



CITY OF FARMINGTON
110 West Columbia
Farmington, Missouri 63640
573.756.1701

STANDARD INSTRUCTIONS FOR BIDDERS
FOR PUBLIC WORKS PROJECTS

1. Receiving Bids. A mandatory Pre-Bid meeting will be held at the Development Services Office, 101 South Jefferson Street, Farmington, Missouri, 63640 at **10:00 A.M., local time, Thursday, April 16, 2026.** Bids will be received by the City Public Works Director, of the City of Farmington, Missouri, at the Development Services Office, 101 South Jefferson Street, Farmington, Missouri, 63640 until **10:00 A.M., local time, Tuesday, April 21, 2026,** and at that time will be publicly opened and read.
2. Each BID must be submitted in a sealed envelope, addressed to the Public Works Director and must be plainly marked as **Bray Road Improvements** and bear the bidder's name and address on the outside of the sealed envelope. If forwarded by mail, the sealed envelope containing the BID must be enclosed in another envelope addressed to the Public Works Director, 101 South Jefferson Street, Farmington, Missouri, 63640.

All BIDS shall consist of the Bid Submittal Checklist and attachments included on the checklist. No other documents are desired in the bid submittal. The BID FORM in the contract included in the bid package, with all blank spaces for BID prices filled in, in ink or typewritten, fully completed and executed when submitted. One (1) copy of the BID FORM is required. A bid is invalid if it has not been deposited at the designated location prior to the time and date for receipt of bids. Bids received by facsimile or e-mail will not be considered valid.

3. Right to Reject Bids. The CITY may consider invalid any bid not prepared and submitted in accordance with the provisions hereof, and may waive any irregularities, or reject any and all bids.
4. Withdrawing of Bids. Any bid may be withdrawn prior to the scheduled time for the opening of bids or authorized postponement thereof. Each bidder, by making his bid, represents that he has read and understands the bid documents and that he has familiarized himself the local conditions and specifications under which the work is to be performed.

5. Interpretations and Addenda. No interpretation of any plans, specifications, or other condition will be made verbally to any bidder. Every such request for interpretation shall be made in writing via e-mail to llacy@farmington-mo.gov, and shall be made not less than five business days prior to the scheduled bid opening. Any and all interpretations, or addenda to the specifications, will be made in writing to all plan holders via e-mail or personal delivery not less than two days prior to the scheduled bid opening.
6. Bid Bond. All bids for projects exceeding \$100,000 will be accompanied by a bid bond payable to the CITY, or a cashier's check issued by a solvent bank, for five percent (5%) of the total amount of the bid, including all bid alternates. Bid bonds will be returned to all unsuccessful bidders upon notification of award to the successful bidder. The bid bond will be returned to the successful bidder upon receipt of the executed contract and payment and performance bond.
7. Payment and Performance Bond. The successful bidder for all projects exceeding \$50,000 will be required to furnish a surety bond, or bonds, as security for faithful performance of the contract and for the payment of all firms or persons performing labor or furnishing materials for the work performed under the contract. The surety on such bond, or bonds, shall be a surety company satisfactory to the CITY.
8. Compliance with Prevailing Wage. The CONTRACTOR shall pay wages not less than the prevailing wage for the type of work performed under this agreement as determined by the Missouri Department of Labor and Industrial Relations, Division of Labor Standards. The CONTRACTOR further agrees to comply with Prevailing Wage Laws as prescribed in Section 290.290 RSMo, and to ensure compliance with the aforementioned statutes by all sub-contractors performing work under this agreement. The CONTRACTOR will pay the CITY as and for liquidated damages, one-hundred dollars (\$100.00) per day, or portion of day, if a worker is paid less than the prevailing rate for any work done under the contract by the CONTRACTOR or by any subcontractor.
9. Unauthorized Alien Affidavit and E-Verify. As a condition for the award of any contract or grant in excess of five thousand dollars (\$5,000.00) by the state or by any political subdivision of the state to a business entity (contractor), the business entity shall, by sworn affidavit and provision of documentation, affirm its enrollment and participation in a federal work authorization program with respect to the employees working in connection with the contracted services. Every such business entity shall sign an affidavit affirming that it does not knowingly employ any person who is an unauthorized illegal alien in connection with the contracted services, per RSMO 285.530. Any entity contracting with the

state, or any political subdivision of the state shall only be required to provide the affidavits required to the state and any political subdivision of the state with which it contracts, on an annual basis. Prior to the award of the bid, the selected contractor must complete and have notarized the attached "Affidavit of Work Authorization" and return it to the CITY.

10. Health and Safety of Employees. In accordance with RSMO 292.675 any contractor for any public body for purposes of construction of public works and any subcontractor to such contractor shall provide a ten-hour Occupational Safety and Health Administration (OSHA) construction safety program for their on-site employees which includes a course in construction safety and health approved by OSHA of a similar program which is at least as stringent as an approved OSHA program, unless such employees have previously completed the required program. All employees who have not previously completed the program are required to complete the program within sixty days of beginning work on such construction project.

Any employee found on a work site subject to this section without documentation of the successful completion of the course required shall be afforded twenty days to produce such documentation before being subject to removal from the project.

The Contractor will forfeit a penalty to the CITY of \$2,500 plus an additional \$100 for each employee employed by the contractor or subcontractor, or each calendar day, or portion thereof, such employee is employed without the required training.

11. Qualifications of Bidders. The CITY may make such investigations as deemed necessary to determine the ability of the any bidder to perform the work, and the bidder shall furnish the CITY with all such information for this purpose as the CITY may request. The CITY reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the CITY that said bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated herein.
12. Worker's Compensation Insurance. The Contractor shall be required to provide proof of Worker's Compensation Insurance and maintain said insurance during the performance of the work prescribed in this agreement. The Contractor shall be further required to provide proof of Worker's Compensation Insurance for all sub-contractors performing work under this agreement. In the event the insurance coverage required under this section is cancelled by the Contractor during the performance of the work under this agreement, the CITY may at its option employ another Contractor to complete the project, and the Contractor

shall indemnify and hold the CITY harmless from any and all damages it sustains as a result of the Contractor's failure to maintain Worker's Compensation Insurance coverage.

13. Public Liability and Property Damage Insurance. The Contractor shall be required to furnish Public Liability and Property Damage Insurance with coverage to name and protect the CITY and the Contractor from all claims for damages for personal injury, including accidental death, as well as claims for property damages, which may arise from work performed under this agreement, whether such claim be a result of actions by the Contractor or any sub-contractor performing work under this agreement. The insurance policy shall be not less than \$1,000,000 personal injury per occurrence and not less than \$1,000,000 aggregate property damage. In the event the insurance coverage required under this section is cancelled by the Contractor during the performance of the work under, the CITY may at its option employ another Contractor to complete the project, and the Contractor shall indemnify and hold the CITY harmless from any and all damages it sustains as a result of the Contractor's failure to maintain insurance coverage.
14. Lien Waivers. The contractor will be required to provide a lien waiver from the contractor, all subcontractors, and all material providers performing work or providing materials under this contract prior to receiving the 5% payment retainage for this contract.
15. State and City Licenses. All contractors or sub-contractors performing work under this contract will be required to provide evidence of valid licenses as required by the State of Missouri and the CITY.
16. Method of Award. The CITY will award this contract based on the lowest bid and best qualified bidder. When selecting the lowest bid and best qualified bidder, the CITY may consider contract participation by local companies and the effect of the contract award on local employment.

The base bid will be awarded with Alternative 1 or 2 and Alternative 3 or 4 included. Alternative 5 may or may not be included in the project.

17. Bids Exceeding Available Funds. The CITY may reject any and all bids if the lowest and best bid exceeds available funds for the project. The CITY may select the lowest and best bidder to negotiate a lower bid based on value-engineering or reduction of project scope.



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BID SUBMITTAL CHECKLIST

PROJECT NAME: Bray Road Improvements BID TIME: 10:00 AM

PROJECT LOCATION: Farmington, MO BID DATE: 4/21/2126

BIDDER NAME: _____

TO: The City of Farmington, Missouri (Owner)

In response to the Invitation to Bids, and in accordance with the Instructions to Bidders and other Bidding Documents, the Bidder declares that he has had an opportunity to examine the site of the Work and has carefully examined the Contract Documents.

Therefore, including Addenda, and on the basis thereof, and being fully familiar with the local conditions affecting the Work, and upon written notice of award of the contract, acknowledges and agrees to provide all labor, material, equipment, tools, management and supervision, safety and technical services, insurance, bonds and incidentals necessary or required for the fully performance of the Contract Work in accordance with the above-referenced documents in a safe, timely and workmanlike manner for the following Bid price.

Base Bid: _____ \$ _____
 (Amount in Words)

Bid Alternate 1: _____ \$ _____
 (Amount in Words)

Bid Alternate 2: _____ \$ _____
 (Amount in Words)

Bid Alternate 3: _____ \$ _____
 (Amount in Words)

Bid Alternate 4: _____ \$ _____
 (Amount in Words)

Bid Alternate 5: _____ \$ _____
 (Amount in Words)

- Checklist of Attachments:
- Itemized Bid Form
 - Bid Bond
 - E-Verify
 - Addenda _____

 (Signature) (Company Name)

 (Print Name) (Telephone Number)

 (Email Address)

Project: Bray Road Improvements

Itemized Bid Form

BASE BID

Number	Description	Unit	Amount	Unit Price	Extended Cost
1	MOBILIZATION	LS	1		
2	CLEARING AND STRIPPING	LF	1		
3	EARTH EXCAVATION (EXCESS DIRT)	CY	220		
4	TELEPHONE CONDUIT REMOVAL (CONDUIT NOT IN USE PER AT&T)	EA	2,001		
5	TELEPHONE BOX/RISER/PEDESTAL REMOVAL	LF	5		
6	15" CMP PIPE REMOVAL	LF	55		
7	18" CMP PIPE REMOVAL	LF	424		
8	24" CMP PIPE REMOVAL	EA	138		
9	ADJUST MANHOLE TO GRADE	EA	2		
10	AREA INLET TO BE REMOVED AND REPLACED	EA	1		
11	EXISTING SIGN TO BE REMOVED AND RELOCATED	EA	6		
12	REMOVE AND RELOCATE MAILBOX/CARRRER	EA	2		
13	EXISTING OVERHEAD POLE/SERVICE TO BE REMOVED	EA	1		
14	GRAVEL ENTRANCE REMOVAL	SF	1,204		
15	ASPHALT PAVEMENT REMOVAL	SF	50,607		
16	10' DIAMETER MANHOLE	EA	1		
17	10' DIAMETER CURB INLET	EA	3		
18	10' DIAMETER DOUBLE CURB INLET	EA	1		
19	CURB INLET	EA	16		
20	DOUBLE CURB INLET	EA	5		
21	AREA INLET	EA	5		
22	18" CLASS V RCP	LF	39		
23	30" CLASS III RCP	LF	45		
24	36" CLASS V RCP	LF	225		
25	36" RCP FLARED END SECTION	EA	2		
26	108"X36" CLASS III RCP BOX CULVERT	EA	90		
27	STREET LIGHT STANDARD	LF	7		
28	PEDESTRIAN HANDRAIL	SF	100		
29	CAST-IN-PLACE CONCRETE WALL	SF	330		
30	MODOT TYPE 2 DITCH LINER	SF	5,755		
31	CONCRETE SWALE REWORK	SF	80		
32	TRENCH DRAIN	LF	30		
33	CONCRETE CURB AND GUTTER	LF	3,525		
34	ROLLED CURB	LF	18		
35	SEEDING (WITH STRAW BLANKET)	ACRE	2		
36	MODIFIED URETHANE PAVEMENT STRIPING - LINE 6"	LF	3,890		
37	MODIFIED URETHANE PAVEMENT STRIPING - TURN ARROW	EA	6		
38	TRAFFIC CONTROL	LS	1		
			BASE BID SUB TOTAL		

Project: Bray Road Improvements

Itemized Bid Form

Number	Description	Unit	Amount	Unit Price	Extended Cost
BID ALTERNATE 1					
43	4" TYPE 5 AGGREGATE BASE	Tons	1,530		
44	8" CONCRETE PAVEMENT	CY	2,266		
				BID ALTERNATE 1 SUB TOTAL	
BID ALTERNATE 2					
45	8" TYPE 5 AGGREGATE BASE	Tons	3,060		
46	8" ASPHALT BASE	Tons	4,440		
47	2" ASPHALT SURFACE	Tons	1,110		
				BID ALTERNATE 2 SUB TOTAL	
BID ALTERNATE 3					
48	18" RCP	LF	930		
49	24" RCP	LF	610		
50	30" RCP	LF	335		
51	36" RCP	LF	815		
				BID ALTERNATE 3 SUB TOTAL	
BID ALTERNATE 4					
52	18" ADS HP PIPE	LF	930		
53	24" ADS HP PIPE	LF	610		
54	30" ADS HP PIPE	LF	335		
55	36" ADS HP PIPE	LF	815		
				BID ALTERNATE 4 SUB TOTAL	
BID ALTERNATE 5					
56	5' WIDE CONCRETE SIDEWALK	SF	15,750		
57	CURB RAMPS WITH DETECTABLE WARNING STRIP	EA	20		
				BID ALTERNATE 5 SUB TOTAL	



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SPECIFICATIONS FOR BRAY ROAD IMPROVEMENTS

1. Scope. These specifications require the furnishing of supplies, machinery, equipment, tools, superintendence, labor, insurance, and other accessories and services necessary to construct the Bray Road Improvements.
2. Bidder's Qualifications. Bids will be accepted only from well-established and qualified contractors; trained and experienced in providing metal building and electrical equipment installation services. No bid will be considered from any Contractor unless they are known to be skilled and were previously engaged in work of a character and scope consistent with these bid specifications.
3. Principles and Definitions
 - A. The word "City" shall refer to the City of Farmington.
 - B. "Contractor" shall mean the successful Bidder to whom a Contract is awarded.
 - C. "Work" shall refer to everything agreed to be done and furnished by the Contractor including all supervision, supplies, labor, transportation and equipment together with all responsibilities and obligations imposed by the Contract Documents.
 - D. "Equipment" shall mean the trucks, earth moving, and other apparatus which are owned and operated by the Contractor and which are required to be maintained by the Contractor for the performance of the Contract in accordance with the Specifications.
 - E. "Specifications" shall mean all specifications pertaining to the Work to be performed.
 - F. "Contract" shall mean the fully executed document which binds the interested parties in an agreement to fulfill all terms, conditions, and specifications pertaining thereto.
 - G. "Invitation for Bids" shall be the means by which the City of Farmington solicits bids from Qualified Contractors for Work which the City of Farmington may from time to time deem necessary to have performed.

H. "Install", "Furnish", "Provide", or words of like import shall mean the Contractor shall install, furnish, or provide, and similarly the words "Approved", "Authorized", "Required", "Satisfactory", "Acceptable", or words of like import shall mean, as applicable, approved by, authorized by, required by, satisfactory to, or acceptable to the City of Farmington, unless otherwise expressly stated.

4. General Requirements.

A Contractor crew shall consist of all necessary personnel and all necessary tools and equipment to safely and efficiently complete the work. The City of Farmington reserves the right to do any Work covered within this Contract by its own forces, to cause such Work to be completed by other means, or to defer any Work to a future date.

Since Contractor(s) employees come in contact with the City of Farmington customers, they shall be completely dressed in suitable clothing which shall be clean at the beginning of each day. Identification badges or other forms of identification which displays the Company's name, person's picture, position, etc. is recommended but not mandatory and must be shown to the customer upon request.

All motor trucks and other vehicles provided by the Contractor to perform the Work shall bear the Contractor's number and shall be well marked and identified with company insignia or name designating the vehicles as property of the Contractor. All equipment must be maintained in such a manner as to minimize downtime. The City of Farmington shall not render payment for any charges in connection with lost productivity due to equipment failure or dysfunction.

When convenient for the City of Farmington, the Contractor may be given permission to park vehicles and equipment on the City of Farmington property. Otherwise, Contractor shall be responsible for parking vehicles and/or storing equipment at locations other than the City of Farmington owned facilities and paying all associated costs. The City of Farmington shall not be responsible for any damage or loss of Contractor's equipment.

Contractor shall observe all generally recognized safety rules, regulations, and methods to prevent injury to all employees and other persons or damage to property of the City of Farmington or the public arising from its operations. The Contractor shall observe all laws and regulations applicable to its operations including without limitation OSHA requirements, Missouri Department of Transportation requirements, Workmen's Compensation, Social Security payments, tax withholding payments, Contractor's License, etc.

Contractor crew foreman shall have a cell phone for the City of Farmington to contact them as needed.

Contractor shall promote a drug and alcohol free working environment.

5. Work.

Contractor shall perform all Work to the complete satisfaction of the City of Farmington and in accordance with all municipal, county, state and other local laws, ordinances, and regulations applicable to Work of this character and nature. All Work performed by the Contractor is subject to inspection and approval by the City of Farmington. Any Work not meeting the minimums as set forth in these Specifications, or generally accepted standards, or Work which has been falsely represented in any fashion by Contractor shall be redone by the Contractor at no (zero) cost to the City of Farmington. Failure by the City of Farmington to inspect Contractor's Work shall in no way operate to relieve Contractor from any obligations, liabilities, or responsibilities in connection with this Contract.

Contractor shall certify that complaints of any nature received from property owners or public authorities resulting from this Work will receive immediate attention and that all efforts will be made to effect a prompt adjustment. If any damage is done to the property of others by Contractor's workforce, Contractor shall repair and restore at its sole expense any such property and correct any damage inflicted thereto, all to the complete satisfaction of the owner(s) of the injured property. All complaints, and any action taken by Contractor in connection with such complaints, shall be reported to the City of Farmington.

Contractor shall secure all permits and licenses necessary for the prosecution of the Work to be performed and pay all charges and fees required for such permits and licenses.

6. Billing Restrictions.

The City of Farmington shall not be charged for time spent on maintenance of equipment, including without limitation fueling of vehicles, oil or antifreeze changes. The City of Farmington will not render payment for equipment that is incapable of fully performing its intended function.

The City of Farmington will not pay for meals and other incidental items for Contractor's employees.

7. Supervision of Work and Workmanship.

Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over

construction means, methods, techniques, and procedures.

Contractor is an independent contractor and neither Contractor nor any of its employees shall be deemed to be agents or employees of the City of Farmington.

Contractor shall employ only workers who are competent to perform the Work assigned to them and who are adequately trained and experienced in performing first-class Work of the character and magnitude required by this Contract and expected of reputable Contractor's performing work similar to the Work necessary under this Contract.

The City of Farmington will periodically review and evaluate crew performance based upon factors such as, but not limited to, quality of work, quantity of work, clearances obtained, safety awareness and public relations efforts.

8. BASIS OF PAYMENT FOR BID ALTERNATE 2

The Bidder acknowledges that the payment per ton for asphalt pavement may vary from month to month dependent on the published Missouri Department of Transportation "Asphalt Price Index". A current copy of the "Asphalt Price Index" is attached as a part of these specifications for informational purposes. The Bidder shall base his bid on the current asphalt price indices (March 2026) of \$497.50 per liquid ton of asphaltic oil. The monthly price per ton of asphalt applied will be calculated for adjustment, using the following equation for that published monthly price index as follows:

$$A = (B \times C) \times (D - E) \quad \text{Where:}$$

A=Adjustment for mix placed during monthly index period.

B=Tons of asphalt mix placed during the select month.

C=Percent (%) of virgin asphalt binder used in the asphalt mix.

D=Monthly price index at the time of asphalt mix placement.

E=Monthly price index at the time of the bid notification.

As an example of the above, consider the following:

EXAMPLE FOR CALCULATING ASPHALT PRICE ADJUSTMENT

Assume the following example:

Say your initial bid amount for asphalt is \$45.00 / ton.

B= Say you placed 1,000 tons of asphalt during a particular month.

C= Say the asphalt oil composition is 5.6% by weight.

D= Say the asphalt index is \$600.00 per liquid ton for the particular month.

E= Initial asphalt index of \$395.00 for January 2021 bid consideration.

$$A = (1,000 \text{ tons} \times 0.056) \times (\$600.00 - \$526.25) = \$4,130.00$$

$$\text{Adjustment per ton of asphalt} = \$4,130.00 / 1,000 \text{ tons} = \$4.13 / \text{ton}$$

$$\text{Price per ton payment} = \$45.00 + \$4.13 = \$49.13 / \text{ton}$$

The Bidder also acknowledges that the "Asphalt Price Index" may vary either upward or downward, and as such, the price paid for asphalt mix placed will also vary accordingly, upward or downward.

The bidder also acknowledges that the City may at any time cause for the addition or elimination of any planned street project.

FARMINGTON CROSSINGS

SECTION 000060 – CIVIL CERTIFICATION

CIVIL CERTIFICATION

I, LEONARD MEERS, HEREBY SPECIFY, PURSUANT TO THE RS MO 327.411, THAT THE DOCUMENTS INTENDED TO BE AUTHORIZED BY MY SEAL ARE LIMITED TO:

SPECIFICATION SECTIONS

033000	CAST-IN-PLACE CONCRETE
312000	EARTH MOVING
315000	EXCAVATION SUPPORT & PROTECTION
321313	CONCRETE PAVING
321373	PAVEMENT MARKINGS
330500	COMMON WORK RESULTS FOR UTILITIES
330500	WATER SYSTEMS
334100	STORM AND SANITARY SEWERS

DRAWINGS

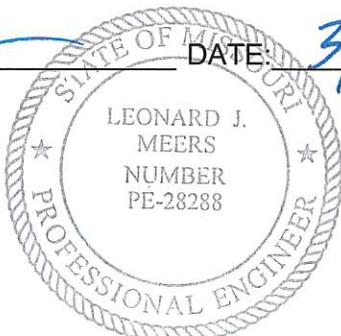
C1.0	TITLE SHEET
C2.0	GENERAL NOTES
C3.0	TYPICAL CROSS SECTIONS
C4.0	BRAY ROAD DEMOLITION PLAN
C5.0-5.3	BRAY ROAD PLAN AND PROFILE
C6.0	BRAY ROAD GRADING
C7.0	SITE DETAILS
C7.1	SITE DETAILS
C7.2	WARPING DETAILS
C7.3	WARPING DETAILS
C7.4	SITE DETAILS
C7.5	SITE DETAILS
C7.6	SITE DETAILS
C8.0	PROPOSED DRAINAGE AREA MAP
C9.0	BRAY ROAD CROSSINGS STORM PROFILES

AND DISCLAIM ANY RESPONSIBILITY FOR ALL OTHER PLANS, SPECIFICATIONS, REPORTS OR OTHER DOCUMENTS OR INSTRUMENTS RELATING TO OR INTENDED TO BE USED FOR ANY PART OR PARTS FOR FARMINGTON CROSSING BRAY ROAD, FARMINGTON, MO.

SEAL:

BY:  DATE: 3/24/2026

END OF SECTION 000060



SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. See Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
 - 2. Design Mixtures for Credit ID 1.1: For each concrete mixture containing portland cement replacements and for equivalent concrete mixtures that do not contain portland cement replacements.
- C. Design Mixtures: For each concrete mixture.
- D. Shop Drawings: For steel reinforcement and formwork. Material test reports and certificates.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete,"
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

- C. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than [60] percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed.
 - 1. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class [I] [II] zinc coated after fabrication and bending.
 - 2. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- E. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from galvanized steel wire into flat sheets.
- F. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, plain steel.
- G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150,

- a. Fly Ash: ASTM C 618, Class C.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
2. Blended Hydraulic Cement: ASTM C 595, Type [IS, portland blast-furnace slag] [IP, portland-pozzolan] [I (PM), pozzolan-modified portland] [I (SM), slag-modified portland] cement.
- B. Normal-Weight Aggregates: ASTM C 33, graded, [1-1/2-inch] nominal maximum coarse-aggregate size.
- 1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Lightweight Aggregate: ASTM C 330, [1-inch] nominal maximum aggregate size.
- D. Water: ASTM C 94/C 94M[and potable].
- E. Air-Entraining Admixture: ASTM C 260.
- F. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
- 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- G. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.

2.4 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
- B. Plastic Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.
- C. Plastic Vapor Retarder: ASTM E 1745, Class C, or polyethylene sheet, ASTM D 4397, not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

2.5 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering]
- G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.6 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- C. Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4000 psi at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - 3. Slump Limit: 5 inches plus or minus 1 inch.
 - 4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.

5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
6. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
7. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb./cu. yd.

D. Proportion structural lightweight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Calculated Equilibrium Unit Weight: 110 lb./cu. ft. plus or minus 3 lb./cu. ft. as determined by ASTM C 567.
3. Slump Limit: 5 inches plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 2 percent at point of delivery for nominal maximum aggregate size greater than 3/8 inch.
5. Air Content: 7 percent, plus or minus 2 percent at point of delivery for nominal maximum aggregate size 3/8 inch or less.
6. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
7. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb./cu. yd.

2.8 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116 and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork according to ACI 301 to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
- C. Cold-Weather Placement: Comply with ACI 306.1.
- D. Hot-Weather Placement: Comply with ACI 301.

3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 - 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one-part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 - 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one-part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent

formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.
 - 1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings, to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view.
 - 2. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4 inch.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

3.9 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project].
 - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
 - 1. Testing Services: Tests shall be performed according to ACI 301.

END OF SECTION 033000

SECTION 312000
EARTH MOVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:

1. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses and plants.
2. Excavating and backfilling for buildings and structures.
3. Excavating and backfilling trenches for utilities and pits for buried utility structures.

- B. Related Sections:

1. Division 00 Section "Geotechnical Report" for information on existing soils.
2. Division 01 Section "Construction Progress Documentation" for recording pre-excavation and earth moving progress.
3. Division 31 Section "Site Clearing" for site stripping, grubbing, stripping topsoil, and removal of above- and below-grade improvements and utilities.
4. Division 31 Section "Excavation Support and Protection" for temporary excavation support and protection systems.

1.03 UNIT PRICES

- A. Work of this Section is affected by unit prices for earth moving specified in Division 01 Section "Unit Prices."
- B. Quantity allowances for earth moving are included in Division 01 Section "Allowances."

1.04 DEFINITIONS

- A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

- B. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

- C. Borrow Material: Satisfactory soil or aggregate imported from off-site for use as fill or backfill.
- D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- E. Drying Agent: Granular material, such as lime or Code L, used to dry soil for proper compaction at optimum soil moisture.
- F. Fill: Soil materials used to raise existing grades.
- G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- H. Special Waste: Contaminated material constituting special waste as defined in the Missouri Code of State Regulations (10 CSR 8-20-010(108) and identified as special waste by the Environmental Engineer. Special waste must be removed from the site and taken to a landfill which is authorized and licensed to accept such material and approved by the Owner's environmental consultant.
- I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- J. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as above ground services within and adjacent to site.

1.05 SUBMITTALS

- A. EGC Submittals:
 - 1. Product Data for EGC Credit 6-2: For products having recycled content, documentation indicating percentages by weight of postconsumer and postindustrial recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Data for Owner's Regional Materials Goal: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

- B. Material Test Reports: For each borrow soil material proposed for fill and backfill as follows:
 - 1. Classification according to ASTM D 2487.
 - 2. Laboratory compaction curve according to ASTM D 1557.
 - 3. Provide locations and details of borrow fill as specified and defined in Division 34 Environmental Specifications.
- C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.06 QUALITY ASSURANCE

- A. Preexcavation Conference: Conduct conference at Project site.

1.07 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Architect and Owner.
- C. Improvements in Public Right-of-Way: Authority for performing earth moving indicated in the public right-of-way adjoining Owner's property will be obtained by Contractor before beginning earth moving.
 - 1. Do not proceed with work in public right-of-way until directed by Architect.
- D. Utility Locator Service: Notify "Missouri One Call" for area where Project is located before beginning earth moving operations.
- E. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 31 Section "Sediment and Erosion Control," are in place.
- F. Do not commence earth moving operations until tree-protection measures specified in Division 31 Section "Site Clearing" are in place.

- G. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
 2. Parking vehicles or equipment.
 3. Foot traffic.
 4. Erection of sheds or structures.
 5. Impoundment of water.
 6. Excavation or other digging unless otherwise indicated.
 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- H. Do not direct vehicle or equipment exhaust towards protection zones.
- I. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials approved by Owner's environmental and geotechnical consultants when sufficient satisfactory soil materials are not available from other onsite excavations.
- B. Satisfactory Soils: Soil Classification Groups GC, SC, CL, ML, GW, GP, GM, SW, SP, and SM according to ASTM D 2487 or Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of rock or gravel larger than 2, 6 or 10 inches (50, 150 or 250 mm) in any dimension as noted on the plans, debris, waste, frozen materials, vegetation, and other deleterious matter.
1. Satisfactory soils for the upper 4 feet (1.25 m) of backfill shall fall under the classification of CL or ML with less than 10 percent rocks or gravel having a maximum size of 2 inches (50 mm) in any dimension.
 2. Satisfactory soils also include onsite soils meeting the classification of CH provided they are not used as backfill for the upper 4 feet (1.25 m) below the building pads.
- C. Unsatisfactory Soils: Soil Classification Groups OL, CH, MH, OH, and PT according to ASTM D 2487 or Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
 2. Unsatisfactory soils also include deleterious materials such as concrete, rock and masonry fragments larger than 10 inches (250 mm) in any dimension, organic material, wood, plastic, metal, tires, trash and other debris.
- D. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent

passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

- E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand meeting the requirements of MSD 1 - Bedding; 100 percent passing a 1-inch (25-mm) sieve and not more than 10 percent passing a No. 100 (0.038-mm) sieve.
- F. Drainage Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.
- G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

2.02 DRYING AGENTS

- H. Hydrated Lime: ASTM C 207, Type N and meeting the requirements of Section 1012 of the IDOT Standard Specifications for Road and Bridge Construction.
- I. Code L: Lime kiln dust meeting the requirements of Section 1012 of the IDOT Standard Specifications for Road and Bridge Construction.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

3.03 EXPLOSIVES

- A. Do not use explosives.

3.04 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include concrete, masonry, rock, soil materials, debris, organic materials and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for concrete, masonry, rock excavation or removal of any debris, organic materials or obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials, concrete, masonry and rock, replace with satisfactory soil materials.
 - 2. All excavated material shall be sifted and screened to remove all metal, wood, trash and other deleterious materials, and any stone, concrete or brick materials larger than 10 inches (250 mm) in any dimension prior to placement as fill in excavations at depths of 6 feet (2 m) or deeper below the proposed subgrade.
 - 3. Any stone, concrete or brick materials larger than 10 inches (250 mm) in any dimension shall be crushed and screened to 6 inches (150 mm) or less in all dimensions and used as fill material onsite for backfilling of excavations from depths of 4 to 6 feet (1.25 to 2 m) below proposed subgrade.
 - 4. No material larger than 2 inches (50 mm) in any dimension shall be used as fill material onsite for backfilling of excavations from depths of 0 to 4 feet (0 to 1.25 m) below proposed subgrade.
- B. Excavations at Edges of Tree-Protection Zones:
 - 1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 - 2. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."
- C. Machine slope banks, to angle of repose or less, until shored. Excavations should be made in accordance with OSHA regulations.
- D. Work around bracing while maintaining integrity of temporary earth support systems or temporary shoring.

3.05 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavation for Manholes and Inlets: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

3.06 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
 1. Clearance: 6 inches (150 mm) each side of pipe or conduit.
- C. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
 1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.07 SUBGRADE INSPECTION

- A. Notify Geotechnical Consultant, Architect or Owner's Representative when excavations have reached required subgrade.
- B. If Geotechnical Consultant, Architect or Owner's Representative determine that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Geotechnical Consultant, Architect or Owner's Representative, without additional compensation.

3.08 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation with satisfactory soils as directed by Geotechnical Consultant, Architect or Owner's Representative.

3.09 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.010 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Surveying locations of underground utilities for Record Documents.
 - 2. Testing and inspecting underground utilities.
 - 3. Removing trash and debris.
 - 4. Removing temporary shoring and bracing, and sheeting.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.011 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill voids with satisfactory soil while removing shoring and bracing.
- D. Place and compact initial backfill of bedding course, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 6 inches (150 mm) over the pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- E. Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.012 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under building slabs, use satisfactory soil material.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.013 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, scarify and aerate, mix with drier onsite soil, or add drying agents to, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified compaction requirements.

3.014 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 10 inches (250 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 5 inches (125mm) in loose depth for material compacted by hand-operated tampers.
- B. Place backfill soil materials uniformly along the full length of each building pad.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
 1. Building pads and five feet beyond: compact each layer of backfill or fill soil material at 90 percent.
 2. Utility trenches: compact each layer of initial and final backfill soil material at 85 percent.
 3. All other areas: compact each layer of backfill or fill soil material at 85 percent.

3.015 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Building Pads and Parking Lots: Plus or minus 1/2 inch (13 mm).
 2. All Other Areas: Plus or minus 1 inch (25 mm).

3.016 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 1. Determine prior to placement of fill that the excavation has been prepared in compliance with the geotechnical requirements.

2. Determine that fill material and maximum lift thickness comply with the geotechnical requirements.
 3. Determine, at the required frequency, that in-place density of compacted fill complies with the geotechnical requirements.
- B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
1. Building Pad Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,500 sq. ft. (232 sq. m) or less of building pad, but in no case fewer than three tests.
 2. All Other Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 5,000 sq. ft. (464 sq. m) or less, but in no case fewer than three tests.
 3. Utility Trenches: At subgrade and at each compacted fill and backfill layer, at least one test for every 200 feet (60 m) or less, but in no case fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.017 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
1. Scarify or remove and replace soil material to depth as directed by Geotechnical Consultant, Architect or Owner's Representative; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, backfill with additional soil material, compact, and reconstruct surfacing.

DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
 - 1. Soil material within the construction limits shall be classified as Special Waste and hauled to (a) landfill(s) authorized and licensed to accept the material. The Contractor's intended landfill shall be pre-approved by the Owner's environmental consultant prior to commencing with the excavation work.
 - 2. Soil material within the public right of way shall be unclassified. The Contractor shall legally dispose of the material off the Owner's property.

END OF SECTION 312000

SECTION 315000
EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes temporary excavation support and protection systems.
- B. Related Sections:
 - 1. Division 01 Section "Construction Progress Documentation" for recording preexisting conditions and excavation support and protection system progress.
 - 2. Division 01 Section "Temporary Facilities and Controls" for temporary utilities and support facilities.

1.03 PERFORMANCE REQUIREMENTS

- A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads where necessary.
 - 1. Temporary excavation support and protection systems shall be the design and execution responsibility of the Contractor. Proposed support and protection systems shall be designed by an engineer registered within the state of Missouri and submitted for review prior to construction. Contractor will comply with City of Farmington requirements regarding excavations adjacent to roadways.
 - 2. Temporary excavation support and protection systems shall comply with all federal, state and local regulations.
 - 3. Provide temporary shoring for utility trench excavation as required by OSHA.
 - 4. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 5. Prevent cave-in or loose soil from falling into excavation.
 - 6. Install excavation support and protection systems without damaging existing utilities, structures, and offsite improvements adjacent to excavation.
 - 7. Monitor vibrations, settlements, and movements.

1.04 SUBMITTALS

- A. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data

signed and sealed by the qualified professional engineer responsible for their preparation.

- B. Photographs or Videotape: Show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems. Submit before Work begins.

1.05 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to excavation support and protection system including, but not limited to, the following:
 - a. Geotechnical report.
 - b. Existing utilities and subsurface conditions.
 - c. Proposed excavations.
 - d. Proposed equipment.
 - e. Monitoring of excavation support and protection system.
 - f. Working area location and stability.
 - g. Abandonment or removal of excavation support and protection system.

1.06 PROJECT CONDITIONS

- A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
 - 2. The geotechnical report is included elsewhere in the Project Manual.
- B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing utilities, structures, and offsite improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 - 1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
 - 1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- D. Promptly repair damages to adjacent offsite improvements, structures, and utilities caused by installing excavation support and protection systems.

3.02 REMOVAL AND REPAIRS

- E. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
 - 1. Remove excavation support and protection systems to a minimum depth of 36 inches (900 mm) below overlaying construction and abandon remainder.
 - 2. Fill voids immediately with approved backfill compacted to density specified in Division 31 Section "Earth Moving."
 - 3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 315000

**SECTION 321313
CONCRETE PAVING**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:

- 1. Driveways.
- 2. Curbs.
- 3. Sidewalks.
- 4. Streets

- B. Related Sections:

- 1. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

1.03 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Other Action Submittals:

- 1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

- C. Qualification Data: For qualified ready-mix concrete manufacturer.

- D. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
 2. Admixtures.
 3. Curing compounds.
 4. Joint fillers.
- E. Material Test Reports: For each of the following:
1. Aggregates.
- F. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- C. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
- D. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.
- E. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and concrete paving construction practices.
 2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete paving subcontractor.

1.06 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.01 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
 - 1. Use flexible or uniformly curved forms for curves with a radius of 100 feet (30.5 m) or less. Do not use notched and bent forms.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.02 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
 - 1. Portland Cement: ASTM C 150, portland cement Type I, Type I/II or Type III. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class C or Class F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4M, uniformly graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: Potable and complying with ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.03 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry or cotton mats.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

2.04 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: asphalt-saturated cellulosic fiber, cork or self-expanding cork, closed cell poly foam, rubber, cross-linked EVA foam or closed cell neoprene in preformed strips.

2.05 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 1. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
 3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-1/2-inch (38-mm) nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture; high-range, water-reducing admixture; high-range, water-reducing and retarding admixture or plasticizing and retarding admixture in concrete as required for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- F. Cementitious Materials: Limit percentage by weight of cementitious materials other than portland cement according to ACI 301 (ACI 301M) requirements as follows:
 - 1. Fly Ash or Pozzolan: 25 percent.
 - 2. Ground Granulated Blast-Furnace Slag: 50 percent.
- G. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. m).

2.06 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M or ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.02 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.03 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - 1. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet (15.25 m) unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch (6-mm) radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.04 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.
- E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- F. Consolidate concrete according to ACI 301 (ACI 301M) by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement and joint devices.
- G. Screed paving surface with a straightedge and strike off.
- H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- I. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

- J. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

- K. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

- L. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.05 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.

- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.06 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.07 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 - 1. Elevation: 1/2 inch (12 mm).
 - 2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
 - 3. Surface: Gap below 10-foot- (3-m-) long, unlevelled straightedge not to exceed 1/2 inch (13 mm).
 - 4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches (13 mm per 300 mm) of tie bar.
 - 5. Joint Spacing: 3 inches (75 mm).

6. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
7. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.08 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain at least one composite sample for each 50 cu. yd. (38 cu. m) or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- I. Prepare test and inspection reports.

3.09 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321723 - PAVEMENT MARKING

PART 1 - GENERAL

1.1 SCOPE

The work covered by this specification consists of furnishing all labor, tools, equipment and materials necessary to place painted pavement markings as shown on the plans or as directed by the Engineer.

1.2 MATERIALS

A. Yellow Paint

1. These specifications cover a ready mixed paint suitable for application on concrete and bituminous pavements. The color of the finished paint shall be Standard Federal Yellow.
 2. The paint shall be homogeneous, well ground, shall not settle badly or cake in the container, and shall be readily broken up with a paddle to a smooth uniform consistency. It shall be free from water, dirt, and other foreign matter and shall dry within the specified period to a good, tough, serviceable film. Any paint which shall have livered or in any way hardened or thickened in the container, or in which the pigment shall have settled out so that it cannot be readily broken up with a paddle to a smooth uniform paint of useable consistency after six months storage, will be returned to the bidder for full refund or credit. The paint shall be strained before filling, using a screen not coarser than 40 mesh or a suitable sieve meeting the approval of the Engineer.
 3. All materials used in manufacture shall meet the requirements herein specified. Any materials not specifically covered shall meet the approval of the Engineer.
 4. The ready-mixed paint shall be purchased by volume, one (1) gallon shall mean two hundred thirty-one (231) cubic inches at seventy-seven (77) degrees Fahrenheit.
- #### 5. Pigment Constituents
- a. Medium Chrome Yellow. This pigment shall comply with ASTM Specification D 211-67 (1973), Type III.
 - b. Titanium Dioxide. This pigment shall comply with ASTM Specification D 476 73, Type I, Anatase.
 - c. Magnesium Silicate. This pigment shall consist substantially of natural hydrous magnesium silicate that is white, fibrous, finely ground, and is commercially known as paint pigment quality.
 - d. Zinc Oxide. This pigment shall comply with ASTM specification D 79-44 (1974).
 - e. Calcium Carbonate. This pigment shall comply with ASTM Specification D 1199-69, (1974) Type GC, Grade I.
 - f. Montmorillonite (Bentone 38-prewet). This pigment shall be a finely divided hydrous aluminum silicate powder suitable for use in paints.

6. Vehicle Constituents

a. Chlorinated Rubber (20 Centipoise Type). The chlorinated rubber shall have the following properties:

Chlorine..... 65 to 69%
Color (Gardner, 20% by weight in toluene)..... 4 maximum
Viscosity (20%, by weight in toluene)..... 17 to 25 Centipoises

b. Alkyd Resin. The alkyd resin solution shall be a medium length soya or linseed oil pure drying type alkyd that has been reduced in VM and P Naphtha to a 59-61% solids content. The VM and P Naphtha shall meet the requirements of Federal Specifications TT-N-95b, Type I. The solution shall contain a minimum of 33% phthalic anhydride based on the alkyd solids. The alkyd resin solution shall be compatible when tested as shown below.

(1) A solution containing 100 grams of chlorinated rubber, 130 grams of alkyd resin solution, 290 grams of methyl ethyl ketone shall be clear, transparent and show no separation after 24 hours storage at 80±5°F.

c. Chlorinated Paraffin. This material shall meet Federal Specification MIL-C-429C, Type I.

d. Methyl Ethyl Ketone. This material shall comply with ASTM Specification D 740-69 (1974).

e. Aromatic Naphtha. This material shall meet the following requirement:

Appearance..... Clear and free of sediment
Color..... Water White
Specific Gravity @ 60°F..... 0.872 to 0.880
Distillation....I.B.P..... 310°F minimum
Dry Point..... 350°F maximum

f. Methyl Alcohol. This material shall be commercial Methyl Alcohol suitable for use in paints.

g. Drier. This material shall be lead and cobalt driers suitable for use in paints.

h. Anti-Skinning Agent. This material shall be an anti-skinning agent suitable for use in paints.

7. Pigment Formulation Percent by Weight

Medium Chrome Yellow Pigment 30.7
Titanium Dioxide Pigment 3.8
Magnesium Silicate Pigment 26.8
Zinc Oxide Pigment 7.7
Calcium Carbonate Pigment 30.7
Bentone 38 0.3
* Thermolite 813

* Thermolite 813 stabilizer is to be added in the ratio of 0.5 pound per 100 gallons of finished paint. This stabilizer is available from M and T Chemicals, Inc., Rahway, New Jersey.

8. Vehicle Formulation Percent by Weight

Alkyd Resin 20.8
Chlorinated Rubber 16.0

Chlorinated Paraffin	12.0
Methyl Ethyl Ketone	48.6
Aromatic Naphtha	0.8
Methyl Alcohol	0.8
Lead Driers (24%)	0.3
Cobalt Driers (6%)	0.2
Anti-Skinning Agent	0.5

9. Mixed Paint

Pigment, percent by weight	50.5 to 52.5
Vehicle, percent by weight	47.5 to 49.5
Grind (Hegman Gage) minimum.....	3
Viscosity, 77°F, Krebs units	72 to 82

- a. Skinning Test. No skinning shall be present on the surface when the paint is allowed to stand in a partly filled closed container for 72 hours. The paint shall be free of lumps and skins when strained through a No. 100 mesh sieve.
- b. Freezing and Thawing. The physical characteristics of the paint shall not be affected when the paint is subjected to 5 cycles of freezing and thawing (18 hours at 0°F, 6 hours at 100°F).
- c. Dry Time. When tested in accordance with ASTM D 711-75, the paint shall dry within ten (10) minutes.

B. White Paint

- 1. These specifications cover a ready-mixed white paint suitable for application on concrete and bituminous pavements.
- 2. The paint shall be homogeneous, well ground, shall not settle badly or cake in the container, and shall be readily broken up with a paddle to a smooth uniform consistency. It shall be free from water, dirt and other foreign matter and shall dry within the specified period to a good, tough, serviceable film. Any paint which shall have livered or in any way hardened or thickened in the container, or in which the pigment shall have settled out so that it cannot be readily broken up with a paddle to a smooth uniform paint of useable consistency, after six months storage, will be returned to the bidder for full refund or credit. The paint shall be strained before filling, using a screen not coarser than 40 mesh or a suitable sieve meeting the approval of the Engineer.
- 3. All materials used in manufacture shall meet the requirements herein specified. Any materials not specifically covered shall meet the approval of the Engineer.
- 4. The ready-mixed paint shall be purchased by volume, one (1) gallon shall mean two hundred thirty-one (231) cubic inches at seventy-seven(77) degrees Fahrenheit.

5. Pigment Constituents

- a. Titanium Dioxide. This pigment shall comply with ASTM Specification D 476-73, Type I, Anatase.
- b. Magnesium Silicate. This pigment shall consist substantially of natural hydrous magnesium silicate that is white, fibrous, finely ground, and is commercially known as paint pigment quality.

- c. Zinc Oxide. This pigment shall comply with ASTM specification D 79-44 (1974).
- d. Calcium Carbonate. This pigment shall comply with ASTM Specification D 1199-69, (1974) Type GC, Grade I.
- e. Montmorillonite (Bentone 38-prewet). This pigment shall be a finely divided hydrous aluminum silicate powder suitable for use in paints.

6. Vehicle Constituents

- a. Chlorinated Rubber (20 Centipoise Type). The chlorinated rubber shall have the following properties:

Chlorine..... 65 to 69%
 Color (Gardner, 20% by weight in toluene)..... 4 maximum
 Viscosity (20%, by weight in toluene)..... 17 to 25 Centipoises

- b. Alkyd Resin. The alkyd resin solution shall be a medium length soya or linseed oil pure drying type alkyd that has been reduced in VM and P Naphtha to a 59-61% solids content. The VM and P Naphtha shall meet the requirements of Federal Specifications TT-N-95b, Type I. The solution shall contain a minimum of 33% phthalic anhydride based on the alkyd solids. The alkyd resin solution shall be compatible when tested as shown below.

(1) A solution containing 100 grams of chlorinated rubber, 130 grams of alkyd resin solution, 290 grams of methyl ethyl ketone shall be clear, transparent and show no separation after 24 hours storage at 80±5°F.

- c. Chlorinated Paraffin. This material shall meet Federal Specification MIL-C-429C, Type I.
- d. Methyl Ethyl Ketone. This material shall comply with ASTM Specification D 740-69 (1974).
- e. Aromatic Naphtha. This material shall meet the following requirement:

Appearance..... Clear and free of sediment
 Color..... Water White
 Specific Gravity @ 60°F..... 0.872 to 0.880
 Distillation....I.B.P..... 310o F minimum
 Dry Point..... 350o F maximum

- f. Methyl Alcohol. This material shall be commercial Methyl Alcohol suitable for use in paints.
- g. Drier. This material shall be lead and cobalt driers suitable for use in paints.
- h. Anti-Skinning Agent. This material shall be an anti-skinning agent suitable for use in paints.

7. Pigment Formulation Percent by Weight

Titanium Dioxide Pigment 34.7
 Magnesium Silicate Pigment 30.3
 Zinc Oxide Pigment 8.7
 Calcium Carbonate Pigment 26.0

Bentone 38 0.3
* Thermolite 813

* Thermolite 813 stabilizer is to be added in the ratio of 0.5 pound per 100 gallons of finished paint. This stabilizer is available from M and T Chemicals, Inc., Rahway, New Jersey.

8. Vehicle Formulation Percent by Weight

Alkyd Resin 21.2
Chlorinated Rubber 16.3
Chlorinated Paraffin 12.2
Methyl Ethyl Ketone 47.7
Aromatic Naphtha 0.8
Methyl Alcohol 0.8
Lead Driers (24%) 0.3
Cobalt Driers (6%) 0.2
Anti-Skinning Agent 0.5

9. Mixed Paint

Pigment, percent by weight 48 to 50
Vehicle, percent by weight 50 to 52
Grind (Hegman Gage) minimum..... 3
Viscosity, 77°F, Krebs units 70 to 80

a. Skinning Test. No skinning shall be present on the surface when the paint is allowed to stand in a partly filled closed container for 72 hours. The paint shall be free of lumps and skins when strained through a No. 100 mesh sieve.

b. Freezing and Thawing. The physical characteristics of the paint shall not be affected when the paint is subjected to 5 cycles of freezing and thawing (18 hours at 0°F, 6 hours at 100°F).

c. Dry Time. When tested in accordance with ASTM D 711-75, the paint shall dry within ten (10) minutes.

C. Beads

1. Properties. The glass beads for pavement marking furnished under this specification shall consist essentially of transparent, water-white glass particles of a spherical shape. They shall be manufactured from a glass of a composition designed to be highly resistant to traffic wear and to the effects of weathering. The glass beads shall conform to the following requirements.

a. Sieve Analysis. The glass beads shall meet the following sieve requirements:

U. S. Standard Total Percent (By Weight)

Sieve Number Passing

20	100
30	75-100
50	15-40
100	0-10

b. Imperfections. The surface of the glass beads shall be free of pits and scratches. The glass beads shall be spherical in shape and shall contain no more than 20 percent by weight of dark particles or irregular shapes when tested by the standard method using a vibratile inclined glass plate.

c. Index of Refraction. The index of refraction of the glass beads shall be not less than 1.50 when tested by the immersion method at 77°F.

d. Silica Content. The glass beads shall contain not less than 65% silica (SiO₂).

1.3 INSTALLATION REQUIREMENTS

Painted pavement markings shall be installed in accordance with the following requirements:

A. Prior to the application of the paint, the Contractor shall make certain that the pavement surface is dry and free of dirt or grease and, if necessary, clean the surface to the satisfaction of the Engineer.

B. Paint shall not be applied at air temperature below 40°F unless approved by the Engineer.

C. The paint shall be applied at a minimum thickness of 20 mils, and beads shall be applied to all painted surfaces (except black) at the minimum rate of 4.5 pounds for each gallon of paint used.

D. Unless directed by the Engineer, lines shall not be laid directly over a longitudinal crack or joint nor over a tar or asphalt painted line. The edge of a centerline or lane line shall be offset a minimum distance of 2 inches from a longitudinal crack or joint. Edge lines shall be approximately 2 inches from the edge of the pavement. The finished center and lane lines shall be straight, with the lateral deviation of any 15 foot line not to exceed 1 inch.

Equipment Requirements. Equipment used for installing painted pavement markings shall meet the following requirements:

1. The application equipment used for placing lane and edge lines shall be of sufficient size and stability to insure smooth, straight application. The equipment must have the capability of automatically placing new intermittent line patterns, as well as continuous lines. The equipment shall be so constructed as to provide the various widths of pavement marking lines specified. The mounting shall be such as to allow the equipment to accurately follow road irregularities and produce lines of uniform dimensions. Words, symbols, and lines other than lane and edge lines may be placed with a hand-operated machine. The Engineer may also permit the use of a hand-operated machine for those locations where only a limited quantity of lane and edge lining is required.

2. A mechanical beader of a design approved by the Engineer shall be used. If it is necessary to perform any work under traffic, traffic control and placement of cones shall be directed by the Engineer and shall be considered incidental to this contract.

END OF SECTION 321723

SECTION 330500
COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Piping joining materials.
 - 2. Dielectric fittings.
 - 3. Sleeves.
 - 4. Identification devices.
 - 5. Grout.
 - 6. Piping system common requirements.
 - 7. Equipment installation common requirements.
 - 8. Concrete bases.
 - 9. Metal supports and anchorages.

1.02 DEFINITIONS

- A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.03 SUBMITTALS

- A. Product Data: For the following:
 - 1. Dielectric fittings.
 - 2. Identification devices.
- B. Welding certificates.

1.04 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

- C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

PART 2 - PRODUCTS

2.01 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.
- H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.02 DIELECTRIC FITTINGS

- A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Hart Industries, International, Inc.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Wilkins Div.
3. Description: Factory fabricated, union, NPS 2 and smaller.
 - a. Pressure Rating: 150 psig minimum at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Water Technologies, Inc.
3. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.
 - a. Pressure Rating: 150 psig minimum.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Calpico, Inc.
 - b. Lochinvar Corporation.

3. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 and smaller.
 - a. Pressure Rating: 300 psig at 225 deg F.
 - b. End Connections: Threaded.

E. Dielectric Nipples:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Perfection Corporation.
 - b. Precision Plumbing Products, Inc.
 - c. Victaulic Company.
3. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.
 - a. Pressure Rating: 300 psig at 225 deg F
 - b. End Connections: Threaded or grooved.

2.03 SLEEVES

- A. Mechanical sleeve seals for pipe penetrations are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
- D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
- G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.04 IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
 2. Location: Accessible and visible.
- B. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.
- C. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.
- D. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.
- E. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.
- F. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.
- G. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.
1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches ; 2-1/2 inches for larger pipes.
 2. Color: Comply with ASME A13.1, unless otherwise indicated.
- H. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.
1. Material: 0.032-inch- thick, polished brass or aluminum.
 2. Material: 0.0375-inch- thick stainless steel.
 3. Material: 3/32-inch- thick plastic laminate with 2 black surfaces and a white inner layer.
 4. Material: Valve manufacturer's standard solid plastic.
 5. Size: 1-1/2 inches in diameter, unless otherwise indicated.
 6. Shape: As indicated for each piping system.
- I. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.
- J. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.

2. Thickness: 1/16 inch, unless otherwise indicated.
 3. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
 4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.
- K. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
1. Green: Cooling equipment and components.
 2. Yellow: Heating equipment and components.
 3. Brown: Energy reclamation equipment and components.
 4. Blue: Equipment and components that do not meet criteria above.
 5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
 6. Terminology: Match schedules as closely as possible. Include the following:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.
 - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
 7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

2.05 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: 5000-psi , 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 DIELECTRIC FITTING APPLICATIONS

- A. Dry Piping Systems: Connect piping of dissimilar metals with the following:
1. NPS 2 and Smaller: Dielectric unions.
 2. NPS 2-1/2 and Larger: Dielectric flanges.
- B. Wet Piping Systems: Connect piping of dissimilar metals with the following:
1. NPS 2 and Smaller: Dielectric couplings or dielectric nipples.
 2. NPS 2-1/2 and Larger: Dielectric nipples.

3.02 PIPING INSTALLATION

- A. Install piping according to the following requirements and Division 33 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Sleeves are not required for core-drilled holes.
- J. Permanent sleeves are not required for holes formed by removable PE sleeves.
- K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - a. **PVC Pipe Sleeves:** For pipes smaller than NPS 6.
 - b. **Steel Sheet Sleeves:** For pipes NPS 6 and larger, penetrating gypsum-board partitions.
- L. Verify final equipment locations for roughing-in.
- M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.03 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 33 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.
- I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.
- K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End PE Pipe and Fittings: Use butt fusion.
 2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
- O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.04 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 3. Install dielectric fittings at connections of dissimilar metal pipes.

3.05 EQUIPMENT INSTALLATION

- A. Install equipment level and plumb, unless otherwise indicated.
- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.
- C. Install equipment to allow right of way to piping systems installed at required slope.

3.06 IDENTIFICATION

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
1. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
 2. Locate pipe markers on exposed piping according to the following:

- a. Near each valve and control device.
 - b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
 - c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
 - d. At manholes and similar access points that permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
- B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.
- 1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
 - 2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.07 CONCRETE BASES

- D. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
- 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.08 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.09 GROUTING

- A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 330500

**SECTION 330510
WATER SYSTEMS**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes water systems piping for potable water service outside the building.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 22 Sections for water distribution systems inside building.
- C. Utility-furnished products include water meters that will be furnished to the site and ready for installation.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure Ratings: Except where otherwise indicated, the following are minimum pressure requirements for water system piping.
 - 1. Underground Piping: 150 psig (1035 kPa).
 - 2. Underground Piping, Downstream of Fire Department Connections: 200 psig (1380 kPa).

1.04 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 01 Specification Sections.
- B. Product data, including pressure rating, rated capacity, and settings of selected models for the following:
 - 2. Backflow preventers.
 - 3. Valves.
 - 4. Fire hydrants.
 - 5. Yard hydrants.
 - 6. Identification materials and devices.
- C. Coordination drawings showing pipe sizes and valves and specialty locations and elevations. Include details of underground structures, connections, anchors, and reaction backing. Show other piping in same trench and clearances from water system

piping. Indicate interface and spatial relationship between piping and proximate structures.

- F. Record drawings at Project closeout of installed water system piping and products according to Division 01 Section "Project Closeout."
- G. Test reports specified in "Field Quality Control" Article in Part 3.
- H. Maintenance data for inclusion in "Operating and Maintenance Manual" specified in Division 01 Section "Project Closeout." Include data for the following:
 - 1. Backflow preventers.
 - 2. Valves.
 - 3. Fire hydrants.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of utility supplying water. Include connection to meter and backflow prevention.
- B. Comply with standards of authorities having jurisdiction for fire protection systems. Include materials, hose threads, installation, and testing
- C. Comply with standards of authorities having jurisdiction for potable water piping and plumbing systems. Include materials, installation, testing, and disinfection.
- D. Comply with NFPA 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances" for materials, installations, tests, and flushing
- E. Comply with NFPA 70 "National Electrical Code" for electrical connections between wiring and electrically operated devices.
- F. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.
- G. Listing and Labeling: Provide equipment and accessories that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- H. Product Options: Water systems specialties and accessories are based on specific types, manufacturers, and models indicated. Components by other manufacturers but having equal performance characteristics may be considered, provided deviations in dimensions, operation, and other characteristics do not change design concept or

intended performance as judged by Architect. The burden of proof of equality of products is on Contractor. Refer to Division 1 Section "Product Substitutions."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, for shipping as follows:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends, flange faces, and weld ends.
 - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. Storage: Use the following precautions for valves, including fire hydrants, during storage:
 - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 - 2. Protect valves from weather. Store valves indoors and maintain temperature higher than ambient dew point temperature. Support valves off ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and piping specialties from moisture and dirt.
- G. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.07 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Verify that water system piping may be installed in compliance with original design and referenced standards.
- C. Site Information: Reports on subsurface condition investigations made during the design of the Project are available for informational purposes only; data in reports are not

intended as representations or warranties of accuracy or continuity of conditions. Owner assumes no responsibility for interpretations or conclusions drawn from this information.

1.08 SEQUENCING AND SCHEDULING

- A. Coordinate connection to water meter with utility company.
- B. Coordinate with pipe materials, sizes, entry locations, and pressure requirements of building fire protection systems piping.
- C. Coordinate with pipe materials, sizes, entry locations, and pressure requirements of building water distribution systems piping.
- D. Coordinate with other utility work.
- E. Coordinate electrical requirements of actual equipment furnished with requirements specified in Division 26.

PART 2-PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements of the City of St. Farmington Water Division and Fire Department, provide products by one of the following:
 - 1. Drilling Machine Corporation Stops:
 - a. Ford Meter Box Co., Inc.
 - b. Hays Div., Romac Industries.
 - c. Mueller Co., Grinnell Corp.
 - 2. Bronze Corporation Stops and Valves:
 - a. Ford Meter Box Co., Inc.
 - b. Hays Div., Romac Industries.
 - c. A.Y. McDonald Mfg. Co.
 - d. Mueller Co., Grinnell Corp.
 - 3. Tapping Valves:
 - a. Clow Valve Co. Div., McWane, Inc.
 - b. East Jordan Iron Works, Inc.

- c. Kennedy Valve Div., McWane, Inc.
 - d. Mueller Co., Grinnell Corp.
 - e. U.S. Pipe & Foundry Co.
4. Gate Valves:
- a. American Darling Valve Div., American Cast Iron Pipe Co.
 - b. Clow Valve Co. Div., McWane, Inc.
 - c. East Jordan Iron Works, Inc.
 - d. Gem Sprinkler Co. Div., Grinnell Corp.
 - e. Hammond Valve Corp.
 - f. Kennedy Valve Div., McWane, Inc.
 - g. Milwaukee Valve Co., Inc.
 - h. Mueller Co., Grinnell Corp.
 - i. Nibco, Inc.
 - j. Stockham Valves & Fittings, Inc.
 - k. U.S. Pipe & Foundry Co.
 - l. Waterous Co.
5. Indicator Posts and Indicator Gate Valves:
- a. American Darling Valve Div., American Cast Iron Pipe Co.
 - b. Clow Valve Co. Div., McWane, Inc.
 - c. Kennedy Valve Div., McWane, Inc.
 - d. Mueller Co., Grinnell Corp.
 - e. Nibco, Inc.
 - f. Stockham Valves & Fittings, Inc.
 - g. U.S. Pipe & Foundry Co.
 - h. Waterous Co.

6. Drains:
 - a. Ancon, Inc.
 - b. Jones Manufacturing Co., Inc.
 - c. Josam Co.
 - d. Jay R. Smith Mfg. Co. Div., Smith Industries, Inc.
 - e. Wade Div., Tyler Pipe Subsid., Tyler Corp.
 - f. Zurn Hydromechanics Div., Zurn Industries, Inc.
7. Detector Check Valves:
 - a. Ames Co., Inc.
 - b. Hersey Products, Inc., Grinnell Corp.
 - c. Kennedy Valve Div., McWane, Inc.
 - d. Viking Corp.
 - e. Watts Regulator Co.
8. Backflow Preventers:
 - a. Ames Co., Inc.
 - b. Cla-Val Co. Div., Griswold Industries.
 - c. Conbraco Industries, Inc.
 - d. Febco.
 - e. Hersey Products, Inc., Grinnell Corp.
 - f. Watts Regulator Co.
 - g. Wilkins Regulator Div., Zurn Industries, Inc.
9. Grooved Couplings for AWWA Ductile-Iron Piping:
 - a. Gustin-Bacon Div., Tyler Pipe Subsid., Tyler Corp.
 - b. Victaulic Co. of America.

2.02 PIPES AND TUBES

- A. Refer to Part 3 Article "Piping Applications" for identification of systems where pipe and tube materials specified below are used.
- B. Ductile-Iron Pipe: AWWA C151-V6, Class 52.
 - 1. Lining: AWWA C104, cement mortar, seal coated.
 - 2. Gaskets, Glands, and Bolts and Nuts: AWWA C111-85.
 - 3. Push-On-Joint-Type Pipe: AWWA C111-85, rubber gaskets.
 - 4. Mechanical-Joint-Type Pipe: AWWA C111-85, rubber gaskets, ductile- or cast-iron glands, and steel bolts and nuts.
 - 5. Encasement: AWWA C105-88, polyethylene film tube.
- B. Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), seamless water tube, annealed temper.

2.03 PIPE AND TUBE FITTINGS

- A. Refer to Part 3 Article "Piping Applications" for identification of systems where pipe and tube fitting materials specified below are used.
- B. Ductile-Iron and Cast-Iron Pipe Fittings: AWWA C110-87, ductile-iron or cast-iron, 250-psig (1725 kPa) minimum pressure rating; or AWWA C153, ductile-iron compact fittings, 350-psig (2400 kPa) pressure rating.
 - 1. Lining: AWWA C104, cement mortar.
 - 2. Gaskets: AWWA C111-85, rubber.
- C. Ductile-Iron and Gray-Iron Flanged Fittings: AWWA C110-87, 250-psig (1725 kPa) minimum pressure rating, with AWWA C104 cement-mortar lining (350 psi when ductile-iron)
- D. Copper Tube Fittings: ASME B16.22, wrought-copper, solder-joint pressure type.

2.04 JOINING MATERIALS

- A. Refer to Part 3 Article "Piping Applications" for identification of systems where joining materials specified below are used.
- B. Ductile-Iron Pipe and Ductile-Iron or Cast-Iron Fittings: The following materials apply:
 - 1. Push-On Joints: AWWA C111 rubber gaskets and lubricant.
 - 2. Mechanical Joints: AWWA C111 ductile-iron or gray-iron glands, high-strength steel bolts and nuts, and rubber gaskets.

3. Flanged Joints: AWWA C115 ductile-iron or gray-iron pipe flanges, rubber gaskets, and high-strength steel bolts and nuts.
 - a. Gaskets: Rubber, flat face, 1/8 inch (3 mm) thick except where other thickness is indicated; and full-face or ring type except where other type is indicated.
 - b. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.
- C. Brazing Filler Metals: AWS A5.8, BCuP (copper-phosphorus) Series.
- D. Solder Filler Metal: ASTM B 32, Alloy Sn95; tin (approximately 95 percent), silver (approximately 4.5 percent), with 0.10 percent maximum lead content.
- E. Pipe Couplings: Iron-body sleeve assembly, fabricated to match outside diameters of pipes to be joined.
 1. Sleeve: ASTM A 126, Class B, gray iron.
 2. Followers: ASTM A 47, Grade 32510, or ASTM A 536 ductile iron.
 3. Gaskets: Rubber.
 4. Bolts and Nuts: AWWA C111.
 5. Finish: Enamel paint.
 6. Encasement: AWWA C105, polyethylene film tube or sheet.

2.05 VAVLES

- A. Nonrising Stem Gate Valves 6 Inches (80 mm) and Larger: AWWA C500-V6, cast-iron double disc, bronze disc and seat rings, bronze stem, cast-iron or ductile-iron body and bonnet, stem nut, 200-psig (1380 kPa) working pressure, mechanical joint ends.
- B. Nonrising Stem Gate Valves, 2 Inches (50 mm) and Smaller: MSS SP-80; body and screw bonnet of ASTM B 62 cast bronze; with Class 125 threaded ends, solid wedge, nonrising copper-silicon alloy stem, brass packing gland, polytetrafluoroethylene (PTFE)-impregnated packing, and malleable-iron handwheel.
- C. Valve Boxes: Cast-iron box having top section and cover with lettering "WATER," bottom section with base of size to fit over valve and barrel approximately 5 inches (124 mm) in diameter, and adjustable cast-iron extension of length required for depth of bury of valve.
 1. Provide a steel tee-handle operating wrench with each valve box. Wrench shall have tee handle with one pointed end, stem of length to operate valve, and socket-fitting valve-operating nut.

- D. Indicator Posts: UL 789, FM-approved, vertical type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of bury of valve.
- E. Service Clamp and Corporation Stops: Complete assembly, including service clamp, corporation stop, and bolts and nuts. Use service clamp and stop compatible with drilling machine.
 - 1. Service Clamp: Cast iron or ductile iron with gasket and AWWA C800 threaded outlet for corporation stop, and threaded end straps.
 - 2. Corporation Stops: Bronze body and ground key plug, with AWWA C800 threaded inlet and outlet matching service piping material.
 - 3. Manifold: Copper with 2 to 4 inlets as required, with ends matching corporation stops and outlet matching service piping.

2.06 FIRE HYDRANTS

- A. General: Cast-iron body, compression-type valve, opening against pressure and closing with pressure, 6-inch (150 mm) mechanical joint inlet, 150-psig (1035 kPa) working pressure.
- B. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
- C. Operating and Cap Nuts: Pentagon 1-1/2 inch (40 mm) point to flat.
- D. Direction of Opening: Open hydrant valve by turning operating nut to the left, or counterclockwise.
- E. Finish: Red exterior alkyd gloss enamel paint.
- F. Dry-Barrel Fire Hydrants: UL 246, FM-approved, two 2-1/2-inch (65 mm) and one 4-1/2-inch (113 mm) outlets, 5-1/4-inch (133 mm) main valve, drain valve, and 6-inch (150 mm) mechanical joint inlet.
- G. Dry-Barrel Fire Hydrants: AWWA C502, two 2-1/2-inch (65 mm) and one 4-1/2-inch (113 mm) outlets, 5-1/4-inch (133 mm) main valve, drain valve, and 6-inch (150 mm) mechanical joint inlet.
- H. Wet-Barrel Fire Hydrants: UL 246, FM-approved, two 2-1/2-inch (65 mm) and one 4-1/2-inch (113 mm) outlets, 6-inch (150 mm) threaded or flanged inlet, and base section with 6-inch (150 mm) mechanical joint inlet.
- I. Wet-Barrel Fire Hydrants: AWWA C503, two 2-1/2-inch (65 mm) and one 4-1/2-inch (113 mm) outlets, 6-inch (150 mm) threaded or flanged inlet, and base section with 6-inch (150 mm) mechanical joint inlet.

2.07 BACKFLOW PREVENTERS

- A. General: ASSE Standard backflow preventers, of size indicated for maximum flow rate and maximum pressure loss indicated.
 - 1. Working Pressure: 150 psig (1035 kPa) minimum except where indicated otherwise.
 - 2. 2 Inches (50 mm) and Smaller: Bronze body with threaded ends.
 - 3. 2-1/2 Inches (65 mm) and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.
 - a. Interior Lining: FDA-approved epoxy coating for backflow preventers having cast-iron or steel body.
 - 4. Interior Components: Corrosion-resistant materials.
 - 5. Exterior Finish: Polished chrome plate when used in chrome-plated piping system.
 - 6. Strainer on inlet where strainer is indicated.
- B. Reduced-Pressure-Principle Backflow Preventer: ASSE 1013, with OS&Y gate valves on inlet and outlet, and strainer on inlet. Include test cocks and pressure-differential relief valve having ASME A112.1.2 air-gap fitting located between 2 positive-seating check valves for continuous-pressure application.
 - 1. Pressure Loss: 12 psig (83 kPa) maximum through middle third of flow range.
- C. Double-Check Backflow Prevention Assemblies: ASSE 1015, with valves on inlet and outlet and strainer on inlet. Include test cocks with 2 positive-seating check valves for continuous-pressure application.
 - 1. Pressure Loss: 5 psig (34 kPa) maximum through middle third of flow range.
- D. Double Check Valve Assembly: UL 312, FM-approved. Assembly has 2 UL 312, FM-approved, iron-body, 175-psig (1200 kPa) working pressure, flanged-end check valves, with 2 UL 262, FM-approved, iron-body, OS&Y, flanged, 175-psig (1200 kPa) working pressure gate valves.
 - 1. Pressure Loss: 5 psig (34 kPa) maximum through middle third of flow range.
- E. Reduced-Pressure Detector Assembly Backflow Preventers: ASSE 1047, FM-approved or UL-listed, with OS&Y gate valves on inlet and outlet, and strainer on inlet. Include pressure-differential relief valve having ASME A112.1.2 air-gap fitting located between 2 positive-seating check valves, test cocks, and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer, for continuous-pressure application.
 - 1. Pressure Loss: 12 psig (83 kPa) maximum through middle third of flow range.
- F. Double-Check Detector Assembly Backflow Preventers: ASSE 1048, FM-approved or UL-listed, with OS&Y gate valves on inlet and outlet, and strainer on inlet. Include 2 positive-seating check valves and test cocks, and bypass with displacement-type water

meter, valves, and double-check backflow preventer, for continuous-pressure application.

1. Pressure Loss: 5 psig (34 kPa) maximum through middle third of flow range.

2.08 ANCHORAGES

- A. Clamps, Straps, and Washers: ASTM A 506, steel.
- B. Rods: ASTM A 575, steel.
- C. Rod Couplings: ASTM A 197, malleable iron.
- D. Bolts: ASTM A 307, steel.
- E. Cast-Iron Washers: ASTM A 126, gray iron.
- F. Concrete Reaction Backing: Portland cement concrete mix, 3000 psi (20.7 MPa).
 1. Cement: ASTM C 150, Type I.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.

2.09 IDENTIFICATION

- A. Plastic Underground Warning Tapes: Polyethylene plastic tape, 6 inches (150 mm) wide by 4 mils (1 mm) thick, solid blue in color with continuously printed caption in black letters "CAUTION - WATER LINE BURIED BELOW."

PART 3-EXECUTION

3.01 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earthwork."

3.02 SERVICE ENTRANCE PIPING

- A. Extend water system piping and connect to water supply source and building water distribution systems at outside face of the building wall in locations and pipe sizes indicated.
 1. Terminate water system piping at building wall until building water systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building water systems when those systems are installed.

- B. Water distribution systems are specified in Division 22 Sections. Sleeves and mechanical sleeve seals are specified in Division 23 Section "Basic Mechanical Materials and Methods."
- C. Install restrained joints for buried piping within 5 feet (1.5 m) of building. Use restrained-joint pipe and fittings, thrust blocks, anchors, tie-rods and clamps, and other supports at vertical and horizontal offsets.

3.03 PIPING APPLICATIONS

- A. Refer to Part 2 of this Section for detailed specifications for pipe and fittings products listed below. Use pipe, tube, fittings, and joining methods according to the following applications. Piping in pits and inside building may be joined with flanges or couplings, instead of joints indicated, for grooved-end AWWA-size piping.
- B. Use pipe, tube, fittings, and joining methods according to following applications.
 - 1. 2 Inches (50 mm) and Smaller: Copper tube, Type K (Type A), copper tube fittings, and soldered joints.
 - 2. 2 Inches (50 mm) and Smaller: Copper tube, Type K (Type A), copper tube fittings, and brazed joints.
 - 3. 2-1/2 Inches (65 mm) to 3-1/2 Inches (90 mm): Copper tube, Type K (Type A), copper tube fittings, and soldered joints.
 - 4. 2-1/2 Inches (65 mm) to 3-1/2 Inches (90 mm): Copper tube, Type K (Type A), copper tube fittings, and brazed joints.
 - 5. 6 Inches (100 mm) to 8 Inches (200 mm): Class 250, ductile-iron pipe, ductile-iron compact fittings, and push-on or mechanical joints.
 - 6. 6 Inches (100 mm) to 8 Inches (200 mm): Class 200, ductile-iron pipe, ductile-iron or gray-iron fittings, and push-on or mechanical joints.
 - 7. 10 Inches (250 mm) and Larger: Class 250, ductile-iron pipe, ductile-iron or gray-iron fittings, rubber gaskets, and push-on or mechanical joints.
 - 8. 10 Inches (250 mm) and Larger: Class 250, ductile-iron pipe, ductile-iron compact fittings, rubber gaskets, and push-on or mechanical joints.
 - a. Use standard pattern pipe fitting for sizes larger than 16 inches (400 mm).
 - 9. 10 Inches (250 mm) and Larger: AWWA C900, Class 200 polyvinyl chloride (PVC) plastic pipe, AWWA C900 PVC fittings, and gasketed joints.
 - a. Use AWWA C905, Class 200 polyvinyl chloride (PVC) pipe and fittings for sizes larger than 12 inches (300 mm).

3.04 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Buried Valves 3 Inches (80 mm) and Larger: AWWA, gate valves, nonrising stem, with valve box.
 - 2. Buried Valves 4 Inches (100 mm) and Larger: UL/FM, gate valves, nonrising stem, with indicator post.
 - 3. Pit and Above ground Installation, Valves 2 Inches (50 mm) and Smaller: MSS, nonrising stem gate valves.

3.05 JOINT CONSTRUCTION

- A. Ductile-Iron Piping Gasketed Joints: Construct joints according to AWWA C600.
- B. Flanged Joints: Align flanges and install gaskets. Assemble joints by sequencing bolt tightening. Use lubricant on bolt threads.
- C. Copper Tube and Fittings, Soldered Joints: Construct joints according to AWS "Soldering Manual," Chapter "The Soldering of Pipe and Tube."
- D. Dissimilar Materials Piping Joints: Construct joints using adapters that are compatible with both piping materials, outside diameters, and system working pressure. Refer to "Piping Systems - Common Requirements" Article for joining piping of dissimilar metals.

3.06 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. General Locations and Arrangements: Drawings indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated except where deviations to layout are approved on coordination drawings.
- B. Install piping at indicated slope.
- C. Install components having pressure rating equal to or greater than system operating pressure.
- D. Install piping free of sags and bends.
- E. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- F. Install fittings for changes in direction and branch connections.
- G. Piping Connections: Except as otherwise indicated, make piping connections as specified below.
 - 1. Install unions, in piping 2 inches (50 mm) and smaller, adjacent to each valve and at final connection to each piece of equipment having 2-inch (50 mm) or smaller threaded pipe connection.

2. Install flanges, in piping 2-1/2 inches (65 mm) and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
3. Install dielectric fittings to connect piping of dissimilar metals.

3.07 ANCHORAGE INSTALLATION

- A. Anchorages: Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 1. Gasketed-Joint, Ductile-Iron Piping: According to AWWA C600.
- B. Apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of installed ferrous anchorage devices.

3.08 VALVE INSTALLATION

- A. General Application: Use mechanical-joint-end valves for 3-inch (80 mm) and larger buried installation. Use threaded- and flanged-end valves for installation in pits and inside building. Use nonrising stem UL/FM gate valves for installation with indicator posts. Use bronze corporation stops and valves, with ends compatible with piping, for 2-inch (50 mm) and smaller installation.
- B. AWWA-Type Gate Valves: Comply with AWWA C600. Install buried valves with stem pointing up and with cast-iron valve box.
- C. UL/FM-Type Gate Valves: Comply with NFPA 24.
 1. Install buried valves and valves in pits with stem pointing up and with vertical cast-iron indicator post.
- D. Bronze Corporation Stops and Curb Stops: Comply with manufacturer's installation instructions. Install buried curb stops with head pointed up and with cast-iron curb box.

3.09 FIRE HYDRANT INSTALLATION

- A. AWWA-Type Fire Hydrants: Comply with AWWA M17. Install with gate valve and provision for drainage as indicated.
- B. UL/FM-Type Fire Hydrants: Comply with NFPA 24. Install with gate valve and provision for drainage as indicated.

3.10 BACKFLOW PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to plumbing and health department authorities having jurisdiction.
- B. Do not install bypass around backflow preventer.

- C. Do not install reduced-pressure-principle-type in pit.
- D. Support backflow preventers, valves, and piping on 3000-psi (20.7 MPa) minimum, portland-cement-mix concrete piers as indicated.

3.11 IDENTIFICATION INSTALLATION

- A. Install continuous plastic underground warning tape during back-filling of trench for underground water service piping. Locate 6 inches (150 mm) to 8 inches (200 mm) below finished grade, directly over piping.

3.12 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours prior to testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2 hours.
 - 1. Increase pressure in 50-psig (350 kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within above limits.

3.13 CLEANING

- A. Clean and disinfect water distribution piping as follows:
 - 1. Purge new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired prior to use.
 - 2. Use purging and disinfecting procedure prescribed by authority having jurisdiction or, if method is not prescribed by that authority, use procedure described in AWWA C651 or as described below:
 - a. Comply with NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 - b. Fill system or part of system with water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) system or part thereof and allow to stand for 24 hours.
 - c. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 parts per million of chlorine; isolate and allow to stand for 3 hours.
 - d. Following allowed standing time, flush system with clean, potable water until chlorine does not remain in water coming from system.

e. Submit water samples in sterile bottles to authority having jurisdiction. Repeat procedure if biological examination made by authority shows evidence of contamination.

B. Prepare reports for purging and disinfecting activities.

END OF SECTION 330510

SECTION 334100
STORM AND SANITARY SEWERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. City of Farmington Storm Water Ordinance (Ordinance No. 11-2I 86)

1.02 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.
 - 2. Cleanouts.
 - 3. Manholes.
 - 4. 2-Grate inlets.
 - 5. Curb inlets
- B. Related Sections:
 - 1. Division 01 Section "Construction Progress Documentation" for recording storm sewer progress.
 - 2. Division 31 Section "Earth Moving" for excavation and backfill of trenches for utilities and buried utility structures.
 - 3. Division 31 Section "Excavation Support and Protection" for temporary excavation support and protection systems.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. EGC Submittals:
 - 1. Product Data for EGC Credit 6-2: For products having recycled content, documentation indicating percentages by weight of postconsumer and postindustrial recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Data for Owner's Regional Materials Goal: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
- C. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
 2. 2-Grate inlets: Include plans, elevations, sections, details, frames, covers, and grates.
- D. Coordination Drawings: For trenchless sewer construction, show excavation sizes, locations, and elevations; pipe material; and casing size and material, if used. Indicate quality control systems used to maintain line and grade of sewer pipe.
- E. Field quality-control reports.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.
- D. Handle 2-grate inlets according to manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

- A. General: Sewer Pipe and fittings material shall comply with the Missouri Department of Transportation Specifications for Sewers and Drainage Facilities.

2.02 DUCTILE-IRON PIPE

- A. Pipe: ASTM A 716, for push-on joints.
- B. Gaskets: AWWA C111, rubber.

2.03 PE PIPE AND FITTINGS

- A. Corrugated PE Pipe and Fittings NPS 12 to NPS 60 (DN 300 to DN 1500): AASHTO M 294M, Type S, with smooth waterway for coupling joints.
 1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

2.04 PVC PIPE AND FITTINGS

- A. PVC Corrugated Sewer Piping:
 1. Pipe: ASTM F 949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.

2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F 477, elastomeric seals.

B. PVC Profile Sewer Piping:

1. Pipe: ASTM F 794, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

C. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

D. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, T-2 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

2.05 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M).

1. Bell-and-spigot or tongue-and-groove ends and gasketed joints with ASTM C 443 (ASTM C 443M), rubber gaskets or sealant joints with ASTM C 990 (ASTM C 990M), bitumen or butyl-rubber sealant.
2. Class III, Wall B.

2.06 ENCASEMENT FOR DUCTILE IRON PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Material: Linear low-density polyethylene film of 0.008-inch (0.20-mm) or high-density, cross-laminated polyethylene film of 0.004-inch (0.10-mm) minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or green.

2.07 CLEANOUTS

A. PVC Cleanouts: PVC body with cast iron frame and lid. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.08 MANHOLES

- A. Manholes shall be precast concrete construction in accordance with the Missouri Department of Transportation Specifications for Sewers and Drainage Facilities.
- B. Manhole Frames and Covers shall be cast iron construction in accordance with the Missouri Department of Transportation Specifications for Sewers and Drainage Facilities.

2.09 2-GRATE INLETS

- A. 2-Grate Inlets shall be precast concrete construction in accordance with the Missouri Department of Transportation Construction Specifications for Sewers and Drainage Facilities.
- B. 2-Grate Inlet Frames shall be steel and Covers shall be cast iron construction in accordance with the Missouri Department of Transportation Specifications for Sewers and Drainage Facilities.
 - 1. Standard B1 and B2 text on the grates shall be replaced with standard A1 and A2 text.

2.010 CURB INLETS

- A. Curb Inlets shall be precast concrete construction in accordance with the Missouri Department of Transportation Specifications for Sewers and Drainage Facilities.
- B. Curb Inlet Frames shall be steel and Covers shall be cast iron construction in accordance with the Missouri Department of Transportation Specifications for Sewers and Drainage Facilities.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.02 PIPING INSTALLATION

- A. Comply with all requirements of the Missouri Department of Transportation Specifications for Sewers and Drainage Facilities.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

- C. When installing pipe under streets, utilities or other obstructions that cannot be disturbed, use Trenchless Sewer Construction methods of bored hole, jacking or microtunneling.
- D. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install ductile-iron piping according to AWWA C600 or AWWA M41.
 - 2. Install PE corrugated sewer piping according to ASTM D 2321.
 - 3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 4. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 5. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.03 PIPE JOINT CONSTRUCTION

- A. Comply with all requirements of the Missouri Department of Transportation Specifications for Sewers and Drainage Facilities.
- B. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
 - 2. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
 - 3. Join PVC corrugated sewer piping according to ASTM D 2321 for elastomeric-seal joints.
 - 4. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
 - 5. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
 - 6. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.

3.04 CLEANOUT INSTALLATION

- A. Comply with all requirements of the Missouri Department of Transportation Specifications for Sewers and Drainage Facilities.
- B. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
- C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.05 MANHOLE INSTALLATION

- A. Comply with all requirements of the Missouri Department of Transportation Specifications for Sewers and Drainage Facilities.
- B. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 2 inches (50 mm) above finished surface elsewhere unless otherwise indicated.

3.06 2-GRATE INLET INSTALLATION

- A. Comply with all requirements of the Missouri Department of Transportation Specifications for Sewers and Drainage Facilities.
- B. Set frames and grates to elevations indicated.

3.07 FIELD QUALITY CONTROL

- A. Comply with all requirements of the Missouri Department of Transportation Specifications for Sewers and Drainage Facilities.
- B. Clear interior of piping and structures of dirt and superfluous material as work progresses.
 - 1. Place plug in end of incomplete piping at end of day and when work stops.
 - 2. Flush piping between manholes and other structures to remove collected debris, as required by the City of Farmington.
- C. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of an approved nine arm mandrel of size not less than 95 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.

3.08 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION 334100

SECTION 400 – FLEXIBLE PAVEMENTS

A. FLEXIBLE PAVEMENTS

1. Bituminous Base Course.

a. Scope of Work. The work shall include all labor, equipment, and materials necessary for the furnishing, mixing, hauling, placing, and consolidation of plant mix bituminous base course in accordance with the plans and contract documents.

b. Materials.

- (1) Asphalt Cement. This material shall be homogenous and free from water, and shall not, on heating, foam below the specified minimum flash point. It shall be prepared by refining crude petroleum by suitable methods. It shall conform to the requirements of the following table for penetration grade 85-100. Material from any one source for any one source for any one contract shall not vary more than 0.02 in specific gravity.

Asphalt Cement Table		
	85 – 100	
Penetration Grade	Min.	Max.
Penetration at 25C (77F) 100g, 5 sec.	85	100
Flash point, (Cleveland open cup), degrees C	232	---
(F)	(450)	
Ductility, 5 cm/min, 25 C (77F), cm	100	---
Solubility in trichloroethylene, percent	99.0	---
Spot test-Standard Naphtha (Note 1)	Negative	
Thin-film oven test 1/8 in., 163 C (325F), 5 hour; Loss on heating percent	---	1.0
Penetration of residue, percent of original	50	---
Ductility of residue, 5 cm/min 25 C (77F), cm	75	---

Note 1 – The spot test shall be conducted in accordance with AASHTO T 102, with the following modifications: Add to Section 5.2.1, “If, however, the drop forms a uniformly brown circular stain, the test shall be reported as negative. In case of dispute, the entire test shall be repeated.” Delete Section 5.3 through 7.3, inclusive.

- (2) Fine Aggregate. Fine aggregate for bituminous base course shall be a fine, granular material naturally produced by the disintegration of rock of a siliceous nature. With written approval of the Engineer, chat sand produced from flint chat in the Joplin area, or

finer manufactured from crushed dolomite, igneous rock and chert gravel, or wet bottom boiler slag may be used as fine aggregate for asphaltic concrete. Fine aggregate shall be free from cemented or conglomerated lumps and shall not have any coating or injurious material. The percentage of deleterious substances shall not exceed the following values:

Item	Percent by Weight
Clay lumps or shale	1.0
Total lightweight particles, including coal or lignite	0.5
Other deleterious substances	0.1

Lightweight sand particles are not considered deleterious lightweight particles. The total lightweight particles requirement shall not apply to wet bottom boiler slag, angular chert sand, or manufactured sand.

- (3) Mineral Filler. Mineral filler shall consist of dolomite dust, Portland cement, or other suitable mineral matter. It shall be thoroughly dry and free of lumps consisting of aggregations of fine particles. When tested in accordance with AASHTO T37 the mineral filler shall conform to the following gradation requirements.

	Percent
Passing No. 30 sieve	100
Passing No. 50 sieve	95 – 100
Passing No. 100 sieve	90 – 100
Passing No. 200 sieve	70- 100

- (4) Graded Aggregate. Graded aggregate for bituminous base shall consist of sound, durable rock particles, free from objectionable coatings. When tested in accordance with AASHTO T 96, the percentage of wear shall not exceed 55. The percentage of deleterious substances shall not exceed the following values and the sum or percentages of all deleterious substances shall not exceed eight (8) percent.

	Percent Passing by Weight
Deleterious Rock	8.0
Mud Balls and Shale combined	2.0
Clay, uniformly dispersed	3.0
Other foreign material	0.5

The gradation of the course aggregate shall be such that the total aggregate meets the gradation requirements specified hereafter in Paragraph three (3) prior to being fed into the cold aggregate feeders.

(5) Type I Aggregate shall conform to the following requirements:

Type I aggregate shall be essentially crushed stone, sand and gravel. It shall not contain more than fifteen (15) percent deleterious rock and shale. Sand may be added only for the purpose of reducing the plasticity index of the fraction passing the No. 40 sieve in the finished product. Any sand, silt, clay, and any deleterious rock and shale shall be uniformly distributed throughout the mass. The aggregates shall conform to the following gradation requirements:

	Percent
Passing one (1) inch sieve	100
Passing one-half (1/2) inch sieve	60 – 90
Passing No. 4 sieve	40 – 60
Passing No. 30 sieve	15 - 35

The fraction passing the No. 40 sieve shall have a plasticity index not to exceed six (6).

(6) Type 5 Aggregate shall conform to the following requirements:

Type 5 aggregate shall be essentially crushed stone, sand and gravel. It shall not contain more than fifteen (15) percent deleterious rock and shale. Sand may be added only for the purpose of reducing the plasticity index of the fraction passing the No. 40 sieve in the finished product. Any sand, silt, clay, and any deleterious rock and shale shall be uniformly distributed throughout the mass. The aggregates shall conform to the following gradation requirements:

	Percent
Passing one (1) inch sieve	100
Passing one-half (1/2) inch sieve	60 – 90
Passing No. 4 sieve	40 – 60
Passing No. 30 sieve	15 - 35
Passing No. 200	0 - 15

The fraction passing the No. 40 sieve shall have a plasticity index not to exceed six (6).

(7) Material. The asphalt cement material used for prime coat shall be Type MC, grade MC-30, and be homogenous and free from water, and shall not, on heating, foam below the

specified minimum flash point. It shall be prepared by refining crude petroleum by suitable methods. It shall conform to the requirements of the following table for the penetration or viscosity grade specified herein. Material from any one source for any one contract shall not vary more than 0.02 in specific gravity.

Type MC Liquid Asphalt		
	MC – 30	
Grade	Min	Max
Water, percent	--	0.2
Flash point (Tag open cup), degrees C	38	--
(F)	(100)	--
Kinematic Viscosity at 60C (140 F), centistokes	30	60
Distillation test:		
Distillate, percentage by volume of total distillate		
To 360 C (680 F)		
To 225 C (437 F)	--	25
To 260 C (500 F)	40	70
To 315 C (600 F)	76	93
Residue from distillation to 360 C (680 F) volume percentage of sample by difference	50	--
Tests on residue from distillation:	120	250
Penetration, 100 g. 5 sec., at 25 C (77 F)		
Ductility, 5 cm/min., cm (Note 1)	100	--
Solubility in trichloroethylene, percent	99.0	--
Spot test-Standard Naphtha (note 2)	Negative	

Note1– If the ductility at 25C *77F) is less than 100 cm, the material will be acceptable if its ductility at 15.6 (60F) is more than 100 cm.

Note 2 – The spot tests shall be conducted in accordance with AASHTO T 102, with the following modifications: Add to Section 5.2.1, “If, however, the drop forms a uniformly brown circular stain, the test shall be reported as negative. In case of dispute, the entire test shall be repeated.”

c. Composition of Mixtures.

- (1) Aggregate composition. The bituminous base shall be composed of a mixture of crushed dolomite or dolomite, except as hereinafter permitted, filler if needed, and asphalt cement. The aggregate prior to mixing with asphalt cement shall meet the following gradation requirements:

	Percent by Weight
Passing 1-inch sieve	100
Passing ½-inch sieve	60 – 90
Passing No. 4 sieve	35 – 65
Passing No. 10 sieve	25 – 45
Passing No. 40 sieve	10 – 30
Passing No. 200 sieve	5 - 12

At the option of the contractor, fine aggregate having 100-percent passing the three eighths (3/8)-inch sieve and not more than six (6) percent passing the No. 200 sieve may be incorporated into the mixture. The total quantity of such fine aggregate shall not exceed thirty (30) percent by weight of the combined aggregate.

The composition of the mixture shall be as directed by the Engineer and shall conform to the following limits by weight.

	Percent
Total Mineral Aggregate	94 – 97
Asphalt Cement	3 – 6

- (2) Job-mix formula. Prior to preparing any of the mixture on the project, the contractor shall submit for the Engineer's approval, a job-mix formula for the mixture to be supplied for the project. No mixture will be accepted for use until the job-mix formula for the project is approved by the Engineer. The job-mix formula shall be within the gradation range specified for bituminous base and shall include the type and sources of all materials, the gradations of the aggregates, and the relative quantity of each ingredient, if more than one, and shall state a definite percentage for each fraction of aggregate. No job-mix formula will be approved which does not permit within the limits specified in Paragraph 3 herein the full tolerances specified; Paragraph 3c herein for asphalt cement and not less than one-half (1/2) the tolerances specified in Paragraph 3d herein for material passing the No. 10 sieve and the material passing the No. 200 sieve. The job-mix formula approved for the mixture shall be in effect until modified in writing by the Engineer. When unsatisfactory results or other conditions make it necessary, or should a source of material be changed, a new job-mix formula may be required.

- (3) Changes in proportions. The Engineer will make such changes in the proportions of asphalt cement and aggregates as he considers necessary within the limits of the specifications. The proposed mixture will be compacted and tested in the laboratory in accordance with AASHTO T 167 and the bulk specific gravity will be determined in accordance with the procedures described in AASHTO T 165. The mixture of mineral aggregate and asphalt cement shall result in a bituminous mixture, which will be durable and retain satisfactory

cohesion and stability in the presence of moisture. Chemical additions approved in writing by the Engineer may be made to the asphalt, cement, or to the mixture.

- (4) Gradation control. In producing mixtures for the project, the plant shall be so operated that no intentional deviations from the job-mix formula are made. Mixtures as produced shall be subject to the following tolerances and controls:
- (5) Total aggregate gradation shall be within the master range specified in Paragraph 3a, herein.
- (6) Maximum variations from the approved job-mix formula shall be within the following tolerances:
 - i. Passing No. 10 sieve +/-5.0% points
 - ii. Passing No. 200 sieve +/-2.0% points
- (7) Quantity of asphalt cement introduced into the mixer shall be that quantity specified in the job-mix formula. No change may be made in the quantity of asphalt cement specified in the job-mix formula without written approval of the Engineer. The quantity of asphalt cement determined by calculation or tests on the final mixture shall not vary more than +/- 0.5 percentage points from the job-mix formula.
- (8) Commercial Mixture. The contractor may, at his option, use an approved commercial mixture. The contractor shall, at least seven (7) days prior to the desired time of use, furnish a statement setting out the source and characteristics of the mixture he proposes to furnish. The statement shall include (1) the types and sources of aggregates, percentage range of each, and range of combined gradation; (2) the percent and grade of asphalt; and (3) the mixing time and range of mixture temperature. The plant shall be designed and operated to produce a uniform, thoroughly mixed material free from segregation. If the proposed mixture is approved by the Engineer, the component materials and the mixture delivered will be accepted or rejected by visual inspection. The supplier shall, with each truck load, furnish a certification in triplicate that the materials and mixture delivered are in conformance with this approved proposal. The mixture shall be transported, placed, and compacted in accordance with the requirements specified hereinafter.

d. Construction Requirements.

- (1) Weather Limitations. Bituminous mixtures shall not be placed (1) when either the air temperature or the temperature of the surface on which the mixture is to be placed is below 35 degrees F and falling, (2) on any wet or frozen surface, or (3) when weather conditions prevent the proper handling or finishing of the mixture.

- (2) Subgrade Preparation. The subgrade shall be prepared in accordance with the requirements of Section III of these Specifications.

- (3) Aggregate Base. Type 1 Aggregate Base shall be placed under all bituminous pavements and shall extend 1'-0" beyond the back of curbs. Refer to Table VII-1 in the "Design Standards for Public Improvements" for required thicknesses. The aggregate material shall be compacted to not less than one hundred percent (100%) of Standard maximum density. Moisture shall be added to the material during compaction only when it is necessary to obtain the required density. Measurement for payment of the aggregate shall be by truck ticket or computed to the lines and grades of the aggregate on plans and weighing 116 pounds per square yard per inch of thickness plus five percent (5%) for moisture, whichever is smaller. All extra aggregate used under pavements shall be the contractor's responsibility.

- (4) Application of Prime Coat. A bituminous prime coat shall be applied to all Aggregate Base courses to which bituminous material shall be applied when the asphalt thickness is less than five (5) inches. The prime coat shall be applied to the width of the section to be primed by means of a pressure distributor in a uniform, continuous spread. The application rate shall be .35 gallon per square yard. The primer shall be heated at the time of application to a temperature specified in the table below.

Application Temperature for Bituminous Materials

Bituminous Mat.	<u>Temperature, Degrees Fahrenheit</u>			
	Spraying		Mixing	
Liquid Asph MC Grade 30	Min.	Max.	Min.	Max.
	70	150	50	110

Care shall be taken that the application of bituminous material at the junctions of spreads is not in excess of the specified quantity. Building paper shall be placed over the end of the previous applications and the joining application shall start on the building paper. Building paper used shall be removed and satisfactorily disposed of. Pools of primer material remaining on the surface after the application shall be removed.

When traffic is maintained, not more than one half of the width of the section shall be treated in one application and one-way traffic will be permitted on the untreated portion of the roadbed. As soon as the bituminous material has been absorbed by the surface and will not pick up, traffic shall be routed to the treated portion and the remaining width of the section shall be primed.

If, after the application of the prime coat, the bituminous material fails to penetrate, and the roadbed must be used by traffic, sand blotter material shall be spread in the quantity required to absorb any excess bituminous material.

The primer shall be properly cured, and the primed surface shall be cleaned of all dirt and surplus sand before the next course is placed.

- (5) Transportation. The prepared base course mixture shall be transported from the paving plant to the work in tight vehicles previously cleaned of all foreign materials. The inside of truck beds shall be lubricated with a thin oil to prevent the mixture from adhering to the bed, but an excess of lubricant will not be permitted. Each load shall be covered with canvas or other suitable material of sufficient size to protect it from the weather. No loads shall be sent out so late in the day that spreading and compacting of the mixture cannot be done during daylight.
- (6) Spreading. The base course, primed surface, or preceding course or layer shall be cleaned of all dirt, packed soil, or any other foreign material prior to spreading the bituminous mixture. When delivered to the roadbed, the mixture shall be at a temperature, which will permit proper placement and compaction. It shall be spread with an approved spreading and finishing machine in the number of layers and in the quantity required to obtain the compacted thickness and cross section shown on the plans. The compacted thickness of a single layer shall not exceed three (3) inches except the uppermost layer directly under the surface course for travel ways and auxiliary lanes shall be placed in a single layer not to exceed the width and thickness shown on the plans. In widening construction the material may be placed in two layers, provided the thickest layer is placed first and no individual layer has a compacted thickness greater than three (3) inches. On base widening work, a succeeding layer of bituminous mixture may be placed the same day as the previous layer, if it can be shown that the desired results are being obtained. On small areas, and on areas which are inaccessible to mechanical spreading and finishing equipment, the mixture may be spread and finished by hand methods if permitted by the Engineer.

The mixture shall be spread without tearing the surface and struck off so that the surface is smooth and true to cross section, free from all irregularities, and of uniform density throughout. Care shall be used in handling the mixture to avoid segregation. Areas of segregated mixture shall be removed and replaced with suitable mixture. The outside edges of the base shall be constructed to an angle of approximately 45 degrees with the surface of the roadbed. The outside edge alignment shall be uniform and any irregularities shall be corrected by adding or removing mixture before compacting.

If required by the contract, a leveling course consisting of a layer of variable thickness shall be spread to the desired grade and cross section to eliminate irregularities in the

existing surface. Spot-leveling operations over small areas, with featheredging at high points and ends of spot areas, may be required prior to placing the leveling course. Rigid control of the placement thickness of the leveling course will be required. The use of an approved finishing machine will be required on the spot leveling and the leveling course, except that the spreading of the spot-leveling with a blade grader will be permitted if results indicate the mixture is practically free from segregation.

- (7) Joints. Longitudinal and transverse joints shall be carefully made and well bonded. Transverse joints shall be formed by cutting back on the previous run so as to expose the full depth of the layer. The longitudinal joints in one layer shall offset those in the layer immediately below by approximately six (6) inches.
- (8) Compaction. Rolling shall include the use of a vibratory steel wheel roller. Rolling shall begin as soon after spreading the mixture as it will bear the weight of the roller without undue displacement. All rollers shall be in satisfactory condition capable of reversing without backlash, and steel wheel rollers shall be equipped with scrapers. Rollers shall have a system for moistening each roll or wheel. A trench roller shall be used on depressed areas inaccessible to regular width equipment. The compacted mixture shall have a density of not less than ninety-five (95%) percent of standard proctor. Density will be determined by the direct transmission nuclear method.

In lieu of roller and density requirements, mixtures used for shoulders adjacent to rigid pavement, shoulders adjacent to resurfaced rigid pavement, temporary bypasses to be maintained at the expense of the contractor, and areas where a commercial mixture is used shall be thoroughly compacted by at least three complete coverages over the entire area with a tandem-type vibratory steel wheel roller weighing not less than ten (10) tons. Final rolling shall be done with the tandem-type steel wheel roller. Rolling shall be performed at proper time intervals on each layer and shall be continued until there is no visible evidence of further consolidation.

- (9) Surface Tolerance. The finished layers shall be substantially free from waves or irregularities and shall be true to the established crown and grade. At transverse construction joints the surface of all layers shall not vary from a ten (10)-foot straightedge, applied parallel to the centerline, by more than one-fourth (1/4) inch, except that the entire surface of the final layer of plant mix bituminous base mixture shall not vary from the ten (10)-foot straightedge by more than one-eighth (1/8) inch if this layer is used as the final riding surface course. Areas exceeding this tolerance shall be rerolled, replaced, or otherwise corrected in a manner satisfactory to the Engineer.
- (10) Tolerance in Pavement Thickness. It is the intent of these specifications that the plant mix bituminous base course shall be constructed strictly in accordance with the thickness shown on the plans. The total thickness of the pavement will be measured by coring.

Where any pavement is found deficient in thickness, corrective actions shall be taken as indicated in this Chapter.

No additional compensation will be allowed the contractor for any plant mix bituminous base course constructed in excess of the thickness requirements of the plans and specifications. The surface from which the cores have been taken shall be restored by the contractor within forty eight (48) hours using a mixture acceptable to the Engineer.

- e. Method of Measurement. Full depth pavement areas of plant mix bituminous base course will be measured to the nearest one tenth (1/10) square yard. Areas requiring a variable thickness bituminous base course will be measured on a per ton basis. The weight of the bituminous base course for the areas requiring a variable thickness will be determined from weight tickets for each truck delivering base course to the job site. Final measurement for variable thickness base course will be to the nearest one tenth (1/10) ton of acceptable base course.
- f. Basis of Payment. Payment for all plant mix bituminous base course shall include all labor, materials, and equipment necessary for the construction of the bituminous base course in place. Prime coat will be considered incidental to said construction unless specified separately in the specifications.

Payment for full depth pavement areas of plant mix bituminous base course will be on a square yard basis. Payment for variable thickness bituminous base course will be on a per ton basis. In case a truck load of bituminous base course is to be spread in both areas of full depth pavement and variable depth pavement, the contractor and Engineer shall agree on the tonnage of that portion of the load used in the variable depth area, prior to its placement. The conversion from tons to square yards is based on 110 lbs./sq. yd/inch.

2. Bituminous Surface Course

- a. Scope of Work. The work shall include all labor, equipment, and materials necessary for the furnishing, mixing, hauling, placing, and consolidation of plant mix bituminous base course in accordance with the plans and contract documents.

- b. Materials.

- (1) Asphalt Cement. This material shall be homogenous and free from water, and shall not, on heating, foam below the specified minimum flash point. It shall be prepared by refining crude petroleum by suitable methods. It shall conform to the requirements of the following table for penetration grade 85-100. Material from any one source for any one contract shall not vary more than 0.02 in specific gravity.

	85 – 100
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Penetration Grade	Min.	Max.
Penetration at 25C (77F) 100g, 5 sec	85	100
Flash point, (Cleveland open cut), degrees C	232	---
(F)	(450)	---
Ductility, 5 cm/min, 25C (77F), cm percent	100	---
Solubility in trichloroethylene, percent	99.0	---
Spot test-Standard Naphtha (Note 1)	Negative	
Thin-film oven test 1/8 in., 163 C (325 F), 5 hour; Loss on heating percent	---	1.0
Penetration of residue, percent of original	50	---
Ductility of residue, 5 cm/min 25C (77F), cm	75	---

Note 1 – The spot test shall be conducted in accordance with AASHTO T 102, with the following modifications: Add to Section 5.2.1, “If, however, the drop forms a uniformly brown circular stain, the test shall be reported as negative. In case of dispute, the entire test shall be repeated.” Delete Section 5.3 through 7.3, inclusive.

- (2) Coarse Aggregate. All coarse aggregate shall consist of sound, durable rock, free from cemented lumps or objectionable coatings. When tested in accordance with AASHTO T96, the percentage of wear shall not exceed 50. The percentage of deleterious substances shall not exceed the following values and the sum of percentages of all deleterious substances shall not exceed eight (8) percent.

	Percent by Weight
Deleterious Rock	8.0
Shale	1.0
Other Foreign Material	0.1

The requirements of this section apply to each size or fraction of aggregate produced.

If a density requirement is specified for plant mix bituminous surface course the total quantity of chert in each size or fraction of produced crushed stone aggregate, including that permitted as deleterious, shall not vary more than ten (10) percentage points from the quantity present in the aggregates used in the approved laboratory job mixtures.

Gravel aggregate shall be washed sufficiently to remove any objectionable coating.

- (3) Fine Aggregate. Fine aggregate for plant mix bituminous base course shall be a fine, granular material naturally produced by the disintegration of rock of a siliceous nature. With written approval of the Engineer, chat sand produced from flint chat in the Joplin area, or fines manufactured from crushed dolomite, igneous rock and chert gravel, or wet bottom boiler slag may be used as fine aggregate for asphaltic concrete. Fine aggregate shall be free

from cemented or conglomerated lumps and shall not have any coating or injurious material. The percentage of deleterious substances shall not exceed the following values:

Item	Percent by Weight
Clay lumps or shale	1.0
Total lightweight particles, including coal or lignite	0.5
Other deleterious substances	0.1

Lightweight sand particles are not considered deleterious lightweight particles. The total lightweight particles requirement shall not apply to wet bottom boiler slag, angular chert sand, or manufactured sand.

- (4) Mineral Filler. Mineral filler shall consist of dolomite dust, Portland cement, or other suitable mineral matter. It shall be thoroughly dry and free of lumps consisting of aggregations of fine particles. When tested in accordance with AASHTO T37 the mineral filler shall conform to the following gradation requirements.

	Percent
Passing No. 30 sieve	100
Passing No. 50 sieve	95 – 100
Passing No. 100 sieve	90 – 100
Passing No. 200 sieve	70 – 100

c. Composition of Mixtures.

- (1) Gradation of Combined Aggregates. The total aggregate prior to mixing with asphalt cement shall meet the following requirements for Grade D mixture:

GRADE D	
Gradation	Percent Passing By Weight
Passing $\frac{3}{4}$ – inch sieve	100
Passing $\frac{1}{2}$ -inch sieve	95 – 100
Passing No. 4 sieve	60 – 90
Passing No. 10 sieve	35 – 65
Passing No. 40 sieve	10 – 30
Passing No. 200 sieve	4 – 12

- (2) The combinations of materials required in this section shall meet the gradation requirements specified for the work.

Not less than fifteen (15) percent or more than thirty (30) percent natural siliceous sand, porphyry sand, manufactured sand or flint sand of approved quality shall be added as a separate ingredient. Sand shall have one hundred (100%) percent passing the three-eighths inch (3/8") sieve and not more than six (6%) percent passing the No. 200 sieve.

(3) The composition of the mixture shall conform to the following limits by weight:

	Percent
Total Mineral Aggregate	92.0 – 96.5
Asphalt Cement	3.5 – 8.0

(4) Job-mix formula. Prior to preparing any of the mixture on the project, the contractor shall submit for the Engineer's approval, a job-mix formula for the mixture to be supplied for the project. No mixture will be accepted for use until the job-mix formula for the project is approved by the Engineer. The job-mix formula shall be within the gradation range specified, and shall include the type and sources of all materials, the gradations of the aggregates, and the relative quantity of each ingredient, and shall state a definite percentage for each fraction of aggregate. No job-mix formula will be approved which does not permit within the limits specified in Paragraphs 3a and 3c, the full tolerances specified in Paragraph 3 (e) herein for asphalt cement and not less than one-half (1/2) the tolerances designated for material passing the No. 10 sieve and the material passing the No. 200 sieve. The job-mix formula approved for the mixture shall be in effect until modified in writing by the Engineer. When unsatisfactory results or other conditions make it necessary, or should a source of material be changed, a new job-mix formula may be required.

(5) Changes in proportions. The Engineer will make such changes in the proportions of asphalt cement and aggregates as he considers necessary within the limits of the specifications. The proposed mixture will be compacted and tested in the laboratory in accordance with AASHTO T 167 and the bulk specific gravity will be determined in accordance with the procedures described in AASHTO T 165.

The mixture of mineral aggregate and asphalt cement shall result in a bituminous mixture, which will be durable and retain satisfactory cohesion in the presence of moisture. Chemical additions approved in writing by the Engineer may be made to the asphalt cement or to the mixture.

(6) Gradation control. In producing mixtures for the project, the plant shall be so operated that no intentional deviations from the job-mix formula are made. Mixtures as produced shall be subject to the following tolerances and controls:

- i. Total aggregate gradation shall be within the master range specified in Paragraph 3a, herein.

- ii. Maximum variations from the approved job-mix formula shall be within the following tolerances: Passing No. 10 sieve +/- 5.0 % points Passing No. 200 sieve +/- 2.0 % points
- iii. Quantity of Asphalt Cement introduced into the mixer shall be that quantity specified in the job-mix formula. No change may be made in the quantity of asphalt cement specified in the job-mix formula without written approval of the Engineer. The quantity of asphalt cement determined by calculation or tests on the final mixture shall not vary more than +/- 0.5 percentage points from the job-mix formula.

(7) Commercial Mixture. The contractor may, at his option, use an approved commercial moisture. The contractor shall, at least seven (7) days prior to the desired time of use, furnish a statement setting out the source and characteristics of the mixture he proposed to furnish. The statement shall include (1) the types and sources of aggregate, percentage range of each, and range of combined gradation; (2) the percent and grade of asphalt; and (3) the mixing time and range of mixture temperature. The plant shall be designed and operated to produce a uniform, thoroughly mixed material free from segregation. If the proposed mixture and plant are approved by the Engineer, the component materials and the mixture delivered will be accepted or rejected by visual inspection. The supplier shall furnish with each truck load, a certification in triplicate that the materials and mixture delivered are in conformance with this approved proposal. The mixture shall be transported, placed, and compacted in accordance with the requirements specified hereinafter.

d. Construction Requirements.

- a) Weather Limitations. Bituminous mixtures shall not be placed (1) when either the air temperature or the temperature of the surface on which the mixture is to be placed is below 35 degrees F and falling, (2) on any wet or frozen surface, or (3) when weather conditions prevent the proper handling or finishing of the mixture.
- b) Subgrade Preparation. The subgrade upon which bituminous surface course is to be placed shall be prepared in accordance with the requirements of Section III of the Specifications. If the bituminous surface course is to be placed upon the top of a completed base course or existing hard surfaced pavement, then the base course or existing pavement, then the base course or existing pavement will be considered the subgrade for the next operation.
- c) Tack Coat.

- 1) Material. The asphalt cement material used for tack coat shall be emulsified asphalt meeting the requirements of AASHTO M140 or M208, and shall be Grade SS-1 or SS-1H as designated by the Engineer.

- 2) Preparation of Surface. The existing surface shall be free of all dust, loose material, grease, or other foreign material at the time the tack is applied. Any fat bituminous surface mixture or bituminous joint material will be removed by others without cost to the contractor before the tack is applied. The surface shall be dry when the tack is applied, except in the case of emulsified asphalt.

- 3) Application. Bituminous material shall be applied uniformly with a pressure distributor at the rate specified in the contract, or as revised by the Engineer to be within a minimum of 0.02 and a maximum of 0.10 gallon per square yard. In using emulsified asphalt, water may be added to the material and mixed therewith in such proportion that the resulting mixture will contain not more than fifty (50) percent of added water, the exact quantity of added water to be specified by the Engineer. The application of the resulting mixture shall be such that the original emulsion will be spread at the specified rate. The tack material shall be heated at the time of application to a temperature specified in the table below. The tack material shall be properly cured and the tacked surface shall be cleaned of all dirt and surplus sand before the next course is placed.

Application Temperatures				
Bituminous Material	Temperature, Degrees Fahrenheit			
	Spraying		Mixing	
	Min.	Max.	Min.	Max.
Asphalt Emulsions SS1	75	130	75	130
SS1H	75	130	75	130

The tack coat shall be applied in such a manner as to cause the least inconvenience to traffic. The tack may be applied full width, provided the tacked surface is blotted with sand in such quantity as specified by the Engineer before it is opened to traffic.

- d) Transportation. Trucks used for hauling bituminous mixtures shall have tight, clean, smooth, metal beds which have been thinly coated with a minimum quantity of paraffin oil, lime solution, or other approved material to prevent the mixture from adhering to the bed. Each load shall be covered with canvas or other suitable material or sufficient size to protect the mixture from the weather. When necessary, truck beds shall be insulated so that the mixture will be delivered on the road to meet the requirements of Paragraph 4e. No loads shall be sent out so late in the day that spreading and compacting of the mixture cannot be completed during daylight.

e) Spreading. The base course, primed surface, or preceding course or layer shall be cleaned of all dirt, packed soil, or any other foreign material prior to spreading the bituminous mixture. When delivered to the roadbed, the mixture shall be at a temperature which will permit proper placement and compaction. It shall be spread with an approved spreading and finishing machine in the number of layers and in the quantity required to obtain the compacted thickness and cross section shown on the plans. The paver shall be operated at a speed that will give the best results. The rate of delivery of the mixture to the paver shall be coordinated so as to provide, where practicable, a uniform rate of placement without intermittent operation of the paver. The compacted thickness of a single layer shall not exceed two (2) inches for the surface course and four (4) inches for the leveling course. On small areas, and on areas which are inaccessible to mechanical spreading and finishing equipment, the mixture may be spread and finished by hand methods when permitted by the Engineer.

(1) Surface Condition. The mixture shall be spread without tearing the surface and struck off so that the surface is smooth and true to cross section, free from all irregularities, and of uniform density throughout. Care shall be used in handling the mixture to avoid segregation. Areas of segregated mixture shall be removed and replaced with suitable mixture. The outside edges of the pavement shall be constructed to an angle of approximately forty-five (45) degrees with the surface of the roadbed. The outside edge alignment shall be uniform and any irregularities shall be corrected by adding or removing mixture before compacting.

f) Spot Wedging and Leveling Course. Leveling course, consisting of a layer of variable thickness used to eliminate irregularities in the existing surface, shall be spread to the desired grade and cross section. Rigid control of the placement thickness of the leveling course will be required. Spot wedging operations over small areas, with featheredging at high points and ends of spot areas, may be required prior to placing the leveling course. The use of an approved finishing machine will be required on the spot wedging and the leveling course, except that the spreading of the spot wedging with a blade grader will be permitted if results indicate the mixture is practically free from segregation.

g) Joints. Longitudinal and transverse joints shall be carefully made and well bonded. Transverse joints shall be formed by cutting back on the previous run so as to expose the full depth of the layer. A single lane of any layer shall not be constructed to a length for which the adjacent lane cannot be completed the succeeding operating day. The longitudinal joints in one layer shall offset those in the layer immediately below by approximately six (6) inches; however, the joints in the final layer shall be at the lane lines of the travel way.

h) Surfaced Approaches. At locations designated in the contract or as specified by the Engineer, approaches shall be tacked in accordance with Paragraph 4c and surfaced with

a plant mix bituminous mixture. The bituminous surface shall be placed in accordance with the details shown on the typical section or as specified by the Engineer. Approaches shall not be surfaced until after the surface course adjacent to the entrance is completed. No direct payment will be made for any work required to condition and prepare the subgrade on the approaches.

- i) **Compaction.** The mixture shall be thoroughly compacted by at least three (3) complete coverage's over the entire area with either a pneumatic tire roller weighing not less than ten (10) tons. All rollers used shall be in satisfactory condition, capable of reversing without backlash, and steel wheel rollers shall be equipped with scrapers. Rollers shall have a system for moistening each roller or wheel. Rolling shall begin as soon after spreading the mixture, as it will bear the weight of the roller without undue displacement. Final rolling shall be done by the steel wheel roller. Rolling shall be performed at proper time intervals and shall be continued until there is no visible evidence of further consolidation and until all roller marks are eliminated.

- j) **Surface Tolerances.** The finished courses shall have the nominal thickness shown on the plans and shall be substantially free from waves or irregularities. The final riding surface, except on medians and similar areas, shoulders, and temporary bypasses shall not vary from a ten (10) foot straightedge, applied parallel to the centerline, by more than one eighth (1/8) inch. At transverse construction joints, the surface of all layers shall not vary from the ten (10) foot straightedge by more than one fourth (1/4) inch. Surfaces exceeding these tolerances shall be re-rolled, replaced, or otherwise corrected in a manner satisfactory to the Engineer.

The surface of the mixture after compacting shall be smooth and true to the established crown and grade. Any mixture showing an excess of asphalt cement or that

- k) **Tolerance in Pavement Thickness.** It is the intent of these specifications that the plant mix bituminous surface course shall be constructed strictly in accordance with the thickness shown on the plans. The total thickness of both the plant mix bituminous surface course and the plant mix bituminous base course will be measured, and where the total thickness is found to be deficient, corrective actions will be taken as indicated hereinafter.

The total combined thickness of the bituminous surface course and the bituminous base course will be measured and determined by average caliper measurement of cores. For the purpose of determining the constructed thickness, ten (10) cores per mile will be taken at random intervals in each traffic lane. In addition, cores may be taken at other locations as may be determined by the Engineer. If the measurement of any core is deficient in excess of one-half (1/2) inch from the plan thickness, additional cores will be

taken at twenty-five (25) foot intervals parallel to centerline ahead and back of the affected location until the extent of the deficiency has been determined.

It will be assumed that each core is representative of the total combined thickness for a distance extending one-half the distance to the next core, measured along centerline, or in the case of a beginning or ending core, the distance will extend to the end of the pavement section.

In those areas of deficient thickness in excess of one-half (1/2) inch that cannot be corrected without affecting the plan crown and grade, the Director of Public Works has the option of requiring removal of the entire bituminous pavement and replacing it with bituminous base course and bituminous surface course of proper thickness or leaving the bituminous pavement in place and requiring the following deductions in payment.

Deficiency in Thickness	Deduction Percent of Contract Unit Price
0 inch to ½ inch	None
Over ½ inch and not over ¾ inch	50
Over ¾ inch and not over 1 inch	100

No additional compensation will be allowed the contractor for any plan mix bituminous pavement constructed in excess of the thickness requirements of the plans and specifications. The surface from which the cores have been taken shall be restored by the contractor within 48 hours using a mixture acceptable to the Engineer.

If removal of the pavement is required, the contractor will be required to remove the pavement and to replace it with one of a satisfactory quality and thickness which, when accepted, will be included in the pay quantities. No payment will be made for any costs incurred in the removal of the pavement deficient in thickness or for the original pavement placement.

- e. Deficient Pavement on Private Projects. Prior to acceptance of private projects by the City, cores will be taken to determine pavement thickness. In those areas of deficient thickness that cannot be corrected without affecting the plan crown and grade, the Director of Public Works has the option of requiring removal of the entire bituminous pavement and replacing it with bituminous base course and bituminous surface course of proper thickness or leaving the bituminous pavement in place and receiving a remittance to the City in an amount equal to the value of deduction shown in Paragraph 4, above. This amount is to offset future maintenance costs necessary because of the deficient pavement. Pavement deficient in thickness in excess of one (1) inch will not be accepted.

- f. Method of Measurement. Final measurement of plant mix bituminous surface course will be made to the nearest one-tenth (1/10) square yard.

- g. Basis of Payment. Payment for plant mix bituminous surface course shall be paid on a square yard basis and shall include all labor, material, and equipment to construct plant mix bituminous surface course in place. Tack coat will be considered incidental to said construction unless specified separately in the specifications.

S2.01 HP Storm 12”-60” Pipe Specification

Scope

This specification describes 12- through 60-inch (300 to 1500 mm) HP Storm pipe for use in gravity-flow storm drainage applications.

Pipe Requirements

HP Storm pipe shall have a smooth interior and annular exterior corrugations.

- 12- through 60-inch (300 to 1500 mm) pipe shall meet ASTM F2881 or AASHTO M330.
- Manning’s “n” value for use in design shall be 0.012.

Joint Performance

Pipe shall be joined using a bell & spigot joint meeting the requirements of ASTM F2881 or AASHTO M330. The joint shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gasket shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly. 12- through 60-inch (300 to 1500 mm) diameters shall have an exterior bell wrap installed by the manufacturer.

Fittings

Fittings shall conform to ASTM F2881 or AASHTO M330. Bell and spigot connections shall utilize a welded or integral bell and valley or inline gaskets meeting the watertight joint performance requirements of ASTM D3212.

Field Pipe and Joint Performance

To assure watertightness, field performance verification may be accomplished by testing in accordance with ASTM F1417 or ASTM F2487. Appropriate safety precautions must be used when field-testing any pipe material. Contact the manufacturer for recommended leakage rates.

Material Properties

Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2881, Section 5 and AASHTO M330, Section 6.1.

Installation

Installation shall be in accordance with ASTM D2321 and ADS recommended installation guidelines, with the exception that minimum cover in traffic areas for 12- through 48-inch (300 to 1200 mm) diameters shall be one foot (0.3 m) and for 60-inch (1500 mm) diameter the minimum cover shall be 2 ft. (0.6 m) in single run applications. Backfill for minimum cover situations shall consist of Class 1 (compacted), Class 2 (minimum 90% SPD), or Class 3 (minimum 95%) material. Maximum fill heights depend on embedment material and compaction level; please refer to Technical Note 2.04. Contact your local ADS representative or visit our website at www.adspipe.com for a copy of the latest installation guidelines.

Build America, Buy America (BABA)

N-12 Plain End pipe (per AASHTO), manufactured in accordance with ASTM F2881 or AASHTO M330, complies with the requirements in the Build America, Buy America (BABA) Act.

Pipe Dimensions

Nominal Pipe I.D. in (mm)	120 (300)	15 (375)	18 (450)	24 (600)	30 (750)	36 (900)	42 (1050)	48 (1200)	60 (1500)
Average Pipe I.D. in (mm)	12.2 (310)	15.1 (384)	18.2 (462)	24.1 (612)	30.2 (767)	36.0 (914)	42.0 (1067)	47.9 (1217)	59.9 (1521)
Average Pipe O.D. in (mm)	14.5 (368)	17.7 (450)	21.4 (544)	28.0 (711)	35.5 (902)	41.5 (1054)	47.4 (1204)	54.1 (1374)	67.1 (1704)
Min. Pipe Stiffness* @ 5% Deflection #/in/in (kN/m ²)	75 (617)	60 (414)	56 (386)	50 (345)	46 (317)	40 (276)	35 (241)	35 (241)	30 (207)

* Pipe O.D. values are provided for reference purposes only, values stated for 12 through 60-inch are ±1 inch. Contact a sales representative for exact values





CITY OF FARMINGTON
 110 West Columbia
 Farmington, Missouri 63640
 573.756.1701

AGREEMENT BETWEEN CITY OF FARMINGTON AND CONTRACTOR FOR PUBLIC WORKS PROJECT(S)

THIS AGREEMENT is made and entered into by and between the CITY OF FARMINGTON, MISSOURI, a Third Class CITY, of the County of St. Francois, State of Missouri, Mailing Address: 110 West Columbia, Farmington, Missouri 63640, hereinafter referred to as the CITY, and (INSERT CONTRACTOR), Mailing Address: (INSERT CONTRACTOR ADDRESS), hereinafter referred to as the CONTRACTOR, based upon the bid for Bray Road Improvements submitted to the CITY on (INSERT BID DATE) and incorporated herein by reference.

1.00 DEFINITIONS

1.01 *Project.* The Project is defined as the work to be performed, including but not limited to providing all materials, supplies, machinery, equipment, tools, superintendence, labor, insurance, and other accessories and services necessary to complete the Project in accordance with the conditions and Specifications as set forth in the CITY'S request for bids for the Project, and according to the proposal submitted by CONTRACTOR, dated _____, and attached hereto. The contract amount is _____ (\$_____).

1.02 *Specifications.* The Specifications followed in completion of the work related to this contract shall be consistent with the plans and Specifications included in the request for bids, and all issued interpretations and addenda, and attached hereto.

1.03 *Working Days.* Working days shall be defined as weekdays, which are not Federal Holidays.

2.00 GENERAL CONDITIONS. The CONTRACTOR agrees to provide all labor and/or materials as set forth in the Specifications and to complete the Project within the time specified in Section 4.00. That in consideration of the CONTRACTOR'S providing said labor and materials the CITY shall pay the CONTRACTOR per unit, progress payments, or lump sum as defined in the attached bid submittal. The CITY retains the right to reduce scope of the project as necessary to meet budgetary constraints. In the event there is a discrepancy between this document and the bid submittal, this document shall govern.

The CONTRACTOR shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, management and

supervision, temporary construction of any nature, and all other services and facilities necessary to execute and complete the Project. Materials and equipment shall be so stored as to insure the preservation of their quality and use. Stored materials and equipment shall be located so as to facilitate prompt inspection. All materials used in completion of the Project shall be installed pursuant to acceptable industry standards, manufacturer's recommendations, and quality workmanship. All materials and equipment used in the completion of the project shall be subject to adequate inspection and testing in accordance with generally accepted standards. The CITY shall be responsible for the cost of all material testing required pursuant to this contract.

3.00 PROGRESS PAYMENTS. Payments shall be made as follows:

3.01 The CITY shall make progress payments on the 1st and 15th of each month based on Applications for Payment made by the CONTRACTOR.

3.02 Each Application shall be based on a percentage of the work completed or if the contract is for a unit price the number of units completed on the date of the submittal.

3.03 The CITY shall pay the CONTRACTOR for the portion of the Project substantially completed in any given pay period less five percent (5%) retainage.

3.04 The portion of the Project substantially completed shall be determined in the sole discretion of the CITY.

3.05 In the event the CONTRACTOR elects to submit a single request for payment upon completion of the work, the CITY will pay the full contract amount in a single lump sum payment within 20 (20) days.

3.06 All checks will be mailed to the contractor's designated remit to address. We will not allow any check pick-up.

4.00 COMMENCEMENT AND COMPLETION OF WORK. The CONTRACTOR shall commence work within thirty (30) days after formal notice to proceed by the CITY. All work shall be completed within 180 calendar days, or as extended by the CITY and shall be included as an addendum to this agreement. If the CONTRACTOR is delayed at any time during the Project due to adverse weather conditions not reasonably anticipated, unanticipated utilities, hazardous materials, rock excavation, or other conditions, the contract term may be extended as mutually agreed.

5.00 LIQUIDATED DAMAGES. No Liquidated Damages on this project.

6.00 LIABILITY INSURANCE. The CONTRACTOR shall be required to furnish Public Liability and Property Damage Insurance with coverage to name and protect the CITY and the CONTRACTOR from all claims for damages for personal injury, including accidental death, as well as claims for property damages, which may arise from work performed under this agreement, whether such claim be a result of actions by the CONTRACTOR or any sub-

contractor performing work under this agreement. The insurance policy shall be not less than \$1,000,000 personal injury per occurrence and not less than \$1,000,000 aggregate property damage. A certificate of insurance shall be submitted upon execution of this agreement in the form provided by the insurance provider. In the event the insurance coverage required under this section is cancelled by the CONTRACTOR during the performance of the work under this agreement, the CITY may at its option employ another CONTRACTOR to complete the Project, and the CONTRACTOR shall indemnify and hold the CITY harmless from any and all damages it sustains as a result of the CONTRACTOR's failure to maintain insurance coverage.

- 7.00 WORKER'S COMPENSATION INSURANCE. The CONTRACTOR shall be required to provide proof of Worker's Compensation Insurance and maintain said insurance during the performance of the work prescribed in this agreement. The CONTRACTOR shall be further required to provide proof of Worker's Compensation Insurance for all sub-contractors performing work under this agreement. In the event the insurance coverage required under this section is cancelled by the CONTRACTOR during the performance of the work under this agreement, the CITY may at its option employ another CONTRACTOR to complete the Project, and the CONTRACTOR shall indemnify and hold the CITY harmless from any and all damages it sustains as a result of the CONTRACTOR's failure to maintain Worker's Compensation Insurance coverage.
- 8.00 COMPLIANCE WITH PREVAILING WAGE. The CONTRACTOR shall pay wages not less than the prevailing wage for the type of work performed under this agreement as determined by the Missouri Department of Labor and Industrial Relations, Division of Labor Standards. The CONTRACTOR further agrees to comply with Prevailing Wage Laws as prescribed in Section 290.290 RSMo, and to ensure compliance with the aforementioned statutes by all sub-contractors performing work under this agreement. The CONTRACTOR will pay the CITY as and for liquidated damages, one-hundred dollars (\$100.00) per day, or portion of day, if a worker is paid less than the prevailing rate for any work done under the contract by the CONTRACTOR or by any subcontractor.
- 9.00 PAYMENT AND PERFORMANCE BOND. The CONTRACTOR shall submit, upon execution of this agreement, a surety bond, or bonds, as security for faithful performance of the contract and for the payment of all firms or persons performing labor or furnishing materials for the work performed under the contract. The surety on such bond, or bonds, shall be a surety company satisfactory to the CITY.
- 10.00 QUALITY OF WORK. In the event that the CITY determines that the CONTRACTOR's work is not to Specifications, or the work cannot be reasonably completed by the CONTRACTOR during the period specified, the CITY may at its option provide the CONTRACTOR ten (10) days written

notice to remedy said default. In the event that the CONTRACTOR has not rectified said default within said ten (10) days, the CITY may at its option terminate this agreement. In the event of said termination, the CITY may at its option employ another contractor to complete the Project, and the CONTRACTOR shall indemnify and hold the CITY harmless from any and all damages it sustains as a result of the CONTRACTOR's failure to perform.

- 11.00 UNAUTHORIZED ALIEN AFFIDAVIT AND E-VERIFY. As a condition for the award of any contract or grant in excess of five thousand dollars (\$5,000.00) by the state or by any political subdivision of the state to a business entity (contractor), the business entity shall, by sworn affidavit and provision of documentation, affirm its enrollment and participation in a federal work authorization program with respect to the employees working in connection with the contracted services. Every such business entity shall sign an affidavit affirming that it does not knowingly employ any person who is an unauthorized illegal alien in connection with the contracted services, per RSMO 285.530. Any entity contracting with the state or any political subdivision of the state shall only be required to provide the affidavits required to the state and any political subdivision of the state with which it contracts, on an annual basis. Prior to the award of the bid, the selected contractor must complete and have notarized the attached "Affidavit of Work Authorization" and return it to the CITY.
- 12.00 HEALTH AND SAFETY OF EMPLOYEES. In accordance with RSMO 292.675 any contractor for any public body for purposes of construction of public works and any subcontractor to such contractor shall provide a ten-hour Occupational Safety and Health Administration (OSHA) construction safety program for their on-site employees which includes a course in construction safety and health approved by OSHA of a similar program which is at least as stringent as an approved OSHA program, unless such employees have previously completed the required program. All employees who have not previously completed the program are required to complete the program within sixty days of beginning work on such construction Project. Any employee found on a work site subject to this section without documentation of the successful completion of the course required shall be afforded twenty days to produce such documentation before being subject to removal from the Project. The CONTRACTOR will forfeit a penalty to the CITY of \$2,500 plus an additional \$100 for each employee employed by the contractor or subcontractor, or each calendar day, or portion thereof, such employee is employed without the required training.
- 13.00 GUARANTEE. The CONTRACTOR hereby expressly guarantees the work performed under this agreement as to workmanship and conformance to the Specifications provided. Upon notification by the Owner, the CONTRACTOR shall make any and all necessary replacements at his own expense to the satisfaction of the CITY within ten (10) days, or within a time acceptable to the CITY. If the CONTRACTOR fails to proceed with such

corrective action as specified by the CITY, the CITY may at its option employ another contractor to take such corrective action, and to charge the cost thereof to the CONTRACTOR.

14.00 HAZARDOUS MATERIALS. The CONTRACTOR hereby expressly guarantees that no asbestos or lead paint containing materials will be used in completion of this Project. The CONTRACTOR hereby expressly guarantees that all demolition material and construction debris will be disposed of in accordance with all Federal, State, or Local regulations.

15.00 ACCEPTANCE AND FINAL PAYMENT. When the work performed under this agreement has been fully completed in accordance with the Specifications provided a final inspection shall be made by the CITY and any defects arising out of said inspections shall be remedied by the CONTRACTOR. Retainage shall be paid by the CITY upon submittal by the CONTRACTOR of lien waivers, certified payrolls, and affidavit of compliance with prevailing wage laws. Final payment and acceptance of such payment by the CONTRACTOR shall release the CITY from all claims of any liabilities of the CONTRACTOR under this agreement, except that the CONTRACTOR shall not be released from liability for defects resulting from unacceptable workmanship or failure to follow Specifications, where said defects are not readily ascertainable by the CITY upon final inspection. The CITY shall make final payment upon the CONTRACTOR's submittal of lien waivers, certified payrolls, and affidavit of compliance with prevailing wage laws.

16.00 RECOVERY OF DAMAGES. In the event the CITY is required to file suit for damages as a result of breach of contract by the CONTRACTOR, then the CITY shall be entitled to collect reasonable attorney fees, costs of litigation, and Court costs from CONTRACTOR.

IN WITNESS WHEREOF WE HAVE SET OUR HANDS ON THIS THE

_____ DAY OF _____, 20____.

CITY OF FARMINGTON:

CONTRACTOR:

(Name and Title)

(Name and Title)

Date

Date

- ATTACHMENTS:
- 1. Specifications
 - 2. Bid Proposal
 - 3. Prevailing Wage Order
 - 4. Payment and Performance Bond
 - 5. Certificate of Worker's Compensation Insurance
 - 6. Certificate of Liability and Property Damage Insurance
 - 7. Affidavit of Compliance (RSMo Section 285.530.2)
 - 8. Project Tax Exempt Certificate

(ACKNOWLEDGEMENT FOR INDIVIDUAL)

STATE OF MISSOURI)
) SS.
COUNTY OF ST. FRANCOIS)

On this _____ day of _____, _____, before me personally appeared , _____, to me known to be the person(s) described in and who executed the foregoing instrument, and acknowledged that they executed the same as their free act and deed.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal in the County and State aforesaid, the day and year first above written.

Notary Public

My Commission Expires:

(ACKNOWLEDGEMENT FOR CORPORATION)

STATE OF MISSOURI)
) ss.
COUNTY OF ST. FRANCOIS)

On this ____ day of _____, _____, before me appeared _____, to me personally known, who, being by me duly sworn did say that he/she is the _____ of _____, _____, a Corporation of the State of Missouri, and that said instrument was signed in behalf of said Corporation and acknowledged to me that he/she executed said instrument to be the free act and deed of said Corporation for the purposes therein stated.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal in the county and state aforesaid, the day and year first above written.

Notary Public

My Commission Expires:

any person who is an unauthorized alien.

6. Further, _____ has performed an electronic
(name of business entity, same as above)
verification check as described above on all workers hired since
January 1, 2009 or obtained documents required for completion of a
federal I-9 form before it began participating in e-verify.

7. Attached to this affidavit is a true and accurate copy of this
company's Memorandum of Understanding with the United States
concerning the use of e-verify.

I certify under penalty of perjury that the statements above are
complete, true and accurate to the best of my knowledge and belief.

Authorized Agent, Partner, Owner or Officer

*If business has a Human Relations Director or equivalent that person
must sign as an affiant as well.*

I certify under penalty of perjury that the statements above
are complete, true and accurate to the best of my knowledge and
belief.

Human Relations Director

*This form is promulgated pursuant to 15CSR 60-15-.020. Use of this form
is not required but the Attorney General has deemed this affidavit
sufficient in form to satisfy the requirements of section 285.540, RSMo.,
Supp. 2008.*

FURTHER THE AFFIANT SAYETH NOT

(Signature)

On this ____ day of _____ in the year 20 ____, before me, _____
a Notary Public in and for said State, personally appeared _____, known to me
to be the person who executed the within affidavit, and acknowledged to me that he/she executed the
same for the purposes therein stated.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal in the
county and State aforesaid, the day and year first above written.

Notary Public

My Commission Expires:

ANTI-COLLUSION STATEMENT

STATE OF MISSOURI

CITY/COUNTY OF _____

being first duly sworn, deposes and says that he is

Title of Person Signing

of _____

Name of Bidder

that all statements made and facts set out in the proposal for the above project are true and correct; and the bidder (The person, firm, association, or corporation making said bid) has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with said bid or any contract which may result from its acceptance.

Affiant further certifies that bidder is not financially interested in, or financially affiliated with, any other bidder for the above project.

BY _____

BY _____

BY _____

SWORN to before me this _____ day of _____ 20 ____.

Notary Public

My Commission Expires _____

Missouri

Division of Labor Standards

WAGE AND HOUR SECTION



MIKE KEHOE, Governor

Annual Wage Order No. 32

Section 095
ST. FRANCOIS COUNTY

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by

Logan Hobbs, Director
Division of Labor Standards

Filed With Secretary of State: _____ **March 10, 2025**

Last Date Objections May Be Filed: **April 9, 2025**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$70.03
Boilermaker	\$25.09*
Bricklayer-Stone Mason	\$51.20
Carpenter	\$61.79
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$59.96
Plasterer	
Communication Technician	\$25.09*
Electrician (Inside Wireman)	\$77.14
Electrician Outside Lineman	\$25.09*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	\$25.09*
Glazier	\$25.09*
Ironworker	\$72.83
Laborer	\$48.59
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$25.09*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	\$72.95
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$48.77
Plumber	\$75.16
Pipe Fitter	
Roofer	\$25.09*
Sheet Metal Worker	\$76.95
Sprinkler Fitter	\$25.09*
Truck Driver	\$25.09*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. The public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title as defined in RSMo Section 290.210.

Heavy Construction Rates for
ST. FRANCOIS County

Section 095

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$25.09*
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$25.09*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$50.90
General Laborer	
Skilled Laborer	
Operating Engineer	\$67.17
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$25.09*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate Sheet.

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

OVERTIME and HOLIDAYS

OVERTIME

For all work performed on a Sunday or a holiday, not less than twice (2x) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work.

For all overtime work performed, not less than one and one-half (1½) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work or contractual obligation. For purposes of this subdivision, **"overtime work"** shall include work that exceeds ten hours in one day and work in excess of forty hours in one calendar week; and

A thirty-minute lunch period on each calendar day shall be allowed for each worker on a public works project, provided that such time shall not be considered as time worked.

HOLIDAYS

January first;
The last Monday in May;
July fourth;
The first Monday in September;
November eleventh;
The fourth Thursday in November; and
December twenty-fifth;

If any holiday falls on a Sunday, the following Monday shall be considered a holiday.