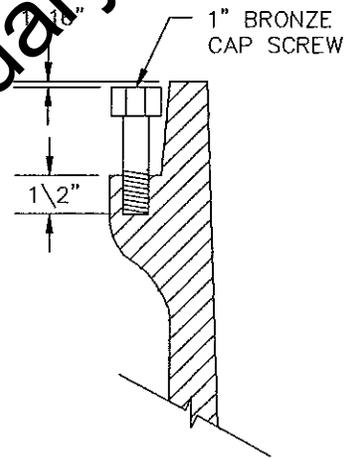


SECTION B-B

CASTING TO BE ANCHORED TO MANHOLE WITH 4 ANCHOR BOLTS



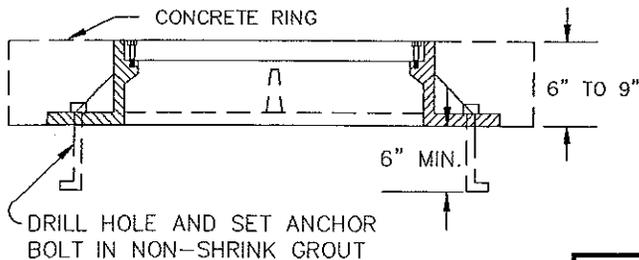
PLAN



HALF SIZE SEAT DETAIL

MIN. OF 3 BRONZE CAP SCREWS REQUIRED FOR EACH CASTING

ALL OTHER DETAILS AND DIMENSIONS ARE SHOWN ON DRAWING FOR STANDARD 24" MANHOLE CASTINGS.



SECTION A-A

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

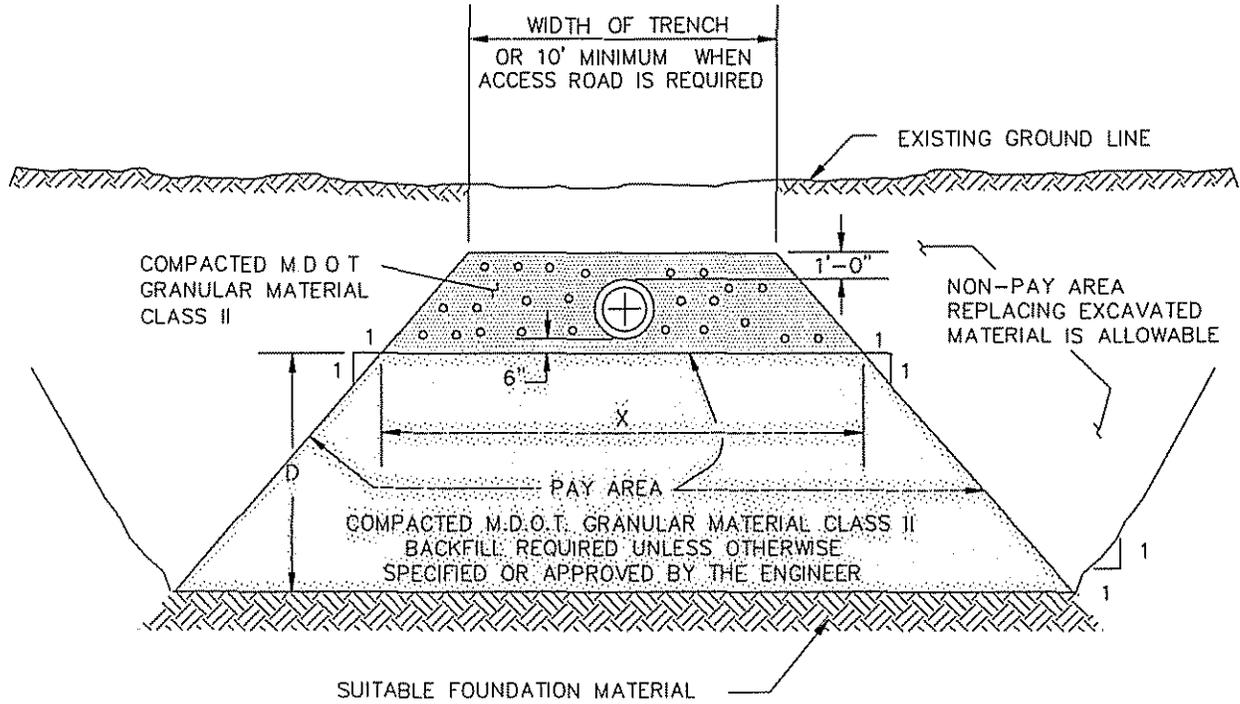
**MANHOLE CASTING  
BOLT DOWN COVER**

S 14	APPROVED <i>[Signature]</i> 3/23/93 CITY ENGINEER DATE	
	DRAWN P.M.H.	CHECKED R.J.B.

## UNSTABLE SOIL REMOVAL PAY AREA

$$VOL = L(X+D)D/27$$

- L = LENGTH OF THE UNSUITABLE AREA (IN FEET)  
 X = WIDTH OF TRENCH + 2(1.5+DIA. OF PIPE) (IN FEET)  
 D = DEPTH FROM INVERT OF PIPE TO THE SUITABLE FOUNDATION  
 LESS 6" (IN FEET)



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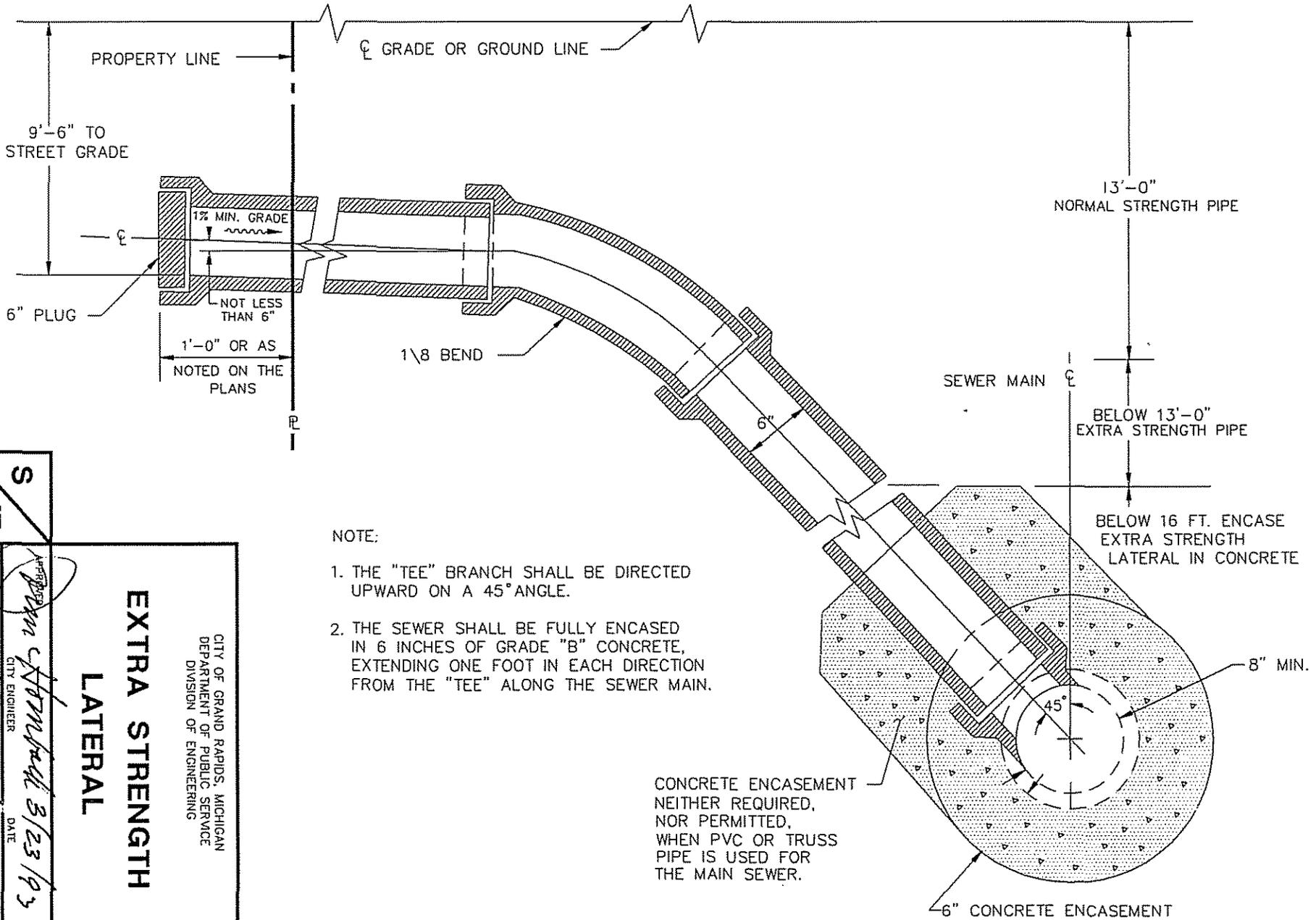
## UNSTABLE SOIL REMOVAL FOR UTILITY

S 15	APPROVED <i>[Signature]</i> <span style="float: right;">3/23/93</span>	CITY ENGINEER	DATE
	DRAWN P.M.H.	CHECKED R.J.B.	

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S 16	APPROVED	
	CITY ENGINEER	DATE
	DRAWN	CHECKED



- NOTE:
1. THE "TEE" BRANCH SHALL BE DIRECTED UPWARD ON A 45° ANGLE.
  2. THE SEWER SHALL BE FULLY ENCASED IN 6 INCHES OF GRADE "B" CONCRETE, EXTENDING ONE FOOT IN EACH DIRECTION FROM THE "TEE" ALONG THE SEWER MAIN.

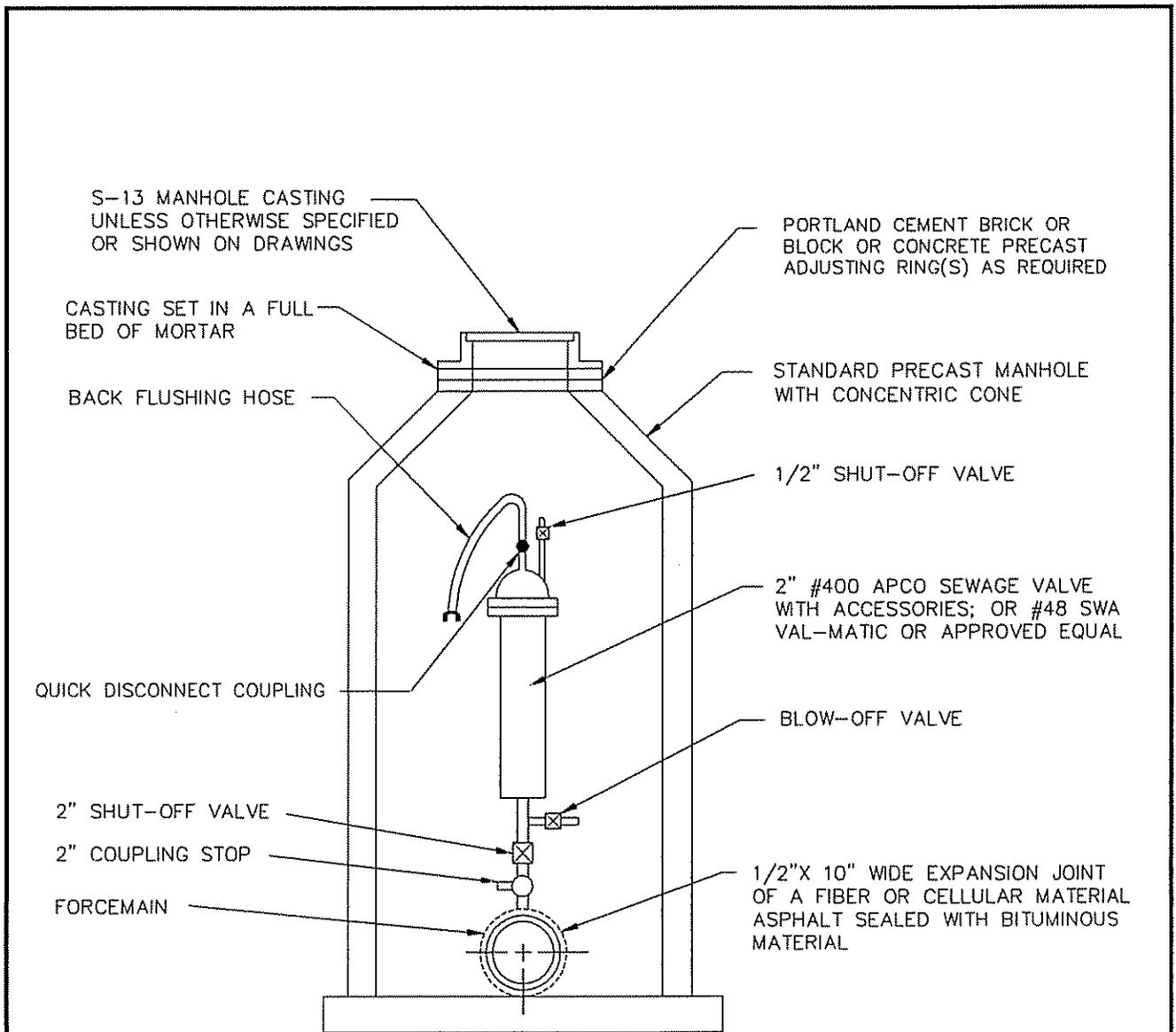
S  
17

DR. *[Signature]*  
P.M.H.  
CITY ENGINEER

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**EXTRA STRENGTH  
LATERAL**

CHECKED R.J.B.  
DATE 3/23/93



S-13 MANHOLE CASTING  
UNLESS OTHERWISE SPECIFIED  
OR SHOWN ON DRAWINGS

PORTLAND CEMENT BRICK OR  
BLOCK OR CONCRETE PRECAST  
ADJUSTING RING(S) AS REQUIRED

CASTING SET IN A FULL  
BED OF MORTAR

STANDARD PRECAST MANHOLE  
WITH CONCENTRIC CONE

BACK FLUSHING HOSE

1/2" SHUT-OFF VALVE

2" #400 APCO SEWAGE VALVE  
WITH ACCESSORIES; OR #48 SWA  
VAL-MATIC OR APPROVED EQUAL

QUICK DISCONNECT COUPLING

BLOW-OFF VALVE

2" SHUT-OFF VALVE

2" COUPLING STOP

FORCEMAIN

1/2" X 10" WIDE EXPANSION JOINT  
OF A FIBER OR CELLULAR MATERIAL  
ASPHALT SEALED WITH BITUMINOUS  
MATERIAL

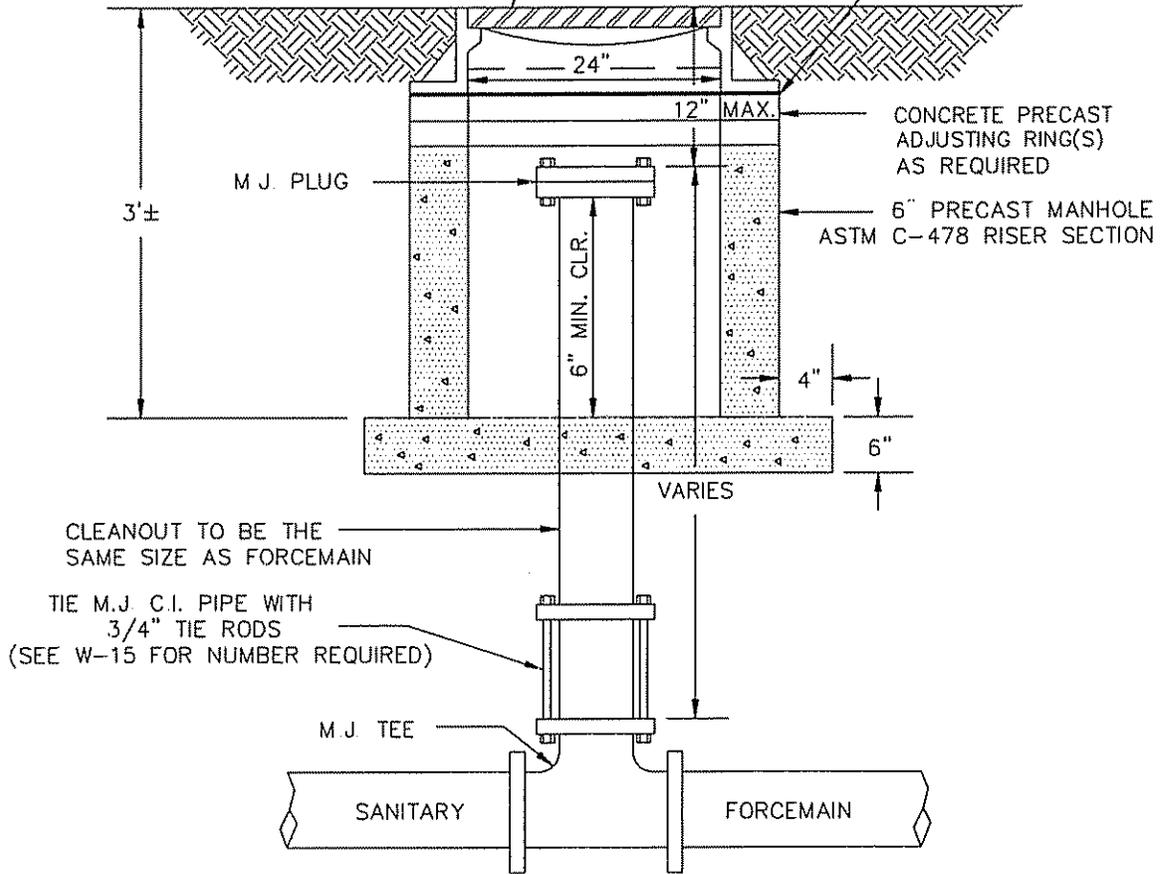
CITY OF GRAND RAPIDS, MICHIGAN  
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DIVISION OF ENGINEERING

## AIR RELIEF VALVE AND CHAMBER

S 18	APPROVE	<i>Jim Armstrong</i> 3/23/93	
	DRAWN	CITY ENGINEER	DATE
	P.M.H.	CHECKED	R.J.B.

S-13 MANHOLE CASTING  
UNLESS OTHERWISE SPECIFIED  
OR SHOWN ON DRAWINGS

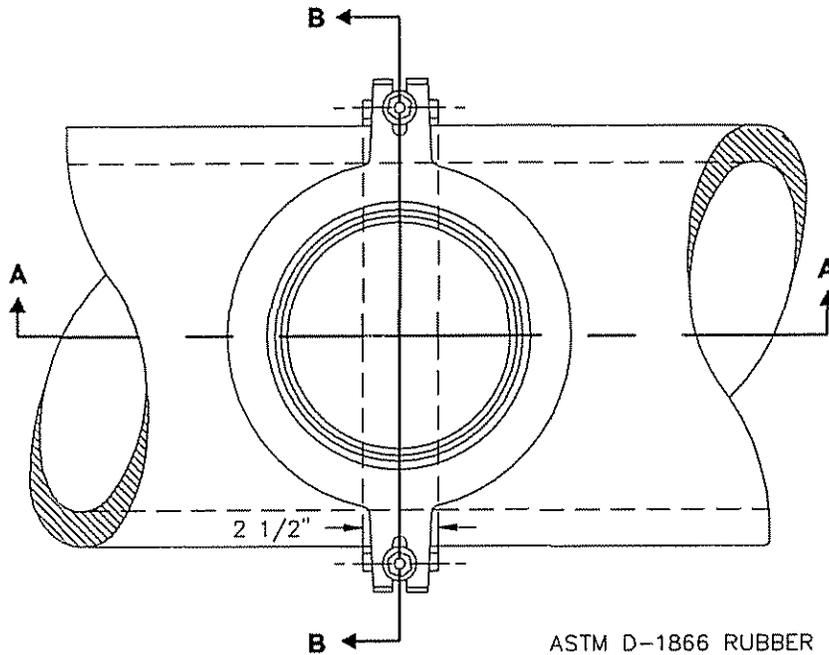
CASTING SET IN A  
FULL BED OF MORTAR



CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

### FORCEMAIN CLEANOUT DETAIL

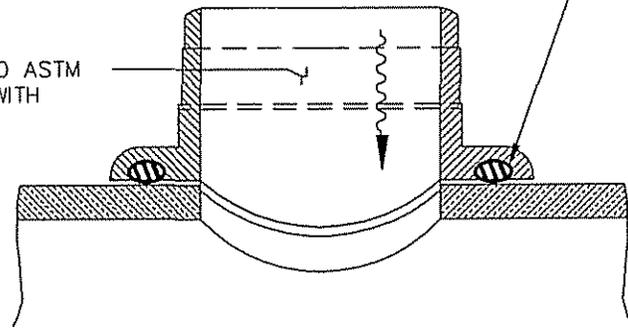
S 19	APPROVED <i>[Signature]</i> 3/23/93	CITY ENGINEER	DATE
	DRAWN P.M.H.	CHECKED R.J.B.	



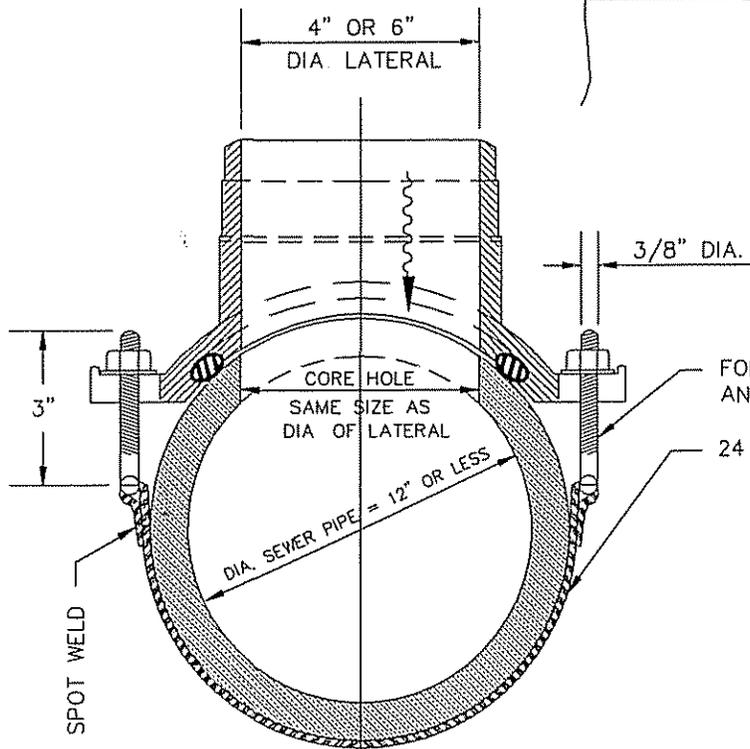
**PLAN VIEW**

CAST IRON SADDLE SHALL CONFORM TO ASTM SPEC A-48 CLASS 35 AND COVERED WITH BLACK ASPHALTUM TYPE PAINT

ASTM D-1866 RUBBER O-RING CEMENTED IN PLACE



**SECTION A-A**



**SECTION B-B**

FORGED SILICON BRONZE T-BOLT, WASHER AND HEX NUT

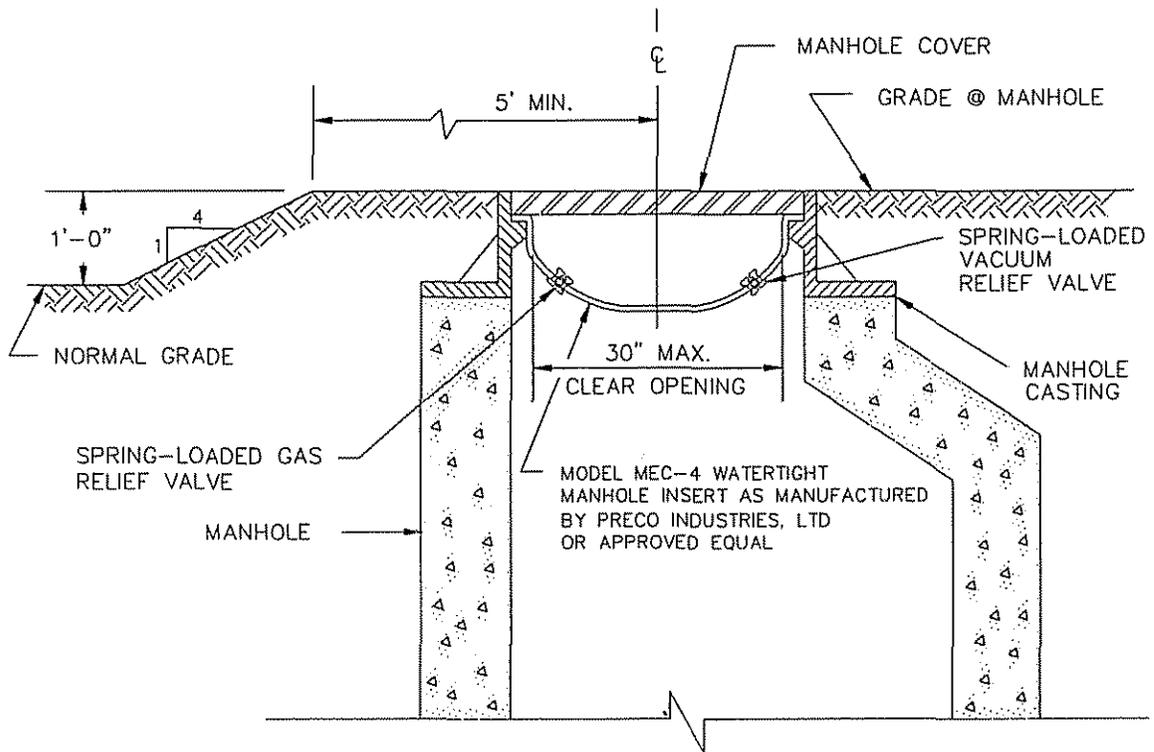
24 GA. STAINLESS STEEL STRAP 2 1/2" WIDE

NOTE: FOR CLAY AND CONCRETE PIPE

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DIVISION OF ENGINEERING

**SEWER SADDLE  
FOR  
12" DIA. OR LESS  
SEWER**

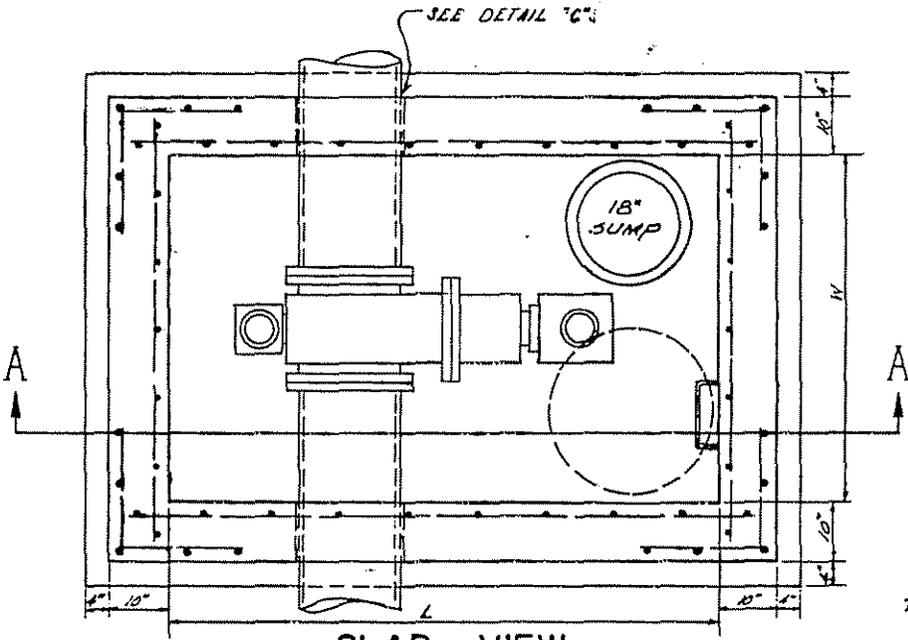
<b>S</b> <b>20</b>	APPROVED	<i>[Signature]</i> 3/23/93
	CITY ENGINEER	DATE
DRAWN	CHECKED	
P.M.H.	R.J.B.	



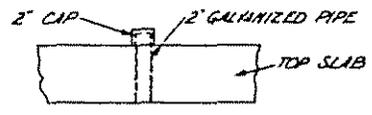
CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

## WATERTIGHT MANHOLE INSERT

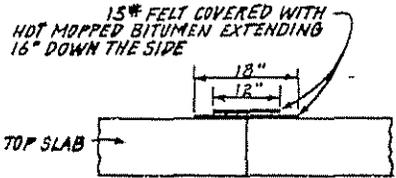
<b>S</b> <b>21</b>	APPROVED <i>[Signature]</i> CITY ENGINEER	DATE 3/23/97
	DRAWN P.M.H.	CHECKED R.J.B.



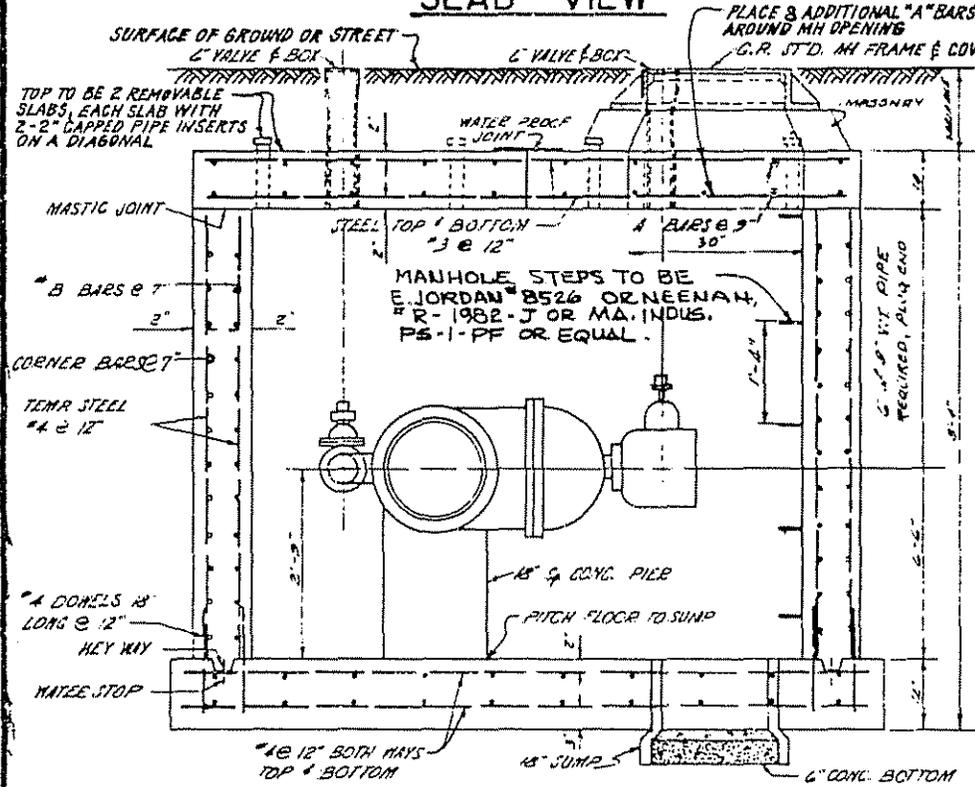
**SLAB VIEW**



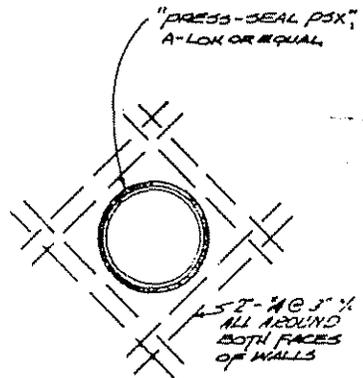
**DETAIL OF PIPE SLEEVE**



**DETAIL OF WATERPROOF JOINT**



**SECTION A-A**



**DETAIL C**

**NOTE:**  
GRADE "A" CONCRETE TO BE USED IN CHAMBER.

**NOTE:**  
FOR INFORMATION ONLY. NOT FOR CONSTRUCTION UNLESS SPECIFICALLY CALLED FOR ON DRAWINGS OR SPECIFICATIONS!!

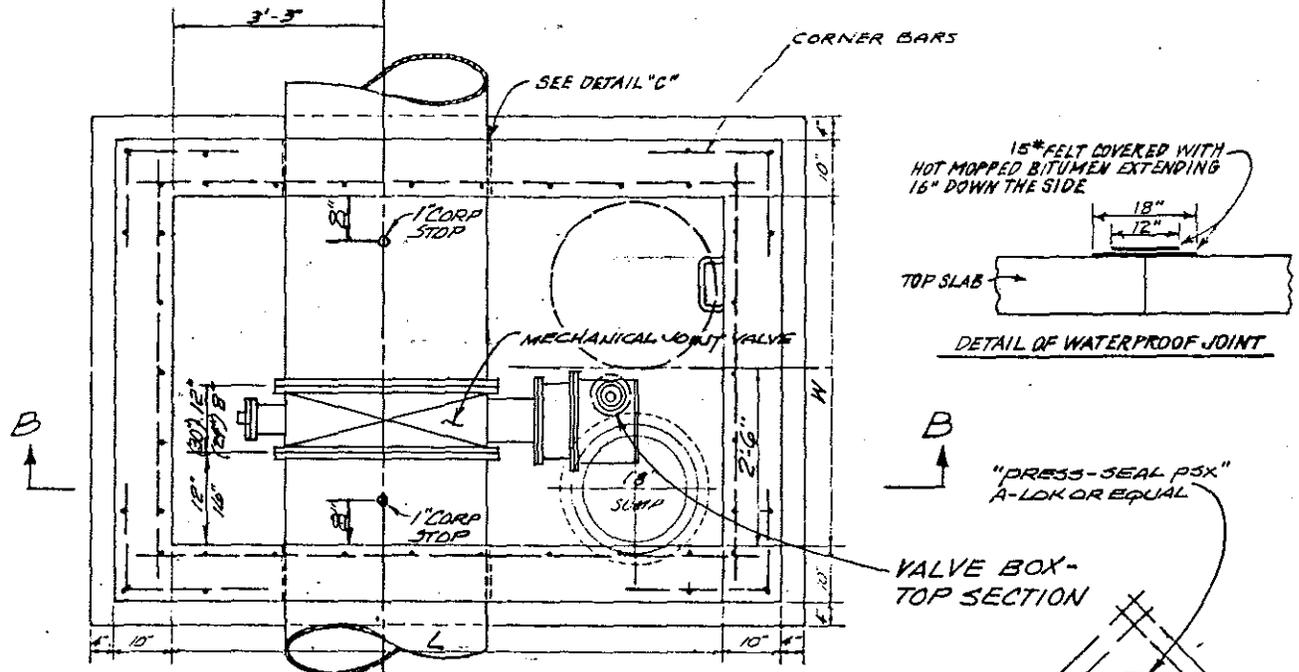
DIMENSIONS					
VALVE SIZE	16"	20"	24"	30"	36"
L	8'-0"	9'-0"	10'-0"	12'-0"	13'-0"
W	5'-6"	5'-6"	6'-0"	7'-0"	8'-0"
STEEL REQUIREMENTS					
#7 BAR SIZE	#5	#6	#6	#7	#8
#8 BAR SIZE	#3	#4	#5	#6	#6
CORNER BAR SIZE	#3	#4	#5	#6	#6
SHORT LEG LENGTH	1'-4"	1'-6"	1'-9"	2'-0"	2'-0"
LONG LEG LENGTH	2'-0"	2'-6"	3'-0"	3'-0"	3'-6"

CITY OF GRANDS RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**VALVE CHAMBER  
FOR 16" TO 36"  
GATE VALVES**

APPROVED: *John J. Lambach*  
DATE: 2/7/69  
CITY ENGINEER

DESIGNED BY: NSM  
CHECKED BY: J.L.H.

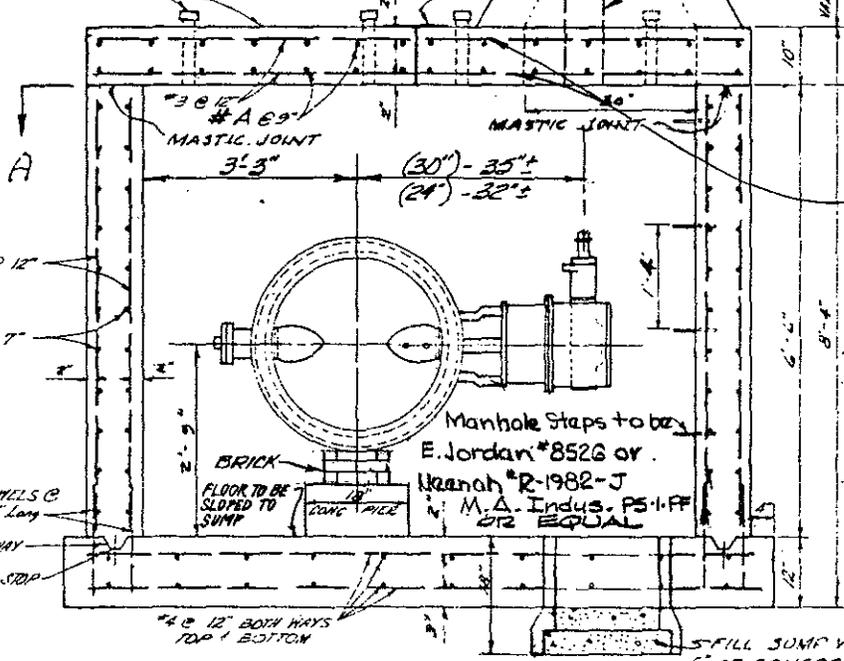


**SECTION A-A**

**VALVE BOX - TOP SECTION**

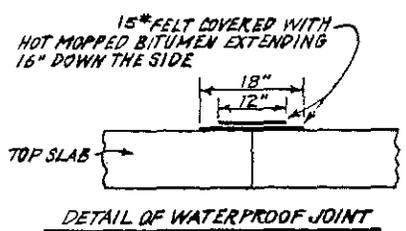
TOP TO BE 2 REMOVABLE SLABS, EACH SLAB WITH 2" CAPPED PIPE INSERTS ON A DIAGONAL

G.R. SEE MANHOLE FRAME & COVER S-13 SET IN FULL BED OF MASTIC WATERPROOF JOINT SURFACE OF GROUND OR STREET

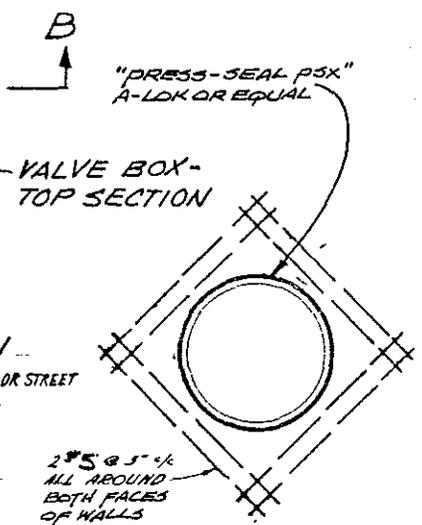


**SECTION B-B**

NOTE. PLACE 8 ADDITIONAL #5 BARS 4" LONG AROUND MANHOLE OPENING.



**DETAIL OF WATERPROOF JOINT**



**DETAIL C**

**NOTE:**  
FOR INFORMATION ONLY. NOT FOR CONSTRUCTION UNLESS SPECIFICALLY CALLED FOR ON DRAWINGS OR SPECIFICATIONS!!

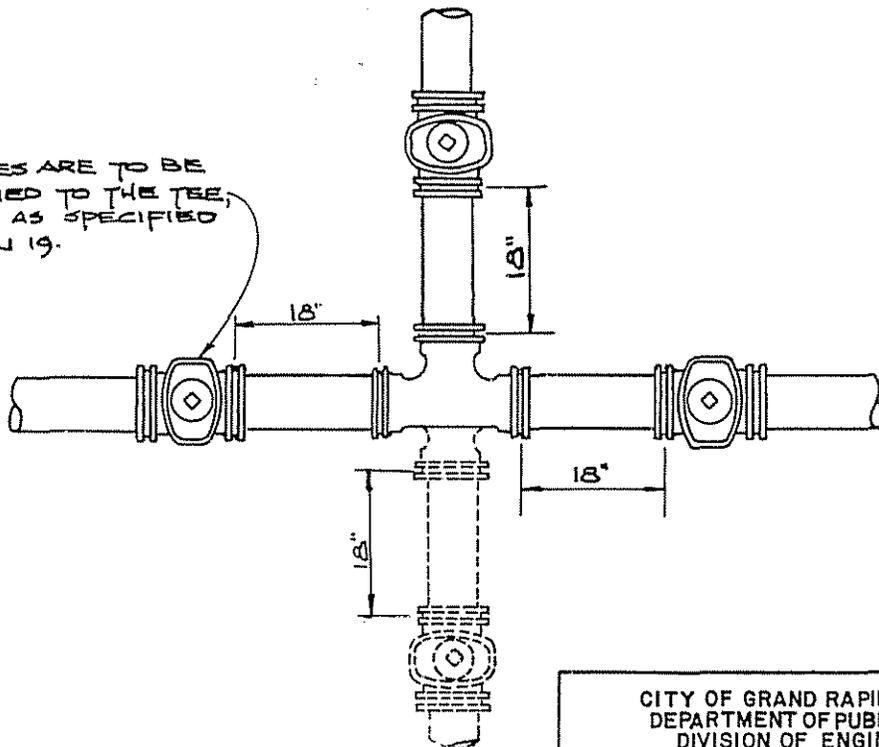
DIMENSIONS			
VALVE SIZE	24"	30"	36"
W	10'-0"	12'-0"	13'-0"
L	6'-0"	7'-0"	8'-0"
STEEL REQUIREMENTS			
#A BAR SIZE	#6	#7	#8
#B BAR SIZE	#5	#6	#6
CORNER BAR SIZE	#5	#6	#6
SHORT LEG LENGTH	1'-9"	2'-0"	2'-0"
LONG LEG LENGTH	2'-9"	3'-0"	3'-6"

CITY OF GRANDS RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**VALVE CHAMBER**  
24", 30" AND 36"  
**BUTTERFLY VALVE**

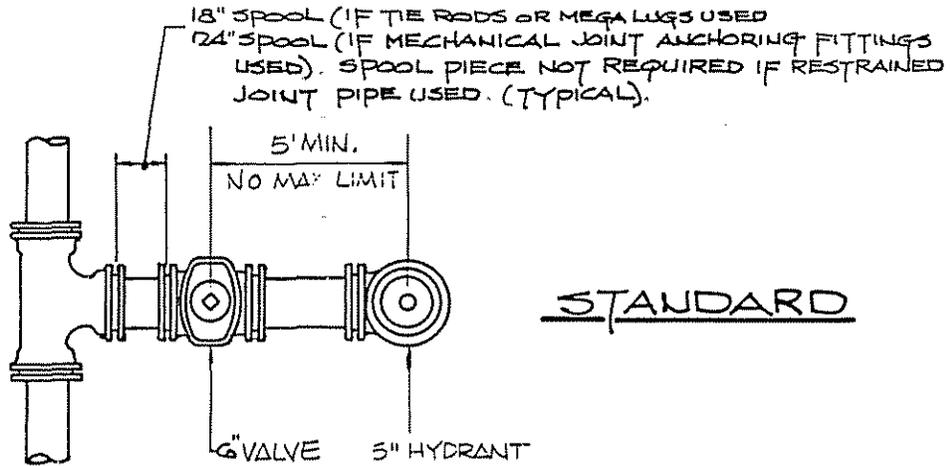
APPROVED: *John J. Gorman*  
DATE: 2/1/69  
DESIGN BY: NBB  
TRACED BY: NSM  
CHECKED BY: JLH  
CITY ENGINEER

ALL VALVES ARE TO BE RESTRAINED TO THE TEE, OR CROSS, AS SPECIFIED IN DIVISION 19.

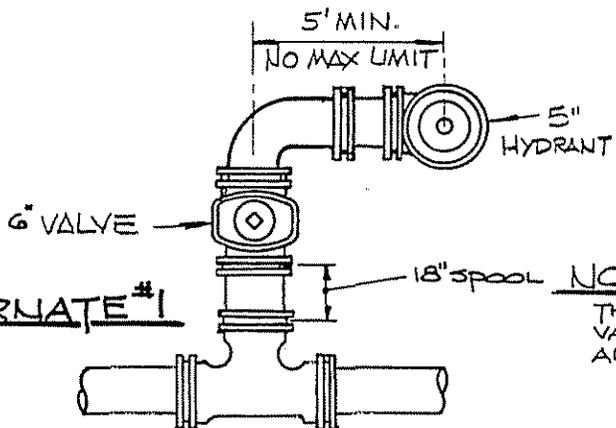


CITY OF GRAND RAPIDS MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING  
 VALVE LOCATION  
 AT  
 INTERSECTION  
 OF  
 WATERMAINS

W 3	APPROVED <i>J. C. Hornum</i> CITY ENGINEER	DATE 7/10/85
	DRAWN H.W.	CHECKED <i>V.L.</i>

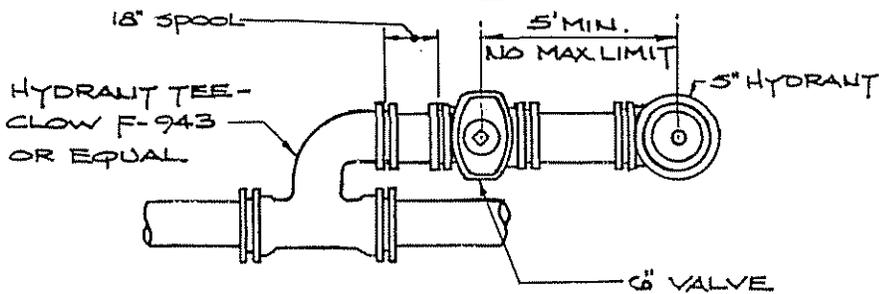


STANDARD



ALTERNATE #1

NOTE:  
THE DISTANCE FROM THE TEE TO THE VALVE WILL VARY WITH THE RESTRAINT ALTERNATIVE BEING USED.



ALTERNATE #2

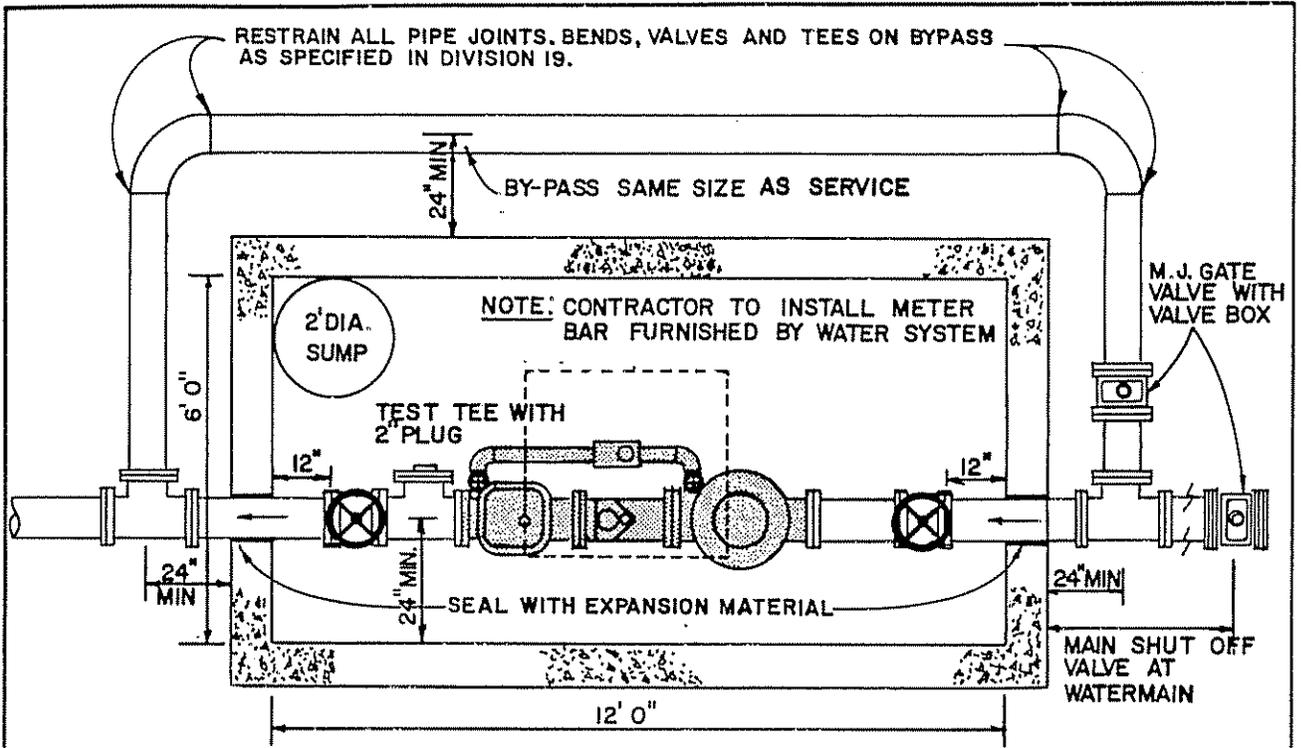
NOTE:

1. JOINT RESTRAINT SHALL BE AS SPECIFIED IN DIVISION 19.
2. IF TIE RODS ARE USED FOR JOINT RESTRAINT, SEE TABLE III IN DIVISION 19 FOR NUMBER OF TIE RODS REQUIRED PER JOINT. ALSO, SEE TIE ROD DETAIL ON STANDARD DETAIL W-15.

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

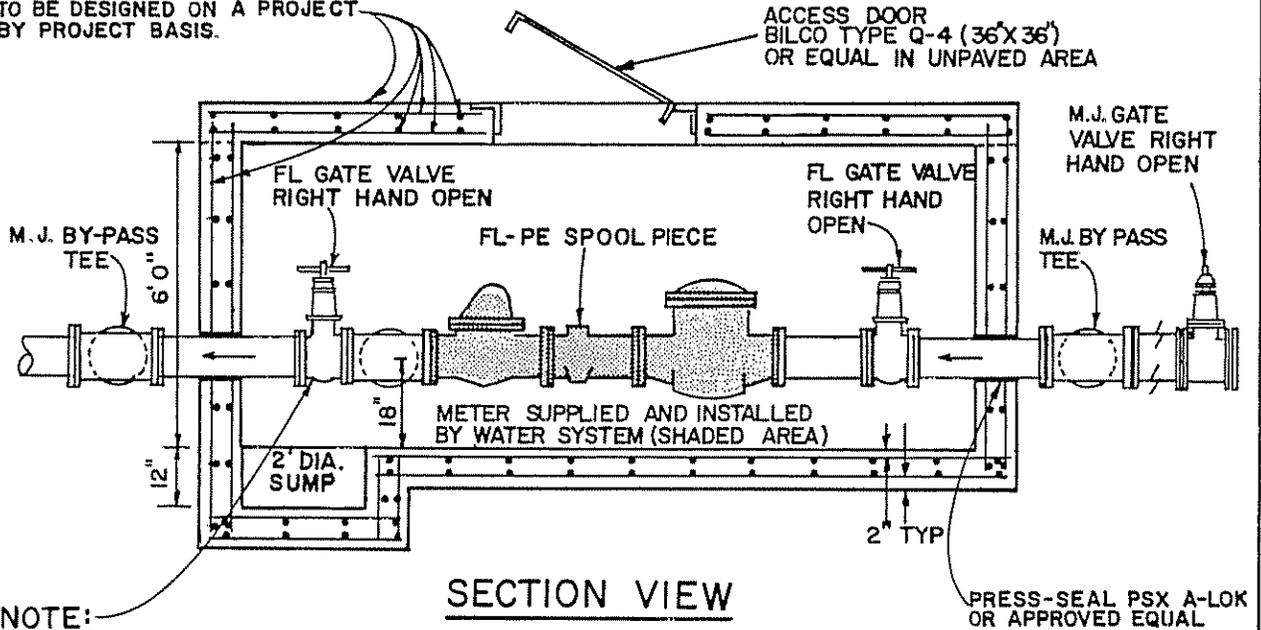
HYDRANT  
INSTALLATION

W 4	APPROVED <i>Jim Hornbach</i> CITY ENGINEER	DATE 7/10/85
	DRAWN HW	CHECKED VU.



**PLAN VIEW**

SCHEMATIC STRUCTURE SHOWN. TOP SLAB, WALLS, FLOOR THICKNESS AND REINFORCING STEEL TO BE DESIGNED ON A PROJECT BY PROJECT BASIS.



**SECTION VIEW**

**NOTE:**

VALVES SHALL BE RESTRAINED IN ACCORDANCE WITH THE REQUIREMENTS FOR PLUGS, BASED ON THE SIZE OF THE WATERMAIN ENTERING THE CHAMBER AS SPECIFIED IN DIVISION 19.

**FOR INFORMATION ONLY:**

NOT FOR CONSTRUCTION UNLESS SPECIFICALLY CALLED FOR ON DRAWINGS OR SPECIFICATIONS.

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**METER SETTING FOR 3" & LARGER METERS AND PIT LAYOUT FOR COMPOUND AND TURBO METERS**

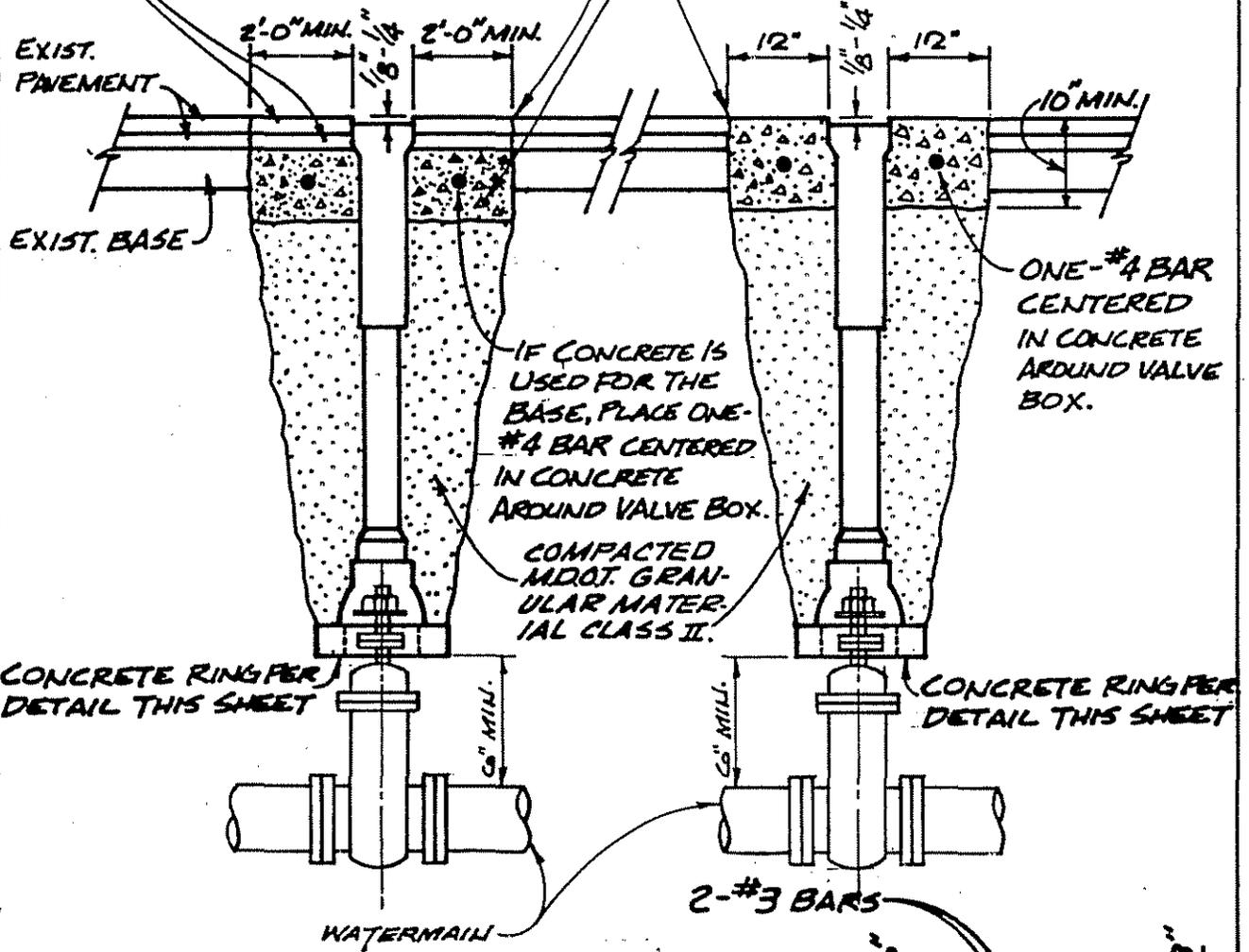
W 5	APPROVED <i>John L. Formball</i> CITY ENGINEER	DATE 3/31/89
	DRAWN J.R.M. CHECKED <i>VJ.</i>	

BITUM. MIXTURE (WEARING COURSE)  
1 1/2" MIN. FOR MAJOR AND LOCAL  
STREETS.

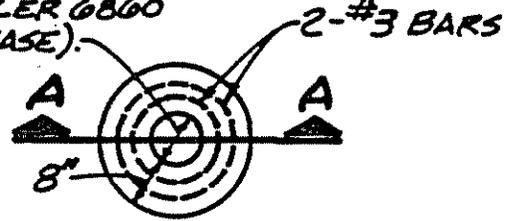
BITUM. MIXTURE (LEVELING  
COURSE) 1 1/2" MIN. FOR MAJOR  
AND LOCAL STREETS.

SAW OR HEAVILY TRIM EDGE WITH  
AIR HAMMER IN A CIRCLE AROUND  
VALVE BOX.

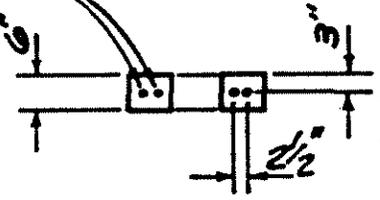
BITUM. BASE MIXTURE, 7" MIN.  
GRAVEL FOR LOCAL STREETS, 8" MIN.  
GRAVEL FOR MAJOR STREETS, 12" MIN.  
CONCRETE, 7" MIN.



DIAMETER TO BE AS  
NEEDED FOR SIZE OF  
VALVE BOX BASE USED  
(9 1/4" FOR TYLER 6860  
SERIES #0 BASE).



**CONCRETE RING DETAIL**



CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**VALVE BOX  
INSTALLATION  
FOR GATE VALVES**

APPROVED *[Signature]* 3/23/93  
CITY ENGINEER DATE

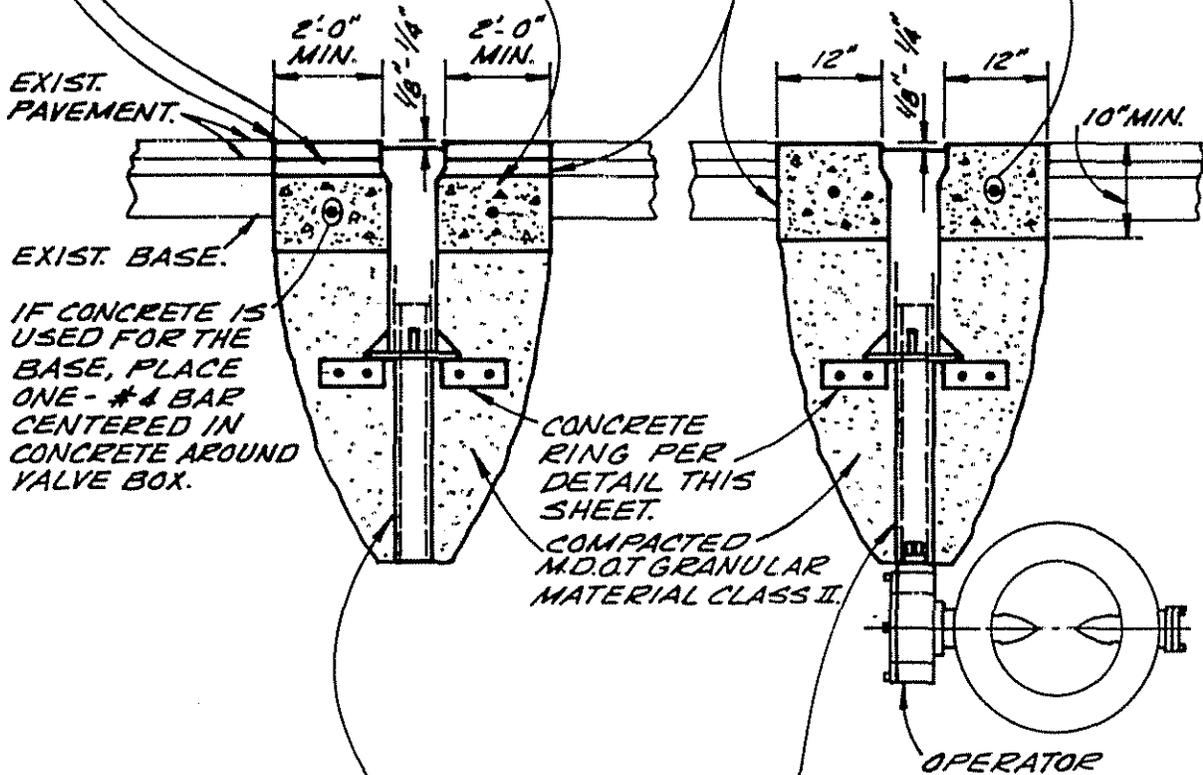
DRAWN P.P. CHECKED

W  
6

BITUM. MIXTURE (WEARING COURSE)  
 1 1/2" MIN. FOR MAJOR AND LOCAL STREETS.  
 BITUM. MIXTURE (LEVELING COURSE)  
 1 1/2" MIN FOR MAJOR AND LOCAL STREETS.  
 BITUM. BASE MIXTURE 7" MIN.  
 GRAVEL FOR LOCAL STREETS 8" MIN.  
 GRAVEL FOR MAJOR STREETS 12" MIN.  
 CONCRETE 7" MIN.

SAW OR NEATLY TRIM EDGE  
 WITH AIR HAMMER IN A  
 CIRCLE AROUND VALVE BOX.

ONE - #4 BAR CENTERED  
 IN CONCRETE AROUND  
 OPENING.



EXIST. PAVEMENT.

EXIST. BASE.

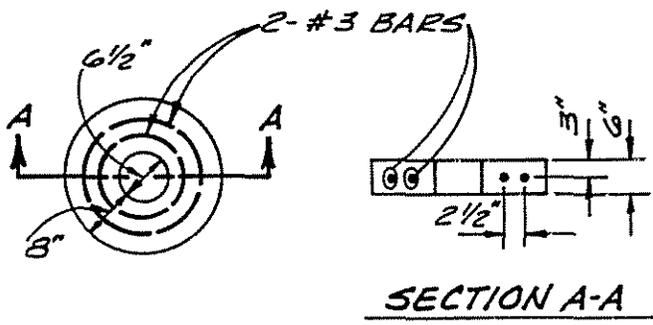
IF CONCRETE IS  
 USED FOR THE  
 BASE, PLACE  
 ONE - #4 BAR  
 CENTERED IN  
 CONCRETE AROUND  
 VALVE BOX.

CONCRETE  
 RING PER  
 DETAIL THIS  
 SHEET.

COMPACTED  
 M.D.T GRANULAR  
 MATERIAL CLASS II.

OPERATOR

5 1/4" SLIP TOP VALVE BOX  
 (TYLER #6855 SERIES)  
 CUT OFF BOTTOM SECTION OF  
 VALVE BOX ABOVE BELL. THIS  
 BOTTOM SECTION WILL REST  
 ON THE TOP OF THE BUTTERFLY  
 VALVE OPERATOR.



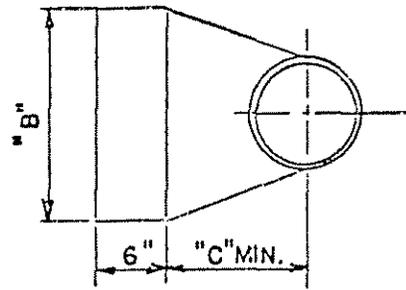
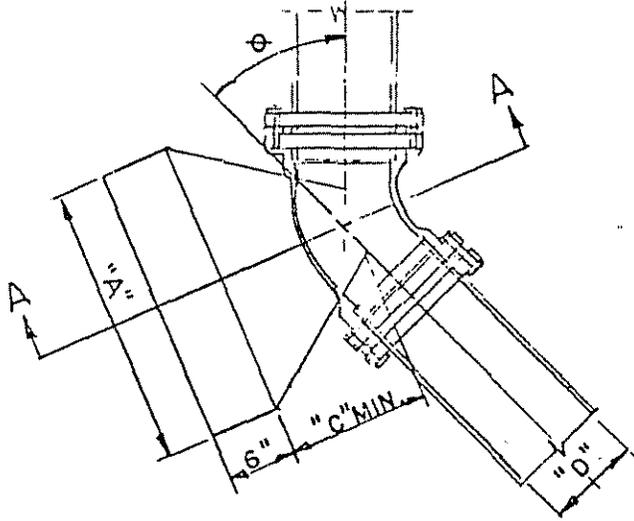
CONCRETE RING  
 DETAIL

CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

### VALVE BOX INSTALLATION FOR BUTTERFLY VALVES

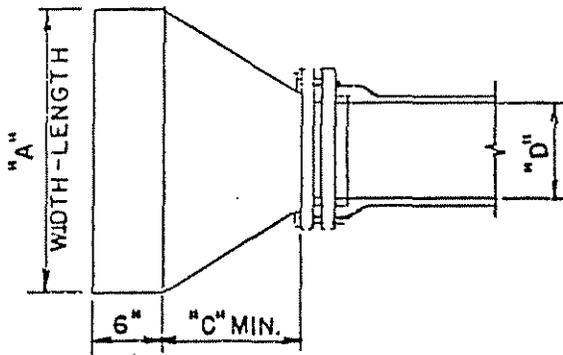
APPROVED: *[Signature]* 3/23/93  
 CITY ENGINEER DATE

W 6A DRAWN: S.J.D. CHECKED

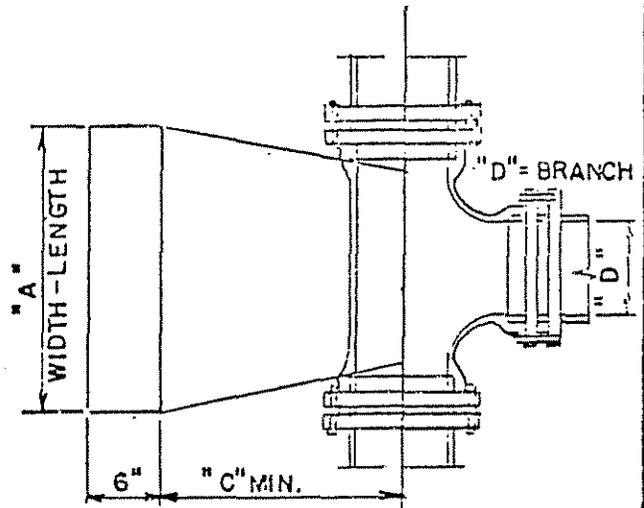


SECTION . A - A

### THRUST BLOCK FOR BENDS



THRUST BLOCK FOR PLUGS



THRUST BLOCK FOR TEES

#### NOTES

1. All concrete in thrust blocks to be grade "A."
2. In areas where adequate backing is not available, the watermain shall be anchored *AS PER SECTION 19.03.14*.
3. FORMING OF THRUST BLOCKS WILL BE AS PER THE TABLE BELOW AND AS REQUIRED BY THE ENGINEER.

W  
7

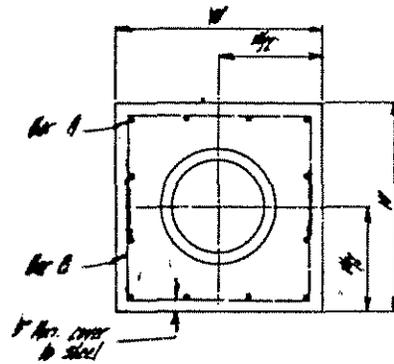
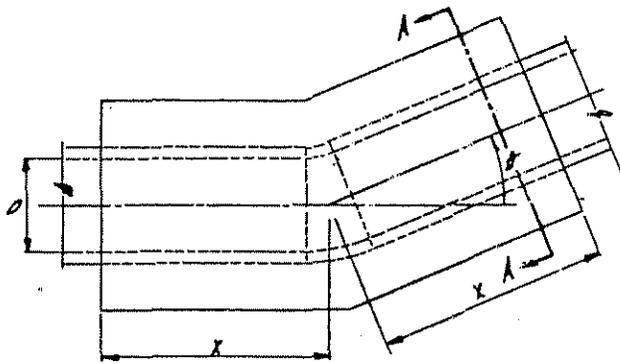
Pipe Dia. D	DIMENSIONS							
		For Bends			For Plugs		For Tees	
	A	B	C	A	C	A	C	
15"	90° 5'-6"	4'-0"	1'-6"	4'-0"	1'-6"	4'-0"	2'-3"	
	45° 3'-9"	3'-0"	1'-6"					
	22 1/2° 3'-6"	2'-0"	1'-6"					
	11 1/4° 2'-0"	1'-6"	1'-6"					
12"	90° 4'-6"	3'-0"	1'-3"	3'-0"	1'-3"	3'-0"	2'-0"	
	45° 3'-3"	2'-0"	1'-3"					
	22 1/2° 2'-3"	1'-6"	1'-3"					
8"	90° 2'-6"	2'-0"	1'-0"	2'-0"	1'-0"	2'-0"	1'-9"	
	45° 2'-0"	1'-6"	1'-0"					
6"	90° 2'-3"	1'-6"	0'-9"	1'-6"	0'-9"	1'-6"	1'-6"	

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

### THRUST BLOCK DETAILS FOR CAST & DUCTILE IRON PIPE

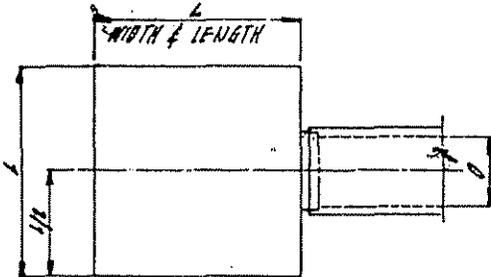
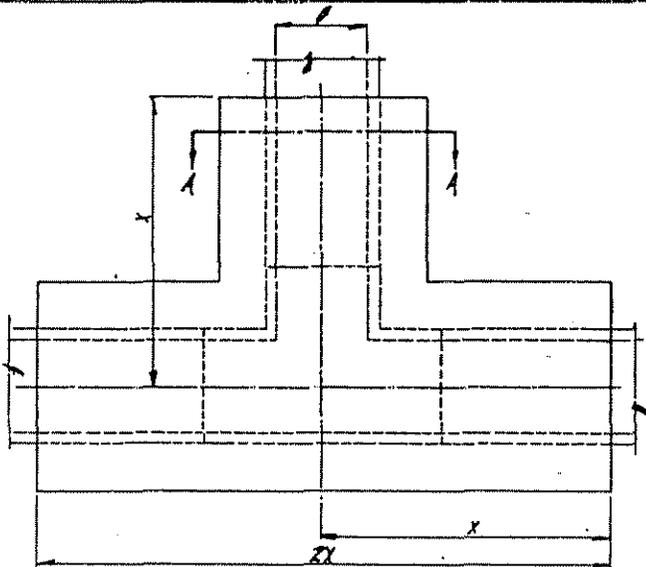
APPROVED: *John J. Hombach*  
DATE: 2-7-69 CITY ENGINEER

DRAWN: NBB      TRACED: PPO      CHECKED: JLH



SECTION A-A

ENCASEMENTS FOR BENDS



DIMENSIONS	
D	L
24"	6'-0"
30"	7'-6"
36"	8'-6"

ENCASEMENTS FOR TEES

THRUST BLOCKS FOR PLUGS

NOTES

- All concrete in encasements to be grade "A".
- For deflection angles not listed in table use next highest values.
- On encasements for tees use same dimensions as for D on 60° bends.
- Min. bar lap to be 30 diameters of steel reinforcement bar.
- Bars to be continuous thru angle points and rear to outside of Tee and Cross encasements.

DIMENSIONS

D	θ	X	W	BAR A	BAR B
24"	11 1/4°	2.5'	4.5'	8-#6	4-#14
24"	22 1/2°	3.0'	4.5'	8-#6	4-#14
24"	30°	4.5'	4.5'	8-#6	4-#14
24"	45°	10.0'	4.5'	8-#6	4-#14
24"	60°	12.5'	4.5'	8-#6	4-#14
24"	90°	15.0'	4.5'	8-#6	4-#14
30"	11 1/4°	3.0'	5.5'	11-#6	4-#14
30"	22 1/2°	4.0'	5.5'	11-#6	4-#14
30"	30°	5.0'	5.5'	11-#6	4-#14
30"	45°	10.0'	5.5'	11-#6	4-#14
30"	60°	12.0'	5.5'	11-#6	4-#14
30"	90°	15.0'	5.5'	11-#6	4-#14
36"	11 1/4°	3.5'	6.5'	14-#6	4-#14
36"	22 1/2°	5.0'	6.5'	14-#6	4-#14
36"	30°	7.0'	6.5'	14-#6	4-#14
36"	45°	13.0'	6.5'	14-#6	4-#14
36"	60°	17.0'	6.5'	14-#6	4-#14
36"	90°	24.0'	6.5'	14-#6	4-#14

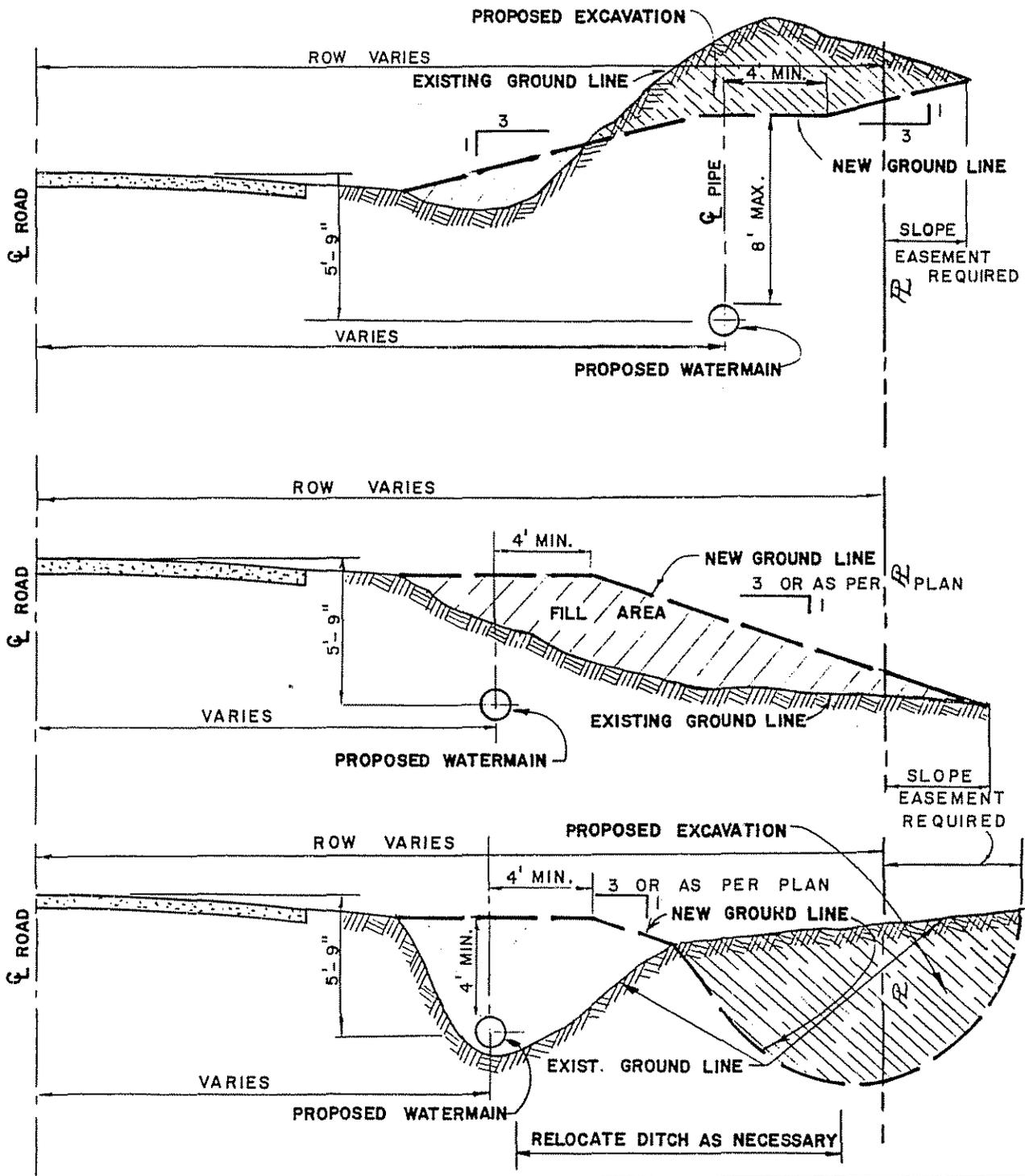
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**ENCASEMENT DETAILS FOR CONCRETE PIPE**

APPROVED: *John J. Hornback*  
DATE: 2-7-69  
CITY ENGINEER

W 8

DRAWN: NBB	TRACED: PPD	CHECKED: JLH
------------	-------------	--------------



SCALE:  
 VERT. 1" = 6'-0"  
 HORZ. 1" = 6'-0"

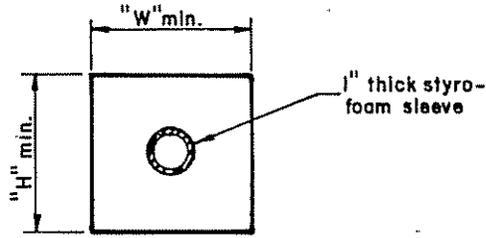
CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

**NORMAL WATERMAIN LOCATION  
 OUTSIDE OF  
 ROADWAY AREAS**

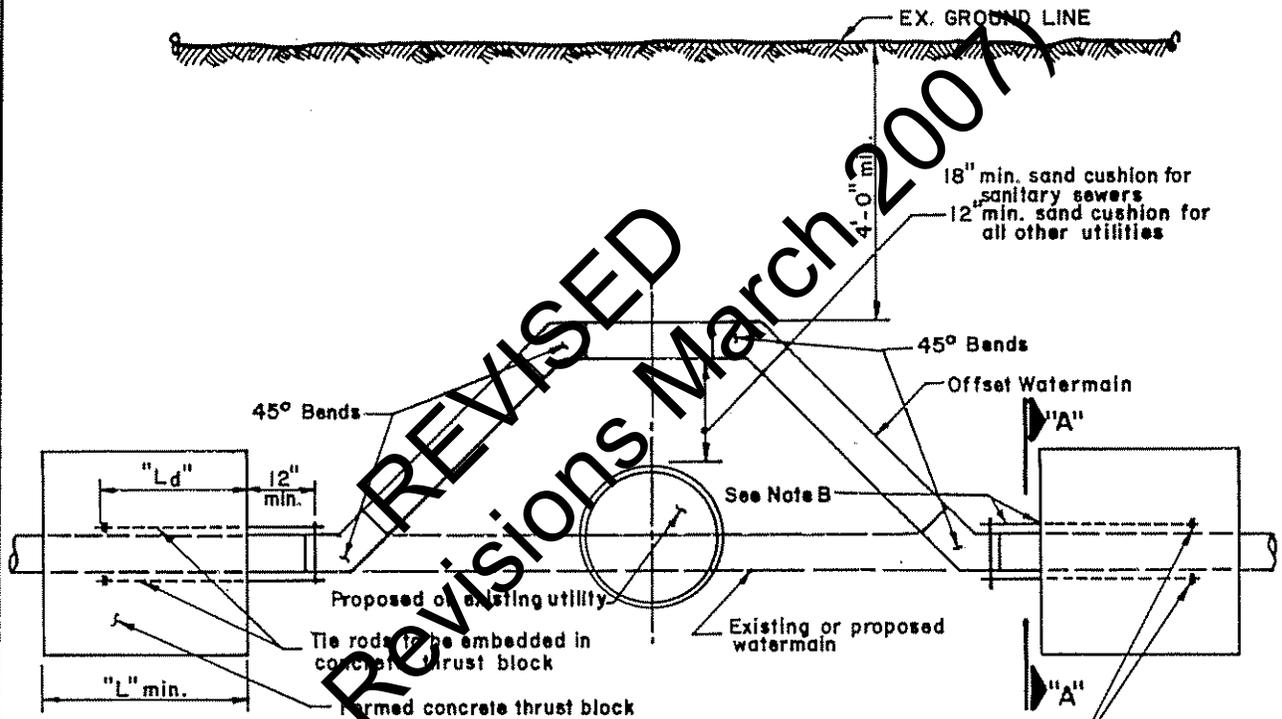
W 9	APPROVED: <i>John L. Lombach</i> CITY ENGINEER	DATE
	DRAWN: CMC	CHECKED: <i>ecc</i> 6/7/76

No watermain joints will be allowed inside the thrust blocks. If a joint conflicts with the thrust block placement as shown, then the joint will be restrained and the thrust block located the minimum distance beyond said joint.

THRUST BLOCK DIMENSIONS				
Pipe Dia.	L	W	H	L <sub>d</sub>
6"	1.5'	3'	3'	15"
8"	2'	3'	3'	18"
12"	4'	4'	3'	36"
16"	5'	4.5'	4'	48"



Section "A-A"



**Note A:**

When the minimum clearance and cover cannot be obtained, the watermain is to be relocated under the sewer.

**NOTE B:**

ON EXISTING WATERMAIN, THE 45° BENDS SHALL BE RESTRAINED AS SHOWN IN THIS DETAIL, INCLUDING THRUST BLOCKS AND AS SPECIFIED IN DIVISION 19. ON NEW CONSTRUCTION, THRUST BLOCKS WILL NOT BE USED AND THE WATERMAIN SHALL BE RESTRAINED AS SPECIFIED IN DIVISION 19.

**NOTE C:**

IF TIE RODS ARE USED FOR JOINT RESTRAINT, SEE TABLE IN DIVISION 19 FOR NUMBER OF TIE RODS REQUIRED PER JOINT. ALSO, SEE TIE ROD DETAIL ON STANDARD DETAIL W/5.

Place nuts on end of tie rods embedded in thrust block.

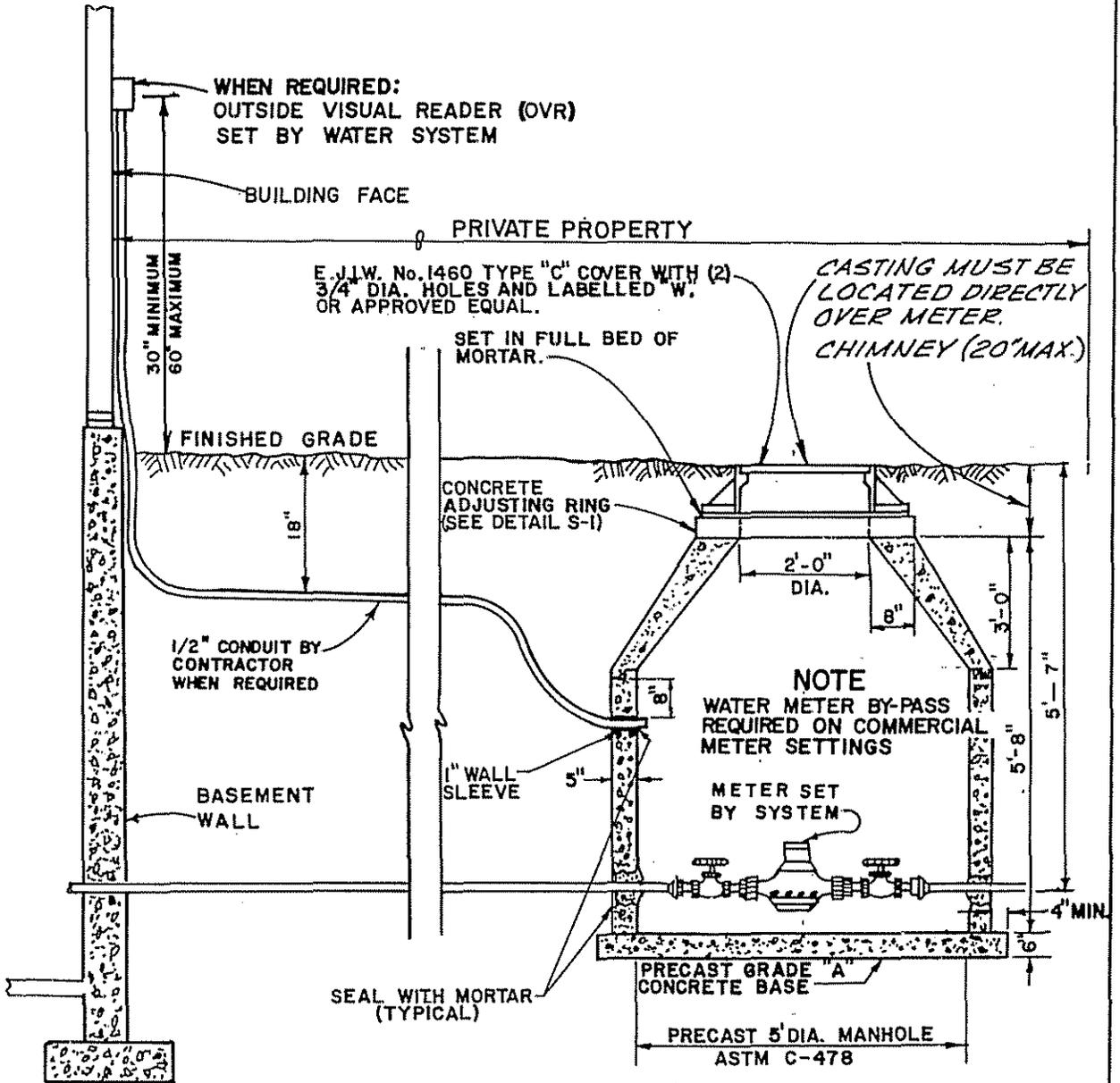
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**WATERMAIN OFF-SET**

W 10	APPROVED <i>John L. Hombach</i> CITY ENGINEER	DATE 3/31/89
	DRAWN LAPINS	CHECKED VU

**NOTE**

METER PIT MUST BE LOCATED ON PRIVATE PROPERTY



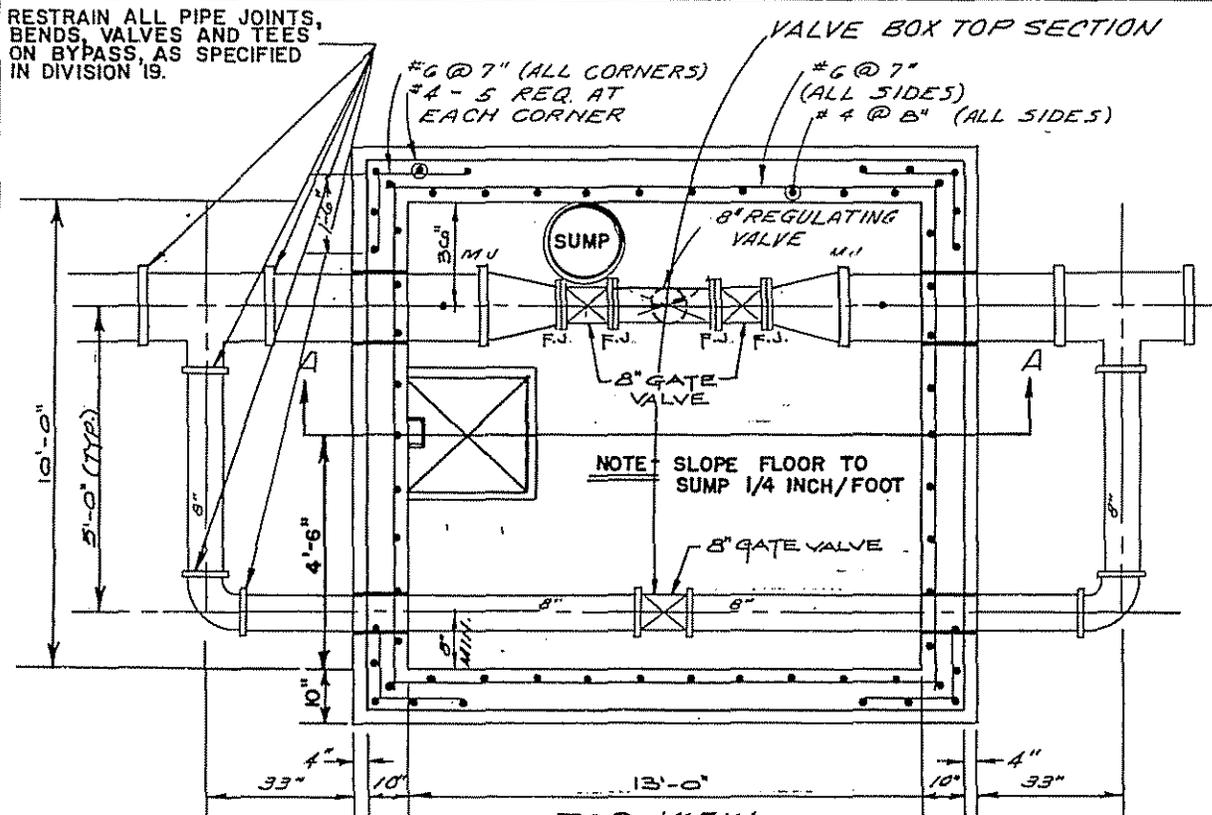
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CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

**PRECAST METER PIT FOR  
 2" OR SMALLER METER  
 (NOT IN ROADWAY)**

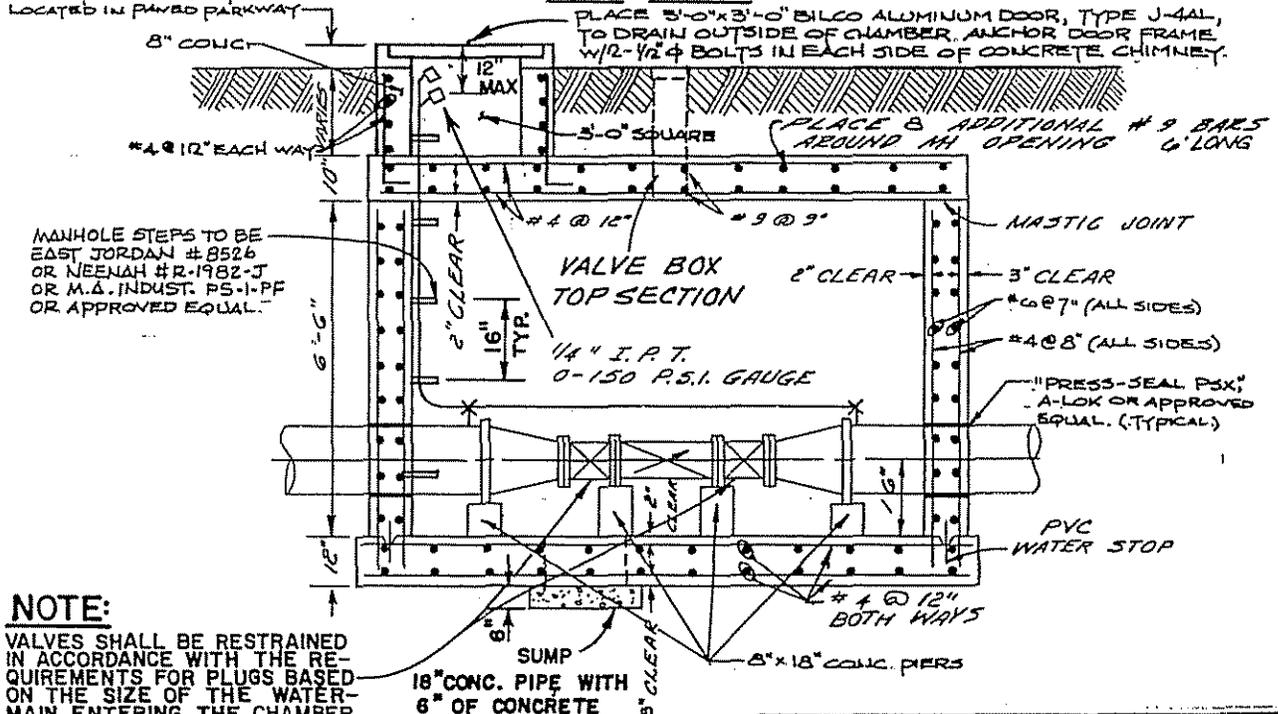
W 11	APPROVED <i>John L. Hombock</i> CITY ENGINEER	DATE 3.31.89
	DRAWN J.R.M.	CHECKED <i>V.L.</i>

RESTRAIN ALL PIPE JOINTS, BENDS, VALVES AND TEES ON BYPASS, AS SPECIFIED IN DIVISION 19.



TOP VIEW

1" IN UNPAVED AREAS FLUSH WHEN LOCATED IN PAVED PARKWAY



SECTION A-A

**NOTE:**  
VALVES SHALL BE RESTRAINED IN ACCORDANCE WITH THE REQUIREMENTS FOR PLUGS BASED ON THE SIZE OF THE WATER MAIN ENTERING THE CHAMBER AS SPECIFIED IN DIVISION 19.

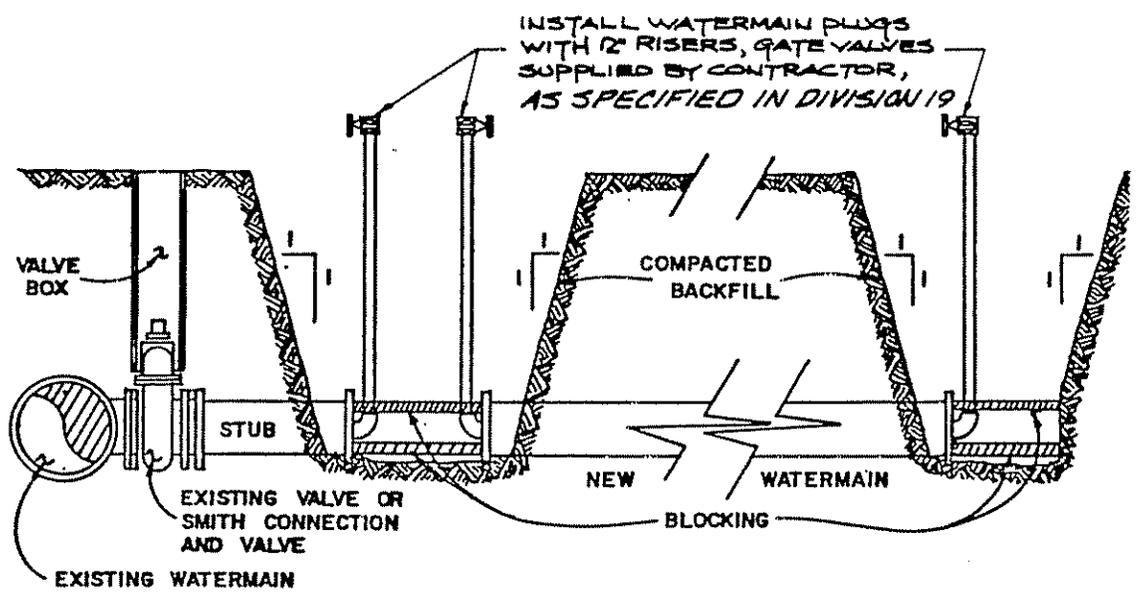
NOTE: CONCRETE TO BE GRADE A.

FOR INFORMATION ONLY:  
NOT FOR CONSTRUCTION UNLESS SPECIFICALLY CALLED FOR ON DRAWINGS OR SPECIFICATIONS.

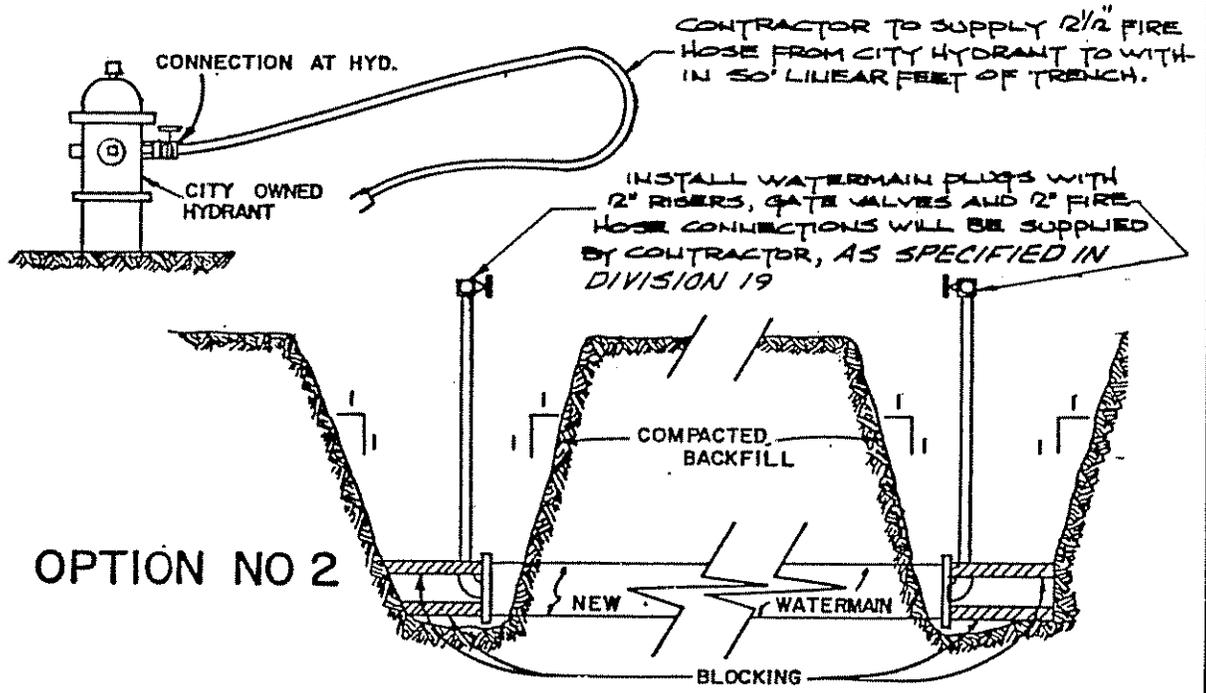
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**REGULATING VALVE  
AND  
CHAMBER**

W 12	APPROVED <i>John L. Lambach</i> 4/11/73 CITY ENGINEER DATE
	DRAWN R.A. CHECKED R.C.



OPTION NO. 1



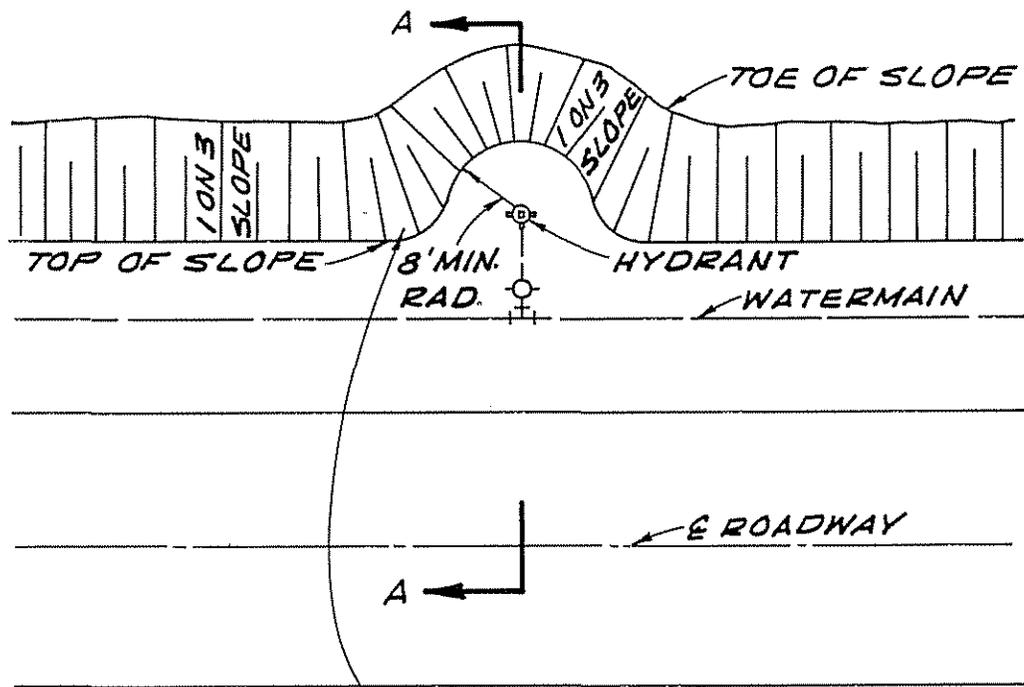
OPTION NO 2

ALL STANDPIPES MUST BE GALVANIZED PIPE. BLACK IRON PIPE IS NOT PERMITTED.

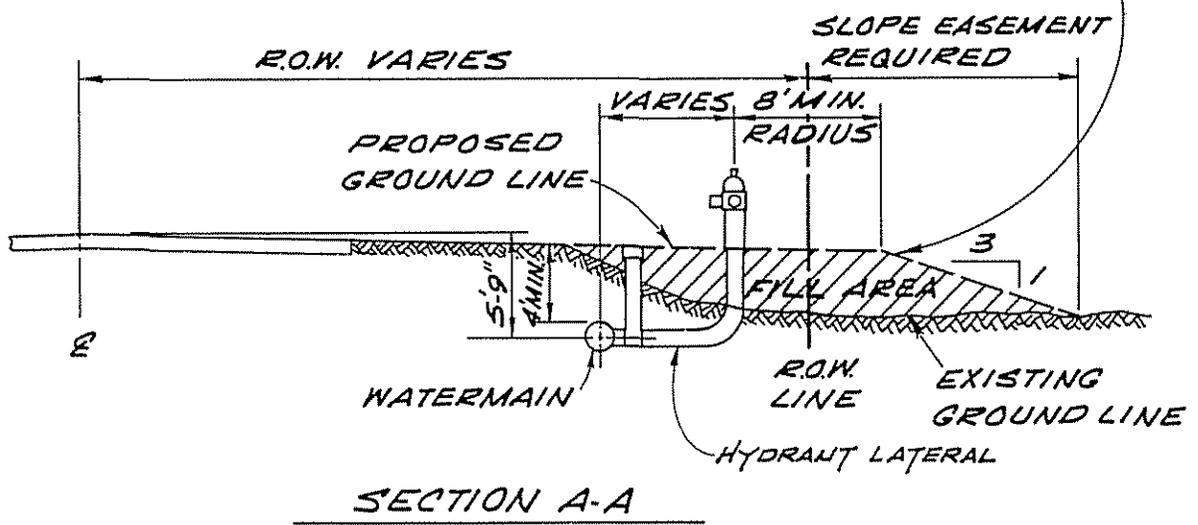
CITY OF GRAND RAPIDS, MICHIGAN  
 DEPARTMENT OF PUBLIC SERVICE  
 DIVISION OF ENGINEERING

**TESTING  
 AND  
 CHLORINATION**

W	APPROVED	<i>John C. Horback</i>	
	13	CITY ENGINEER	DATE 3-31-89
	DRAWN	S.D	CHECKED NU



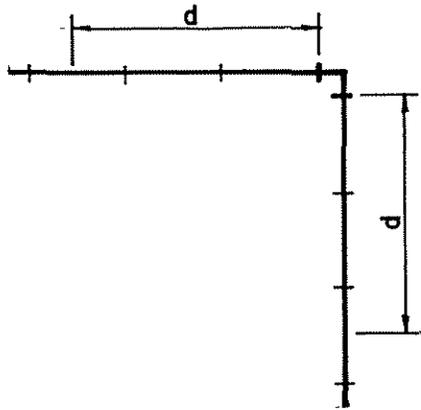
PLACE 4" TOPSOIL. SEED,  
FERTILIZE AND MULCH  
ALL DISTURBED SLOPES  
AND FILL AREA.



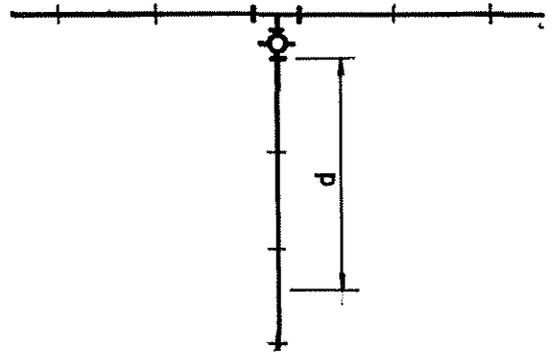
CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**HYDRANT LOCATION  
FOR ROADWAYS  
REQUIRING FILL**

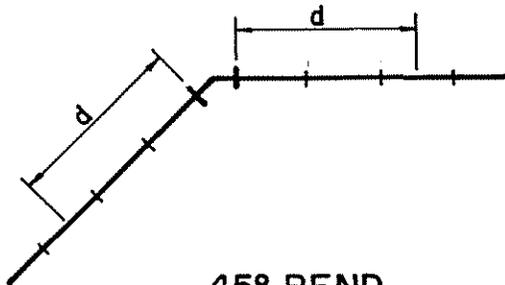
W 14	APPROVED <i>James Hornbach</i> CITY ENGINEER	DATE 3-31-89
	DRAWN S.D.	CHECKED <i>V.L.</i>



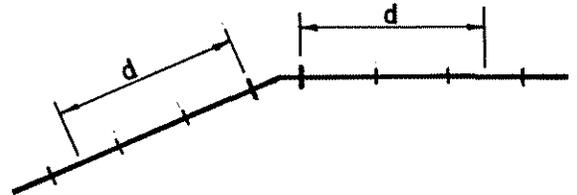
90° BEND



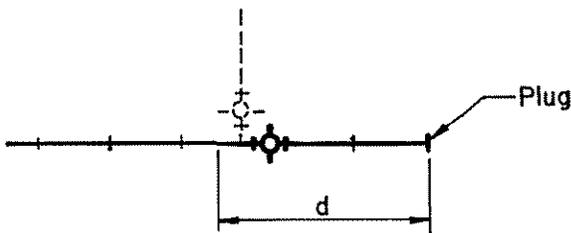
TEE



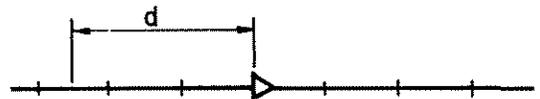
45° BEND



22 1/2° BEND OR LESS

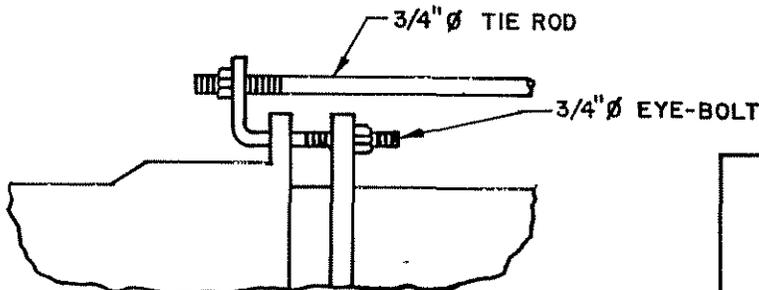


DEAD END



REDUCERS

Dimension "d" = See Table IV, Section 19.03.16



TIE ROD DETAIL

CITY OF GRAND RAPIDS, MICHIGAN  
DEPARTMENT OF PUBLIC SERVICE  
DIVISION OF ENGINEERING

**JOINT RESTRAINT  
REQUIREMENTS  
AND  
TIE ROD DETAIL**

<b>W</b>  15	APPROVED <i>John L. Hombach</i> CITY ENGINEER	DATE 3-31-89
	DRAWN LAPINS	CHECKED <i>JU.</i>