



**City of Springfield, Missouri**

**General Conditions & Technical  
Specifications for Public Improvements**

**Adopted: 7/1/2015**

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Director of Public Works**

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## 1 DEFINITIONS

### 1.1 DEFINITION OF ABBREVIATIONS

1. AASHTO – American Association of State Highway and Transportation Official
2. ACI – American Concrete Institute
3. ANSI – American National Standards Institute
4. ASTM – American Society for Testing and Materials
5. AWWA – American Water Works Association
6. IMSA – International Municipal Signal Association
7. ITE – Institute of Transportation Engineers
8. NEMA – National Electrical Manufacturing Association

### 1.2 DEFINITIONS AND TERMINOLOGY

**1.2.1 Definitions.** Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. **Addenda.** Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
2. **Agreement.** The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.
3. **Application for Payment.** The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
4. **Asbestos.** Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. **Advertisement.** The public announcement, as required by law, inviting bids for work to be performed or materials to be furnished.
6. **Award.** The action of the City accepting the proposal of the lowest responsible bidder for the work, subject to the execution and approval of a satisfactory contract therefor and bond to secure the performance thereof, and to such other conditions as may be specified or as required by law.
7. **Bid.** The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
8. **Bidder.** The individual or entity who submits a Bid directly to Owner.
9. **Bidding Documents.** The Bidding Requirements and the proposed Contract Documents (including all Addenda).
10. **Bidding Requirements.** The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.
11. **Bid Security.** A bid security shall be a bond provided by a surety company authorized to do business in this State, or the equivalent in cash, or otherwise supplied in a form satisfactory to the City in an amount equal to or at least 5% of the amount of the bid.
12. **Change Order.** A document which is signed by Contractor, Engineer of Record, and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
13. **Contract Documents.** Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.
14. **Claim.** A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.
15. **Contaminated Environmental Media.** Soil, sediment, ground water, or air contaminated with Hazardous Substances.
16. **Contract.** The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.
17. **Contract Bond.** The form of security approved by the City to be used by the contractor and his surety or sureties guaranteeing complete performance of the contract and the

payment of all legal debts pertaining to the construction of the project, and conditioned as may be required by the Code of the City of Springfield, Missouri.

- 18. Contract Documents.** Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.
- 19. Contract Price.** The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Chapter 2 Paragraph 11.03 in the case of Unit Price Work).
- 20. Contract Times.** The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.
- 21. Contractor.** The individual or entity with whom Owner has entered into the Agreement.
- 22. Cost of the Work.** See Chapter 2 Paragraph 11.01 for definition.
- 23. Ditch Line.** A line where the roadway ditch meets the back slope. It is located at the lowest point of a V-bottom ditch or furthest point from the roadway of a flat bottom ditch where the roadway slopes back to the existing ground line.
- 24. Duct.** An enclosed tubular casing, or raceway, for protecting wires, lines, or cables that is often flexible or semi-rigid (1-3% diametric deflection). The casing, or raceway, is separate from the cable or conductor that passes through it.
- 25. Engineer.** The Director of Public Works, and his designee(s), including the individual whom the Director of Public Works has identified as Project Manager overseeing the Work. Engineer is a representative of Owner.
- 26. Engineer of Record.** The Registered Professional Engineer responsible for signing, sealing and dating all submitted contract plans and job special provisions.
- 27. Float.** The amount of time between the early start date and the late start date, or the early finish date and the late finish date, of any of the activities in the progress schedule.
- 28. Extra Work.** An item of work not provided for in the contract as awarded but found essential to the satisfactory completion of the contract and within the intended scope of the contract, as determined by the Engineer.
- 29. Hazardous Environmental Condition.** The presence at the Site of hazardous materials or conditions, including, but not limited to, Contaminated Environmental Media, Asbestos, metal bearing protective coatings, paints, and linings, PCBs, Petroleum,

Hazardous Waste, Radioactive Material, metals such as but not limited to arsenic, cadmium, chrome, cobalt, lead, and mercury, and other Hazardous Substances; in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto or cause them to come under the application of a federal, state, or local regulation.

- 30. Hazardous Substance.** This term shall have the meaning provided in 29 CFR 1910.120 titled "Hazardous Waste Operations and Emergency Response," as amended from time to time.
- 31. Hazardous Waste.** The term Hazardous Waste shall have the meaning provided in 40 CFR 261 titled "Identification and Listing of Hazardous Waste," as amended from time to time.
- 32. Inspector.** The Principal Engineer of Construction Inspection for the Department of Public Works, and his designee(s), employees of Owner, whom Owner has assigned to the Site or any part thereof. Inspector is a representative of Owner.
- 33. Laws and Regulations; Laws or Regulations.** Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
- 34. Liens.** Charges, security interests, or encumbrances upon Project funds, real property, or personal property.
- 35. Milestone.** A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.
- 36. Notice of Award.** The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.
- 37. Notice to Contractors.** The notification provided prospective bidders, containing a general description of the proposed work, and including information and requirements for the submission of bids.
- 38. Notice to Proceed.** A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.
- 39. Owner.** The City of Springfield, Missouri, its agents, employees, and representatives, with whom Contractor has entered into the Agreement and for whom the Work is to be performed.
- 40. PCBs.** Polychlorinated biphenyls.

- 41. Petroleum.** Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.
- 42. Pay Item.** An item of work specifically described and for which a price, either unit or lump sum, is provided. It includes the performance of any and all work and the furnishing of any and all labor, equipment, and materials contemplated or described on the plans or in the text of the specifications included in the contract.
- 43. Plans.** That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Plans as so defined.
- 44. Progress Schedule.** A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.
- 45. Project.** The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.
- 46. Project Manual.** The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.
- 47. Proposal.** The written offer submitted by the bidder in the required manner on the form of proposal to perform the work contemplated at his bid prices.
- 48. Form of Proposal.** The approved form furnished by the Public Works Department on which the bid prices for the work are to be submitted.
- 49. Proposal Guaranty.** The security furnished with a proposal to insure that the bidder will enter into the contract if his proposal is accepted.
- 50. Radioactive Material.** Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
- 51. Responsible Bidder.** Any person, firm, or corporation submitting a bid for the work contemplated who maintains a permanent place of business, has adequate plant equipment to do the work properly and within the time limit that is established, and has adequate financial status to meet his obligations contingent to the work.
- 52. Responsive Bidder.** Any person, firm, or corporation submitting a bid for the work contemplated whose Bid Form is complete and regular, free of exclusions or special

conditions and has no alternative bids for any item unless requested in the Technical Specifications, and has submitted all required information with the bid.

- 53. Right-of-Way.** Property rights acquired by the City of Springfield for the construction and maintenance of an improvement.
- 54. Samples.** Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
- 55. Schedule of Submittals.** A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.
- 56. Schedule of Values.** A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.
- 57. Shop Drawings.** All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
- 58. Site.** Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.
- 59. Special Provisions.** Directions or requirements, peculiar to the Work and not otherwise thoroughly or satisfactorily detailed or set forth in the General Conditions or Specifications. Special provisions may be included in the specifications or may be included as a note or special detail on the plans. Special Provisions shall prevail over General Conditions, Plans, and Specifications whenever in conflict therewith.
- 60. Specifications.** That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.
- 61. Subcontractor.** An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.
- 62. Substantial Completion.** The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

- 63. Successful Bidder.** The Bidder submitting a responsive Bid to whom Owner makes an award.
- 64. Supplier.** A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.
- 65. Surety.** A corporate body duly authorized to do business in the State of Missouri, and which has executed a bid bond with the bidder or a contract bond with the contractor.
- 66. Underground Facilities.** All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
- 67. Utility:** Privately, publicly or cooperatively owned line, facility or system for producing, transmitting, or distributing communications, cable television, power, electricity, light, heat, gas, oil, crude products, water, steam, waste, storm water not connected with highway drainage or any other similar commodity, including any fire or police signal system or street lighting system which directly or indirectly serves the public and does not include privately owned facilities devoted exclusively to private use. The term utility also means the utility company inclusive of any wholly owned or controlled subsidiary. The term "utility" includes those facilities used solely by the utility that are a part of its operating plant. The term also includes those utility type facilities that are owned or leased by a government agency for its own use or otherwise dedicated solely to governmental use.
- 68. Work.** The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.
- 69. Working Drawings.** Shop drawings, bending diagrams for reinforcing steel, or any other supplementary plans or similar data which the contractor is required to submit to the Engineer for approval.

**1.2.2 Terminology.** The words and terms discussed in Paragraph 1.2.2.1 through 1.2.2.5 are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

**1.2.2.1 Intent of Certain Terms or Adjectives.** The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize

an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Chapter 2 Paragraph 9.09 of the General Conditions and Technical Specifications or any other provision of the Contract Documents.

**1.2.2.2 Day.** The word "day" means a calendar day of 24 hours measured from midnight to the next midnight and is any day of the year, no days being excepted.

**1.2.2.3 Defective.** The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents; or
2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
3. has been damaged prior to Owner's written acceptance of the Work.

**1.2.2.4 Furnish, Install, Perform, Provide.**

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.

**1.2.2.5** Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

**STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT**

**CITY OF SPRINGFIELD, MO**

**REVISED JUNE 20, 2013**

**ARTICLE 1 - DEFINITIONS AND TERMINOLOGY** [Entire section of EJCDC deleted and replaced with Owner-specific requirements, which can be found in Chapter 1 of the City of Springfield's *General Conditions and Technical Specifications*.]

## **ARTICLE 2 - PRELIMINARY MATTERS**

### *2.01 Delivery of Bonds and Evidence of Insurance*

A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified **herein in the Supplementary Conditions**, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

### *2.02 Copies of Documents*

A. **Owner shall furnish to Contractor, free of charge, three (3) copies of the Specifications and three (3) sets of the Plans, together with all Addenda. Additional copies of the Project Manual and Plans may be obtained from Owner upon request at the cost of reproduction.** ~~Owner shall furnish to Contractor up to ten printed or hard-copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.~~

B. ~~Owner must approve any change by an authorized representative at least thirty (30) days prior to consideration of any change orders.~~

### *2.03 Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier, **unless stated otherwise in the Special Provisions.**

#### 2.04 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

#### 2.05 *Before Starting Construction*

A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents.;

~~2. a preliminary Schedule of Submittals; and~~

~~3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.~~

#### 2.06 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

#### 2.07 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

City of Springfield, Missouri General Conditions.

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Revision: June 20, 2013

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
- ~~2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.~~
- ~~3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.~~

### ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

#### 3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all. **In case of discrepancy, calculated dimensions shall prevail over scaled dimensions; Special Provisions shall prevail over Plans; Plans shall prevail over Specifications.**
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.
- C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

#### 3.02 *Reference Standards*

##### A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

### 3.03 *Reporting and Resolving Discrepancies*

#### *A. Reporting Discrepancies:*

1. *Contractor's Review of Contract Documents Before Starting Work:* Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby. **Contractor shall take no advantage of any apparent error or omission in the plans or Specifications.**

2. *Contractor's Review of Contract Documents During Performance of Work:* If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

#### *B. Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

- a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or
- b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

### 3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by ~~either a Change Order or a Work Change Directive.~~

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

- ~~1. A Field Order;~~
2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or
3. Engineer's written interpretation or clarification.

### 3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

1. have or acquire any title to or ownership rights in any of the **Plans Drawings**, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer **or Engineer of Record** or its consultants, including electronic media editions; or
2. reuse any such **Plans Drawings**, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer **or Engineer of Record** and specific written verification or adaptation by **the entity responsible for those documents** ~~the Engineer~~.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

### 3.06 *Electronic Data*

A. Unless otherwise stated ~~in the Supplementary Conditions~~, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

#### **ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS**

##### *4.01 Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05. **Owner will acquire all easements in the plans unless noted in the Special Provisions.**

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

##### *4.02 Subsurface and Physical Conditions*

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A. *Reports and Drawings:* The **Special Provisions** ~~Supplementary Conditions~~ identify:

1. those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and
2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the **Special Provisions** ~~Supplementary Conditions~~. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

**C. *Cautionary note regarding Karst Features:* The predominant limestone strata in the Springfield area are extensively weathered, resulting in the formation of numerous karst features; caves, springs, sinks, losing streams, cherty clay residuum, etc. In many areas stream erosion has removed the residuum, and rock is at or very close to the surface, whereas in other areas as much as 40 feet of residuum remains. The contact between the bedrock and residual soil is extremely pinnacled. Bedrock pinnacles commonly have 10 to 15 feet of relief and as much as 30 feet. Typically the limestone pinnacles project vertically upward from narrow bedrock lows or cutters between the pinnacles. Locally, a mass of limestone may be "floating", with clay completely surrounding the large limestone block. Contractor expressly acknowledges that no representations are made in the Plans as to either the presence or absence of karst features and Contractor agrees to be stopped from making any claims regarding such features which may be encountered.**

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

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1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or
2. is of such a nature as to require a change in the Contract Documents; or
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;  
then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

*B. Engineer's Review:* After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of ~~Owner's~~ obtaining additional exploration or tests with respect thereto, and **issue Engineer's findings and conclusions advise Owner in writing (with a copy to Contractor).** ~~of Engineer's findings and conclusions.~~

*C. Possible Price and Times Adjustments:*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
  - a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and
  - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:
  - a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

c. Contractor failed to give the written notice as required by Paragraph 4.03.A.

3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

#### 4.04 *Underground Facilities*

A. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer **of Record** by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the **Special Provisions** ~~Supplementary Conditions~~:

1. Owner and Engineer **of Record** shall not be responsible for the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following ~~shall will~~ be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all such information and data;

b. locating all Underground Facilities shown or indicated in the Contract Documents;

c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

*B. Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer **of Record**. Engineer **of Record** will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, ~~a Work Change Directive or a~~ Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

**3. Generally, service connections are not indicated on the Plans. Contractor shall be responsible for discovery of existing underground installations, in advance of excavating or trenching, by contacting all local utilities and by prospecting.**

*4.05 Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

#### 4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings*: The **Special Provisions** ~~Supplementary Conditions~~ identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.

B. *Limited Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the **Special Provisions** ~~Supplementary Conditions~~. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in **Plans Drawings** or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected

area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.

F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

~~G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.~~

H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site. **Abatement of Hazardous Environmental Conditions at the Site is covered in the Special Provisions.**

**ARTICLE 5 - BONDS AND INSURANCE** [Entire section of EJCDC deleted and replaced with Owner-specific requirements.]

**5.01. Performance, Payment, and Other Bonds.**

**The Contractor shall furnish a Performance Bond and a Labor and Materials Payment Bond with surety approved by Owner and on the forms approved by Owner, each bond shall be in the full amount of contract conditioned upon the full and faithful performance of all major terms and conditions of this contract and payment of all labor and material suppliers. It is further mutually agreed between the parties hereto that if at any time after the execution of this agreement and the surety bond(s) hereto attached for its faithful performance and payment of labor and material suppliers, Owner shall deem the surety or sureties upon such bond(s) to be unsatisfactory, or if, for any reason, such bond(s) ceases to be adequate to cover the performance of the work, the Contractor shall, at its expense, within five (5) days after the receipt of notice from Owner to do so, furnish an additional bond or bonds, in such form and amount, and with such surety or sureties as shall be satisfactory to Owner. In such event no further payment to the Contractor shall be deemed to be due under this contract until such new or additional security for the faithful performance of the work and the payment of labor and material suppliers shall be furnished in a manner and form satisfactory to Owner. The corporate surety on any performance or payment bond must be licensed by the State of Missouri and if the required bond exceeds \$25,000.00 must be listed in United States Treasury Circular 570.**

**5.02. Licensed Sureties and Insurers.**

**A. All Bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue Bonds or insurance policies for the limits and coverages so required, and shall meet such additional requirements and qualifications as may be provided in the Special Provisions.**

**B. Without limiting any of the other obligations or liabilities of the Contractor, the Contractor shall secure and maintain at its own cost and expense, throughout the duration of this Contract and until the work is completed and accepted by Owner, and the Board of Utilities, insurance of such types and in such amounts as may be necessary to protect it and the interests of Owner, and the Board of Utilities, against all hazards or risks of loss as hereunder specified or which may arise out of the performance of the Contract Documents. The form and limits of such insurance, together with the underwriter thereof in each case, are subject to approval by the Owner, and the Board of Utilities. Regardless of such approval, it shall be the responsibility of the contractor to maintain adequate insurance coverage at all times during the term of the Contract. Failure of the Contractor to maintain coverage shall**

**not relieve it of any contractual responsibility or obligation or liability in general or under the Contract Documents.**

**The certificates of insurance, including evidence of the required endorsements hereunder or the policies, shall be filed with Owner within ten (10) days after the date of the receipt of Notice of Award of the Contract to the Contractor and prior to the start of work. All insurance policies shall require that the insurance company in question provide thirty (30) days written notice prior to modification or cancellation of such insurance. Such notices shall be mailed, certified mail, return receipt requested, to:**

**City of Springfield - Public Works Department, P.O. Box 8368, Springfield, MO 65801-8368; and**

**Such policies shall name Owner as an additional insured, with limits of liability not less than the sovereign immunity limits for Missouri public entities calculated by the Missouri Department of Insurance as of January 1 each calendar year and published annually in the Missouri Register pursuant to Section 537.610, RSMo.**

**(See, <http://insurance.mo.gov/industry/sovimmunity.php>)**

### **5.03. Certificates of Insurance.**

**A. Contractor shall deliver to Owner, with copies to each additional insured or loss payee as identified in the Special Provisions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.**

**B. Owner shall deliver to Contractor, with copies to each additional insured or loss payee as identified in the Special Provisions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.**

**C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.**

**D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.**

**E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.**

**5.04. Contractor's Liability Insurance.**

**A. The policies of insurance so required by this Paragraph 5.04 to be purchased and maintained shall:**

- 1. Include at least the specific coverages and be written for not less than the limits of liability specified or required by Laws or Regulations, whichever is greater;**
- 2. Include completed operations insurance;**
- 3. Include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.07, 6.11, and 6.20;**
- 4. Contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 shall so provide);**
- 5. Remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07;**
- 6. Include completed operations coverage;**
  - a. Such insurance shall remain in effect for two years after final payment.**
  - b. Contractor shall furnish Owner and each other additional insured to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.**
- 7. Contain a cross liability or severability of interest clause or endorsement. Insurance covering the specified additional insureds shall be primary insurance, and all other insurance carried by the additional insureds shall be excess insurance; and**
- 8. With respect to workers' compensation and employers' liability, comprehensive automobile liability, commercial general liability, and umbrella liability insurance, and all other liability insurance specified herein to be provided by Contractor, Contractor shall require its insurance carriers to waive all rights of subrogation against Owner, , and its officers, employees, and agents.**

**9. Legislative or Judicial Changes.** In the event the scope or extent of Owner's tort liability as a governmental entity as described in Section 537.600 through 537.650 RSMo is broadened or increased during the term of this agreement by legislative or judicial action, Owner may require Contractor, upon 10 days written notice, to execute a contract addendum whereby the Contractor agrees to provide, at a price not exceeding Contractor's actual increased premium cost, additional liability insurance coverage as Owner may require to protect Owner from increased tort liability exposure as the result of such legislative or judicial action. Any such additional insurance coverage shall be evidenced by an appropriate certificate of insurance and shall take effect within the time set forth in the addendum.

**10. Subcontracts.** In case any or all of this work is sublet, the Contractor shall require the subcontractor to procure and maintain all insurance required in subparagraphs B, C, and D hereof and in like amounts. Contractor shall require any and all subcontractors with whom it enters into a contract to perform work on this project to protect Owner and the Board of Utilities through insurance against applicable hazards or risks and shall, upon request of Owner, provide evidence of such insurance.

**B. Workers' Compensation....Statutory coverage per RSMo 287.010 et seq.  
Employer's Liability.....\$1,000,000.00**

**C. Commercial General Liability Insurance, including coverage for Premises, Operations, Products and Completed Operations, Contractual Liability, Broad Form Property Damage, Independent Contractors, Explosion, Collapse, and Underground Property Damage and endorsed for blasting if blasting required. Such coverage shall apply to bodily injury and property damage on an "Occurrence Form Basis" with limits of at least Two Million Six Hundred Eighteen Thousand Two Hundred Thirty and no/100 Dollars (\$2,618,230.00) for all claims arising out of a single accident or occurrence and at least Three Hundred Ninety-Two Thousand Seven Hundred Thirty-Four and no/100 Dollars (\$392,734.00) with respect to injuries and/or death of any one person in a single occurrence and an amount not less than at least \$1,000,000 for all claims to property arising out of a single occurrence and at least \$100,000 to any one owner with respect to damages to property. Contractor agrees that the proceeds of such insurance policy shall first be used to pay any award, damages, costs, and/or attorneys' fees incurred by or assessed against Owner, its employees, officers and agents, before payment of any award, damages, costs or attorneys fees of Contractor, its employees, officers or agents. Contractor agrees to cause its insurer to name Owner as an additional insured on such insurance policy, including the Owner as an additional insured for coverage under its products-completed operations hazard, and said policy shall be primary and noncontributory.**

**D. Automobile Liability Insurance covering bodily injury and property damage for owned, non-owned and hired vehicles, with limits of at least Two Million Six**

**Hundred Eighteen Thousand Two Hundred Thirty and no/100 Dollars (\$2,618,230.00) for all claims arising out of a single accident or occurrence and at least Three Hundred Ninety-Two Thousand Seven Hundred Thirty-Four and no/100 Dollars (\$392,734.00) with respect to injuries and/or death of any one person in a single accident or occurrence.**

**E. Owner's and Contractor's Protective Liability Insurance to protect the Owner, its agents, servants and employees from claims which may arise from the performance of this Contract, with limits of at least Two Million Six Hundred Eighteen Thousand Two Hundred Thirty and no/100 Dollars (\$2,618,230.00) for all claims arising out of a single accident or occurrence and at least Three Hundred Ninety-Two Thousand Seven Hundred Thirty-Four and no/100 Dollars (\$392,734.00) with respect to injuries and/or death of any one person in a single accident or occurrence. Owner's and Contractor's Protective Liability Insurance must:**

- 1. Be a separate policy with the named insured being: Owner and the Board of Utilities;**
- 2. Be with the same insurance company with which the Contractor carries its Commercial General Liability Insurance and Automobile Liability Insurance; and**
- 3. Contain an endorsement that disclaims coverage for any claim barred by the doctrines of sovereign immunity or official immunity, except attorney's fees and other litigation costs incurred in defending a claim. Nothing contained in this policy (or this endorsement thereto) shall constitute any waiver of whatever kind of these defenses or sovereign immunity or official immunity for any monetary amount whatsoever.**

**5.08. *Acceptance of Bonds and Insurance; Option to Replace.***

- A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the Bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 30 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the Bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent Bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.**

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Revision: June 20, 2013

## ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

### 6.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

### 6.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

**C. As identified in the contract document, night work (between 5 p.m. and 7 a.m.) may only be undertaken with the permission of Owner; such permission, however, may be revoked at any time by Owner if Contractor fails to maintain adequate equipment and supervision for the proper execution and control of work at night.**

### 6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall

expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

**D. Until final completion of the Work is acknowledged by Owner, Contractor shall have responsible charge and care of the Work and of all equipment and materials to be used therein, and shall bear the risk of injury, loss, or damage to any part thereof by action of the elements or from any other cause.**

**E. Contractor shall rebuild, repair, restore, and make good all injuries, losses, or damage to any portion of the Work or the equipment or materials occasioned by any cause before completion and acceptance of the Work and shall bear the expense therefore. Contractor shall, at no additional cost to Owner, provide suitable drainage and suitable structures as necessary to protect the Work or any portion thereof from damage.**

**F. Suspension of the Work or the granting of an extension of time for any cause whatever shall not relieve Contractor of his responsibilities for the Work as specified herein.**

#### 6.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and "Or-Equals "* [Entire section of EJCDC deleted and replaced with Owner-specific requirements, which are modeled on the Missouri Department of Transportation's Standard Specifications For Highway Construction, Section 104.6.]

**A. Value Engineering Proposals. A Value Engineering Change Proposal (VECP) shall provide a product of equal or improved quality that will reduce the project cost, improve safety or decrease the time required to complete the project. A Practical Design Value Engineering Change Proposal (PDVECP) may use an existing item in**

City of Springfield, Missouri General Conditions.

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**place or underrun contract items. The PDVECP shall not adversely affect safety or function of the final product. The Contractor is encouraged to submit to the Engineer, in writing, VECP's and PDVECP's for modifying the plans, specifications or other requirements of the contract. Proposed modifications shall not impair, in any manner, essential functions or characteristics of the project, including but not limited to, service life, economy of operation, ease of maintenance, desired appearance, design or safety standards, and shall not significantly delay the completion of the project. Proposals shall be submitted to the Engineer in advance of the work to be performed with sufficient time allowed for review. The Owner will not be liable to the Contractor for failure to accept or act upon the proposal nor for any delays to the work attributable to any such proposal.**

**1. Submitting Proposals. Value engineering proposals shall be submitted on the proper form available from the Public Works Department and shall contain the following information:**

**a. A description of both the existing contract requirements for performing the work and the proposed changes.**

**b. A detailed estimate of the cost of performing the work under the existing contract and under the proposed change.**

**c. A statement of the time within which the Engineer must make a decision thereon, including the probable effect the proposal will have on the contract completion time.**

**d. An itemized list of the contract items of Work affected by the proposed changes, including any quantity variation attributable thereto.**

**e. A description of any previous use or submission of the same proposal by the Contractor, including dates, job numbers, results, and/or outcome of proposal if previously submitted.**

**B. Conditions. The Engineer will only consider VECP's that meet the following conditions.**

**1. The Contractor may submit value engineering proposals that propose changes in the basic design of a bridge or a pavement, except for pavement and shoulder type. Value engineering proposals will be considered only when the proposal will not significantly delay the completion of the project.**

**2. The Contractor shall continue to perform the work in accordance with the requirements of the Contract until a Change Order incorporating the value engineering proposal has been approved, unless otherwise directed by the Engineer. If a Change Order has not been approved by the date upon which**

**the contractor's value engineering proposal specifies that a decision thereon should be made, the proposal shall be deemed rejected, unless the time allowed for a decision has been extended by mutual agreement of both parties.**

**3. The Owner expressly reserves the right to adopt a value engineering proposal as standard practice for use on other contracts administered by the Owner. If an accepted value engineering proposal is adopted as design policy, only contractors submitting such a proposal will be eligible for compensation pursuant to this section until the proposal is incorporated into design policy, and in that case, only as to those contracts awarded to the contractor prior to submission of the accepted value engineering proposal. Value engineering proposals identical or similar to previously submitted proposals will be eligible for consideration and compensation under the provisions of this Section 6.05 if the identical or similar previously submitted proposals were not adopted as design policy by the City, or included in the present contract. Subject to the provisions contained herein, the Owner will have the right to use all or any part of any submitted value engineering proposal without obligation or compensation of any kind to the Contractor, except as noted in Section 6.05.B.4.**

**4. The Contractor may request the return of information submitted with a value engineering proposal if the proposal is rejected, provided this request is in writing and submitted with the proposal. If the proposal is accepted, this request will be void, and the Owner may use or disclose in whole or in part any information necessary to utilize the proposal.**

**5. Prior to approval, it may be necessary for the Engineer to modify a proposal, with the concurrence of the Contractor, to make the proposal acceptable. If any modification increases or decreases the net savings resulting from the proposal, the Contractor's share will be determined on the basis of the proposal as modified.**

**6. Four copies of the complete proposal shall be submitted to the Engineer for review. The Contractor may submit a conceptual proposal for approval stating the basic proposal and approximate cost savings in order to provide the Contractor with the opportunity to submit an idea without large initial development costs if the proposal is rejected. Approval or disapproval of proposals will be granted within ten days of receipt of the proposal.**

**7. A proposal will be disqualified if additional information is not provided at the request of the engineer. This will include design computations, field investigations, results, surveys, etc.**

**8. Reimbursement for modifications to the proposal to adjust field or other conditions will be limited to the total amount of the contract bid prices.**

**Rejection, limitation or reimbursement shall not be a basis for any claim against the Owner.**

**9. The Contractor will have no claim to additional costs or delays, including development costs, loss of anticipated profits, or increased material or labor costs, if the proposal is rejected.**

**10. The Engineer will decide whether or not to consider a proposal. The basis for proposal rejections will include excessive review requirements, evaluation or investigation, or if the proposal is inconsistent with project design policies or criteria.**

**C. Payment. Payment will meet the following conditions:**

**1. The Engineer will be the sole judge of the acceptability of a value engineering proposal and of the estimated net difference in construction costs from the adoption of all or any part of such a proposal. The Engineer may adjust contract prices if, in the judgment of the Engineer, such prices do not represent a fair measure of the value of work to be performed or to be deleted.**

**2. If the Contractor's cost reduction is accepted in whole or in part, such acceptance will be by a change order, which will specifically state that the Change Order is executed in accordance with Section 6.05 of the General Conditions. Such Change Orders will incorporate the changes in the Plans and Specifications necessary to permit the value engineering proposal or any part of the proposal that has been accepted, to be put into effect, and will include any conditions upon which the Owner's approval thereof is based, if the approval of the Owner is conditional. The Change Order will also set forth the price for performing those items of work affected by the Change Order and the estimated net savings in the cost of performing the work attributable to the value engineering proposal in the change order, and will further provide that the Contractor will be paid 50 percent for VECP's or 25 percent for PDVECP's of the actual net savings of the construction costs at the completion of the work affected by the Change Order. All reasonable documented engineering costs incurred by the contractor to design and develop a value engineering proposal will be reimbursed and subtracted from the savings of the construction costs. All costs incurred by Engineer to review and implement the VECP will be at the Owner's expense.**

**3. The amount and time specified in the Change Order will be considered full compensation to the Contractor for the value engineering proposal and for the performance of that work.**

**4. Only the Contractor may submit proposals and be reimbursed for savings, however the Contractor may submit proposals for any approved subcontractor.**

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

B. If the **Bidding Documents or the Contract Documents** ~~Supplementary Conditions~~ require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the **Bidding Documents or the Contract Documents** ~~Supplementary Conditions~~, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer, or **Inspector** to reject defective Work. **Particular consideration will be given to the qualifications of each Subcontractor proposed on the List of Subcontractors. The use of Subcontractors proposed by Bidder and accepted by Owner prior to the Notice of Award will be required in the performance of the Work unless otherwise permitted or directed by Owner.**

C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor
2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.

F. The divisions and sections of the Specifications and the identifications of any **Plans Drawings** shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, Engineer, and all other individuals or entities identified in the **Special Provisions** ~~Supplementary Conditions~~ to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

**H. No Subcontractor shall under any circumstances relieve the Contractor or his surety of his liability and obligation under the Contract, and all transactions will be made through the Contractor. Subcontractors shall be recognized and dealt with only as workmen and representatives of the Contractor.**

**I. If approval is given for subletting Work, the Contractor shall perform with his own organization bid items amounting to not less than forty (40) percent of the total contract cost. The percentage of Work to be performed shall be computed using the bid items as shown on the bid proposal and unit prices as submitted by Contractor. No breakdown of the bid items will be allowed, such as breaking excavation bid item into labor, equipment, fuel, etc. The unit prices used in the computation will be the bid price on the bid proposal, not the price Contractor is to pay Subcontractor. A Subcontractor may not subcontract any portion of his work.**

**J. The Contractor shall be as fully responsible to the Owner for the acts and omissions of his Subcontractors and material suppliers, and of persons either directly or indirectly employed by them, as he is for acts and omissions of persons directly employed by him. The Contractor shall cause appropriate provisions of the Plans and Specifications to be inserted in all subcontracts, and contracts for the supply of materials relative to the work, to bind Subcontractors to the Contractor by the terms of these Contract Documents insofar as is applicable, and to give the Contractor the same power as regards terminating the subcontract that Owner may exercise over**

**the Contractor under any provision of the Contract Documents. Nothing contained in this Contract shall create any contractual relation between any Subcontractor and Owner, and the Contractor shall defend, indemnify, and save harmless Owner and Engineer of Record from and against any and all liability, suits, claims, damages, costs (including attorney's fees), losses, outlays, and expenses in any manner arising out of or connected with Subcontractor claims and damages arising out of matters covered by terms of these Contract Documents which Contractor either failed to insert in subcontract documents or materially modified, notwithstanding any possible negligence (whether sole, concurrent, or otherwise) on the part of Owner, its agents or employees, and Engineer of Record.**

#### *6.07 Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

~~B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.~~

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

**D. Contractor shall furnish to Owner at the time of initial submittal, satisfactory evidence that Suppliers of proprietary materials, equipment, devices, or processes to be furnished or used in the performance of the Work do indemnify, keep, and save**

**harmless Contractor and Owner from all liabilities, judgments, costs, damages, and expenses which may arise from the use of such proprietary materials, equipment, devices, or processes, furnished to Contractor for incorporation in or use in performance of the Work and their operation by Owner after acceptance of the Work. Such satisfactory evidence shall consist of patent licenses or patent releases covering proprietary materials, equipment, devices, or processes.**

6.08 *Permits*

A. Unless otherwise provided in the **Special Provisions** ~~Supplementary Conditions~~, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and **Plans** ~~Drawings~~ are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

**D. Employment Requirements. Employment requirements shall be as specified herein and in the attachments at the end of the Special Provisions.**

**E. Work in Confined Spaces. Contractor is hereby notified that manholes and other structures included under the confined-space definition of 29 CFR 1910.146, shall be considered as hazardous locations with hazardous atmospheric conditions. The**

**structures may contain methane, hydrogen sulfide, carbon dioxide, and other gases which are dangerous to life or health. Contractor shall allow its personnel or Subcontractors to enter these confined spaces only through compliance with an entry permit program as specified herein. Contractor shall establish and maintain a confined-space entry program appropriate to the structures and conditions encountered. The program shall meet the requirements of 29 CFR 1910.146 and shall specifically address the provisions of Paragraph (d) therein. Contractor shall enforce the requirements of 29 CFR 1910.146 Paragraphs (e) and (f) therein, shall establish and conduct a training program in accordance with Paragraph (g) therein, and shall comply with all other applicable requirements of the referenced regulation.**

**F. Labor Standards and Prevailing Wages. Contractor will be required to furnish an affidavit to Owner stating that he has paid the prevailing wages as set forth in the latest annual Wage Order for Greene County issued by the Missouri Division of Labor Standards. All labor utilized in the construction of the aforementioned improvements shall be paid a wage of no less than the "prevailing hourly rate of wages" for work of a similar character in this locality, as established and amended at any time by the Department of Labor and Industrial Relations of the State of Missouri. The Contractor shall submit to the Construction Inspector monthly certified copies of payrolls including any subcontractors that may be working that month. At any time the contractor is found to not have paid prevailing wages, the contractor shall forfeit as a penalty to Owner one hundred dollars for each underpaid worker employed, for each calendar day, or portion thereof such worker is paid less than the said stipulated rates for any work done under this contract. Wage interviews of the Contractor's and Subcontractors' work force may be made at random to verify that the prevailing wage rate is being paid. These interviews may be on site examinations or a questionnaire mailed to the individual.**

**G. Employment of Unauthorized Aliens. Pursuant to Section 285.530, RSMo., Contractor and its subcontractors, shall not knowingly employ, hire for employment, or continue to employ an unauthorized alien to perform work within the State of Missouri, and shall affirm, by "E-Verify", its enrollment and participation in a federal work authorized program with respect to the employees working in connection with contracted services. Further, Contractor shall sign an affidavit affirming that it does not knowingly employ any person who is an unauthorized alien in connection with the contracted services. In accordance with sections 285.525 to 285.550, RSMo a general contractor or subcontractor of any tier shall not be liable when such a contractor or subcontractor contracts with its direct subcontractor with its direct subcontractor who violates subsection 1 of section 285.520, RSMo if the contract binding the contractor and subcontractor affirmatively states that the direct subcontractor is not knowingly in violation of subsection 1 of section 285.530, RSMo and shall not henceforth be in such violation and the contractor or subcontractor receives a sworn affidavit under the penalty of perjury attesting to the fact that the direct subcontractor's employees are lawfully present in the United States.**

**H. Missouri Products and Missouri Firms. In accordance with Chapter 71.140, Missouri Revised Statutes, preference shall be given to Missouri products. Pursuant to Section 34.076, RSMo., a preference shall be given to those persons doing business in Missouri firms, corporations, or individuals, or which maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less. In addition, in order for a nondomiciliary Missouri bidder to be successful, his bid must be that same percentage lower than a domiciliary Missouri bidder's bid, as would be required for a Missouri bidder to successfully bid in the nondomiciliary's state.**

#### 6.10 Taxes

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

**B. Missouri State Sales Tax Law, Section 144.030.1, RSMo. exempts purchases for construction materials associated with the Work from state sales/use tax. Owner will issue Contractor a tax-exempt letter to use as proof of this tax exemption.**

#### 6.11 Use of Site and Other Areas

##### A. Limitation on Use of Site and Other Areas:

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.
2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.
3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner, ~~and Engineer, and the~~ its officers, ~~directors,~~ ~~members,~~ ~~partners,~~ employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, ~~Engineer,~~ or any other party indemnified

hereunder to the extent caused by or based upon Contractor's performance of the Work.

*B. Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

*C. Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

*D. Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

***E. Storm Water Management Practices:* Contractor shall take sufficient precautions to prevent pollution of streams, lakes, ponds, sinkholes and reservoirs, with fuels, oils, bitumens, calcium chloride, or other harmful materials. Contractor shall schedule and conduct his operations so as to avoid or minimize siltation of streams, lakes, ponds, sinkholes, or reservoirs. In areas particularly subject to erosion, Contractor shall, subject to approval of Engineer, conduct his operations in such a manner to reduce exposure to uncompleted portions of the project to the shortest time practicable.**

***F. Vehicle/Equipment Identification:* Each Contractor and Subcontractor working on Owner right-of-way shall have its name or recognizable logo, and the name of the city and state of the principal office of the company on each motor vehicle and motorized piece of equipment being utilized.**

#### 6.12 Record Documents

A. Contractor shall maintain in a safe place at the Site one record copy of all **Plans Drawings**, Specifications, Addenda, Change Orders, ~~Work Change Directives, Field Orders,~~ and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

#### 6.13 Safety and Protection

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not

relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;
2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The **Special Provisions** ~~Supplementary Conditions~~ identify any Owner's safety programs that are applicable to the Work.

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

E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of **Plans Drawings** or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

#### 6.14 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

#### 6.15 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

#### 6.16 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a ~~Work Change Directive or~~ Change Order will be issued.

#### 6.17 *Shop Drawings and Samples* [Entire section deleted and replaced with Owner-specific requirements.]

**A. Requirements for shop drawings, samples, and submittal procedures shall be as specified in the Contract Documents. Structural steel beams and trusses shall require Shop Drawings to be submitted for review by the Engineer of Record.**

#### 6.18 *Continuing the Work*

A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

#### 6.19 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;
2. recommendation by Engineer or payment by Owner of any progress or final payment;
3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
4. use or occupancy of the Work or any part thereof by Owner;
5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;
6. any inspection, test, or approval by others; ~~or~~
7. any correction of defective Work by Owner; **or**
- 8. any expiration of a correction period.**

#### 6.20 Indemnification

A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner ~~and Engineer, its and the officers, directors, members, partners,~~ employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner ~~or Engineer, its and the officers, directors, members, partners,~~ employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. ~~The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:~~

- ~~1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or~~
- ~~2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.~~

**D. It is anticipated that storm, surface, and possible ground or other waters will be encountered at various times and locations during the construction process. Such waters may interfere with Contractor's operation and may cause damage to adjacent or downstream private and/or public property by flooding, lateral erosion, sedimentation, or pollution if not properly controlled by Contractor. Any Contractor working in Owner right-of-way or contracted with the Owner shall be required to follow a storm water management plan and required to repair any and all damage caused by said waters. Contractor, by working on Owner right-of-way, assumes all said risk, and agrees to hold the Owner harmless.**

#### 6.21 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer **of Record** will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals

related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer **of Record**.

C. Owner and Engineer **of Record** shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer **of Record** have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph 6.21, **Engineer of Record's** ~~Engineer's~~ review and **acceptance of signed and sealed certifications of performance and design criteria used when designing systems, materials, or equipment and design drawings** ~~approval of design calculations and design drawings~~ will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. ~~Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.~~

E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

**F. When professional design services are required by the Contract Documents, Contractor shall provide certification that the design has been performed by a design professional in accordance with the Contract Documents and that the associated construction conforms to the design provided by the design professional.**

## ARTICLE 7 - OTHER WORK AT THE SITE

### 7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to Contractor prior to starting any such other work; and
2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.

B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and

patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

#### 7.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in **Special Provisions** ~~Supplementary Conditions~~:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;
2. the specific matters to be covered by such authority and responsibility will be itemized; and
3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the **Special Provisions** ~~Supplementary Conditions~~, Owner shall have sole authority and responsibility for such coordination.

#### 7.03 *Legal Relationships*

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.

C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

## **ARTICLE 8 - OWNER'S RESPONSIBILITIES**

### *8.01 Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer **or Inspector**.

### *8.02 Replacement of Engineer*

A. In case of termination of the employment of Engineer, Owner shall appoint a ~~an~~ **replacement** engineer ~~to whom Contractor makes no reasonable objection~~, whose status under the Contract Documents shall be that of the former Engineer.

### *8.03 Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

### *8.04 Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

### *8.05 Lands and Easements; Reports and Tests*

A. Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

### *8.06 Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

### *8.07 Change Orders*

A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

### 8.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

### 8.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

### 8.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

### 8.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

### 8.12 *Compliance with Safety Program*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

## **ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION**

### 9.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

### 9.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the

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Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

### 9.03 *Inspector Project Representative*

A. ~~If Owner and Engineer agree, Engineer will furnish an Inspector a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Inspector Resident Project Representative and assistants will be as provided in the Special Provisions Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.~~

### 9.04 *Authorized Variations in Work*

A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. ~~These may be accomplished by a Field Order, and~~ will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner, **Engineer** or Contractor believes that **an authorized minor variations in the Work** ~~a Field Order~~ justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

### 9.05 *Rejecting Defective Work*

A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed

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Revision: June 20, 2013

Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

*9.06 Shop Drawings, Change Orders and Payments*

~~A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.~~

B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

*9.07 Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

*9.08 Decisions on Requirements of Contract Documents and Acceptability of Work*

A. **The Director of Public Works** ~~Engineer~~ will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between **Engineer** ~~Owner~~ and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to **the Director of Public Works** ~~Engineer~~ in writing within 30 days of the event giving rise to the question.

B. **The Director of Public Works** ~~Engineer~~ will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of **the Director of Public Works'** ~~Engineer's~~ decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. ~~The Director of Public Works' Engineer's~~ written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.

~~D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.~~

#### 9.09 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the **Inspector Resident Project Representative**, if any, and assistants, if any.

#### 9.10 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

## ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

### 10.01 *Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, ~~or a Work Change Directive~~. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, ~~that should be allowed as a result of a Work Change Directive~~, a Claim may be made therefor as provided in Paragraph 10.05.

### 10.02 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

### 10.03 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with **an authorized minor variation in the Work** ~~a Work Change Directive~~; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

#### 10.04 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

#### 10.05 *Claims*

A. *Engineer's Decision Required:* All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the **Director of Public Works Engineer** for decision. A decision by **the Director of Public Works Engineer** shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.

B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to **the Director of Public Works Engineer** and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the **Director of Public Works Engineer** and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to **the Director of Public Works Engineer** and the claimant within 30 days after receipt of the claimant's last submittal (unless **the Director of Public Works Engineer** allows additional time).

C. *Engineer's Action:* Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

1. deny the Claim in whole or in part;
2. approve the Claim; or
3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

## **ARTICLE 11 - COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK**

### 11.01 *Cost of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
  - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
  - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
  - c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
  - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
  - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
  - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages

have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

**B. *Costs Excluded:*** The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

**C. *Contractor's Fee:*** When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is

determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

*D. Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

~~11.02 Allowances~~ [Entire section deleted.]

### 11.03 Unit Price Work

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease; **and**

**4. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment by Change Order if:**

**a. The variation of the actual quantity of an item of Unit Price Work performed by Contractor differs by more than 50 percent from the estimated quantity of that item indicated in the Bid, and**

**b. The item of Unit Price Work is equal to or greater than ten percent (10%) of the project cost, either before or after the adjustment in quantity.**

## **ARTICLE 12 - CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES**

### *12.01 Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or
2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or
3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

C. *Contractor's Fee:* The Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or
2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
  - a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;
  - b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that ~~the any higher tier Subcontractor and Contractor~~ will each be paid a fee of five percent of the amount paid to the ~~next lower tier~~ Subcontractor **who actually performs the Work**;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

#### 12.02 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the **Director of Public Works Engineer** and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

**C. A claim for an extension of the Contract Times (or Milestones), otherwise allowable under the Contract Documents, shall be granted only to the extent the time lost exceeds the float for the delayed activity at the time of the event giving rise to the claim. Float, whether expressly disclosed or implied in any manner, is jointly owned by the project participants.**

**D. Contractor shall not use float suppression techniques (including, but not limited to, preferential sequencing caused by late starts of follow-up trades, unreasonably small crews, extended durations, or imposed dates) in information provided to Engineer.**

**E. Paragraphs C and D of this Section 12.02 shall only apply when critical path scheduling is used for the Work.**

City of Springfield, Missouri General Conditions.

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### 12.03 *Delays*

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract ~~Price or the Contract Times, or both~~. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

## **ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK**

### *13.01 Notice of Defects*

A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

### *13.02 Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

### *13.03 Tests and Inspections*

A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;
2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and
3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase

thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.

F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

#### 13.04 *Uncovering Work*

A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.

D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

#### 13.05 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of

Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

#### 13.06 *Correction or Removal of Defective Work*

A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

#### 13.07 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas; or
2. correct such defective Work; or
3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

**F. Nothing in this Article 13 concerning the correction period shall establish a period of limitation with respect to any other obligation which Contractor has under the Contract Documents. The establishment of time periods relates only to the specific obligations of Contractor to correct the Work, and has no relationship to the time within which Contractor's obligations under the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish Contractor's liability with respect to Contractor's obligations other than to specifically correct the Work.**

#### 13.08 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, ~~Owner (and, prior to Engineer's recommendation of final payment, Engineer)~~ prefers to accept it, **Engineer** ~~Owner~~ may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

#### 13.09 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in

accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

## **ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION**

### *14.01 Schedule of Values*

A. ~~The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer.~~ Progress payments on account of Unit Price Work will be based on the number of units completed.

### *14.02 Progress Payments*

#### *A. Applications for Payments:*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor

~~covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.~~

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

**4. Schedules and Data. During the progress of the Work, each Application for Payment shall be accompanied by Contractor's updated schedule of operations or progress report, with such shop drawings schedules, procurement schedules, values of materials and equipment on hand included in Application of Payment, and other data specified or reasonably required by Engineer.**

*B. Review of Applications:*

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests

called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

- a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;
- b. the Contract Price has been reduced by Change Orders;
- c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or
- d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

*C. Payment Becomes Due:*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D **and less five (5) percent retainage**) become due, and when due will be paid by Owner to Contractor. **If the Owner determines that a higher rate of retainage is required to ensure performance of the contract, the Owner may withhold up to ten (10) percent retainage until the work is fully completed and accepted by the City.**

*D. Reduction in Payment:*

1. Owner may refuse to make payment of the full amount recommended by Engineer because:
  - a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;
  - b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
  - c. there are other items entitling Owner to a set-off against the amount recommended; or
  - d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.
2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay

Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.

#### 14.03 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

**B. The Contractor shall be responsible for the condition of all material and all Work performed as part of this contract and such material and labor shall be guaranteed by the Contractor and his surety against defective workmanship and/or material found to be defective in manufacture or which has been damaged in handling or placement after delivery for a period of 12 months after acceptance by the Owner. Contractor shall repair, replace, or otherwise make good at its own expense any such defect or failure which may become evident within the guarantee period, excepting as may be due to normal use or wear.**

#### 14.04 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify ~~Owner and~~ Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.

B. Promptly after Contractor's notification, ~~Owner,~~ Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to **Contractor** a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. ~~Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised~~

~~tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.~~

D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. ~~Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.~~

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

#### 14.05 *Partial Utilization*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.
2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto. \_

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

#### 14.06 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

#### 14.07 *Final Payment*

##### *A. Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
  - a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;
  - b. consent of the surety, if any, to final payment;
  - c. a list of all Claims against Owner that Contractor believes are unsettled; and
  - d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full,

Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

*B. Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, ~~Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same at that time~~ Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

*C. Payment Becomes Due:*

1. Thirty days after the presentation to Owner of the Application for Payment, **Affidavit of Compliance** and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and **payment process will be initiated** by Owner to Contractor.

*14.08 Final Completion Delayed*

A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

*14.09 Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and
2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

#### **14.10 Liquidated Damages**

**A. Contractor shall furnish all supervision, labor, tools, equipment, materials and supplies as stated in Article 6 necessary to complete the Contract within the Contract Times. All time limits for Substantial Completion, and completion and readiness for final payment are of the essence to the Contract.**

**B. Contractor shall have all Work substantially complete within the Contract Times specified in the Job Special Provisions, and completed and ready for final payment in accordance with Paragraph 14.07.B within 45 calendar days after the Engineer issues a Certificate of Substantial Completion.**

**C. Failure or delay in completing work on time as specified or such additional time as may be allowed by the Engineer under the contract shall result in liquidated damages. This amount of liquidated damages is agreed upon by Contractor and Owner, not as a penalty, but as liquidated damages for difficult to quantify losses to the Owner and the public. Permitting the Contractor to continue and finish the work or any part of it after the expiration of the specified time, or after the extension of the time, shall in no way operate as a waiver on the part of the Owner or of any of its rights under the contract.**

**1. Contractor shall pay Owner liquidated damages in an amount specified in the Contract for each day that expires after the time specified for Substantial Completion until the Work is substantially completed.**

**2. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times or any proper extension thereof granted by Owner, Contractor shall pay Owner fifty dollars (\$50.00) for each day that expires after the time specified in Paragraph 14.10.B for completion and readiness for final payment until the Work is completed and ready for final payment.**

**3. The liquidated damages set forth in Paragraphs 14.10.C.1 and 14.10.C.2 shall not be cumulative. If Substantial Completion of the Work is not met within the time specified for final completion of all Work, the liquidated damages shall continue to be at the rate or rates specified for default on**

**Substantial Completion until Substantial Completion is attained. If the Work is not then finally completed, the rate or rates specified for default on final completion shall apply until final completion is attained.**

**4. Owner shall have the right to deduct the liquidated damages from any money in its hands, otherwise due, or to become due, to Contractor, or initiate applicable dispute resolution procedures and to recover liquidated damages for nonperformance of this Contract within the time stipulated.**

## **ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION**

### *15.01 Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

### *15.02 Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);
2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;
3. Contractor's repeated disregard of the authority of Engineer; or
4. Contractor's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site,

and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);

2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and

3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

~~F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.~~

**F. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Owner fails to act without cause on any Application for Payment within 60 days after it is submitted, or (iii) Owner fails for 60 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner, and provided Owner does not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.**

### 15.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;
3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and
4. reasonable expenses directly attributable to termination.

B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

#### 15.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

## ARTICLE 16 - DISPUTE RESOLUTION

### 16.01 *Methods and Procedures*

A. Either Owner or Contractor may request mediation of any Claim submitted to **the Director of Public Works Engineer** for a decision under Paragraph 10.05 before such decision becomes final and binding. ~~The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract.~~ Timely submission of the request shall stay the effect of Paragraph 10.05.E.

B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

1. elects in writing to invoke any dispute resolution process provided for in the **Special Provisions Supplementary Conditions**; or
2. agrees with the other party to submit the Claim to another dispute resolution process; or
3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

## ARTICLE 17 - MISCELLANEOUS

### 17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or
2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

### 17.02 *Computation of Times*

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

### 17.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

### 17.04 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

**B. Contractor shall obtain from all Suppliers and manufacturers any and all warranties and guarantees of such Suppliers and manufacturers, whether or not specifically required by the Specifications, and shall assign such warranties and guarantees to Owner. With respect thereto, Contractor shall render reasonable assistance to Owner when requested, in order to enable Owner to enforce such warranties and guarantees. The assignment of any warranties or guarantees shall not affect the correction period or any other provisions of these Contract Documents.**

### 17.05 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

### 17.06 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

### 3 EARTHWORK

#### 3.1 CLEARING AND GRUBBING

**3.1.1 Scope of Work.** This work shall consist of clearing, grubbing, removing, and disposing of vegetation within the limits of right-of-way and easement areas, except such vegetation as is designated to remain or to be selectively treated. Demolition of buildings and structures including foundations and slabs shall be as specified in the Special Provisions or on the plans.

**3.1.2 Construction Requirements.** The Engineer will establish right-of-way and construction lines and will designate all trees, shrubs, and plants that are to remain. The contractor shall preserve without damage any trees and shrubs designated to remain. All trees, stumps, brush, and hedge not designated to remain shall be cleared and grubbed as required and shall be disposed of in an acceptable manner.

Stumps and roots in fill and cut areas shall be grubbed to a depth of not less than 12 inches below the existing earth grade. Stump holes shall be back-filled with suitable material and compacted to the approximate density of the adjacent area. Grubbing of borrow areas, channel changes, and inlet and outlet easements will be required only to the extent necessitated by the proposed construction.

Burning of products from clearing and grubbing operations will not be permitted without obtaining a burning permit from the City Fire Department. The burial of stumps and debris will not be permitted on the right-of-way. Products of clearing and grubbing shall be removed from the right-of-way and disposed of out of sight from the roadway provided an acceptable written agreement with the property owner on whose property the products are placed is submitted by the contractor.

Within the construction limits of the project, the contractor shall trim any tree which does not provide nine (9) feet vertical clearance above any sidewalk and fourteen (14) feet vertical clearance above any street. Tree trimming shall be done before final payment and the trees shall be shaped at the direction of the Engineer. This tree trimming shall be considered incidental to the contract and no additional compensation shall be allowed.

Contractor shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of the Engineer. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

**3.1.3 Basis of Payment.** The accepted quantities of clearing and grubbing will be paid for at the lump sum price as stated in the contract. Payment for this item will be made at the completion of the clearing and grubbing operation. When no pay item for clearing or grubbing is included in

the contract, clearing and grubbing, including scalping, will be considered incidental to the work and no direct payment will be made.

## **3.2 GRADING**

**3.2.1 Scope of Work.** This section governs the furnishing of all labor, equipment, tools, and materials, and the performance of all work required for grading the project in coordination with all previous work performed, at the locations shown on the plans, in accordance with the requirements of applicable sections and as provided for in the Special Provisions.

### **3.2.2 Materials and Definitions.**

**3.2.2.1** Grading as used herein shall be construed to mean the performance of all excavation, embankment, and backfill in connection with the construction of all improvements.

**3.2.2.2** Excavation is defined as the removal of materials from the construction area to the lines and grades shown on the plans.

**3.2.2.2.1 Unclassified Excavation.** Unclassified excavation is defined as the removal of all material encountered regardless of its nature.

**3.2.2.2.2 Rock.** Rock is defined as being sandstone, limestone, chert, granite, siltstone quartzite, slate, shale occurring in its natural undisturbed state, hard and unweathered, in ledges 6 inches or more in thickness or similar material in masses more than 1 ½ cubic yard in volume.

Should rock be encountered in two or more ledges, each ledge being more than 6 inches thick and with interlying strata of earth, clay, shale, or gravel not more than 12 inches thick in each stratum, the entire volume between the top of the top ledge and bottom of the bottom ledge will be classified as rock.

**3.2.2.2.3 Earth.** All materials not classified as rock shall be classified as earth. Chert (joint flint rock) broken by intermittent clay partings or clay seams or stratified chert cemented with clay seams (hardpans) shall be classified as earth.

**3.2.2.3** Embankment is defined as the placing and compacting of suitable material in the construction area to the lines and grades shown on the plans.

**3.2.2.4** Material suitable for use as embankment material shall be entirely imperishable and shall be judged acceptable by the Engineer on the site.

**3.2.2.4.1 Earth Materials.** Material suitable for earth embankment shall be free of waste material, contain less than forty (40) percent by volume of rock and gravel, and contain no particles having a maximum dimension greater than four (4) inches.

**3.2.2.4.2 Rock Materials.** Materials suitable for rock embankment shall be free of waste material and contain sixty (60) percent or more by volume of rock or gravel containing particles with a maximum dimension greater than three (3) inches but not greater than (12) twelve inches.

**3.2.2.5 Unsuitable or Waste Material.** Material not suitable for use as embankment material shall include excess excavation material and waste material including mulch, frozen material, organic material, topsoil, rubbish and rock larger than (12) twelve inches, maximum dimension.

**3.2.2.6 Structures.** Structures as used herein refers to bridges, culverts, basins, street drainage structures, headwalls, retaining walls, footings, foundation walls and similar construction.

**3.2.3 Construction Details.** The contractor shall call Missouri One Call System (1-800-DIG-RITE) and note location of all existing utilities and facilities as shown on the plans, or as confirmed as a result of a pre-construction conference attended by contractor representatives, public utility organizations, and other interested persons and concerns. The contractor shall be responsible for the protection and preservations of such utilities and facilities.

Grading, excavation and back-filling for roadways, roadway intersections, sidewalks, shoulders, and parkways shall be made to the lines, grades, and cross-sections shown on the plans. During construction, the area shall be maintained in such condition that it will be well drained at all times.

Waste materials including organic material, trees, stumps, rubbish, and debris shall be removed from the site and disposed of as an incidental part of the grading work. Excess excavation material including muck, topsoil, and rocks larger than twelve (12)inches, maximum dimension, shall be paid for on the basis of the applicable unit bid price for excavation.

It shall be the contractor's responsibility to take the necessary precautions to preserve and protect all existing tile drains, sewers and other subsurface drains affected by his operations. All existing subsurface facilities shall be maintained so their use is not interrupted. The contractor shall repair or replace, at his own expense, any such drainage facility damaged because of negligence on his part.

**3.2.4 Excavation.** All suitable material removed by excavation shall be used as far as practicable in the formation of embankments as required to complete the work. Any rock encountered within six (6) inches of finished subgrade shall be removed. The contractor shall sort all excavated material and stockpile when necessary, so as to provide suitable materials for embankments. The cost involved in sorting stockpiling, or wasting of such material shall be included in the cost for excavation or the cost for embankment, but not both, depending upon which is the basis for bidding as listed in the proposal.

Excavated material in excess of the amount needed to complete the grading shall be considered as waste material and shall be removed from the site. When permitted by the Engineer, a portion of the waste which is suitable for embankment may be disposed of at the site by equitable distribution of the material to specified areas within the project limits. The disposition of all waste material shall be considered as incidental to the performance of grading work.

**3.2.5 Embankment.** The embankments shall be formed with suitable materials, as herein defined, procured from excavations made on the project site, or from a contractor furnished site as required to complete the grading work.

The existing surface upon which embankment material is to be placed shall have all unstable and unsuitable material, such as topsoil, peat, mulch, coal seams, disintegrated shale, rubbish, logs or stumps, and unconfined saturated soils, removed to the depths shown before starting the embankment work.

When embankments two (2) feet or less in depth are to be placed on areas covered by existing pavement, the existing pavement shall be removed and the cleared ground surface shall be compacted at optimum moisture to the specified density. Where embankments greater than two (2) feet in depth are to be placed on areas covered by existing pavement, the existing pavement shall be broken into pieces not larger than twelve (12) inches maximum dimension, left in place and the embankment started thereon.

**3.2.5.1 Placing Earth Embankment.** Earth shall be placed in successive horizontal layers distributed uniformly over the full width of the embankment area. Each layer of material shall not exceed nine (9) inches in thickness (loose state) and shall be compacted to not less than the required density before the next layer is placed thereon. As the compaction of each layer progresses, continuous blading will be required to level the surface and to insure uniform compaction. Embankment construction shall not be performed when material contains frost, is frozen, or a blanket of snow prevents proper compaction.

**3.2.5.2 Placing Rock Embankment.** Successive horizontal layers of rock embankment not exceeding twenty-four (24) inches in depth, shall be made by placing the larger stones uniformly over the embankment area, and between which shall be added small stone fragments, sand, earth or gravel to fill all voids. Rocks, boulders, or old rubble walls too large to permit placing in twenty-four (24) inch layers shall be broken as necessary, or placed so that proper compaction is obtained around them. Each layer shall be thoroughly compacted before the next layer is placed.

The larger rocks shall be withheld from the top twelve (12) inches or more of the embankment and only crushed stone or earth shall be used in this layer as ordered by the Engineer. The crushed stone shall be well graded from three (3) inches down to form a dense mass when compacted.

**3.2.5.3 Embankment Compaction.** Density and moisture requirements for embankment and existing surfaces shall be in relation to the maximum density and optimum moisture as determined by ASTM Designation D-698. Embankment material shall be placed with moisture content within the tolerance of the moisture range for each type of material at the specified percent of maximum density as determined by the moisture density curve.

Earth embankment, except the top six (6) inches, and the surface of the existing ground on which embankment is to be placed shall be compacted to at least 90% of the maximum density as

determined above. The top six (6) inches of the embankment shall be compacted to at least 95% of the maximum density.

All the work involved in either adding moisture to, or removing moisture from embankment materials to within the moisture limits shall be considered incidental to the completion of the grading operation.

During the progress of the work, the in-place density of the embankment will be determined by ASTM Designation D-1556 or D-2167. Unless otherwise stated in the Special Provisions, testing for compaction shall be at the expense of the City.

**3.2.6 Cut Compaction and Undergrading.** Where materials are encountered below grade which are deemed unsatisfactory by the Engineer for use in the work, either cut compaction or undergrading shall be preformed, as determined by the Engineer.

**3.2.6.1 Cut Compaction.** Cut Compaction shall include the temporary removal of material twelve (12) inches below the bottom of the lowest base course for the full width of the road bed. The exposed material, to a depth of six (6) inches, shall be manipulated and compacted to not less than the required density. The previously excavated material above this compacted plane shall then be replaced in layers not exceeding eight (8) inches loose thickness, after being wetted or dried as necessary, and compacted to the specified density. The entire volume so handled and compacted including the six (6) inch layer compacted in place, will be considered as Cut Compaction and paid for at the rate specified in the Contract Documents .

**3.2.6.2 Undergrading.** Undergrading shall include the removal of earth materials below grade to a maximum depth of twenty-four (24) inches and to the limits designated by the Engineer. The excavated area shall be back-filled in twelve (12) inch lifts with crushed stone or crushed concrete ranging in size from two (2) to six (6) inches and free of soil fines. The back-fill material shall be compacted with a minimum of three passes with a vibratory roller with a manufactures rating of sixteen (16) to twenty (20) tons of compacting power. Contractor is to place material until the fill surface is below finished subgrade elevation. The excavation and back-fill will be considered as Undergrading and paid for at the rate specified in the Contract Documents.

**3.2.7 Slides in Grading Work.** Slides in the side slopes, after construction to the lines and grades shown on the plans shall be repaired by the contractor at his own expense before final acceptance by the City.

**3.2.8 Finishing.** The entire project area shall be left in a finished and neat appearing condition.

The final graded surface shall be made free of rock, concrete, and brick, or fragments thereof, or rubbish, and shall be finished to the lines, grades, and cross-section shown on the plans, including shoulder, berm and sidewalk spaces.

The contractor shall repair any damaged surface, and shall not use any finishing equipment that will leave a marred surface.

**3.2.9 Cleanup.** Cleanup shall follow the work progressively and final cleanup shall follow immediately behind the finishing. The contractor shall remove from the site of the work all equipment, tools, and discarded materials, and other construction items. The entire right-of-way or easement shall be left in a finished and neat condition. Cleanup shall be considered as incidental to the completion of the grading work. If in the opinion of the Engineer a hazardous, unsafe or nuisance condition exists, the Engineer shall order cleanup operations to commence immediately.

**3.2.10 Basis of Payment.** Unless otherwise set out in the Special Provisions, payment for grading work will be based on quantities computed from the plans for units itemized in the Proposal. No direct payment for rock removal will be made unless specified in the Contract Documents.

### 3.3 SUBGRADE PREPARATION

**3.3.1 Scope of Work.** This work shall consist of preparing the subgrade upon which a base course is to be constructed or a surfacing placed.

**3.3.2 Preparing the Subgrade for Pavements.** The subgrade for pavements shall consist of compacted earth overlaid with a minimum of four (4) inches of compacted Type 1, Type 5 or Type 7 aggregate base and shall extend to 1'-0" outside back of curb.

Shape the earth subgrade to longitudinal and cross-section grade. Scarify to a depth of at least 8" in both cut and fill sections, adjust the moisture content to a range of  $\pm 2\%$  from optimum moisture content for stability. Contractor to verify that compaction is a minimum of 95% Standard Proctor Density (ASTM D-698) before any aggregate is placed. Shaping, scarifying, and compaction are to be done on singularly large areas in one continuous operation. The contractor is to use compaction equipment of a type and design manufactured to have all the capabilities required to fully meet all the needs of the project.

The aggregate base shall be spread in one lift at a depth greater than the four (4) inches required to allow for shaping and compacting. Water shall be applied as necessary to obtain a density of not less than ninety five (95) percent of standard maximum density as determined by ASTM D-698.

**3.3.2.1 Type 1 Aggregate.** Type 1 aggregate for base shall be essentially limestone or dolomite. The aggregate shall not contain more than 15 percent deleterious rock and shale. Sand may be added only for the purpose of reducing the plasticity index of the fraction passing the No. 40 sieve in the finished product. Any sand, silt and clay and any deleterious rock and shale shall be uniformly distributed throughout the material. The fraction passing the No. 40 sieve shall have a maximum plasticity index of six (6).

The aggregate shall be in accordance with the following gradation requirements:

Sieve	Percent by Weight
Passing 1-inch	100
Passing 1/2-inch	60-90
Passing No. 4	35-60
Passing No. 30	10-35

**3.3.2.2 Type 5 Aggregate.** Type 5 aggregate for base shall consist of crushed stone or sand and gravel. The aggregate shall not contain more than 15 percent deleterious rock and shale. If crushed stone is used, sand may be added only for the purpose of reducing the plasticity index of the fraction passing the No. 40 sieve in the finished product. The fraction passing the No. 40 sieve shall have a plasticity index not to exceed six. Any sand, silt and clay, and any deleterious rock and shale shall be uniformly distributed throughout the material. When sand and gravel aggregate are used, the fraction passing the No. 200 sieve shall be less than one half of that fraction passing the No. 30 sieve.

Type 5 aggregate shall be in accordance with the following gradation requirements:

Sieve	Percent by Weight
Passing 1-inch	100
Passing 1/2-inch	60-90
Passing No. 4	35-60
Passing No. 30	10-35
Passing No. 200	0-15

**3.3.2.3 Type 7 Aggregate.** Type 7 aggregate for base shall consist of crushed stone, sand and gravel, or reclaimed asphalt or concrete. The aggregate shall not contain more than 15 percent deleterious rock and shale. The fraction passing the No. 40 sieve shall have a plasticity index not to exceed six. Any sand, silt and clay, and any deleterious rock and shale shall be uniformly distributed throughout the material.

Type 7 aggregate shall be in accordance with the following gradation requirements:

Sieve	Percent by Weight
Passing 1 1/2-inch	100
Passing 1-inch	70-100
Passing No. 8	15-50
Passing No. 200	0-12

Shaping and compacting shall be performed until a true, even, and uniform surface of proper grade, cross section and density is obtained.

**3.3.3 Compacting the Disturbed Subgrade for Sidewalks.** The subgrade for sidewalk pavements shall be tamped or rolled until compacted to 95% density for a depth of at least six (6) inches.

**3.3.4 Protection and Maintenance of Subgrade.** The newly finished subgrade shall be protected or repaired from action of the elements. Any settlement or washing that occurs prior to the acceptance of the work shall be repaired and the specific lines, grades, and cross-section re-established.

The contractor shall protect all pavements, curbs, curb and gutters and sidewalks from his subgrade operation with an earth cushion, timber planking, or both where tractors, graders, rollers, or other equipment are required to pass or turn around. All resulting damage shall be repaired. Any damaged work which cannot be repaired to the satisfaction of the Engineer, shall be replaced by the contractor at his own expense.

**3.3.5 Construction Requirements.** The subgrade shall be substantially uniform in density throughout its entire width. It shall conform to the lines, grades, and typical cross sections shown on the plans, or as established by the Engineer. Where hauling results in ruts or other objectionable irregularities, the contractor shall reshape and re-roll the subgrade before the base or surfacing is placed. If any existing roadway comprises any part of the roadbed, the contractor shall loosen the compacted portions to a depth of at least six (6) inches and shall reshape the roadbed.

The subgrade shall be brought to the specified lines, grades, and cross-section by repeatedly adding or removing material and compacting to the specified density with a suitable roller.

The subgrade shall be checked after rolling, and if not at the proper elevation at all points, sufficient material shall be removed or added and compacted to bring all portions of the subgrade to the required elevation and density.

Prior to laying base or setting paving forms on projects, the subgrade shall conform to the density requirements for compaction. Soft spots and unsuitable material shall be removed and back-filled with approved stable material.

**3.3.6 Testing.** Unless otherwise set out in the Special Provisions, testing as required above shall be at the expense of the City.

After all grading operations have been completed, the subgrade elevations shall be checked by a method approved by the Engineer. Extreme care shall be taken in forming the crown and shaping the subgrade to assure that the specified thickness of pavement will be attained.

The finished subgrade at the time of paving shall be moist, but sufficiently firm to resist rutting or deformation. During prolonged periods of dry weather some clay subgrades will require special treatment to prevent differential expansion of the subgrade and distortion of the pavement.

**3.3.7 Basis of Payment.** No direct payment will be made for subgrade preparation.

### **3.4 FILLING EXISTING MANHOLES, CATCH BASINS, INLETS AND MISCELLANEOUS STRUCTURES**

**3.4.1 Scope of Work.** This work shall consist of all work necessary to abandon existing manholes, catch basins and inlets and miscellaneous structures in accordance with the specifications, when indicated on the plans or directed by the Engineer.

#### **3.4.2 Method of Construction.**

**3.4.2.1 Adjustments.** The tops of all existing manholes, catch basins, and inlets to be abandoned shall be lowered to at least eighteen (18) inches below the subgrade of the proposed improvement, the outlet connection shall be securely sealed with concrete or brick masonry, and the structure filled with granular material and thoroughly tamped.

**3.4.2.2** Frames and grates of manholes, catch basins, and inlets to be abandoned shall be carefully removed and delivered to the city at a designated location.

**3.4.3 Basis of Payment.** This work shall be paid on a unit price basis for each item complete including all labor, construction, equipment, and materials.

### **3.5 DEMOLITION**

**3.5.1 Scope of Work.** This work shall consist of the removal and satisfactory disposal of existing structures, except such structures, or portions thereof, as may be required or permitted to be left in place by the plans and specifications or at the direction of the Engineer.

#### **3.5.2 Construction Methods.**

**3.5.2.1 General.** Unless otherwise specified, all portions of existing structures within the right-of-way above the ground surface as it existed before the work was started, that interfere in any way with the new construction shall be removed.

When explosives are used in demolition, the contractor shall use the utmost care to prevent injury to persons and property, and shall meet all Federal, State, County and City requirements for handling and storing explosives.

Blasting or other operations which might endanger the new work shall be completed prior to the construction of any part of the new structure.

When required by the plans or special provisions, all materials from existing structures which the Engineer deems fit for use elsewhere shall be moved without damage, in Sections which may be readily transported and shall be disposed of as directed by the Engineer.

**3.5.2.2 Removal of Concrete and Other Structures.** Existing structures shall be removed for their entire width and depth unless otherwise noted on the plans. Existing drainage structures

shall be removed, or the ends completely and substantially sealed with masonry as required by the Engineer.

If abandoned underground tanks of any kind are encountered, the contractor shall contact the Project Engineer for further direction. The Project Engineer will discuss with Environmental Services to ensure all Federal, State and local laws and regulations are met.

**3.5.2.3 Disposal of Concrete, Asphalt, and Other Materials.** All concrete and masonry, drainage pipes, reinforcement steel, structural steel, castings, or timbers not salvable shall be disposed of by the contractor at his own expense, and to the satisfaction of the Engineer at a location provided by the contractor outside the limits of the right-of-way. Any of the above materials deposited adjacent to the right-of-way shall be deposited with the written approval of the property owner. The contractor shall obtain and file with the Engineer the written approval of the property owner.

**3.5.2.4 Disposal of Salvaged Material.** All materials removed from old structures which are required to be salvaged under the contract and which the Engineer deems fit to re-use shall be stored without damage in a neat and presentable manner at locations designated by the Engineer.

**3.5.3 Basis of Payment.** If the contract contains a separate item and unit price for REMOVAL OF EXISTING STRUCTURES, such price shall be payment in full for the satisfactory removal and disposal of the existing structures so designated on the plans or in the proposal as a unit under this item. The cost of removal and disposal of all other existing structures shall be considered as included in the contract unit price for the major item of work in the contract.

### **3.6 REMOVAL OF EXISTING PAVEMENT, CURB, COMBINATION CURB AND GUTTER, DRIVEWAY PAVEMENT, AND SIDEWALK**

**3.6.1 Scope of Work.** This work shall consist of the removal and satisfactory disposal of existing Portland cement concrete pavement and/or base course, curb, curb and gutter, gutter, or sidewalk, floors and similar objects.

#### **3.6.2 Construction Methods.**

**3.6.2.1 General.** Unless otherwise specified, all portions of existing pavement, curb, combination curb and gutter, or sidewalk, floors and similar objects within the right-of-way above the ground surface as it existed before the work was started, that interfere in any way with the new construction shall be removed.

When explosives are used in demolition, the contractor shall use the utmost care to prevent injury to persons and property, and shall meet all Federal, State, County and City requirements for handling and storing explosives.

Blasting or other operations which might endanger the new work shall be completed prior to the construction of any part of the new structure.

**3.6.2.2 Removal of Concrete and Other Structures.** Existing structures shall be removed for their entire width and depth unless otherwise noted on the plans.

**3.6.2.3 Disposal of Concrete, Asphalt, and Other Materials.** All concrete, asphalt, drainage pipes, reinforcement steel, structural steel, etc., shall be disposed of by the contractor at his own expense, and to the satisfaction of the Engineer at a location provided by the contractor outside the limits of the right-of-way. Any of the above materials deposited adjacent to the right-of-way shall be deposited with the written approval of the property owner. The contractor shall obtain and file with the Engineer the written approval of the property owner.

**3.6.2.4** Where portions of these objects are to be left in place, they shall be removed to an existing joint or to a new joint sawed to a minimum depth of one (1) inch with a true line and vertical face. Sufficient portions of such objects shall be removed to provide for proper grade and connection to the new work.

**3.6.3 Basis of Payment.** Removal of existing pavement, curb, combination curb and gutter, driveway pavement or sidewalk shall include the removal and satisfactory disposal of the item and payment shall be as stated in the contract or proposal.

## 4 SANITARY SEWERS

### 4.1 SEWER PIPE

**4.1.1 Scope of Work.** The work shall consist of furnishing all materials, equipment, and labor necessary for the construction of sanitary sewer lines and accessories in conformance with the lines and grades shown on the plans or as established by the Engineer, and as specified herein. Items of work or materials not specifically mentioned, but necessary for the completion of the sanitary sewer line construction shall be considered as incidental to other items in the contract.

#### 4.1.2 Materials.

**4.1.2.1 Pipe.** The type, size, and class of pipe shall be shown on the plans. Type, size, or class of pipe may not be changed during the progress of the work without approval of the Engineer. The pipe, type, and class shall be one of the following:

**4.1.2.1.1 Tee Connections** shall be an approved molded tee made of the same material as the sanitary sewer. Molded tees shall be used on all new sewer lines. Insert-a-tees shall be used in place of long skirted saddles on taps to existing sewer mains.

**4.1.2.1.2 Reinforced Concrete Sewer Pipe** shall conform to ASTM designation C76.

**4.1.2.1.3 Concrete Sewer Pipe** shall conform to ASTM designation C14.

**4.1.2.1.4 Cast Pipe and fittings** shall conform to United States of America Standards Institute, Specifications A-21, Class 50 with mechanical joints or slip on joints.

**General Note:** This subsection applies to the requirements for unplasticized PVC plastic for sanitary sewers, house connections, pipe fittings, couplings, and joints. All shall conform to the requirements listed below except as otherwise modified by the Plans or Specifications.

Pipe Size (inches)	ASTM	Wall Thickness Min
4"	D1785	SCH40
8"-18"	D3034	SDR35
18"-30"	F679	"T-1" only
21"-48"	F789	PS 46
	D2241	SDR 21
8"-12"	DR18	Class 150

**4.1.2.1.5 Polyvinyl Chloride (PVC) Sewer Pipe** shall conform to ASTM designate D3034 (SDR 35). Fittings shall conform to ASTM designation D3034 (SDR 35 or as otherwise shown on the Standard Drawings).

**4.1.2.1.6** SDR 35 Poly (Vinyl Chloride) (PVC) Connections shall be molded tees. Molded tees shall be used on all new sewer lines. Compression locking tees are to be used on existing lines, unless saddles are requested by Engineer. An approved long skirted strap-on saddle type connection will be allowed on existing sanitary sewer lines only. (Short skirted strap-on saddle type connections are not acceptable.)

**4.1.2.1.7** PS 46 Poly (Vinyl Chloride) (PVC) Sewer pipe shall conform to ASTM designation F789. Fittings shall conform to ASTM designation F789 or as otherwise shown on Standard Drawing.

**4.1.2.1.8** PS-46 Poly (Vinyl Chloride) (PVC) Connections shall be molded tees. Molded tees shall be used on all new sewer lines. Compression locking tees are to be used on existing lines, unless saddles are requested by Engineer. An approved long skirted strap-on saddle type connection will be allowed on existing sanitary sewer lines only. (Short skirted strap-on saddle type connections are not acceptable.)

**4.1.2.1.9** SDR 21 Class 200 Poly (Vinyl Chloride) (PVC) Sewer pipe shall conform to ASTM designation D2241. Fittings shall conform to ASTM designation D2241 or as otherwise shown on Standard Drawing.

**4.1.2.1.10** SDR 21 Class 200 Poly (Vinyl Chloride) (PVC) Connections shall be molded tees. Molded tees shall be used on all new sewer lines. Compression locking tees are to be used on existing lines, unless saddles are requested by Engineer. An approved long skirted strap-on saddle type connection will be allowed on existing sanitary sewer lines only. (Short skirted strap-on saddle type connections are not acceptable.)

All pipe and connections will require a certification, from the supplier, stating that the material supplied meets all applicable specifications. The certification will be required on or before the material is delivered to the job site.

#### **4.1.2.2 Pipe Joints.**

**4.1.2.2 .1** Joints for reinforced concrete sewer pipe shall be flexible watertight, neoprene gaskets of the proper size conforming to the requirements of ASTM designation C-443.

**4.1.2.2 .2** Joints for cast or ductile iron pipe shall conform to USASI specification A21.11 for mechanical or push-on joints.

**4.1.2.2 .3** Joints for PVC pipe shall conform to ASTM D3212

**4.1.2.3 Couplings.** (A mechanical device for joining parts together.)

**4.1.2.4 Bedding and Backfill.** All required bedding and backfill material shall be considered incidental and no additional payments will be made for these items.

Bedding Material shall be crushed stone or crushed gravel conforming to the requirements of ASTM Standard C 33 or ASTM D 448 size no. 67, and having a gradation as follows:

Sieve	% Passing
1"	100
¾"	90 - 100
3/8"	20 - 55
No.4	0 - 10
No.8	0 - 5

**4.1.2.5 Miscellaneous Materials.** Any materials requested by the contractor for use during construction but not described in this specification will be subject to the approval or rejection of the Engineer.

**4.1.3 Construction Methods.**

**4.1.3.1** Classification of Excavated Materials will be made as follows:

- A. Rock is defined as sandstone, limestone, chert, granite, siltstone quartzite, slate, shale occurring in its natural undisturbed state, hard and unweathered, in ledges 6 inches or more in thickness, or similar material in masses or boulders, each being more than 1 ½ cubic yards in volume.

Should rock be encountered in two or more ledges, each ledge being more than 6 inches thick and with interlying strata of earth, clay, shale, or gravel not more than 12 inches in each stratum, the entire volume between the top of the upper ledge and bottom of the lower ledge will be classified as rock.

- B. Earth. All materials not classified as rock shall be classified as earth. Chert (joint flint rock) broken by intermittent clay partings or clay seams or stratified chert cemented with clay seams (hardpans) shall be considered as earth.
- C. Unclassified excavation will consist of the excavation of all materials of whatever character encountered in the work. All material required to be excavated will be considered as "Unclassified Excavation" unless the contract specifically states otherwise.

**4.1.3.2** Excavation shall consist of the removal of any and all material below ground level necessary in order to carry out the installation and construction required by the plans and specifications and shall include: (1) Additional excavation required for bedding; (2) All sheeting, shoring, bracing, protection of adjacent property and underground conduits or structures and preparation of the sub-grade; (3) The cost of diversion of surface water, pumping, draining or otherwise de-watering of excavation; and (4) The subsequent handling and disposal of such material not used in the backfill.

Trench excavation shall not be performed any farther ahead of the bedding and pipe laying operations than is necessary to permit a continuous operation. The elevation of the bottom of the

trench shall be continually checked for conformance to the lines and grades shown on the plans. Excavation made below proper sub-grade elevation shall be refilled with bedding material and thoroughly compacted at the contractor's expense. Sheeting, timbering or bracing shall be placed by the contractor wherever necessary for the safety of workmen or the public and for the preservation of any excavation, embankment, or structure. Where the excavation is of such an unstable character or other conditions are such as to render it necessary, the sheeting shall be closely driven and to such depth below the lowest point of the final trench elevation as required for stability. The contractor shall be held responsible for the determination of the need for sheeting or other types of protection and for the sufficiency of all sheeting and bracing used and for all persons injured or property damaged as the result of improper quality, strength, placing, maintaining, or removing the same. No additional compensation will be made for any sheeting, bracing, or other protective measures whether left in place or not.

The contractor shall, at his own expense, shore up and protect from damage all buildings, retaining walls, viaduct piers and footings, storm sewers, sanitary sewers, gas lines, water lines, fences, curbs, trees or other property liable to be damaged during the progress of the work, and he will be held responsible for all damage which may occur by reason of prosecution of the work.

The contractor shall furnish and operate sufficient pumps and equipment, and shall provide all materials, labor, etc., required to prevent interference with the work by water, ice or snow. Damage of any kind resulting from insufficient pumping facilities or similar lack of proper protection of the work shall be repaired or replaced by the contractor at his own expense.

Where leaks or springs are encountered which, in the opinion of the Engineer, affect the safety, usefulness or satisfactory operation of any of the permanent work, he may direct special precautions to be taken and payment hereof made in accordance with Chapter 2 of these Specifications.

The width of the trench at the top of the pipe shall provide at least six inches of clear space on each side of the pipe to permit compaction of the bedding material. The minimum trench size for any pipe size shall be 18".

The location of sewers and structures as shown on the plans have been selected to provide the least possible interference with or the crossing of existing utilities and aboveground obstructions. The City reserves the right to make minor variations in the location of the sewers and structures during the construction to adjust for any changed conditions discovered and no additional payment will be allowed the contractor for shifts in alignment.

Arrangements shall be made by the contractor with all persons, firms, corporations owning or using any poles, pipes, tracks, or conduits, etc., affected by the construction on this project to maintain and protect such facilities during construction with the cost of any such protection paid by the contractor and considered as incidental to other items in the contract.

For requirements relating to the use of explosives, refer to Chapter 2 and Chapter 3 of the General Conditions.

Tunneling shall be done only where shown on the plans or by written direction or approval of the Engineer. Tunnels shall be of sufficient size, height, and width to permit proper installation of the pipe, proper bracing of the tunnel section and to permit ample room for the prosecution of the work and safety of the workmen.

Boring installations are made where pipelines must pass under airport runways, highways, railroad tracks, and other locations where conditions prevent the use of “open-cut” excavation. Accuracy in alignment and grade of the casing pipe is very important in maintaining the established invert grade of the pipeline to be inserted. Proper grade of the inserted pipe is a must for satisfactory operation of the gravity flow line (See Standard Drawing SAN-15).

**4.1.3.3 Bedding and Laying Pipe.** The subgrade of the trench shall be excavated to a depth so as to provide space for at least four (4) inches of bedding material between the subgrade and the pipe if the subgrade material is earth, and six (6) inches of bedding material between the subgrade and the pipe if the subgrade material is rock. Bedding material shall be placed in the trench and carefully graded and compacted to the proper elevation so that the pipe, when placed, shall be within ½” of the specified line and grade. The Engineer or Survey Crew will initially provide the contractor with line and grade stakes set on the natural ground surface. It shall be the Contractor’s responsibility to transfer the line and grade to the bottom of the trench. A laser beam shall be used for this purpose or some other method of checking the pipe grade and line approved by the Engineer in writing. The contractor must verify the trench grade or the grade of the top line and sewer pipe, and will be held responsible for the correct flow of sewers. Any apparent inaccuracy in the grade stakes shall be called to the Engineer’s attention immediately upon discovery.

If, in the opinion of the Engineer, subgrade conditions are such that the bedding described above will not adequately support the pipe, he may order the contractor to install one of the two types of concrete cradle shown on the Standard Drawings. Payment for the concrete cradle will be made in accordance with Chapter 2, Article 12 of the General Conditions.

At locations where it is necessary to construct the sewer line across an existing water line and there is less than an 18-inch vertical distance between the top of the lower line and the bottom of the upper line, the sewer line shall be constructed of Class 200 pressure water line pipe and must be air tested at a pressure not less than four (4) pounds per square inch for five (5) minutes to assure water tightness. A manhole or approved adapter must be located at each end of the pressure pipe; and, the near side of the manholes can be no closer than ten (10) feet from the water main. When the elevation of the sewer cannot be verified to meet the above requirement, the water main or sewer shall be relocated to provide this separation. If a water line is parallel to the sewer line and located within ten (10) feet horizontally and eighteen (18) inches vertically, the sewer line shall be constructed as set out above for vertical separation.

Unless approved by the Director of Public Works, sanitary sewers shall not be constructed with less than four (4) feet of cover over the top of the pipe. If less than four (4) feet of cover is allowed and the sewer is under the pavement or the near side of the sewer trench is within two (2) feet of the curb, then cast iron or ductile iron pipe, as described above, will be required. If no

portion of the sewer trench is within two (2) feet of the curb and less than four (4) feet of cover is allowed, then Class 200 pressure water line pipe will be required.

If more than twelve (12) feet of cover to the top of the sewer pipe is necessary for construction of the sewer line, then Class 200 pressure water line pipe will be required.

**4.1.3.4 Laser.** The contractor shall provide and maintain in good working order, on the site, at all times, a laser beam. Each length of pipe shall be laid on an even, firm bed, so that no uneven strain will exist to prevent the pipe from bearing on the sockets. Bell holes for bell and spigot pipe shall be dug at each joint as hereinbefore specified. Each pipe shall be laid in conformity with the line and grade stakes given by the Engineer. Pipe laying shall commence at the manhole connection at the low point of the project and progress up grade, unless otherwise expressly permitted by the Engineer. The bell-end of the pipe shall be laid up grade. The alignment of all pipelines between adjacent manholes shall be true to line and grade. The pipeline from manhole to manhole shall reflect the full bore of the pipe. The end of each joint pipe shall be truly centered and fully positioned into the abutting pipe. Pipe laid in the trench shall not be covered until approved by the Engineer or Inspector.

The laser beam used to control line and grade for the pipe-laying operation must be verified at the beginning of each day, at least once between manholes, and at any other time the Engineer or Inspector deems necessary to ensure the proper line and grade of the pipe.

**4.1.3.5 Tees.** On all sewers serving individual lots, one (1) molded tee for lateral sewer or house connection shall be furnished and should be laid to center of every lot where possible, extending 5' onto property. Additional tees may be required for unplatted areas and large lots, as the Engineer directs. They shall be four (4) inches in diameter unless otherwise shown on the plans or specified by the Engineer and shall be capped or plugged in accordance with manufacturer's recommendations. No saddle tees will be accepted on new sewers.

The exact location of all tees shall be carefully ascertained by the Engineer or Inspector before concealment by backfilling, by accurate measurement from the center of the manhole downstream in the same line of pipe so that a true and exact record may be preserved for future use. No tees will be permitted to connect to the main opposite each other. The minimum distance permitted between tees shall be two (2) feet.

**4.1.3.6 Laterals.** All laterals shall have a minimum of ¼-inch per foot slope, unless otherwise approved. On PVC tees and lateral lines, all joints must be glued with an approved adhesive. The plans shall show the stationing of all in-line tees and shall be placed as near as possible to the center of the lot, so as to provide maximum clearance for driveways and utility lines. All PVC laterals shall be Schedule 40 pipe.

No more than 700 feet of sewer line shall be constructed prior to commencing construction of laterals. At the option of the contractor, construction of the sewer lines and laterals may be performed concurrently. If, in the opinion of the Engineer, the lateral construction is not proceeding in a timely manner, the Engineer may order the contractor to cease work on the sewer

line construction until such time as lateral construction has proceeded to a point satisfactory to the Engineer.

If the sewer is being constructed within the street right-of-way, all laterals shall extend to the right-of-way line. All laterals within street right-of-way shall be a minimum of four (4) feet deep at the right-of-way line. It will be the responsibility of the contractor to assure service to each property. If the main sewer line is deep enough, then service shall be provided to basements. If a tee is to be placed but no lateral is required on a main sewer line eight (8) feet or more in depth, a four (4)-inch riser shall be placed, bringing the connection to a maximum depth of seven (7) feet below finished ground level. This riser will be measured and paid for as lateral line.

No lateral can be located within two (5) feet of a manhole or connected into a manhole without approval of the Engineer. If lateral is to be connected to an existing manhole, the manhole shall be cored and fitted with an insert-a-lock or approved equal.

Any lateral connected to a manhole shall have an approved channeling device. Refer to Standard Drawing San-6 or Chapter 4.2.3, Construction Methods (Inverts).

A general purpose flexible marker shall be required at the end of each lateral, extending 1' above finish grades.

Before backfilling, laterals shall be plugged or capped in a manner acceptable to the inspector.

**4.1.3.6.1 Clean-outs.** When new lateral sewer lines are installed and connected to an underground facility within the public right-of-way, or if such infrastructure is fully replaced by excavation within the public right-of-way, the Contractor is required to place tracer wire and cleanout for gravity sewer laterals (Standard Drawing Details SAN-24 and SAN-25). All protective enclosures and cleanouts shall be extended to grade and installed so that it is easily accessible. For sewer laterals operating under pressure or vacuum, tracer wire shall be placed within the protective enclosure to provide approximate location of the underground facilities in these areas that are located within a public right-of-way. An underground facility owner shall not be liable to any party for damages or injuries resulting from an excavation if they are in compliance with this section. This section shall apply to all installations of sewer laterals without regard to their status as underground facilities.

**4.1.3.6.2 Locator Wire.** The locator wire shall be green no. 12 awg copper clad steel(ccs). to allow for grade adjustment, a minimum of 12" of excess wire shall be coiled at the cleanout for all wires.

Conductive type pipe locator/tracer wire shall be installed to locate all sewer laterals. The wire shall extend the entire length of the proposed lateral. The wire shall be installed directly on top the pipe and secured to the lateral by tape at base of riser, sewer main and every 15'. Corrosion proof/filled wire connectors shall be used at splice locations. Electrical tape shall be used and no bare wire shall be exposed. Test stations shall be installed inside all cleanout vaults and existing wires shall be connected. Zinc or magnesium anodes shall be attached at the end of the tracer wire as shown on Standard Drawing Detail SAN-25. A typical layout of the locator wire and

cleanout is provided in Standard Drawing Detail SAN-25. Conductivity is to be tested by the City before acceptance.

**4.1.3.6.3 Anodes.** The anode shall be ½ lb bare zinc or magnesium. The anodes shall be buried at the same elevation and in close proximity to the sewer lateral. The 1.315" diameter anodes shall be connected to the green no. 12 awg copper clad steel(ccs) wire.

**4.1.3.7 Cleaning.** The interior of the sewer line shall, as the work progresses, be cleaned of all dirt and other foreign material. On small pipe sewers where cleaning after laying may be difficult, a swab or drag shall be kept inside the pipeline and pulled forward past each joint immediately after its completion.

At the end of each workday, the end of the sewer pipe or manhole shall be plugged or capped to prevent the intrusion of water, dirt, gravel, and all other foreign material. At the beginning of each workday, the trench shall be dewatered (by pumping) before opening the end of the sewer pipe. The end of the pipe shall be cleared to prevent the intrusion of foreign material.

Note: If the City Forces are hired to clean and flush lines, a minimum of four (4) hours will be charged to the contractor.

**4.1.3.8 Joints.** Joints for reinforced concrete pipe with flexible rubber gaskets shall be made in accordance with manufacturer's recommendation. Bell and spigot, or tongue and groove ends of the pipe shall first be wiped clean before actual jointing operations are started.

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

Mechanical joints for cast iron pipe or D.I.P. shall be carefully assembled to assure that the two ends will be centrally located in the joint. The surfaces coming in contact with the rubber gasket shall be thoroughly cleaned with a wire brush just prior to assembly to remove all loose rust or foreign materials, and the gasket brought toward the flange evenly by partially tightening the bottom and top bolts, then the side bolts, and last, the remaining bolts. The cycle should be repeated until all bolts are properly tightened. If effective sealing is not attained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Overstressing on bolts to compensate for improper installation will not be permitted.

**4.1.3.9 Backfilling.** The backfilling of the trench shall follow closely behind the pipe-laying operation, but not until inspected by the Engineer or Inspector and the location of all connections recorded. In all cases, the pipe shall be backfilled the same day as laying.

The backfill material around the sewer pipe and lateral, to a height of six (6) inches above the top of the pipe, and from trench wall to trench wall, shall be aggregate bedding material, as specified

hereinbefore, carefully placed and compacted so as not to disturb the pipe location. In any trench where the flowline of the sewer is more than twelve (12) feet below finish grade, then the backfill around the pipe and to a height of twelve (12) inches above the top of the pipe, shall be aggregate bedding material.

The backfill material for sewers and laterals constructed in open cuts crossing or parallel to roadways, driveways, sidewalks, other existing pavements, or having the near side of the trench walls within two (2) feet of back/bottom of street curb, and at other locations shown on the plans or specified, all of the backfill shall consist of granular material meeting the requirements for bedding material, specified hereinbefore. This material shall be placed and thoroughly compacted.

Except as specified above, the backfill material may be suitable earth material from the excavation.

**4.1.3.9.1** No rocks in the backfill material shall exceed 4” in diameter in any direction. Care shall be taken to avoid injury to the pipe, structure, or producing unequal pressures thereon.

**4.1.3.9.2** Earth backfill shall be compacted by thoroughly “mechanical means” (or any other acceptable method) the material.

**4.1.3.9.3** The top four (4) inches of the backfill shall be made with topsoil and graded as required under Chapter 13.1.2.1 of these specifications.”

**Note:** Flowable fill must be approved by the Engineer.

**Mechanical Compaction.** Any acceptable compaction method used to achieve minimum compaction requirements. At the discretion of the Engineer, any project within the City of Springfield may require testing by an independent testing laboratory at the expense of the contractor. Minimum compaction shall be 90% standard proctor in accordance with ASTM D698.

All surplus excavation material not used in the backfill shall be disposed of by the contractor at his expense. Upon receipt of written notice from the Engineer, any settlement of the backfill below the original ground surface shall be remedied by the contractor for a period of one (1) year after final completion and acceptance.

Tunnels. The backfill material for all sewers laid in tunnels shall be sand or finely crushed limestone of which one hundred (100) percent shall pass a 3/16-inch sieve. The backfill shall be thoroughly compacted or blown in.

#### **4.1.3.10 Pavement Replacement.**

**4.1.3.10.1 Temporary Replacement.** If for any reason a roadway must be opened for traffic, after the sewer is in place but before the pavement is replaced, then the contractor must provide a one (1) inch asphalt cap on the trench backfill within 24 hours. This asphalt cap shall be the

contractor's responsibility and no additional compensation will be allowed. Backfill and/or asphalt shall be removed as necessary prior to placement of the permanent pavement.

**4.1.3.10.2 Permanent Replacement.** All pavement and curbs damaged during construction, in the opinion of the Engineer or Inspector, shall be removed and replaced. In order to determine the amount of damage to the pavement and curbs during construction, all existing cracks in the street or curb should be marked/painted in advance of construction. Permanent pavement replacement shall not occur any later than thirty (30) calendar days after backfilling, unless otherwise approved by the Engineer.

The existing pavement necessary to be removed for construction shall follow the Pavement Repair Standard Drawing Detail ST-13. The existing pavement shall be sawed in a neat line and removed prior to excavation. The width of this removal shall not exceed the width specified on the plans or approved by the Engineer.

The pavement shall be sawed prior to replacement to ensure a straight edge and a uniform patch. The subgrade for the new pavement shall be further compacted by rolling or tamping. The pavement shall then be replaced with eight (8) inches of concrete pavement. The pavement shall be doweled with 1"x18" dowels on twenty-four (24) inch centers along all transverse joints. Dowel bars shall be omitted when repairing bituminous pavement.

#### **4.1.4 Method of Measurement.**

**4.1.4.1 Pipe.** Final measurement of all pipe will be to the nearest foot.

**4.1.4.2 Encasement.** Final measurement of all encasements will be to the nearest foot.

**4.1.4.3 Rock Excavation.** Final measurement of rock excavation, if specified, will be to the nearest cubic yard.

**4.1.4.4 Pavement Replacement.** Final measurement of all pavement will be to the nearest square yard within a maximum trench width of six (6) feet unless otherwise specified or approved by the Engineer.

**4.1.5 Basis of Payment.** Contractor will be paid for quantities actually constructed or performed as determined by field measurement at the unit price bid for the items listed in the schedule of the proposal or for such extra work as may be authorized and approved by the Engineer. The cost of incidental work not listed in the schedule of the proposal but necessary for the completion of the project shall be considered as completely covered by bid prices for other items in the contract.

Quantities of work acceptably completed under the terms of the contract shall be determined by the Engineer based on his actual measurements.

**4.1.5.1 Sewer Pipe in place** will be paid for on horizontal length of sewer laid from inside edge of manhole or structure to inside edge of manhole or structure and shall include the cost of all

labor, materials, including joints, tee branches, and other necessary fittings, excavation, backfill, rough grading, testing, and equipment.

**4.1.5.2 Lateral Pipe in place** will be paid for on length of lateral laid from tee or wye to end of lateral. Unit price for laterals shall include the costs of all labor, materials, joints, and necessary fittings, excavation, backfill, rough grading, testing, and equipment.

**4.1.5.3 Concrete Encasement** will be paid for at the bid price per lineal foot, or as extra work if not listed in the schedule of the proposal.

**4.1.5.4 Rock Excavation.** Rock excavation, if specified, will be calculated at a width of three (3) feet for pipe up to and including twenty-four (24) inches in diameter. For pipe having a diameter greater than twenty-four (24) inches, the trench width to be paid for will be calculated as the pipe width plus six (6) inches on each side of pipe. Unless specified, no payment for rock excavation will be made.

## **4.2 MANHOLES**

**4.2.1 Scope of Work.** The work shall consist of furnishing all materials, equipment, and labor necessary for the construction of manholes and accessories at the location and in accordance with the details of the plans and as specified herein. Manholes shall be of the precast-concrete or poured-in-place concrete type. Items not specifically mentioned, but necessary for completion of the work shall be considered as incidental to other items in the contract.

### **4.2.2 Materials.**

**4.2.2.1** Concrete for manhole bases, pipe encasement, or cradle shall conform to the requirements of Chapter VI of these specifications except that the slump shall be four (4) inches plus or minus one (1) inch.

**4.2.2.2** Cast iron fittings and piping with mechanical joints shall be in accordance with USASI Specification A21, Class 50 and the plan details.

**4.2.2.3** Cast iron frames and covers shall conform to the requirements of the Standard Drawing San-1.

**4.2.2.4** Precast concrete manholes shall receive an application of asphaltic waterproofing paint on the exterior at the plant site.

### **4.2.3 Construction Methods.**

**4.2.3.1** If manholes are constructed of precast sections, each precast section shall be set in a preformed, bitumastic gasket material. A minimum of 6" bedding material shall be used under manhole base.

**4.2.3.2** Inverts shall be precast or constructed with cement mortar after all precast sections are in place. Inverts shall be smoothly finished to assure smooth flow through the manhole with a minimum of two-tenths fall across the manhole and in accordance with the plans.

**4.2.3.3** The elevation of manhole cover shall be adjusted to the required grade by shimming with concrete ring laid in a bitumastic material. Type “A” frame and covers shall be used in all areas.

**4.2.3.4** Manholes shall be waterproofed on the exterior. Inlet and outlet pipes shall be joined to the manhole with a gasketed, flexible, watertight connection or any watertight connection arrangement that allows differential settlement of the pipe and manhole wall to take place.

**4.2.3.5 Cold Weather Requirements.** Whenever the temperature of the surrounding air is below 40 degrees F, or when the possibility exists that the temperature will fall below 40 degrees F within the 24-hour period after concrete operations, concrete placed in the forms shall have a temperature between 80 degrees F and 100 degrees F. All concrete shall be maintained at a temperature of not less than 50 degrees F for at least 72 hours, and shall be protected from freezing for at least an additional 72 hours or for as much time as is necessary to ensure proper curing of the concrete. The housing, covering, or other protection used in connection with curing shall remain in place and intact for at least 24 hours after the artificial heating is discontinued. No dependence shall be placed on salt or other chemicals for the prevention of freezing. Contractor will be held responsible for any damage to concrete as a result of cold weather operations.

**4.2.3.6 Finishing.** The top surfaces of structures shall be struck off with a straight edge and finished with a wood float. Forms will be removed between 12 and 24 hours, and all exterior form ties shall be removed to a depth of one (1) inch below the surface. All fins caused by forms, joints, and other projections shall be removed, and all pockets cleaned and filled with mortar. All exposed surfaces shall then be wetted and hand rubbed with a rubber float using a sand and cement mixture to obtain a smooth and uniform texture as directed by the Engineer.

**4.2.3.7 Curing.** As soon after the completion of the specified finishing operations as the condition of the concrete will permit without danger of consequent damage thereto, all exposed surfaces shall either be covered with plastic sheet, or covered with earth and/or burlap, or when not required to be painted, sprayed with liquid conforming with ASTM designation C309.

**4.2.3.8 Backfilling.** Manholes, which lie within an area to be paved, shall be backfilled with granular material meeting the requirements for bedding materials specified hereinbefore. This material shall be placed and thoroughly compacted. All other manholes shall be backfilled with earth materials and shall be placed and jetted in the same manner as for sewer lines, specified hereinbefore.

**4.2.3.9 Removal of Forms.** Forms shall remain in place until, in the opinion of the Engineer, it is safe to remove them. In determining the time for removal of forms, consideration shall be given to the location and character of the structure, the weather, and other conditions influencing the setting of the concrete, and the requirements for curing and finishing.

**4.2.4 Method of Measurement.** Manholes exceeding eight (8) feet in depth will be measured to the nearest 1/10 foot.

**4.2.5 Basis of Payment.** Manholes up to six (6) feet in depth include all labor, equipment, materials, backfill, excavation, concrete base, cone, ring, and cover, and all fittings and appurtenances for sealing the manhole or construction drops associated with the manhole and acceptance testing, as well as the sidewalls, and will be paid for at the base price of each manhole complete in place. Additional payment will be made for any depth over six (6) feet at the unit bid price per vertical lineal foot. All excavation for manholes shall be included in the unit price per manhole. No direct payment will be made for furnishing and placing asphaltic paint, premolded, asphaltic filler, or other types of joint separators. The cost therefor shall be included in the price bid for the item of work of which they are a part.

### 4.3 MANHOLE ADJUSTMENTS

**4.3.1 Scope of Work.** The work shall consist of the adjustment of sanitary sewer manhole frames and structures within the construction area to the lines and grades shown on the plans or as established by the Engineer.

**4.3.2 Materials.** On Sanitary Sewer manhole grade adjustments, 4 inches and smaller, high density, polyethylene (HDPE) adjustment rings may be used as an equal to concrete adjustments rings. The following may be used in adjusting the grade of the manhole tops:

**4.3.2.1** Precast Reinforced Concrete or HDPE Adjustment Rings

**4.3.2.2** Manhole sections per ASTM designation C478

**4.3.2.3** Preformed Flexible Joint Material per AASHTO designation M-198.

**4.3.2.4** High Density Polyethylene(HDPE) adjustment rings.

- A. The adjustment rings shall be manufactured from polyethylene plastic as identified in ASTM Designation D-1248 (Standard Specification for Polyethylene Plastic Molding and Extrusion Materials).
- B. The plastic rings shall be manufactured utilizing the injection molding process as defined by SPE (Society of Plastic Engineers).
- C. The adjustment rings shall be tested to assure compliance with impact and loading requirements per the ASSHTO Standard Specification for Highway Bridges.
- D. The annular space between the rings and cone basin, the rings, and the rings and cover frame shall be sealed utilizing an approved butyl sealant.
- E. Installation shall be per manufacturer's recommendations only.

**4.3.3 Construction Methods.** The grade of a manhole may be raised a maximum of twelve (12) inches by removing the frame and building up with precast concrete or HDPE adjustment rings as prescribed above. The frame shall be reset in preformed flexible joint material. Where

required to raise the grade of a manhole more than twelve (12) inches, the Contractor shall be required to remove the cone section of the manhole, add a barrel section approximately the height of the grade and replace the cone section and necessary adjustment rings, etc. as directed by the Engineer.

Where it is required to lower the grade, (unless there is a sufficient height of precast concrete or HDPE adjustment rings in place above the cone section (which can be removed) the cone section and a sufficient number of barrel sections shall be removed and the cone section replaced or changed as directed by the Engineer.

The existing manhole ring and lid shall be removed and placed in a location designated by the Inspector and become the property of the City. A standard Type A ring and lid shall be installed on the manhole as a part of the adjustment.

**4.3.4 Basis of Payment.** Manhole adjustments for sanitary sewer manhole frames and covers shall include all labor, equipment, material, including new ring and lid and excavation, to complete the adjustments to the lines and grades shown on the plans or as established by the Engineer.

#### **4.4 SEWAGE PUMPING STATIONS**

**4.4.1 Scope of Work.** The work shall consist of the furnishings of all labor, equipment, tools, and materials to install sewage pumping stations as required by the Plans, Special Provisions, and these Specifications.

**4.4.2 Pumps.** Pumps must be designed so that it is not necessary to disconnect piping, valves, electrical circuits, and other appurtenances in the wet well when the pumps are replaced.

**4.4.3 Wet and Dry Well Access.** Suitable and safe means of access shall be provided to dry wells and wet wells of pump stations. Stairways should be installed in dry wells with rest landings not to exceed ten (10)-foot vertical intervals. All wet wells shall be given an application of asphaltic waterproofing paint.

**4.4.4 Electrical Equipment.** Electrical equipment in enclosed places where gas may accumulate shall comply with the National Board of Fire Underwriters specifications for hazardous conditions (NEMA Type 7).

**4.4.5 Alarm Systems.** Alarm systems shall be provided for all pumping stations. The alarm shall be activated in cases of power failure, pump failure, or any cause of pump station malfunction. The alarm system shall be capable of transmitting over phone lines an audio-visual signal to the Southwest Wastewater Treatment Plant. The system shall also have a remote station at the pump station, which will give the same audio-visual signal as at the Treatment Plant.

**4.4.6 Emergency Power Supply.** Provision of an emergency power supply for pumping stations shall be made, and may be accomplished by connection of the station to at least two (2) independent public utility sources, or by provision of in-place internal combustion engine equipment which will generate electrical or mechanical energy.

**4.4.7 Instructions and Equipment.** A complete set of operational instructions for pump station and emergency power generation equipment, including emergency procedures, maintenance schedules, tools, and such spare parts as may be necessary, must be provided.

**4.4.8 Fencing.** A fence surrounding the station site shall be provided. The fence shall be eight (8) feet high (Minimum) with a twelve (12)-foot wide, double-leaf gate. The fence may be either galvanized chain link or wooden privacy type. Supporting posts for all types of fences shall not be more than eight (8) feet apart and be concrete encased below grade. Minimum bury depth to be two and one-half (2 ½) feet. Wooden fences shall be constructed of pressure treated or other approved weather resistant wood. Wooden support posts shall be 4" x 4" minimum. The gate is to be located so that entranceway does not go over manholes. Pump station and generator unit to be easily accessible for maintenance from entranceway. Gate to be set back twenty-five (25) feet from edge of road.

**4.4.9 Outside Lighting.** An outside weatherproof pole-mounted light, with enough illuminating power to adequately light the pump station site at night, shall be provided. The light is to be of the high-pressure, sodium type with electric eye for dusk-to-dawn operation.

**4.4.10 Enclosure.** Enclosure shall be of sufficient area to provide a twenty (20) by twelve (12)-foot parking area and enclose all pump station buildings and equipment. A two (2) by four (4)-inch wooden header will be placed around the enclosure, inside the fence, and a four (4)-mil polyethylene sheeting shall be placed on the entire enclosed area and covered with at least four (4) inches crushed rock or gravel.

**4.4.11 Accessibility to Site.** The pump station site must be accessible by an acceptable all-weather, hard surface road. Junction of pump station road and public street shall have a sixteen (16)-foot long culvert of acceptable diameter in ditch if necessary.

**4.4.12 Locks.** Locks shall be provided on all wet wells, dry wells, and gates. Two keys for each lock shall be furnished to the Engineer at the time of final inspection.

**4.4.13 Painting.** All metal, except galvanized and stainless steel items which are not painted at the factory, shall receive a prime and finish coat of paint that is recommended for use in the environment in which the item is installed. Color to be determined by the Engineer.

**4.4.14 Surfacing of Lift Station Area.** The area inside the fence must be constructed of four (4) inches of Type I aggregate on a four (4) mil polyethylene sheeting placed over the entire enclosed area with three (3) one (1)-inch holes per square yard. Prior to placing the sheeting, the soil to be covered is to be treated with a soil sterilant Diuron (Karmex by DuPont), or equal, and applied as directed by the manufacturer.

## **4.5 FORCE MAINS**

**4.5.1 Scope of Work.** The work shall consist of the furnishing of all labor, equipment, tools, and materials to install force mains as required by the Plans, Special Provisions, and these Specifications.

**4.5.2 Materials.** Materials for pressure sewage force mains shall conform to the following standards:

**4.5.2.1** Polyvinyl Chloride (PVC) pressure pipe shall meet the requirements of AWWA C-900.

**4.5.2.2** Ductile iron pipe shall meet the requirements of American National Standard Institute Specification A-21 .51 with push-on joints.

**4.5.3 Air Release Valve.** An APCO Sewage Air Release Valve Model 401, or approved equal, shall be placed at high points in the force main to prevent air locking. A standard four (4)-foot diameter manhole with standard frame and cover to be installed around force main and relief valve for maintenance access to valve.

**4.5.4 Termination.** Force mains should enter the gravity sewer system at a point not more than two feet above the flow line of the receiving manhole.

**4.5.6 Bedding.** Bedding shall be in accordance with required bedding specified for sewer pipe, hereinbefore.

## **4.6 ACCEPTANCE TESTS FOR SEWERS**

**4.6.1 Scope of Work.** The work shall consist of the furnishing of all labor, equipment, tools, and materials, and the performance of any or all acceptance tests as required by the Plans, Special Provisions, and these Specifications.

### **4.6.2 General Requirements.**

**4.6.2.1** The contractor shall furnish the Engineer or Inspector with every reasonable facility for ascertaining whether or not the work performed was in accordance with the requirements and intent of the plans and specifications. Any work done (except excavation) or material used without suitable supervision or inspection by the Engineer or Inspector may be ordered removed and replaced at the contractor's expense.

**4.6.2.2** After substantial completion of the work, which includes compaction, backfilling, and rough cleanup, from time to time as the work progresses, the contractor shall, under the direction of the Engineer, make such test of the entire work or any part thereof as may be required to demonstrate the efficiency of the sewer and accessories. If required, the contractor shall make such openings as the Engineer may direct and shall restore the part of the work so disturbed to the satisfaction of the Engineer. Should any part of the work be found faulty in any respect, the

contractor shall repair such defects or replace them with new work as may be directed by the Engineer.

**4.6.2.3** The contractor shall provide facilities to the Engineer to make a visual observation test of the proper alignment of each section of sewer between two adjacent manholes.

#### **4.6.3 Acceptance Tests for Gravity Sewers.**

##### **4.6.3.1 Visual Inspection.**

**4.6.3.1.1** Contractor shall clean pipe of excess mortar, joint sealant, and other dirt and debris prior to acceptance.

**4.6.3.1.2** The contractor will be required during construction to install a line throughout the entire length of the sewer district. This line will be used for running a mandrel through the sewer lines. The ends of the line will be secured in a manner satisfactory to the Engineer or Inspector to ensure that the line will not be removed from the sewer before inspection. The line to be installed shall be one-quarter (1/4)-inch nylon or Polypropylene yellow or white rope.

**4.6.3.1.3** A mandrel will be furnished by the City for the contractor to use to mandrel all sewer lines in checking for the presence of any misaligned, displaced, or broken pipe, and the presence of visible infiltration, debris, or other defects. Mandrelling of installed pipe sections will occur after approved compaction of the backfill. Exceptions are when granular backfill is used, soil is compacted to 90% proctor or approved flowable fill is used. All mandrelling must be done in the presence of the Engineer or Inspector.

**4.6.3.1.4** The contractor shall correct all defects found during mandrelling operations prior to conducting leakage tests.

**4.6.3.2 Air Leakage Testing.** An air leakage test shall be performed on the full length of all sewer lines and lateral lines prior to acceptance.

**4.6.3.2.1** Contractor must perform air tests on all pipe less than eighteen (18)-inch diameter and may be required to perform air tests for all pipe sizes.

**4.6.3.2.2** The contractor must furnish all facilities required, including necessary piping connections, test pumping equipments, pressure gauges, bulkheads, regulator to avoid over-pressurization, and all miscellaneous items required.

**4.6.3.2.3** The pipe plug for introducing air to the sewer line shall be equipped with two taps. One tap will be used to introduce air into the line being tested, through suitable valves and fittings, so that the input air may be regulated. The second tap will be fitted with valves and fittings to accept a pressure test gauge readable from ground level indicating internal pressure in the sewer pipe. An additional valve and fitting will be incorporated on the tap used to check internal pressure so that a second test gauge may be attached to the internal pressure tap. The pressure test gauge will also be used to indicate loss of air pressure due to leaks in the sewer line.

**4.6.3.2.4** The pressure test gauge shall meet the following minimum specifications:

Size (diameter)	4 to 4 ½ inches
Pressure Range	0 – 30 P.S.I.
Figure Intervals	.5 P.S.I. Increments
Pressure Tube	Bourdon Tube or diaphragm
Accuracy	+/- 0.25% of maximum scale reading
Dial	White coated aluminum with black lettering, 270 degree arc
Pipe Connection	Low male ½” N.P.T.

Calibration data will be supplied with all pressure test gauges. Certification of pressure test gauge will be required from the gauge manufacturer. This certification and calibration data will be available to the Engineer whenever air tests are performed. The test gauges shall be calibrated at least every six months.

**4.6.3.2.5** The contractor shall test each reach of sewer pipe between manholes after completion of installation of all utilities.

**4.6.3.2.6** The contractor shall plug ends of line and cap or plug all connections to withstand internal pressure. One of the plugs provided must have two taps for connecting equipment. After connecting air control equipment to the air hose, monitor air pressure so that internal pressure does not exceed 5.0 psig. After reaching 4.0 psig, throttle the air supply to maintain between 4.0 and 3.5 psig for at least two (2) minutes in order to allow equilibrium between air temperature and pipe walls. During this time, check all plugs to detect any leakage. If plugs are found to leak, bleed off air, tighten plugs, and again begin supplying air. After temperature has stabilized, the pressure is allowed to decrease to 3.5 psig. At 3.5 psig, begin timing to determine the time required for pressure to drop to 2.5 psig. If the time, in seconds, for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than that shown in the table below, the pipe shall be presumed free of defects.

Pipe Size	Required Time Per 100 LF	Minimum Required Time
8”	1 min. 10 sec.	3 min. 47 sec.
10”	1 min. 50 sec.	4 min. 43 sec.
12”	2 min. 38 sec.	5 min. 40 sec.
15”	4 min. 08 sec.	7 min. 05 sec.
18”	5 min. 56 sec.	8 min. 30 sec.
21”	8 min. 05 sec.	9 min. 55 sec.
24”	10 min. 34 sec.	11 min. 20 sec.
27”	12 min. 45 sec.	12 min. 45 sec.
30”	14 min. 11 sec.	14 min. 11 sec.
33”	16 min. 35 sec.	16 min. 35 sec.

If the air test fails to meet the above requirements, repeat test as necessary after all leaks and defects have been repaired. Prior to acceptance all constructed sewer lines shall satisfactorily pass the low-pressure air test.

**4.6.3.2.7** In areas where groundwater is known to exist, the contractor shall install a one-half-inch diameter capped pipe nipple, approximately ten (10) inches long, through manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed.

Immediately prior to the performance of the acceptance test, groundwater level shall be determined by removing pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the pipe nipple. The hose shall be held vertically and a measurement of height in feet of water shall be taken after the water stops rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings.

**4.6.3.3** CCTV Inspection. Closed Circuit Television (CCTV) inspection will be performed on the full length of all sewer lines and lateral connections after successful completion of visual inspection, mandrel and air leakage testing prior to acceptance.

**4.6.3.3.1** The contractor is to provide clean lines prior to CCTV inspection. If flushing is required due to debris accumulation, the city will flush the lines at the Contractor's expense.

**4.6.3.3.2** The City will perform the CCTV inspection of the lines.

**4.6.3.3.4** Upon successful completion of visual inspection, mandrel test and air leakage testing the contractor will contact Sewer Maintenance at 864-1923 a minimum of 72 hours in advance to schedule the inspection.

**4.6.3.3.5** The contractor will be responsible for providing clear and acceptable access prior to final grading for the City Inspection vehicles to access the manholes for inspection.

**4.6.4 Acceptance Tests for Force Mains.** All force main piping shall be subject to a hydrostatic and leakage test.

**4.6.4.1 Hydrostatic Tests.** The hydrostatic test shall be conducted in accordance with Section 4 of AWWA C-600, at a test pressure determined by the following formula (if no head pressure is specified on the plans, then use pipe pressure rating in psi):

Test Pressure = Total design head pressure X 0.433 X 1.5. The test pressure must be maintained for at least two hours duration.

**4.6.4.2 Leakage Test.** The leakage test shall be conducted concurrently with the hydrostatic test. Leakage shall be considered as the volume of water added to maintain the test pressure determined by the formula above. The leakage test shall be conducted in accordance with

Section 4 of the AWWA specifications. Allowable leakage must not exceed the volumes specified below for each 1,000 feet of the particular diameter of pipe being tested:

Pipe Diameter	Allowable Leakage/1000 L.F.
2"	0.19 gallons/hr.
4"	0.37 gallons/hr.
6"	0.55 gallons/hr.
8"	0.74 gallons/hr.
12"	0.92 gallons/hr.

If testing results in leakage greater than the allowed maximum, the defective pipe and joint/joints shall be located and repaired. When repair work is complete, tests shall be performed again to determine that leakage is within the allowable limit.

#### 4.7 ACCEPTANCE TESTS FOR MANHOLES

**4.7.1 Scope of Work.** The work shall consist of the furnishing of all labor, equipment, tools, and materials, in the performance of any acceptance test.

**4.7.1.1** All manholes must be tested to assure water tightness.

**4.7.1.2** After the manhole is in place and backfilled to finish grade, then the contractor shall plug the inlet and outlet sewer feeds in a watertight manner. The manhole may then be tested using either a water test or a vacuum test.

**4.7.2 Vacuum Testing Manholes.** The contractor will furnish all facilities required, including necessary piping connections, test pumping equipment, pressure gauges, bulkheads, regulator, avoid over pressurization, and all miscellaneous items required. Calibration data will be supplied with all pressure test gauges. Certification of vacuum test gauge will be required from the gauge manufacturer. This certification and calibration data will be available to the Engineer whenever air tests are performed. Test each manhole and accessories after the complete installation. Stabilize the vacuum at 10" Hg (mercury). After temperature has stabilized, the gauge is allowed a maximum of 1" Hg drop during the test period. The required test period is two minute (minimum) for all sizes and manholes depths. If the vacuum test fails to meet the above requirement, repeat test as necessary after all leaks and defects have been repaired.

**4.7.3** No additional payment will be made for acceptance testing.

#### 4.8 ADJUSTMENTS OF SANITARY SEWER LATERALS

**4.8.1 Scope of Work.** At many locations, the house connections to the main sanitary sewer located within the present pavement area consist of a riser from the sewer to the point close to the existing pavement subgrade, from this point the connection runs nearly horizontally to the house connection. Experience has indicated that in many instances the house connections are

above the elevation of the proposed subgrade, making it necessary to relay house connections at a lower grade. This work shall include all equipment, materials, and labor for the adjustment of sewers to accommodate the paving project.

This work shall consist of all work necessary for the lowering of the riser and adjustment in grade to coincide with proposed elevations.

**4.8.2 Materials.** Sanitary sewer pipe shall meet the requirements specified in Chapter IV of these specifications.

**4.8.3 Construction Methods.** Extra riser pipe shall be removed to the elevation indicated by the Engineer. Construction methods for riser pipe shall meet the requirements for sewer pipe specified in Chapter IV of these specifications.

All existing sanitary sewer pipe removed because of necessary grade adjustments shall be disposed of by the contractor and replaced with new pipe of the diameter required, meeting the specifications as set forth above.

**4.8.4 Method of Measurement.** Measurement of pipe will be to the nearest foot.

**4.8.5 Basis of Payment.** Sanitary sewer house connections shall be paid on a lineal foot basis for all pipe removed and replaced at the direction of the Engineer or as shown on the plans. This shall include all labor, equipment, and materials necessary to remove and replace the sanitary sewer house connections.

## 5 STORM SEWERS

### 5.1 PIPE

**5.1.1 Scope of Work.** The work shall consist of furnishing all labor, materials, and equipment for the complete installation of storm sewer pipe, and appurtenances, in conformance with the lines and grades shown on the plans or as established by the Engineer and as specified herein. Items of work or materials not specifically mentioned, but necessary for the completion of storm sewer line construction shall be considered as incidental to other items in the contract.

### 5.1.2 Materials.

**5.1.2.1 Pipe.** Storm sewer pipe placed under pavement or where the nearest edge of the pipe trench is within two (2) feet of the back of curb shall be Reinforced Concrete, Polypropylene, or Corrugated Metal pipe, as specified below.

**5.1.2.1.1 Unreinforced Concrete Sewer Pipe.** Unreinforced concrete sewer pipe shall conform to the Specifications for Concrete Sewer Pipe, A.S.T.M. Designation C14, the pipe furnished to be of the class designated as Non-Reinforced Concrete Sewer Pipe, Class I, II, or III (depending on D-load strength required).

**5.1.2.1.2 Reinforced Concrete Culvert Pipe.** Reinforced concrete pipe shall conform to the requirements of the Specifications for Reinforced Concrete Culvert Pipe, A.S.T.M. Designation C76. Unless otherwise shown on the plans or stated in the Special Provisions, installations shall be made with circular pipe conforming to the requirements for Class III, Wall B of this A.S.T.M. specification. When reinforced concrete elliptical pipe is to be used, installation shall be made with pipe conforming to the requirements of A.S.T.M. Designation C507, Class HE-111.

**5.1.2.1.3 Dual Wall and Triple Wall Polypropylene Pipe.** Dual wall pipe and fittings 12 inch through 30 inch diameter pipe shall conform to ASTM F2736 and triple wall pipe 30 inch through 60 inch shall conform to ASTM F2764. Dual wall polypropylene pipe shall have a smooth interior and annular exterior corrugation. Triple wall polypropylene pipe shall have a smooth interior and exterior with annular inner corrugations. Pipe shall have a minimum pipe stiffness of 46 pii when tested in accordance with ASTM D2412. Pipe shall be joined with an integral bell and spigot joint on all sizes. The joints shall be watertight in accordance with ASTM D3212. The spigot shall have two gaskets meeting the requirements of ASTM F477. The gaskets shall be installed by the pipe manufacturer and shall be covered with a removable, protective wrap to ensure the gaskets are free from debris. Pipe shall have a reinforced bell with a polymer composite band installed by the manufacturer. A joint lubricant shall be used on the gasket and pipe bell during assembly.

Each individual section of pipe shall be marked in accordance with ASTM F 2736 or ASTM F 2764, and shall have “ASTM F 2736” or ASTM F 2764” and the manufacture’s name marked on the pipe.

**5.1.2.1.4 Corrugated Metal Pipe.** Aluminum coated steel pipe, polymer coated steel pipe and aluminum alloy pipe may be used in the construction of storm sewer applications. All metal coated steel pipes shall be Type I, Type IA or Type IR in compliance with AASHTO M 36 unless otherwise specified. Sheet steel must be certifiable in accordance with AASHTO M 274. All pipes will be subject to inspection of the engineer at the source of manufacture, at an intermediate shipping terminal or at destination. The engineer shall be allowed unlimited access to all facilities and records, as required, to conduct inspection and sampling.

The interior roughness coefficient (Manning’s ‘n’ value) of Corrugated Metal Pipe shall be equal to or less than 0.013.

The thickness of the coated steel shall be a minimum thickness as follows:

Pipe Dia. Inches	Minimum Gauge of Steel Pipe	
	2 2/3" x 1/2"	3"X1"
	3/4" x 3/4" x7 1/2"	5"X1"
< 42"	14	14
42" < 60"	12	12
60" < 78"	10	12
78" < 108"	N/A	12
108" and above	N/A	10

**5.1.2.2 Concrete Pipe Joints.** Joints for concrete pipe shall be any of the following:

**5.1.2.2.1 Neoprene Gaskets.** Flexible Neoprene Gaskets of the proper size conforming to the requirements of A.S.T.M. Designation C443.

**5.1.2.2.2 Bituminous Mastic Joint Compound.** This compound shall be a homogeneous blend of bituminous material, inert filler, and suitable solvents or plasticizing compounds thoroughly mixed at the factory to a uniform consistency.

**5.1.2.3 Dual Wall and Triple Wall Polypropylene Joints.** Field joints shall provide circumferential and longitudinal strength to maintain the pipe alignment, prevent separation of pipe and prevent infiltration of fill material. Coupling bands, if used, shall be of the same base material as the pipe. Prior to use, the design of coupling bands and fastening devices shall be submitted to and approved by the Engineer. Final acceptance of coupling bands and fastening devices will be based on field performance.

**5.1.2.4 Corrugated Metal Pipe Joints.** Field joints shall provide circumferential and longitudinal strength to maintain the pipe alignment, prevent separation of pipe and prevent infiltration of fill material. Corrugated Metal Coupling bands shall conform to AASHTO M36 standard joining systems.

**5.1.2.5 Bedding Material.** Material for bedding shall be crushed stone, crushed gravel, or crushed concrete conforming to the requirements of ASTM Standard C 33 or ASTM D 448 size no. 67, and having a gradation as follows:

Sieve	% Passing
1"	100
¾"	90 - 100
3/8"	20 - 55
No.4	0 - 10
No.8	0 - 5

**5.1.2.6 Miscellaneous Materials.** Any materials requested for use by the contractor during construction but not described in this specification will be subject to the approval or rejection of the Engineer.

**5.1.3 Construction Methods.**

**5.1.3.1 Classification of Excavated Materials.** Classification of excavated materials will be made as follows:

**5.1.3.1.1 Rock.** Rock is defined as being sandstone, limestone, chert, granite, siltstone quartzite, slate, shale occurring in its natural undisturbed state, hard and unweathered, in ledges six (6) inches or more in thickness or similar material in masses or boulders, each being more than 1 ½ cubic yards in volume.

Should rock be encountered in two (2) or more ledges, each ledge being more than six (6) inches thick and with interlying strata of earth, clay, shale, or gravel not more than twelve (12) inches thick in each stratum, the entire volume between the top of the upper ledge and bottom of the lower ledge will be classified as rock.

**5.1.3.1.2 Earth.** All materials not classified as rock shall be classified as earth. Chert (joint flint rock) broken by intermittent clay partings or clay seams or stratified chert cemented with clay seams (hardpans) shall be classified as earth.

**5.1.3.1.3 Unclassified.** Unclassified excavation will consist of the excavation of all materials of whatever character encountered in the work. All material required to be excavated will be considered as "Unclassified Excavation" unless the contract specifically states otherwise.

**5.1.3.2 Excavation.** Excavation shall consist of the removal of any and all material below ground level necessary in order to carry out the installation and construction required by the plans and specifications and shall include: (1) Additional excavation required for bedding; (2) All sheeting, shoring, bracing, protection of adjacent property, and underground conduits, or structures, and preparation of the subgrade; (3) The cost of diversion of surface water, pumping, draining, or otherwise dewatering of excavation; and (4) The subsequent handling and disposal of such material not used in the backfill.

Trench excavation shall not be performed any farther ahead of the bedding and pipe laying operations than is necessary to permit a continuous operation. The elevation of the bottom of the trench shall be continually checked for conformance to the lines and grades shown on the plans. Excavation made below proper subgrade elevation shall be backfilled with bedding material and thoroughly compacted at the contractor's expense. Sheeting, timbering, and bracing shall be placed by the contractor whenever necessary for the safety of workmen or the public, and for the preservation of any excavation, embankment, or structure. When the excavation is of such an unstable character or other conditions are such as to render it necessary, the sheeting shall be closely driven and to such depth below the lowest point of the final trench elevation as required for stability. The contractor shall be held responsible for the determination of the need for sheeting or other types of protection and for the sufficiency of all sheeting and bracing used and for all persons injured or property damaged as the result of improper quality, strength, placing, maintaining, or removing the same. No additional compensation will be made for any sheeting, bracing, or other protective measures whether left in place or not.

The contractor shall at his own expense, shore up, protect, and ensure from damage all buildings, retaining walls, viaduct piers and footings, storm sewers, sanitary sewers, gas lines, water lines, fences, curbs, trees, or other property liable to be injured during the progress of the work, and he will be held responsible for all damage which may occur by reason of prosecution of the work.

The contractor shall furnish and operate sufficient pumps and equipment and shall provide all materials, labor, etc., required to prevent interference with the work by water, ice, or snow. Damage of any kind resulting from insufficient pumping facilities or similar lack of protection of the work shall be repaired or replaced by the contractor at his own expense. No water shall be allowed to run into or over any concrete work unless by special permission in writing by the Engineer.

Where leaks or springs are encountered which, in the opinion of the Engineer, affect the safety, usefulness, or satisfactory operation of any of the permanent work, he may direct special precautions to be taken and payment herefor made in accordance with the General Conditions, Chapter 2.

The width of the trench at the bottom of the pipe shall provide at least six (6) inches of clear space on each side of the pipe to permit compaction of the bedding material.

The location of storm sewers and structures as shown on the plans have been selected to provide the least possible interference with or the crossing of existing utilities and above-ground obstructions. The City reserves the right to make minor variations in the location of the sewers and structures during the construction to adjust for any changed conditions discovered, and no additional payment will be allowed the contractor for shifts in alignment.

Arrangements shall be made by the contractor with all persons, firms, corporations owning or using any poles, pipes, tracks, or conduits, etc., affected by the construction on this project to maintain and protect such facilities during construction with the cost of any such protection paid by the contractor, and is considered as incidental to other items in the contract.

For requirements relating to the use of explosives, refer to Chapter 2 and Chapter 3 of the General Conditions.

Tunneling shall be done only where shown on the plans or by written direction or approval of the Engineer.

Tunnels shall be of sufficient size, height, and width to permit proper installation of the pipe, proper bracing of the tunnel section, and to permit ample room for the prosecution of the work and safety of the workmen.

**5.1.3.3 Bedding and Pipe Laying.** The subgrade of the trench shall be excavated to a depth as to provide space for at least four (4) inches of bedding material between the subgrade and the pipe if the subgrade material is earth and six (6) inches of bedding material between the subgrade and the pipe if the subgrade material is rock. Bedding material shall be placed in the trench and carefully graded and compacted to the proper elevation so that the pipe, when placed, shall conform to the specified line and grade. The Contractor shall be responsible for establishing the horizontal and vertical alignment of all storm sewers. The contractor must verify the trench grade or the grade of the top line and storm sewer pipe, and will be held responsible for the correct flow of storm sewers. Any apparent inaccuracy in the grade stakes shall be called to the Engineer's attention immediately upon discovery.

If, in the opinion of the Engineer, subgrade conditions are such that the bedding described above will not adequately support the pipe, he may order the contractor to install one of the two types of concrete cradle shown on the Drawing SAN-12.

**5.1.3.4 Laser.** The contractor shall provide and maintain in good working order, on the site, at all times, a laser beam or a gauge rod of sufficient length to reach from the invert of the storm sewer pipe being laid to the top line strung on the three batter boards. The gauge rod shall be graduated and numbered each foot of its entire length. The gauge rod shall be equipped with either a plumb line or two spirit levels, and the utmost care used to ensure a truly vertical gauge rod at the time the reading is taken and pipe is being set. Each length of pipe shall be laid on an even, firm bed, so that no uneven strain will exist to prevent the pipe from bearing on the sockets. Bell holes for bell and spigot pipe shall be dug at each joint as hereinbefore specified. Each pipe shall be laid in conformity with the line and grade established by the Contractor. Pipe laying shall commence at the low point of the project and progress upgrade, unless otherwise expressly permitted by the Engineer. The bell-end of the pipe shall be laid upgrade. The alignment of all pipelines shall be true to line and grade. The end of each joint of pipe shall be truly centered and fully positioned into the abutting pipe. Pipe laid in the trench shall not be covered until approved by the Engineer.

In the event a laser beam is used to control line and grade for the pipe laying operation, the laser must be checked at the beginning of each day and at any other time the Engineer deems necessary to ensure the proper line and grade of the pipe.

**5.1.3.5 Cleaning.** The interior of the storm sewer line shall, as the work progresses, be cleaned of all dirt, excess jointing material, and superfluous materials of every description.

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

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

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

**5.1.3.7 Backfilling.** The backfilling of the trench shall follow closely behind the pipe-laying operation, but not until inspected by the Engineer. In all cases the pipe shall be backfilled the same day as laying.

The backfill material for all storm sewer pipe laid in tunnels shall be sand or finely crushed limestone of which one hundred (100%) percent shall pass a three-sixteenth (3/16)-inch sieve. It shall be thoroughly compacted.

**5.1.3.7.1 Backfill Material Under Pavements.** This includes all backfill material for storm sewers constructed in open cuts crossing or parallel to roadways, parking lots, driveways, sidewalks, and other existing pavements, or having the trench wall within two (2) feet of the back of street curb or edge of surface. Backfill shall consist of granular material meeting the requirements for bedding material, specified hereinbefore. In addition, granular backfill material shall be placed between pipes on all parallel storm sewer pipes located closer than two (2) times the largest pipe diameter. This material shall be placed and thoroughly compacted.

**5.1.3.7.1.1 Reinforced Concrete Culvert Pipe.** Backfill shall consist of thoroughly compacted granular material meeting the requirements for bedding material, specified hereinbefore. Minimum depth for storm sewers on improved streets shall be twelve (12) inches plus the pipe depth, and the minimum depth under unimproved streets shall be twenty-four (24)-inches plus the pipe depth.

**5.1.3.7.1.2 Dual Wall, Triple Wall Polypropylene and Corrugated Metal Pipe.** Backfill shall consist of thoroughly compacted granular material meeting the requirements for bedding material, specified hereinbefore. Minimum cover for 12"- 48" diameter pipe shall be 12" from the top of rigid pavement or to the bottom of flexible pavement. If 60" diameter pipe is used,

minimum cover shall be 24” from the top of rigid pavement or to the bottom of flexible pavement. A minimum cover of 12” to the top of ground surface is required when outside of pavement.

**5.1.3.7.2 Backfill material not under pavements.** This includes all backfill material for storm sewers not placed under pavements or within two (2) feet of the back of street curb shall be compacted granular material placed to the midpoint on all storm sewer pipe. Suitable embankment material as described in Chapter 3 – Earthwork shall be placed from the mid point of the pipe to one (1) foot above the pipe. Compaction of the select material shall be performed with hand-held tampers to a minimum distance of one (1) foot above the pipe and six (6) inches beyond the sides of the pipe. The backfill material shall be placed in lifts not to exceed twelve (12) inches in thickness. The backfill shall be placed and compacted on both sides of the pipe simultaneously. Heavier compaction equipment may not be used until the backfill has been placed in a minimum of one (1) foot above the top of pipe, or as directed by the Engineer.

No frozen material shall be used in the backfill. Care shall be taken to avoid injury to the pipe or structures or producing unequal pressures thereon. Earth backfill shall be thoroughly compacted to a density of at least ninety percent (90%) of the maximum density for the material used as determined by ASTM designation D-698. The top four (4) inches of the backfill shall be made with topsoil and graded as required under Chapter 8 of these specifications. All surplus excavation material not used in backfilling shall be disposed of by the contractor. Upon receipt of written notice from the Engineer, any settlement of the backfill below the original ground surface shall be remedied by the contractor for a period of one (1) year after final completion and acceptance.

### **5.1.3.8 Pavement Replacement.**

**5.1.3.8.1 Temporary Replacement.** If for any reason a roadway must be opened for traffic after the storm sewer is in place but before the pavement is replaced, then the contractor must provide a one (1) inch asphalt cap on the trench backfill. This asphalt cap shall be the contractor’s responsibility, and no additional compensation will be allowed. Permanent pavement replacement shall not occur any later than thirty (30) calendar days after backfilling unless otherwise approved by the Engineer. Backfill and/or asphalt shall be removed as necessary prior to placement of the permanent pavement.

**5.1.3.8.2 Permanent Replacement.** All pavement and curbs damaged during construction, in the opinion of the Engineer, shall be removed and replaced. In order to determine the amount of damage to the pavement and curbs during construction, all existing cracks in the street or curb should be marked in advance of construction. Pavement replacement (whether temporary or permanent) shall closely follow backfilling operation.

The existing pavement necessary to be removed for construction shall follow the Pavement Repair Standard Drawing Detail ST-13. The existing pavement shall be sawed in a neat line and removed prior to excavation. The width of this removal shall not exceed the width specified on the plans or approved by the Engineer.

The pavement shall be sawed prior to replacement to ensure a straight edge and a uniform patch. The subgrade for the new pavement shall be further compacted by rolling or tamping. The pavement shall then be replaced with eight (8) inches of concrete pavement. The pavement shall be doweled with 1"x18" dowels on twenty-four (24) inch centers along all transverse joints. Dowel bars shall be omitted when repairing bituminous pavement.

#### **5.1.4 Method of Measurement.**

**5.1.4.1 Pipe.** Final measurement of all pipe will be to the nearest foot.

**5.1.4.2 Encasement.** Final measurement of all encasements will be to the nearest foot.

**5.1.4.3 Rock Excavation.** Final measurement of rock excavation, if specified, will be to the nearest one-tenth (1/10) cubic yard.

**5.1.5 Basis of Payment.** Contractor will be paid for quantities actually constructed or performed as determined by field measurements at the unit price bid for the items listed in the schedule of the proposal or for such extra work as may be authorized and approved by the Engineer. The cost of incidental work not listed in the schedule of the proposal but necessary for the completion of the project shall be considered as completely covered by bid price for other items in the contract.

Quantities of work acceptably completed under the term of the contract shall be determined by the Engineer based on his actual measurement.

**5.1.5.1 Storm sewer pipe** in place will be paid for on length of storm sewer laid from inside edge of structure to inside edge of structure and shall include the cost of all labor, materials, including joints, and other necessary fittings, excavation, backfill, and equipment.

**5.1.5.2 Rock Excavation**, if specified, will be calculated at a width of three (3) feet for pipe up to and including eighteen (18) inches in diameter. For pipe having a diameter greater than eighteen (18) inches, the trench width to be paid for will be calculated as the pipe width plus six (6) inches on each side of the pipe.

## **5.2 JUNCTION BOXES, INLETS, AND CATCH BASINS**

**5.2.1 Scope of Work.** The work shall consist of furnishing all labor, materials, and equipment necessary to perform all operations in connection with the construction of junction boxes, inlets, and catch basins required for the project in accordance with the specifications and drawings. Items not specifically mentioned, but necessary for completion of the work shall be considered as incidental to other items in the contract.

## **5.2.2 Materials.**

**5.2.2.1** Concrete shall be Class “A” Portland Cement Concrete in accordance with the requirements of Chapter VI of these specifications.

**5.2.2.2** Reinforcing steel shall consist of deformed bars of grade 60 steel conforming to the requirements of A.S.T.M. designation A615 or of wire fabric conforming to A.S.T.M. designation A185.

**5.2.2.3** Expansion Joint Fillers shall be of a non-extruding type conforming to A.S.T.M. designation D1751 and cut to the dimensions shown on the plans.

**5.2.2.4** Precast units may be substituted provided they meet plan intent.

## **5.2.3 Construction Methods.**

**5.2.3.1 Forms.** Forms shall be of wood, plywood, or any other suitable material, designed, constructed, braced, and maintained so that the finished concrete will be true to line and elevation and will conform to the required dimensions. They shall be designed to withstand the pressure of the concrete; the effect of vibration as the concrete is placed in all other loads incidental to the construction operations without distortion or displacement. They shall be mortar tight. Oiling both inside and outside surfaces will be required to prevent warping, shrinkage, or swelling.

Forms shall be constructed and designed so that their removal can be effected without injury to the concrete, and so that portions where surface finishing is required may be removed without disturbing forms that are to remain. Dirt, chips, sawdust, nails, and other foreign matter shall be removed before any concrete is deposited therein.

Tie rods, belts, and anchorages within the forms shall be constructed so as to permit their removal to a depth of at least one and one-half (1 ½)-inches from the face without injury to the concrete. In case wire ties are used, upon removal of the forms, all projecting wire shall be cut back at least one-half (1/2) inch from the face of all surfaces that will be exposed to view after completion of the work and flush with the face of all concrete surfaces that will not be exposed to view. All fittings for metal ties shall be of such design that, upon their removal, the cavities, which are left, will be of the smallest practical size.

**5.2.3.2 Inlet and Outlet Pipe.** Pipe or tile placed in the concrete for inlet or outlet connections shall extend through the concrete walls beyond the outside surfaces of the walls a sufficient distance to allow for connections. The pipe or tile shall be placed through the forms and poured in place.

The ends of the pipe shall be flush with the inside wall of the structure. Inlet pipe(s) shall be placed so that the minimum invert elevation is two-tenths (0.2) feet higher than the outlet pipe, unless otherwise authorized by the Engineer.

**5.2.3.3 Bedding.** The subgrade for the structure shall be excavated a sufficient depth so as to provide space for at least four (4) inches of bedding material between the subgrade and the structure. Bedding material shall be placed and compacted to the proper elevation. If rock is encountered within six (6) inches of the bottom of the structure, then excavate down a minimum of six (6) inches and backfill with bedding material.

**5.2.3.4 Reinforcement.**

**5.2.3.4.1 Placement.** Reinforcing bars shall be accurately placed as shown on the plans and shall be firmly and securely held in position in accordance with Concrete Reinforcing Steel Institute “Recommended Practice for Placing Reinforcing Bars,” and by using concrete or metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under full load. Metal chairs which extend to the surface of the concrete (except where shown on the plans) and wooden supports, shall not be used. Placing bars in layers of fresh concrete as the work progresses and adjusting bars during the placing of concrete will not be permitted. Before placing in the forms, all reinforcing steel shall be cleaned thoroughly of mortar, oil, dirt, loose mill scale, loose or thick rust, and coatings of any character that would destroy or reduce the bond. No concrete shall be deposited until the placing of the reinforcing steel has been inspected and approved.

**5.2.3.4.2 Splicing.** Splices of bars shall be made only where shown on the plans or as approved by the Engineer. Where bars are spliced, they shall be lapped at least forty-eight (48) diameters, unless otherwise shown on the plans.

Splicing shall be accomplished by placing the bars in contact with each other and wiring them together.

Welding of reinforcing steel or cutting with a cutting torch will not be permitted unless specifically authorized by the Engineer.

**5.2.3.4.3 Bending Reinforcement.** Bends and hooks in bars shall be made in the manner prescribed in the “Manual of Standard Practice” of the American Concrete Institute.

Bars shall not be bent or straightened in a manner, which will injure the material. Bars with kinks or unspecified bends shall not be used.

**5.2.3.4.4 Welded Wire Fabric.** Welded wire fabric shall be spliced not less than two (2) meshes. It shall be lifted carefully into its specified position after the concrete is placed but still plastic.

**5.2.3.4.5 Placing Concrete.** Concrete shall be conveyed, deposited, and consolidated by any method which will preclude the segregation or loss of ingredients.

Chutes used in conveying concrete shall be sloped to permit concrete of the consistency required to flow without segregation. Where necessary to prevent segregation, chutes shall be provided with baffle boards or a reversed section at the outlet.

Where a sequence for placing concrete is shown on the plans, no deviation will be permitted unless approved in writing by the Engineer.

Where concrete is to be deposited against hardened concrete at horizontal construction joints, placing operations shall begin by conveying a grout mixture through the placing system and equipment, and depositing the mixture on a joint. The grout mixture shall consist of a modification of the concrete specified to reduce the quantity of coarse aggregate in the mix larger than pea-gravel size to one-half (1/2) the quantity specified.

To avoid segregation, concrete shall be deposited as near to its final position as is practicable. The use of vibrators for extensive shifting of the mass of concrete will not be permitted. Concrete that has partially hardened or is contaminated by foreign materials shall not be deposited in the structure.

Concrete shall be placed in horizontal layers insofar as practical. Placing shall start at the low point and precede upgrade unless otherwise permitted by the Engineer. Concrete shall be placed in a continuous operation between construction joints and shall be terminated with square ends and level tops unless otherwise shown on the plans.

Concrete shall not be permitted to fall more than six (6) feet without the use of pipes or tremies. Pipes or tremies shall be at least six (6) inches in diameter, or the equivalent cross sectional area for rectangular sections. Concrete shall not be placed in horizontal members or sections until the concrete in the supporting vertical members or sections has been consolidated and a two (2)-hour period has elapsed to permit shrinkage to occur.

Concrete shall be thoroughly vibrated in a manner that will encase the reinforcement and inserts, fill the forms, and produce a surface or even texture free of rock pockets and excessive voids.

Structural concrete, except slope paving steeper than one (1) inch per foot, such as spillway aprons and channel lining, and concrete placed under water, shall be consolidated by means of high-frequency, internal vibrators of a type, size, and number approved by the Engineer. The location, manner, and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete without separation of the mortar and coarse aggregate, and without causing water or cement paste to flush to the surface. Internal vibrators shall not be held against the forms or reinforcing steel.

The number of vibrators employed shall be sufficient to consolidate the concrete within fifteen (15) minutes after it has been deposited in the forms. At least two (2) vibrators in good operating condition shall be available at the site of the structure in which more than twenty-five (25) cubic yards of concrete is to be placed.

**5.2.3.4.6 Joints.** The work shall be so prosecuted that construction joints will occur at designated places shown on the plans unless otherwise authorized by the Engineer. The contractor shall construct, in one continuous concrete placing operation, all work comprised between such joints. Joints shall be kept moist until adjacent concrete is placed.

All construction joints having a keyed, stepped, or roughened surface shall be cleaned prior to placement of the adjacent concrete as directed by the Engineer.

Expansion and contraction joints in concrete structures shall be formed where shown on the plans. No reinforcement shall be extended through the joints, except where specifically noted or detailed on the plans.

No direct payment will be made for furnishing and placing asphaltic paint, premolded asphaltic filler, or other types of joint separators. The cost therefore shall be included in the price bid for the item of work of which they are a part.

**5.2.3.4.7 Cold Weather Requirements.** Whenever the temperature of the surrounding air is below 40 degrees F or when the possibility exists that the temperature will fall below 40 degrees F, within the 24-hour period after concrete operations, concrete placed in the forms shall have a temperature of between 80 degrees F and 100 degrees F. All concrete shall be maintained at a temperature of not less than 50 degrees F for at least 72 hours or for as much time as is necessary to ensure proper curing of the concrete. The housing, covering, or other protection used in connection with curing, shall remain in place and intact at least 24 hours after the artificial heating is discontinued. No dependence shall be placed on salt or other chemicals for the prevention of freezing. Contractor will be held responsible for any damage to concrete as a result of cold weather operations.

**5.2.3.4.8 Finishing.** The top surfaces of structures shall be struck off with a straight edge and finished with a wood float. As soon after the completion of the specified finishing operations as the condition of the concrete will permit without danger of consequent damage thereto, all exposed surfaces shall either be covered with burlap or sprayed with white pigmented membrane curing compound conforming with A.S.T.M. designation C309, Type 2. Forms shall be removed between twelve (12) and twenty-four (24) hours after concrete placement and all exterior form ties shall be removed to a depth of one (1) inch below the surface, all fins caused by forms, joints, and other projections, shall be removed, and all pockets cleaned and filled with mortar. All exposed surfaces shall then be wetted and hand rubbed with a rubber float using a sand and cement mixture to obtain a smooth and uniform texture as directed by the Engineer.

**5.2.3.4.9 Inverts.** Inverts for inlet boxes, junction boxes, and other drainage structures shall be constructed with cement mortar after other concrete work has been done. Inverts shall be smoothly finished in accordance with the plans and to ensure a smooth flow of water through the structure.

**5.2.3.4.10 Backfilling.** Structures which lie within the area to be paved, or within two (2) feet of the back of curb, such as curb inlets or junction boxes, shall be backfilled with granular material meeting the requirements of bedding material specified hereinbefore. Backfill not within two (2) feet of the paving area may be suitable embankment material. Bedding material shall be placed and thoroughly compacted. Earth backfill shall be placed in accordance with the requirements specified hereinbefore for pipe backfilling.

**5.2.3.4.11 Removal of Forms.** Forms shall remain in place until, in the opinion of the Engineer, it is safe to remove them. In determining the time for removal of forms, consideration shall be given to the location and character of the structure, the weather, and other conditions influencing the setting of the concrete and the requirements for curing and finishing.

**5.2.3.4.12 Exposed Metal.** All exposed metal shall be painted and primed in accordance with the Standard Drawings.

**5.2.4 Basis of Payment.** Inlets, junction boxes, and catch basins include all labor, equipment, materials, excavation, backfill, forms, reinforcement, and frame and grate, or ring and lid, as per plan or standard, to complete the structure in place as per the location called for on the plans. These structures shall be paid for at the base price for each structure complete in place.

### **5.3 FIELD TESTS AND INSPECTIONS**

The contractor shall furnish the Engineer with every reasonable facility for ascertaining whether or not the work performed is in accordance with the requirements and intent of the plans and specifications. Any work done (except excavation) or material used without suitable supervision or inspection by the Engineer may be ordered removed and replaced at the contractor's expense.

## 6 PORTLAND CEMENT CONCRETE

**6.1 DESCRIPTION.** The concrete described herein shall consist of a mixture of Portland cement, fine aggregate, coarse aggregate, an air-entraining agent and water combined in the proportions specified for the various classes of concrete used in construction work and as set forth in these specifications. Admixtures may be added as specifically permitted. Unless specified, Class A and Class X Concrete are interchangeable. All concrete mix designs shall have a minimum 28-Day compressive strength of 4,000psi with the specification listed herein.

### 6.2 MATERIALS

**6.2.1 Cement.** Cement shall conform to the ASTM Designation C-150. Type I, and II cement shall be used unless specified in special provisions. Different brands or different types of cement from the same mill or the same brand or type from different mills shall not be mixed or used alternately in the same item of construction unless authorized by the Engineer. The Contractor shall not store cement at the site of the work without prior approval of the Engineer. The right is reserved by the Engineer to sample the cement either at the origin of the shipment or after delivery at the site of the work or the ready-mix concrete plant. Provisional acceptance by the Engineer prior to the completion of tests shall in no way act as a waiver of the right to reject cement which has been shipped and unused, if upon completion of the tests, it fails to meet the requirements of the specifications.

#### 6.2.1.1 Supplementary Cementitious Materials (Mineral Admixtures)

**6.2.1.1.1 Fly Ash.** Fly Ash shall conform to ASTM Designation C-618 Class C or Class F.

**6.2.1.1.2 Ground Granulated Blast Surface Slag (GGBFS).** GGBFS shall conform to ASTM C 989 and meet the activity performance in Table 1 Grade 100 or grade 120.

**6.2.2 Water.** Water shall comply with requirements of ASTM C 1602.

**6.2.2.1 Recycled Water.** Recycled water from production and stormwater runoff meeting the requirements of ASTM C 1602 and other non-potable water sources shall be tested daily, or at intervals directed by the Engineer, and shall meet the requirements of ASTM 1602 Table 2. The concrete chloride ion content shall be in accordance with of ACI 318.

**6.2.3 Fine Aggregate.** Fine aggregate shall consist of natural sand, manufactured sand, or a combination thereof that is free from cemented or conglomerated lumps. Fine aggregate shall conform to the requirements of ASTM Designation C-33 Table 1 with respect to deleterious substances, soundness, and abrasion resistance.

**6.2.3.1** The gradation requirements of fine aggregate shall be as follows:

ASTM C-33 Sand	
Sieve	% Passing
3/8"	100
No. 4	95 - 100
No. 8	80 - 100
No. 16	50 - 85
No. 30	25 - 60
No.50	5 - 30
No.100	0 - 10

The fine aggregate shall not have more than 45% passing any sieve and its fineness modulus shall be between 2.3 and 3.10.

**6.2.4 Coarse Aggregate.** The coarse aggregate shall consist of crushed stone or crushed gravel. Coarse aggregates shall be of uniform quality and conform to the requirements of ASTM Designation C-33 Table 3 Class Designation 4S with respect to deleterious substances (excluding deleterious rock), soundness, lightweight chert (specific gravity less than 2.4), lignite, and abrasion resistance.

**6.2.4.1** Testing for hard and soft chert, and deleterious aggregate shall be performed in accordance with MoDOT TM-71 Deleterious Content of Aggregate and shall meet the requirements as follows:

Chert and Deleterious Material in Aggregate	
Total of all Deleterious Rock	6.0
Total Shale	1.0
Total Hard and Soft Chert	4.0
Total Other Foreign Material	0.5

**6.2.4.2** Coarse aggregates for Class “A” and Class “X” concrete shall meet the gradation requirements as follows:

<b>Coarse Aggregate Gradation Requirements</b>				
U. S. Standard Sieve Size	Percent Passing by Weight			
	Class A		Class X	
	ASTM C 33 No. 467	ASTM C 33 No. 57	ASTM C 33 No.67	ASTM C 33 No. 89
2"	100	--	--	--
1½"	95 - 100	100	--	--
1"	--	95 - 100	100	--
¾"	35 - 70	--	90 - 100	--
½"	--	25 - 60	--	100
⅜"	30-Oct	--	20 - 55	90 - 100
No.4	0 - 5	0 - 10	0 - 10	20 - 55
No.8	--	0 - 5	0 - 5	30-May
No. 16	--	--	--	0 - 10
No. 50	--	--	--	0 - 5
No. 200	2.5 max.	2.5 max.	2.5 max.	2.5 max.

### 6.2.5 Admixtures

**6.2.5.1 Air Entrainment.** Air entraining admixtures shall conform to the requirements of ASTM C 260.

**6.2.5.2** All other Admixtures except air entrainment for concrete shall conform to the requirements of ASTM C 494.

**6.2.5.3** Calcium chloride may only be used in concrete without reinforcing steel or imbedded metal items when approved by the Engineer. Calcium chloride shall not exceed 3% by weight of cement and must meet the requirements of ASTM D 98.

### 6.3 PROPORTIONS OF MATERIALS

**6.3.1 Cement Content.** Class "A" concrete and Class "X" concrete shall contain not less than 564 pounds of cement per cubic yard. Cement content includes weight of pozzolan.

**6.3.2 Water Content.** The water to cementitious ratio, including free surface moisture on the aggregate, shall not exceed 0.45.

**6.3.3 Air Content.** Portland cement concrete shall have an air content of  $6.0\% \pm 1.5\%$  of the volume of the concrete when tested in accordance with ASTM Designation C-173 or ASTM C 231.

**6.3.4 Fly Ash Content.** The Portland cement concrete can contain up to a maximum of 25% by weight of fly ash per cubic yard.

**6.3.5 Slump.** The slump, when tested in accordance with ASTM Designation C-143, shall not exceed 4.0". If a water reducing admixture (WRA) is used then the slump shall not exceed 5.0". If a high range water reducing admixture (HRWR) is used then the slump may not exceed 8.0".

## 6.4 GENERAL REQUIREMENTS

**6.4.1 Weather Limitations.** Additional precautions must be taken when placing concrete during hot and cold weather to insure it will have the strength and durability to function properly. The Contractor shall assume all risks when performing work under the conditions identified below, regardless of the precautions taken or approved by the Engineer. All costs associated with hot and cold weather concreting shall be incidental to the work being performed.

**6.4.1.1 Cold Weather Concreting.** Cold weather concreting conditions exist when the ambient air temperature has fallen to, or is expected to fall below 40°F during the placement and/or curing period of concrete. Concrete shall not be placed unless the ambient air temperature is 35°F and rising without prior approval from the Engineer as described herein.

Contractor shall submit in writing to the Engineer detailed procedures for the production, transportation, placement, protection, curing, and temperature monitoring of concrete during cold weather conditions. The submittal shall include procedures to be implemented upon abrupt changes in weather conditions or equipment failures. The Contractor shall not begin cold weather concreting until these procedures have been reviewed and accepted by the Engineer.

Contractor shall maintain cold weather protection for a minimum of three days at a curing temperature of 50°F, or until the minimum strength has been obtained. Contractor shall also furnish temperature monitoring equipment and shall bear the responsibility to demonstrate to the Engineer the concrete has been protected from freezing throughout the protection period.

**6.4.1.2 Hot Weather Concreting.** Hot weather concreting conditions exist when the ambient air temperature has risen to, or is expected to rise above 90°F during the placement and/or curing period of the concrete.

Contractor shall submit in writing to the Engineer, detailed procedures for the production, transportation, placement, protection, curing, and temperature monitoring of concrete during hot weather conditions. The submittal shall include procedures to be implemented upon abrupt changes in weather conditions or equipment failures. The Contractor shall not begin hot weather concreting until these procedures have been reviewed and accepted by the Engineer.

**6.4.2 Ready-Mix Concrete Plants and Delivery Mixers** shall meet the requirements of ASTM C 94 Standard Specification for Ready-Mix Concrete. The manufacturer shall afford the Engineer all reasonable access, without charge, for making necessary checks of the production facility and for securing necessary samples to determine if the concrete is being produced in accordance with this Specification and the Job Special Provisions.

**6.4.2.1 Calibration and Certification of Plants and Delivery Mixers** shall be certified by the National Ready Mixed Concrete Association (NRMCA). The manufacturer shall have an independent scale company calibrate all scales and measuring devices for batching, cement, water, and aggregates every twelve (12) months. Admixture measuring devices shall be calibrated and certified by the admixture supplier. Anytime a repair is made on plant equipment which can affect the calibration of the measuring devices, a new calibration is required. Blades and drums of the mixers shall be in good condition and be in compliance with the mixer manufacturers' requirements. When excessive buildup is observed in a drum, the truck shall not be used until the buildup is removed.

**6.4.2.2 Plant Calibration.** Plant scales and watering devices shall be calibrated and certified by an approved commercial scale service. A copy of the calibration and certification shall be provided to the Engineer upon request. Plants are to be calibrated and certified annually and when found to be out of tolerance during verification.

**6.4.3 Delivery Tickets.** The concrete manufacturer shall furnish a delivery ticket for each batched load to the Construction Inspector with volumetric batch information containing the quantities of each ingredient at the proportions used to batch that load of concrete. The information included on delivery tickets shall be in accordance with ASTM C 94 which includes, but is not limited to, the following information:

- The mix design batch weights for one cubic yard of concrete submitted for the project, and the batched weights of all materials shall be printed on the delivery ticket.
- The saturated surface-dry batch weights of the aggregates and the free water moisture content of the aggregates shall be printed on the delivery ticket.
- Batch Time, which starts at the time all ingredients have been charged into the delivery vehicle.
- All information that is necessary to calculate the total mixing water.
- The amount of water that can be added on the job site without exceeding the specified water to cement ratio.

**6.4.4 Delivery.** The concrete shall be delivered to the jobsite in trucks so designed and operated that the concrete will be thoroughly mixed during the time it is in transit. The concrete shall be discharged at the site within a period of ninety (90) minutes from batch time. In hot weather conditions, as defined in 6.4.1, the discharge time shall be reduced to sixty (60) minutes. When concrete is placed at the job site, it shall have the proper consistency and slump for satisfactory workability and shall not exhibit signs of mix segregation. The temperature of the concrete shall not be less than 55°F or greater than 85°F for structural items and not greater than 90°F for non-structural items at the time of placement, unless approved by the Engineer.

**6.4.5 Testing.** Quality assurance testing will be conducted at intervals determined by the Engineer.

## **6.5 CONCRETE PROTECTION CURING AND PLACING INTO SERVICE**

**6.5.1 Concrete Protection and Curing.** All concrete will be cured with a curing compound meeting the requirements of ASTM C 309. Follow the requirements of section 6.4.1.1 for Hot weather protection and curing or section 6.4.1.2 for cold weather protection and curing, and as directed by the Engineer.

**6.5.1.1 Application.** Immediately after the finishing operation has been completed and as soon as marring of the concrete will not occur, the entire surface of the newly placed concrete shall be cured by spraying with a uniform application of a curing compound. Follow the curing compound manufacturer's requirements for application rates. If rain falls on the newly coated surface before the film has dried sufficiently to resist damage, or if the film is damaged in any other way, the Contractor will be required to apply additional curing material to the affected portions.

**6.5.1.2 Acceptance.** If the spraying pattern does not appear to give uniform coverage or the sprayed pattern produces a finish aesthetically unacceptable to the Engineer the Contractor may be required to remove or replace the structure.

**6.5.2 Concrete Curing Componds.** Water retention properties for all curing compounds shall be determined by ASTM Test Method C 156. The vehicle class of all curing compounds shall be Class A.

**6.5.2.1 Type 1-D Curing Componds.** Type 1-D liquid membrane-forming curing compounds shall be in accordance with ASTM C 309 for Type 1-D, clear or translucent with fugitive dye.

**6.5.3 Removing Protection and Placing the Concrete Component into Service.** The minimum compressive strength Formwork Concrete or Falsework Concrete must attain prior to being placed into service and removal of protection requirements in accordance with Chapter 6.

**6.5.3.1 Formwork Concrete.** Is defined as machine or hand formed concrete work, forms are used to contain poured concrete and mold it into required dimensions and support until the concrete has set. The compressive strength must attain a minimum of 75% of the 28 day strength of the concrete mix design prior to removing protection and placing in service.

**6.5.3.2 Falsework Concrete.** Is defined as a temporary structure, which maintains load bearing support for the cast in place concrete structure during curing and protection until it has attained enough compressive strength to support itself and the expected loads placed upon it during service. The minimum compressive strength requirement will be directed by the Engineer.

## 7 MISCELLANEOUS

### 7.1 CONCRETE STRUCTURES

**7.1.1 Scope of Work.** The work shall consist of furnishing all labor, materials, and equipment to perform all operations in connection with the construction cast in place of retaining walls, traffic islands, concrete culverts and headwalls, and any other miscellaneous concrete structures, except those covered elsewhere in these specifications, required for the project in accordance with the specifications and drawings.

#### 7.1.2 Materials.

**7.1.2.1 Concrete.** Concrete shall be Class “A” Portland Cement Concrete in accordance with the requirements of Chapter VI of these specifications.

**7.1.2.2 Reinforcing Steel.** Reinforcing steel shall consist of deformed bars of grade 60 steel conforming to the requirements of ASTM designation A615 or of wire fabric conforming to ASTM designation A185.

**7.1.2.3 Expansion Joint Fillers.** Expansion joint fillers shall be of a non-extruding type conforming to ASTM designation D1751 and cut to the dimensions shown on the plans.

**7.1.2.4 Bedding Material.** Material for bedding shall be crushed stone or crushed gravel conforming to the requirements of ASTM Standard C33, and having a gradation as follows:

	Sieve Size	% Passing
Passing	½”	100
Passing	3/8”	30-100
Passing	No. 4	0-5

#### 7.1.3 Construction Methods.

**7.1.3.1 Forms.** Forms shall be of wood, plywood, or any other suitable material, designed, constructed, braced, and maintained so that the finished concrete will be true to line, and elevation will conform to the required dimensions. They shall be designed to withstand the pressure of the concrete, the effect of vibration as the concrete is placed, and all other loads incidental to the construction operations, without distortion or displacement. They shall be mortar tight. Oiling both inside and outside surfaces will be required to prevent warping, shrinkage, or swelling.

Forms shall be constructed and designed so that their removal can be effected without injury to the concrete and so that portions where surface finishing is required may be removed without disturbing forms that are to remain. Three-fourths (3/4)-inch chamfer strips shall be placed on

all edges to be exposed. Dirt, chips, sawdust, nails, and other foreign matter shall be removed before any concrete is deposited therein.

Tie rods, belts, and anchorages within the forms shall be constructed so as to permit their removal to a depth of at least one and one half (1 ½) inches from the face without injury to the concrete. In case wire ties are used, upon removal of the forms, all projecting wire shall be cut back at least one half (1/2) inch from the face of all surfaces that will be exposed to view after the completion of the work and flush with the face of all concrete surfaces that will not be exposed to view. All fittings for metal ties shall be of such design that, upon their removal, the cavities which are left will be of the smallest practical size.

**7.1.3.2 Inlet and Outlet Pipe.** Pipe or tile placed in the concrete for inlet or outlet connections shall extend through the concrete walls beyond the outside surfaces of the walls a sufficient distance to allow for connections. The pipe or tile shall be placed through the forms and poured in place.

### **7.1.3.3 Reinforcement.**

**7.1.3.3.1 Placement.** Reinforcing bars shall be accurately placed as shown on the plans and shall be firmly and securely held in position in accordance with concrete Reinforcing Steel Institute's "Recommended Practice for Placing Reinforcing Bars," and by using concrete or metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under full load. Metal chairs which extend to the top surface of the concrete (except where shown on the plans) and wooden supports, shall not be used.

Placing bars on layers of fresh concrete as the work progresses, and adjusting bars during the placing of concrete will not be permitted. Before placing in the forms, all reinforcing steel shall be cleaned thoroughly of mortar, oil, dirt, loose mill scale, loose or thick rusts, and coatings of any character that would destroy or reduce the bond. No concrete shall be deposited until the placing of the reinforcing steel has been inspected and approved by the Engineer.

**7.1.3.3.2 Splicing.** Splicing of bars shall be made only where shown on the plans or as approved by the Engineer. Where bars are spliced, they shall be lapped at least thirty (30) diameters, unless otherwise shown on the plans.

Splicing space shall be accomplished by placing the bars in contact with each other and wiring them together.

Welding of reinforcing steel or cutting with a cutting torch will not be permitted unless specifically authorized by the Engineer.

**7.1.3.3.3 Bending Reinforcement.** Bends and hooks in bars shall be made in the manner prescribed in the "Manual of Standard Practice" of the American Concrete Institute.

Bars shall not be bent or straightened in a manner which will injure the material. Bars with kinks or unspecified bends shall not be used.

**7.1.3.3.4 Welded Wire Fabric.** Welded wire fabric shall be spliced no less than two (2) meshes. It shall be lifted carefully into its specified position after the concrete is placed but still plastic.

**7.1.3.4 Bedding.** The subgrade for the structure shall be excavated a sufficient depth so as to provide space for at least four (4) inches of bedding material between the subgrade and the structure. Bedding material shall be placed and compacted to the proper elevation.

**7.1.3.5 Placing Concrete.** Concrete shall be conveyed, deposited, and consolidated by any method which will preclude the segregation or loss of ingredients.

Chutes used in conveying concrete shall be sloped to permit concrete of the consistency required to flow without segregation. Where necessary to prevent segregation, chutes shall be provided with baffle boards or a reversed section at the outlet.

Where a sequence for placing concrete is shown on the plans, no deviation will be permitted unless approved in writing by the Engineer.

Where concrete is to be placed against hardened concrete, the hardened concrete shall be wetted immediately before placing the fresh concrete, and then vibrated sufficiently to ensure no voids.

To avoid segregation, concrete shall be deposited as near to its final position as is practicable. The use of vibrators for extensive shifting of the mass of concrete will not be permitted. Concrete that has partially hardened or is contaminated by foreign materials shall not be deposited in the structure.

Concrete shall be placed in horizontal layers insofar as practical. Placing shall start at the low point and precede upgrade unless otherwise permitted by the Engineer. Concrete shall be placed in a continuous operation between construction joints and shall be terminated with square ends and level tops unless otherwise shown on the plans.

Concrete shall not be permitted to fall more than six (6) feet without the use of pipes or tremies. Pipes or tremies shall be at least six (6) inches in diameter, or the equivalent cross sectional area for rectangular sections. Concrete shall not be placed in horizontal members or sections until the concrete in the supporting vertical members or sections has been consolidated and a two- (2) hour period has elapsed to permit shrinkage to occur.

Concrete shall be thoroughly vibrated in a manner that will encase the reinforcement and inserts, fill the forms, and produce a surface or even texture free of rock pockets and excessive voids.

Structural concrete, except slope paving steeper than one (1) inch per foot, such as spillway aprons and channel lining, and concrete placed under water, shall be consolidated by means of high frequency internal vibrators of a type, size, and number approved by the Engineer. The location, manner, and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete without separation of the mortar and coarse aggregate,

and without causing water or cement paste to flush to the surface. Internal vibrators shall not be held against the forms or reinforcing steel.

The number of vibrators employed shall be sufficient to consolidate the concrete within fifteen (15) minutes after it has been deposited in the forms. At least two (2) vibrators in good operating condition shall be available at the site of the structure in which more than twenty-five (25) cubic yards of concrete is to be placed.

**7.1.3.6 Joints.** The work shall be so prosecuted that construction joints will occur at designated places shown on the plans unless otherwise authorized by the Engineer. The contractor shall construct, in one continuous concrete placing operation, all work compromised between such joints. Joints shall be kept moist until adjacent concrete is placed.

All construction joints having a keyed, stepped, or roughened surface shall be cleaned prior to placement of the adjacent concrete as directed by the Engineer.

Three fourths (3/4) inch expansion and contraction joints for cast-in-place concrete structures shall be constructed at a minimum distance between joints of fifty (50) feet, and in no case shall exceed seventy five (75) feet. No reinforcement shall be extended through the joints, except where specifically noted or detailed on the plans.

No direct payment will be made for furnishing and placing asphaltic paint, pre-molded asphaltic filler, or other types of joint separators. The cost, therefore, shall be included in the price bid for the item of work of which they are a part.

**7.1.3.7 Cold Weather Requirements.** Whenever the temperature of the surrounding air is below 40 degrees F within the 24-hour period after concrete operations, concrete placed in the forms shall have a temperature of between 50 degree and 90 degree F. All concrete shall be maintained at a temperature of no less than 50 degrees F for at least 72 hours or for as much time as is necessary to ensure proper curing of the concrete. The housing, covering, or other protection used in connection with curing shall remain in place and intact at least twenty-four (24) hours after the artificial heating is discontinued. No dependence shall be placed on salt or other chemicals for the prevention of freezing. Contractor will be held responsible for any damage to concrete as a result of cold weather operations. No concrete will be placed on a bridge superstructure when the air temperature is less than 40 degrees F.

**7.1.3.8 Finishing.** The top surfaces of structures shall be struck off with a straight edge and finished with a wood or aluminum float. As soon after the completion of the specified finishing operations as the condition of the concrete will permit without danger of consequent damage thereto, all exposed surfaces shall either be covered with burlap or sprayed with white pigmented membrane curing compound conforming ASTM designation 309, type 2. Forms shall be removed between four (4) and twelve (12) hours after concrete placement and all exterior form ties shall be removed to a depth of one (1) inch below the surface, all fins caused by forms, joints, and other projections shall be removed, and all pockets cleaned and filled with mortar. All exposed surfaces shall then be wetted and hand rubbed with a rubber float using a sand and cement mixture to obtain a smooth and uniform texture as directed by the Engineer.

**7.1.3.9 Backfilling.** Structures which lie within the area to be paved, or within two (2) feet of the back of curb shall be backfilled with granular material meeting the requirements of bedding material specified hereinbefore. Backfill not within two (2) feet of the paving area may be clean earth. Bedding material shall be placed and thoroughly compacted. Earth backfill shall be placed in accordance with the requirements specified in Chapter V of these specifications for pipe backfilling.

**7.1.3.10 Removal of Forms.** Forms shall remain in place until, in the opinion of the Engineer, it is safe to remove them. On structures such as box culverts, forms shall not be removed until the concrete has attained a strength of 3,000 pounds per square inch. In determining the time for removal of forms, consideration shall be given to the location and character of the structure, the weather and other conditions influencing the setting of the concrete, and the requirements for curing and finishing.

**7.1.4 Basis of Payment.** The concrete structures specified herein will be paid for at base price per cubic yard of concrete as per plan dimensions and will include all labor, equipment, materials, excavation, backfill, forms, reinforcement, except castings, as per drawings and specifications to complete the structure in place.

Special castings used in these structures will be paid for as provided in the contract documents or special provisions.

## 7.2 MANHOLE ADJUSTMENTS

**7.2.1 Scope of Work.** The work shall consist of the adjustment of sanitary sewer and storm sewer manhole frames and structures within the construction area to the lines and grades shown on the plans or as established by the Engineer.

**7.2.2 Materials.** The following materials may be used in adjusting the grade of the manhole tops:

- A. Precast Reinforced Concrete (Adjustment Rings)
- B. Manhole sections per ASTM designation C478
- C. Preformed Flexible Joint Material per AASHTO designation M-198

**7.2.3 Construction Methods.** The grade of a manhole may be raised a maximum of twelve (12) inches by removing the frame and building up with precast concrete or HDPE adjustment rings as prescribed in section 4.3.2 for manhole adjustment rings. The frame shall be reset in preformed flexible joint material. Where required to raise the grade of a manhole more than one (1) foot, the contractor shall be required to remove the cone section of the manhole, add a barrel section approximately the height of the grade change, and replace the cone section and necessary adjustment rings, etc. as directed by the Engineer. See section 4.3.2 for manhole adjustment rings.

Where it is required to lower the grade, (unless there is a sufficient height of precast concrete adjustment rings in place above the cone section which can be removed) the cone section and a sufficient number of barrel sections shall be removed and the cone section replaced or changed as directed by the Engineer. Reconstruction of the manhole shall be in accordance with applicable requirements of Sanitary Sewer Construction in Chapter 4 of these Specifications.

The existing manhole ring and lid shall be removed and placed in a location designated by the Inspector and become the property of the City. A new standard manhole Type A ring and lid shall be installed on the manhole as a part of the adjustment.

**7.2.4 Basis of Payment.** Manhole adjustments for sanitary sewer manhole frames and covers shall include all labor, equipment, material, including new ring and lid, and excavation, to complete the adjustments to the lines and grades shown on the plans or as established by the Engineer.

### **7.3 ADJUSTMENT OF DOWNSPOUT DRAINS**

**7.3.1 Scope of Work.** The work shall consist of reconnecting existing downspout drains now located in the existing curb into and through the proposed curb or curb and gutter.

**7.3.2 Material.** In general, the relocated drains shall be of the same diameter as the existing drains. Wherever practical, existing drains shall be re-laid.

**7.3.3 Construction Methods.** Existing drains are indicated on the plans. The contractor shall exercise care while removing existing curb and excavating between existing curb and new curb or curb and gutter not to damage existing drains. The Engineer in the field shall determine the location of the removal to ensure proper drainage. Usable drain pipe removed shall be cleaned. Existing concrete drains with steel covers shall be removed to the locations indicated by the Engineer and all material disposed of outside of the right-of-way.

Specification for relaying existing or new drains shall conform to specifications included in Chapter V of these specifications. Drain tile shall be poured in place in proposed curb or curb and gutter at locations indicated by the Engineer.

**7.3.4 Method of Measurement.** Measurement of downspout drains will be to the nearest foot or as specified in the contract documents.

**7.3.5 Basis of Payment.** Downspout drains shall be paid on a lineal foot basis for all pipe removed and replaced or adjusted at the direction of the Engineer, or as shown on the plan. This shall include all labor, equipment, and material necessary to remove and replace or adjust the downspout drain.

#### **7.4 ADJOINING STREETS AND ALLEYS**

All roadways adjacent to the new construction shall be graded for a satisfactory connection with slopes not greater than one (1) foot vertical to fifteen (15) feet horizontal, unless otherwise authorized by the Engineer. All approaches or connections shall be smoothly finished and present a good appearance and provide for proper drainage.

#### **7.5 STONE RIPRAP FACING**

Stone riprap facing shall be of such shape as to form a stable protection of the required section.

Stone shall be sound, durable, hard, resistant to abrasion, and free from laminations, weak cleavage planes, and the undesirable effects of weathering. It shall be of such character that it will not disintegrate from the action of air, water, or the conditions to be met in handling and placing. All materials shall be clean and free from deleterious impurities, including alkali, earth, clay, refuse, and adherent coatings.

Each piece of facing stone shall have its greatest dimension not greater than three (3) times its least dimension and shall have an apparent specific gravity not less than 2.2 according to ASTM C127.

Each load of stone shall be reasonably well graded from the smallest to the maximum size specified. Control of grading shall be by visual inspection. Stones must be placed by hand to achieve proper placement and distribution.

The larger stones shall be well distributed, and the entire mass of stones shall be roughly graded to conform to the approximate distribution specified. The finished stonework shall be free from objectionable pockets of small stones and clusters of larger stones.

Rocks shall be placed with the longitudinal axis normal to the alignment of the embankment face, and each rock should have a three-point bearing. No rock shall be dependent upon an overlying rock to hold it in place nor shall any rock be dependent upon chinking with smaller rocks to hold it in a temporary stable position.

Unless otherwise indicated in the plans or specifications, the stone shall be shot rock with a maximum size of twenty-four (24) inches, chinked rock shall be no smaller than four (4) inches in diameter and the maximum depression in any face will be six (6) inches. The stone shall be even graded between four (4) inches and twenty four (24) inches.

## 8 PORTLAND CEMENT CONCRETE CURB AND GUTTER

### 8.1 CURB AND GUTTER

**8.1.1 Scope of Work.** Furnish all labor, materials, and equipment to perform all operations in connection with construction of concrete curb and gutter, in accordance with the specifications and drawings, subject to the terms and conditions of the contract.

#### 8.1.2 Materials.

**8.1.2.1** Class “A” concrete shall be Portland Cement Concrete in accordance with Chapter 6 of these specifications. Admixtures shall not be used unless specifically approved by the Engineer.

**8.1.2.2** Expansion joints shall be made with preformed expansion joint filler of a non-extruding type conforming to ASTM Designation D1751, configuration of the curb and gutter as indicated in Standard Drawing ST-2 included in these specifications.

**8.1.2.3** Joint sealing compound for contraction joints shall be one of the following:

1. Cold pour polymer fortified crack fill material generally conforming with ASTM D-1190, approved by the Engineer; or
2. Hot pour polymer rubber asphalt sealer meeting the requirements of ASTM D-3405. A certification will be required from the Contractor certifying that the joint sealer meets this specification.

**8.1.2.4** Concrete curing compound shall conform to Chapter 6.5 of these specifications.

#### 8.1.3 Method of Construction.

**8.1.3.1** Forms shall be made of metal and shall have a depth equal to or greater than the prescribed edge thickness of the pavement slab. The minimum length of each section of form used shall be ten (10) feet. Each section or form shall be uniform and free from undesirable bends or warps.

The maximum deviation of the top surface of any section shall not exceed one-eighth (1/8) inch, or the inside face not more than one-fourth (1/4) inch from planned alignment. The method of connection between sections shall be such that the joint thus formed shall be free from movement in any direction. Forms shall be of such cross-section and strength and so secured as to resist the pressure of the concrete when placed, and the impact where placed, and the impact and vibration of any equipment which they support, without springing or settling.

Every ten (10) foot length of form shall have at least three (3) form braces and pin sockets which shall be spaced at intervals of not more than five (5) feet, having the end brace and socket not

more than six (6) inches from the end of the form. Approved flexible forms shall be used for construction where the radius is 150 feet or less.

The subgrade under the forms shall be compacted and cut to grade so that the form when set will be uniformly supported for its entire length at the specified elevation. Forms shall be joined neatly and in such a manner that the joints are free from play or movement in any direction. The supply of forms shall be sufficient to permit their remaining in place for at least twelve (12) hours after the concrete has been placed. All forms shall be cleaned and oiled prior to use.

The alignment and grade elevations of the forms shall be checked by the Contractor and the necessary corrections made immediately before placing the concrete. When any form has been disturbed or any subgrade thereunder has become unstable, the form shall be reset and rechecked.

**8.1.3.2 Placing concrete.** The subgrade shall be moist, but not muddy, at the time of placing of the concrete. If required by the Engineer, the prepared subgrade shall be saturated with water the previous night, or not less than six (6) nor more than twenty (20) hours prior to placing the concrete. If the subgrade subsequently becomes too dry, it shall be sprinkled again ahead of placing the concrete, in such a manner as not to form mud or puddles of water.

Contractor shall give the Engineer at least eight (8) hours advance notice before placing concrete and the subgrade shall be checked and approved by the Engineer before any concrete is placed.

The concrete shall be mixed in quantities required for immediate use and shall be deposited on the subgrade to the required depth and width of the curb and gutter in successive batches and in a continuous operation without the use of intermediate forms or bulkheads. The concrete shall be placed as uniformly as possible in order to minimize the amount of additional spreading necessary. While being placed, the concrete shall be vibrated with suitable tools so that the formation of voids or honeycomb pockets is prevented.

The concrete shall be especially well vibrated and tamped against the forms and along all joints. Care shall be taken in the distribution of the concrete to deposit a sufficient volume along the outside form lines so that the curb section can be consolidated and finished simultaneously with the slab.

No concrete shall be placed around manholes or other structures until they have been adjusted to the required grade and alignment.

**8.1.3.3 Finishing.** The curb shall be tooled to the required radii as soon as possible after the concrete takes its initial set. The gutter shall be shaped with a wood float at least four (4) feet long. After the face forms and templates are removed the joints shall be tooled and the surface shall be final finished with a hard bristle broom to remove all imperfections without additional mortar or dryer. In all cases the resulting surface shall be smooth and of uniform color, free from sags, twists, or warps, and true to the specified lines and grades shown on the plans.

#### **8.1.3.4 Joints.**

**8.1.3.4.1** Expansion joints shall be formed with bituminous preformed expansion joints three-quarter (3/4) inch thick or as specified on the plans and precut to exact cross section of curb and shall be placed at all driveway radii and intersection radii and at intervals of not more than five hundred (500) feet, and at the location shown on the plans or standard drawings, so that they are not moved by depositing and compacting the concrete at these joints. Preformed expansion joint filler shall be of non-extruding type and shall conform to ASTM Designation D1751.

**8.1.3.4.2** Contraction joints shall be sawed or formed with templates at intervals not greater than twenty five (25) feet and at locations shown on the plans or standard drawings. The joint shall be sawed one and one half (1 ½) inches deep. Contraction joints in proposed medians shall match the locations of the joints in the pavement. A template shall be one-quarter (1/4) inch thick, cut to the configuration of the curb section shown on the plans. Templates shall be secured so that they are not moved by depositing and compacting the concrete. As soon as the concrete has hardened sufficiently, the templates shall be removed from all contraction joints. The edges of the joint shall be rounded with an edging tool of one-eighth (1/8) inch radius. Asphaltic material used in filling these joints shall be as follows:

**8.1.3.4.2.1 Hot pour polymer rubber asphaltic sealer.** Immediately before applying the joint sealer, all loose debris, dust, and moisture shall be removed from the joint with filtered and dry compressed air at a minimum pressure of 80 psi. Any excess sealer shall be removed from the pavement immediately after sealing. The specified sealer requires a special pot and the recommended pour temperature is 390 degrees F. This material shall conform to ASTM D3405 and a certification shall be required from the Contractor certifying the joint sealer meets this specification. The City reserves the right to inspect and evaluate the equipment that will be used to perform this operation; or

**8.1.3.4.2.2 Cold pour polymer fortified crack fill material.** Immediately before applying the joint sealer, all loose debris, dust, and moisture shall be removed from the joint with filtered, dry compressed air at a minimum pressure of 80 psi. Fill each joint with sealer slightly above the pavement surface (some shrinkage will occur). Allow sealant to cure two (2) to twelve (12) hours. Do not apply sealer if ambient temperature is below 50 degrees F. This material shall generally conform to ASTM D-1190 and a certification shall be required from the Contractor certifying the joint sealer meets this specification.

**8.1.3.5 Curing.** The application of curing compound shall be in accordance with Chapter 6.5 of these Specifications.

**8.1.3.6 Cold Weather Protection.** Cold weather protection shall be as provided in Section 6 of these specifications.

**8.1.3.7 Curb and Gutter.** Curb and gutter laid by slip-form or extruding equipment will be accepted providing it complies with all of the above requirements other than forms.

**8.1.3.8 Backfilling.** After curing, the curb shall be immediately backfilled to within four (4) inches of the top of the curb to eliminate any possibility of washing beneath the curb. The remaining four (4) inches shall be topsoil.

**8.1.4 Method of Measurement.** Final Measurement will be made to the nearest lineal foot of acceptable Portland Cement Concrete curb and gutter in place.

**8.1.5 Basis of Payment.** Payment for concrete curb and gutter shall be on a lineal foot basis and include all labor, materials and equipment necessary for the completion of the concrete curb and gutter in place including backfilling and grading.

## **9 PORTLAND CEMENT CONCRETE PAVEMENT AND INTEGRAL CONCRETE CURB**

### **9.1 PORTLAND CEMENT CONCRETE PAVEMENT**

**9.1.1 Scope of Work.** The work shall consist of furnishing all labor, materials, and equipment necessary to perform all operations in connection with construction of Portland Cement Concrete pavement, in accordance with the specifications and drawings, subject to the terms and conditions of the contract.

#### **9.1.2 Materials.**

**9.1.2.1** Class “A” Concrete shall be Portland Cement Concrete in accordance with Chapter 6 of these Specifications.

**9.1.2.2** Reinforcing steel, if specified by the plans, shall consist of deformed bars of grade 60 steel conforming to the requirements of ASTM Designation A615 or of wire fabric conforming to ASTM Designation A185.

**9.1.2.3** Expansion joints shall be preformed expansion joint fillers of a non-extruding type conforming to ASTM Designation D1751.

**9.1.2.4** Joint sealing compound for contraction and construction joints exceeding 1/8 inch in width shall be one of the following types of material.

- 1) Hot pour polymer rubber asphaltic sealer. Immediately before applying the joint sealer, all loose debris, dust, and moisture shall be removed from the joint with filtered and dry compressed air at a minimum pressure of 80 psi. Any excess sealer shall be removed from the pavement immediately after sealing. The specified sealer requires a special pot and the recommended pour temperature is 390 degrees F. This material shall conform to ASTM D3405 and a certification shall be required from the Contractor certifying the joint sealer meets this specification. The City reserves the right to inspect and evaluate the equipment that will be used to perform this operation; or
- 2) Cold pour polymer fortified crack fill material. Immediately before applying the joint sealer, all loose debris, dust, and moisture shall be removed from the joint with filtered, dry compressed air at a minimum pressure of 80 psi. Fill each joint with sealer slightly above the pavement surface (some shrinkage will occur). Allow sealant to cure two (2) to twelve (12) hours. Do not apply sealer if ambient temperature is below 50 degrees F. This material shall generally conform to ASTM D-1190 and a certification shall be required from the Contractor certifying the joint sealer meets this specification.

**9.1.2.5** Metal supports for tiebars or reinforcing bars shall be channel shaped pressed out of 12-gauge sheet steel or heavier or as shown on the plans.

**9.1.2.6** Dowel bars, where specified, for transverse joints shall be smooth, round bars of the size specified. Burrs, mill scale, and rust shall be removed. The free end shall be painted with a suitable paint followed by a thin uniform coating of graphite grease.

**9.1.2.7** Expansion tubes or dowel caps shall be manufactured from 32-gauge sheet metal, shall be indented to provide a limiting stop for the dowel bar, and shall provide unobstructed expansion space of not less than one (1) inch to permit movement of the dowel bar. They shall be of proper size to fit the specified bars tightly and the closed end shall be watertight.

**9.1.2.8** Concrete curing compound shall conform to Chapter 6.5 of these specifications.

### **9.1.3 Construction Methods.**

**9.1.3.1** Aggregate base shall be placed under all pavements in accordance with ST-1 and shall extend 1'-0" beyond the back of curbs or edge of pavement. The aggregate material shall be compacted to not less than 95% 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 one hundred sixteen (116) pounds per inch per square yard plus five (5) percent for moisture, whichever is smaller. All extra aggregate used under pavements shall be the Contractor's responsibility. Once aggregate is in place, the inspector will perform the necessary tests to ensure proper depth, if aggregate is less than in the required depth, then aggregate shall be removed and subgrade lowered to obtain the proper requirement. Concrete pavement will not be placed until aggregate subgrade is approved by the City.

**9.1.3.2** Forms shall be made of metal and shall have a depth equal to or greater than the prescribed edge thickness of the pavement slab. The minimum length of each section of form used shall be ten (10) feet. Each section of form shall be uniform and free from undesirable bends or warps.

The maximum deviation from planned grade of the top surface of any section shall not exceed one-eighth (1/8) inch, or the inside face not more than one-fourth (1/4) inch from planned alignment. The method of connection between sections shall be such that the joint thus formed shall be free from movement in any direction. Forms shall be of such cross-section and strength and so secured as to resist the pressure of the concrete when planed, and the impact when planed, and the impact and vibration or any equipment which they support, without springing or settlement.

Each ten (10) foot length of form shall have at least three (3) form braces and pin sockets which shall be spaced at intervals of not more than five (5) feet, having the end brace and socket not more than six (6) inches from the end of the form. Approved flexible forms shall be used for construction where the radius is 150 feet or less.

The subgrade under the forms shall be compacted and cut to grade so that the form when set will be uniformly supported for its entire length at the specified elevation. Forms shall be joined neatly and in such a manner that the joints are free from play or movement in any direction. The supply of forms shall be sufficient to permit their remaining in place for at least twelve (12) hours after the concrete has been placed. All forms shall be cleaned and oiled prior to use.

The alignment and grade elevations of the forms shall be checked by the Contractor and the necessary corrections made immediately before placing the concrete. When any form has been disturbed or any subgrade thereunder has become unstable, the form shall be reset and rechecked.

**9.1.3.3 Placing Concrete.** The subgrade shall be moist, but not muddy, at the time of the placing of the concrete. If required by the Engineer, the prepared subgrade shall be saturated with water the previous night, or not less than six (6) nor more than twenty (20) hours prior to placing the concrete. If the subgrade subsequently becomes too dry, it shall be sprinkled again ahead of placing the concrete, in such a manner as not to form mud or puddles of water.

Contractor shall give the Engineer at least eight (8) hours advance notice before placing concrete and the subgrade shall be checked and approved by the Engineer before any concrete is placed.

The concrete shall be mixed in quantities required for immediate use and shall be deposited on the subgrade to the required depth and width of the construction lane in successive batches and in a continuous operation without the use of intermediate forms or bulkheads. The concrete shall be placed as uniformly as possible in order to minimize the amount of additional spreading necessary. While being placed, the concrete shall be vibrated with suitable tools so that the formation of voids or honeycomb pockets is prevented.

The concrete shall be well vibrated and tamped against the forms and along all joints. Care shall be taken in the distribution of the concrete to deposit a sufficient volume along and outside form lines so that the curb section can be consolidated and finished simultaneously with the slab.

No concrete shall be placed around manholes or other structures until they have been adjusted to the required grade and alignment.

**9.1.3.4 Consolidating and Finishing.** The pavement shall be struck off and consolidated with mechanical finishing machine or by hand-finishing methods. When a mechanical finishing machine is used, the concrete shall be struck off at such a height that after consolidation and final finishing it shall be at the elevations as shown on the plans. A depth of excess concrete shall be carried in front of the strike-off screed for the full width of the slab, whenever the screed is being used to strike off the pavement. The finishing machine shall be provided with a screed, which will consolidate the concrete by pressure. The concrete shall, through the use of this machine, be brought to a true and even surface, free from rock pockets, with the fewest possible number of passes of the machine. The edge of the screeds along the curb line may be notched out to allow for sufficient concrete to form the integral curb. Hand-finishing tools shall be kept available for use in case the finishing machine breaks down.

When hand finishing is used, the pavement shall be struck off and consolidated by a vibrating screed or other approved equipment to the elevation shown on the plans. The vibrating screed must be approved by the Engineer, prior to placement of concrete. When the forward motion of the vibrating screed is stopped, the vibrator shall be shut off and not be allowed to idle on the concrete. Internal mechanical vibration shall be used alongside all formed surfaces. Vibration operation shall be completed prior to final hand finishing.

**9.1.3.5 Floating, Straightening, and Edging.** After the concrete has been struck off and consolidated, it shall be further smoothed by means of a wood or aluminum float at least five (5) feet wide with a handle long enough to reach the entire width of the slab being placed. The float shall be operated so as to remove any excess water and laitance, as well as surface irregularities. After the floating operation, the pavement surface should be within the specified tolerances.

While the concrete is still plastic, the slab surface shall be tested for smoothness with a ten (10)-foot straight edge swung from handles three (3) feet longer than one-half the width of the slab. The straight edge shall be placed on the surface parallel to the centerline of the pavement and at not more than five (5)-foot intervals transversely. After each test, the straight edge shall be moved forward one half its length and the operation repeated. When irregularities are discovered, they shall be corrected by adding or removing concrete. All disturbed places shall again be floated with the wooden float and again straight edged. The pavement surface shall have no depression in which water will stand. Before final finishing is completed and before the concrete has taken its initial set, the edges of the slab and curb shall be carefully finished with an edger of the radius shown on the plans.

**9.1.3.6 Final Surface Finish.** A broom finish shall be used as the final finishing method. A hard bristle broom shall be used, which shall be kept clean and used in such a manner as to provide a uniform texture surface. The curb shall have the same final finish as the pavement.

The final surface of the concrete pavement and curb shall have a uniform gritty texture free from excessive roughness and true to the grades and cross section shown on the plans. The Engineer may require changes in the final finishing procedure as required to produce the desired final surface texture.

**9.1.3.7 Joints.** Longitudinal and transverse joints shall be constructed as shown on the plans or standard drawings.

Longitudinal joints are those joints parallel to the lane of construction. They may be either center joints or the construction joints between construction lanes.

Transverse joints shall be contraction joints or construction joints. Construction joints are put in transversely whenever construction operations require them.

Expansion joints may be either longitudinal or transverse. They are used only where specifically shown on the plans or standard drawings.

The edges of the pavement and those joints where such edging is shown on the plans shall be rounded with an edger having a radius of not larger than 1/8 inch. Transverse joints, except keyed and tied construction joints, shall be continuous across the entire paved area including the curb.

**9.1.3.7.1 Transverse Joints.** Transverse joints shall be contraction, expansion, or construction joints. Contraction and expansion joints shall be placed as indicated on the plans and construction joints wherever construction may require them. They shall make a right angle with the centerline of the pavement and with the surface of the subgrade.

Expansion joints shall be installed in accordance with the size and locations shown on the plans, and shall conform to the “Materials” requirements of these specifications. They shall extend the entire width and thickness of the pavement and shall conform to the exact configuration of the curb section. The filler shall be held accurately in place during the placing and finishing of the concrete by means of a bulkhead, a metal channel cap, or other approved methods.

Under no circumstances shall any concrete be left above or below the expansion material or across the joint at any point. Any concrete spanning the ends of the joint next to the forms shall be carefully cut away after the forms are removed.

Transverse contraction joint shall be of the sawed type, unless otherwise shown on the plans. Care must be taken to saw the joints soon after concrete placement to prevent contraction cracks. All transverse joints shall be sawed at least one third (1/3) of the slab depth. Any procedure for sawing joints that results in premature or uncontrolled cracking shall be revised immediately by adjusting the time interval between the placing of the concrete and the cutting of the joints.

Transverse construction joints of the type shown on the plans or standard drawings shall be placed wherever the placing of concrete is suspended for more than thirty (30) minutes. A butt-type joint with dowels shall be used if the joint occurs at the location of a contraction joint. Keyed joints with tiebars are used if the joint occurs at any other location.

If joints are to be equipped with dowels, they shall be of the dimension and the spacing and location indicated on the plans. They shall be firmly supported in place, and accurately aligned parallel to the pavement grade and the centerline of the pavement by means of a dowel support which will remain in the pavement and will ensure that the dowels are not displaced during construction. One-half of each dowel shall be painted and greased and in an expansion joint, one end shall be equipped with a tight-fitting expansion tube of the dimensions shown on the plans and conforming to the “Materials” requirements of these Specifications.

**9.1.3.7.2 Longitudinal Joints.** Longitudinal joints shall be placed as shown on the plans or standard drawings. They shall be of the sawed or the keyed construction type, unless otherwise shown on the plans.

Sawed longitudinal center joints shall be sawed grooves made with a concrete saw after the concrete has hardened. The saw cut shall be at least one third (1/3) of the slab depth. These

joints are otherwise formed in the same manner as the transverse sawed joints entitled “Transverse Contraction Joints.”

Longitudinal keyed construction joints (i.e., joints between construction lanes) shall be of the dimensions shown on the plans or standard drawings.

**9.1.3.7.3 Tiebars.** Tiebars or tiebolts when shown on the plans or standard drawings shall be of deformed steel and of the dimensions and at the spacing specified. Tiebars shall be firmly supported by subgrade chairs or so installed as not to be displaced during construction operation.

**9.1.3.7.4 Joint Sealer.** After the curing period, all sawed and tooled joints exceeding 1/8 inch in width in the pavement shall be cleaned and sealed as follows. Immediately before applying the joint sealer, all loose debris, dust, and moisture shall be removed from the joint with filtered and dry compressed air at a minimum pressure of 80 psi. Joints shall be lightly underfilled (about 1/2 inch) to prevent extrusion of sealer. Any excess material has to be removed from the pavement as soon after sealing as possible. The type of sealer used must be one of the sealer materials listed in the material section for joint sealing compound.

**9.1.3.8 Structures.** All manholes, catch basins, or structures of a permanent nature encountered in the area to be paved shall be raised or lowered as the case may be, to the surface of the new pavement, and the necessary expansion joint material placed around each structure for the full depth of the slab and of the thickness shown on the plans of standard drawings. Payment for this work shall be in accordance with Section VII of these specifications.

**9.1.3.9 Curing.** The application of curing compound shall be in accordance with Chapter 6.5 of these Specifications.

**9.1.3.10 Cold Weather Protection.** Cold weather protection shall be in accordance with Chapter 6 of these specifications.

**9.1.3.11 Tolerance in Pavement Thickness.** It is the intent of these specifications that pavement shall be constructed strictly in accordance with the thickness shown on the plans. The thickness of the pavement will be measured, and where any pavement is found deficient in thickness, it may be compensated for at an adjusted unit price or shall be removed and replaced.

The thickness of the pavement will be determined by average caliper measurement of cores. For the purpose of determining the constructed thickness of the pavement, 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-quarter (1/4) 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 pavement thickness for a distance extending one-half (1/2) 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.

The drilling of cores in irregular areas, or on projects involving less than 2,500 square yards of concrete pavement, may be waived by the Engineer. In this case the designed thickness will be considered as the measured thickness.

**9.1.3.12 Pavement Smoothness.** This work shall consist of measuring the smoothness of the final pavement surface for all mainline paving and turning lanes.

**9.1.3.12.1 Longitudinal Straightedging.** Longitudinal Straightedging shall be measured using a 10-foot straightedge. The straightedge path in the longitudinal direction shall be parallel to the centerline and located three feet from the outside edge of the driving lane. Additional paths with suspected roughness may be selected at the Engineer's discretion. Any variations in the longitudinal direction exceeding 1/8 inch in 10 feet shall be marked for correction.

**9.1.3.12.2 Transverse Straightedging.** The Engineer shall randomly check driving lanes for variations in the transverse direction with a 4-foot straightedge. Any variations in the transverse direction more than 1/4 inch shall be marked for correction.

**9.1.3.12.3 Method of Correction.** Corrective action to smooth the pavement shall be accomplished by a method approved by the Engineer. Diamond grinding may be used for bumps, but the use of an impact device, such as a bush hammer or milling machine, will not be permitted. Total grinding depth shall be limited to 1/4 inch. The final surface texture of corrected pavement shall be comparable to adjacent sections that do not require correcting. Satisfactory longitudinal grinding is acceptable as the final surface of the corrected pavements. The cost of correcting the smoothness and associated traffic control shall be at the Contractor's expense.

**9.1.3.13 Protection and Opening to Traffic.** The Contractor shall protect the pavement against all damage prior to final acceptance of the work by the Engineer. Traffic shall be excluded from the pavement by erecting and maintaining barricades and signs for at least seven (7) days, or until the concrete pavement achieves a strength of 3,000 pounds per square inch.

**9.1.3.14 Paving by Slip Form.** Slip-forming equipment will be accepted providing it produces a paving operation in compliance with all the foregoing requirements other than forms.

**9.1.4 Method of Measurement.** Final measurement will be made to the nearest 1/10 square yard for acceptable concrete pavement in place.

### **9.1.5 Basis of Payment.**

Concrete pavement without integral curb shall be paid on a square yard basis and shall not include any curb or gutter. Curb and gutter shall be paid as a separate item.

Concrete pavement with integral curb shall be paid on a square yard basis and shall be measured to the face of the curb. Integral curb shall be paid as a separate item.

Concrete pavement shall include all labor, equipment, and materials necessary for the completion of the pavement in place including excavation, backfill, grading, smoothness testing, and all other work incidental to the completion of the street.

If any core measurement is deficient, the Director of Public Works shall have the option of requiring removal and replacement of the pavement at the Contractor’s expense or requiring the Contractor to leave the deficient pavement in place and requiring the following deductions in payment.

Deficiency in Thickness	Deduction Percent of Contract Unit Price
0 – ¼ inch	None
Over ¼” and not over ½”	20
Over ½” and not over ¾”	50
Over ¾” and not over 1”	100

The above deductions will be applied to a section of pavement twenty five (25)-feet long and extending from the edge of the pavement to a longitudinal joint in that section of pavement in which the deficient measurement was found. Deductions for deficient thickness or damaged pavement will be entered on any estimate after the information becomes available.

If removal of the payment 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.

**9.1.6 Deficient Pavement on Private Projects.** Prior to acceptance of private projects by the City, cores will be taken to determine pavement thickness. If the pavement is found to be deficient in thickness, the Director of Public Works has the option of requiring removal of the entire deficient pavement or having the Contractor or Developer remit to the City an amount equal to the value of the deduction shown in the Deficiency in Thickness table 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.

**9.2 INTEGRAL CURB**

**9.2.1 Scope of Work.** The work shall consist of furnishing all labor, materials, and equipment necessary to construct integral curbs in accordance with the plans and specifications. Integral curbs shall be required along the edges of all street pavement as indicated on the plans, except at such location as the Engineer may direct. Depressed curbs shall be provided at all driveway entrances and sidewalks shown on the plans.

### **9.2.2 Materials.**

**9.2.2.1** Class “A” Concrete shall be Portland Cement Concrete in accordance with Chapter VI of these Specifications.

**9.2.2.2** Expansion joints shall be preformed expansion joint fillers of a non-extruding type conforming to ASTM Designation D1751.

**9.2.2.3** Joint sealing compound for contraction and construction joints shall be one of the following types of material.

- 1) Hot pour polymer rubber asphaltic sealer. Immediately before applying the joint sealer, all loose debris, dust, and moisture shall be removed from the joint with filtered and dry compressed air at a minimum pressure of 80 psi. Any excess sealer shall be removed from the pavement immediately after sealing. The specified sealer requires a special pot and the recommended pour temperature is after sealing. The specific sealer requires a special pot and the recommended pour temperature is 390 degrees F. This material shall conform to ASTM D3405 and a certification shall be required from the Contractor certifying the joint sealer meets this specification. The City reserves the right to inspect and evaluate the equipment that will be used to perform this operation; or
- 2) Cold pour polymer fortified crack fill material generally conforming with ASTM D-1190 approved by the Engineer. This material will have some shrinkage so crack must be slightly overfilled so that when cured in two (2) to twelve (12) hours, the result is about 1/2 to 1/4 of an inch underfilled.

A certification is required from the Contractor certifying that the joint sealer meets this specification and is reasonable for its condition up to six (6) months after acceptance of projects.

**9.2.2.4** Concrete curing compound shall conform to Chapter 6.5 of these specifications.

### **9.2.3 Construction Methods**

The integral curb shall be constructed immediately following the finishing operation unless otherwise shown on the plans. Special care shall be taken so that the curb construction does not lag the pavement construction and form a “Cold Joint.”

Metal curb forms shall be required to form the backs of all curbs except where street returns of small radius or other special sections make the use of steel forms impractical.

In placing curb concrete, sufficient vibrating shall be done to secure adequate bond with the paving slab and eliminate all voids in the curb.

Curbs shall be formed to the cross section as shown on the drawings with a mule or templates supported on the side forms and with a wood float not less than four feet in length.

The finished surface of the curb and gutter shall be checked by the use of the ten (10)-foot straight edge and corrected if necessary. Where grades are flat and while the concrete is still plastic, the Engineer may require the Contractor to check the drainage at the gutter by pouring water at the gutter summit and observing its flow to the inlet. In order to prevent damage to the concrete surface, water should be poured into a piece of impervious paper or plastic.

In the construction of transverse joints of concrete integral curb pavement, special care must be taken to see that all transverse joints extend continuously through the pavement and curb.

**Joint Sealer.** After the curing period, all sawed and dummy groove joints in the pavement shall be cleaned and sealed as follows: Immediately before applying the joint sealer, all loose debris, dust, and moisture shall be removed from the joint with filtered and dry compressed air at a minimum pressure of 80 psi. Joints shall be lightly underfilled (about ½ inch) to prevent extrusion of sealer. Any excess material has to be removed from the pavement as soon after sealing as possible. The type of sealer used must be one of the sealer materials listed in the material section for Joint Sealing compound.

**9.2.4 Method of Measurement.** Final measurement will be made to the nearest lineal foot of acceptable integral concrete curb in place.

**9.2.5 Basis of Payment.** Payment for integral concrete curb shall be on a lineal foot basis and include all labor, materials, and equipment necessary for the completion of the curb in place, including backfilling and grading.

## 10 SIDEWALKS AND DRIVEWAYS

**10.1 SCOPE OF WORK.** Sidewalks, sidewalk ramps, and driveways shall be constructed or reconstructed to the configuration, and to the lines and grades shown by the plans and generally after the curbing is constructed. Sidewalk ramp construction shall comply fully with all requirements in the most current ADA Standards for Accessible Design and the Public Right of Way Accessibility Guidelines (PROWAG).

### 10.2 MATERIALS

**10.2.1 Concrete Mix.** Sidewalks and driveways are to be constructed using a minimum of 28-day 4,000-psi Portland cement concrete in accordance with Chapter 6 of these General Conditions and Technical Specification.

**10.2.2 Expansion Joints.** Expansion joints shall be made with 1/2-inch thick bituminous preformed expansion joint filler of a non-extruding type conforming to ASTM Designation D1751, for the full depth of the concrete and precut to the width of the sidewalk.

**10.2.3 Joint Sealer.** Joint sealer is generally not required unless shown on the plans.

**10.2.4 Reinforcement.** Reinforcement is only required when shown on the plans.

**10.2.5 Curing Compound.** Concrete curing compound shall conform to Chapter 6.5 of these specifications.

**10.2.6 Detectable Warning Tiles.** Detectable warning surfaces and their components shall be manufactured and/or supplied in a red color homogenous throughout the tile and matching the pattern shown in standard drawing ST-12 with a slip resistance surface, such as that manufactured by “Amor-Tile” or its equivalent.

### 10.3 CONSTRUCTION METHODS

**10.3.1 Removal.** Existing sidewalks, sidewalk ramps or driveways shall be totally removed to the nearest contraction or isolation joint, unless otherwise specified by the Engineer. Any partial section removal shall be saw cut full depth. The curb and gutter section in front of a driveway (radius point to radius point) shall be saw cut full depth and removed before the driveway is constructed. Any curb and gutter broken or cracked outside the radius points during this removal and or reconstruction shall also be removed and replaced accordingly. Any damage to the existing street shall be the responsibility of the Contractor.

**10.3.2 Grading and Subgrade Preparation.** All excavation or embankment required in the grading and subgrade preparation shall be unclassified and cleared in accordance with Chapter 3 – Earthwork.

**10.3.2.1 Embankment material** and placement shall be in accordance with Chapter 3 – Earthwork.

**10.3.2.2 Subgrade.** The top 6 inches of the subgrade shall be compacted to obtain a density of 95 percent of maximum before a minimum of 4 inches of compacted Type 1, Type 5, or Type 7 aggregate is placed.

**10.3.3 Forms.** All forms shall be in good condition, clean, and free from imperfections. Each form shall not vary more than ¼ inch in horizontal or vertical alignment for each 10 feet in length.

**10.3.3.1 Material and Size.** Forms shall be made of metal unless otherwise approved by the Engineer and shall have a height equal to or greater than the depth of the sidewalk or driveway being constructed.

**10.3.3.2 Strength.** Forms shall be of such cross-section and strength, and so secured as to resist the pressure of the concrete when struck off, vibrated, and finished, and the impact and vibration of any equipment, which they may support.

**10.3.3.3 Installation.** The forms shall be set true to line and grade, supported through their length and joined neatly in such a manner that the joints are free from movement in any direction.

**10.3.3.4. Preparation.** Forms shall be cleaned and lubricated prior to each use and shall be so designed to permit their removal without damage to the new concrete.

**10.3.4 Slip-Form Machine.** A slip-form machine may be used in lieu of forms. The machine must be equipped with mechanical internal vibrators and be capable of placing concrete to the correct cross section, line and grade within the allowable tolerances.

**10.3.5 Joints.** Unless directed by the Engineer the joints shall be formed at right angles to the alignment of the sidewalk and driveway and to the configuration specified by the plans or standard drawings.

**10.3.5.1 Sidewalk Joint Patterns.** Sidewalk surfaces shall be marked using a grooving tool to form the control joint; the groove shall not be wider than ¼ inch and edged with a 1/8-inch radius with a transverse joint spaced at a distance equal to the width of the sidewalk. Longitudinal joints spaced not less than 30 inches not more than 60 inches with transverse joints spaced to form a square pattern shall divide sidewalks greater than 6 feet in width. Edger tool marks shall remain showing unless the sidewalk is slip-formed and subsequently sawed. Curb joints should align with sidewalk joints where they abut.

**10.3.5.2 Driveway Joint Patterns.** In general, no driveway slab dimension shall exceed 10 feet without a joint, although widths no more than 24 times the slab thickness will be permitted to match existing joint patterns.

**10.3.5.3 Expansion Joints.** Expansion joints shall be placed at a minimum of every 100' feet or as directed by the Engineer. The preformed isolation joint material shall be left ½ inch below the surface to allow for the application of joint sealer in accordance with Chapter 6 – Portland Cement Concrete Pavement. The isolation joints shall be secured in a manner so depositing and consolidating the concrete will not disturb them and rounded with an edging tool of ¼ inch radius.

**10.3.5.4 Control Joints.** Joints are to be constructed such that they shall extend to ¼ the depth of the sidewalk. If a grooving tool is used to form the control joint, the groove shall not be wider than ¼-inch and edged with a 1/8-inch radius. If the control joints are sawed, the groove shall not be less than 1/8-inch wide. Joint sealer is not required.

**10.3.6 Concrete Work.** Deposit and consolidate concrete as close to the final position as possible, beginning at one corner of the forms. Perform necessary hand spread with shovels or come-along, not with rakes or vibrators. Do not walk in the fresh concrete with boots or shoes coated with earth or foreign substances. When concrete is placed on a sloped surface, begin concrete placement at the lowest area.

**10.3.6.1 Finishing.** Strike off the concrete with a vibratory or a hand strike-off method when adequate consolidation is attained. Immediately after strike-off, the concrete may be bullfloated to remove any high or low spots. Minimize the use of the bullfloat. Do not finish concrete with water standing on the surface. All edges of the slab shall be carefully finished with a ¼ inch radius edger. After finishing the surface of the concrete shall be broomed perpendicular to the traffic flow with a fine clean broom to provide an antiskid surface, and the edges and joints retooled. In all cases the finished sidewalk and driveway shall have a true surface, free from sags, twists, or wraps, and shall have a uniform color and appearance.

**10.3.6.2 Curing.** The application of curing compound shall be in accordance with Chapter 6.5 of these Specifications.

**10.3.6.3 Protection.** The Contractor shall protect the concrete work against damage or defacement of any kind until which is damaged or defaced, shall be removed and replaced or repaired to the satisfaction of the Engineer, at the expense of the Contractor.

**10.3.7 Backfill.** A minimum of 24 hours shall elapse before forms are removed and 5 days shall elapse or the concrete must have attained 75% of its 28-day compressive strength before pavement is backfilled unless otherwise approved by the Engineer. The Contractor shall be responsible for the removal of excess dirt, rock, broken concrete, splatters and overspray from the construction area within 10 days unless otherwise directed by the Engineer. The Contractor shall also be responsible for the repair of any street pavement disturbed by the construction.

**10.3.8 Surface Tolerances.** Sidewalks and driveways shall have a surface tolerance of ¼ inch in 10 feet when checked with a 10-foot straightedge. Vertical deflections at sidewalk joints shall not exceed ¼ inch.

**10.3.9 Detectable Warning Surfaces.** Detectable warning surfaces consisting of truncated domes aligned in a square grid pattern shall be provided where a curb ramp or landing connects to a crosswalk.

**10.3.9.1 Location.** The detectable warning surfaces shall be located so that the nearest edge is 6 inches minimum to 8 inches maximum from the face of the curb line and the far edge is no more than 5 feet from the back of the curb line. The detectable warning surface shall extend a minimum of 24 inches in the direction of travel and the full width of curb ramp.

**10.3.9.2 Dome Size.** Truncated domes shall have a diameter of 0.9 inch at the bottom, a diameter of 0.4 inch at the top, a height of 0.2 inch and a center-to-center spacing of 2.35 inches measured along diagonal of a square arrangement.

**10.3.9.3 Visual Contrast.** There shall be a minimum of 70 percent contrast in light reflectance between the detectable warning and the adjoining surface. The coloring shall be red and made an integral part of the detectable warning surface.

#### **10.4. METHOD OF MEASUREMENT**

**10.4.1 Sidewalks.** Sidewalks will be measured to the nearest tenth of a square foot.

**10.4.2 Sidewalk Ramps.** Sidewalk ramps including the detectable warning and flare portion of the ramp will be measured to the nearest tenth of a square foot. The gutter portion of the ramp will not be included as ramp area but paid as part of the curb and gutter.

**10.4.3 Driveways.** Driveways will be measured to the nearest tenth of a square foot. The gutter portion of the driveway will not be included as driveway area but paid as part of the curb and gutter.

#### **10.5 BASIS OF PAYMENT**

Furnish all labor, material, and equipment to perform all operations in connection with construction or reconstruction of concrete sidewalks, sidewalk ramps, and driveways. All items in this section will be paid for by the contract unit bid price.

## 11 PLANT MIX BITUMINOUS BASE AND PAVEMENT

### 11.1 GENERAL

**11.1.1 Description.** This work shall consist of a bituminous mixture placed, spread and compacted as shown on the plans or as directed by the Engineer.

### 11.2 MATERIAL

**11.2.1** The grade of asphalt binder shall be PG 64-22 or as specified in the Special Provisions. When the plasticity index on individual aggregate fractions with 10 percent or more passing the No. 30 sieve exceeds 3, a moisture susceptibility test shall be required during the mix design process. If the plasticity index exceeds that of the material approved for the mix design, additional testing may be required.

#### 11.2.2 Coarse Aggregate.

**11.2.2.1** All coarse aggregate shall consist of sound, durable rock, free from cemented lumps or objectionable coatings. The percentage of deleterious substances shall not exceed the following values and the sum of percentages of all deleterious substances shall not exceed 8.0 percent.

Deleterious Material	Percent by Weight
Deleterious Rock	8.0
Mud Balls and Shale Combined	2.0
Clay, uniformly dispersed	3.0
Other Foreign Material	0.5

The above requirements apply to combined aggregates during production when used in accordance with these specifications.

If a density requirement is specified for asphaltic concrete, the total quantity of chert in each size or fraction of produced crushed stone aggregate, including that permitted as deleterious, shall not vary by more than 10 percent from the quantity present in the aggregate used in the approved laboratory job mixtures.

Crushed stone shall be produced from rock of uniform quality. Rock tested from any combination of ledges shall meet the following criteria:

Property	Value
Los Angeles Abrasion, AASHTO T 96, percent loss, max.	55
Absorption, AASHTO T 85, percent, max.	4.5

**11.2.2.2** Gravel aggregate shall be washed sufficiently to remove any objectionable coatings and shall meet the following criteria:

Property	Value
Los Angeles Abrasion, AASHTO T 96, percent loss, max.	55
Absorption, AASHTO T 85, percent, max.	5.5

**11.2.2.3** Steel slag consisting primarily of a fused mixture of oxides and silicates shall be a synthetic aggregate produced as a by-product of the basic oxygen steelmaking process or electric arc steelmaking furnaces. The steel slag shall be aged at least three months after crushing and screening. Steel slag which has been previously crushed, screened, and aged three months will not be required to receive additional aging. Steel slag from one source shall not be blended with steel slag from a different source.

**11.2.2.4** The aggregate shall be in accordance with the following requirements for the grade specified in the Contract or Job Special provisions. If grade is not specified, any listed grade may be used.

		Percent Passing						
		Sieve Size						
Grade	Type of Material	3/4 in.	1/2 in.	3/8 in.	#4	#8	#30	#200
1	Crushed Stone or Porphyry	100	95 – 100	65 – 95	20 – 55	2 – 20	....	0 – 5
2	Gravel	100	95 – 100	....	40 – 80	15 – 50	0 – 30	0 – 5
3	Chat	100	95 – 100	....	45 – 85	30 – 60	0 – 30	0 – 5

**11.2.3 Fine Aggregate.** Fine aggregate for asphaltic concrete shall be a fine, granular material passing the 3/8-inch sieve, naturally produced by the disintegration of rock of a siliceous nature and/or manufactured by the mechanical reduction of sound durable rock. With written approval from the Engineer and compliance with this specification, chat sand produced from flint chat in the Joplin area, dolomite chat as produced in the southeast lead belt area, fines manufactured from igneous rock, 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 and shale	1.0
Total lightweight particles, including coal and lignite	0.5
Other deleterious substances	0.1

The total lightweight particle requirement will not apply to wet bottom boiler slag, angular chert sand or manufactured sand.

**11.2.4 Mineral Filler.** Mineral filler shall be in accordance with AASHTO M 17.

**11.2.5 Hydrated Lime.** Hydrated lime shall be thoroughly dry and free of lumps. Hydrated lime shall be in accordance with AASHTO M 303, Type I or II, except the gradation shall be determined in accordance with AASHTO T 37.

**11.2.6 Performance Graded Asphalt Binder (PG).**

**11.2.6.1 General.** Performance graded asphalt binder shall be an asphalt-based binder produced from petroleum either with or without the addition of non- particulate organic modifiers. Asphalt Binders shall be in accordance with AASHTO M 320 for the grade specified. The grade shall PG 64-22 or as specified in the Special Provisions.

**11.2.6.2 Acceptance Procedures.** The supplier shall certify that the bituminous material complies with the specification requirement. The supplier shall furnish the truck driver a copy of the bill of lading, manifest or truck ticket to be available to the Engineer. This document shall provide the following information: type and grade of the material, specific gravity at 60°F, net gallons, consignee, truck number, identification number, weight of truck before and after loading, destination, date loaded, name and location of source.

**11.2.6.3 Test Methods.** Asphalt Materials must meet specifications as follows:

Property	Test Method
Sampling	AASHTO T 40
Water	AASHTO T 55
Flash Point (Cleveland Open Cup)	AASHTO T 48
Solubility in Trichloroethylene	AASHTO T 44
Viscosity (Rotational)	ASTM D 4402
Dynamic Shear	AASHTO 315
Rolling Thin Film Oven Test	AASHTO T 240
Pressure Aging Test	AASHTO R 28
Creep Stiffness	AASHTO T 313

**11.2.7 Recycled Asphalt Material.** Recycled asphalt materials shall be in accordance with the following specification:

Deleterious Material	Percent by Weight
Deleterious Rock	8.0
Mud Balls and Shale Combined	2.0
Clay, uniformly dispersed	3.0
Other Foreign Material	0.5

**11.2.7.1 Reclaimed Asphalt.** A maximum of 20 percent virgin effective binder replacement may be used in mixtures. The asphalt binder content of recycled asphalt materials shall be determined in accordance with AASHTO T 164, ASTM D 2172 or other approved method of solvent extraction. A correction factor for use during production may be determined for binder ignition by burning a sample in accordance with AASHTO T 308 and subtracting from the binder content determined by extraction. The aggregate specific gravity shall be determined by performing AASHTO T 209 in calculating the  $G_{se}$  to use in lieu of  $G_{sb}$  as follows:

$$G_{se} = \frac{100 - P_b}{\frac{100}{G_{mm}} - \frac{P_b}{G_b}}$$

**11.2.7.2 Reclaimed Asphalt Pavement.** Reclaimed Asphalt Pavement (RAP) may be used in mixture. All RAP material shall be tested in accordance with AASHTO T 327.

**11.2.7.3 Reclaimed Asphalt Shingles.** Reclaimed Asphalt Shingles (RAS) may be used up to 3% total in base mixture specified to use PG 64-22 in accordance with AASHTO PP 53. Shingles shall be ground to 3/8-inch minus. Waste, manufacturer or new, shingles shall be essential free of deleterious materials. Post-consumer RAS shall not contain more than 1.5 percent wood by weight or more than 3.0 percent total deleterious by weight. Post-consumer RAS shall be certified to contain less than the maximum allowable amount of asbestos as defined by national or local standards. The gradation of the aggregate may be determined by solvent extraction of the binder or using the following as a standard gradation:

Shingle Aggregate Gradation	
Sieve Size	Percent Passing by Weight
3/8 in.	100
No. 4	95
No. 8	85
No. 16	70
No. 30	50
No. 50	45
No. 100	35
No. 200	25

### 11.3 COMPOSITION OF MIXTURES.

**11.3.1** Aggregate sources shall be from the specific ledge or combination of ledges within a quarry, or processed aggregate from a particular product, as submitted in the mix design. The total aggregate prior to mixing with asphalt binder shall be in accordance with the following gradation requirements:

Sieve Size	Percent Passing by Weight			
	Base	BP-1	BP-2	BP-3
1 inch	100	100	100	100
3/4 inch	85-100	100	100	100
1/2 inch	60-90	85-100	95-100	100
3/8 inch	---	---	---	100
No. 4	35-65	50-70	60-90	90-100
No. 8	25-50	30-55	40-70	---
No. 16	---	---	---	30-60
No. 30	10-35	10-30	15-35	---
No. 200	6-12	5-12	5-12	7-12

#### 11.4 JOB MIX FORMULA.

**11.4.1** At least 30 days prior to placing any mixture on the project, the Contractor shall submit a mix design for verification and approval by the Engineer. The mixture shall be designed in accordance with Asphalt Institute Publication MS-2, *Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types*. The mixture shall be compacted and tested at a minimum of three asphalt contents separated by a maximum of 0.5 percent in accordance with AASHTO T 245, except as specified herein. The test method shall be modified by short-term aging the specimens in accordance with AASHTO R 30. A detailed description of the mix design process shall be included with the job mix formula.

**11.4.2 Required Information.** The mix design shall include raw data from the design process and shall contain the following information:

- A. Source, grade and specific gravity of asphalt binder.
- B. Source, type (formation, etc.), ledge number(s) if applicable, gradation, and deleterious content of the aggregate.
- C. Plasticity index of each aggregate fraction.
- D. Bulk and apparent specific gravities and absorption of each aggregate fraction in accordance with AASHTO T 85 for coarse aggregate and AASHTO T 84 for fine aggregate, including all raw data.
- E. Specific gravity of hydrated lime, mineral filler or baghouse fines, if used, in accordance with AASHTO T 100.
- F. Percentage of each aggregate component.
- G. Combined gradation of the job mix.
- H. Percent of asphalt binder, by weight, based on the total mixture.
- I. Bulk specific gravity (Gmb) by AASHTO T 166, Method A of a laboratory compacted mixture.
- J. Percent air voids (Va) of the laboratory compacted specimen.
- K. Voids in the mineral aggregate (VMA) and voids in the mineral aggregate filled with asphalt binder (VFA).
- L. Theoretical maximum specific gravity (Gmm) as determined by AASHTO T 209 and AASHTO R 30.

- M. Mixing temperature and molding temperature.
- N. Bulk specific gravity (Gmb) of the combined aggregate.
- O. Percent chert contained in each aggregate fraction.
- P. Baghouse fines added for design.
  1. Batch and continuous mix plants – Indicate which aggregate fraction to add baghouse percentage during production.
  2. Drum mix plants – Provide cold feed settings with and without baghouse percentage.

**11.4.3 Mixture Approval.** No mixture will be accepted for use until the job mix formula for the project is approved by the Engineer. The job mix formula approved for each mixture shall be in effect until modified in writing by the Engineer. When unsatisfactory results or other conditions occur, or should a source of material be changed, a new job mix formula may be required.

**11.4.4 Mixture Characteristics.** Base, BP-1 and BP-2 mixtures shall have the following properties, when tested in accordance with AASHTO T 245. The number of gyrations shall be 35 with a gyratory compactor. BP-1 and BP-2 mixtures shall have between 60 and 80 percent of the VMA filled with asphalt binder. BP-3 mixtures shall have a minimum 75 percent of the VMA filled with asphalt binder. The ratio of minus 200 materials to effective asphalt binder ( $P_{be}$ ) shall be no less than 0.8 and no greater than 1.6.

Mix Type	Percent Air Voids	AASHTO T 245 Stability lb	Minimum Voids in Mineral Aggregate (VMA)
BB	3.5	750	13.0 <sup>a</sup>
BP-1	3.5	750	13.5
BP-2	3.5	750	14.0
BP-3	3.5	750	15.0

<sup>a</sup> Bituminous base mixtures that would require 12.0 percent VMA following Asphalt Institute MS-2 will have a minimum 12.0 percent requirement.

**11.4.5 Moisture Susceptibility.** Moisture susceptibility may be tested in accordance with AASHTO T 283. A minimum retained strength of 70 percent shall be obtained when tested for moisture susceptibility. An approved anti-strip additive may be added to increase retained strength to a passing level.

**11.4.6 Time Limit.** A mix design may be transferred to other projects for a period of three years from the original approval date provided satisfactory results are obtained during production and placement.

## 11.5 GRADATION AND DELETERIOUS CONTENT CONTROL

**11.5.1** In producing mixtures for the project, the plant shall be operated such that no intentional deviations from the job-mix formula are made. The Contractor shall determine on a daily basis at minimum, the gradation on the aggregate reclaimed from the RAP by either extraction or binder ignition. The gradation results shall be used to determine the daily specification compliance for the

combined gradation. Mixtures as produced shall be subject to the following tolerances and control.

- A. The maximum variations from the approved job-mix formula shall be within the tolerances as shown in the table below:

Sieve Size	Percent Passing by Weight	
	Tolerance	Action Limit
No. 8a	± 5.0	± 10.0
No. 200	± 2.0	± 4.0

<sup>a</sup> Use No. 16 sieve for BP-3

- B. The deleterious content of the material retained on the No. 4 sieve shall not exceed the limits specified as follows:

Deleterious Material	Percent by Weight
Deleterious Rock	8.0
Shale	1.0
Other Foreign Material	0.5

- C. If the plasticity index of any fraction exceeds that of the material approved for the mix design, additional testing may be required.
- D. The quantity of asphalt binder introduced into the mixer shall be the quantity specified in the job-mix formula. No changes shall be made to the quantity of asphalt binder without written approval from the Engineer. The quantity of asphalt binder determined by tests on the final mixture shall not vary by more than ± 0.3 percent from the job-mix formula.

**11.5.2 Sample Location.** The gradations of the total aggregate will be determined from samples taken from the hot bins on batch-type plants or continuous mixing plants or from the composite cold feed belt on drum mix plants. The deleterious content of the total aggregate shall be determined from samples taken from the composite cold feed belt. When required, samples for plasticity index shall be taken from the stockpile. The RAP shall be sampled from the RAP feeding system on the asphalt plant. Samples for asphalt content determination may be taken at the plant.

**11.5.3 Moisture Content.** The bituminous mixture, when sampled and tested in accordance with AASHTO T 329, shall contain no more than 0.5 percent moisture by weight of the mixture.

**11.5.4 Contamination.** The bituminous mixture shall not be contaminated with deleterious agents such as unburned fuel, objectionable fuel residue or any other material not inherent in the job mix formula.

## 11.6 LABORATORY

**11.6.1** The laboratory shall contain certified equipment to perform all testing. The laboratory may be used at anytime by the City of Springfield to perform compliance testing.

## 11.7 CONSTRUCTION REQUIREMENTS

**11.7.1 Weather Limitations.** Bituminous mixtures shall not be placed on any wet surface or frozen pavement. No paving will be permitted under 45°F. Temperatures shall be obtained in accordance with MoDOT Test Method TM 20.

**11.7.2 Bituminous Mixing Plant.** The plant shall be specifically designed for satisfactorily heating, drying, and mixing bituminous mixtures. Plant scales and equipment shall be calibrated annually and provided to the Engineer upon request. The asphalt plant shall be equipped with an automatic ticket printer connected to the weighing system in such a manner that the printer automatically detects and prints the weight determined by the system. The printing system shall be capable of keeping and printing cumulative totals for asphalt mixtures for each project. The tickets shall show the following:

- A. Gross and Tare weights
- B. Current date and time
- C. Mix type
- D. Unique ticket number
- E. Job number, route

**11.7.3 Subgrade Preparation.** The subgrade upon which the bituminous mixture is to be placed shall be substantially uniform in density throughout the entire width of the subgrade. The subgrade shall be constructed to drain surface water to the side ditches and all ditches shall be kept open by Contractor. The subgrade shall be checked after rolling and, if not at the proper elevation at all points, sufficient material shall be removed or added and compacted to bring all portions of the subgrade to the required elevation and density. For base widening work, the bottom of the trench shall be compacted until further consolidation is not visually evident, by use of a trench roller having a weight of no less than 300 psi of width of rear roller, or by mechanical tampers or other methods approved by the Engineer. Suitable excavated material may be used in shouldering operations. On the outside of curves, the design depth of trench at the beginning of the superelevation transition shall be varied gradually to the minimum depth at the end of the superelevation transition. Slight transitioning of the width of the base widening will be necessary to permit the indicated angle of repose or shear angle outside of the ultimate edge of surface. The bottom of the trench shall in no case be less than 3 inches below the surface of the existing pavement. All surplus excavated material shall be disposed of by the Contractor in areas to be secured by the Contractor beyond the right of way limits. An acceptable written agreement with the property owner on whose property the material is placed shall be submitted to the Engineer.

**11.7.4 Tack coat.** This work shall consist of preparing and treating an existing bituminous or concrete surface with bituminous material. Tack coat material shall be applied anytime a surface course is placed on an intermediate course. All pavement surfaces that have been in place longer than one (1) calendar day shall have a tack coat and for those less than one (1) day it shall be at the discretion of the Engineer.

**11.7.4.1 Material.** All material shall be specifically as follows:

Emulsified Asphalt (SS-1, SS-1H, CSS-1 or CSS-1H) shall meet AASHTO M 208

**11.7.4.2 Application.** Asphalt emulsion shall be applied uniformly with a pressure distributor that is certified by the Engineer prior to use, and the Contractor shall furnish all equipment, material and assistance necessary if calibration is required. The rate of application shall be within a minimum of 0.02 gallons per square yard and a maximum of 0.10 gallons per yard as directed by the Engineer. Water may be added to the emulsion resulting in a mixture that will contain no more than 50 percent water. The asphalt emulsion will be heated at time of application and spread at the specified rate. The temperature chart for emulsions and RC and MC liquid asphalts follows. The tack shall be properly cured and the tack surface shall be cleaned of all dirt and surplus before the next course is placed.

**11.7.5 Prime Coat.** If required by the Contract, this work shall consist of preparing and treating an existing surface with bituminous material in accordance with these specifications.

**11.7.5.1 Material.** The type and grade of bituminous material will be specified in the contract. All material shall be specifically as follows:

Item	Test Method
RC Liquid Asphalts	AASHTO M 81
MC Liquid Asphalts	AASHTO M 82
Emulsified Asphalt	AASHTO M 140

**11.7.5.2 Application.** The surface to be primed shall be shaped to the required grade and cross section, shall be free from any segregated materials or other irregularities, and shall be uniformly compacted by rolling. Bituminous material 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 between 0.2 and 0.5 gallons per square yard as directed by the Engineer. The primer shall be heated at time of application as follows:

Bituminous Material	Temperature, Degrees Fahrenheit			
	Spraying		Mixing	
	Min	Max	Min	Max
<b>Asphalt Binder</b>				
PG 46-28	260	325	----	----
All Other Grades	285	350	275	350
<b>Liquid Asphalt RC-MC</b>				
Grade				
30	70	150	50	110
70	100	180	90	140
250	150	220	130	170
800	180	260	170	210
3000	210	290	200	240
<b>Asphalt Emulsions</b>				
RS-1	70	140	----	----
RS-2	125	185	----	----
SS-1	70	160	70	160

SS-1h	70	160	70	160
CRS-1	125	185	----	----
CRS-2	125	185	----	----
CSS-1	70	160	70	160
CSS-1h	70	160	70	160
EA-90P	130	180	----	----
CRS-2P	130	180	----	----

**11.7.6 Hauling Equipment.** Trucks used for hauling bituminous mixtures shall have tight, clean, smooth, metal beds that have been thinly coated with an approved bituminous mixture release agent. Use of diesel fuel or other detrimental products will not be permitted. Each truck shall have a cover of canvas or other suitable material to protect mixture from weather.

**11.7.7 Spreading.** The base course, primed surface, or preceding course or layer shall be cleaned of all dirt, packed soil or any other foreign matter prior to spreading the bituminous mixture. The mixture shall be spread in the number of layers and in the quantity required to obtain the compacted thickness and cross section shown on the plans. When placing multiple layers with varying thicknesses, the thicker layer shall be placed first. The compacted thickness of a single layer of bituminous pavement mixture shall be no more than 2 inches for the surface course and 4 inches for the leveling course.

**11.7.7.1 Irregularities.** The mixture shall be spread without tearing the surface and struck off such 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 a suitable mixture at the Contractor's expense. The outside edge alignment shall be uniform. Irregularities shall be corrected by adding or removing mixture before compacting. Segregated mixtures shall be removed and replaced to the limits determined by the Engineer.

**11.7.7.2 Leveling Course.** 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 feather-edging 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 mixture shall be free from segregation.

**11.7.7.3 Base Widening.** The specified total thickness of base widening shall be completed to the adjacent traveled way elevation as shown on the plans. Additional thickness of base widening may be placed as required prior to coldmilling, at the Contractor's expense, and shall subsequently be coldmilled to the same elevation as the traveled way, if conducive to expedite operations. 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 that are inaccessible to mechanical spreading and finishing equipment, the mixture may be spread and finished by hand methods if permitted by the Engineer. At least one lane of the existing pavement and the adjacent shoulder shall be kept open to traffic at all times during construction, except for short intervals when the movement of the Contractor's equipment will seriously hinder the flow of traffic. Intervals during which the Contractor will be allowed to halt traffic shall be as designated by the Engineer. The Contractor shall not open more trench ahead of the first layer of

the base widening than is necessary for placing that layer in one half a day's operations. The first layer of the base widening shall not be placed for a greater distance ahead of the second layer than is necessary for placing the second layer in one half a day's operations. The second layer shall not be placed for a greater distance ahead of the final layer than is necessary for placing the final layer in one day's operation. Any changes in these lengths shall be made only with written permission from the Engineer.

**11.7.7.4 Edge Differential.** For roadways constructed under traffic, no pavement edge differential shall be left in place for more than seven days, unless approved by the Engineer.

**11.7.8 Surfaced Approaches.** At locations designated in the contract or as specified by the Engineer, approaches shall be shaped to the required grade and cross section, shall be free from all ruts, corrugations, segregated material or other irregularities, and shall be uniformly compacted to City of Springfield standards by rolling. The bituminous surface shall be placed as shown on the plans or as directed by the Engineer. Approaches shall not be surfaced before 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.

**11.7.9 Joints.** The minimum density of all traveled way pavement within 6 inches of a longitudinal joint, including the pavement on the traveled way side of the shoulder joint, shall be no less than 2.0 percent below the specified density. Once an established procedure has been demonstrated to provide the required density for longitudinal joints, at the Engineer's discretion, the procedure may be used in lieu of density tests provided no changes in the material, typical location or temperatures are made. Pay adjustments due to longitudinal joint density shall apply to the full width of the lane paved. Adjustments due to joint density shall apply to the day's production from which the cores are obtained. Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the layer. When a transverse vertical edge is to be left in place and opened to traffic, a temporary depth transition shall be constructed as approved by the Engineer. The longitudinal joints in one layer shall offset those in the layer immediately below by approximately 6 inches. The joints in the final surface layer shall be at the lane lines of the traveled way, except that the placement width shall be adjusted such that pavement marking shall not fall on a longitudinal joint. Each side of the joint shall be flush and along true lines.

**11.7.10 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 thickness of both the plant mix bituminous surface course and the plant mix bituminous base course will be measured, and where thickness is found to be deficient, corrective actions will be taken as follows. The thickness of the bituminous course will be measured and determined by the average caliper measurement of the cores. For the purpose of determining the constructed thickness the cores taken for density results will be measured for thickness and reported to the nearest tenth. In addition, cores may be taken at other locations as may be determined by the Engineer. If the measurement of any core is deficient of one-half (1/2) inch from 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 extend to the end of 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 Engineer has the option of requiring that defective pavement will be removed and replaced with a bituminous course of proper thickness or leaving in place and require 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 requirement so he 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.

### 11.8 QUALITY CONTROL

The Contractor shall maintain equipment and qualified personnel to perform QC field inspection, sampling and testing in accordance with this specification.

**11.8.1 Mixture Testing.** The Contractor shall test the mixture at least once every 750 tons of production or a minimum of once per day for the gradation, deleterious content, and the asphalt content. If RAP is used and AASHTO T 308 is used to determine the asphalt content, the binder ignition oven shall be calibrated in accordance with MoDOT Test Method TM 77. At the Engineer’s discretion, testing may be waived when production does not exceed 150 tons per day. The Contractor shall certify the proper proportions of a previously proven mixture were used. The final field mix acceptance will be based on the items below:

Tested Property	Test Method	Contractor Testing Frequency
Effective Asphalt to Minus No.200		1/Lot
Mat Density (% of Laboratory Max. Theoretical density)	AASHTO T 166	1Set/Lot (4/ Set)
Unconfined Joint Density (% of Laboratory Max. Theoretical Density)	AASHTO T 166	1Set/ Lot (4/ Set)
Gradation & Deleterious content	AASHTO T 27 AASHTO T 11	1/Lot

Asphalt Content	AASHTO T 164 AASHTO T 287 AASHTO T 308	1/Lot
Asphalt content of RAP	AASHTO T 164	1/Project
VMA @ Ndes	AASHTO T 312	1/Lot
Va @ Ndes	AASHTO T 312	1/Lot
Theoretical Maximum SG of Mixture	AASHTO T 209	1/Lot

**11.8.2 Failing Test.** If a Va, Vma, Dust to Effective Binder ratio, Density, or Asphalt Content test result falls outside of the specification tolerances, a review or adjustment of the plant settings and production shall be made and another sample shall be immediately taken. If the second test falls outside of the specification tolerances, production shall be immediately ceased until the mixture can be brought back into specification. Plant production for the following day shall not resume until the mixture is brought back into specification. If a gradation test falls outside the Job Mix Formula, production shall cease until the mixture is brought back into specification.

**11.8.2.1 Payment Adjustments and Removal Limits.** Payment for mixture placed at or below the required minimum tolerances will be adjusted or removed as follows:

Test Property	Tolerance Limit/Action Plan <sup>a</sup>	Deduction	Removal Limit
Effective Asphalt to Minus No. 200	0.8 to 1.6	See Chapter 2 Article 14.02.D	See Chapter 2 Article 13
Mainline Density	90 to 96	See 11.8.5.1	See 11.8.5.1
Joint Density	88 to 96	See 11.8.5.1	See 11.8.5.1
Asphalt Content	±0.3% From Job Mix Formula	See Chapter 2 Article 14.02.D	See Chapter 2 Article 13
Vma @ Ndes	-1.0% to +2.0% From Job Mix Formula	See Chapter 2 Article 14.02.D	See Chapter 2 Article 13
Va @ Ndes	2.7% to 5%	2.5% to 2.7% 10% of Contract Unit Price	Below 2.5%

<sup>a</sup>Contractor shall notify the Construction Inspector immediately of all tests that fall outside of the specification tolerances.

**11.8.3 Retained Samples.** One half of the Contractor’s sample for gradation, deleterious content, plasticity index, and asphalt content and all cores shall be retained for the Engineer. The Contractor shall retain the samples for 7 days after testing has been completed and the results accepted by the Engineer.

**11.8.4 Pavement Testing.** During construction, the Engineer will designate as many tests as necessary to ensure that the course is being constructed of proper thickness, composition and density. Density of the roadway shall be determined by a daily sample consisting of four mainline cores and four joint cores obtained by the Contractor at random locations selected by the Engineer. A joint density sample shall consist of four cores taken from alternating sides of the lane placed at random locations selected by the Engineer. The daily Field  $G_{mm}$  shall be used in the calculation for this determination. Four inch diameter core samples shall be taken the full depth of the layer to be tested. The Contractor shall restore the surface from which samples have been taken immediately with the mixture under production.

**11.8.5 Density.** The compacted mixture shall have a minimum density of 92.0 percent determined by the specific gravity method. The Contractor shall calculate the  $G_{mm}$  from material obtained behind the paver for each set of cores representing that lot. When the contractor elects to place a lift of mixture greater than six times the nominal maximum aggregate size, cores shall be cut in half and the density of each half determined separately.

**11.8.5.1 Density Adjustment.** Payment for mixture placed at or below the required minimum density will be adjusted as follows. Joint cores only apply to cores within six inches of unconfined joints.

Mainline Density (from Field $G_{mm}$ )	Percent of Contract Unit Price <sup>a</sup>	Joint Density (from Field $G_{mm}$ )	Percent of Contract Unit Price <sup>a</sup>
92 or above	100%	90 or above	100%
91.9 to 91.5, inclusive	97%	89.9 to 89.5, inclusive	90%
91.4 to 91.0, inclusive	94%	89.4 to 89.0, inclusive	85%
90.9 to 90.5, inclusive	90%	88.9 to 88.5, inclusive	80%
90.4 to 90.0, inclusive	85%	88.4 to 88.0, inclusive	75%
Below 90.0	Remove and Replace	Below 88.0	Remove and Replace

<sup>a</sup> When adjustments are necessary, the lower percent of the contract unit price of either the pavement or joint density adjustment will apply.

**11.9 Quality Assurance.** Acceptance tests will be performed by a certified city representative at the Contractor’s laboratory at a rate of one independent sample per day when production exceeds 500 tons per day. A favorable comparison will be considered when the owners test is within the specification tolerances. At least once for every five days of production, a split of the Contractor’s sample will be tested. If the results of the split sample are not within five percent on all sieves above the No. 200, two percent on the No. 200, within the specification ranges on the deleterious content, within two percentage points on the plasticity index, and within 0.5 percent on the asphalt content from the Contractor’s results, another split sample will be taken jointly with the Contractor and tested. If the second test results do not compare within the specification tolerances, production shall cease until the discrepancy is resolved. If the second test results compare within the above tolerances, production may continue.

**11.10 Surface Smoothness.** The finish of the pavement surface shall be substantially free from waves or irregularities, shall be true to the established crown and grade, and shall be in accordance with Chapter 9.1.3.12.

**11.11 Defective Mixture.** Any mixture showing an excess of bituminous material or that becomes loose and broken, mixed with dirt, or is in any way defective, shall be removed and replaced with a satisfactory mixture, which shall be immediately compacted to conform with the surrounding area.

**11.12 Basis of Payment.** The accepted quantities of plant mix bituminous pavement and base course will be paid for at the contract unit price for each of the pay items included in the contract. No Payment for obtaining and delivering samples of compacted mixture from the base and replacement of the surface will be made.

## 13 SEEDING AND SODDING

### 13.1 SEEDING

**13.1.1 Scope of Work.** The work shall consist of furnishing all labor, equipment, and materials necessary for the preparation, fertilization, seeding, and mulching of the areas specified in the contract. All disturbed areas shall be seeded and mulched except for sodded areas, surfaced areas, and solid rock. Disturbed areas outside of authorized construction limits shall be seeded and mulched, or sodded at the contractor's expense.

#### 13.1.2 Materials.

**13.1.2.1 Topsoil.** Topsoil furnished by the Contractor shall consist of a natural friable surface soil without admixtures of undesirable subsoil, refuse, or foreign materials. It shall be reasonably free from roots, hard clay, and coarse gravel stones larger than one inch in any dimension, noxious weeds, tall grass, brush, sticks, stubble or other material which would be detrimental to the proper development of vegetative growth. Topsoil shall be obtained from naturally well drained sites where topsoil occurs, at least 4- inches deep. Topsoil shall not be obtained from bogs or marshes.

Topsoil shall conform to the following grading:

<u>Sieve Sizes</u>	<u>Percentage Passing:</u>
2 inch	100%
1 inch	80% - 100%
No.4	60% - 100%
No.10	40% - 100%
No.200	10% - 60%

Topsoil shall contain not less than 3%, or more that 20% organic matter, by weight as determined by loss-on-ignition of oven-dried samples in accordance with ATM T-6. Organic material shall be decomposed and free of wood.

The Owner's Representative shall be notified on the location from which the Contractor proposes to furnish topsoil at least 30 calendar days prior to delivery of topsoil to the Project from that location. The topsoil and its source will be inspected and tested by the Owner's Representative before approval will be granted for its use.

Topsoil sources lacking organic matter may be used if, prior to delivery to the Project, sufficient organic matter in the form of pulverized peat moss or rich organic soil from 31 other sources is thoroughly mixed with the topsoil to provide a product meeting the above requirements.

Organic material for incorporation into topsoil, if required, shall be partially decomposed fibrous or cellular stems and leaves of any of several species of Sphagnum mosses, or rotted manure. Organic material may require chopping to shredding to insure thorough mixing with the topsoil.

All topsoil shall be fertilized as follows: the application rates of the fertilizer and limestone per 1,000 square feet of ground area of topsoil furnished by the CONTRACTOR shall be approved by the Owner's Representative, based on soil analysis tests so that the total natural and applied chemical constituents are as follows:

Nitrogen	1.0 lb. minimum - 1.5 lb. maximum per 1,000 square feet
Phosphoric Acid	1.0 lb. minimum - 2.0 lb. maximum per 1,000 square feet
Potassium	1.0 lb. minimum - 2.0 lb. maximum per 1,000 square feet
Limestone	Limestone requirements shall conform to the following table:

<u>LIMESTONE REQUIREMENTS</u>	
Soil pH	Tons per Acre
Above 6.0	0
5.0 - 6.0	1.5
Below 5.0	3.0

**13.1.2.2 Seed.** Seed shall be of the following minimum percentages for mixture, purity, and germination.

Minimum	Parts	Purity	Germination
Falcon Tall Fescue	34%	98%	85%
Rebel Tall Fescue	33%	98%	85%
Mustang or Jaguar Tall Fescue	33%	98%	85%

The seed shall be free from Johnson Grass, Canadian Thistle, or field bind weed seed, and shall not contain more than two (2%) percent of other weed seeds. A certification of this mixture shall be furnished to the Engineer prior to seeding.

**13.1.2.3 Fertilizer.** Fertilizer shall be a mixture containing thirteen (13) pounds each of soluble nitrogen, phosphoric acid, and potash per one hundred pounds.

**13.1.2.4 Lime.** Agricultural lime material shall be used for soil neutralization with not less than ninety (90) percent passing the No. 4 sieve.

**13.1.2.5 Mulch.** Mulch shall consist of the application of a vegetative covering of one of the following types. If a specific type of mulch is not specified, Type I mulch shall be required.

**13.1.2.5.1 Type I Mulch.** Type I Mulch (Straw) shall be a cereal straw from stalks of oats, rye, wheat, barley, or clean fescue. The straw and fescue shall be clean and bright, relatively free of noxious and undesirable seed, and foreign material. It shall be dry enough to spread evenly over the entire area to be mulched. The mulch shall be wetted at the time of application.

**13.1.2.5.2 Type III Mulch.** Type III Mulch (Hydroseed) shall be a material consisting of virgin wood cellulose fibers. Virgin wood cellulose fibers shall be produced by either the ground or cooked fiber process and have the following properties:

- A. Moisture content- percent by weight, maximum-15
- B. Organic Matter- Wood fiber, percent by weight minimum-80
- C. PH 4.3-8.5

### **13.1.3 Method of Construction.**

**13.1.3.1** For Type I Mulch, seedbed preparation shall be accomplished by grading the disturbed areas and adding at least four (4) inches of topsoil. The surface on which the topsoil is to be placed shall be free of all loose rock and foreign material greater in any dimension than one-half (1/2) the depth of the topsoil to be added. It shall be raked or otherwise loosened just prior to being covered with topsoil. Topsoil shall be placed and spread over the designated areas to a depth sufficiently greater than shown on the plans or specified so that after settling, the completed work will conform with the thickness and elevations shown on the plans. After spreading, all large clods and foreign material shall be removed by the contractor. Before final raking, areas to be seeded shall be limed at the rate of twenty (20) pounds per thousand (1,000) square feet of area and fertilized with the specified mixture by spreading evenly at the rate of twelve (12) pounds per thousand (1,000) square feet of area. Both operations shall be performed by using a mechanical spreader of the rotary type. The area shall then be raked to a smooth, even surface and the soil loosened to a depth of one (1) inch in preparation for the seed. No seed or mulch shall be placed until the Engineer accepts the grade and seedbed.

Seeding shall be accomplished by using a mechanical spreader. The seed shall be evenly distributed over the area at the rate of twelve (12) pounds per one thousand (1,000) square feet. Immediately after the seeding is completed, all seeded areas shall be completely covered by a layer of mulch, approximately one-quarter (1/4) inch in depth. Mulch shall be applied as described below for that type of mulch specified.

**13.1.3.2** For Type III Mulch, seedbed preparation shall be accomplished in the same manner as for Type I mulch through topsoil placement and removal of large clods and foreign material. The lime, fertilizer, seed, and mulch will be mixed and applied simultaneously with equipment approved by the Engineer and the amounts previously specified.

**13.1.3.2.1** Type I Mulch must be applied at a rate of two and one half (2 ½) tons per acre. Immediately after placement of the mulch, the entire mulched area shall be thoroughly saturated with water.

**13.1.3.2.2** Type III Mulch shall be green in color after application, and shall have the property to be evenly dispersed and suspended when agitated in water. Virgin wood cellulose fiber mulch containing eighty (80) percent or greater organic matter shall be hydraulically applied at a rate of two thousand (2,000) pounds per acre. The mulch shall be mixed with water in a manner to provide homogeneous slurry. Equipment for mixing and applying the slurry shall be capable of applying a uniform mixture over the entire area to be mulched. The slurry mixture shall be agitated during application to keep the ingredients thoroughly mixed.

The seeded area shall be maintained as necessary to assure growth for a two-(2) week period after application. Seeding shall not be placed from June 1 to September 1 nor from November 1 to March 15 unless otherwise authorized by the Engineer. If a project is completed except for seeding and this project completion occurs during the period when seeding is not allowed, the contractor will be required to complete all seeding and have confirmed growth within thirty (30) calendar days after the next seeding period begins.

**13.1.4 Method of Measurement.** Measurement will be made to the nearest one-tenth (1/10) acre of the area seeded or as specified in Bid Form.

**13.1.5 Basis of Payment.** Seeding will be paid for on a unit price per acre on those contracts containing a seeding bid item. This unit price is to include all costs associated with the seeding, liming, fertilizing, mulching, and maintenance of the seeded areas until the job is accepted by the Engineer.

If a contractor working on a public contract is being assessed Liquidated Damages as of June 1 or November 1, and the project is completed except for seeding, the Liquidated Damages will cease until the beginning of the next seeding period At which time, the Contractor will be required to have confirmed growth within 30 days. If confirmed growth does not occur over the entire project area within 30 days after the start of the next seeding season, Liquidated Damages will be assessed until such growth is confirmed.

Ground cover must be established immediately upon completion of construction. If work is completed outside of the seeding season, then the contractor shall use temporary seed such as; annual rye or erosion control blankets. See Sediment and Erosion Control guidelines for more information.

## **13.2 DRILL SEEDING**

**13.2.1 Scope of Work.** The work shall consist of providing all labor, equipment, and materials necessary for soil preparation, fertilization, seeding and mulching of the areas specified in the contract documents. The work will provide drill seeded lawns with Type I mulch. Any disturbed areas not indicated in the contract documents that require seeding will be done so at the contractor's expense.

### **13.2.2 Materials**

**13.2.2.1 Lawn Seed.** Lawn seed will be fresh clean and new crop seed mixture. The mixture must be mixed by an approved method. The seed shall be composed of the following varieties, mixed to the specified proportions by weight and tested to achieve minimum percentages for purity and germination.

Minimum	Parts	Purity	Germination
Falcon Tall Fescue	34%	98%	85%
Rebel Tall Fescue	33%	98%	85%
Mustang or Jaguar Tall Fescue	33%	98%	85%

The seed shall be free from *Poa annua*, bent grass and not contain more than two percent (2%) of other noxious weed seed. A certification of this mixture shall be furnished to the Engineer prior to seeding.

**13.2.2.2 Fertilizer.** Fertilizer shall be ten pounds of 13-13-13, non-burning fertilizer per 1,000 S.F. composed of not less than 50% organic slow acting guaranteed analysis fertilizer.

**13.2.2.3 Topsoil.** Topsoil furnished by the Contractor shall consist of a natural friable surface soil without admixtures of undesirable subsoil, refuse, or foreign materials. It shall be reasonably free from roots, hard clay, and coarse gravel stones larger than one inch in any dimension, noxious weeds, tall grass, brush, sticks, stubble or other material which would be detrimental to the proper development of vegetative growth. Topsoil shall be obtained from naturally well drained sites where topsoil occurs, at least 4- inches deep. Topsoil shall not be obtained from bogs or marshes.

Topsoil shall conform to the following grading:

<u>Sieve Sizes</u>	<u>Percentage Passing:</u>
2 inch	100%
1 inch	80% - 100%
No.4	60% - 100%
No.10	40% - 100%
No.200	10% - 60%

Topsoil shall contain not less than 3%, or more than 20% organic matter, by weight as determined by loss-on-ignition of oven-dried samples in accordance with ATM T-6. Organic material shall be decomposed and free of wood.

The Owner's Representative shall be notified on the location from which the Contractor proposes to furnish topsoil at least 30 calendar days prior to delivery of topsoil to the Project from that location. The topsoil and its source will be inspected and tested by the Owner's Representative before approval will be granted for its use.

Topsoil sources lacking organic matter may be used if, prior to delivery to the Project, sufficient organic matter in the form of pulverized peat moss or rich organic soil from 31 other sources is thoroughly mixed with the topsoil to provide a product meeting the above requirements.

Organic material for incorporation into topsoil, if required, shall be partially decomposed fibrous or cellular stems and leaves of any of several species of Sphagnum mosses, or rotted manure. Organic material may require chopping to shredding to insure thorough mixing with the topsoil.

All topsoil shall be fertilized as follows: the application rates of the fertilizer and limestone per 1,000 square feet of ground area of topsoil furnished by the CONTRACTOR shall be approved by the Owner's Representative, based on soil analysis tests so that the total natural and applied chemical constituents are as follows:

Nitrogen	1.0 lb. minimum - 1.5 lb. maximum per 1,000 square feet
Phosphoric Acid	1.0 lb. minimum - 2.0 lb. maximum per 1,000 square feet
Potassium	1.0 lb. minimum - 2.0 lb. maximum per 1,000 square feet
Limestone	Limestone requirements shall conform to the following table:

<u>LIMESTONE REQUIREMENTS</u>	
Soil pH	Tons per Acre
Above 6.0	0
5.0 - 6.0	1.5
Below 5.0	3.0

**13.2.2.4 Mulch.** Mulch shall consist of the application of a vegetation covering specific for Type I.

**13.2.2.4.1 Type I Mulch** shall be a cereal straw from stalks of oats, rye, wheat, barley, or clean fescue. The straw and fescue shall be clean and bright, relatively free of noxious and undesirable seed, and foreign material. It shall be dry enough to spread evenly over the entire area to be mulched. The mulch shall be wetted at the time of application.

**13.2.3 Method of Construction**

**13.2.3.1 For Type I Mulch,** limit preparation to the areas in which immediate seeding will occur. Preparation that is required is as follows; mow all lawn areas at lowest possible deck setting. This will allow drill seeding operation direct contact with soil and to promote germination and establishment. All stones over 2” in any dimension will require removal. Also remove all sticks, toots, rubbish and extraneous matter. Final preparation, grade lawn areas to a smooth, free draining, even surface with a loose, moderately coarse texture. Remove ridges and fill depressions as required to drain. No seed or mulch shall be placed until the Engineer accepts the grade and seedbed.

Seed immediately after preparation of soil is complete and has the approval by the Engineer. Seed shall be done between March 15<sup>th</sup> and April 15<sup>th</sup> or September 15<sup>th</sup> and October 15<sup>th</sup>. Mulching may be performed when wind gust do not exceed 5 miles per hour velocity. When applying seed mixture, make sure to spread evenly and thoroughly over all lawn areas. Special care should be taken not to place seed in shrub beds and ground cover areas. Cover all seeded areas thoroughly with mulch or cleas straw to prevent erosion. The grass seed should be applied at a rate of 8.0 lbs per 1,000 S>.F. (350 lbs/acre).

**13.2.4 Method of Measurement.** Measurement will be made to the nearest one-tenth (1/10) acre of the area seeded or as specified in bid form.

**13.2.5 Basis of Payment.** Seeding will be paid for on a unit price per acre on those contracts containing a seeding bid item. This unit price is to include all costs associated with the seeding, liming, fertilizing, mulching, and maintenance of the seeded areas until the job is accepted by the Engineer.

If a contractor working on a public contract is being assessed Liquidated Damages as of June 1 or November 1, and the project is completed except for seeding, the Liquidated Damages will cease until the beginning of the next seeding period At which time, the Contractor will be required to have confirmed growth within 30 days. If confirmed growth does not occur over the entire project area within 30 days after the start of the next seeding season, Liquidated Damages will be assesses until such growth is confirmed.

Ground cover must be established immediately upon completion of construction. If work is completed outside of the seeding season, then the contractor shall use temporary seed such as; annual rye or erosion control blankets. See Sediment and Erosion Control guidelines for more information.

### 13.3 NATIVE GRASS AND WILDFLOWERS

**13.3.1 Scope of Work.** Furnish all labor, materials, supplies, equipment, tools, and transportation, and perform all operations in connection with and reasonably incidental to complete installation of the native grasses and wildflowers, and guarantee/warranty as shown on the drawings and as specified herein. The items of work specifically included are Native Grasses and Wildflowers.

#### 13.2.2 Materials

**13.2.2.1 Herbicide.** A broad-spectrum non-selective foliar applied herbicide such as; “Roundup” manufactured by Monsanto Chemical Company, or equivalent.

**13.2.2.2 Organic Soil Conditioner.** A product of composted plant materials only, with total carbon: nitrogen ratio no greater than 10:1 per AOAC method. Shall be in uniform “beaded” homogenous matrix, all material must pass through a No. 4 sieve per ASTM method. All materials must be coated with a water-soluble biodegradable binder. Shall contain in available

form; a minimum of 3% organic phosphate and 1% organic potash, 500/g aerobic-anaerobic bacteria, yeast and mold, 1% iron, .05% manganese and .05% zinc. Packaged weight will be no more than 50 lbs. With manufacturer's name, product name, percentage of nutrients, and net weight of materials shown on label.

**13.2.2.3 Water.** The contractor will furnish water at the project site as required for the execution of all work until all work has been completed.

**13.2.2.4 Seed Mix.** Mix shall be fresh, clean, new crop seed. The Contractor is to provide recommendations for Native Seed Mix and rate typical for the region to include short stem grasses (min 3-5) and wildflowers (min 5-7) (\*all quantities to be shown as Pure, Live Seed (PLS) per acre. PLS shall be defined as the sprout-able seed of specified variety and calculated as the product of viable germination times the purity. The seed quantities indicated per acre for the native grasses and forb seed shall be the amount of Pure, Live Seed per acre for each species.) Seed must be labeled as Missouri Source seed "Yellow Tag". Each species indicated in construction documents must be approved by owner.

**13.2.3 Method of Construction.** When preparing the soil for native grasses and wildflower, repair any eroded areas and adjust grading as needed to provide adequate drainage and to meet grade at all walks and paved surfaces. All stones that are two inch (2") in diameter need to be removed along with all existing vegetation, roots, brush, wire, grade stakes, and any other deleterious materials. Drag seeded areas with approved equipment to insure a smooth surface to all Grasses and Wildflowers. The areas that will receive new seed needs to mowed and have thatch removed during the active growing seasons. Once mowing has been completed, treat area with "Roundup" or equal to. After the first application wait 14 days and treat again. Reapply as necessary until all non-native vegetation is dead. After unwanted vegetation is removed, the Contractor will examine the site and determine the areas that need to be smoothed or filled. Any depression exceeding 2" deep needs to be filled to allow for positive drainage. After existing plant material has been treated, stake zones for grasses and wildflowers to be approved by the Owner prior to seeding.

The Contractor will need to provide an approved plan for seeding at least two weeks prior to seeding. A ten day notification period will be required prior to beginning seeding operations. The Contractor needs to utilize no-till planters and drills to install all seed. The planters and drill need are required to meet the following conditions; they shall be Rangeland or Truax type grass drill and no-till rangeland and grass drill planters shall be specifically designed for the seeding of native grasses and forbs. Seeding depth must be adjustable to provide final seed depth of less than ½ inch. Also, prior to starting work, all seeding equipment shall be calibrated and adjusted to sow seeds at the proper seed rate. Equipment shall be operated in a manner to insure complete coverage of entire area to be seeded. Any gaps between areas of growth that are greater than five square feet shall be reseeded and/or replanted.

To establish good seed coverage, make two passes in two different directions. Once seeding has been completed, roll the seeded areas to firmly bed the seed into the soil using a cultipacker to gently firm the soil around the seed. To protect seeded slopes from exceeding 4:1, install erosion control blankets and staple per manufacture's recommendations. Protect seeded slopes

exceeding 6:1 against erosion with jute or coil-fiber erosion control mesh installed and stapled per manufactures recommendation. Also protect slopes that are less than 6:1 from erosion by spreading straw mulch after completion of seeding operations. Spread uniformly at a minimum rate of 2 tons per acre to form a continuous blanket 1-1/2 inches loose depth over seeded areas. Spread by hand, blower or other suitable equipment. Straw that is speeded needs to be anchored by one of the following methods; anchor straw mulch by crimping into topsoil by suitable mechanical equipment or anchor straw mulch by spraying with asphalt-emulsion tackifier at a rate of 10 to 13 gal per 1000 sq-ft. Take precautions to prevent damage or staining of structure or other planting adjacent to mulched areas.

**13.2.4 Method of Measurement.** Measurement will be made to the nearest one-tenth (1/10) acre of the area seeded or as specified in bid form.

**13.2.5 Basis of Payment.** Seeding will be paid for on a unit price per acre on those contracts containing a seeding bid item. This unit price is to include all costs associated with the seeding, liming, fertilizing, mulching, and maintenance of the seeded areas until the job is accepted by the Engineer.

If a contractor working on a public contract is being assessed Liquidated Damages as of June 1 or November 1, and the project is completed except for seeding, the Liquidated Damages will cease until the beginning of the next seeding period At which time, the Contractor will be required to have confirmed growth within 30 days. If confirmed growth does not occur over the entire project area within 30 days after the start of the next seeding season, Liquidated Damages will be assesses until such growth is confirmed.

Ground cover must be established immediately upon completion of construction. If work is completed outside of the seeding season, then the contractor shall use temporary seed such as; annual rye or erosion control blankets. See Sediment and Erosion Control guidelines for more information.

## **13.4 SODDING**

**13.4.1 Scope of Work.** The work shall consist of preparing the areas for sodding and placing approved live sod. The entire area designated for sodding shall be covered with sod except where the item Strip Sodding is indicated in the contract.

### **13.4.2 Materials.**

**13.4.2.1 Sod.** The sod shall be a turf-type tall fescue blend at least two (2) years old, densely rooted and thrifty, unless otherwise specified in the contract. The sod shall contain a growth of not more than ten (10%) percent of other grasses, be free from all prohibited and noxious weeds, and be reasonably free of all weeds. The sod shall be cut in strips of uniform thickness with a minimum depth of one and one-half (1 ½) inches; each strip containing at least one-half (1/2) square yard and not more than one (1) square yard. Sod shall be cut into strips. At the time of sod lifting, the top growth shall not exceed three (3) inches in length. All sod shall conform to

the laws of Missouri and shall be obtained from sources meeting the approval of the Department of Agriculture, Division of Plant Industries.

**13.4.2.2 Fertilizer.** Fertilizer shall be a mixture containing twelve (12) pounds each of soluble nitrogen, phosphoric acid, and potash per one hundred pounds.

**13.4.3 Construction Requirements.**

**13.4.3.1** Sod shall not be placed during a drought nor placed during the period June 1 to September 1 unless authorized by the Engineer, and shall not be placed on frozen ground. No dry or frozen sod shall be used.

**13.4.3.2** The sod-bed shall be prepared in accordance with Section 3 and shall have a uniform surface free from rills, washes, and depressions and shall conform to the finished grade and cross section as shown on the plans. The area to be sodded shall be fertilized with the specific mixture by spreading evenly at the rate of twelve (12) pounds per one thousand (1,000) square feet of area. Fertilizer will not be required where strip sodding is designated. The bed shall be in a firm but uncompacted condition with a relatively fine texture at the time of sodding. No sod shall be placed until the sodbed is approved by the Engineer. Sod shall be moist and shall be placed on a moist earth bed. Sod strips shall be laid along contour lines, by hand, commencing at the base of the area to be sodded and working upward. The transverse joints of sod strips shall be broken, and the sod carefully lay to produce tight joints. The sod shall be firmed, watered, and refirmed immediately after it is placed. The firming shall be accomplished by use of a lawn roller or tamper. On 3:1 slopes, or steeper, the sod shall be pegged with wood pegs approximately one half (1/2) inch X twelve (12) inches driven into the ground, leaving about one half (1/2) inch of the peg above the sod, and spaced not more than two (2) feet apart. Pegging of sod shall be done immediately after the sod has been firmed. When sodding is completed, the sodded areas shall be cleared of loose sod, excess soil, or other foreign material, and a thin application of topsoil shall be scattered over the sod as a top dressing, and the areas thoroughly moistened.

**13.4.3.3** The contractor shall keep all sodded areas thoroughly moist for three (3) weeks after laying. The sod shall be living at the time of final acceptance of the area.

**13.4.4 Method of Measurement.** Measurement will be made to the nearest square yard of approved sodded surface area, or as otherwise specified in the plans or specifications.

**13.4.5 Basis of Payment.** The accepted quantities of sodding will be paid for at the unit bid price for each of the pay items included in the contract. No direct payment will be made for fertilizing sodded areas.

If a contractor working on a public contract is being assessed Liquidated Damages as of June 1 or November 1, and the project is completed except for seeding, the Liquidated Damages will cease until the beginning of the next seeding period At which time, the Contractor will be required to have confirmed growth within 30 days. If confirmed growth does not occur over the entire project area within 30 days after the start of the next seeding season, Liquidated Damages will be assesses until such growth is confirmed.

Ground cover must be established immediately upon completion of construction. If work is completed outside of the seeding season, then the contractor shall use temporary seed such as; annual rye or erosion control blankets. See Sediment and Erosion Control guidelines for more information.

## 14 TRAFFIC SIGNALS

### 14.1 GENERAL

**14.1.1 Scope of Work.** This work includes the furnishing and installing of traffic signal equipment as shown on the plans and shall include all materials, equipment, labor, tools, transportation, permits, licenses, and all other miscellaneous items necessary to provide an operable system as required by the contract documents. All work shall be in accordance with these specifications, all governing local ordinances and regulations, and the latest revisions of the *National Electrical Code (NEC)*, *National Electrical Safety Code (NEC)*, *National Electrical Manufacturers Association (NEMA)*, *Manual on Uniform Traffic Control Devices (MUTCD)*, other relevant standards as referenced, and the contract documents. References to certain sections of *Missouri Standard Specifications for Highway Construction*, including revisions current at the time projects are bid, are made herein. Other relevant standards and specifications include:

AASHTO	American Association of State Highway and Transportation Officials
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWS	American Welding Society
Caltrans	California Department of Transportation
ICEA	Insulated Cable Engineers Association
IMSA	International Municipal Signal Association
ITE	Institute of Transportation Engineers
RETMA	Radio Electronics Television Manufacturers Association
UL	Underwriters Laboratories

The Engineer shall resolve any conflicts.

**14.1.2 Crafts Must Be Certified And Registered:** In accordance with the *Springfield City Code*, enforced by the Department of Building Development Services, “Before a person shall engage in the business of contracting for electrical work, such person shall register by name of business, name of officers, and address, and shall designate the name of the certified master electrician who shall be authorized to apply for permits and accept service of process and shall

designate the names of other certified personnel responsible for the names of work crews. Electrical contractors shall be licensed and all work shall be by, or under, the supervision of the holder of a master electrician license and a certificate of qualification” [Section 36-1230-B].

**14.1.3 General.** Existing traffic signals shall be maintained in effective operation by the Contractor, except for shutdowns approved by the Engineer for alterations or final removal. After any modifications have been made or after work is begun on an existing signalized installation, the Contractor shall maintain the signals in accordance with the plans. The Contractor shall contact the Engineer for approval at least five (5) business days, excluding weekends and City holidays, prior to operational shutdown of any traffic signal. The Contractor shall contact the Engineer for approval at least two (2) days, excluding weekends and City holidays, prior to disconnecting existing vehicle or pedestrian detection. All traffic signal equipment that the Contractor uses or installs on the project, whether furnished by the City or the Contractor, either on a temporary or permanent basis, shall, upon installation or upon initial use by the Contractor, be operated and maintained by the Contractor until the project is complete and accepted. Any malfunction of an existing signal installation resulting from the Contractor’s operation, regardless of the nature of the work, shall be corrected at the Contractor’s expense, as directed by the Engineer. All work within operational signal cabinets and splice cabinets shall be performed under the supervision of City Traffic Signal personnel, including, but not limited to signal timing, traffic cameras, interconnect, and ITS equipment. Programming of the controller and termination of fiber optic cable will be the responsibility of the City. If directed by the Engineer, the Contractor shall provide off-duty City police officers to control traffic during signal shutdown or turn on. If any adjustments are required to the operation of an existing signal installation due to the Contractor’s operation, the Contractor shall provide a minimum of two (2) business days notice to the Engineer for approval.

**14.1.4 Temporary Traffic Signals.** Installation of temporary traffic signals shall consist of, but not be limited to, furnishing and installing poles for span wire signals, span and tether wires, control and power cable, power supply and connection to a power source, the controller, signal heads, detectors, luminaires, and all mounting hardware, unless specified otherwise. Maintenance of the installation and all other equipment and material necessary to provide the temporary installation will be the responsibility of the Contractor. If the temporary traffic signal installation is not shown on the plans, the Contractor shall submit a plan to the Engineer for approval prior to the installation of temporary signals. Any existing or City furnished signal equipment to be used in the temporary signal shall be shown on the temporary signal plan. Temporary signals shall have the signal heads covered until placed in operation. A minimum of two (2) signal faces shall be oriented toward each street approach positioned a minimum of eight (8) feet apart, center to center, and a minimum of 16 feet above the surface of the traveled way to the bottom of the backplate. Existing signals shall not be taken out of operation until the temporary signals are ready for operation and approved by the Engineer. A flashing operation shall be used during shutdown of the temporary signals. If directed by the Engineer, the Contractor shall provide off-duty City police officers to control traffic during signal shutdown or turn on. See *Standard Drawing TS-20: Span Wire Details – Wood Poles*.

**14.1.4.1** All temporary signal equipment shall be removed by the Contractor after the new installation is in operation, or as directed by the Engineer. Contractor furnished equipment that

will become the property of the City shall be of new stock and shall meet all applicable specifications. Contractor furnished equipment that will remain the property of the Contractor may be new or used, if approved by the Engineer. City owned equipment will remain the property of the City, unless specified otherwise, and shall be disposed of as shown on the plans or as directed by the Engineer.

**14.1.5 Removal of Signals.** This work includes removing, salvaging, and disposal of traffic signal equipment including, but not limited to, cabinets, poles, structures, and wiring as indicated on the plans, including all necessary excavation and backfilling. Removal of PCC foundations shall extend a minimum of 24 inches below the finished final grade of the surrounding area. Prior to salvaging equipment, the Contractor shall meet on site with the Supervisor of Signal Operations to determine the condition of existing signal equipment and which equipment will be salvaged. The Contractor shall deliver the controller and cabinet, and equipment deemed salvageable to the City Signal Shop at 1134 W. Nichols Street. Salvageable signs may be reused as directed by the Engineer. Salvageable signal heads and signs shall be removed from the poles and mast arms, mounting brackets disassembled, and cable removed from heads, fittings, arms, posts, and conduits as necessary. Contact the Supervisor of Signal Operations at the City Signal Shop (417-864-1977) a minimum of one (1) business day (24 hours) prior to removal of salvaged equipment to schedule delivery and inspection of equipment. It shall be the Contractor's responsibility to dispose of the remaining equipment. Replacement cost of damaged salvageable signal equipment will be withheld from Contractor's final payment.

**14.1.6 Inspection of Work.** Work performed and materials furnished will be subject to inspection by the Engineer at any time. The contractor shall give the Engineer a minimum one (1) business day advance notice when work and materials are ready for inspection, testing, review, approval, or retesting as applicable. The Contractor shall provide such facilities as are deemed necessary by the Engineer for sufficient and safe access to the work or to the material.

**14.1.6.1** Inspections, tests, measurements and other actions taken by the Engineer are for the sole purpose of assisting the Engineer to methodically assess, with reasonable assurance, whether or not work, materials, rate of progress, and quantities, comply with the Contract. These actions by the Engineer shall not relieve the Contractor from determining, independently, that full compliance with the Contract is met at all times, or relieve the Contractor from providing quality materials, workmanship, and processes in strict compliance with the Contract.

**14.1.6.2** Upon request, the Contractor shall remove or uncover any portions of completed work for inspection by the Engineer. After inspection, the Contractor shall restore them to the standards required by the Contract.

**14.1.6.3 Testing of Signal Equipment.** After the project is open to normal traffic, the contractor shall notify the Engineer in writing the date the signal, or signal system, will be ready for testing. Upon concurrence of the Engineer, the contractor shall place the signal or signal system in operation for a consecutive 21-day test period. If the signal is to operate independently of other signals or signal systems, it shall be tested as a single installation. If the signal is part of a system, the test period shall not be started until all signals in the system are ready to be tested. A system shall be tested as a unit. Any failure or malfunction of the equipment during the test

period shall be corrected at the contractor's expense and the signal system tested for an additional consecutive 21-day period. This procedure shall be repeated until the signal equipment has operated satisfactorily for 21 consecutive days.

**14.1.7 Method of Measurement.** Conduit and cable, except detector loop cable, will be measured to the nearest linear foot, as shown on the plans. Contract quantities will be used for final payment except for authorized changes during construction or where appreciable errors are found in the contract quantities. The revision or correction will be computed and added or deducted from the contract quantities. Detector loop cable shall be measured per linear foot of cable installed, unit price shall include cable, saw-cutting, sealant, and installation. Posts, mast arms, signal heads, pedestrian heads, pushbuttons, signal controller (including specified equipment), splice cabinets (including specified equipment), pull boxes, and power supply assemblies shall be measured per each. Concrete for bases shall be per cubic yard of concrete as specified on the plans. PC concrete for sidewalks and ramps shall be measured per square foot. All other equipment and material shall be measured as shown on the plans.

**14.1.8 Basis of Payment.** No direct payment will be made for any incidental materials or work required to complete a signal installation unless specifically provided for in the contract. Any other incidental work or materials for which no basis of payment is specifically provided will be considered as completely covered by the unit price bid for items including in the contract. There will be no separate payment for material on site.

**14.1.9 Unauthorized Work.** The City will not pay for unauthorized or defective work. Work and materials that do not conform to the requirements of the Contract, work done beyond lines and grades shown on the plans or established by the Engineer, or extra work and materials furnished without written approval of the Engineer will be considered defective and unauthorized work. Such work shall be at the Contractor's risk and expense and may be rejected, even if the work has been inspected, or progress payments made. Upon order of the Engineer, such work shall immediately be remedied, removed, replaced, or disposed of. All costs associated with such work shall be at the Contractor's sole expense.

## **14.2 EQUIPMENT**

### **14.2.1 General.**

**14.2.1.1 Equipment and Material.** Equipment and material shall be of new stock unless the contract provides for relocation of existing units or use of units furnished by others. New equipment and material shall be the product of reputable manufacturers, shall be in accordance with Caltrans 2070 Controller and Cabinet Specifications, the regulations of the National Board of Fire Underwriters, Standards referenced in 14.1.1, as applicable, all governing local ordinances and regulations, these specifications, the contract documents, and shall meet the approval of the Engineer.

**14.2.1.2** Any equipment or materials proposed for use must be pre-approved by the Traffic Engineer. Two copies of the list of materials to be supplied by the Contractor shall be submitted

to the Engineer and approved by the Engineer in writing before items are purchased. It is preferable that the list be submitted and approved before the Notice to Proceed is issued. If the list has not been submitted and approved prior to the effective date of the Notice to Proceed, no construction work of any nature will be permitted on the signal project until the list has been approved. Approval of the items on the list will not relieve the Contractor of responsibility for satisfactory performance of the installation.

**14.2.1.3 Certification.** If requested by the Engineer, the Contractor shall provide a manufacturer's certification in triplicate, showing typical test results representative of the equipment and materials, and certifying that the supplied equipment and materials conform to all the requirements specified.

**14.2.1.4 Warranties.** The Contractor shall furnish to the Engineer any guaranty or warranty furnished as a normal trade practice in connection with the purchase (by the Contractor or a subcontractor) of any equipment, materials, or items incorporated in the project. Further, the Contractor shall be responsible for the condition of all material and all work performed as part of this contract and such material and labor shall be guaranteed by the Contractor and his surety against defective workmanship and/or material found to be defective in manufacture or which has been damaged in handling or placement after delivery for a period of 12 months after acceptance by the City. Contractor shall repair, replace, or otherwise make good at his own expense any such defect or failure which may become evident within the guarantee period, excepting as may be due to normal use or wear. Final determination of a material defect or failure will be made by the Engineer.

**14.2.2.1 Cable.** Except as noted, all conductors shall be soft drawn, Class B or C stranded copper wire in accordance with NEMA WC70/ICEA A-95-658. Solid conductors may be used only for grounding where connected to a ground rod.

**14.2.2.2 Power Cable.** Low voltage power cable shall be 600-volt, single conductor cable and thermoplastic or thermosetting cross-linked polyethylene insulated. All cable shall be plainly marked on the outside with the manufacturer's name and identification in accordance with industry practice. Insulation type shall be THHN/THWN-2 or XHHW-2. Black cables shall be used for the hot conductors and white cable shall be used for the neutral conductor. Green conductors shall be used for the equipment ground. Size and number of cables shall be as shown on the plans. Placing marking tape on cable will not meet the color-coding requirement of this section.

**14.2.2.3 Multi-Conductor Signal Cable.** Multi-conductor signal cable shall be rated at 600 volts and shall meet the requirements per the latest revision of IMSA Specification No. 20-1. The number and size of conductors shall be as specified on the plans.

**14.2.2.4 Pushbutton Detector Cable.** Pushbutton detector cable shall be two-conductor No. 14 AWG wire, with Type THHN insulation rated at 600 volts.

**14.2.2.5 Induction Loop Cable.** Induction loop detector cable shall be single-conductor No. 14 AWG wire, with Type THHN insulation rated at 600 volts.

**14.2.2.6 Induction Loop Shielded Lead-In Cable.** Lead-in cable used between the loop detector and the controller shall be two-conductor, twisted, shielded No. 14 AWG wire rated at 600 volts. The cable shall be in accordance with IMSA Specification No. 50-2.

**14.2.2.7 Video Detection Cable.** Control cables and power cables for video detection equipment shall be as specified by the manufacturer.

**14.2.2.8 Luminaire Cable.** Luminaire cable shall be 1c #8 THHN, 19-strand cable installed from the lighting controller to the base of the combination mast arm pole. Within the pole, from the base to the luminaire head, the cable installed shall be 1c #10 THHN, 19-strand, two black and one white conductor.

**14.2.2.9 Copper Interconnect Cable.** Copper interconnect cable shall meet IMSA Specification No. 40-6 for 6 pair 22 AWG cable.

**14.2.2.10 Equipment Grounding Conductor.** A 1c#10 AWG THHN/THWN stranded copper green system ground cable shall be installed to provide a bonded system.

**14.2.2.11.1 Fiber Optic Interconnect Cable.** Fiber optic cable shall be all-dielectric, loose tube, contain the number and type of fibers as shown on the plan, and be used for communication within the Traffic Signal System General Considerations. The cable shall be new, unused, and of current design and manufacture. The cable manufacturer shall provide installation procedures and technical support concerning the items contained in this specification. All fibers in the cable must be usable fibers and meet required specifications.

**14.2.2.11.2** The fiber optic cable is to be of all-dielectric loose tube design and shall be designed for underground conduit applications. The cable shall contain a glass reinforced plastic central strength member. High tensile aramid and/or fiberglass yarn, helically stranded evenly around the buffer tubes, shall be utilized for additional tensile strength.

**14.2.2.11.4** Each buffer tube shall be filled with a gel with anti-oxidant additives to prevent water intrusion and migration. The gel shall be chemically and mechanically compatible with all cable components, nonnutritive to fungus, nontoxic and non-hydroscopic. All voids in the cable including the core shall be filled with a filler that will prevent water ingress and migration.

**14.2.2.11.4** The fiber optic cable jacket material shall be black high-density or medium density polyethylene (minimum 1.4 mm thickness) containing a suitable antioxidant system. The surface of the jacket shall be marked with the manufacturer's name, the words "Optical Cable", year of manufacturer and sequential length marks. The markings shall be repeated every one meter. The markings shall be in a contrasting color to the cable jacket for easy visibility. The cable shall contain at least one ripcord under the sheath for easy sheath removal.

**14.2.2.11.5** Each reel of fiber optic cable received from the manufacturer shall be accompanied by optical time domain reflectometer (OTDR) attenuation test data on each fiber.

**14.2.2.11.6** The fiber optic cable shall contain the number and type of optical fibers as shown on the plans, 6 fibers per loose tube. Each tube shall be color coded (EIA/TIA Standard).

**14.2.2.11.7 Quality Control Tests.** The fiber optic cable shall meet or exceed the requirements of the standards specified:

- A. Crush Resistance - EIA-455-41, the cable shall have a compressive strength of 1350 lbs. at 20 C.
- B. Impact Resistance - EIA-455-25A - no significant attenuation will result from 25 impacts of the specified impact at a sample temperature of -30 C or +25 C.
- C. Cyclic Flex Resistance (Test Conditions I and III) - no significant attenuation results after 25 flex cycles when tested in accordance with EIA-455-104A using a bend radius of 5 times the cable outside diameter.
- D. Temperature Cycling - EIA-455-3A. no attenuation increase at -40 C and +70 C.
- E. High and Low Temperature Bend Resistance (Test Level I) - No significant attenuation shall result from testing in accordance with EIA-455-37A at temperatures of -30 C + 60 C.
- F. Water Penetration - The cable shall meet the requirements of EIA-455-82B.
- G. Compound Flow (Drip) Resistance - Test results shall indicate compliance with the requirements of EIA-455-81A at a test temperature of 60 C.

**14.2.2.11.8 Reel Lengths.** Fiber optic cable shall be shipped on reels of 1100, 1700, 2200, 3300 or 4400 meters.

**14.2.2.11.9 Single Mode Fiber Optic Cable.** The fibers shall be designed for dual wavelength operation at both 1310 and 1550 nm. Each fiber shall have a mechanically strippable color-coated acrylic protective coating. The color of the inks applied to fibers shall be clearly distinguishable from one another (EIA/TIA Standard) and remain so after cleaning and end preparation for splicing. Each fiber shall have been subjected to and passed a tensile proof stress test equivalent to 100 ksi for 1.0 second dwell time without damage of any kind. The induced attenuation due to fiber wrapped around a mandrel of 75 mm diameter for 100 turns at 1310 nm shall not be greater than 0.05 DB.

**14.2.2.11.10 Optical Fiber Parameters.** The fiber shall meet the following specifications:

- A. Core Diameter:  $9\mu\text{m} \pm 0.5\mu\text{m}$  (Single-mode),  $62.5\mu\text{m}$  (Multi-mode)
- B. Cladding Diameter:  $125\mu\text{m} \pm 3.0\mu\text{m}$
- C. Coating Diameter:  $250\mu\text{m} \pm 15\mu\text{m}$ .
- D. Mode-Field Diameter at 1310 nm =  $8.7$  to  $10\mu\text{m} \pm 0.5\mu\text{m}$
- E. Core to Cladding Offset:  $1.0\mu\text{m}$
- F. Max. Attenuation at 1310 nm: 0.5 db/km.
- G. Max. Attenuation at 1550 nm: 0.4 db/km.

**14.2.2.12 Certification.** All cables and conductors shall be accompanied by certification from the supplier indicating: (1) the supplier is familiar with the requirements of these specifications and, (2) cable furnished was from a lot manufactured by (manufacturer's name) whose test results are in accordance with these specifications.

### **14.2.3 Conduit.**

**14.2.3.1 Rigid Steel Conduit.** Rigid steel conduit shall conform to the requirements of ANSI C80.1 and shall be galvanized on both the inside and the outside surfaces. The weight (mass) of zinc coating shall be no less than 0.5 ounce per square foot of coated surface, as determined in accordance with AASHTO T 65. The interior or exterior surface, or both, may be given a coating of suitable material to facilitate installation of wires and cables and to permit the conduit to be readily distinguished from pipe used for purposes other than electrical.

**14.2.3.2 Rigid Steel Conduit, Fittings.** Fittings shall conform to the requirements of ANSI C80.4.

**14.2.3.3 Inspection.** Conduit and fittings will be inspected for compliance with the specifications, and any desired samples will be taken at either the project location or warehouse, at the option of the Engineer. Test specimens for determination of weight (mass) of coating will be not less than 2 inches long, and cut not less than 6 inches from the end of the length of conduit selected for testing. If the prescribed two additional samples for retests are taken, and either does not comply, the lot represented will be rejected.

**14.2.3.4 Polyvinyl Chloride Conduit (PVC).** PVC conduit, bends, couplings, and fittings shall be schedule 40 rigid polyvinyl chloride conforming to the requirements of Underwriters Laboratories Standard UL 651. The conduit may be continuous or in sections, and shall be gray in color. Each length of conduit, nipple and elbow shall be marked with the manufacturer's name or trademark and Underwriters Laboratories label.

**14.2.3.5 Fittings for Polyvinyl Conduit.** Fittings for PVC conduit shall be in accordance with UL 514. Cement used for the fittings shall be in accordance with the conduit manufacturer's recommendations.

**14.2.3.6 High Density Polyethylene Conduit (HDPE).** HDPE conduit shall be schedule 40 High Density Polyethylene, orange in color, conforming to the requirements of ASTM D 3035 SDR 11. Each length of conduit shall be marked with the manufacturer's name or trademark and Underwriters Laboratories label.

**14.2.3.7 Fittings for High Density Polyethylene Conduit.** Fittings for HDPE conduit shall be in accordance with ASTM D 2683 and the conduit manufacturer's recommendations. Transitions between HDPE and PVC conduits, if approved by the Engineer, shall conform to the manufacturer's recommendations.

**14.2.3.8 Inspection of PVC and HDPE Conduit.** The material will be inspected for compliance with the specification, and desired samples will be taken at either the project location or warehouse, at the option of the Engineer.

**14.2.3.9 Certification.** The Contractor shall furnish a manufacturer's certification that the material supplied is in accordance with all requirements. If requested by the Engineer, the Contractor shall also furnish typical test results representative of the material.

**14.2.3.10 Dimensions.** The dimensions of all conduit shall be in accordance with the plans.

**14.2.4.1 Pull Boxes.** Pull boxes may be cast-in-place concrete, precast concrete, preformed polymer concrete or preformed fiberglass reinforced polymer concrete as shown on the plans. Each pull box shall be equipped with four (4) galvanized steel or brass cable hooks with a minimum diameter of 3/8 inch and a minimum length of 5 inches.

**14.2.4.2 Preformed Pull Boxes.** Preformed pull boxes shall withstand a wheel load of 20,000 pounds. Pull box walls may be either flared or vertical. Pull boxes shall have a collar or ring at the top that will allow for securing the concrete apron. Metal conduit, if used in preformed pull boxes, shall be electrically bonded to one another inside each pull box.

**14.2.4.3 Cast-In-Place Concrete Pull Boxes.** Cast-in-place concrete pull boxes shall be constructed Class B concrete in accordance with MoDOT Standard Specifications. Pull boxes shall be cast in a neat and clean manner. See *Standard Drawing TS-3: Cast-in-Place Pull Box*.

**14.2.4.4 Pull Box Covers.** Preformed pull boxes shall be equipped with a bolt down cover. The threaded hole that receives the cover lock-down bolt shall be open at the bottom to allow the cleanout of sand, dirt and other debris. Lock-down bolts shall be stainless steel or brass with a penta-head. Frames and covers for cast-in-place and precast concrete pull boxes shall be cast iron in accordance with AASHTO M105, Class 30, and shall be of the dimensions shown on the plans. Preformed pull box covers shall be polymer concrete and shall meet a load category of Tier 15 and have a design load rating of 15,000 pounds and a test load of 22,500 pounds, all of which meet the ANSI/SCTE 77 specification. A lift opening shall be provided on all covers. Covers for pull boxes to be used for traffic signals shall be embossed with "TRAFFIC SIGNALS". Covers for pull boxes to be used for fiber optics shall be embossed with "TRAFFIC SIGNAL FIBER OPTICS".

**14.2.5.1 Signal Post and Mast Arm Pre-Approval.** Fabricators shall submit five (5) copies of shop drawings and supporting calculations to the Engineer. Submittals shall be approved by the Engineer in writing prior to fabrication of the signal posts and mast arms. Shop drawings shall indicate complete design details required for post and mast arm fabrication, including material grades and thicknesses, welding and orientation of any longitudinal seams. The projected areas and weights (masses) of signs and signals used in the design of the post and mast arms shall be shown on the shop drawings. Design details for all possible post and mast arm combinations shown on the plans may be submitted. Shop drawings shall provide post and mast arm installation and hardware details. All welding procedures shall be prepared by the manufacturer as a written procedure specification and shall be submitted with the shop drawings for approval. Approval of the weld procedures will be required before approval of the shop drawings. Shop drawings shall indicate the specific approved welding procedure to be used for each joint. Shop drawings and supporting stress calculations shall be signed and sealed by a registered professional engineer in the State of Missouri. Manufacturers shall submit all required documentation, in accordance with 14.2.5.2.6. Upon written approval, pre-approved drawings may be used on any project where the design conditions of the shop drawings are not exceeded.

**14.2.5.2.1 Steel Posts and Mast Arms.** Steel posts and mast arms shall be round, continuously tapered, hollow shafts fabricated as one continuous shaft or as individual segments at least 10 feet long, joined together using electrically welded, intermediate, transverse, full penetration, circumferential joints. Steel posts and mast arms shall be fabricated from basic oxygen or open-hearth steel sheet. The continuous, tapered, hollow shafts or individual segments shall be manufactured from one or two lengths of steel sheet, with one or two continuous, welded, longitudinal seams. The longitudinal seams in the mast arm shall be located outside of the upper half of the cross section of the member. Where transverse, full penetration, circumferential welds are used, the fabricator shall furnish to the Engineer written certification that 100 percent of all such welds have been radiographed or ultrasonic tested by an independent testing agency using a qualified non-destructive testing technician, as described in Section 6.14.7 of ANSI/AWS D1.1 Structural Welding Code-Steel and equipment calibrated annually. The testing agency shall be approved by the Engineer prior to fabrication. Post base and mast arm attachment plates shall be plate steel attached to the larger end of the shafts by continuous welds on the inside and outside of the shaft. After manufacture, the material shall have a minimum yield strength of 48,000 psi.

**14.2.5.2.2** A handhole equipped with a suitable metal cover shall be provided in the post near the base, and 12 inches above the mast arm connection if luminaire mounting is specified. A grounding lug or connector shall be provided inside the post near the handhole. A removable rain-tight metal pole cap shall be provided on the top of the post and on the small end of each mast arm. All handhole covers and metal caps shall be securely attached to the post or arm with a galvanized steel chain and shall be held in place by screws. The chain shall be attached to the inside of the post or arm and shall be of sufficient length to allow maintenance access. An aluminum or stainless steel identification tag shall be provided with all posts and mast arms as shown on *Standard Drawing TS-6: Steel Mast Arm*. The letters and numbers on the tag shall be embossed or engraved. The post tag shall be attached to the pole 6 inches above the top of the handhole. The mast arm tag shall be attached 3 inches from the base of the end cap. The base plate shall be equipped with four cast steel or cast iron nut covers in accordance with AASHTO M 103 or M 105, or four aluminum nut covers and shall have four galvanized or stainless steel screws for securing covers to the pole. All poles, shoe bases, base plates and cast steel or cast iron nut covers shall be fully galvanized after fabrication. All anchor bolt nuts shall be completely covered by nut covers. Luminaire bracket arms, when specified, shall be included with the post and mast arm. The Contractor may furnish posts with the shape, gage and dimensions meeting or exceeding those required by the plans and specifications, provided shop drawings are submitted and approved in accordance with 14.2.5.1.

**14.2.5.2.3** Welding and fabrication of the assemblies shall be in accordance with the ANSI/AWS D1.1 Structural Welding Code-Steel. All requirements of the welding code for tubular structures will apply to the fabrication for the post and mast arm shafts, and shall include any welds used to attach these members to plates or other hardware. The manufacturer shall employ qualified personnel to perform all visual and nondestructive testing (NDT) required. In addition to the visual inspections and NDT that may otherwise be required by the welding code, the manufacturer shall perform 100 percent magnetic particle (MT) testing of circumferential fillet welds used to attach the flange plate to the larger end of the mast arm shaft. NDT personnel

shall be qualified as set forth in paragraph 6.14.7 of ANSI/AWS D1.1 Structural Welding Code-Steel. Qualifications of NDT personnel shall be submitted to the Engineer for approval.

**14.2.5.2.4** The post and mast arm manufacturer shall be certified under the AISC certification program, Conventional Steel Building, or higher category. Evidence of current AISC certification will be required prior to the approval of shop drawings, and lapsing of the certification will be cause for non-approval of the manufacturer.

**14.2.5.2.5** Steel posts, luminaire bracket arms, mast arms, nut covers and plate steel bases shall be hot-dip galvanized inside and out after fabrication, visual inspections and NDT testing. Galvanized material shall be handled in such a manner to avoid damage to the surface. Any galvanized material on which the coating has been damaged will be rejected or may, with approval from the Engineer, be repaired in a manner approved by the Engineer.

**14.2.5.2.6 Fabricator's Certification.** Prior to erection of the posts and mast arms, the Contractor shall furnish to the Engineer a fabricator's certification. The certification shall specifically state the fabricated posts and mast arms have been quality control inspected by the fabricator and all material and manufacturing processes used were in full compliance with the specification requirements and the approved shop drawings and weld procedures. Certification shall be accompanied by supporting documentation, including the results of the visual inspections and NDT in accordance with 14.2.5.2.3 and copies of the pre-approved shop drawings required by 14.2.5.1.

**14.2.6.1 Power Supply.** The power supply assembly shall consist of all equipment and materials necessary for the distribution of secondary electrical power to the traffic signal equipment and signal pole mounted lighting, as shown on the plans. The configuration and installation of the equipment mounted on the assembly shall meet the safety requirements and approval of Springfield City Utilities and the City of Springfield Building Development Services. All hinges, catches and other hardware shall be non-ferrous metal or stainless steel. All specified equipment and cable, the conduit attached to the pole or pedestal, and all necessary attachment hardware shall be included in the unit cost of the power supply.

**14.2.6.2 Meter Boxes and Enclosures.** Combination service entrance enclosures with separate lockable compartments for the meter socket/utility termination section, and the City service panel shall be used. The enclosure shall be NEMA 3R or NEMA 4, 120/240 VAC, single-phase, 3-wire, 100 amp, minimum 12 branch spaces. The enclosure shall accept either overhead or underground service feeds.

**14.2.6.3 Circuit Breakers.** All circuit breakers shall be molded-case thermal-magnetic circuit breakers. The number and trip rating of circuit breakers shall be as shown in Standard Drawings TS-7 and TS-10. All breakers shall be designed for panel mounting with cable connections on the line and load sides.

**14.2.6.4 Type I Power Supply.** The Type I power supply assembly shall consist of the combination enclosure, lighting controller (if specified on the plans), circuit breakers as specified in Standard Drawing TS-7: Power Supply Wiring, rigid steel conduit, weatherhead and all

necessary hardware, accessories, and appurtenances to be mounted on a 30 foot Class 4 or 5 service pole. It shall also include the pole, ground rods, guy wires and anchors as required by the plans except those items furnished by Springfield City Utilities. See *Standard Drawing TS-8: Type I Power Supply*.

**14.2.6.5 Type II Power Supply.** The Type II power supply assembly shall consist of the combination enclosure, lighting controller (if specified on the plans), circuit breakers as specified in *Standard Drawing TS-7: Power Supply Wiring*, rigid steel conduit and all necessary hardware, accessories, and appurtenances to be mounted on a W6 x 9 or W6 x 15 galvanized steel post with a concrete footing. See *Standard Drawing TS-9: Type II Power Supply*.

**14.2.6.6 Type III Power Supply and Lighting Controller.** The Type III power supply assembly shall consist of a NEMA Type 3R rainproof 0.125" natural aluminum pedestal with separate lockable compartments for the meter socket, utility termination section, and the City service panel. All hinges shall be continuous piano type stainless steel. The door for the City service compartment shall be provided with a Corbin lock for a standard No. 2 key. The service pedestal shall be rated 120/240 volt single phase 3 wire. The service pedestal shall be mounted on a concrete base as shown on the plans. Anchor bolts from the pedestal manufacturer are to be provided. The service pedestal shall provide a 100 amp ringless meter socket, an identified 100 amp main breaker, minimum 12 blank breaker spaces, pre-wired twist lock photoelectric cell receptacle, photocell, contactor, test switch, and appropriate terminal blocks for up to four 240 volt luminaires. All distribution and control equipment shall be factory wired using 600 volt wire sized to meet applicable UL and NEC standards. Circuit breakers shall be installed as specified in *Standard Drawing TS-7: Power Supply Wiring*. The Contractor shall provide manufacturer's catalog cuts or drawings for approval before ordering pedestals. See *Standard Drawing TS-9A: Type III Power Supply*.

**14.2.6.7.1 Lighting Controller.** The lighting controller shall consist of a locking NEMA 3R or NEMA 4 dust-tight, watertight, 14 Ga aluminum or stainless steel enclosure mounted on the Type I service pole or Type II steel pedestal as shown on the plans. Included in the lighting controller shall be a main breaker, control breaker, auto-manual switch, contactor, photoelectric switch and socket, neutral terminal strip, lighting terminal strip, and all necessary hardware, accessories, and appurtenances. See *Standard Drawing TS-10: Lighting Controller*.

**14.2.6.7.2 Photoelectric Controls.** Photoelectric controls shall be of the cadmium-sulfide or solid-state type operating on 120 volts or 240 volts, as necessary, and shall operate on a line supply of 50 to 60 hertz. The load capacity of the photoelectric cell relays shall be a minimum of 1000 watts. Photoelectric cells shall operate a lighting system through mercury load relays or contactors as shown on the plans. The photoelectric cell circuitry shall be designed to be normally closed at night. The photoelectric cell shall be configured such that in the event of failure, the lights shall be on. The turn-on range shall be adjustable from 1.0 to 3.0 footcandles (10 to 32 lux). A turn-on setting of 1.0 footcandle (10 lux) and a turn-off setting of 2.0 footcandles (22 lux) shall be made at the factory. The photoelectric cell shall have a time delay to avoid operation due to lightning and transient light. A suitable bracket for mounting the photoelectric cell shall be provided. The photoelectric cell shall be mounted into a three-prong, twist lock socket. All top mount photoelectric controls shall face an open sky, and side mount

photoelectric controls shall face north or east. Each photoelectric control unit shall include a lightning arrester. Test switches used with photoelectric controls shall be three-position switches or two single-pole breakers as shown in *Standard Drawing TS-10: Lighting Controller*. Test switches shall be clearly labeled and mounted in the control cabinet.

**14.2.6.7.3 Contactors.** Contactors shall be NEMA Type 1 enclosed, magnetic-type, two-pole, single phase for 600 volts, 60-hertz service. The operating coil shall be designed for 120-volt or 240-volt operation, as shown on the plans. The contactor shall be electrically held, have the minimum rating and shall be housed in the control cabinet as shown in *Standard Drawing TS-10: Lighting Controller*. Mercury load relays shall be two-pole, normally-open, mercury contact, magnetic-type with load capacity as shown in *Standard Drawing TS-10: Lighting Controller*.

**14.2.6.8 Electrical Permit.** The Contractor shall obtain an electrical permit from the City of Springfield Building Development Services for new or relocated power supplies. Permit and inspection fees are the responsibility of the Contractor.

**14.2.7.1 Pedestrian Push Button.** Pedestrian push button detectors shall be the type and number shown on the plans.

**14.2.7.2 Type I Pedestrian Push Button.** Type I push buttons shall have pressure activated piezo driven solid state switches. Each detector shall be a removable switch assembly mounted in a rectangular cast aluminum case by means of two (2) screws. The housing shall be shaped to fit the curvature of the post to which it is attached and shall provide a rigid installation. Saddles shall be provided to make a neat fit when required. The case shall have one outlet tapped for 1/2-inch pipe. The button shall be 2 inches in diameter and be stainless steel on a black powder coated aluminum body. Maximum operating force shall not exceed 3 lbs. Activation shall be confirmed by flashing LED and audible tone. The entire assembly shall be weatherproof, secure against electrical shock to the user and of such construction as to withstand continuous hard usage. Type I push buttons shall meet the requirements of the Americans with Disabilities Act current at the time the project is bid.

**14.2.7.3 Type II Pedestrian Push Button.** Type II push button stations shall consist of a system (electronic control equipment, mounting hardware, pushbuttons, and signs) capable of providing visual, audible, and tactile cues to pedestrians, and shall meet the following requirements:

- A. Provide a push button locator tone.
- B. Push button activation confirmation via audible tone, LED activation, and vibrotactile pulse.
- C. Audible walk indication via chirp, cuckoo, or voice message during walk phase.
- D. Automatic volume adjustment in response to ambient sound level.
- E. Tactile directional arrow activates with the WALK phase.
- F. The ability to provide verbal countdown information, locator tone, or other custom sound during pedestrian clearance interval.
- G. The push button system shall be capable of providing certain custom features including custom messages or sounds for locating tones, pedestrian information, clearance interval, and walk phase information.

The push button station shall have a pressure activated piezo driven solid state switch. The button shall be 2 inches in diameter and be stainless steel mounted in a black powder coated aluminum body. Maximum operating force shall not exceed 3 lbs. The switch body shall be of a one piece design and shall accommodate a weatherproof speaker and a mounting area for a pedestrian information sign. Activation shall be confirmed by flashing LED and audible tone. The entire assembly shall be weatherproof, vandal resistant, secure against electrical shock to the user and of such construction as to withstand continuous hard usage. All necessary equipment and materials, including control boards, power supplies, etc. shall be included in the cost of the pedestrian pushbutton system. Type II push buttons shall meet the requirements of the Americans with Disabilities Act current at the time the project is bid.

Substantiating documentation for meeting ISO, NEMA, IEC, and FCC requirements must be supplied from an outside Testing Services Laboratory.

**14.2.7.3.1 General Description.**

- A. The System shall be backward compatible with the Polara Navigator 2-wire system or equivalent.
- B. The System shall consist of a Central Control Unit and Pedestrian Push Button Stations, as described below, and a hand held infrared device for programming the system settings.
- C. The System shall be manufactured by an ISO 9001:2008 registered company.

**14.2.7.3.2 Design Compliance.**

- A. The System shall meet the functionality requirements of MUTCD 2009 – 4E.
- B. The System shall meet NEMA TS 2 Section 2.1 Temperature & Humidity requirements.
- C. The System shall meet NEMA TS 2 Section 2.1 Transient Voltage Protection requirements.
- D. The System shall meet NEMA TS 2 Section 2.1 Mechanical Shock and Vibration requirements.
- E. The System shall meet IEC 61000-4-4, IEC 61000-4-5 Transient Suppression requirements.
- F. The System shall meet FCC Title 47, Part 15, Class A Electronic Noise requirements.
- G. The Push Button Station (PBS) Enclosure shall meet NEMA 250 – Type 4X Enclosure requirements.
- H. The Central Control Unit (CCU) & Ped Station Monitor (PSM) Enclosures shall meet NEMA 250 – Type 1 requirements.
- I. The System shall meet NEMA TS 4 – Electrical Reliability requirements (applicable portions of Section 8).

**14.2.7.3.3 Functional Requirements.**

- A. The System shall support from 2-16 PBS's per intersection (maximum of 4 push buttons per channel) controlled by a single base unit located in the traffic control cabinet.
- B. The System shall be able to be set to vibrate a tactile arrow button during the WALK interval following a button push, and/or every time the walk comes up.

- C. The System shall have the field-selectable function known as “Locating Tone”. This means that during the FLASHING DON’T WALK and the DON’T WALK intervals, the system shall provide a locating tone that emanates from the Pedestrian Push Button Station. The system shall provide at least three different sounds to choose from.
- D. The System shall have the field selectable function known as “Extended Push Activation”. This means that the audible WALK message will only be activated and sound during the WALK interval if the button is depressed for a field selectable minimum period of time (from 0 to 6 seconds). Also, for the following walk phase, the volumes have a separately settable minimum and volume level.
- E. The System shall have the field selectable function known as “Informational Message”. This means that a custom message giving the location of the street to cross and the intersection (or other information) will be vocalized only when the button is depressed for a minimum field selectable time.
- F. The System shall provide a “Wait” message that plays once the button is activated until the walk cycle goes into effect. This message must have the field selectable option of OFF or playing every 4, 6, 8 or 10 seconds.
- G. The System shall have standard “Travel Direction” options that can be selected at the time of installation.
- H. The System shall have at least five field selectable walk sound options including a cuckoo, a chirp, a rapid tick or custom voice message.
- I. The System shall provide 3 Ped-clearance sound choices including audible countdown (field selectable). The audible countdown shall represent the time remaining during the pedestrian clearance interval. Timing is automatically adjusted to CLEARANCE INTERVAL timing.
- J. The System shall provide two language capabilities, selectable by user (as a custom feature).
- K. The System shall provide Emergency preemption message in conjunction with a preemption system (selectable feature).
- L. LOCATE tone and “Walk”, “Pedestrian Clearance” audible feature must have independent settable minimum and maximum volume limits.
- M. All sounds for all PBS’s must be synchronized.
- N. The system shall have an ambient sensing microphone located in the pedestrian station in a non-visible, environmentally protected housing.
- O. All sounds levels shall adjust automatically in response to ambient noise over a 60-dB range with additional control to have the sound level at ambient, 5dBA or 10dBA over ambient, to a maximum of 100 dBA.
- P. The system shall have an independent ambient adjustment setting for the locate tone that allows the locate tone volume to be set to play below the ambient noise level.
- Q. The system shall utilize high quality digital audio technology by using 12-bit samples at a 16k Hz sample rate audio amplifier and must have total harmonic distortion of less than 3%.
- R. The firmware and voice messages shall be updatable via the USB port at the PBS. There shall be no requirement for the hardware to be changed out to update.
- S. The System shall have the option to mute sounds on all crosswalks except activated crosswalk (selectable feature).

- T. The System shall have no field replaceable fuses. All fuses shall be self-resetting.
- U. The System shall have the ability to have two separate program configurations with all features available that can be turned on through an external input.
- V. All field selectable options must be settable using an infrared remote or via Ethernet with password security.

**14.2.7.3.4 Central Control Unit (CCU) The CCU is the power supply and control unit that provides power and data for the Push Button Stations.**

- A. Shall be installed inside the Traffic Cabinet and powered by the AC supply mains (115 VAC).
- B. Shall control up to 16 PBS's in a maximum of 4 channels up to 4 PBS's per channel.
- C. Shall control up to four Pedestrian channels, receiving its timing from the Walk and Don't Walk signals.
- D. Shall be able to self test all PBS's and put a channel into recall should a PBS fail the self test.
- E. Shall provide optically isolated general purpose inputs.
- F. Shall be provided with a 4-cable interface harness assembly.
- G. Shall be provided with an interface connection board.
- H. Shall have Ethernet access to PBS's through the CCU to be able to change the settings of PBS as well as monitor the self test Events of the PBS's and report back to the Central Control Station.
- I. Shall have internal memory to store a few hundred events with a date-time stamp for each event.
- J. Shall have an internal real-time clock.
- K. Firmware for the CCU shall be updated by USB port on the CCU.
- L. The CCU shall have 2 built in conflict monitoring systems:
  - 1. Monitors the PBS and the ped-head lights and powers off the channel upon a conflict.
  - 2. Processors monitor each other and reset the CCU upon loss of internal communication.
- M. Shall meet NEMA 250 – Type 1 enclosures requirements.

**14.2.7.3.5 Pole Mounting Assembly** (This equipment is typically mounted on a pole near the start of a crossing. It is commonly referred to as the "Pedestrian Push Button Station" or "PBS").

- A. PBS shall be a single fixture that contains the vibro-tactile 2" ADA-compliant pedestrian push button with directional tactile arrow, a weatherproof speaker, and the appropriate sign for each location.
- B. All audible sounds shall emanate from the PBS.
- C. The external housing shall not have any polycarbonate or plastic parts.
- D. PBS's must require only two wires coming from the traffic control cabinet for each phase / crosswalk.
- E. Each PBS shall have a system unique ID.
- F. SPEAKER: 8 Ohms, 12 Watt maximum, weather-proof.

- G. **PUSH BUTTON:** ADA compliant with raised arrow on the button plunger. Cast Aluminum, Nickel plated and powder coated for color contrast. The arrow on the PBS shall be able to be changed to one of four directions.
- H. **PUSH BUTTON:** Uses Piezo switch technology rated to greater than 20 million operations.
- I. **VIBRATOR POWER:** Arrow button shall pulse at 20 Hz with a 0.003 inch displacement against an applied 2 lb force.
- J. **CONFLICT WALK MONITOR:** Circuitry shall have a separate microcontroller that independently monitors the main microcontroller outputs and “Walk Mode” for conflict condition, the PBS is reset in case of a conflict detection.
- K. The firmware and voice messages shall be updatable via the USB port at the PBS. There shall be no requirement for the hardware to be changed out to update.
- L. **VOLTAGE TRANSIENT PROTECTION:** Meets applicable NEMA TS 2 requirements.
- M. Meets or exceeds NEMA 250 type 4X enclosure requirements.
- N. **CONSTRUCTION:**
  - 1. **FRAME:** Cast Aluminum, Powder Coated.
  - 2. **MESSAGE SIGN:** Aluminum, Powder Coated, Ink Markings.
  - 3. **PUSH BUTTON:** Aluminum, Powder Coated.
- O. **MESSAGE MARKING:** At time of order, the customer may specify the Message Sign Markings to be the **International Walking Person** or the **Informational Explanations** for the three (3) distinct pedestrian displays (WALK, DON'T WALK, and PED CLEAR) that a pedestrian would see on an active pedestrian head.

**14.2.7.3.6 Infrared Programming Device** – (A hand held remote used for programming the APS system)

- A. Shall use Infrared technology with an LCD display to program the PBS's as well as the CCU.
- B. Shall be password protected.
- C. Shall be capable of setting all volumes and features of the APS system specific to the PBS's.
- D. Shall be capable of setting/updating a single PBS or all PBS's on the intersection for most functions from a single PBS (Global updating).
- E. Shall have the ability to save 4 user defined and 3 factory pre-set program configurations.

**14.2.8.1.1 Traffic Signal Heads.** Each traffic signal face shall consist of a number of identical signal sections, rigidly fastened together in such a manner as to present a continuous pleasing appearance. The design of the signal shall be such that, with the aid of simple tools and the addition of certain standard parts, it shall be possible to make an assembly consisting of one, two, three, four or more signal sections as shown on the plans. All signal heads shall be weatherproof. Traffic signal housings, doors, and visors shall be black. All indications shall be 12 inches in diameter unless specified otherwise.

**14.2.8.1.2 Housing, Door and Visor.** All new signal sections shall be clean, smooth and free from imperfections. The connection between signal housings shall be weatherproof. Housings

shall be rigidly fastened together by a three- or four-bolt assembly or other connectors approved by the Engineer. Doors that will exclude dust and moisture shall be used to ensure a weatherproof unit. Each door shall be attached to the housing by means of two stainless steel hinge pins. Two stainless steel wing screws are installed on the side of the door to provide for opening and closing the signal door without the use of any special tools. A tunnel visor shall be supplied with each signal section and each door shall have provisions for attachment of the tunnel visor. All visors shall be held in place by four stainless steel fastening screws or bolts and shall be capable of being removed without opening the signal head door. Internal bosses or inserts shall be provided in each housing for mounting a terminal block and for the attachment of backplates. The top and bottom exterior of the housing shall be flat to ensure perfect alignment of assembled sections. The housing of each section shall be one piece with sides, back, top and bottom integrally molded. The housing of each section shall be constructed of ultraviolet stabilized color-impregnated black polycarbonate resin. Scratches shall not expose uncolored material. The housing shall have a minimum thickness of 0.09 inch and shall be ribbed or plated to produce added strength. If signal housings are not ribbed, minimum 0.10 inch aluminum plates shall be furnished and installed inside and outside the section housing at all points of attachment of the mounting bracket. Complete signal faces shall provide positive locked positioning when used with serrated brackets, mast arm or span wire fittings. Mounting and servicing of signal head assemblies on signal supports shall be accomplished using ordinary tools.

**14.2.8.1.3 Terminal Blocks.** Each signal head shall be furnished with a six position terminal block for termination of field wiring. All terminal blocks shall be rigidly secured to the section housing.

**14.2.8.1.4 Optical System.** All signal indications in conventional signal heads shall be illuminated with LED modules. All 12-inch Circular LED Signal Indications shall fully and completely comply with all sections of ITE Vehicle Traffic Control Signal Heads: Light Emitting Diode Vehicle Circular Traffic Signal Supplement specifications dated June 27, 2005. All 12-inch Arrow LED Signal Indications shall fully and completely comply with all sections of ITE Vehicle Traffic Control Signal Heads: Light Emitting Diode Vehicle Arrow Traffic Signal Supplement dated July 1, 2007. All signal heads shall have a uniform non-pixelated illumination appearance.

**14.2.8.1.5 Optically Limiting Signal Heads.** The signal section shall be a self-contained assembly consisting of an optical unit, section housing, housing door, terminal block and necessary gaskets to ensure a weatherproof unit. The optically limiting signal head shall be capable of separate mounting or inclusion in a signal face containing two or more signal sections. If existing housings are to be combined with new housings, the new housings shall be adaptable to the existing. Each signal section shall be installed and directed and the optical limiter masked in accordance with manufacturer's recommendations to provide indications in accordance with the plans or as directed by the Engineer.

**14.2.8.1.6 Backplates.** Backplates shall be provided on signal heads as shown on the plans. Backplates shall be black in color and constructed of flat pre-cut or preformed thermoplastic. Flat pre-cut thermoplastic backplates shall have a minimum thickness of 0.250 inch. Preformed

thermoplastic backplates shall have rolled out edges and a minimum final thickness of 0.10 inch. Stainless steel bolts, nuts and flat washers shall be used to fasten the backplate to the head.

**14.2.8.2 Hardware.** Hardware for mast arm mounting shall be Pelco Astro-Brac with cable mount kits or approved equal. Aluminum pipe brackets shall be a gusseted tube with a spun finish. Side mount brackets may be aluminum or molded, glass-impregnated polycarbonate no greater than 12 inches (300 mm) in length. Elbows, tees and crosses shall be straight threaded and furnished with a square head set screw at each connection point to ensure rigid mounting. Fittings attached to the signal housing shall incorporate serrations or, by the use of an adapter ring, shall be compatible with the serrations on the signal housing.

**14.2.8.3 Countdown Pedestrian Signal Heads.** All 16 inch x 18 inch Countdown Pedestrian Traffic Signal Modules shall fully and completely comply with all sections of ITE Pedestrian Traffic Control Signal Indications – LED Pedestrian Traffic Signal Modules Part 2 LED Pedestrian Traffic Signal Module specifications dated March 19, 2004. All modules shall have a uniform non-pixelated illumination appearance. Modules shall be fully compliant with MUTCD 2009 Section 4E.07. The pedestrian signal housing shall be constructed of ultraviolet stabilized color-impregnated black polycarbonate resin. Scratches shall not expose uncolored material. LED color shall be Portland Orange for countdown and hand indications, Lunar White for the person indication. They shall require no special wiring or electronic modules to operate. Heads shall only be mounted with upper and lower arms. Clam shell mounting will not be accepted.

**14.2.9.1 Lighting.** This work shall consist of furnishing and installing lighting equipment and material as shown on the plans. All work shall meet NEC, NESC and NEMA standards. See Section 14.2.6.7.1 for lighting controller requirements. Luminaire heads shall be furnished by others and installed by the contractor.

**14.2.9.2 Bracket Arms.** Bracket arms shall be either single tube or truss type, arranged for 2-inch slipfitter luminaire mounting, and shall be attached to the poles in accordance with the manufacturer's recommendations. Bracket arm mounting plates shall match the shape of the pole. A one-inch pipe nipple shall be welded in place in the wire entrance hole on the mounting plate. The welds shall be placed on the side of the plate away from the pole.

#### **14.2.10 Detectors.**

**14.2.10.1 Induction Loop Detectors.** Induction loop vehicle detectors shall be Model 222 or 224 units as shown on the plans. Model 222 and 224 loop detector units shall conform to requirements of Chapter 5, Sections 1 and 2 of CALTRANS "Transportation Electrical Equipment Specifications" (TEES) dated March 12, 2009 including all revisions and addenda thereto current at the time the project is advertised. Only detectors listed on the CALTRANS Qualified Products List will be accepted. All detector units shall have solid state outputs. In case of conflict, the City's specifications shall govern.

**14.2.11.1 Traffic Controller Assemblies.** Traffic controller assemblies shall consist of a Type 2070 ATC controller unit, a wired cabinet and all auxiliary equipment required to control the system as specified in these specifications, and as shown on the plans and in the special

provisions. Except as herein modified, Type 2070 ATC controller assemblies shall be in full compliance with the most current "Transportation Electrical Equipment Specifications (TEES)" and "Qualified Products List (QPL)" issued by the State of California, Business, Transportation & Housing Agency: Department of Transportation (Caltrans), and all revisions and addenda thereto current at the time the project is advertised. The Contractor shall provide a certification that the equipment proposed is included on the most current "Qualified Products List (QPL)" of Caltrans. Exception: City specific equipment that is not defined in the Caltrans specification is exempt from this QPL requirement. In case of conflict, the City's specifications shall govern. Prior to shipping to the project site, each traffic controller assembly shall be delivered to the Traffic Signal Shop for testing. Minimum test period shall be 14 days.

**14.2.11.2.1 Controller.** Except as herein modified, the Microcomputer 2070 ATC controller with 1C module shall be in accordance with the Caltrans "Transportation Electrical Equipment Specifications (TEES)", dated March 12, 2009, and all applicable errata and addenda, which shall form a part of these specifications. Certification shall be provided that the equipment proposed is included on the most current "Qualified Products List (QPL)" of Caltrans. The Type 2070 ATC microcomputer controller shall be fully compatible with McCain's software.

**14.2.11.3.1 Type 2070 Controller Cabinets.** Controller cabinets shall be the model shown on the plans. Controller cabinets, including the auxiliary door(s), shall be cast aluminum or 0.125 inch reinforced sheet aluminum alloy and be of clean-cut design and appearance. The cabinets to be furnished shall be in accordance with the most current "Transportation Electrical Equipment Specifications (TEES)" and "Qualified Products List (QPL)" issued by the State of California, Business, Transportation & Housing Agency: Department of Transportation (Caltrans), and all revisions and addenda thereto current at the time the project is advertised, except as modified in these specifications. In case of conflict, the City's specifications shall govern.

Bidders shall provide a certification that the equipment proposed is included on the most current "Qualified Products List (QPL)" of Caltrans. Exception: City specific equipment that is not defined in the Caltrans specification is exempt from this QPL requirement.

The additional requirements for the models 332L, 332D and 336L cabinet assemblies are as follows. All cabinets shall exhibit a "bare" aluminum finish. An auxiliary door equipped with a raintight gasket shall allow access to a police panel and shall be equipped with a lock whose key will not unlock the main door. Each cabinet door shall have a No. 2 Corbin cabinet lock and provisions for locking with a padlock. Two keys shall be furnished for each type of lock used. The doors shall be louvered to direct the incoming air downward. The cabinet shall be supplied with a replaceable furnace-type fiberglass filter mounted behind the louvers and shall cover the vent openings. A filter shell shall be provided to fit over the filter to provide mechanical support. The handles for each door shall swing outward. The 336L cabinet shall be provided with an M base adapter. All cabinets shall be supplied with anchor bolts.

Each 332L cabinet shall include two (2) fluorescent lighting fixtures mounted inside the front and back portion of the cabinet. Model 332D cabinets shall have four (4) fluorescent lighting fixtures. Model 336L cabinets will require only one (1) fluorescent lighting fixture. These fixtures shall include a cool white lamp with protective cover and shall operate by a normal

power UL listed ballast. The fixtures shall be installed to automatically power on when the cabinet door is opened and automatically power off when the cabinet door is closed. A manual on/off switch shall be provided for each fixture. Each switch should work each individual light.

#### **14.2.11.4.1 Cabinet Components.**

**14.2.11.4.2 Pull Out Drawer.** All cabinet types shall contain a pull out, hinged-top drawer, including sliding tracks, with lockout and a quick-disconnect feature, such as a Vent-Rak Retractable Writing Shelf, #D-4090-13, or equivalent. The pull out drawer shall extend a minimum of 14 inches to facilitate removal of the processor by providing an aluminum platform covered with a formica-type, chemical-proof plastic sheet while the rear connector is being removed. The interior of the drawer shall be accessible by lifting the hinged platform. Minimum interior dimensions of the drawer shall be one inch high, 13 inches deep and 16 inches wide. The drawer shall be capable of supporting 40 pounds when fully extended and shall be mounted immediately below the controller assembly.

**14.2.11.4.3 Service Panel Assembly.** All cabinet assemblies shall be supplied with a service panel assembly Number 2L, (PDA#2L) with a solid state relay. The service panel assembly shall not contain a mercury contactor. If the solid state relay fails to open during either maintenance flash or a cabinet monitor unit fault condition, the cabinet must interrupt the 24 VDC control to the load switches. If an auxiliary output file is specified, C5 connections shall be included. The SPA shall contain a model 206L power supply (switching type) that is high efficiency and power factor corrected. A plug-able line voltage transient suppressor must be included to provide clean power.

**14.2.11.4.4 Police Panel.** Each controller cabinet shall be furnished with a clearly labeled switch that is mounted in the access or police panel to place the signals on flash. Operation of this switch shall not affect the electrical power supply to the controller. The switch shall be labeled FLASH/AUTOMATIC. This shall be the only control switch accessible from the police panel.

**14.2.11.4.5 Termination.** All output field conductors shall be terminated in the cabinet on a one-piece copper 600-volt heavy duty mechanical screw connector offset tang assembly. Each mechanical screw connector shall accommodate up to four No. 12 AWG conductors. Each clamp shall be captive to the contact screw and the screw captive to the contact. Field wiring shall not be spade lugged. The A.C. neutral bus and chassis ground bus shall be a 17-position solid copper neutral bar with set screws that allow the wires to be attached without tang or spade assemblies.

**14.2.11.4.6 Output File.** The output file shall be hand wired and printed circuit boards will not be allowed, except for red fail monitoring. The back of the load switch bay and the conflict monitor bay shall be enclosed to prevent wires interfering with plugging in of components. A 420 auxiliary output file will be required when specified on the plans or if more than 12 load switches are required.

**14.2.11.4.7 Input Files.** Both I and J input files shall be provided unless otherwise specified.

**14.2.11.4.8 Cable Routing.** All cables shall be located and secured such that the cables do not interfere with removal of the controller or the opening of the controller front panel.

**14.2.11.4.9 Surge Protection.** Each cabinet shall be provided with devices to protect the control equipment from surges and over voltages. This shall include incoming power lines, the input and output files and communication lines.

All input file inputs shall be protected with a 30V Metal-Oxide Varistor (MOV) with a 30 Joule rating, P/n ERZ-C20 DK 470 or equal. All load switch outputs shall be protected with a 150V MOV with an 80 Joule rating, P/n ERZ-C20 DK 241U or equal. Each MOV shall be connected from the A.C. positive field terminal to the chassis ground. Each output MOV shall be mounted on the field terminal side of the output assembly.

- A. **14.2.11.5.1 332A Panel Termination.** The 332A panel termination shall have appropriate input surge protection and shall be mounted in the service panel assembly (SPA). The PDA#2L of each controller cabinet shall include a surge protection unit on the alternating current service input. The protector shall be installed between the applied line voltage and earth ground. The surge protector shall be capable of reducing the effect of lightning transient voltages applied to the A.C. line. The protection device shall be a two-stage series parallel device, and shall be an SHA 1250-TEES.

**14.2.11.6 Cabinet Accessories.** Each cabinet shall be equipped with the following, unless specified otherwise:

Model 222 Loop Detector Amplifiers. The loop detector amplifier units shall be as specified in the Caltrans Specifications. A quantity of 8 units shall be provided per cabinet.

Model 242 D.C. Isolator. The D.C. isolators shall be the Model 242 as specified in the Caltrans Specifications. A quantity of 3 units shall be provided per cabinet.

Model 200 Load Switch. The load switch shall be the Model 200 as specified in the Caltrans Specifications. A quantity of 16 units shall be provided per cabinet.

Model 204 Flasher. The flashers shall be the Model 204 as specified in the Caltrans Specifications. Each cabinet shall be supplied with two (2) model 204 flashers.

Model 252 A.C. Isolator. The A.C. isolators shall be the Model 252 as specified in the Caltrans Specifications. The quantity of units shall be as described on the plans.

Model 430 Flash Transfer Relay. The flash transfer unit shall be the Model 430 as specified in the Caltrans Specifications. Each cabinet shall be supplied with four (4) model 430 flash transfer relays. Two (2) additional model 430 flash transfer relays shall be provided when a 420 auxiliary is shown on plans.

**14.2.11.7 Model 2010 Conflict Monitor.** Each cabinet shall be supplied with a Model 2010 ECLip conflict monitor. The conflict monitor shall be external to the controller circuitry in accordance with the Caltrans specifications. The monitor shall cause immediate transfer to flashing operation when conflicting or absent indications occur or when a voltage fault occurs. When the conflict monitor actuates flashing operation, the controller shall freeze or stop timing in the condition causing the actuation until manually reset. A single lamp failure in any signal head shall not cause the monitor to actuate.

A connector and terminal assembly designated as P20 (Magnum P/N 722120 or equivalent), for monitoring the absence of red shall be an integral part of the output file. The connector shall terminate and shall be compatible with the cable and connector of the conflict monitor unit. The pin assignments of the P20 connector and terminal assembly shall be provided with the cabinet plans. The P20 connector shall be designed such that the cable may only be inserted into the P20 connector in one direction. Unused red channels shall be programmed through jumpers. These jumpers shall cause 115V A.C. to be applied to any and all unused red monitoring channels. These jumpers and the respective attachment points shall be part of the output file.

**14.2.11.8.1 Testing Requirements.** All equipment shall be tested for conformance to these specifications. Testing may be done by an independent laboratory if the manufacturer does not have sufficient facilities to conduct the testing. A copy of the test results for all equipment shall be supplied by the manufacturer to the Engineer.

**14.2.11.8.2 Conflict Monitor Test Cable.** To facilitate testing of the conflict monitor, one additional 4-foot (1.2 m) connector cable shall be furnished by the manufacturer and installed in each cabinet. The cable shall utilize an 18 AWG (1.0 mm) wire to connect a 36-pin plug to the back panel terminals as specified below. The connector cable shall utilize a 36-circuit polarized nylon Waldon Molex type receptacle, P/N 03-06-1361, using a 0.062-inch (1.57 mm) female terminals made of 70/30 spring tempered 0.010 inch (0.254 mm) thick tin-plated brass with contact of resistance 0.0025 ohm millivolts, drop of 2.5 millivolts at one amp with 250 volts, 4 amps maximum per circuit. This connector cable shall "free float" in the bottom front 6 inches (150 mm) of the cabinet and shall not be used in the normal operation of the controller. A moisture-proof cap shall be provided to prevent the accumulation of moisture on the plug terminals. The cap shall remain attached to the connector when the cable is in use.

Receptacle Circuit	Terminal Phase	Receptacle Circuit	Terminal Phase
1	1 G	19	4 WALK
2	1 Y	20	8 WALK
3	2 G	21	1 AUX G <sup>a</sup>
4	2 Y	22	1 AUX Y <sup>a</sup>
5	3 G	23	3 AUX G <sup>a</sup>
6	3 Y	24	3 AUX Y <sup>a</sup>
7	4 G	25	5 AUX G <sup>a</sup>
8	4 Y	26	5 AUX Y <sup>a</sup>
9	5 G	27	6 AUX G <sup>a</sup>

10	5 Y	28	6 AUX Y <sup>a</sup>
11	6 G	29	I14-W STOP TIME
12	6 Y	30	DC GROUND
13	7 G	31	MONITOR RESET
14	7 Y	32	DC GROUND
15	8 G	33	2 AUX G <sup>a</sup>
16	8 Y	34	2 AUX Y <sup>a</sup>
17	2 WALK	35	4 AUX G <sup>a</sup>
18	6 WALK	36	4 AUX Y <sup>a</sup>

<sup>a</sup> Circuits used only in a 332A cabinet with an auxiliary output file

**14.2.11.8.3.1 Controller Testing.** Each Model 2070 ATC controller unit shall be tested over a temperature range of -29 to 165 F (-34 to 74 C). Proper operation of the unit shall be verified at both temperature extremes and at ambient temperature. Testing shall be conducted prior to final inspection, and will not constitute a substitute for any quality control testing or final inspection testing normally performed.

**14.2.11.8.3.2** The environmental chamber(s) shall have provisions for remotely operating the Model 2070 ATC controller under test. Front panel displays shall be visible from a window in the environmental chamber. Signal outputs shall be brought out of the chamber to a display board if controllers cannot be directly observed. Cold and hot soak times shall be sufficient to allow all components in the device to reach the specified temperatures. A minimum soak time of three hours shall be used for all testing.

**14.2.11.8.3.3** The manufacturer shall submit to the Engineer a proposed testing procedure and schedule 30 days prior to testing for evaluation. Test procedures, environmental chambers, automatic test equipment, display boards, power supplies and controls shall be described in detail.

**14.2.11.8.3.4** The controller shall pass the following test at least five times at each temperature extreme and ambient:

- A. Recovery from a short power interruption of approximately 500 milliseconds.
- B. Recovery from a long power interruption of approximately 5 seconds.

**14.2.11.8.3.5** The vendor shall provide a method of testing controller inputs and outputs. Diagnostic software and wraparound connector for controller harnesses may be used. If diagnostic software is not used, outputs shall be brought out to a display board. Inputs may be paralleled to each controller.

**14.2.11.8.4 Cabinet Testing.** Cabinets shall be tested at ambient conditions only. An automatic or semi-automatic method of checking cabinet wiring between equipment harnesses and field connections will be required.

**14.2.11.8.5** The Engineer reserves the right to relieve any or all testing requirements if certain specifications are met.

**14.2.12 Concrete for Bases.** Concrete shall be Portland Cement Concrete in accordance with Chapter 6 of the General Conditions and Technical Specifications. Reinforcing steel for concrete bases shall be in accordance with AASHTO M 42 or AASHTO M 53. Anchor bolts for posts and mast arms and controllers shall be as shown on the manufacturer's approved shop drawings.

### 14.3 INSTALLATION

**14.3.1.1 Pull Boxes.** Pull boxes shall be installed at locations as shown on the plans. Pull box size and type shall be as shown on the plans. The top surface of all pull boxes shall be flush with surfaced areas and approximately one inch above earth or sodded areas. A stone drain consisting of ½ inch to ¾ inch clean limestone 18 inches deep shall be constructed under each pull box.

**14.3.1.2** Conduit shall enter the pull box in the side of the box a minimum of 18 inches deep and at least 4 inches above the bottom of the box. Conduit shall extend into the box a minimum of 2 inches and a maximum of 4 inches. Where preformed pull boxes are used, the holes for the conduit shall be drilled as recommended by the manufacturer. The holes shall be round and no more than ½ inch larger than the conduit to prevent the entry of water, silt, mud, gravel, sand or other foreign material. If it becomes necessary to increase the excavation depth and extend the pull box, no direct payment will be made. The excavated opening outside the pull box shall be wide enough to allow compaction of the backfill material. Cinders, broken concrete, broken rock or other hard or undesirable material shall not be used for backfilling. The backfill material shall be placed in layers not to exceed 6 inches deep, and each layer shall be thoroughly compacted with a tamper before the next layer is placed. To avoid damage to the pull box, backfill shall not be compacted with a vehicle wheel or backhoe bucket.

**14.3.1.3 Preformed Pull Boxes.** Preformed pull boxes shall have a 12-inch pad, 9 inches deep installed on all four sides of the pull box. Reinforcing steel shall be installed in the pad as shown on *Standard Drawing TS-2: Preformed Pull Boxes*.

**14.3.1.4 Cast-In-Place Pull Boxes.** Cast-in-place pull boxes shall be constructed of Class B concrete in a neat and workmanlike manner. Minimum wall thickness shall be 6 inches. Forms will be required for the inside surfaces of the pull box walls. If the excavation is irregular, forms will also be required for the outside surfaces of the walls. An outside form shall be installed across all trenches leading into the pull box excavation. Means shall be provided to hold forms rigidly in place, both inside and outside. The ends of all conduits through the walls shall fit tightly against the form. If directed by the Engineer, 5-inch x 5-inch x 4-inch Styrofoam blocks may be installed in each wall of the pull box for future conduit access. Frames and covers shall be cast iron meeting the requirements of AASHTO M 105, Class 30. Dimensions shall be as shown on *Standard Drawing TS-3: Cast-in-Place Pull Boxes*.

**14.3.1.5** If preformed pull boxes are specified, the Contractor may use standard concrete pull boxes in lieu of the preformed pull boxes, if approved by the Engineer.

### **14.3.2 Bases.**

**14.3.2.1 Concrete Bases.** Excavation for bases shall be made in a neat and workmanlike manner. While concrete is being placed, forms shall be level and sufficiently rigid to prevent warping or deflection. Conduit and anchor bolts shall be held rigidly in place before and during concrete placement. Anchor bolts for the signal posts and the controller pedestals shall be set in place by means of a template constructed to space the anchor bolts in accordance with the pattern as shown on the manufacturer's approved shop drawings. Bottom of anchors shall be secured by wire or welded rebar. The center of the template and the center of the concrete base shall coincide, and all conduits shall exit the base as nearly as possible to the center of the base. Ends of conduit shall be capped before placing concrete. Anchor bolt size and anchor bolt projection shall be in accordance with manufacturer's recommended practices. Concrete shall be consolidated using an internal concrete vibrator. Reinforcing steel for concrete bases shall be in accordance with AASHTO M 42 or AASHTO M 53. A 3/4-inch x 10 foot copper clad ground rod shall be driven beside each base, with a 1 inch PVC conduit provided in the base concrete to accommodate the grounding cable. An Engineer approved marker shall be set on the top of the base to identify the location of the grounding cable conduit. Grounding cable shall be bare 1c #6 solid copper attached to the ground rod with a ground rod clamp that is corrosion resistant, UL listed, and approved for direct burial in earth and concrete. During cold weather periods, concrete shall be placed only when the ambient air temperature is thirty-five (35) degrees Fahrenheit and rising. Concrete shall not be placed on frozen materials. The Contractor is responsible for any damage to the concrete due to weather conditions or other factors. Tops of all bases shall be finished level, or as directed by the Engineer, and the perimeter edged to a radius of 1/2 inch. Exposed surfaces of bases shall be given a rubbed finish as soon as practical after removing forms.

**14.3.2.2 Post Bases.** Concrete bases for posts shall be in accordance with the dimensions shown on the plans. The final 6 inches of base in or adjacent to a sidewalk shall be poured after the mast arm is erected or pedestal pole installed and the pole plumbed. Final top elevation shall match sidewalk grade. If directed by the Engineer, the pole cap may be poured integral with the sidewalk. If the base is not adjacent to the sidewalk, the final top elevation shall be 4 inches above finished final grade of earth or sodded areas, or as directed by the Engineer. The top 12 inches of the bases shall be formed square. Care shall be taken to ensure that proper signal head clearances over the roadway are maintained. Anchor bolts for steel posts and mast arms shall be as shown on the manufacturer's approved shop drawings. Leveling nuts and washers shall be provided for each anchor bolt. Size and number of conduits shall be as shown on the plans. Conduit shall extend above all post bases a nominal two inches. Install pre-formed expansion joint material between the pole foundation and any abutting concrete. See *Standard Drawings TS-13: Type A Signal Base* and *TS-14: Type D Signal Base*.

**14.3.2.3 Controller Bases.** Concrete bases for controllers shall be constructed as shown on the plans. Aprons will be considered part of the controller base. The size and number of anchor bolts for controller cabinets shall be as specified by the cabinet manufacturer. Size and number

of conduits shall be as shown on the plans. Conduit shall extend above all controller bases no more than one inch. See *Standard Drawing TS-15: Controller Bases*.

**14.3.3.1 Conduit System.** The work shall consist of furnishing all labor, materials, equipment, and tools for excavation of trenches, pits and associated incidental elements relating to the construction of underground conduits and appurtenances and the backfilling of these excavations as shown on the plans, or as necessary to complete the project. Conduit shall be placed as shown on the plans. Unless otherwise specified, Schedule 40 PVC or Heavy Duty Polyethylene conduit shall be used in underground applications. HDPE conduit shall be used as interconnect conduit. Conduits exposed to direct sunlight, such as conduit on power supplies, shall be Galvanized Rigid Steel conduit. Conduit shall be placed so that the top of the conduit is a minimum of 18 inches below finished grade and shall slope to drain. A change in direction of conduit shall be accomplished by bending the conduit uniformly to a radius that will fit the location, or by the use of standard bends or elbows. The minimum radius of the bend shall be six times the internal diameter of the conduit. All conduit and fittings shall be free from burrs and irregularities. All conduits shall be cleaned and swabbed before cables are installed. All fittings shall be tightly connected to the conduit. Open ends of conduit placed for future use shall be capped or plugged in a manner approved by the Engineer. If approved by the Engineer, conduit shown as trenched may be installed either by trenching or boring; however, payment will be made at the unit price specified in the contract for trenched conduit. Pull rope shall be installed in all conduits and shall be an incidental cost to the installation of the conduit.

**14.3.3.2 Rigid Steel Conduit.** All rigid steel conduit ends shall be provided with a threaded grounding bushing to protect the cable from abrasion. All metal conduits shall be electrically bonded by threaded grounding bushings and bare No. 6 AWG solid copper wire. All metal conduits in the controller base shall be electrically bonded to the power company ground. Nipples shall be used to eliminate cutting and threading where short lengths of conduit are required. If it becomes necessary to cut and thread steel conduit, exposed threads will not be permitted. Sharp kinks in the conduit or the substitution of non-metallic materials for rigid steel conduit will not be permitted. Bends in rigid steel conduit shall be made using pipe bending equipment designed for that purpose.

**14.3.3.3 Trace Wire – PVC & HDPE Conduit.** PVC or HDPE, either empty or containing only fiber optic cable, shall contain a No. 14 AWG THHN/THWN stranded copper tracer wire. The insulation for tracer wire shall be brown or blue. Tracer wire shall not be pulled into the controller cabinet or bases. An additional 3 feet of tracer wire shall be coiled in each pull box through which the fiber optic cable passes. Tracer wire in pull boxes shall be capped, not electrically bonded to any ground wires, and tagged "TRACER". No direct payment shall be made for tracer wire.

**14.3.3.4 Polyvinyl Chloride Conduit.** PVC conduit joints shall be cut square, reamed and chamfered, and shall be free of burrs and obstructions. Both joint surfaces shall be clean and free of moisture. Primer conforming to ASTM F-656 for PVC joints shall be applied to both joint surfaces. Joints shall be made while the cement is wet. Solvent cement conforming to ASTM D-2564 for PVC joints shall be applied to all joint surfaces. Bends in PVC conduit shall be made

using factory fittings and elbows, or by the use of heating boxes, tubes, or blankets as approved by the Engineer.

**14.3.3.5 High Density Polyethylene Conduit.** HDPE is typically used for interconnect and in bored applications. It is preferable that HDPE conduit be continuous from pull box to pull box. The Engineer may allow splices in HDPE conduit using approved fittings and methods outlined in section 14.2.3.7, except that if a splice is allowed in bored conduit, it must be a fusion splice.

**14.3.3.6 Conduit in Trench.** Conduit runs shall be as straight as possible between points of termination. Conduit shall be placed so that the top of the conduit is a minimum of 18 inches below finished grade or 24 inches below the lowest pavement level, if area is to be paved. Trenches shall be excavated to the width and depth necessary for conduit installation. Immediate cover for conduit under non-paved surfaces shall be 6 inches minimum of white sand. Immediate cover for conduit under paved surfaces shall be ½” clean rock fill. Backfill for the remainder of the trench shall use previously excavated earth, gravel, or sand containing no stone over 6 inches in its largest dimension. Cinders, broken concrete and other hard or objectionable material that might cause mechanical damage to the conduit shall not be used for backfilling. The bottom of the trench shall be free of such material before the conduit is placed. Backfill material shall be deposited in the trench in layers not exceeding 6 inches deep and each layer shall be compacted with a mechanical tamper to the approximate density of the adjacent material before the next layer is placed. All trenches shall be backfilled as soon as practical after the installation of conduit. Conduit shall not be placed without approval of the trench from the Engineer. Whenever excavation is made across parkways, driveways, or sodded areas, the sod, topsoil, crushed stone and gravel shall be replaced or restored as nearly as possible in its original position and the whole area involved shall be left in a neat and presentable condition. Seeding and Sodding shall be in accordance with Chapter 13 of the General Conditions and Technical Specifications. Trenching or excavation in sidewalk areas will require replacement of complete sidewalk slab sections. Concrete pavements and base courses and bituminous surfaces, including driveways, cut during trenching shall be repaired with new materials as required by the City’s specifications. See *Standard Drawing TS-16: Trench and Conduit Detail*.

**14.3.3.7 Bored Conduit.** If bored conduit is specified, the conduit shall be installed without disturbing the existing surface. Methods for boring conduit must be approved by the Engineer. Pushing or jacking may only be used if approved by the Engineer. Minimum depth for bored conduit is 24 inches below lowest pavement level, including boring under driveways. Bored conduit shall extend at least two feet beyond the surface under which conduit is indicated to be bored in the plans. All work and incidentals included in the boring and placement of conduit in bored holes shall be considered completely covered by the respective bid items for bored conduit.

**14.3.4 Reserved for Future.** This section is reserved for future use.

### **14.3.5 Wiring.**

**14.3.5.1 Pulling.** Cables shall be pulled through conduit by hand using a cable grip providing a firm hold on exterior coverings. Cable shall be pulled with minimal dragging on the ground or

pavement. Frame-mounted pulleys or other suitable devices shall be used for pulling cables out of conduit into pull boxes. Only lubricants specifically designed for this purpose may be used to facilitate the pulling of cable. A pre-lubricated woven polyester pull tape with a minimum tensile strength of 1,250 pounds shall be used to pull cable through conduit. Polyester rope will not be permitted to facilitate pulling of cable. Slack in each cable, except fiber optic cable, shall be provided by a 4 foot loop coiled in each pull box, 3 feet in each signal base, and 6 feet in each controller cabinet. A cable-pulling machine may be used if approved by the Engineer. A pre-lubricated woven polyester pull tape with a minimum tensile strength of 1,250 pounds shall be left in each conduit run for future use.

**14.3.5.2 Signal Cable.** All cable runs shall be continuous and un-spliced from the connections made in the handhole compartment of the signal base to the terminal compartment in the controller cabinet. Conductor groupings and splicing may be made in the controller cabinet. These splices shall be insulated. All conductor cable combinations to the signal heads shall be as shown on the plans. No substitutions will be permitted. The termination of each cable in the signal bases shall be as follows:

**5-CONDUCTOR TO PEDESTRIAN SIGNAL HEADS**

Black	Spare
White	Signal Neutral
Red	Don't Walk
Green	Walk
Orange	Spare

**7-CONDUCTOR TO VEHICLE SIGNAL HEADS\***

Black	Green Arrow
White	Signal Neutral
Red	Red Ball
Green	Green Ball
Orange	Amber Ball
Blue	Amber Arrow
White Black Trace	Spare

**16-CONDUCTOR TO THE BASE OF THE POLE\***

Red	Thru Red
Orange	Thru Amber
Green	Thru Green
White	Signal Neutral
Black Red Trace	Left Turn Red Protected
Blue	Left Turn Amber
Black	Left Turn Green
Red Black Trace	2 & 6 Ped Don't Walk
Green Black Trace	2 & 6 Ped Walk

Red White Trace	4 & 8 Ped Don't Walk
Green White Trace	4 & 8 Ped Walk
White Black Trace	Ped Neutral
Orange Black Trace	Spare
Blue Black Trace	Spare
Black White Trace	Spare
Blue White Trace	Spare

\* Conductors corresponding to phases or indications not present shall be considered spare.

Phasing shall be as specified in *Standard Drawing TS-17: Signal Phasing Layout* or as otherwise specified on the plans.

**14.3.5.3 Power Cable.** Power cable runs shall be continuous and unspliced from the power disconnect switch located on the power supply to controller cabinet terminals. Power cable shall be encased in conduit of the size shown on the plans. Energized power cables shall run to circuit breakers. The neutral cable shall be terminated on the neutral bus bar and the equipment ground conductor shall be terminated on the ground bus in the controller cabinet.

**14.3.5.4 Pushbutton Detector Cable.** Each pushbutton detector shall be connected to the controller by a separate two-conductor cable as shown on the plans.

**14.3.5.5 Detector Lead-in Cable.** Each detector loop shall be connected to the controller by a separate No. 14 AWG two-conductor shielded cable. These cables shall be continuous from the terminal compartment in the controller cabinet to a splice made with the detector leads in the first pull box or junction box adjacent to the detector. The splice shall be made using 3M DBY splice kits or approved equal.

**14.3.5.6 Luminaire Cable.** Where luminaires are required, pole and bracket cable shall be installed between the luminaire and the power cable at the base of the post. Each luminaire shall be connected to the power cable by No. 10 AWG conductors. A premolded fused connector assembly shall be installed on each conductor. A slug shall be installed in the connector on the neutral (white) conductor. The assembly and cable shall be insulated with a protective rubber boot designed for the premolded connector.

**14.3.5.7 Identification.** Each cable shall be properly labeled in the controller cabinet and all pull boxes by means of stamped non-conductive wrap around or sleeve type identification labels securely attached to all conductor cables. Information stamped on the labels shall identify equipment served by the conductor cable in accordance with designations used on the plans, such as:

POLE 1	Signal pole number 1
LUMINAIRE 1	Luminaire, signal pole number 1
PUSHBUTTON 42	Pedestrian pushbutton number 42
LOOP 22	Detector loop number 22
VIDEO 1	Video detector number 1
CAMERA 1	Traffic monitoring camera number 1

EQUIP GRND 1	Equipment ground, signal pole number 1
TRACER	Tracer wire
COMM NATIONAL & GRAND	Interconnect to National & Grand

**14.3.5.8.1 Fiber Optic Interconnect Cable.** The Contractor shall provide trained and experienced personnel to supervise the installation of the fiber optic cable. Methods of fiber optic installation and all types of work with fiber optic cable shall be approved by the Engineer before implementation by the Contractor. The cable shall be installed in continuous runs in conduit and pull boxes between traffic signal controller cabinets or splice cabinets. No splices outside of the cabinets will be allowed. An additional 60 feet of cable shall be pulled into each cabinet for splicing. Slack cable in pull boxes shall be as directed by the Engineer. Without exception, fiber optic cables shall not be disconnected or cut without the express approval of the Engineer and Signal Shop personnel being on site.

**14.3.5.8.2 Conduit.** The conduit containing only fiber optic interconnect cable shall be polyvinyl chloride or high density polyethylene conduit in accordance with Section 14.2.3 and shall be orange in color. A No. 14 AWG stranded copper tracer wire shall be installed in the conduit.

**14.3.5.8.3** Each end of the interconnect cable shall be sealed with a manufacturer-approved end cap or pulling grip for use during installation. Caps or grips may be removed only after complete installation of cable and for cable acceptance testing. End caps shall be installed to remain in place where fibers are not to be terminated.

**14.3.5.8.4** The minimum bend radius and maximum pulling force of the interconnect cable shall not be exceeded during installation. The pulling of cable shall be hand-assisted at each pull box and cabinet. The cable shall not be kinked, crushed, or forced around a sharp corner. Pulling equipment may be used; however, all pulling equipment and hardware must maintain the cable's minimum bend radius. Such equipment that may contact the cable includes sheaves, capstans, bending shoes, and quadrant blocks designed for use with fiber optics. Where pulling equipment such as a winch is used, cable tension must be continuously monitored. This may include the use of a winch with a calibrated maximum tension or a dynamometer or in-line tensiometer. All pulling equipment must be approved by the Engineer.

**14.3.5.8.5 Lubricants.** If a lubricant is used, it shall be water-based as approved by the cable manufacturer and shall be compatible with the pre-lubricated conduit. If used, lubricant type and manufacturer shall be supplied to the Engineer for approval.

**14.3.5.8.6** Installation of the fiber optic cable shall also be in accordance with the manufacturer's specifications and recommended practices. Should the manufacturer's specifications and/or recommended practices appear to conflict with any part of this specification, the matter shall be brought to the attention of the Engineer for resolution.

**14.3.5.8.7 Identification.** At each pull box and controller cabinet, the fiber optic cable shall be visibly marked "Caution - Fiber Optic Cable" by self-adhesive, weatherproof tags. This requirement is in addition to Section 14.3.5.7.

**14.3.5.8.8 Testing.** After the fiber optic cable installation, each fiber in each section shall be tested for attenuation and continuity, as a minimum. The City shall provide all personnel, equipment, instrumentation and supplies necessary to perform all testing unless otherwise specified in the contract documents. Any sections that fail the testing shall be replaced at the Contractor's expense, and retested.

### **14.3.6. Detectors.**

**14.3.6.1 Detector Type.** Detection type shall be as shown on the plans.

**14.3.6.2 Induction Loop Detectors.** The location of traffic signal detector loops is critical; therefore, final location of detector loops shall be approved by the Engineer. The Contractor shall give the Engineer two (2) business days notice before loop installation. Slots shall not be sawed until seven days after placement of Portland cement concrete. Sawed slots shall be made by wet cutting using a power concrete saw. Placement of loop slots across cracks and joints shall be avoided, unless an exception is approved by the Engineer. If the slot crosses an expansion joint, depth must be increased slightly to provide a little play in the cable for expansion. Before cable is placed in the slot, all debris and moisture must be removed. The cable is then placed in the slot and pushed into proper position by use of a blunt nonmetallic object. Care shall be taken to ensure that the loop cable does not float up in the slot. The loop slot shall be 1½ inches deep in concrete pavements, 3½ inches deep in asphalt pavements, and a maximum of 3/8 inch in width. Conduit shall be installed between the sawed loop slot and the first pull box. The conduit opening at the end of the lead-in slot shall be at the bottom of the sawed slot. After the loop cable is installed, and before the slot is sealed, the resistance of the loop to ground shall be checked. The resistance test shall be performed by the Contractor in the presence of the Engineer, or assigned personnel, and documented. After a satisfactory test, showing a resistance no less than 10 megaohms, the slot shall be sealed. The conduit opening at the end of the lead-in slot, and any drilled conduit holes in the pavement, shall be sealed with a pliable duct sealant prior to the application of loop sealant. All sawed slots shall then be sealed with an approved detector loop sealant. Loop sealant shall be installed according to manufacturer's specifications and recommendations. Excessive overfill will not be permitted. All detector cable between the loop and lead-in cable shall be twisted at least three turns per foot. Unless otherwise specified by the Engineer, slot must be sawed such that the wire does not turn an angle greater than 45 degrees at the corners.

**14.3.6.3 Video Detection Systems.** This work shall consist of furnishing, installing and placing into operation a vehicle detection system that detects vehicles by processing video images and providing detection outputs to a traffic signal controller. The system shall include all equipment shown on the plans and described in the bid specifications, and shall include any incidental items necessary for the satisfactory operation and maintenance of the system. The video detection system shall be installed per the manufacturer's recommendations. All cable runs shall be continuous without splice from the cabinet to the camera. If requested by the Engineer, a factory certified representative from the supplier shall be available for on-site assistance for a minimum of one day during installation.

**14.3.6.3.1 Camera.** The bottom of the video camera shall be mounted a minimum of 30 feet

above the pavement unless otherwise approved by the Engineer.

**14.3.6.4 Radar Detection Systems.** This work shall consist of furnishing, installing and placing into operation a vehicle detection system that detects vehicles by emitting a series of radar beams that create a radar zone, a two-dimensional image of an approach that can track vehicles, distinguish lanes, and accurately detect presence at the stop bar and providing detection outputs to a traffic signal controller. The system shall include all equipment shown on the plans and described in the bid specifications, and shall include any incidental items necessary for the satisfactory operation and maintenance of the system. The radar detection system shall be installed per the manufacturer's recommendations. If requested by the Engineer, a factory certified representative from the supplier shall be available for on-site assistance for a minimum of one day during installation.

**14.3.6.5 Pedestrian Pushbuttons.** Pushbuttons and housings shall be installed according to the manufacturer's recommendation and applicable sections of the Americans with Disabilities Act. Due to the critical nature of correct pushbutton placement, the Engineer or assigned personnel shall mark the locations for pedestrian pushbuttons in the field.

## 15 LANDSCAPING

**15.1 TREE PRESERVATION PLAN** [reference to APWA Tree Protection & Preservation]  
Plan shall meet the approval of the Engineer.

### 15.2 TREE PLANTING

**15.2.1 Scope of Work.** The work shall consist of furnishing all labor, equipment, and materials necessary for the preparation, fertilization, seeding and planting of the areas specified in the contract.

#### 15.2.2 Materials.

**15.2.2.1 Plants:** Provide plants typical of their species or variety; with normal, densely developed branches and vigorous, fibrous root systems. Provide only sound, healthy, vigorous plants free from defects, disfiguring knots, sunscald injuries, and frost cracks, abrasions of the bark, plant diseases, insect eggs, borers, and all forms of infestations. All plants shall have a fully developed form without voids and/or open spaces.

**15.2.2.2 Balled and Burlapped.** Balled and burlapped plants shall have firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Provide ball sizes complying with the latest edition of the ANSI Z60.1, "American Standard for Nursery Stock." Broken, cracked, or crushed balls are not acceptable. The measurements for height shall be taken from the ground level to the average height of the top of the plant and not the longest branch. Side branches shall be generous and well twigged. Shrubs shall be well densely foliated to the ground.

**15.2.2.3 Container-grown stock.** Container-grown stock shall be grown in a container for sufficient length of time for the root system to have developed to hold the soil together, firm and whole. When using container-grown stock, the following must comply; no plants shall be loose in the container, and container stock shall not be root bound.

Plants larger than those specified in the plant list may be used when acceptable to the City's representative (at no additional expense). If the use of larger plants is accepted, all pertinent specifications herein shall apply to the larger size of the plant.

Plants shall be in a moist, vigorous condition, free from dead wood, bruises, or other branch injuries.

**15.2.2.4 Mulch.** Mulch must be free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following types: shredded hardwood shall be oak, cypress or cedar. The City's bulk wood mulch or MoMulch are acceptable and both are available at the City's Yard waste Recycling Center at the contractor's expense. The size shall be within

the following rages, for length a 2 inch min, and 4 inch max. The width shall be between ½ inch min and 1 inch max. The mulch shall be of a natural color.

**15.2.2.5 Water.** Water needs to be provided by water hoses or other methods of transportation furnished by Contractor.

**15.2.2.6 Herbicide.** Herbicide needs to be Snapshot or Treflan pre-emergent and Roundup post-emergent as per label after mulch installation.

**15.2.3 Construction requirements.** Prepare the planting pits in accordance with the latest edition of Missouri Department of Conservation “How to Plant a Tree” publication. Planting shall be performed only by an experienced workman familiar with planting procedures under the supervision of a qualified supervisor and no planting of trees, shrubs, or ground cover when the ground is frozen. The Contractor shall stake all beds and tree locations for approval by the City’s representative three (3) days prior to planting. If obstructions are encountered that are not shown on the drawings, do not proceed with planting operations until alternate plant locations have been selected and approved by the City’s representative.

Install plants in accordance with; the latest edition of Missouri Department of Conservation “How to Plant a Tree” publication. For proper installation, set plant materials in planting pit to proper grade and alignment. Also set plants upright, plumb, and faced to same direction as grown in nursery (as indicated by plant marking on base of trunk). Do not fill around plants that have settled. When trees require backfilling, do not use frozen or muddy mixtures. When installing be sure to remove all containers, burlap, ropes, wires and other transport materials from around plant. Once backfill has occurred, where necessary, install mulch around trees and apply pre-emergent herbicide as per label after final installation of mulch.

The following provisions need to also be met. Stake and guy all trees as per plan details immediately after planting as directed by the City. Prune plants only to remove dead or damaged branches in accordance with the latest edition of Missouri Department of Conservation “Basic Pruning Guidelines” publication. Check soil moisture not less than once per week until accepted. Water trees five (5) gallons per trunk caliper inch per week unless rainfall or irrigation has been sufficient. If irrigation system is present, notify city to request verification of possible needed adjustments. City is to make all such adjustments. Guard against soil saturation.

**15.2.4 Method of Measurement.** Measurement will be made to the nearest one-tenth (1/10) acre of the area seeded or as specified in bid form.

**15.2.5 Basis of Payment.** Tree planting will be paid for on a unit price per acre on those contracts containing a tree planting bid item. This unit price is to include all costs associated with the planting, liming, fertilizing, mulching, and maintenance of the planted areas until the job is accepted by the Engineer.

If a contractor working on a public contract is being assessed Liquidated Damages as of June 1 or November 1, and the project is completed except for seeding, the Liquidated Damages will cease until the beginning of the next seeding period At which time, the Contractor will be

required to have confirmed growth within 30 days. If confirmed growth does not occur over the entire project area within 30 days after the start of the next seeding season, Liquidated Damages will be assessed until such growth is confirmed.

Ground cover must be established immediately upon completion of construction. If work is completed outside of the seeding season, then the contractor shall use temporary seed such as; annual rye or erosion control blankets. See Sediment and Erosion Control guidelines for more information.

### 15.3 LANDSCAPE TOPSOIL

**15.3.1 Scope of Work.** The work shall consist of providing all labor, equipment, and materials necessary for furnishing and placing topsoil at the locations shown on the drawing and island details.

#### 15.3.2 Materials.

**15.3.2.1 Topsoil.** Topsoil furnished by the Contractor shall consist of a natural friable surface soil without admixtures of undesirable subsoil, refuse, or foreign materials. It shall be reasonably free from roots, hard clay, and coarse gravel stones larger than one inch in any dimension, noxious weeds, tall grass, brush, sticks, stubble or other material which would be detrimental to the proper development of vegetative growth. Topsoil shall be obtained from naturally well drained sites where topsoil occurs, at least 4- inches deep. Topsoil shall not be obtained from bogs or marshes.

Topsoil shall conform to the following grading:

<u>Sieve Sizes</u>	<u>Percentage Passing:</u>
2 inch	100%
1 inch	80% - 100%
No.4	60% - 100%
No.10	40% - 100%
No.200	10% - 60%

Topsoil shall contain not less than 3%, or more than 20% organic matter, by weight as determined by loss-on-ignition of oven-dried samples in accordance with ATM T-6. Organic material shall be decomposed and free of wood.

The Owner's Representative shall be notified on the location from which the Contractor proposes to furnish topsoil at least 30 calendar days prior to delivery of topsoil to the Project from that location. The topsoil and its source will be inspected and tested by the Owner's Representative before approval will be granted for its use.

Topsoil sources lacking organic matter may be used if, prior to delivery to the Project, sufficient organic matter in the form of pulverized peat moss or rich organic soil from 31 other sources is thoroughly mixed with the topsoil to provide a product meeting the above requirements.

Organic material for incorporation into topsoil, if required, shall be partially decomposed fibrous or cellular stems and leaves of any of several species of Sphagnum mosses, or rotted manure. Organic material may require chopping to shredding to insure thorough mixing with the topsoil.

All topsoil shall be fertilized as follows: the application rates of the fertilizer and limestone per 1,000 square feet of ground area of topsoil furnished by the CONTRACTOR shall be approved by the Owner's Representative, based on soil analysis tests so that the total natural and applied chemical constituents are as follows:

Nitrogen	1.0 lb. minimum - 1.5 lb. maximum per 1,000 square feet
Phosphoric Acid	1.0 lb. minimum - 2.0 lb. maximum per 1,000 square feet
Potassium	1.0 lb. minimum - 2.0 lb. maximum per 1,000 square feet
Limestone	Limestone requirements shall conform to the following table:

<u>LIMESTONE REQUIREMENTS</u>	
Soil pH	Tons per Acre
Above 6.0	0
5.0 - 6.0	1.5
Below 5.0	3.0

**15.3.3 Method of Construction.** All areas beyond the sidewalk or roadway shoulder that are disturbed during construction which are not covered with pavement, concrete, or base course, shall be graded to a neat, uniform grade-line and appearance, as determined by the Owner's Rep., and covered with a neat uniform, three inch minimum thickness of topsoil, unless otherwise shown on the Drawings, or directed by the Owner's Rep.

The topsoil shall be evenly spread on the designated areas to a depth, which, after settlement and compaction, shall be three inches, unless otherwise directed by the Owner's Rep. Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the WORK, as determined by the Owner's Rep. Roadway surfaces shall be kept clean during hauling and spreading operations.

After spreading has been completed, large clods, stones larger than one-inch in any dimension, roots stumps, and other litter shall be raked up and removed.

The final grading of the topsoil prior to seeding shall be to a tolerance that will not permit ponding of water in excess of one inch in depth.

Topsoil Finish grading, if a pay item will not be approved for start-up until the topsoil has been graded to within the tolerances given above.

The contractor will need to be able to comply with the following stipulations: the CONTRACTOR shall provide labor personnel experienced with landscaping work that involves fine grading of topsoil for residential or commercial lawns. The Owner's Rep. will determine the location of those areas requiring finish grading and the time required to bring the graded topsoil to the desirable finish appearance. The CONTRACTOR shall remove and dispose of all excess materials resulting from the finish grading of the topsoil. The WORK required to remove and dispose of this excess material from piles placed along the roadway will be considered incidental to other WORK under the contract.

**15.3.4 Method of Measurement.** Measurement will be made to the nearest one-tenth (1/10) acre of the area seeded or as specified in bid form.

**15.3.5 Basis of Payment.** Topsoil will be paid for on a unit price per acre on those contracts containing a topsoil bid item. This unit price is to include all costs associated with the installation and spreading of topsoil in the areas identified on the drawing and island details until the job is accepted by the Engineer.

If a contractor working on a public contract is being assessed Liquidated Damages as of June 1 or November 1, and the project is completed except for seeding, the Liquidated Damages will cease until the beginning of the next seeding period. At which time, the Contractor will be required to have confirmed growth within 30 days. If confirmed growth does not occur over the entire project area within 30 days after the start of the next seeding season, Liquidated Damages will be assessed until such growth is confirmed.

Ground cover must be established immediately upon completion of construction. If work is completed outside of the seeding season, then the contractor shall use temporary seed such as; annual rye or erosion control blankets. See Sediment and Erosion Control guidelines for more information.

## 16 TEMPORARY EROSION AND SEDIMENT CONTROL

**16.1 Applicability.** This Chapter applies to work being performed under contract to the City of Springfield (City). Public improvements on private developments shall comply with City Code Chapter 96 Article III Land Disturbance Activity.

**16.2 Scope of Work.** The work shall consist of furnishing all materials, equipment, and labor necessary to adhere to, install, and maintain best management practices (BMPs) as specified in the SWPPP or project plans or as directed by the Engineer or Inspector, and to complete and adhere to the requirements and conditions described herein. The Contractor is required to follow and abide by all applicable local, state, and federal rules and regulations.

**16.3 Purpose.** The purpose of erosion and sediment control is to protect water quality by minimizing the amount of sediment and other pollutants leaving the construction site as required by federal, state, and local regulations.

### 16.4 Definitions.

**16.4.1 Best Management Practices (BMPs).** BMPs are structural or non-structural practices that prevent or minimize erosion and the discharge of sediment and other pollutants from the construction site. Examples of structural BMPs include silt fence and erosion control blanket. Examples of non-structural BMPs include sequencing (also referred to as scheduling or phasing) to reduce the amount and duration of soil exposure, and sweeping of streets.

**16.4.2 Designated Responsible Person (DRP).** The DRP is the person designated by the Contractor to be responsible for day-to-day operation and maintenance of BMPs. The DRP shall have a thorough and demonstrable knowledge of the SWPPP and erosion and sediment control practices in general.

**16.4.3 Stormwater Pollution Prevention Plan (SWPPP).** A SWPPP is a site-specific written document, including a site plan and narrative, identifying and describing the BMPs for the site. The SWPPP format and required components shall follow the City's SWPPP template.

**16.5 Materials.** BMP selection, design, installation, and maintenance shall adhere to the City's Erosion and Sediment Control Guidelines, or as approved by the Engineer.

**16.6 Requirements and Conditions for Projects Disturbing 1 acre or Greater.** A City land disturbance permit is required for projects disturbing 1 acre or greater. The Contractor shall complete and adhere to the following requirements for projects disturbing 1 acre or greater.

**16.6.1 SWPPP Compliance.** The Contractor shall be responsible for complying with the SWPPP provided and approved by the City for the project. The Contractor shall be responsible

for providing information requested by the Engineer or Inspector for inclusion in the SWPPP, including but not limited to the following:

**16.6.1.1 Designated Responsible Person.** The Contractor shall designate a DRP in the SWPPP.

**16.6.1.2 Project Sequencing.** The Contractor shall work with the Engineer and Inspector to establish and describe a sequencing plan as required in the SWPPP to minimize the extent and duration of soil exposure and minimize the discharge of sediment and other pollutants from the site.

**16.6.1.3 Disposal of Material Off-Site.** The Contractor shall specify the location of off-site fill areas. If the off-site fill areas do not meet the conditions for permit coverage under the land disturbance permit for the project, the Contractor shall provide documentation that off-site fill areas are covered by another land disturbance permit or are less than 1 acre.

**16.6.2 Pre-Construction Requirements.** The Contractor shall complete and adhere to the following requirements prior to disturbing any site vegetation or earth.

**16.6.2.1 Pre-Construction Meeting.** The Contractor is required to schedule and participate in a pre-construction meeting with the Stormwater Quality Division of the Department of Environmental Services in order to review and discuss the SWPPP and associated requirements.

**16.6.2.2 Initial BMP Inspection.** The Contractor shall schedule an initial BMP inspection with the Stormwater Quality Division of the Department of Environmental Services prior to disturbance of any site vegetation or earth, except as needed to install BMPs. The requirements of the initial BMP inspection are as follows.

**16.6.2.2.1 Installation of BMPs.** The Contractor shall install the BMPs as shown and described in the SWPPP for the first phase of construction as described in the SWPPP sequencing plan.

**16.6.2.2.2 Public Notification Sign.** The Contractor shall post a public notification sign provided by the City, which displays the land disturbance permit number and contact information, at a location visible to the public.

**16.6.2.2.3 SWPPP Storage.** The Contractor shall provide a secure location protected from the weather for storing the SWPPP onsite.

**16.6.2.3 Issuance of Land Disturbance Permit.** Upon satisfactory completion of a pre-construction meeting and initial BMP inspection, the City will issue a land disturbance permit for the project. No disturbance of site vegetation or earth shall occur, except as necessary for installation of BMPs, until a land disturbance permit has been issued.

**16.6.3 Requirements and Conditions During Construction.** The Contractor shall complete and adhere to the following requirements during construction.

**16.6.3.1 SWPPP Storage.** The Contractor shall ensure that the current copy of the SWPPP is stored in the designated location on-site.

**16.6.3.2 Notification to Subcontractors.** The Contractor shall notify each subcontractor performing work at the site, including utility crews, of the existence of the SWPPP and what actions or precautions shall be taken while on-site to minimize the potential for erosion, damaging of BMPs, and discharge of sediment or other pollutants from the site. The Contractor shall identify in the SWPPP each subcontractor engaged in activities at the site that could impact stormwater, and each subcontractor shall sign a Subcontractor Certification which shall be attached to the SWPPP.

**16.6.3.3 BMP Implementation and Maintenance.** The Contractor shall be responsible for implementing and adhering to non-structural BMPs described in the SWPPP throughout construction. The Contractor shall be responsible for ensuring that structural BMPs are installed and maintained as described in the SWPPP throughout construction. Maintenance includes but is not limited to removal of sediment as needed for BMP effectiveness, and replacement of BMPs whose functionality has become compromised with equal BMPs.

**16.6.3.4 Sequencing and Stabilization.** The Contractor shall be responsible for implementing and adhering to the sequencing plan described in the SWPPP and for temporary and permanent stabilization of disturbed areas. Seeding and sodding shall adhere to Chapter 13 of the General Conditions and Technical Specifications.

**16.6.3.4.1 Temporary Stabilization.** Temporary stabilization consisting of vegetation or other BMPs including but not limited to check dams, silt fences, or mulch, is required where soil disturbing activities will cease on any portion of the site and are not planned to resume for a period exceeding 14 calendar days. Temporary stabilization must be initiated immediately upon knowing the duration is more than 14 days, and must be completed within 7 calendar days. If the slope of the area is greater than 3:1 (3 feet horizontal to one foot vertical) or if the slope is greater than 3% and greater than 150 feet in length, then the Contractor shall establish temporary stabilization within 7 days of ceasing operations on that part of the site. Allowances to the 7 day completion period may be made due to weather and equipment malfunctions. The use of allowances shall be documented in the SWPPP. The requirement to immediately initiate stabilization is further defined in the SWPPP. The Contractor shall be responsible for maintaining and re-establishing temporary stabilization as needed.

**16.6.3.4.2 Final Stabilization.** Final stabilization of disturbed areas must be initiated immediately and completed within 7 calendar days whenever any clearing, grading, excavating or other earth disturbing activities have permanently ceased on any portion of the site. Allowances to the 7 day completion period may be made due to weather and equipment malfunctions. The use of allowances shall be documented in the SWPPP. The requirement to immediately initiate stabilization is further defined in the SWPPP.

**16.6.3.5 Pavement Cleaning.** The Contractor shall clean paved surfaces, including but not limited to streets and sidewalks, as needed or as directed by the Engineer or Inspector to

minimize dust and the discharge of sediment and other pollutants from the site and to clean up sediment tracked or discharged from the site.

**16.6.3.6 Non-Sediment Pollution Control.** The Contractor shall follow good housekeeping and pollution prevention measures as described in the City's Erosion and Sediment Control Guidelines and in the SWPPP, including but not limited to collection and disposal of trash and construction debris, proper handling and storage of concrete wash-out, chemicals and hazardous materials, cleanup of spills or leaks, and providing and maintaining adequate temporary toilet facilities as needed.

**16.6.3.7 Inspections.** The City's Inspector will conduct erosion and sediment control inspections weekly and after rain events that generate runoff onsite. The Contractor shall correct any deficiencies noted by the Inspector within the timeframe specified by the Inspector, not to exceed 7 calendar days unless documented weather conditions prevent correction.

**16.6.4 Requirements and Conditions Upon Completion of Construction.** The Contractor shall complete and adhere to the following requirements upon completion of construction.

**16.6.4.1 Removal of Temporary BMPs.** Upon satisfactory inspection by the Inspector of final stabilization on any portion of the site throughout the life of the project, the Contractor shall remove temporary BMPs. Temporary BMPs shall not be removed prior to satisfactory final stabilization.

**16.6.4.2 Permit Termination.** The Contractor shall be responsible for contacting the Stormwater Quality Division of the Department of Environmental Services to schedule an inspection to terminate the City land disturbance permit. The permit can be terminated when perennial vegetation, pavement, buildings, or structures using permanent materials cover all areas that have been disturbed. With respect to areas that have been vegetated, vegetation cover shall be at least 70% plant density over 100% of the site. Permit termination also requires removal of temporary BMPs and any accumulated sediment or debris in the stormwater system or waterway. Final payment will not be made until the permit is terminated.

**16.6.4.3 Return of SWPPP.** Final payment will not be made until the Contractor has returned the SWPPP to the City.

**16.7 Requirements and Conditions for Projects Disturbing Less Than 1 Acre.** The Contractor shall complete the following requirements for projects disturbing less than 1 acre. A City land disturbance permit and SWPPP are not required.

**16.7.1 BMP Implementation and Maintenance.** The Contractor shall be responsible for implementing and adhering to any non-structural BMPs described on the project plans throughout construction. The Contractor shall be responsible for ensuring that any structural BMPs shown on the project plans are installed and maintained throughout construction. Maintenance includes but is not limited to removal of sediment as needed for BMP effectiveness, and replacement of BMPs whose functionality has become compromised with equal BMPs.

**16.7.2 Disposal of Material Off-Site.** Prior to removal of excavated or dredged material from the project site, the Contractor shall specify the location of off-site fill areas. Off-site fill areas shall be permitted by a state land disturbance permit and any applicable local land disturbance permit, or shall be less than 1 acre.

**16.7.3 Pavement Cleaning.** The Contractor shall clean paved surfaces, including but not limited to streets and sidewalks, as needed or as directed by the Engineer or Inspector to minimize dust and the discharge of sediment and other pollutants from the site and to clean up sediment tracked or discharged from the site.

**16.7.4 Non-Sediment Pollution Control.** The Contractor shall follow good housekeeping and pollution prevention measures as described in the City's Erosion and Sediment Control Guidelines, including but not limited to collection and disposal of trash and construction debris, proper handling and storage of chemicals and hazardous materials, cleanup of spills or leaks, and providing and maintaining adequate temporary toilet facilities as needed.

**16.7.5 Stabilization.** The Contractor shall be responsible for stabilization of disturbed areas. Seeding and sodding shall adhere to Chapter 13 of the General Conditions and Technical Specifications.

**16.7.6 Removal of Temporary BMPs.** Upon completion and satisfactory inspection of final stabilization by the Inspector, the Contractor shall remove temporary BMPs.

**16.7.7 Inspections.** The City's Inspector may conduct periodic erosion and sediment control inspections on projects disturbing less than 1 acre. The Contractor shall correct any deficiencies noted by the Inspector within the timeframe specified by the Inspector.

**16.8 Indemnity.** The Contractor shall indemnify and hold the City harmless for any penalties, fines, fees or costs, including costs of defense, which are charged or assessed by any federal, state or local agency including, but not limited to, the United States Environmental Protection Agency or the Missouri Department of Natural Resources.

**16.9 Payment.** Payment for EROSION AND SEDIMENT CONTROL will be on a lump sum basis prorated over the construction period when control measures are adequately maintained. Upon failure of the Contractor to comply with any order of the Engineer to correct a deficiency in Erosion and Sediment Control, the Engineer shall have the authority to cause said conditions to be corrected and to deduct the cost from any payment due or to become due to the Contractor.

**16.10 Progressive Enforcement.** If, at any time, the Contractor is found to be in violation of the requirements herein, the following Progressive Enforcement Policy will be followed.

**16.10.1 Verbal or Written Notification.** A verbal or written notification shall be issued to the Contractor. The Contractor shall correct the deficiency noted within the timeframe given by the Inspector or Engineer.

**16.10.2 Notice of Violation (NOV).** Upon failure of the Contractor to comply with a verbal or written notification, in the event of an egregious violation (as determined by the City or other government agencies), or in the event of repeated violations of a similar nature, a Notice of Violation may be issued. The Contractor shall comply with the terms of the NOV.

**16.10.3 Stop Work Order.** In the event that the Contractor disturbs any vegetation or earth prior to issuance of a land disturbance permit for sites disturbing 1 acre or greater, except as needed for installation of BMPs, a Stop Work Order may be issued. A Stop Work Order may also be issued upon failure of the Contractor to comply with an NOV. The City shall have the right to make the necessary corrections and deduct the related costs from the amount to be paid to the Contractor. The Stop Work Order shall remain in effect until all deficiencies have been corrected.

**16.10.4 Further Enforcement Actions.** Further enforcement actions may be taken in accordance with the General Conditions and Technical Specifications and City Code.

**16.11 Liquidated Damages.** At the City's discretion, Liquidated Damages may be recovered and withheld for each NOV. The amount of Liquidated Damages to be recovered and withheld may be in the amount of \$500.00 per NOV.