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By submitting a bid, except for those items listed by Bidder below or on additional copies of this page, attached to this page, Bidder certifies that steel and each manufactured product, is produced in the United States (as defined by the FTA Buy America requirements) and that components of unknown origin are considered to have been produced or manufactured outside the United States. In case of conflicts with corresponding provisions of other Bidding Documents, Buy America provisions govern.

Bidders may obtain from METRO a list of products excepted from this provision. Use additional copies of this page as required.

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The above information is true and complete to the best of my knowledge and belief.

(Printed or typed Name of Signatory)

Signature  Date

Note: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

END OF DOCUMENT 00456
SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Location

Project consists of traffic signal upgrades at 12 intersections along Main Street, from Leeland Street to Franklin Street along the METRO Red Line LRT corridor, in the City of Houston, in Harris County, Texas.

B. General

The Scope of Work for this Project shall consist of providing all supplies, support services, data, labor, tools, materials, equipment, supervision, construction and all else required to prepare the site and upgrade twelve (12) signalized intersections, see list below, with traffic signals and/or pedestrian signals, along Main Street, from Leeland Street to Franklin Street in Houston TX 77002 (key map 493L, M and Q), in its entirety as shown on the construction documents. All meeting City of Houston IDM requirements.

List of Intersections:
1. Main @ Leeland (EB)
2. Main @ Bell (WB)
3. Main @ Clay (EB)
4. Main @ Polk (WB)
5. Main @ Lamar (WB)
6. Main @ McKinney (EB)
7. Main @ Walker (WB)
8. Main @ Texas (EB)
9. Main @ Prairie (WB)
10. Main @ Preston (EB)
11. Main @ Congress (WB)
12. Main @ Franklin (EB)

C. Project Scope

The Work shall include, but not be limited to, the following major items, to the extent specified and indicated:

1. Provide administration and construction support services to complete the work.
2. Coordination with utility owners, government agencies, businesses, neighborhood associations and any other stakeholders within the project limits.

3. Coordination with METRO LRT for flaggers and track allocation requests necessary for work in the proximity of the LRT tracks and related facilities.

4. Construct the new traffic signal poles per plan at project intersections.

5. Install the traffic signal heads per plan at project intersections.

6. Connect the traffic signals to the existing traffic system.

7. Remove and/or salvage existing traffic signal poles, traffic signal heads and related equipment per plan at project intersections.

8. Remove and replace sidewalk/hardscape to original condition or better.

9. Tree pruning as per plan.

10. SWPPP and Tree Protection - ensure the protection of trees, shrubs, vegetation, irrigations systems, and other facilities as shown on the construction plans. Provide SWPPP per City of Houston requirements.

11. Utility Relocation/Adjustments – adjustment or relocation of water meters, water valves, gas valves, handholes, and traffic pull boxes.

12. All improvements shall meet or exceed ADA, TDLR, METRO and City of Houston design standards.

13. Provide a clean and safe Construction Work Zone during the construction and prior to written acceptance by METRO.

14. Final inspection, signal activation and troubleshooting with all stakeholders including City of Houston, Houston Downtown Management District and METRO.

D. Work Sequence

1. Construct the Work in Phases during the construction period; coordinate construction schedule and operations with METRO and City of Houston. The work of the project shall be phased so that impact to the adjacent commercial area is kept to a minimum for the duration of the project. The work in each phase will be conducted in segments. All work within Phase 1 and each successive phase shall be in a “substantially complete condition” prior to beginning the construction of the next Phase or the contractor may begin a new phase of construction with consent of the Engineer.
2. The term “work” as used below refers to the following sequence of construction activities, as applicable: construction of all traffic signal work, and paver work. The work also includes landscaping, storm water pollution prevention, traffic control, site restoration and inspections.

3. Vehicular traffic shall be maintained throughout construction. All traffic operations shall be coordinated with the City of Houston and METRO.

4. The existing traffic signals shall remain in operation until the new signal pole, mast arm and signal heads are constructed, and they are operational.

Phase 1:

1. Contractor shall contact METRORail Operation, Mr. Marc Reaux, 48-hour prior to beginning work.
2. Contractor shall mobilize, and implement SWPPP and Traffic Control Plan as shown in the drawing plan set.
3. Excavate the drilled shafts and pour the foundation for the new signal pole.
4. Install the new signal pole, mast arm and signal heads. Bag the new signal heads until they are operational.
5. Install traffic signal cable and conduit according to the “Traffic Signal Pole Schedule & Cable Schematic” in the plan set.

Phase 2:

1. Restore any pavers that were impacted during construction to its original condition or better.
2. Contractor shall contact City of Houston representative, METRO project PM, METRO Traffic Operation, and the Consultant for signal turn-on.
3. Remove and salvage existing traffic signal equipment according to the plan set.

1.2 QUALITY ASSURANCE

A. The Work shall comply with the requirements of the Contract Documents including cited national specifications and standards; state and local government authority codes, regulation, and specifications.

B. In case of conflicts or discrepancies between cited national and local standards, local requirements shall govern unless otherwise directed in writing. In case of conflicts or discrepancies between institutional, national and federal specifications as referenced for inclusion with a METRO standard specification, the most stringent of the specifications listed shall govern unless otherwise directed in writing. All conflicts shall be brought to the attention of METRO in writing for resolution.

1.3 OTHER REQUIREMENTS
A. A Construction schedule for the Project shall be submitted in accordance with Section 01311 - Construction Schedule of these specifications.

B. Except as otherwise specified or indicated, the following shall be provided as part of the Project:

1. Labor, management, and superintendence as required to complete the work.

2. Construction supplies, equipment, products, tools, machinery, materials, and all appurtenances necessary to execute and complete the Work of the Contract.


4. Other facilities and services as necessary to execute and complete the Work of the Contract.

5. All governmental permits, licenses and fees required for execution and completion of the Work, in the Contractor's name.

C. The City of Houston and any affected utility owner shall be notified not less than 14 days prior to starting work in an area in which a utility may be located. Notices shall be in writing. An affected utility owner and METRO shall be notified 72 hours prior to commencing construction operations.

D. The Contractor shall prosecute the Work as indicated, in accordance with the Contract Documents, and in a timely manner so as to ensure coordination of all parts of the Work with work of other parties under adjoining and interfacing contracts, including governmental bodies and utility companies.

E. Proposals for scheduling work at times other than the normal work period of a calendar day shall be submitted to METRO not less than 48 hours in advance of those times. Such proposals shall outline all special precautions to be taken to control the hazards presented by prosecuting the Work at times other than the normal work period of a calendar day. The proposal shall include supplementary lighting of work areas, availability of medical facilities, security precautions and all other precautions necessary.

F. Construction equipment and vehicles which exceed the weight, size and noise limitations of the authorities having jurisdiction shall not be operated outside the Construction limits of the Site. Refer to Section 01560 - Environmental Impact Controls of these Specifications.

1.4 DEFINITIONS

A. CONSTRUCTION DRAWINGS: All professional design drawings, exclusive of Shop Drawings, prepared for parts of the Work not indicated on METRO-furnished Drawings. Construction Drawings become part of the Contract Drawings upon
written approval of that Drawing by METRO.

B. CONTRACT DOCUMENTS: Documents applicable to and specified to an individual Contract, normally consisting of, but not necessarily limited to, the Agreement or Contract, Standard Technical Specifications, Contract Drawings, and errata thereto. Addenda to the Contract Documents issued prior to the Bid date will become part of the Contract Documents. Change orders issued after Contract execution will become part of the Contract Documents.

C. CONSTRUCTION SPECIFICATIONS: Normally consisting of the technical specifications prepared to cover corresponding construction operations, materials, workmanship, and/or service performance required to produce the work.

D. CONTRACT DRAWINGS: The plans, profiles, cross-sections, elevations, schedules and details which show locations, character, dimensions and arrangements of the parts of the Work, including, METRO-furnished Drawings, approved Construction Drawings and approved Shop Drawings. Unless otherwise defined, the term Drawings shall mean the Contract Drawings.

E. CONTRACTOR: The individual, firm, partnership, or corporation, or combination thereof, private, municipal, or public, including joint ventures, who, as an independent contractor, has entered into a contract with METRO to carry out the intent of the Contract Documents.

F. DAYS: Whenever used in the Contract Documents, "days" means calendar days.

G. ENGINEER: For definition refer to Article 1, Definitions of the Proposed Contract, of the Invitation for Bid.

H. FURNISH: Except as otherwise defined, term "furnish" is used to mean supply and delivery to Project Site, ready for unloading, unpacking, assembly, installation, and so forth, as applicable in each instance.

I. INSTALL: Except as otherwise defined, term "install" is used to describe operations at Project Site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance.

J. INSTALLER: The term "installer" is defined as the entity (person or firm) engaged by the Contractor, its subcontractor or sub-subcontractor for performance of a particular unit of work at the Project Site, including installation, erection, application and similar required operations. It is a general requirement that installers be qualified in the operations they are engaged to perform.

K. METRO-FURNISHED DRAWINGS: The METRO Standard Drawings, furnished under separate cover.

L. PROJECT (WORK): The providing of construction, labor, materials, equipment,
and compliance with contractual requirements as specified and indicated in the Contract Documents to produce the Work, ready for intended use. Project includes Transit Center and such other work as identified in the Contract Documents. "Project" and "Work" shall have the same meaning as used in these Specifications.

M. PROVIDE: Except as otherwise defined, term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.

N. SHOP DRAWINGS: Drawings furnished by the Contractor to illustrate specific parts of the Work not indicated on the Contract Drawings of the Construction Drawings. Shop Drawings include drawings, diagrams, illustrations, schedules, charts, brochures, tables and other data graphically indicating and describing fabrication and installation of specific portions of the Work. Shop Drawings become part of the Contract Drawings upon written approval of that Drawing by METRO.

O. SITE: The tract of real estate in possession of METRO, where the Work is to be performed for METRO, within the indicated limits, in accordance with the terms of the Contract, and as required by the Contract Documents. The term "Site" is defined as the space available to the Contractor for performance of the Work, either exclusively or in conjunction with others performing other work adjacent to the Project. The extent of the Project Site as shown on the Drawings, may or may not be identical with the description of the land upon which the project is to be built.

1.5 INTERPRETATION

A. Final Authority

Where "indicated," "specified," "detailed," "required," "directed," "requested," "authorized," "permitted," or phrases of similar import are used, it shall be understood that the reference is made to the elements of the Contract Documents as interpreted by METRO, unless stated otherwise. However, no such implied meaning shall be interpreted to extend the Engineer's responsibility into the Contractor's area of construction supervision.

B. Imperatives

The word "shall" is an auxiliary verb which expresses mandatory requirements on the part of the contractor. The word "will" is an auxiliary verb which expresses probable intent or action on the part of METRO. The word "may" is an auxiliary verb which expresses permissible requirements on the part of the party addressed in the Contract. A statement of requirements for the performance of the Contract in the imperative mood shall be interpreted by the Contractor as if the verb "shall" is included in such statement (e.g., "submit all test results" shall have the same meaning as "Contractor shall submit all test results.") Imperative language is used generally in these Specifications. Except as otherwise indicated, requirements expressed imperatively shall be performed by the Contractor.

C. References
References to prime Articles include Articles under the Article referenced, e.g., a reference to Article 1.05 is also a reference to Articles 1.05, A through H.

D. Methods and Means

Interpretations, directions, observations, and suggestions of the Engineer shall not be construed as dictating, controlling, directing, or supervising the Contractor's methods, means, techniques, sequences, and procedures.

E. Approved and Approvals

Where used in conjunction with METRO’s response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of term "approved" will be held to limitations of METRO responsibilities and duties as specified in the Contract Documents. In no case will "approval" by METRO be interpreted as a release of Contractor from responsibilities to fulfill requirements of Contract Documents. The requirement to submit a document or Drawing to METRO for review and approval shall not be interpreted to imply automatic approval thereof by METRO. METRO may invoke or defer such action regarding approvals as it deems necessary.

F. Overlapping and Conflicting Requirements

Where compliance with two or more industry standards or sets of requirements is specified or indicated, and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, the most stringent requirement is intended and will be enforced by METRO, unless specific language in the Contract Documents clearly indicates that a less stringent requirement is to be fulfilled. Refer apparently-equal but different requirements, and uncertainties as to which level of quality is more stringent, to METRO for a written decision before proceeding with the Work in question.

G. Minimum Quality/Quantity

In every instance, the quality level or quantity indicated or specified is intended to be the minimum for the work to be performed or provided. Except as otherwise indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable limits. In complying with these requirements, indicated numerical values are either minimums or maximums as noted, or as appropriate for context of the requirements. Refer instances of uncertainty to METRO for a written decision before proceeding with the Work in question.

H. Specialist Assignments

In certain instances, Specification text requires that specific work is to be performed by specialists of expert entities (e.g., Installer, Landscape Architect,
Geotechnical Consultant), who shall be engaged for the performance of that work. Such assignments shall be recognized as special requirements over which the Contractor has no option. These requirements shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the Work; they are also not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party involved in a specific unit of work is recognized as "expert" for the indicated process or operation. Nevertheless, the final responsibility for fulfillment of the Contract requirements shall remain with the Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - MEASUREMENT AND PAYMENT (Not Used)

END OF SECTION 01010
SECTION 01040
PROJECT COORDINATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section specifies the minimum administrative and supervisory requirements necessary for integration and coordination of work on Project including, but not limited to, the following:

1. Project Meetings
2. Outside Agencies
3. Quantity Measurements
4. Special Reports
5. Conservation and Salvage

B. Work Included: To enable orderly review during progress of the work and to provide for systematic discussion of problems, the Engineer will conduct project meetings throughout the construction period.

C. Related Work

1. Documents affecting work of this Section include, but are not necessarily limited to, Contract Articles, Drawings and Technical Specifications.

2. The Contractor's relations with his subcontractors and materials suppliers, and discussions relative thereto, are the Contractor's responsibility and normally are not part of project meetings content.

1.2 QUALITY ASSURANCE

A. For those persons designated by the Contractor to attend and participate in project meetings, provide required authority to commit the Contractor to solutions agreed upon in the project meetings.

1.3 SUBMITTALS

A. In accordance with Section 01340 - Shop Drawings, Product Data, Samples, and Record Documents of these Specifications, the following shall be submitted:

1. Agenda Items: To the maximum extent practicable, advise the Engineer at least 24 hours in advance of project meetings regarding items to be added to the agenda.
2. Minutes: The Engineer will compile minutes of each project meeting, and will furnish one copy to the Contractor.

1.4 CONTRACTOR COORDINATION

A. Coordinate scheduling, submittals, and work of various Specification sections to assure efficient and orderly sequence of installation of interdependent construction elements.

B. Coordinate completion and cleanup of the Work prior to the Date of Substantial Completion and for portions of the Work designated for METRO’s partial occupancy.

C. Coordinate access to the site for correction of nonconforming work to minimize disruption to METRO’s activities where METRO is in partial occupancy.

PART 2 - PRODUCTS (Not Used)

PART 3 - MEETINGS

3.1 MEETING SCHEDULE

A. Except as noted below for Pre-construction Meeting, project meetings shall be called throughout the progress of the work as deemed necessary by the Engineers.

B. Coordinate as necessary to establish mutually acceptable schedule for meetings.

3.2 MEETING LOCATION

A. The Engineer will establish meeting location. To the maximum extent practicable, meetings will be held at the job site.

3.3 PRE-CONSTRUCTION MEETING

A. Pre-construction Meeting will be scheduled by METRO prior to the Notice to Proceed.

1. Provide attendance by authorized representatives of the Contractor and major subcontractors.

2. The Engineer will advise other interested parties.

B. Minimum Agenda: Data will be distributed and discussed on at least the following items:

1. Organizational arrangement of Contractor's forces and personnel, and those of subcontractors and materials suppliers.
2. Channels and procedures for communication.

3. Construction schedule, including sequence of critical work.

4. Contract Documents, including distribution of required copies of original Documents and revisions.

5. Processing of Shop Drawing and other data submitted for review.

6. Processing of Change Orders, Bulletins, and field decisions.

7. Rules and regulations governing performance of the work.


9. Other contracted related items such as conflicts/compatibility problems, weather limitations, manufacturer recommendations, acceptance of substrates/adjoining work, temporary facilities, space and access limitations, governing regulations and inspection/testing requirements.

3.4 SITE MOBILIZATION CONFERENCE

A. When required by Contract documents, Project manager will schedule a conference at the Project site prior to Contractor mobilization.

B. Attendance Required: METRO representatives, Design Consultant, special consultants, Superintendent, and major Subcontractors.

C. Agenda:

1. Use of premises by METRO and Contractor.

2. Safety and first aid procedures.

3. Construction controls provided by METRO

4. Utility Adjustments/Relocations

5. Survey and layout


7. Field office requirements.
3.5 PROJECT MEETINGS

A. Attendance

1. The Contractor’s Project Manager and/or Superintendent shall represent the Contractor at all project meetings throughout progress of the work.

2. Subcontractors, materials, suppliers, and others may be invited to attend those project meetings in which their aspect of the work is involved.

B. Minimum Agenda

1. Review, revise as necessary, and approve minutes of previous meetings.

2. Review progress of the work since last meeting, including status of submittals for approval.

3. Review of construction schedule, pay estimates, cash flow curve, payroll and compliance submittals.

4. Field observations, problems, and necessary decisions.

5. Identify problems which impede planned progress.


7. Review of RFI and FRP status.

8. Modification status.

9. Review of off-site fabrication and delivery schedules.


11. Develop corrective measures and procedures to regain planned schedule.

12. Planned progress during the succeeding work period.

13. Coordination of projected progress.


15. Effect of proposed Modifications on Construction Schedule and coordination.


17. Complete other current business.
C. Revisions to Minutes

1. Unless published minutes are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the activities and decisions of the meeting.

2. Persons challenging published minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes three working days prior to next regularly scheduled meeting.

3. Challenge to minutes shall be settled as priority portion of "old business" at the next regularly scheduled meeting.

PART 4 - OUTSIDE AGENCIES

4.1 Contractor shall interface with outside agencies as required for Contract conformance. Contractor shall appraise/copy METRO on all correspondence, between Contractor and governing agencies, which is necessary to meet the terms of this Contract.

4.2 Contractor shall coordinate the inspection of work from all outside governing agencies as required.

PART 5 - QUANTITY MEASUREMENTS

5.1 The Contractor shall supply necessary manpower, equipment, and tools to assist METRO representative in the field measurement of Contract pay quantities.

PART 6 - SPECIAL REPORTS

6.1 REPORT TIMING

A. Contractor shall submit special reports directly to METRO within one (1) day of an occurrence on the site. A copy of the report shall also be submitted to the other entities that are affected by the occurrence within one (1) day.

6.2 REPORTING UNUSUAL EVENTS

A. When an event of an unusual, unscheduled, or significant nature occurs at the Site, Contractor shall prepare and submit a special report. Such special report shall list chain of events, and times of occurrence, persons participating, action by Contractor's personnel, an evaluation of the results or effects and similar pertinent information.

6.3 REPORTING ACCIDENTS
A. Contractor shall prepare and submit reports of accidents at Site and anywhere else related work is in progress. Report shall record and document names, dates and actions. For this purpose, "accident" is defined to include events where personal injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury. Reporting shall comply with requirements of OSHA and other local authorities having jurisdiction.

PART 7 - CONSERVATION AND SALVAGE

7.1 GENERAL

A. During supervision and administration of the work, construction operations shall be carried out with the maximum possible consideration given to conservation of materials. In addition, maximum consideration shall be given to salvaging materials and equipment involved in performance of the work, but not incorporated therein. Disposition of salvage materials which are METRO's property shall be as directed in writing by METRO.

PART 8 - MEASUREMENT AND PAYMENT

8.1 GENERAL

A. No separate measurement or payment will be made for the items in this specification. All costs associated with this work will be considered incidental to the total contract bid amount.

END OF SECTION 01040
SECTION 01145

USE OF PREMISES

PART 1 - DESCRIPTION

1.1 General use of the site including properties inside and outside of rights-of-way, work affecting road, ramps, streets and driveways and notification to adjacent occupants.

PART 2 - RIGHTS-OF-WAY

2.1 Confine access, and operations and storage areas to rights-of-way provided by METRO; trespassing on abutting lands or other lands in the area is not allowed.

2.2 Make arrangements, at no cost to METRO, for temporary use of private properties. Contractor and Surety shall indemnify and hold harmless METRO against claims or demands arising from such use of properties outside of rights-of-way. Submit a copy of agreements between private property owners and Contractor prior to use of the area. Agreements between private property owners and Contractor shall be notarized or bear the signatures of two witnesses.

2.3 Obtain written permission from City of Houston for storage of materials on medians and other areas within rights-of-way under that department’s jurisdiction. Submit copies of written permission prior to use of the area.

2.4 Restrict total length of distributed materials along the route of construction to 1,000 linear feet unless otherwise approved in writing by METRO Engineer.

PART 3 - PROPERTIES OUTSIDE OF RIGHTS-OF-WAY

3.1 Do not alter the condition of properties adjacent to and along rights-of-way.

3.2 Do not use ways, means, methods, techniques, sequences, or procedures that result in damage to properties or improvements.

3.3 Restore damaged properties outside of rights-of-way at no cost to METRO.

PART 4 - USE OF SITE

4.1 Obtain approvals from governing authorities prior to impeding or closing public roads and streets.
4.2 Notify Project Manager, City of Houston and TxDOT at least five working days prior to closing a street or street crossing. Obtain permits for street closures in advance.

4.3 Maintain 10-foot-wide minimum access lanes for emergency vehicles including access to fire hydrants.

4.4 Avoid obstructing drainage ditches or inlets. When obstruction is unavoidable due to requirements of the Work, provide grading and temporary drainage structures to maintain unimpeded flow.

4.5 Locate and protect private lawn sprinkler systems that may exist within the site or along the rights-of-way. Repair or replace damaged systems to condition existing at start of the Work, or better. Test irrigation systems prior to construction.

4.6 Conform to daily clean-up requirements Section 01010 – Summary of Work.

4.7 Beware of overhead power lines existing in area and in close proximity of the Project. When 10 feet of clearance between energized overhead power line and construction-related activity cannot be maintained, request Center Point Energy (CPE) de-energize or move conflicting overhead power line. Contact CPE representatives at (713) 207-2222. Schedule, coordinate and pay costs associated with de-energizing or moving conflicting overhead power lines. When there is no separate pay item for this effort, include these costs in various items of bid that make such work necessary.

PART 5 - NOTIFICATION TO ADJACENT OCCUPANTS

5.1 Notify individual occupants in areas to be affected by the Work of proposed construction and time schedule. Notify not less than 72 hours or more than two weeks prior to work performed within 200 feet of homes or businesses. Follow form and content of sample door hanger provided by Project Manager.

5.2 Include in notification nature of the Work, and names and telephone numbers of two company representatives for resident contact available on 24-hour call.

5.3 Submit proposed notification to Project Manager for approval. Consider ethnicity of the neighborhood where English is not the dominant language. Provide notice in an understandable language.
PART 6 - PUBLIC, TEMPORARY AND CONSTRUCTION ROADS AND RAMPS

6.1 Construct and maintain roads to provide for normal public traffic flow when it is necessary to close public roads or streets.

6.2 Provide mats or other means to prevent overloading or damage to existing roadways from tracked equipment, large tandem axle trucks or equipment that will damage the existing roadway surfaces.

6.3 Construct and maintain access roads and parking areas as specified in Section 01555 – Traffic Control and Regulation.

PART 7 - EXCAVATION IN STREETS AND DRIVEWAYS

7.1 Avoid hindering or inconveniencing public travel on streets or intersecting alleys for more than two blocks at any one time, except by permission of City of Houston Engineer.

7.2 Obtain METRO and City of Houston Engineer's approval when nature of the Work requires closure of an entire street. Permits required for street closure are Contractor's responsibility. Avoid unnecessary inconvenience to abutting property owners.

7.3 Remove surplus materials and debris and open each block for public use, as work in that block is complete.

7.4 Acceptance of any portion of the Work will not be based on return of street to public use.

7.5 Avoid obstructing driveways or entrances to private and commercial property.

7.6 Provide temporary crossings or complete excavation and backfill in one continuous operation to minimize duration of obstruction when excavation is required across entrances.

7.7 Provide barricades and signs in accordance with Section VI of the State of Texas Manual on Uniform Traffic Control Devices.

PART 8 - TRAFFIC CONTROL

8.1 Comply with traffic regulation as specified in 01535 – Temporary Traffic Channelizing Devices.
PART 9 - SURFACE RESTORATION

9.1 Restore the site including landscaping to the condition existing before construction, or better.

9.2 Repair damaged turf areas, level with topsoil conforming to Section 02935 – Sodding, and re-sod in accordance with Section 02935 – Sodding. Water and level newly sodded areas with adjoining turf using appropriate steel wheel rollers for sodding. Do not use spot sodding or sprigging.

PART 10 - LIMITS OF CONSTRUCTION

10.1 Confine operations to lands within construction work limits shown on Drawings.

PART 11 - EQUIPMENT AND MATERIAL SALVAGE

11.1 Upon completion of the Work, carefully remove salvageable equipment and material. Deliver them to METRO as directed by Project Manager. Dispose of equipment offsite at no additional cost to METRO when Project Manager deems equipment unfit for further use.

PART 12 - MEASUREMENT AND PAYMENT

12.1 No separate measurement or payment will be made for the items in this specification. All costs associated with this work will be considered incidental to the total contract bid amount.

END OF SECTION 01145
SECTION 01205
PROJECT TESTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section specifies the testing responsibilities and guidelines for the Contractor, as required by the Contract Documents and as directed by the Engineer.

1.2 METRO’S INDEPENDENT TESTING LABORATORY

A. METRO shall employ an Independent Testing Laboratory (ITL) to ensure Contract Document compliance.

B. The ITL shall not be authorized to revoke, modify, or release any requirement of the Specifications, nor to approve or accept any portion of the Work. When it appears that the material furnished or Work performed fails to fulfill contractual requirements, the ITL shall promptly inform the METRO, in writing, of such deficiencies.

C. Copies of all laboratory tests and inspection reports shall be issued promptly and directly to METRO, and as may be directed. Test reports shall indicate, by notation (⁎) alongside, all tests that fall below norms with an explanation therefor. The Contractor shall be furnished copies of all test reports by METRO. The Contractor may use these reports for his own convenience, but at his own risk.

1.3 CONTRACTOR DUTIES

A. The Contractor may employ a Testing Laboratory Service (TLS) to ensure Contract Document compliance for areas not covered by METRO’s ITL.

B. The Contractor shall fully cooperate with any ITL employed by METRO to facilitate testing services so as to expedite the Work.

C. Contractor shall provide access for METRO’s ITL representative to obtain samples of materials proposed for use and which are required to be tested. Contractor shall cooperate in obtaining material samples for testing. Advise METRO’s ITL at least 48 hours in advance to allow for test completion and personnel assignments.

D. Representatives of METRO’s ITL shall have access to the Work at all times. The Contractor shall provide for and facilitate such access in order that METRO’s ITL may properly perform its functions.
1.4 SPECIAL INSTRUCTIONS

A. Inspections or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

B. When initial tests indicate noncompliance with the Contract Documents, any subsequent retesting occasioned by such noncompliance will be performed by the ITL and the cost thereof borne by the Contractor.

C. The Contractor's Testing Laboratory Service shall prepare and maintain control of METRO-approved, concrete mix designs in accordance with ACI 318, ACI 211.1, and ACI 214 for each specified and indicated strength.

D. The Contractor shall immediately notify METRO in writing, if, at any time during construction, the concrete resulting from the approved mix design proves to be unsatisfactory for any reason. The Contractor's Testing Laboratory Service shall modify the design, subject to written approval, until a satisfactory concrete mix is obtained.

E. If, as determined by the Engineer, concrete of poor quality or workmanship has been placed, additional tests shall be made as directed by the Engineer and at the expense of the Contractor. Tests may be compression test on cored cylinders, ASTM C 42, or load tests as outlined in ACI 318, Section 20.3, or as directed, verification check tests of the mix.

F. The Contractor shall be responsible for furnishing Steel Mill Test Reports and Material Certificates. Contractor shall also submit proposed mix designs and test records in accordance with ACI 318, Section 4.3.1.1, for review and approval.

PART 2 - MEASUREMENT AND PAYMENT

2.1 GENERAL

A. No separate measurement or payment will be made for the items in this specification. All costs associated with this work will be considered incidental to the total contract bid amount.

END OF SECTION 01205
SECTION 01310

DOCUMENT CONTROL REQUIREMENTS

PART 1 - GENERAL

1.1 OVERVIEW

A. Documentation is a critical task for the successful implementation of the Project and subsequently the operation of it. METRO requires that all project documentation be properly recorded, distributed, filed, archived and disposed.

B. METRO has implemented ManageIT for this Project. METRO and the Contractor will be utilizing a single system using a common database in a 3rd party hosting environment which will allow the contractor access 24/7 and will be the electronic medium to transfer official records and documents to METRO. The purpose of this common database system is to eliminate double entries and to expedite the exchange of documents. METRO will provide the access needed to the system database for the Contractor to be able to perform the work.

C. The Contractor shall follow METRO’s administrative procedures for correspondence control and shall adhere to METRO’s record retention policies and procedures. The Contractor shall also follow record retention requirements established by the Federal Transit Administration (FTA) for projects sponsored by that agency. The Contractor shall adopt the business processes established by METRO for this Project.

D. The Contractor is required to retain all project records including records submitted through ManageIT for five years after the completion of the Program/Project. If any litigation claim, negotiation, audit or other action involving the records has been started before the expiration of the five year period, the records must be retained until completion of the action and resolution of all issues which arise from it, or until the end of the regular five year period, whichever is later.

1.2 REFERENCES

A. The Contractor shall become familiar with the following procedures regarding the managing of record documents for this Project.

4. METRO Capital Programs – Engineering and Construction Records “AS-BUILT” Policy; Revision 0, dated 07/19/11.
5. METRO Solutions – Administrative Manual, Revision 1, dated 05/21/08.
7. METRO’s Capital Programs – Procedure CM-BUS-002, dated 04/30/12.
8. METRO’s Capital Programs – Procedure CM-BUS-003, dated 04/30/12.

1.3 GENERAL SCOPE

A. In general, the Capital Programs Procedures shall serve as a guide for the managing of Program/Project documents. These documents shall include; but are not limited to, correspondence, specifications, conceptual, schematics, design plans, construction, and manufacturing plans, reports, graphics, pictures and all other submittals required or prepared by the Contractor. All correspondence shall include the contract number on the first page of the document. On design plans or schedules which have a title block, the contract number shall appear on all pages. The Contractor shall expect other additional requirements specific to the different disciplines involved on the Project.

B. The Contractor is required to deliver all correspondence electronically utilizing ManageIT 3rd party hosting services. The internet address of METRO’s location is: www.metro.atser.com

METRO will provide the access to the Contractor to METRO’s domain. The Contractor will deliver the electronic correspondence in a manner that will require minimum or no manipulation by METRO staff. Upon the delivery (uploading) of the documents in ManageIT, the Contractor shall distribute the documents to the Project Manager. The email address for METRO: document.control@ridemetro.org

METRO will also deliver correspondence to the Contractor in a similar manner. All official correspondence shall be delivered via ManageIT.

C. Digital signatures: METRO will allow the use of digital signatures in lieu of wet signatures. However, the Contractor shall secure a written authorization from METRO and the following requirements must be fulfilled:

1. Digital signatures shall fulfill legal requirements by the State of Texas and Federal Law.
2. The system used to issue the digital signatures shall be a secure system capable to authenticate the author of the signature and shall be tamper proof.
3. The system must be approved by METRO.

In addition, METRO may require wet signature in key legal documents such as the Project Contract, invoices and documents required by the law.

D. The use of ManageIT does not relieve the Contractor of the requirement to provide hard copies or wet signature documents as required in the contract or as directed by METRO’s Project Manager. However, METRO may exempt the Contractor from submitting hard copies for those documents that have been signed digitally with an approved system.
1.4 FORMATS

A. The Contractor shall use software that is compatible with METRO’s software. METRO utilizes ManageIT; Microsoft Office 2010 including Microsoft Word 2010, Microsoft Excel 2010, Microsoft Access 2010, Microsoft Outlook 2010, Microsoft PowerPoint 2010 and Microsoft Visio 2010. METRO also utilizes Adobe Acrobat Professional for managing PDF documents. Periodically, METRO updates the software. The Contractor is expected to follow a path that will allow the exchange of documents seamless between the parties. Before updating any software or introducing any new software, the Contractor shall secure an approval from METRO.

B. The Contractor is required to provide electronic searchable PDF files for all textual correspondence such as contracts, change management documents, RFI’s, reports, letters, proposals, etc. The purpose of the searchable PDF files is to be able to search for text strings within the documents. The accuracy of the searchable file shall be 99% or better. If the Contractor for some reason cannot provide searchable PDF files, he/she should inform METRO and note it in the transmission of the documents. METRO may request the application or native software files to be able to make use and search for information.

C. The Contractor is required to use Bentley MicroStation V8i Select Series 3 for all CAD files. The Contractor is required to produce PDF files for construction and manufacturing drawings at a minimum resolution of 300 DPI. These PDF and CAD files shall be loaded in the ManageIT System utilizing the drawing module. In addition to the PDF, METRO requires that the Contractor submit the native files. For additional requirements for the preparation of Computer Aided-Design work, the contractor shall refer to METRO’s CADD Guidelines.

D. For graphics, visual files and photos, METRO expects that the Contractor utilizes the Adobe family of software including, but not limited to, Adobe Photoshop, Adobe Illustrator, Adobe Premiere, and Adobe After Effects, Adobe Encore, Adobe Soundbooth. In the case of graphics files, METRO typically requires JPEG and TIFF files with a minimum resolution of 300 DPI. METRO reserves the right to ask for the native files.

E. Since this is a fast changing technological area, METRO will upgrade from time to time the requirements for this type of work.

1.5 PROCESSES AND PROCEDURES

METRO requires that the contractor utilize the system to deliver all official correspondence to METRO. The correspondence included, but not limited to, are: letters, RFI’s, transmittals, notices, non-compliance notices, meeting minutes, emails, telephone records (if any), faxes, safety, quality, field reports, punch list, etc. METRO does not accept the use of emails for official correspondence.
However, METRO is aware that on very rare occasions emails may be used in emergency situations. When this situation occurs, the Contractor shall make it official by copying METRO’s Project Manager and adding the word “OFFICIAL RECORD” on the subject line and in bold letters beneath the signature name. METRO may ask the contractor to follow with formal correspondence, i.e.: letters, change notices, transmittals, etc.

A. METRO will be responsible for the overall configuration of the system. This includes the official name of companies, addresses, email addresses, user accounts, etc. If the Contractor needs to add, replace or modify Project Information, it shall be done in coordination with METRO’s Project Manager.

B. The Contractor is required to notify METRO’s Project Manager and any other METRO designees via ManageIT’s email functionality upon delivery of any letters, correspondence, change management documents, drawings, submittals, notifications, etc. The system does not automatically generate e-mail notification. Therefore, it is critical that the Contractor take this step.

C. The Contractor is required to log into the system on a daily basis to check for information delivered by METRO.

D. Correspondence: The Contractor shall make use of ManageIT to record the official project correspondence. The following modules will be used from the communication folder.

1. Request for Information (RFI’s): The Contractor shall use the RFI module for requests to clarify uncertainty regarding work at hand and should be limited to technical matters. RFIs shall be used to request clarifications and directions from METRO, suppliers and subcontractors and shall be used when time is of essence and responses are expected immediately. RFIs may also signal an imminent risk that could later be disputed or could be first discovery that could lead to contract changes.

2. Letters: The Contractor shall use letters as formal communication between the Contractor and METRO. They are designed for a more general scope than RFIs and require less immediate action. Letters may address more than one item or one item with multiple possible ramifications. Letters will be transmitted to METRO using ManageIT.

3. Meeting Minutes, Conference Calls and Video Conference Calls: The Contractor shall use Meeting Minutes to record actions, decisions made at these meetings and to assign new actions through ball-in-court. The Contractor will be responsible for populating action items regarding response from and to METRO.

4. Correspondence Sent. METRO will use it to log all outgoing correspondence to the Contractor and 3rd parties.
5. Correspondence Received: METRO will use it to keep logs of all correspondence delivered to METRO. Contractor shall use this module to transmit and deliver documents to METRO.

6. Noncompliance Notices: The Contractor shall use this module to post non-conformance quality control documents, non-OSHA reportable safety violations, and deviations from project standards, and procedures.

7. Safety Records and Reports: The Contractor shall use this module to prepare OSHA reports and safety notices for Projects that require OSHA reporting. This information shall immediately be distributed to METRO safety representatives. These reports are needed for construction projects.

8. Telephone Records: In the event that a telephone conversation needs to be documented, the Contractor and METRO staff shall record the actions or decisions arising from phone conversations. Formal written communication shall follow within five business days for items having impact on scope, budget or schedule.

B. The Contractor shall also be responsible for maintaining project document logs.

1. The Contractor shall utilize ManageIT to log and submit electronic drawings. There are two primary ways to perform this task. One is handling the individual drawings and the other is by drawing sets. Depending on the complexity of the project, METRO will determine the ways and means on how to handle this task.

2. Submittals: The Contractor shall provide a Contract Deliverable Requirement List of documents (CDRLs) at the beginning of the contract. Submittals shall be populated within two weeks of notice-to-proceed (NTP). The CDRL shall also be populated by the Contractor with a required date. The Contractor shall coordinate this task with the METRO’s Project Manager.

3. Daily Reports: Daily reports prepared by the Contractor, METRO staff, or Consultants acting on behalf of METRO shall be generated in the system using ManageIT. These reports are needed for construction projects.

1.6 QUALITY ASSURANCE AND CONTROL

METRO requires that the Contractor validate all the information submitted to METRO. The information and content shall be reviewed and approved before submitting to METRO. The information shall be free of defects. In the case of electronic files, the media and files shall be free of viruses and shall be properly organized to facilitate the use of the product by METRO staff.

A. Audits: The Contractor shall perform periodic self-audits of the plans and
specifications being used to assure the latest documents are being utilized. If the Contractor finds noncompliance results, the Contractor shall take corrective action and inform METRO. The Contractor shall also audit its subs and suppliers. Results of these shall be made available to METRO upon request.

B. Before submitting information to METRO, the Contractor shall review the information to assure compliance with METRO requirements and specifications. The Contractor shall have quality control and quality assurance procedures in place.

C. The Contractor shall review all correspondence received from METRO. If the Contractor finds any abnormalities, defects or incompleteness, he/she shall notify METRO within five (5) business days requesting new deliverables.

D. Personnel: METRO expects the Contractor to have qualified trained and experienced document control staffing to perform the tasks. The Contractor shall inform METRO of the document control personnel assigned to the Project and METRO in its sole discretion shall have the right to reject any personnel whom the Contractor assigns to the Project. In advance of assigning any person to perform services, the Contractor shall inquire diligently into and screen for qualifications of each person whom Contractor assigns to perform services and Contractor shall not assign any person that poses a reasonable risk to the safety or property of METRO or its employees, and business partners. Risk means any propensity to engage in computer hacking, fraud and other malicious activities.

1.7 PROJECT CLOSEOUT

At the end of the Project significant efforts shall be made to assure all Project documentation gets turned over to METRO. The Contractor and METRO shall reconcile all program/project documentation. This effort shall be made in tandem with the contract requirements of the project, law requirements, regulatory agencies, code requirements, and METRO’s requirements.

For multi-phase project/program, the closeout practice shall be applied at the various stages of the project; upon deliverable completion; upon phase completion; upon iteration completion, at designated times during the project’s life, or at whatever other juncture represents a completed segment of work. The following items are typically expected by METRO as part of the documentation closeout.

A. Contract Closeout Records: The Contractor shall deliver all contract closed-out records stated in the Contract. These records shall be stamped as “FINAL CONTRACT RECORDS”. These records include items such as final payment request, contractor’s and sub-contractor release(s), summary of contract amount, consent of surety, OCIP forms, small business compliance records, Davis Bacon records, subcontractors’ payment records, etc.

B. As-Built Drawings and Mark ups: In addition to the Record Drawings, METRO
requires that all the redlined “as-built” drawings collected during the construction be submitted to METRO. Changes shall be properly noted on the drawing block and revisions shall be clouded. Red shall be used to annotate changes and additions; green shall be used to delete; yellow shall be used to review and quality control; black shall be used to annotate comments and remarks. Other colors shall be used at the discretion of the Contractor. These records shall be stamped “AS BUILT DRAWINGS” in bold and red ink letters. METRO requires that the Contractor submits original records plus a set of color scanned PDF documents.

C. Commissioning Records: The Contractor shall submit records pertaining to the commissioning of facilities and vehicles using approved METRO forms when applicable. Records shall be properly signed including signatures by METRO Safety Representative. In addition to uploading records in ManageIT, the Contractor shall submit properly prepared binders.

D. Occupancy, Certificate of Occupancy and Certificate to Operate Records: The Contractor shall submit all original occupancy, certificate of occupancy and certificate to operate approved records. METRO will instruct the Contractor where to upload these documents.

E. Warranty Information: As part of the closeout documentation, the Contractor shall submit all warranty information and shall produce a log with the status of the warranty information. The information shall include but not limited to:

1. Description
2. Part Number
3. Serial Number
4. Expiration date
5. Manufacturer name, address, phone, contact person
6. Registration information

F. Manual and Operating Procedures: The Contractor shall collect all manuals and operating procedures needed for the operation of the facilities. METRO requires this information in PDF and in English language.

G. Master Equipment List and Spare parts: The Contractor shall submit a spreadsheet outlining the master equipment and the spare part lists.

H. Inventory of Extra Material: At the end of the contract, the Contractor shall produce an inventory of extra material and other items paid by METRO.

I. Lien Releases: The Contractor shall furnish METRO with lien releases from all subcontractors.

J. Final Meter Readings: The Contractor shall submit final meter reading for utility services being transferred to METRO.
PART 2 - MEASUREMENT AND PAYMENT

2.1 GENERAL

A. No separate measurement or payment will be made for the items in this specification. All costs associated with this work will be considered incidental to the total contract bid amount.

END OF SECTION 01310
SECTION 01340

SHOP DRAWINGS, PRODUCT DATA, SAMPLES AND RECORD DOCUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for preparing and submitting Shop Drawings, product data, samples and Record Documents required by the Contract Documents.

1.2 SHOP DRAWINGS

A. General

Shop Drawings shall be identified by cross references to Contract Drawing numbers and to Technical Provisions Section and page numbers. The maximum size of Shop Drawings shall be 22 in. x 34 in.

B. Changes

Changes in products for which Shop Drawings have been reviewed and approved will not be permitted, unless those changes have been submitted to and approved in writing by METRO, as specified in Section 01630 - Products and Substitutions of these Specifications.

C. Quality Assurance

Shop Drawings shall be prepared to a standard of quality as set forth in the latest revision of DOD-STD-100, Military Standard Engineering Drawing Practices. Drafting quality shall enable microfilming in accordance with applicable standards of the National Microfilm Association.

D. Coordination

Submittals hereunder shall be coordinated with the requirements of Section 01340 - Shop Drawings, Project Data Samples and Record Documents, and Section 01700 - Project Closeout of these Specifications.

1.3 PRODUCT DATA

A. Manufacturer's standard schematics, drawings, diagrams, details, procedures, instruction, schedules, illustrations, calculations and other descriptive data shall be modified to delete information which is not applicable to the Project and to highlight...
project-related pertinent information. Dimensions, coordination, clearances, performance characteristics and capacities, interfaces, limitations, precautions, wiring diagrams, inputs, outputs and controls shall be shown.

B. Notarized Certificates of Compliance shall be submitted for those products for which no samples or test results are specified. Notarized Certificates shall demonstrate proof positive of compliance of product with specification requirements and shall be signed by an authorized representative of the manufacturer. One copy of such certificates shall accompany each lot of product delivered to the Site. METRO may refuse the use of certain products where the only basis of compliance is a certificate of Compliance.

C. Part replacement and maintenance data for products shall be as specified in Section 01730 - Operating and Maintenance Data of these Specifications.

1.4 SAMPLES

A. Samples shall be of size and quantities to clearly illustrate full color range and functional characteristics of products and materials, with complete accessories or attachment devices. After review and written approval by METRO, samples may be used in construction, if not damaged and as directed by METRO.

B. Changes in products for which samples have been approved will not be permitted, unless those changes have been reviewed and approved in writing by METRO.

1.5 SUBMITTAL RESPONSIBILITY

A. Deviations in submittals from requirements of the Contract Documents shall not be relieved by METRO review and approval of submittals, unless those specific deviations have been acknowledged and waived in writing by METRO.

1.6 LIMITED APPROVALS

A. All Shop Drawings, product data and samples submitted by the Contractor shall illustrate details of work, equipment, materials, products, systems, designs or workmanship that the Contractor intends to use in order to comply with the design concept established in the Contract Documents. METRO’s review of these submittals is only for the limited purpose of checking the same for conformity with the design concept of the Work as established in the Contract Documents, and is not intended to be for the purpose of determining the accuracy of other matters that they may be contained in such submittals, including but not limited to such matters as dimensions, quantities, performance of equipment and systems designed by the Contract, Contractor-furnished engineering and design, construction means, methods, techniques, sequences, procedures or safety precautions, the correctness of which shall be the sole responsibility of the Contractor. METRO will undertake its review within ten working days so as to cause minimum delay. METRO’s review of a specific item shall not indicate
approval of an assembly of which the item is a component or in which it functions.

1.7 SUBMISSION REQUIREMENTS

A. Submittals, including test results and Certificates of Compliance, shall be made in sufficient time before the work covered by the submittal is scheduled to be performed. Times may be mutually agreed upon so as not to delay the Project Schedule. Unless otherwise directed, submittals for a given Technical Section of these Specifications shall be completed in one submission.

1.8 DISTRIBUTION OF APPROVED SUBMITTALS

A. Ten (10) copies of Shop Drawings and product data bearing the Contractor's stamp of approval and signature shall be transmitted to METRO. METRO shall return three (3) copies of Shop Drawings and product data to the Contractor approved as noted.

1.9 RECORD DOCUMENTS

A. One record copy of all Contract Documents, Shop Drawings, and one set of full-size Contract Drawings shall be maintained at the Site. A set of the Contract Documents, including a full-size set of the Contract Drawings, shall be annotated by the Contractor to indicate the following.

1. Horizontal and vertical location of underground facilities and utilities.

2. Location of utilities, equipment and appurtenances concealed in construction as referenced to visible and accessible features of the construction.

3. Field changes of dimensions, details, locations and substitutions, as changes occur.

4. Details not on original Contract Drawings.

5. All other changes as required to result in a complete set of Record Documents to reflect "as built" conditions of the Project.

6. All changes and notations to record drawings shall be made with red erasable pencil and dated.

7. Record Drawings shall be kept current and shall be reviewed by METRO or METRO's representative for being up to date prior to the approval of any progress payment.

B. All such documents shall be stamped "Record Documents" and kept available for examination by METRO. Record Documents shall be maintained in a dry, clean
and legible condition.

C. One copy of all certificates for installed material, mill certificates, weight tickets, product modifications, and related documents shall be maintained and submitted to METRO for inclusion in the Record Documents.

D. A clean reproducible copy of the Record Documents shall be transmitted to METRO at the time of Project closeout. Record Documents shall become the property of METRO. Refer to Section 01700 - Project Closeout of these Specifications for detailed closeout requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

A. No separate measurement or payment will be made for the items in this specification. All costs associated with this work will be considered incidental to the total contract bid amount.

END OF SECTION 01340
SECTION 01351

ENVIRONMENTAL SAFETY AND WORKER PROTECTION

PART 2 - GENERAL

1.1 SECTION INCLUDES

Environmental Safety and Worker Protection including monitoring emissions and exposure to workers and providing an appropriate response. The role of the Certified Industrial Hygienist (CIH) is also defined.

1.2 REFERENCES

The following is a list of applicable requirements to this project. It is not intended to be a complete listing of all laws and regulations to which the Contractor must comply.

A. Code of Federal Regulations

1. 29 CFR 1910, "Occupational Safety and Health Standards".
   a. 29 CFR 1910.146 "Permit-required confined spaces".

   a. 29 CFR 1926.33 "Access to Employee Exposure and Medical Records".
   b. 29 CFR 1926.51, "Sanitation Standard".
   c. 29 CFR 1926.59, "Hazard Communication".
   d. 29 CFR 1926.62, "Lead".
   e. 29 CFR 1926.103 "Respiratory Protection".

3. 40 CFR 50, "National Primary and Secondary Ambient Air Quality Standards"
4. 40 CFR 58, "Ambient Air Quality Surveillance".

5. 40 CFR 60 Appendix A, "Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Fires".

6. 40 CFR 117, "Determination of Reportable Quantities for Hazardous Substances".

7. 40 CFR 122, "Administered Permit Program: The National Pollutant Discharge Elimination System".

B. National Institute for Occupational Health and Safety

NIOSH Method 7082, "Lead" (or equivalent).

C. American Society for Testing and Materials


D. EPA (Environmental Protection Agency) Publications

1. SW-846, "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods".

2. EPA Method 3050, "Acid Digestion of Sediments, Sludges, and Soils".

E. SSPC Guide 6, "Guide for Containing Debris Generated During Paint Removal Operations".

F. SSPC Guide 7, "Guide for the Disposal of Lead Contaminated Surface Preparation Debris".

G. SSPC Publication 91-18, "Industrial Lead Paint Removal Handbook".

H. Texas Commission on Environmental Quality

1. Texas Administrative Code (TAC) 30, Chapter 101, "General Rules".

2. Texas Administrative Code (TAC) 30, Chapter 111, "Control of Air Pollution from Visible Emissions and Particulate Matter".

3. Texas Administrative Code (TAC) 30, Chapter 290, "Water Hygiene".

4. Texas Administrative Code (TAC) 30, Chapter 307, "Surface Water Quality
Standards).

5. Texas Administrative Code (TAC) 30, Chapter 309, "Effluent Limitations".

6. Texas Administrative Code (TAC) 30, Chapter 335, "Industrial Solid Waste and Municipal Hazardous Waste".

1.3 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 – Submittal Procedures.

B. Submittals shall conform to appropriate codes for regulatory requirements.

1.4 DEFINITION

A. Acceptance Criteria: Minimum standards for the content of programs, plans, procedures, and designs required by this specification for the performance of this project. Acceptance criteria will be the basis for judging the responsiveness of Contractors' programs and will also be used as a basis for suspending work, if necessary.

B. Action Level: Employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air (μg/m^3) calculated as an eight hour time-weighted average (TWA).


D. Competent Person: One who is capable of identifying existing and predictable lead hazards in the surroundings or working conditions and who has authorization to take prompt corrective measures to eliminate them.

E. Containment System: An enclosure built around lead paint removal areas designed to contain lead paint debris and prevent emissions to the environment.

F. Dust Collection: Mechanical ventilation system designed specifically for the containment, capture, and removal of airborne particulate from the containment. Dust collection systems shall include ductwork, plenums and/or hoppers, and dust collector(s) for the removal of leaded paint dust from the air stream prior to discharging to the atmosphere.

G. Emission: A release of material to the air, water, or ground.

H. Entry/Exit Airlock: An isolated enclosure located at the entrance of the containment in
which the workers remove contaminated dust and debris from their work clothes.

I. **EPA:** The US. Environmental Protection Agency. Regulations are contained in Title 40 of the Code of Federal Regulations (40 CFR).

J. **Hazardous Waste (lead paint debris):** Waste that is classified as hazardous due to its concentrations of regulated hazardous substances. Paint debris is classified as hazardous waste if, after testing by the Toxicity Characteristic Leaching Procedure (TCLP), the leachate contains any of the 8 metals or other substances in concentrations at or above limits established in 40 CFR 261.

K. **HEPA:** A high efficiency particulate filter (HEPA) that is 99.97% efficient against particles of 0.3 microns in size or larger.

L. **Lead Containing Dust and Debris:** Dust and debris generated during the project which contains lead in any amount, including but not limited to pulverized paint, spent abrasive, filters (wet and dry), and containment materials upon which lead is still present.

M. **NIOSH:** National Institute of Occupational Safety and Health.

N. **OSHA:** Occupational Safety and Health Administration. Standards are contained in Title 29 of the Code of Federal Regulations, Parts 1910 and 1926 (29 CFR 1910 and 29 CFR 1926).

O. **Owner:** The City of Houston

P. **PEL:** Permissible Exposure Limit. An employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 50 μg/m³ over an 8 hour TWA.

Q. **POTW:** Publicly Owned Treatment Works


S. **Regulated Area:** Area established by the Contractor to demarcate the zone(s) beyond which airborne concentrations of lead do not exceed the Action Level.

T. **SSPC:** Society for Protective Coatings. An independent, non-profit organization of engineers, technical specialists, and Contractors whose goal is research and development of new coatings and methods for removal, application, and disposal of existing coatings on industrial structures.

U. **Tarpaulins:** Flexible fabric, vinyl, plastic or canvas cover sheets, impenetrable to dust, wind, and water, used to enclose the cable and/or scaffold support system comprising
the containment enclosure.

V. **TCLP**: Toxicity Characteristic Leaching Procedure. Laboratory tests conducted on wastes that determine the amount of hazardous materials that leach out into a test solution. The test is intended to simulate the properties of water as it leaches through a solid waste landfill. TCLP testing is defined in 40 CFR 261, Appendix II.

W. **TSP**: Total Suspended Particulate

PART 2 - PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. The Contractor is to supply materials and equipment to insure the safety and protection of workers and the environment in accordance with these specifications.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL PROTECTION AND MONITORING

A. Protection of Ambient Air: Visible emissions are to be controlled to meet, as a minimum, TAC 30 Chapter 111, "Control of Air Pollution from Visible Emissions and Particulate Matter" requirements and SSPC-Guide 61 (CON), Level 1 Emissions. Air monitoring and analysis may be performed by the City during abrasive blast cleaning operations. Such monitoring will be in accordance with 40 CFR 50, Appendix B, "Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere" and/or 40 CFR 50, Appendix G, "Reference Method for the Determination of Lead in Suspended Particulate Matter Collected from Ambient Air". The limits for down wind pollutant concentrations allowed during blasting operations are as follows:

PM-10: 450 micrograms/cubic meter/8 hr. (40 CFR 50.6)

Lead (Pb): 13.5 micrograms/cubic meter/8 hr. (40 CFR 50.12)

Visible emissions and/or monitored emissions for PM-10 and TSP lead in excess of the above levels shall be cause for shut down of the project until corrections to control/containment system or paint removal/surface preparation operations are made to comply with these requirements.

B. Protection of Surface and Storm Water: The Contractor shall take all necessary precautions to ensure lead contaminants do not enter surface waters or storm water drainage systems.

1. The Contractor shall protect the area around ditches and drainage inlets. Daily verification of proper protection to minimize the potential contaminants
reaching the drainage system shall be performed.

2. The Contractor shall collect all potentially contaminated process waters for testing and, as appropriate, treatment. Process water from pressure washing, wet abrasive blast cleaning or hygiene facilities shall not be discharged to drainage systems or surface waters.

3. The Contractor may remove lead or other heavy metals from such waters through filtration, ion exchange or other approved means. Following treatment, water samples must be tested prior to disposal. Discharge to sanitary sewer lines requires authorization, in writing, from a POTW.

C. Protection of Soil and Grounds: The Contractor shall protect the soil around the structure to ensure that the soil does not become contaminated. Where lead is present in the coatings to be removed, the Contractor shall provide for the sampling and analysis of soil samples for total lead content.

1. Sampling and analysis shall be performed prior to commencement of paint removal operations to establish a background "base level".

2. Samples from each area shall be taken in a minimum of four directions, at circular increments of 90°, one of which shall include the direction of prevailing wind. Samples shall also be obtained, at the direction of the engineer, at the closest points of public access (i.e. housing, park, school).

3. The soil sampling procedure shall be as outlined in SSPC Guide 6 Section 5.5.5. Each sampling point shall be sufficiently identified on a site map to allow return to the exact location upon project completion.

4. Each sample shall be split in two portions, one for immediate analysis and the other sealed, preserved and furnished to the Engineer. The samples shall be analyzed in accordance with EPA Method 3050, "Acid Digestion of Sediments, Sludges and Soils", and shall be performed by a qualified laboratory approved by the Engineer.

5. Samples shall be obtained at the completion of work (post-construction samples) from all locations from which pre-construction samples were obtained. Samples shall be collected, handled and tested in the same manner as described above.

6. Upon completion of the work, soils found to be contaminated with lead in greater quantity than found in the background "base level", established at the start of the work, shall be removed by the Contractor to the depth necessary to achieve a lead content equivalent to, or below, the pre-construction background levels. Disposal shall be in accordance with applicable regulations.
7. The Contractor shall replace in-kind (i.e., topsoil, structural fill, etc.) with an equivalent amount of non-contaminated soil, compact in place and grade to pre-existing conditions. The Contractor shall also replace in-kind any surface improvements, such as grass, shrubs, etc. that were damaged or destroyed by the work. The soil removal, replacement and related work is to be performed by the Contractor at no additional cost to the Owner.

3.2 WORKER PROTECTION

A. The Contractor shall develop a written Compliance Program to establish and implement practices and procedures for assuring that no employee is exposed to lead at concentrations greater than 50 micrograms per cubic meter of air ($\mu g/m^3$), the OSHA permissible exposure limit (PEL). This program is in addition to other OSHA hazard communication and safety and health requirements of the project, and shall be revised and updated at least every six months.

1. The program shall establish methods for complying with this specification and the OSHA Construction Industry Lead Standard, 29 CFR 1926.62(e)(2)(ii). The Federal regulation is referred to as the "Lead Standard" for the purpose of this specification.

2. The program shall apply to all Contractor employees associated with lead on the project, and to subcontractors working under the direct control of the Contractor who are associated with lead on the project.

3. The program shall assign the specific responsibility for implementation and enforcement of the program to the Contractors' company management. The Contractor's Competent Person(s) shall be identified, by name, and qualifications submitted. The Competent Person shall be on-site during any operations which involve the removal, handling or disturbing of lead containing materials.

4. The program shall contain a description of each activity in which lead is emitted (e.g. equipment used, material involved, controls in place, crew size, employee job responsibilities, operating procedures and maintenance practices).

5. The program shall contain a report of the technology considered in meeting the PEL and air monitoring data which documents the source of lead emissions.

6. The program shall contain a work practice program which includes items required in the lead standard such as protective clothing and equipment, housekeeping, and hygiene facilities and practices.

B. Exposure Monitoring: The Contractor shall be responsible for conducting and reporting worker exposure assessments in accordance with 29 CFR 1926.62.
1. Representative personal air samples shall be collected at the beginning of the lead removal work to determine employee lead exposures. Tasks involving potential lead exposure include, but are not limited to, paint removal operations, clean-up, and debris handling operations. Full shift (at least 7 hours) air samples shall be collected for each job classification in the exposure area. The range of exposures for lead removal and cleanup activities shall be determined.

2. During the initial monitoring, workers performing the following activities (or equivalent) shall be protected to the anticipated exposure levels which are dictated by the lead standard:

   a. 500 μg/m$^3$: Manual demolition of structures containing lead-containing coatings or paint (e.g., dry wall), manual scraping, manual sanding, heat gun applications, power tool cleaning with dust collection systems, and spray painting with leadpaint.

   b. 2,500 μg/m$^3$: Using lead-containing mortar, lead burning, or conducting the following activities where lead-containing coatings or paint are present: rivet busting, power tool cleaning without dust collection systems, clean-up activities where dry expendable abrasives are used, and the movement and removal of abrasive blasting enclosures.

   c. More than 2,500 μg/m$^3$: Activities involving lead containing coatings or paint on structures disturbed by abrasive blasting, welding, cutting, and torch burning.

3. Protection requires compliance with the necessary respiratory protection, personal protective clothing and equipment, change areas and washing facilities, blood lead and zinc protoporphyrin monitoring, and employee training. The protection measures shall be modified, as necessary, after the exposure results are received.

4. Where initial monitoring indicates that lead exposures are below the Action Level, and where work activities and conditions remain the same as at the time of initial sampling, additional monitoring need not be repeated for that work activity.

5. Where the initial monitoring of a given work activity indicates that lead exposures are at or above the Action Level, additional exposure monitoring shall be conducted monthly. The monthly monitoring is more frequent than frequencies established in the lead standard which are at least every 6 months if above the Action Level, but below the PEL, or every 3 months if above the PEL.
6. All air samples shall be collected and analyzed according to NIOSH Method 7082, or equivalent. All samples shall be analyzed by laboratories accredited by the American Industrial Hygiene Association for metals analysis.

7. All exposed employees shall be notified in writing of the monitoring results within five (5) days after receiving the results.

8. The Action Level for airborne lead exposure is $30 \mu g/m^3$, as an 8-hour time weighted average (TWA) concentration, without regard to the use of respirators. Whenever workers’ airborne lead exposures exceed the Action Level, the Contractor shall implement the following:
   a. Periodic Exposure Monitoring
   b. Employee Information and Training
   c. Employee Medical Surveillance and Medical Removal Protection
   d. Housekeeping
   e. Record keeping
   f. Signs and Regulated Areas

9. The Permissible Exposure Limit (PEL) for airborne lead exposure is $50 \mu g/m^3$, as an 8-hour TWA concentration. When the work area contains airborne lead levels above the PEL the Contractor shall implement the following in addition to those items listed in 3.02.B.8 of this section:
   a. Compliance Program
   b. Respiratory Protection
   c. Protective Clothing and Equipment
   d. Hygiene Facilities and Practices

C. Respiratory Protection: After feasible engineering controls and work practices have been implemented, respiratory protection shall be used to maintain employees' lead exposures below the PEL.

1. Respirators shall be worn by all employees, other Contractors, inspectors, or observers who enter regulated areas.

2. The Contractor shall develop a written Respiratory Protection Program in compliance with 29 CFR 1910.134, paragraphs (b), (d), (e), and (f), and the lead standard. The program shall address the selection, use, maintenance, and inspection of respirators, and qualifications for respirator users.

D. Protective Clothing and Equipment: The Contractor shall provide protective clothing and equipment and ensure they are worn by all employees whose lead exposures exceed the PEL, or who enter regulated areas.

1. Protective clothing shall include washable and/or disposable full body
coveralls, gloves, foot coverings, and hoods. Other protective equipment shall include face shields, hard hats, eye protection, and hearing protection as appropriate.

2. Disposable protective clothing shall be used for no more than one work day. Such clothing may have to be disposed of as hazardous waste.

3. Reusable protective equipment shall be cleaned or replaced weekly if exposure levels are less than 200 \( \mu g/m^3 \), or daily if the exposure levels are greater than or equal to 200 \( \mu g/m^3 \).

4. Clothing shall not be removed or "cleaned" by any means which could reintroduce the lead dust into the ambient air. This includes brushing, shaking, and blowing. Vacuums equipped with HEPA filters shall be used for this purpose.

E. Housekeeping: Accumulations of lead-containing dust and debris generated by work activities shall be removed and cleaned daily.

1. All persons doing the cleanup shall be trained in performing lead activities, respirator qualified, and participate in the medical surveillance program. Respirators and protective clothing shall be worn by all persons doing the cleanup.

2. Compressed air may be used for housekeeping if used within containment and in conjunction with a ventilation system designed to capture the dust. Otherwise, HEPA-filtered vacuum cleaners shall be employed.

3. All lead-containing dust and debris shall be collected in sealed containers. The waste shall be tested to determine whether it will be disposed of as hazardous waste.

F. Personal Hygiene Facilities and Practices

1. Clean change areas shall be provided when employees' lead exposures exceed the PEL. The change areas shall be equipped with storage facilities for street clothing and a separate area for the removal and storage of lead-contaminated clothing and equipment. They shall be designed and used so that contamination of street clothing does not occur. Employees shall not leave the project site wearing any clothing worn while performing lead activities. Airborne lead exposures in the change area shall be maintained below the Action Level.

2. Shower facilities shall be provided whenever employees' lead exposures exceed the PEL. Shower facilities shall comply with OSHA Sanitation Standard, 29 CFR 1929.51. All employees whose lead exposures exceed the PEL shall shower at the end of each work shift or before leaving the project area. The shower facilities shall be made available for use by the Owner and
its representatives, such as inspectors or observers.

3. Arrangements shall be made with the local POTW for the proper disposal of the shower and wash water after filtration (e.g., through a three stage 100, 50, and 5 micron filtering system), ion exchange, or other approved treatment technology.

4. Clean lunch areas shall be provided for all employees whose lead exposures exceed the PEL. Employees shall remove or clean (by vacuuming) their protective clothing and wash their hands and face before entering the lunch area. Lead exposures in the lunch area shall be maintained as free as practicable from lead contamination.

5. An adequate number of clean lavatory and hand washing facilities shall be provided. These shall comply with the OSHA Sanitation Standard, 29 CFR 1929.51.

6. Eating, drinking, smoking, chewing of food or tobacco products, or the application of cosmetics shall not be permitted in any areas where the lead exposures exceed the PEL. Thorough washing of hands and face is required prior to undertaking any of these activities.

G. Medical Surveillance and Medical Removal Protection

1. All employees who are exposed to lead above the Action Level in a single day during this project shall be provided with initial and periodic medical examinations and blood lead tests as required by the lead standard. A final blood lead test shall be provided for each worker upon completion of the project, or at any time a worker's employment at the project ceases.

2. When blood lead levels over 50 μg/dl are encountered, the Contractor shall provide for the temporary removal of employees from lead exposure above the Action Level. The required medical surveillance and periodic blood lead tests shall be provided in strict accordance with the lead standard throughout the removal.

3. Employees who will be required to wear a respirator or who request one shall be provided with a respirator and the necessary medical examinations to determine their ability to wear a respirator.

4. All examinations shall be provided by the Contractor and shall be performed by or under the direct supervision of a licensed physician.

H. Employee Information and Training

1. The Contractor shall provide lead training for all employees who are exposed to lead above the Action Level for this project.
2. The content of lead training shall include, as a minimum, those items listed in the lead standard.

3. Training shall also include hazard communication in accordance with 29 CFR 1926.59.

4. The Contractor shall notify other employers at the project site of the nature of the lead exposure work, the need to remain out of exposure areas, the warning sign and labeling system in effect, and the potential need for them to take measures to protect their employees.

I. Signs and Regulated Areas

1. The Contractor shall establish a regulated area surrounding activities where lead exposures exceed the Action Level. This includes locations where lead-containing debris is handled or transferred to storage containers.

2. The regulated area shall be demarcated by ropes, tape, walls, or containment's with caution signs posted at all accessible sides. Signs shall contain the legend:

   WARNING LEAD WORK AREA
   POISON
   NO SMOKING OR EATING

3. The Contractor shall control access of persons into regulated areas. Access shall be limited to individuals with proper training and personal protective equipment, and medical surveillance testing.

4. All persons entering regulated areas shall wear protective clothing and respirators.

5. Eating, drinking, smoking, and chewing of food or tobacco products shall be prohibited in regulated areas and in any area where lead exposures exceed the Action Level.

J. Record keeping: All records relating to training, medical examinations, blood lead monitoring, and exposure monitoring shall be maintained by the Contractor as required by the lead standard. All records shall be available for review by the Owner or its representative upon request.

3.3 CERTIFIED INDUSTRIAL HYGIENIST (CIH)

A. The Contractor shall provide for the services of a Certified Industrial Hygienist (CIH) who must be certified by the American Board of Industrial Hygiene in comprehensive practice.
B. Duties of the CIH shall be as follows:

1. Conduct and/or verify training for contractor employees in accordance with 29 CFR 1926.62 (l).

2. Review and approve Contractor's Written Compliance Plan for conformance to 29 CFR 1926.62(e)(2)(ii) and this Specification.

3. Monitor and evaluate work weekly to assure conformance with the approved plan and that hazardous exposure is adequately controlled in accordance with worker safety and health requirements of these specifications.

4. Provide monthly reports of work compliance with control requirements in regards to working in a lead environment.

C. Activities of the CIH shall include:

1. Meet with City to discuss details of Contractor's Written Compliance Plan for lead paint removal.

2. Ensure worker and area air monitoring, testing and reporting are conducted by or under the direction of the CIH.

3. Furnish a detailed worker and area air monitoring schedule coordinated with Contractor's proposed production schedule.

4. Directing, monitoring and inspecting lead paint removal work to ensure that the requirements of the Contract have been satisfied during the entire lead paint removal operation.

5. Report results of air monitoring samples to the Engineer, signed by the CIH within 48 hours after the air samples are taken.

6. The CIH shall review sampling data, collected on a day when lead paint removal operations occur, to determine if conditions require any change in work methods. Removal work shall not continue until approval is given by the CIH.

7. The CIH shall verify in writing and submit monitoring data to verify that:

   a. Air borne lead levels at and beyond the lead control (regulated) area were and remained less than 30 mg/m$^3$ of air

   b. Contractor conformance to 29 CFR 1926.62 and Item 3.02, above

   c. There were no visible accumulations of lead contaminated paint, dust or debris on the work site. Adjacent areas that may have become contaminated were properly cleaned and inspected.
d. The CIH shall verify that the work area and contractor's equipment have been adequately cleaned of lead contamination prior to demobilization from the work site.

3.4 DEMOBILIZATION

A. The Contractor shall not remove the lead control area, boundaries, warning signs, etc. prior to proper removal of all hazardous wastes, debris and materials from the site and the City's receipt and acceptance of the CIH's verification.

PART 4 - MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for the items in this specification. All costs associated with this work will be considered incidental to the total contract bid amount.

END OF SECTION 01351
SECTION 01450
TESTING LABORATORY SERVICES

PART 1 – GENERAL

1.1 SCOPE

A. A qualified independent testing laboratory and/or geotechnical engineering service, selected by the Owner and paid by the Owner, will perform the professional testing and laboratory services specified herein.

B. The inspecting agency shall make all inspections and perform all tests in accordance with the rules and regulations of the building code, local authorities, the Specifications of the ASTM and these Contract Documents.

C. Materials and workmanship not meeting the required standards or performance obligations are to be removed and replaced. Replacement and subsequent testing shall be at the expense of the Contractor.

D. Where the terms "inspector" and "Laboratory" are used, they mean and refer to an officially designated and accredited inspector of the testing laboratory or geotechnical service engaged by the Owner.

E. Testing, inspection, and certifications specified in other sections of these Specifications shall be paid by the Contractor, unless otherwise indicated, and shall be by agencies approved by the Architect.

F. Inspection by the laboratory shall not relieve the Contractor or Fabricator of his responsibility to furnish materials and workmanship in accordance with the Contract Documents.

G. This specification should be worked with Section 01205 – Project Testing for procedures. Required testing shall follow this specification.

1.2 QUALIFICATIONS

A. Testing agencies will meet the requirements of ASTM E 329, "Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction" and ASTM E 543, "Determining the Qualification of Nondestructive Testing Agencies".

B. Testing agencies shall be insured against errors and omissions by a professional liability insurance policy.
The inspection and testing services of the testing agency will be under the direction of a Registered Engineer licensed in the State of Texas, charged with engineering managerial responsibility, and having at least five years engineering experience in inspection and testing of construction materials.

Inspecting personnel monitoring concrete work will be ACI certified inspectors.

Primary inspectors performing structural steel inspection will be currently certified AWS Certified Welding Inspectors (CWI), in accordance with the provisions of AWS QCI, "Standard and Guide for Qualification and Certification of Welding Inspectors". The inspector may be supported by assistant inspectors who may perform specific inspection functions under the supervision of the inspector. Assistant inspectors will be currently certified AWS Certified Associate Welding Inspectors (CAWI). The work of assistant inspectors will be regularly monitored by the inspector, generally on a daily basis.

1.3 RESPONSIBILITIES OF CONTRACTOR

A. See respective technical sections for specific requirements.

B. Deliver to the Laboratory, without cost to the Owner, adequate quantities of representative samples of materials proposed for use, which are required to be tested.

C. Notify Laboratory and Architect sufficiently in advance of construction operations to allow laboratory to complete any required checks or tests and to assign personnel for field inspection and testing as specified.

D. Provide adequate facilities for safe storage and proper curing of concrete test samples on project site for the first 24 hours and also for subsequent field curing as required by ASTM Specifications C31.

E. Furnish such nominal labor equipment as is required to assist laboratory personnel in obtaining and handling samples at the site and in accessing work for inspection.

F. Furnish concrete mix designs, in accordance with ACI 301, Section 3.9, made by an independent testing laboratory or qualified concrete supplier. Where mix designs by an independent testing laboratory are required, the laboratory shall be selected and paid by the Contractor.

G. Obtain required inspections or approvals of the building official. All inspections requests and notifications required by the building code are the responsibility of the Contractor.

H. Provide current welder certifications for each welder to be employed.
I. Prequalification of all welding procedures to be used in executing the work.

1.4 AUTHORITY AND DUTIES OF LABORATORY PERSONNEL

A. A representative of the testing laboratory, who has reviewed and is familiar with the project and specification, will participate in all preconstruction conferences. He will coordinate material testing and inspection requirements with the Contractor and his subcontractors consistent with the planned construction schedule. The laboratory representative will attend, throughout the course of the project, such conferences as may be required or requested to address quality control issues.

B. Laboratory personnel will inspect and/or test materials, assemblies, specimens, and work performed, including design mixes, methods and techniques and report to the Architect the progress thereof.

C. If the material furnished and/or work performed fails to meet requirements of Contract Documents, laboratory inspector will promptly notify both the Contractor and the Architect of such failure.

D. Laboratory technicians do not act as foreman, or perform other duties for Contractor. Work will be checked as it progresses, but failure to detect any defective work or materials shall not, in any way, prevent later rejection when such defect is discovered.

E. The laboratory inspector is not authorized to revoke, alter, relax, enlarge, or release any requirement of the Contract Documents or to approve or accept any portion of the work, except where such approval is specifically called for in the Specifications.

F. Comply with all building code requirements for "Special Inspection" whether or not such inspections are specified herein.

1.5 SUBMITTAL

A. Submit copies of reports of each and every inspection and test as follows:

1. Owner – 1
2. Contractor – 2
3. Architect – 1
4. Engineer – 1

B. State in report all details of each inspection and test. Indicate compliance or noncompliance with requirements of the Contract Documents. Also, report should state any and all unsatisfactory conditions.
C. In addition to furnishing a written report, notify the Architect and the Contractor verbally of any uncorrected conditions or failures to comply with the requirements of the Contract Documents.

D. At completion of each trade or branch of work requiring inspecting and testing, submit a final certificate attesting to satisfactory completion of work and full compliance with requirements of Contract Documents.

E. Submit copies of test results, sealed by Registered Engineer, to municipal authorities having jurisdiction, as required.

1.6 REFERENCE STANDARDS

A. The latest adopted edition of all standards referenced in this Section shall apply, unless noted otherwise. In case of conflict between these Contract Documents and a referenced standard, the Contract Documents shall govern. In case of conflict between these Contract Documents and the Building Code, the more stringent shall govern.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.1 PIER DRILLING OPERATION

A. A representative of the testing firm will provide services herein specified.

B. Laboratory representative will make continuous inspections of drilled pier construction to check the following:

1. Verify soundness of bearing stratum and desired penetration.
2. Verify pier dimensions and reinforcing used.
3. Monitor condition of hole and removal of water and loose material from bottom.
4. Monitor placement of concrete and use of tremie or pumps.

C. Observe and Report on the Following:

1. Number and size of bars.
2. Bending and lengths of bars.
4. Clearance to forms including chair heights.
5. Clearance to sides and bottom of trench if soil-formed.
6. Clearance between bars or spacing.
7. Rust, form oil, and other contamination.
8. Grade of steel.
10. Excessive congestion of reinforcing steel.
11. Installation of anchor bolts and placement of concrete around such bolts.
12. Fabrication and installation of embedded metal assemblies, including visual inspection of all welds.
13. Visually inspect studs and deformed bar anchors on embedded assemblies for compliance with Contract Documents. Check number, spacing and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360° fillet has not been obtained for a particular stud or bar, such stud or bar shall be struck with a hammer and bent 15° off perpendicular and then bent back into position. Anchors failing this test shall be replaced.

D. Provide a qualified, experienced inspector to inspect reinforcing steel. Inspector will have a minimum of 3 years experience inspecting reinforcing steel in projects of similar size

3.2 CONCRETE INSPECTION AND TESTING

A. Receive and evaluate all proposed concrete mix designs submitted by Contractor. If mix designs comply with Drawings and Specifications, laboratory shall submit a letter to Architect certifying compliance. Mix designs not complying with Drawings and Specifications shall be returned by laboratory as unacceptable.

B. Secure composite samples of concrete at the jobsite in accordance with ASTM C 172.

C. Mold and cure 3 specimens from each sample in accordance with ASTM C 31. Supervise curing and protection provided (by others) for test specimens in field, and transportation from field to laboratory. Test cylinders shall be stored in the field 24 hours and then be carefully transported to laboratory and cured in accordance with ASTM C31.

D. Test specimens in accordance with ASTM C 39. 2 specimens shall be tested at 28 days for acceptance and it shall be tested at 7 days for information.

E. Make 1 strength test (2 cylinders) for each 100 cubic yards, or fraction thereof, of each mix design of concrete placed in any 1 day.

F. Make 1 slump test for each set of cylinders following procedural requirements of ASTM C 143 and C 172. Make additional slump tests whenever consistency of concrete appears to vary. Do not permit placement of concrete having a measured slump outside limits given on Drawings, except when approved by Architect. Slump tests corresponding to samples from which strength tests are made shall be reported with strength test results. Other slump tests need not be reported.

G. Determine total air content of air entrained normal-weight concrete sample for
each strength test in accordance with ASTM C231.

H. Determine air content and unit weight of lightweight concrete sample for each strength test in accordance with ASTM C 173 and C567.

I. Determine temperature of concrete sample for each strength test.

J. Testing laboratory shall monitor addition of water to concrete at jobsite and length of time concrete is allowed to remain in the truck before placement. Inspector shall compare mixture with criteria on approved mix design and report any significant deviation to Architect, Contractor and concrete supplier. Do not permit addition of water which will exceed maximum water/cement ratio for the mix as given on approved mix design.

K. Observe placing of all concrete, except non-structural slabs-on-grade and site work. Observe and report on placing method, consolidation, cold joints, length of drop, and displacement of reinforcement. Report deficiencies to Contractor immediately for corrective action. Inspections may be reduced to a periodic basis when all procedures have been deemed satisfactory by laboratory.

L. Testing laboratory shall certify each delivery ticket indicating class of concrete delivered (or poured), amount of water added and time at which cement and aggregate was dispensed into truck, and time at which concrete was discharged from truck.

M. Evaluation and Acceptance:

1. If measured slump, or air entrained concrete, falls outside specified limits a check test shall be made immediately on another portion of same sample. In the event of a second failure, concrete shall be considered to have failed to meet requirements of the specifications, and shall not be used in structure.

2. Strength level of concrete will be considered satisfactory if averages of all sets of 3 consecutive strength test results are equal to, or exceed, specified strength and no individual test result (average of 2 cylinders) is below specified strength by more than 500 psi.

3. Completed concrete work will be accepted when requirements of "Specifications for Structural Concrete for Buildings," ACI 301, Chapter 18, have been met.

N. Concrete Test Reports:

1. Reports shall be made and distributed immediately after respective test or inspections are made.

2. Where reports indicate deviations from Contract Documents, they shall also include a determination of probable cause of deviation and, where
applicable, a recommendation for corrective action.

3. Whenever testing laboratory recognizes a trend of decreasing quality in concrete due to changing seasons, conditions of curing, or other cause, this shall be brought to Architects attention, along with a recommendation for corrective action to be taken before materials fall below requirements of Specifications.

O. Comply with ACI 311, "Guide for Concrete Inspection" and "ACI Manual of Concrete Inspection" (SP-2).

P. Inspect application of curing compound and monitor all curing conditions to assure compliance with specification requirements. Report curing deficiencies to Contractor immediately and submit a written report to Architect.

3.3 TESTING NON-SHRINK GROUT

A. Make 1 strength test for every 10 base plates grouted and for every 10 bags of grout used in joints between members.

B. Each test shall consist of 4 cubes, 2 to be tested at 7 days and 2 at 28 days, made and tested in accordance with ASTM C 109, with exception that grout shall be restrained from expansion by a topplate.

3.4 MASONRY

A. Inspection:
   1. Provide a qualified inspector to inspect all structural masonry work on a periodic basis. Inspect the work in progress at least once for each 5,000 square feet of wall laid, but not less than once each day, to check compliance with the Contract Documents and applicable building code.
   2. Inspect the following:
      a. Preparation of masonry prisms for testing.
      b. Placement of reinforcing.
      c. Grout spaces (prior to grouting and prior to closing cleanouts, if any).
      d. Mortar mixing operations.
      e. Bedding of mortar for each type of unit and placing on units.
      f. Grouting operations.
      g. Condition of unit; before laying for excessive absorption.
   3. Provide a report of each inspection.

B. Field Compressive Test for Mortar:
   1. Secure composite samples of mortar at the jobsite in accordance with ASTM C 780.
   2. Mold and cure three cube specimens in accordance with ASTM C 109 and ASTM C 780. Supervise the curing protection provided (by others) for test specimens in the field and the transportation from the field to the laboratory.
The test cylinders shall be stored in the field 24 hours and then be carefully transported to the laboratory and cured in accordance with ASTM C 31.

3. Test specimens in accordance with ASTM C 39. Two specimens shall be tested at 28 days for acceptance and one specimen shall be tested at seven days for information.

4. Make one strength test (three cubes) for each 5,000 square feet of wall area.

C. Field Compressive Tests for Grout:

1. Secure composite samples of grout at the jobsite in accordance with ASTM C 172.

2. Mold and cure three, 3" X 6" cylindrical specimens form each sample in accordance with ASTM C 31. Supervise the curing protection provided (by others) for test specimens in the field and the transportation from the field to the laboratory and cured in accordance with ASTM C 31.

3. Test specimens in accordance with ASTM C 39. Two specimens shall be tested at 28 days for acceptance and one specimen shall be tested at seven days for information.

4. Make on strength test (three cylinders) for each 10 cubic yards of grout poured but not less than one strength test for each 5,000 square feet of wall area, as requested by Architect.

D. Prism Test:

1. Test prisms in advance of operations using materials under same conditions, and with same bonding arrangement, as for structure. Observe and inspect actual construction of prisms. Moisture content of unit at time of laying, consistency of mortar and width and thickness of mortar joints shall be same as used in the structure.

2. Cure and test prisms in accordance with applicable provisions of ASTM E 447. Test five specimens of each type of masonry unit before delivering material to jobsite and submit results for approval. During construction, test three specimens of each type of masonry unit for each 5,000 square feet of wall placed.

3. The standard age of test specimens is 28 days, but seven day tests may be used, provided relation between seven day and 28 day strengths is established by test for materials used.

4. Build prisms of hollow masonry units the same width as unit by 16" long in plan and 16" high. Using specified masonry units apply mortar to only the face shells. Do not fill hollow core with grout. Compute value of ultimate net compressive strength, by dividing ultimate load by net face shell area of masonry units (length X twice face shell thickness).
5. Build brick prisms one brick width and length in plan and five bricks high, using full bed joints as specified. Compute ultimate compressive strength by dividing ultimate load by gross area of masonry units.

6. Build prisms on job using same materials and methods as for wall construction. Store prisms in a place where they will be undisturbed for two days and have approximately same curing conditions as wall construction. After two days, transport to laboratory in a manner which will not disturb mortar bond and then cure and test as set forth under ASTM E 447.

7. When the average strength of a set of prisms falls below the specified compressive strength (fm), the masonry corresponding to the test shall be deemed unacceptable. In such case, notify the Architect and Contractor immediately.

E. Absorption Tests:

1. Perform a field test of water absorption on three representative clay units, at least once for each 5,000 square feet of wall, before laying.

2. The field test shall consist of drawing a one inch diameter circle with a wax pencil (the diameter of a quarter). Place 20 drops of water from a medicine dropper in rapid succession within the circle. If all of the water is absorbed into the brick in less than 90 seconds, the units are too dry and should be pre-wet.

3.5 STRUCTURAL STEEL

A. Inspect structural steel during fabrication and during and after erection for conformance with Contract Documents and shop drawings. Review and report on fabricator’s quality control procedures and capabilities.

B. Shop Inspection:

1. Periodic inspection of fabrication process, including welding, to monitor effectiveness of quality control program. Inspection of shop welding to be "verification inspection," in accordance with AWS D1.1, Chapter 6.

2. Ultrasonic testing of all full penetration welds

3. Examination of installation of shop welded shear studs.

C. Field Inspection:

1. Proper erection of all pieces.

2. Proper installation of all bolts, including checking of calibration of impact
wrenches used with high-strength bolts.
3. Plumbness of structure and proper bracing.
4. Proper painting and galvanizing.
5. Initial inspection of welding process and periodically thereafter as necessary.
6. Visual examination of all completed welds.
7. Ultrasonic testing of all penetration field welds.
8. Installation of field welded shear studs.
9. Inspect all shop fabricated members, upon arrival at jobsite, for member straightness and alignment and for defects incurred during transit and handling.

D. Qualifications of Welders: Fabricator and erector shall provide testing laboratory with names of welders to be employed on work, along with certification that each welder has passed qualification tests within the last year, using procedures covered in American Welding Society "Structural Welding Code-Steel," D1.1, latest edition. Verify all welder qualifications.

E. Inspection of Field Welding Shall Include the Following:

1. Visually inspect fillet welds for size, soundness, and proper return around ends. Check for seams, Colds, and delamination.
2. Ultrasonically test all penetration welds in accordance with ASTM E 164.
3. Inspect surfaces to be welded. Surface preparations, fit-up and cleanliness of surface shall be noted. Electrodes shall be checked for size, type and condition.
4. Welding inspector shall be present during alignment and fit-up of members being welded, and shall check for correct surface preparation of root openings, sound weld metal, and paper penetration in root pass. Where weld has not penetrated completely, inspector shall order joint to be chipped down to sound metal, or gouged out, and re-welded. Root passes shall be thoroughly inspected for cracks. All cracks shall be gouged out and re-welded to 2" beyond each end of crack.
5. Inspector shall check that all welds have been marked with welder's symbol and shall mark welds requiring repairs and shall make a re-inspection. Inspector shall maintain a written record of all welds. Work completed and inspected shall receive an identification mark by the inspector. Unacceptable material and work shall be identified by work "reject" or "repair" marked directly on material.
6. Testing agency shall advise Owner and Architect of any shop and/or field conditions, which in his opinion, may require further tests and examination by means other than specified. Such further tests and examinations shall be
performed as authorized by Owner and Architect.

7. Owner reserves the right to use ultrasonic or radiographic inspection to verify adequacy of all welds. Testing procedures and acceptance criteria shall be as specified in AWS 1.1.

F. Inspection of bolted construction shall be in accordance with AISC Specifications for structural steel buildings and as follows:

1. All bolts shall be visually inspected to ensure plies have been brought into snug contact.

2. High strength bolting shall be inspected in accordance with Section 9 of "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

3. For all high strength bolts, unless specifically noted on Drawings, are to require only "snug-tight" installation. Inspector shall observe required jobsite testing and calibration, and shall confirm procedure to be used does provide required tension. He then shall monitor the work to assure tested procedures are routinely followed.

3.6 EXPANSION BOLT INSTALLATION

A. Inspect drilling of each hole and installation of each expansion bolt for compliance with Contract Documents and shop drawings.

B. Verify installation torque for each expansion bolt for compliance with manufacturer's installation instructions.

3.7 METAL DECK

A. Field inspection shall consist of the following:

1. Check types, gauges and finishes for conformance with contract documents and shop drawings.

2. Examination for paper erection of all metal deck, fastenings, reinforcing of holes, deck reinforcing, miscellaneous deck supports, hanger tabs, shear studs, deck closures, painting or other coating.

3. Certification of welders.

4. Field welded shear studs used to fasten metal floor decking to supporting steel shall be inspected and tested as described in the paragraph addressing structural steel.
PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

A. No separate measurement or payment will be made for the items in this specification. All costs associated with this work will be considered incidental to the total contract bid amount.

END OF SECTION 01450
SECTION 01452
INSPECTION SERVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Inspection services and references.

1.2 INSPECTION

A. METRO will appoint an Engineer to represent the METRO and perform inspections, tests, and other services specified in individual Specification sections.

B. METRO may also appoint, employ, and pay an independent firm to provide additional inspection or construction management services as indicated in Section 01450 - Testing Laboratory Services.

C. The independent firm will submit reports to Engineer, indicating observations and results of tests and indicating compliance or noncompliance with Contract requirements.

D. Contractor shall assist and cooperate with the Engineer; furnish samples of materials, design mix, equipment, tools, and storage.

E. Contractor shall notify the Engineer 24 hours prior to expected time for operations requiring services.

F. Contractor shall sign and acknowledge reports for Engineer.

PART 2 - MEASUREMENT AND PAYMENT

No separate measurement or payment will be made for the items in this specification. All costs associated with this work will be considered incidental to the total contract bid amount.

END OF SECTION 01452
SECTION 01505
MOBILIZATION

PART 1    GENERAL

1.1 DESCRIPTION

A. This Section specifies the mobilization of the construction facilities and equipment at the Work Site; the requirements for materials and supplies necessary for the prosecution of the work, but not to be incorporated in the Work; the construction of temporary buildings and facilities; the requirements for personnel and facilities for work preparatory to commencing the Work; and demobilization. Mobilization also includes the following:

1. Providing construction fences and gates or repairing any existing fencing used for construction site security.

2. Providing a field office for the exclusive use of METRO if called for and as specified in Section 01504 – Temporary Facilities and Controls of these Specifications.

PART 2    PRODUCTS

2.1 FACILITIES AND EQUIPMENT

A. Construction facilities and equipment shall be of the capacity, type, quality and function suitable for, and provided in the quantity necessary for, timely prosecution of the Work.

PART 3    EXECUTION

3.1 GENERAL

A. The location of construction facilities and equipment shall be subject to approval by the Engineer prior to commencing operations.

B. The construction facilities, including equipment and personnel, shall not only have sufficient excess capacity to permit the work to progress and to be completed within the time stipulated in the Contract, but shall also have sufficient excess capacity for emergencies and overloading.

C. METRO shall have the right to inspect, and will reject, construction facilities and equipment which are unsafe, improper, or inadequate. Rejected construction facilities and equipment shall be brought to acceptable condition, or shall be
removed from the work site and replaced with acceptable items. Neither increase in Contract time nor cost will be allowed for delays occasioned by such rejection.

3.2 DEMOBILIZATION

A. Upon completion of the work, the Contractor shall remove construction facilities, equipment, materials, supplies, temporary buildings and other items necessary for mobilization and the area restored to acceptable conditions as directed.

PART 4 MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. MOBILIZATION of the construction facilities and equipment shall be measured per lump sum, in place at the work site.

B. PERMITS AND FEES will not be separately measured for payment, but shall be included in the measurement for each item requiring permitting.

4.2 PAYMENT

A. The basis for payment shall be the lump sum, fixed price for "Mobilization" as it appears on the bid form, which shall be full compensation for furnishing all labor and materials necessary for timely preparation and prosecution of the work, including demobilization. Contractor shall receive partial payments for staged mobilization.

1. The Contractor shall receive 25% of lump sum payment when the contractor mobilizes on the work site.

2. The Contractor shall receive 50% of lump sum payment upon receipt and approval by METRO of the following items, as applicable:

   a. Safety Program;
   b. Contractor’s Quality Control Plan;
   c. Initial Construction Photographs;
   d. Preliminary Construction Schedule and Billing Forecast;
   e. Construction Schedule;
   f. Submittal Schedule.

3. The Contractor shall receive 25% of the lump sum payment when demobilization including all required submittals is complete.

END OF SECTION 01505
SECTION 01541

MAINTENANCE AND PROTECTION OF UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for providing protection, support, removal of existing supports, and maintenance of existing utilities within, adjacent to, or affected by the Work under this Contract.

1.2 QUALITY ASSURANCE

A. Reference Standards Applicable to this Section

1. ANSI: American National Standards Institute
   a. A 10: Safety Requirements Series.

2. AWWA: American Water Works Association
   a. Standards and Manuals.

3. City of Houston

4. NECA: National Electrical Contractors Association

B. Work Standards

Utilities shown on the Contract Drawings and encountered in the limits of the Work area shall remain in service and be maintained in-place and protected in their locations, unless otherwise specified or indicated. Methods of temporary support and protection of various facilities, if shown on the Contract Drawings, are suggestions only, and the requirements specified herein shall apply. Such suggestions shall not be construed as dictating the Contractor's methods, means, techniques, sequences, and procedures.

C. Locating Utilities

Within the limits of and adjacent to the Work, there are known to exist public and private utilities, storm and sanitary sewers, underground and aerial power lines, telephone lines, telecom and communication lines, gas and water service lines, street lighting, traffic signalization, and petroleum product lines.

1. The Contract Drawings indicate known existing utilities, and proposed utilities by others, in their approximate locations from information shown on record drawings, furnished by others as of the date of the contract drawings.

2. METRO does not warrant the accuracy of these locations, nor that all existing utilities within the limits of the Work have been shown on the Drawings.

3. Before commencing the Work, coordinate with utility owners to determine actual location of existing and proposed utilities. Location of utilities, as indicated, shall not relieve the Contractor of his contractual obligations of contacting utility owners. Municipally owned utility lines such as water, sanitary sewer, storm sewer, and traffic signalization may not be located by their owners and in such case determine the location of each affected line, structure, or apparatus. Coordinate all Work affecting the utilities with appropriate utility owners and the Engineer.

4. Before commencing the Work, contact the owner and verify by field investigation the locations of all utility facilities within and adjacent to the construction limits that may be affected by Work operations. Conflicts which result due to failure to locate, existing utilities which are shown on the Construction Drawings or which the Contractor has been given notice or has knowledge of, shall be the sole responsibility of the Contractor. The cost of remedial work, removal of portions of the work or extensive design changes occasioned by the failure of the Contractor to verify the location of existing utilities as described above, shall be borne by the Contractor.
5. If a utility line, structure, or apparatus which was not located and was not shown on the plans is encountered, notify the Engineer and determine ownership of that utility. If ownership cannot be determined through reasonable inquiry to utility owners, the utility line, structure, or apparatus shall be treated as an active utility. As appropriate, either provide support of the utility across or adjacent to the excavation as required to proceed with the work or make a more in-depth investigation of the utility line, structure, or apparatus if the location impacts the work and proceed as directed by the Engineer.

D. Notices

1. Provide written notice to all public and private utility owners at least 14 days prior to scheduled commencement of work.

2. Notify the Utility Coordinating Committee’s (UCC) one-call center at (713) 223-4567, and other necessary one-call centers at least 48 hours before commencing excavation. Weekends and holidays shall not be included in the 48 hour notice period. Locate requests to one-call centers shall be made only for work that is scheduled to be performed within the next ten working days and shall not exceed a fourteen calendar day period.

3. The notification to the one-call center shall not relieve the Contractor of his responsibility to notify all public and private utilities, municipalities and agencies having jurisdiction.

4. Maintain a log of all locate requests at all times and it shall be made available to the Engineer upon request. The log shall contain an accurate description of the instructions to the municipalities, utility companies, the name of the one-call center, date of the contact, the notification number provided by the one-call center if applicable.

5. If a locate request is not fulfilled by a member of the appropriate one-call center, contact the one-call notification center and request a status on the "locate" requested for the non-responsive utility company and notify Engineer. If during the status investigation the utility has indicated either they have no facilities in the vicinity of the work and the contract documents depict a utility line, structure, or apparatus or that they did not respond, the appropriate one-call center will re-notify the utility that a "locate" is required. If a "locate" of the utility line, structure or apparatus is still not made and the plans indicates a utility line, structure, or apparatus exists in the vicinity of the excavation, contact the appropriate one-call center for a direct contact with the non-responsive utility company. The utility company contact provided by the one-call center shall be used only for the specific non-response for that locate request. All subsequent utility locate requests shall be in accordance with the provisions of these contract documents.
6. Notify in writing all utility owners not belonging to a one-call center at least 72 hours in advance of his intent to excavate any segment of the Site, so each utility owner may mark utility locations to ensure safety of utilities as required by law. Weekends and holidays shall not be included in the 72 hour notice period.

7. Notify the Engineer immediately and notify in writing within 24 hours the affected utility owners and METRO of damage to or loss of any utility. Repairs will be made by the utility owner, or by Contractor when directed by the Utility owner, at the Contractor's expense, for damage or loss caused by the Contractor's or his subcontractor's operations.

8. The City of Houston, other cities in the area, municipal utility districts, water control and improvement districts, and Harris County are not members of a one-call system. Determine the exact location of these utilities prior to excavating. The Engineer will supply the name, address and phone number of each municipal utility owner representative.

1.3 OTHER CONTRACTS

A. Contracts may be let for utility relocation. The Contractor shall be cognizant of these relocations, and protect and support in-place as necessary the relocated utilities. When an underground facility, according to the plans, will be excavated beneath, or the soil support undermined, develop and submit to the utility owner for approval, a design of the proposed support system. Support system designs shall be submitted to the utility owner a minimum of 14 calendar days prior to the proposed excavation around the utility line, structure, or apparatus. Supports and protection shall be removed when no longer needed by the Contractor or utility owner, and as directed by the Engineer.

1.4 SAFETY


1.5 REARRANGEMENT OF UTILITIES

A. Rearrangement of existing utility will be performed by their owners, or others as deemed appropriate by utility owners, in close coordination with the Work of this Contract. For rearrangement of utilities by owners, give the owners advance written notice of the Work schedule. Written notice to utility owners shall be at least 14 working days prior to the Contractor's scheduled commencement of Work. However, rearrangements by owners may or may not be started or completed at the end of the minimum notice period. The Engineer may direct the Contractor to schedule and participate in meetings with utility owners as deemed necessary by the Engineer to coordinate both Contractor's and utility owner's work schedules.
B. Where utilities or their appurtenances conflict with permanent construction, work involved in permanently relocating or otherwise altering such utilities and their appurtenances will be done by utility owners or others.

C. If the Contractor wishes to have any utilities temporarily or permanently relocated, braced, or otherwise supported for his own convenience, he shall make necessary arrangements with utility owners and compensate them at his own expense for the cost of such work as mutually agreed upon. Compensation shall be by certified check in advance of the contemplated work.

D. In accordance with OSHA Section 1926.651 General Requirements, utilities exposed in the excavation shall be protected, supported or removed as necessary to safeguard employees.

1.6 COOPERATION AND ACCESS

A. Provide access to utility owners, and others as designated, to the Work Site at all times to relocate, service, and inspect their facilities. Cooperate with utility owners and others in facilitating such work so as not to delay the Work of this Contract.

1.7 CONTINUITY OF SERVICE

A. Ensure continuity of utility service and maintain, in a safe and satisfactory operating condition, all overhead, surface, and subsurface utilities. This Article shall apply equally to utilities owned or operated by METRO, public utilities, and private owners.

B. Existing service connections to buildings are not necessarily shown on the Drawings, but protect, support, and maintain such connections to ensure continuous service.

1.8 PRESERVATION OR ABANDONMENT OF PROPERTY

A. Rearranged facilities and existing utilities not indicated as abandoned or to be abandoned shall be protected. When a utility has been placed in-service, the utility owner will verify that those facilities to be abandoned are out-of-service before the Contractor starts work in that area. Abandoned utilities shall be verified by the utility owner and Contractor before removal of the utility. Verification shall be confirmed in writing by the Contractor to both the utility owner and the Engineer.

1.9 SUBMITTALS

A. In accordance with Section 01340 - Shop Drawings, Product Data, Samples, and Record Documents of these Specifications, prepare and submit Shop Drawings to the Engineer and utility owners for review and approval of all utilities which conflict with construction of the Work.
B. Work Plan

Shop Drawings shall identify the plan and schedule for performing the Work. The plan for performing the Work shall include, but not necessarily be limited to, the horizontal and vertical locations of existing and rearranged utility services, conflicts which such utilities and facilities present to the Work, details of proposed temporary support and protection systems for facilities designated on the Contract Drawings, or where required to be protected and supported, and how the Contractor proposes to proceed with the Work. Work shall not be started until the Engineer and the utility owner have approved the plan in writing. Approval shall not relieve the Contractor of his obligation to comply with the Contract Documents.

C. Notices

Submit to the Engineer a copy of all notices and correspondence with utility companies and public agencies including locate requests.

PART 2 - PRODUCTS

2.1 GENERAL

A. Unless otherwise specified or indicated, all materials for Work hereunder shall conform to the requirements of the respective Sections of these Specifications for each system to which such materials pertain.

B. Existing manhole frames and covers, grates, valve boxes, indicator posts, curb cocks, meter boxes, and similar items shall be adjusted, supported in place, replaced in kind, or repaired to governing standards for which such materials pertain.

C. Existing utility poles indicated on the drawings may or may not be relocated by their owners. Unless indicated otherwise on the drawings, assume utility poles are to remain in place.

PART 3 - EXECUTION

3.1 INSPECTION

A. Locate and identify subsurface existing structures indicated to remain before beginning the Work in the vicinity of such structures. Work shall be performed so as not to damage existing subsurface structures.

3.2 EXCAVATION, BACKFILLING, AND COMPACTION

A. All excavation shall be in accordance with Section 02315 – Roadway Excavation, of these Specifications.
B. Perform backfilling and compaction as specified in Section 02200 - Earthwork of these Specifications.

3.3 REMOVAL AND REPLACEMENT OF PAVEMENTS, SIDEWALKS, CURBS, AND GUTTERS

A. Remove and replace pavements, sidewalks, curbs and gutters as required to perform excavation work. Each utility owner will perform removal and restoration work as required for their appropriate portion of the Work, unless otherwise indicated or directed by the Engineer.

3.4 UNSAFE AND UNSUITABLE FACILITIES

A. If condition or location of a facility is unsafe or unsuitable for maintenance and support, and if an unsafe or unsuitable condition is a result of work performed by utility owners, the Contractor shall immediately notify the Engineer and the utility owner, with written follow-up within 24 hours, of the conditions requiring remedial action. Do not proceed further without written direction from the Engineer.

3.5 SANITARY, STORM AND COMBINED SEWERS

A. Maintain active sewers, house connections and laterals in operating condition and a closed system at all times. Adequate precautions and safety measures shall be taken to avoid flooding of the job during storms and to avert dangers from sudden increases in flows, for any reason, that might clog, damage, or interfere with normal operations. Discharge of storm water and construction-generated sediment into the sanitary and combined sewer systems, and flow of waste water contaminants across surfaces of streets, property, into open excavations or other natural or man-made systems shall not be permitted. Work hereunder shall be coordinated with that of Section 01560 - Environmental Impact Controls of these Specifications.

B. Temporary sewer facilities and supports of design and capacity necessitated by construction shall be provided where indicated or required. Plan and design temporary sewer facilities and supports and construct same in accordance with approved Shop Drawings. Furnish, install, maintain and ultimately remove temporary sewer facilities and supports. Furnish and install new sewer facilities at proper line and grade, as indicated or required.

C. Maintain minimum requirements for backfilling and compacting exposed existing sewer facilities and for new installations in accordance with City of Houston Standard Specifications listed in Section 1.02-A-3, above.

3.6 WATER MAINS

A. Maintain continuity of all existing water mains, and shall provide for temporary support and protection of these facilities at the Site.
B. Details for supporting water mains during construction shall be submitted in writing a minimum of 14 calendar days prior to excavation for review and approval by the City of Houston Water Department.

C. Perform work in connection with relocation, removal, replacement, and construction of new, permanent and temporary water mains and service connections as indicated. Where water mains are to be abandoned or taken out of service, City of Houston Water Department will disconnect lines and services and cap water mains prior to any removal work except as indicated or provided for in the contract documents. City of Houston Water Department will supervise removal of temporary supports from its lines, and placement and compaction of backfill around and over its waterlines.

D. Water line owner will disinfect the water main and perform one bacteriological test on Contractor-installed mains. Retests will be done at the Contractor's expense and with no increase in Contract time.

E. Conformance to the Specifications of the City of Houston Water Department, as listed in Section 1.02-A-3 above and applicable AWWA Standards and Manuals shall be required.

F. Perform hydrostatic or pressure tests.

3.7 ELECTRICAL DISTRIBUTION AND SERVICE

A. Maintain continuity of existing electrical facilities and provide protection of CenterPoint Electric facilities on the Site.

B. When excavating within five feet (5-feet) and beneath a depth of three feet (3-feet) below existing grade of a utility pole or anchor to which CenterPoint Electric facilities are attached, CenterPoint Electric or its contractor will secure or otherwise brace these poles and anchors prior to excavation. The cost of Houston Lighting and Power's work shall be included in the contract bid price and no additional compensation will be made.

C. CenterPoint Electric will perform all work in connection with relocation, removal, replacement, and construction of new permanent building service connections, duct banks, and manhole adjustments, at no cost to the Contractor, unless otherwise indicated. Where electric lines are to be abandoned or taken out of service, CenterPoint Electric will disconnect lines and services prior to any removal work by the Contractor. CenterPoint Electric will oversee removal of temporary supports from its underground facilities, and also oversee placement and compaction of backfill around and over its underground facilities.

D. Details for electrical ducts and manholes to be supported in-place during construction shall be submitted in writing a minimum of 14 calendar days prior to
excavation for review and approval by CenterPointElectric.

3.8 GAS MAINS AND SERVICES AND PETROLEUM PRODUCT LINES

A. Maintain continuity of existing gas facilities and protection of CenterPoint Energy facilities during construction operations.

B. CenterPoint Energy or its designated contractor, will perform all work in connection with relocation, removal, replacement, support, and construction of permanent and temporary gas mains and service connections identified in the Contract. Where gas mains are to be taken out of service or abandoned, CenterPoint Energy will disconnect mains and services and cap mains to remain, prior to any removal work by the Contractor. CenterPoint Energy will oversee removal of temporary supports from its line, and placement and compaction of backfill around and over gas mains.

C. CenterPoint Energy will provide details for supporting in-place, its gas facilities during construction. A minimum of 14 calendar days prior to excavation submit in writing to CenterPoint Energy details for any alternative system for supporting in-place, the CenterPoint Energy gas facilities during construction. CenterPoint Energy is under no obligation to approve the Contractor's proposed system for supporting in-place, the CenterPoint Energy gas facilities.

D. Articles 3.08 A thru C hereinabove shall apply as appropriate to petroleum product or other natural gas facilities, with the owners thereof substituted in lieu of CenterPoint Energy.

3.9 TELECOM FACILITIES

A. Maintain continuity of existing telephone facilities and temporary support and protection of these facilities on the Site.

B. AT&T Texas, or its designated contractor, will perform all work in connection with relocation, removal, and replacement of telephone service identified in the Contract. Where telephone lines are to be abandoned or taken out of service, AT&T Texas, or its designated contractor, will disconnect lines and services prior to any removal work by the Contractor. AT&T Texas will supervise removal of temporary supports from its lines, and also supervise placement and compaction of backfill around and over its underground facilities.

C. Details for telephone ducts and manholes to be supported in-place during construction shall be submitted by the contractor in writing a minimum of 14 calendar days prior to excavation for review and approval by AT&T Texas.

D. Provide support and otherwise brace utility poles and anchors on which there are no CenterPoint Electric facilities as required. Maintain the facility in a safe condition. Prevent any movement of utility poles and anchors during or as a result
of the excavation.

3.10 TRAFFIC SIGNALS

A. Maintain continuity of existing and rearranged facilities, and temporary support and protection of these facilities on the Site as directed by the City of Houston and the engineer.

3.11 STREET LIGHTS

A. Maintain existing intensity and adequacy of illumination along all pedestrian walkways, grade separations, and streets where existing lighting has been removed or disconnected for construction, as directed by CenterPoint Electric and the Engineer.

3.12 OTHER FACILITIES

A. Maintain continuity of any and all facilities, adequate temporary support and protection of these utilities at the Site as directed by the Engineer.

PART 4 - MEASUREMENT AND PAYMENT

3.1 GENERAL

A. All costs associated with this work will be considered incidental to the total contract bid amount.

END OF SECTION 01541
SECTION 01554

TRAFFIC CONTROL AND STREET SIGNS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Materials, hardware and installation of Traffic Signs.

1.2 SUBMITTALS

A. Contractor shall submit a list of intended suppliers and products to be used for all signs, posts, and associated hardware. METRO reserves the right to request actual product samples prior to approval.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The following ASTM Standards and documents, of the issue in effect on the date of Invitation for Bid, form a part of this specification to the extent herein.

1. ASTM B 209 Specification for Aluminum and Aluminum Alloy Sheet and Plate

2. ASTM D 523 Standard Method for Test for Specular Gloss

3. ASTM D 4956 Standard Specification for Retroreflective Sheeting for Traffic Control

4. ASTM E 284 Standard Definition of Terms Relating to Appearance of Materials

5. ASTM E 308 Computing the Colors of Objects by Using the CIE System

6. ASTM E 810 Standard Test Method for Coefficient of Retroreflection of Retroreflective Sheeting

7. ASTM E 1164 Standard Practice for Obtaining Spectrophotometric Data for Object-Color Evaluation

B. Substrate (Sign Blanks). This shall be aluminum alloy 5052-H38 and otherwise in conformance with ASTM B-209 and have gold chromate finish. The size, shape and thickness of the sign blanks are as indicated on the standard detail sheet in
the plans or as specified by the Engineer.

1. **Metal working.** The aluminum shall be free of burrs and pits on both sides, including edges and holes, and shall be made ready for applications of the sheeting.

2. **Surface Preparation.** The aluminum shall be thoroughly cleaned and degreased with solvent and alkaline emulsions cleaner by immersion, spray, or vapor degreasing and dried prior to application of the gold chromate sheeting coat. The aluminum shall be new and corrosion-free with holes drilled or punched, corners rounded to the radii shown in the standard detail sheet, and all edges smoothed prior to application of sheeting. The heavy or medium chromate coating shall conform in color and corrosion resistance to that imparted by the Alodine 1200F treatment.

3. **Size.** The dimensions of substrate applications for regulatory, warning, and guide signs shall be as specified by the Engineer and as shown on the plans.

C. Sign Face (Background, Legends, Symbols, and Colors). These shall be in accordance with the Standard Highway Sign Designs (SHSD) for Texas and with the Texas Manual of Uniform Traffic Control Devices (TMUTCD).

1. The sign face, made of electronic film and retro-reflective sheeting shall comply with the appearance, specification, and good workmanship designated by the using agency for sign faces constructed of screen processed retro-reflective sheeting of the same type.

2. All sign blanks shall be covered with appropriate retro-reflective sheeting.
   a. All ground mounted stop signs, warning signs, and other regulatory signs, shall use at a minimum High Intensity Prismatic Reflective Sheet.
   b. All overhead signs shall use Diamond Grade Reflective Sheet.
   c. All other signs shall use Super Engineer Grade Sheet.

3. **Application Methods.** The method of application of sheeting, letters, numbers, and symbols shall be precisely as prescribed in writing by the manufacturer.
   a. Legend Spacing and Layout. Spacing and layout for all traffic control signs shall conform to the SHSD.
   b. Tolerance for Horizontal Alignment. Letters, numerals, and symbols shall be horizontally aligned to a tolerance of 1/16 inch.
c. Tolerance for Vertical Alignment. Letters, numerals, and symbols shall be vertically aligned to a tolerance of 1/16 on each letter in each line.

D. Sign Posts. Steel post shall conform to the standard specification for hot rolled carbon sheet steel, structural quality, ASTM designation A570, Grade 50. Average minimum yield strength after cold forming is 60,000 psi. The cross section of the post shall be square tube formed steel, carefully rolled to size and shall be welded directly in the corner by high frequency resistance welding or equivalent process and externally scarified to agree with corner radii. Sign posts shall be hot dipped galvanized conforming to ASTM A653, G90.

1. Installation. The square end of the post shall not be modified or pointed.

   a. Flange. When sign post installation is required over building basements, bridges and cavities, a galvanized cast iron pipe flange shall be used. The base shall be 8 inches in diameter with six 5/16 inch holes drilled equidistant around the circumference, ¾ inch from the outer edge. The neck of the flange shall be 3 inches in diameter, drilled and threaded to receive a 2 inch diameter galvanized post.

   b. Hardware. All ground mounted signs shall be attached to posts using 5/16” nut and bolt assembly, the bolt being 2 ½” in length. Stainless steel banding material, brackets and clips will be used for signs installed on light standards or mast arms.

   c. Construction. Anchors shall be anchored in a minimum of one cubic foot of class “C” concrete, 28 inches deep, with a 6 inch long, ¾ inch diameter pin inserted through the pre-drilled hole 3 inches from the bottom of the pole. Where the pole installation requires surface mounting, an 8 inch flange with a 2 inch threaded collar shall be used. The pole shall be galvanized, two inches in diameter and threaded to fit the flange. Sign placement and orientation shall be as specified in the construction plans.

E. Each finished sign shall have the following sticker affixed to the back in a location where it will be visible when the sign is installed.
The sticker shall be Zebra Technologies Z-Ultimate 3000 White or approved equal. Finished product shall be weather and fade resistant for the expected life of the sign.

F. Warranty. The Contractor shall warrant the materials and workmanship of each sign in accordance with the maximum limits of material warranties extended by manufacturers of raw materials, subject to the conditions they specify. The retro-reflective sheeting will be considered unsatisfactory if it has deteriorated due to natural causes to the extent that: (1) the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions; or (2) the coefficient of retro-reflection is less than the minimum specified for that sheeting. When sign failure occurs prior to the minimum years indicated and an inspection demonstrates that the failure is caused by materials warranted to contractor to endure at least that long, the sign will be replaced or repaired free of materials charges. When failure occurs and inspection demonstrates that such failure is due to poor workmanship, the sign will be replaced or repaired at Contractor's expense, including shipping charges.

PART 3 - EXECUTION

3.1 EQUIPMENT

A. The contractor shall provide machinery, tools, and equipment necessary for proper execution of the work.

3.2 CONSTRUCTION

A. Construction shall be high quality with no visible defects in the finished product. Fabrication shall be in accordance with these specifications. Street name signs shall always be supplied and installed at each project intersection whether signs
previously existed at the location or not.

B. The removal of existing signs shall be coordinated with the Traffic Operations Section of the Public Works Department (713-803-3054) and arrangements made for a convenient time to deliver City signs and poles. All salvaged traffic signs shall be delivered to the Traffic Operations Center located at 2200 Patterson Street. All deliveries to the Traffic Operations Center requires a minimum notice of two (2) working days prior to returning or delivering any sign and/or sign related material.

3.3 RESPONSIBILITIES

A. The contractor is responsible for providing and supplying aluminum traffic signs covered with retro-reflective sheeting, applying standard legends (or special legends if shown in the plans) to the covered sign blanks, galvanized steel sign poles, pole anchors, all hardware for installing the signs and poles, and for installing traffic signs, poles and anchors as shown in the plans or call for in the contract documents, complete and ready for field installations.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. SMALL TRAFFIC SIGNS shall be measured per Each at the location indicated on the drawings and the measurement shall include all equipment, labor and materials required to provide a complete and serviceable installation.

4.2 PAYMENT

A. The work performed and the materials furnished as prescribed by this item and measured as provided under “MEASUREMENT” shall be paid for at the contract unit price bid for each item as presented in the bid form for “Pavement Markings and Signage” or “Extra Work Items”. The unit price bid for each item shall be full compensation for furnishing and placing all materials, and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work in accordance with the drawings and specifications.

END OF SECTION 01554
SECTION 01555
TRAFFIC CONTROL AND REGULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements for signs, signals, control devices, traffic barriers, flares, lights and traffic signals; construction parking control, designated haul routes, and bridging of trenches and excavations.

B. Qualifications and requirements for use of flagmen.

1.2 REFERENCES

A. Texas Manual on Uniform Traffic Control Devices (TMUTCD)

B. Article 4413 (29bb), commonly referred to as Private Investigators and Private Security Agencies Act, and Article 2.12, Texas Code of Criminal Procedure.

C. Code of Ordinances, City of Houston, Texas.

   1. Chapter 10 Buildings And Neighborhood Protection, Article X Cleanup After Demolition Or Removal Of Structures

   2. Chapter 40 Streets and Sidewalks, Article XVII Pedestrian Way Impairments

1.3 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Traffic control plan:

   1. If using traffic control plan contained in the Contract without modification, submit a letter confirming use of the plan.

   2. If using a different traffic control plan, submit the plan for approval. The plan must conform to TMUTCD requirements and be sealed by a Registered Texas Professional Engineer.

C. Submit copies of approved lane closure permits issued by City Traffic Engineering Branch.
D. Submit Schedules of Values for traffic control plan and flagmen within 30 days following Notice to Proceed.

E. Submit records verifying qualifications of Uniformed Peace Officers and Certified Flagmen proposed for use on the Work.

F. When working in the central business district, submit copies of approved Pedestrian Way permits issued by the City’s Traffic Engineering Branch.

1.4 FLAGMEN

A. Use Uniformed Peace Officers and Certified Flagmen to control movement of vehicular and pedestrian traffic when construction operations encroach on public traffic lanes. Unless otherwise approved by Project Manager, use Uniformed Peace Officer for work along major thoroughfares, schools, churches, hospitals and Work at signalized intersections.

B. Certified Flagman: Individual who receives compensation as a flagman and meets the following qualifications:

1. Formally trained and certified in traffic control procedures by the City’s E. B. Cape Center.

2. Speaks English. Ability to speak Spanish is desirable but not required.

3. Paid for flagman duty at an hourly rate not less than the wage rate set for Rough Carpenter under the City’s Wage Scale for Engineering Construction.

C. Certified Flagmen must wear a distinctive uniform, bright-colored vest, and be equipped with appropriate flagging and communication devices while at the Work site. They must also have in their possession while on duty, a proof of training identification card issued by the appropriate training institute.

PART 2 - PRODUCTS

2.1 SIGNS, SIGNALS, AND DEVICES

A. Comply with TMUTCD requirements.

B. Traffic cones and drums, flares and lights: Conform to local jurisdictions’ requirements.

C. When working in the Central business district, provide pedestrian pathway signage approved by the City’s Traffic Engineering Branch.
PART 3 - EXECUTION

3.1 PUBLIC ROADS

A. Submit requests forms for lane closure and sidewalk closure to the City’s Traffic Engineering Branch at least three working days prior to need for blocking vehicular lanes or sidewalks. Do not block lanes or sidewalks without approved permits. Obtain application from the City’s Traffic Engineering Branch at 611 Walker, 5th floor or at the following internet address: http://www.ci.houston.tx.us/pwe/mrow/laneclosure.htm.

B. Follow laws and regulations of governing jurisdictions when using public roads. Pay for and obtain permits from jurisdiction before impeding traffic or closing lanes. Coordinate activities with Project Manager.

C. Give Project Manager one-week notice before implementing approved traffic control phases. Inform local businesses of impending traffic control activities.

D. Notified police department, fire department, METRO, and local schools, churches, and businesses in writing a minimum of five business days prior to beginning work.

E. Maintain 10-foot wide all-weather lanes adjacent to the Work for emergency vehicle use. Keep all-weather lanes free of construction equipment and debris.

F. Do not obstruct normal flow of traffic from 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. on designated major arterials or as directed by Project Manager.

G. Maintain local driveway access to residential and commercial properties adjacent to work areas at all times. Use all-weather materials approved by Project Manager to maintain temporary driveway access to commercial and residential driveways.

H. Keep streets entering and leaving job site free of excavated material, debris, and foreign material resulting from construction operations in compliance with applicable ordinances.

I. Remove existing signage and striping that conflict with construction activities or that may cause driver confusion.

J. Provide safe access for pedestrians along major cross streets.

K. Alternate closures of cross streets so that two adjacent cross streets are not closed simultaneously.

L. Do not close more than two consecutive esplanade openings at a time without prior approval from Project Manager.
3.2 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and the City's operations.

B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.3 FLARES AND LIGHTS

A. Provide flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.4 HAUL ROUTES

A. Utilize haul routes designated by authorities or shown on drawings for construction traffic.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

3.5 TRAFFIC SIGNS AND SIGNALS

A. Construct necessary traffic control devices for temporary signals required to complete the Work including loop detectors, traffic signal conduits, traffic signal wiring and crosswalk signals. Notify the City’s Traffic Engineering Branch a minimum of 60 days in advance of need for control boxes and switchgear. The City will perform necessary service, programming or adjustments, to signal boxes and switchgear if required during construction.

B. Install and operate traffic control signals to direct and maintain orderly traffic flow in areas under Contractor's control affected by Contractor's operations. Post notices, signs and traffic controls before moving into next phase of traffic control.

C. Relocate traffic signs and signals as the Work progresses to maintain effective traffic control.

D. Unless otherwise approved by Project Manager, provide driveway signs with name of business that can be accessed from each crossover. Use two signs for each crossover.

E. Replace existing traffic control devices in Project area.

F. Project Manager may direct Contractor to make minor adjustments to traffic control
Main Street Traffic Signal Upgrades

signage to eliminate driver confusion and maintain orderly traffic flow during construction at no additional cost to METRO.

3.6 BRIDGING TRENCHES AND EXCAVATIONS

A. When necessary, construct bridges over trenches and excavation to permit an unobstructed flow of traffic across construction areas and major drives. Use steel plates of sufficient thickness to support H-20 loading and install to operate with minimum noise.

B. Shore trench or excavation to support bridge and traffic.

C. Secure bridging against displacement with adjustable cleats, angles, bolts or other devices when:

1. bridging is placed over existing bus routes,
2. more than five percent of daily traffic is comprised of commercial or truck traffic,
3. more than two separate plates are used for bridging, and
4. when bridge is to be used for more than five consecutive days.

D. Extend steel plates used for bridging a minimum of 1 foot beyond edges of trench or excavation. Use temporary paving materials such as premix to feather edges of plates to minimize wheel impact on secured bridging.

3.7 REMOVAL

A. Remove equipment and devices when no longer required.

B. Repair damage caused by installation.

C. Remove post settings to a depth of 2 feet.

3.8 TRAFFIC CONTROL, REGULATION AND DIRECTION

A. Use Flagmen to control, regulate and direct an even flow and movement of vehicular and pedestrian traffic, for periods of time as may be required to provide for public safety and convenience, where:

1. multi-lane vehicular traffic must be diverted into single lane vehicular traffic,
2. vehicular traffic must change lanes abruptly,
3. construction equipment must enter or cross vehicular traffic lanes and walks,
4. construction equipment may intermittently encroach on vehicular traffic lanes and unprotected walks and crosswalk,

5. traffic regulation is needed due to rerouting of vehicular traffic around the Work site, and

6. where construction activities might affect public safety and convenience.

B. Use of Flagmen to assist in the regulation of traffic flow and movement does not relieve Contractor of responsibility to take other means necessary to protect the Work and public.

3.9 INSTALLATION STANDARDS

A. Place temporary pavement for single lane closures, in accordance with MUTCD.

B. Reinstall temporary and permanent pavement markings as approved by Project Manager. When weather conditions do not allow application according to manufacturer’s requirements, alternate markings may be considered. Submit proposed alternate to Project Manager for approval prior to installation. No additional payment will be made for use of alternate markings.

3.10 MAINTENANCE OF EQUIPMENT AND MATERIAL

A. Submit name, address and telephone number of individual designated to be responsible for maintenance of traffic handling at construction site to Project Manager. Individual must be accessible at all times to immediately correct deficiencies in equipment and materials used to handle traffic including missing, damaged, or obscured signs, drums, barricades, or pavement markings.

B. Inspect signs, barricades, drums, lamps and temporary pavement markings daily to verify that they are visible, in good working order, and conform with traffic handling plans as approved by Project Manager. Immediately repair, clean, relocate, realign, or replace equipment or materials that are not in compliance.

C. Keep equipment and materials, signs and pavement markings, clean and free of dust, dirt, grime, oil, mud, or debris.

D. Obtain approval of Project Manager to reuse damaged or vandalized signs, drums, and barricades.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. TRAFFIC CONTROL shall be measured per Day, complete in place.
Measurement shall include preparation and submittal of traffic control plan if different than shown on Drawings, and provision of all traffic control devices, equipment, and personnel necessary to protect the Work and public. Payment will be based on Contractor’s Schedule of Values for traffic control and regulation.

B. CITY OF HOUSTON LANE CLOSURE PERMITS shall be measured per lump sum. Measurement shall include preparation and submittal of traffic control plans, application requirements and any necessary fees to obtain any and all necessary lane closure and mobility permits to construct the project. Payment will be based on Contractor’s Schedule of Values for traffic control and regulation.

C. FLAGMEN / UNIFORMED POLICE OFFICER shall be measured per Day.

4.2 PAYMENT

A. The work performed, and the materials furnished as prescribed by this item and measured as provided under “MEASUREMENT” shall be paid for at the contract unit bid price for each item presented in the bid form for “Traffic Control and Regulation”. The unit price bids for each item shall be full compensation for furnishing and placing all materials, and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work in accordance with the drawings and specifications.

END OF SECTION 01555
SECTION 01560
ENVIRONMENTAL IMPACT CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION
A. This Section specifies the controls required to control and minimize environmental impact caused by construction activities

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL
Contractor shall provide facilities, establish procedures, and conduct construction activities in a manner which will ensure compliance with those regulations controlling construction activities at Project Site. Contractor shall designate one person, the General Superintendent or other, to enforce strict discipline on activities related to generation of wastes, pollution of air/water/soil, generation of noise, and similar harmful or deleterious effects which might violate regulations or reasonably irritate persons at or in vicinity of Project Site.

3.2 NOISE CONTROL
A. General
1. Noise caused by construction activities shall be minimized. Construction equipment and machinery shall be equipped with efficient noise suppression devices for the protection of both employees and the public

3.3 TEMPORARY IMPROVEMENTS FOR WATER QUALITY/FLOODING/DRAINAGE
A. Work hereunder shall be coordinated with the work of Section 01504 -Temporary Facilities and Controls of these Specifications. The City of Houston and Harris County Flood Control District and Water Pollution ordinances of the City, State and Federal Governments and the Texas Natural Resource Conservation Commission (TNRCC) regulations shall govern.

B. Temporary improvements shall be demolished when no longer required. Debris shall be removed and Site shall be restored to its original condition or as directed by METRO
3.4 AIR POLLUTION

A. Motor Emissions

1. Emission control devices shall be used on gasoline and diesel construction equipment. Idling and unnecessary operation of equipment shall be prohibited to prevent and control air pollution in accordance with applicable City of Houston ordinances and Environmental Protection Agency criteria.

2. Contractor shall use low-sulfur (500 ppm or less) diesel fuel in all diesel operating vehicles and motorized equipment used by the contractor and its subcontractors in the performance of this work. No diesel operating vehicle or motorized equipment used in the performance of this work shall utilize a high-sulfur diesel fuel in excess of the required 500 ppm sulfur content. If the contractor or its subcontractors are found to be using high-sulfur diesel fuel during the performance of this work, METRO may, at its discretion, order the contractor to cease operation of all such vehicles and motorized equipment until this requirement has been complied with. The contractor shall not be entitled to any claims for compensation therefor. Either off-road sulfur "red-eye" diesel fuel or on-road low-sulfur diesel containing 500 ppm or less sulfur content may be used to comply with this requirement. Contractors and subcontractors using this type of fuel must have invoices/receipts available upon demand by METRO's Contract Administrator to ensure compliance with this low-sulfur fuel use requirement.

B. Dust Control

Work and access areas shall be maintained free of dust. Loaded trucks shall be covered and dust-generating surfaces shall be sprinkled with water or receive a light application of bitumen. Trucks and equipment shall be washed down prior to leaving the construction Site. Adjacent streets shall be swept as directed by METRO to remove all spilled material. Sediments and construction materials reaching a public or private road shall be removed by street cleaning, not flushing before the end of each working day.

C. Burning

Burning of trees, shrubs, rubbish and other materials is prohibited. Burning of waste materials on METRO-controlled property will not be permitted. All materials shall be disposed of off-site in a legal manner.
3.5 EROSION AND SEDIMENT CONTROLS

A. General

Erosion and sediment controls shall:

1. Divert upslope water around disturbed areas of the Site.
2. Limit the exposure of disturbed areas of the Site.
3. Remove sediment from storm water before it leaves the Site.

B. Seeding, mulching, netting and watering shall be provided on sloped surfaces, berms at the top of the slopes, interceptor ditches at end of berms and at locations to ensure that erosion during construction will be minimized.

C. Sediment Controls

1. Silt dams, traps, dikes, barriers, fences, and related control appurtenances shall be provided as required to prevent sedimentation of existing drainage systems.
2. Temporary improvements for sedimentation control shall be removed upon completion of the Work for which the controls were provided.

D. Stabilization Practices

1. Undertake stabilization practices to cover or maintain existing cover over site soils. Minimize the amount of existing vegetated area that is disturbed or denuded, especially those areas outside the immediate zone of construction activity.

2. Stabilization practices shall include temporary and permanent seeding, mulching (or combinations of seeding and mulching applied by hydraulic planting or hydro-mulch seeding), sodding, the use of vegetative buffer strips, protection of trees and other mature vegetation, the use of woven geotextile fabrics, riprap, gabions; erosion mats, blankets or netting made of certain fibrous materials; and other appropriate measures, such as specialized soil retaining systems, or other practices specified or approved by METRO

E. Implementation of Stabilization Practices

1. Stabilization practices shall be undertaken within 14 days after construction activity on any portion of the construction site has temporarily or permanently ceased.
2. If construction activities on a portion of the site are scheduled to resume within 21 days of being suspended, METRO may allow the Contractor to delay implementing temporary stabilization on that portion of the site if its storm water runoff is discharged through an appropriate sediment trapping device.

3. METRO will determine the definition of Portion of the Construction Site based on construction sequencing, the Contractor’s submitted construction schedule, or the type and scope of the project.

F. Construction and Maintenance of Stabilization Practices

1. Stabilization practices shall be in accordance with HC/COH Storm Water Management Handbook for Construction Activities, Appendix C; as specified in Section 02922 – Sodding of these Specifications; as shown on the drawings; and in accordance with the project Storm Water Pollution Prevention Plan (SWPPP) specified in Section 01570 - Storm Water Pollution Prevention of these Specifications.

2. Stabilization practices shall be inspected after each storm event of record for erosion or other storm related damage. Repair any storm damage within 24 hours of said inspection and promptly repair any other degradation to the effectiveness of a specific stabilization practice.

G. Structural Practices

1. Structural practices specified in the project SWPPP shall be designed to prevent water from crossing disturbed areas of the site or to remove sediment from site runoff before it is discharged or both.

2. Approved structural practices shall include earth dikes and drainage swales (when combined, commonly called diversions), silt fences, sediment traps, check dams, level spreaders, subsurface drains, pipe slope drains, temporary storm drain diversions, storm drain inlet protection, rock outlet protection, sump pits, temporary or permanent Sediment basins, temporary waterway crossings, wind breaks, construction entrance/exit stabilization measures, and other practices specified or approved by METRO.

3. Structural practices that are not approved for implementation on METRO projects include the use of brush barriers and the use of straw bales as sediment fences, traps, barriers, dikes, or check dams - inclusive of whether or not said brush barriers or straw bales are proposed to be covered with filter fabric.
H. Construction and Maintenance of Structural Practices

1. Structural practices shall be in accordance with HC/CH Storm Water Management Handbook for Construction Activities, Appendix C, and in accordance with the dimensions shown on drawings or specified in the project SWPPP or both.

2. Structural practices shall be inspected after each storm event of record for damage or sediment accumulation. Repair any storm related damage within 24 hours of said inspection and otherwise perform routine maintenance of structural practices as stated in the project SWPPP, or as directed by METRO.

3.6 STORM WATER MANAGEMENT MEASURES (SWMMs)

A. Specified Management Measures

SWMMs include the use of on-site infiltration devices, storm water flow attenuation by the use of vegetative swales or natural depressions, storm water outfall velocity dissipation devices, storm water retention structures including those with artificial wetlands, storm water quality detention structures, combinations of these management measures, and other approved measures.

B. Construction and Maintenance of SWMMs

1. SWMMs shall be constructed in accordance with the project plans and/or as specified in the project SWPPP.

2. SWMMs that are constructed to function during construction shall be inspected after each storm event of record for damage or sediment accumulation. Repair any such storm related damage within 24 hours of said inspection and shall otherwise perform routine maintenance of SWMMs as stated in the project SWPPP, or as directed by METRO.

3. Responsibility for the maintenance of permanent SWMMs constructed as part of the project shall revert to METRO or another designated party at the completion and close-out of the project.

3.7 CONSTRUCTION SITE HOUSEKEEPING BEST MANAGEMENT PRACTICES

A. General

Appropriate construction site housekeeping Best Management Practices (BMPs) shall be instituted to minimize the opportunities for toxic and hazardous substances to enter storm water discharges from construction activities.
3.8 CLEANING

A. Safety Requirements

1. The Site shall be maintained in a neat, orderly and hazard-free condition in accordance with local ordinances and anti-pollution regulations until final acceptance of the Work.

2. Volatile wastes shall be stored in covered metal containers and removed from the Site daily.

3. Accumulation of wastes which create hazardous conditions shall be prevented.

4. Adequate ventilation shall be provided during the use of volatile or noxious substances.

B. Interim Cleaning

1. Cleaning shall be performed daily to ensure that the Site facilities, shelters, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.

2. Loose materials on exposed surfaces shall be removed or secured at end of each day's work or more often to maintain the Site in hazard-free condition. Dislodgement of materials due to wind and other forces shall be prevented.

3. Dry materials and rubbish shall be wet down to prevent blowing dust.

4. On-site containers shall be provided for collection of waste materials, debris and rubbish. Containers shall be regularly emptied and contents disposed of legally off-site.

5. Interiors of shelters shall be vacuum cleaned when ready to receive finish painting or special coatings. Vacuum cleaning shall continue as required, until shelters are ready for final acceptance.

6. Dropping or throwing of materials from heights will be prohibited.

7. Cleaning operations shall be scheduled so that dust and other contaminants resulting from cleaning processes will not fall on wet, newly painted surfaces.

8. Waste materials shall not be buried in site excavations.
C. Final Cleaning

1. Refer to Section 01700 - Project Closeout of these Specifications. A final inspection shall be conducted, in the company of METRO, of exposed interior and exterior surfaces in preparation for Substantial Completion.

2. Grease, dust, dirt, stains, spilled paint and concrete, labels (except UL and FM labels), fingerprints and other materials shall be removed from exposed finished surfaces.

3. Marred surfaces shall be repaired and refinished to specified finish to match adjacent surfaces at no additional cost to METRO. Paved surfaces shall be broom cleaned.

4. Thoroughly sweep and washdown pavement surfaces on or along the site and adjacent streets or properties subject to off-site tracking of sediments or fugitive dust as specified in this Section and the project's SWPPP specified in Section 01570 - Storm Water Pollution Prevention of these specifications.

5. Cleaning operations shall continue until Work has been finally accepted by METRO in writing.

3.9 SITE SPECIFIC COMMITMENTS

A. Where specific mitigation measures or more rigorous criteria and specifications are identified in such documents, the more stringent requirements shall take precedence over these Specifications.

PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

A. No separate measurement or payment will be made for the items in this specification. All costs associated with this work will be considered incidental to the total contract bid amount.

END OF SECTION 01560
SECTION 01576

WASTE MATERIAL DISPOSAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Disposal of waste material and salvageable material.

1.2 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit copy of approved "Development Permit", as defined in Chapter 19 of Floodplain Ordinance (City Ordinance Number 81-914 and Number 85-1705), prior to disposal of excess material in areas designated as being in "100-year Standard Flood Hazard Area" within the City and areas designated as being in “500-year Standard Flood Hazard Area”. Contact the City of Houston Floodplain Management Office at the Houston Permitting Center (1002 Washington Avenue, 3rd Floor), at (832) 394-8854 for floodplain information.

C. Obtain and submit disposal permits for proposed disposal sites, if required by local ordinances.

D. Submit copy of written permission from property owner, with description of property, prior to disposal of excess material adjacent to Project. Submit written and signed release from property owner upon completion of disposal work.

E. Describe waste materials expected to be stored on-site and a description of controls to reduce Pollutants from these materials, including storage practices to minimize exposure of materials to storm water; and spill prevention and response measures in the Project's Storm Water Pollution Prevention Plan (SWPPP). Refer to Section 01410 - TPDES Requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SALVAGEABLE MATERIAL

A. Excavated Material: When indicated on Drawings, load, haul, and deposit excavated material at location or locations shown on Drawings outside limits of Project.
B. Base, Surface, and Bedding Material: Load shell, gravel, bituminous, or other base and surfacing material designated for salvage into City trucks.

C. Other Salvageable Materials: Conform to requirements of individual Specification Sections.

D. Coordinate loading of salvageable material on City trucks with Project Manager.

3.2 EXCESS MATERIAL

A. Remove and legally dispose of vegetation, rubble, broken concrete, debris, asphaltic concrete pavement, excess soil, and other materials not designated for salvage from job site.

B. Excess soil may be deposited on private property adjacent to Project when written permission is obtained from property owner. See Paragraph 1.02 D above.

C. Verify floodplain status of any proposed disposal site. Do not dispose of excavated materials in area designated as within 100-year and 500-year Standard Flood Hazard Areas unless "Development Permit" has been obtained. Remove excess material placed in "100-year and 500-year Standard Flood Hazard Areas" within the City without "Development Permit", at no additional cost to the City.

D. Remove waste materials from site daily, in order to maintain site in neat and orderly condition.

PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

A. No separate measurement or payment will be made for the items in this specification. All costs associated with this work will be considered incidental to the total contract bid amount.

END OF SECTION 01576
SECTION 01610

BASIC PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements for transportation, delivery, handling, and storage of Products.

1.2 PRODUCTS

A. Products: Defined in specification requirements for each item of work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components designated for reuse.

B. For material and equipment specifically indicated or specified to be reused in the work:

1. Use special care in removal, handling, storage and reinstallation, to assure proper function in completed work.

2. Arrange for transportation, storage and handling of products which require off-site storage, restoration or renovation. Include cost in unit price for related items.

C. When contract documents require that installation of work comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in installation, including two copies to Project Manager. Maintain one set of complete instructions at job site during installation until completion.

D. Provide Products from the fewest number of manufacturers as practical, in order to simplify spare parts inventory and to allow for maximum interchangeability of components. For multiple components of the same size, type or application, use the same make and model of component throughout the Work.

1.3 TRANSPORTATION

A. Make arrangements for transportation, delivery, and handling of Products required for timely completion of the Work.

B. Transport and handle Products in accordance with manufacturer's instructions.
C. Consign and address shipping documents to proper party giving name of the Project and its complete street address. Shipments shall be delivered to Contractor.

1.4 DELIVERY

A. Arrange deliveries of Products to accommodate short-term site completion schedules and in ample time to facilitate inspection prior to Installation. Avoid deliveries that cause lengthy storage or overburden of limit storage space.

B. Coordinate deliveries to avoid conflict with the Work and conditions at the site and to accommodate the following:

1. Work of other contractors or METRO.
2. Limitations of storage space.
3. Availability of equipment and personnel for handling Products.
4. METRO's use of premises.

C. Have Products delivered to the site in manufacturer's original, unopened, labeled containers.

D. Immediately upon delivery, inspect shipment to assure:

1. Product complies with requirements of the Contract.
2. Quantities are correct.
3. Containers and packages are intact; labels are legible.
4. Products are properly protected and undamaged.

1.5 PRODUCT HANDLING

A. Coordinate off-loading of Products delivered to the site. If necessary during construction, move and relocate stored Products at no additional cost to METRO.

B. Provide equipment and personnel necessary to handle Products, including those provided by METRO, by methods to prevent damage to Products or packaging.

C. Provide additional protection during handling as necessary to prevent breaking, scraping, marring, or otherwise damaging Products or surrounding areas.

D. Handle Products by methods to prevent over-bending or overstressing.
E. Lift heavy components only at designated lifting points.

F. Handle Products in accordance with manufacturer's recommendations.

G. Do not drop, roll, or skid Products off delivery vehicles. Hand-carry or use Suitable materials handling equipment.

1.6 STORAGE OF PRODUCTS

A. Store and protect Products in accordance with manufacturer's recommendations and requirements of these Specifications.

B. Make necessary provisions for safe storage of Products. Place Products so as to prevent damage to any part of the Work or existing facilities and to maintain free access at all times to all parts of the Work and to utility service company installations in the vicinity of the Work. Keep Products neatly and compactly stored in locations that will cause minimum inconvenience to other contractors, public travel, adjoining owners, tenants, and occupants. Arrange storage in a manner so as to provide easy access for inspection.

C. Restrict storage to areas available on the site for storage of Products as shown on Drawings or approved by Project Manager.

D. Provide off-site storage and protection when on-site storage is not adequate. Provide addresses of, and access to, off-site storage locations for inspection by Project Manager.

E. Do not use lawns, grass plots, or other private property for storage purposes without written permission of owner or other person in possession or control of premises.

F. Protect stored Products against loss or damage.

G. Store in manufacturers' unopened containers.

H. Neatly, safely, and compactly stack Products delivered and stored along the line of the Work to avoid inconvenience and damage to property owners and general public, and maintain at least 3 feet clearance around fire hydrants. Keep public, private driveways and street crossings open.

I. Repair or replace damaged lawns, sidewalks, streets or other improvements to satisfaction of Project Manager. Total length that Products may be distributed along route of construction at one time is 1000 linear feet, unless otherwise approved in writing by Project Manager.

PART 2 - PRODUCTS (Not Used)
PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

A. No separate measurement or payment will be made for the items in this specification. All costs associated with this work will be considered incidental to the total contract bid amount.

END OF SECTION 01610
SECTION 01630

PRODUCTS AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for preparing and submitting requests for substitution for specified products and methods.

1.2 LIST OF PRODUCTS PROPOSED FOR USE

A. General

The Contractor's options in selecting products are limited by requirements of the Contract Documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects.

B. Standards

Where products are specified in the Contract Documents by reference standards or code only, any product meeting or exceeding those standards may be proposed. Listing shall indicate the name and address of manufacturer, model number or catalog designation, manufacturer's reference standards and pertinent test data indicating compliance with the referenced standard, code, or regulation.

C. Approved Equal

Where products are specified by naming one or more products and "approved equal", the intent shall be to establish a quality standard, a performance standard and an appearance standard for the product and any other product equaling or exceeding those standards, for the application intended, may be proposed. A formal request for substitution shall be submitted for consideration of any product not specifically named in the Contract Documents. Contractor shall comply with the Contract Documents provisions for substitutions to obtain METRO approval of an unnamed product.

D. Proprietary

Where products are specified by naming only one product, or manufacturer, the intent is to establish not only a quality standard, but continuity to ensure form, fit, function, and compatibility on all METRO projects and facilities, and not to restrict competition. Other products may not be accepted, unless the Specification
indicates possible consideration of other products. Advise METRO before proceeding, when it is discovered that the named product is not a feasible solution.

E. Response

METRO will respond to the Contractor in writing within 10 working days of receipt of the product-listing submitted. No response by METRO within the 10 working day time period constitutes no objection to the listed products or manufacturers, but does not constitute a waiver of the requirement that products comply with the requirements of the Contract Documents. METRO's response will include the following:

1. Listing of unacceptable product selections, if any, containing an explanation of the reasons for this action.

2. A request for additional data necessary for the review and possible acceptance of the products and manufacturer's listed.

1.3 SUBSTITUTIONS FOR PRODUCTS AND METHODS

A. General

Three copies of written requests for substitutions for products or methods, to replace those items specified or indicated, shall be submitted to METRO in sufficient time for METRO's review and comment so as not to delay the Work.

B. Limited Approval

1. Approval of substitutions by METRO shall be only for the characteristics and use specifically indicated in the approval. Approved substitutions shall neither be interpreted as a modification to the Contract Document requirements nor as an acceptance of the product or method for any use other than that specifically indicated in the approval for the substitution.

2. All Shop Drawings, product data and samples submitted by the Contractor shall illustrate details of work, equipment, materials, products, systems, designs or workmanship that the Contractor proposes to use in order to comply with the design concept established in Contract Documents. METRO's review of these submittals is only for the limited purpose of checking the same for conformity with the design concept of the Work as established in the Contract Documents. This review is not intended to be for the purpose of determining the accuracy of other matters that may be contained in such submittals, including but not limited to such matters as dimensions, quantities, performance of equipment and systems designed by the Contractor, Contractor-furnished engineering and design, construction means, methods, techniques, sequences, procedures or safety precautions, the correctness of which as set forth in the submittal shall be the sole responsibility of the Contractor. METRO will undertake its review with reasonable promptness so
as to cause no delay. METRO's review of a specific item shall not indicate approval of an assembly of which the item is a component or in which it functions.

C. Suitability Evaluation

Where a request for use of a substitute product or method requires redesign or rework of another portion of the Work, the time and cost required to effect such redesign or rework shall be considered in evaluating the suitability of the requested substitution. The costs of all such redesign or rework as required to incorporate the substitution shall be considered a part of the Work.

D. Written Requests

In each request, identify the product or fabrication or installation method to be replaced by the substitution; include related Specification section and Drawing numbers, and complete documentation showing compliance with the requirements for substitutions. Include the following information, as appropriate, with each written request:

1. Complete product data, drawings, descriptions, and procedures substantiating compliance with the Contract Documents requirements.

2. Detailed comparison of the proposed substitution with the product or method specified or indicated. Comparison shall include estimated service life in the application intended, estimated preventive maintenance, spare parts availability, repair service availability, energy consumption, performance, operating characteristics and requirements, warranties and other significant qualities and differences.

3. Product identification including manufacturer's name, address, local representative and complete literature relative to the proposed substitution.

4. Detailed description of construction methods, means, techniques, sequences, and procedures, including drawings or photographs illustrating such items, where necessary for clarification.

5. Provide complete coordination information. Include all changes required in other elements of the Work to accommodate the substitution, including work performed by METRO and other Contractors.

6. Provide a statement indicating the effect the substitution will have on the Work schedule in comparison to the schedule without approval of the proposed substitution. Include information regarding the effect of the proposed substitution on the Contract Period of Performance.

7. Provide complete cost information, including a proposal of the net change, if any in the Contract Sum.
8. Provide certification by the Contractor to the effect that, in the Contractor's opinion, after thorough evaluation, the proposed substitution will result in work that in every significant respect is equal-to or better than the work required by the Contract Documents, and that it will perform adequately in the application indicated. Include in this certification, the Contractor's waiver of rights to additional payment or time due to failure of the substitution to perform adequately.

E. Certification

In making a request for substitution, Contractor shall certify in writing that he will:

1. Provide at least the same guarantee for the substitution as may be required for the product specified or indicated.

2. Coordinate the installation of the substitution and make or have made all necessary adjustments and changes to interfacing work.

3. Replace substitutions which fail to meet the Contract Documents requirements, including substitutions in kind which have not yet failed, if so directed, at no additional cost to METRO.

F. Conditions

The Contractor's request for a substitution will be considered when extensive revisions to the Contract Documents are not required, when the proposed changes are in keeping with the general intent of the Contract Documents, when the requests are timely, fully documented and properly submitted. Substitutions will not be considered if indicated or implied on Shop Drawings or product data submittals for which no written request for substitution has been submitted. The Contractor's submittal of and METRO's acceptance of Shop Drawings, product data or samples which relate to work not complying with requirements of the Contract Documents, does not constitute an acceptable or valid request for a substitution, nor approval thereof.

G. Notification

Within 7 working days of receipt of the Contractor's request for substitution, METRO will request additional information or documentation as may be needed for evaluation of the request. Within 10 working days of receipt of the request, or within 7 working days of receipt of the requested additional information or documentation, whichever is later, METRO will notify the Contractor of either the acceptance or rejection of the proposed substitution. Acceptance will be in the form of a Change Order. Rejection will include a statement giving reasons for the rejection. METRO's approval of substitutions shall not be construed as approval of the Contractor's methods, means, techniques, sequences, and procedures submitted for clarification purposes at METRO's request.
H. Visual Matching

Where matching an established sample is required, the final judgment of whether a product substitution proposed by the Contractor matches the sample satisfactorily will be determined by METRO. Where there is no product available within the specified product category that matches the sample satisfactorily and also complies with other specified requirements, Contractor shall comply with the provisions of this Section 01630 and the Contract Documents concerning "substitutions" for selection of a matching product.

I. Visual Selection

Except as otherwise indicated, where specified product requirements include the phrase "as selected from the manufacturer's standard colors, patterns, textures. . . ." or similar phrases, the Contractor may select the proposed product and manufacturer, provided the selection complies with other specified requirements. METRO will select the color, pattern and texture from the product line proposed by the Contractor.

J. Producer's Statement of Applicability

Where directed by METRO, the Contractor shall submit a written certified statement from the producer stating that the producer has reviewed the proposed application of the product. This statement shall state that the producer agrees with or does not object to METRO's specification and the Contractor's selection of the product for use in the Work. The statement shall also state that the proposed application of the product on the Work is suitable and proper.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

A. No separate measurement or payment will be made for the items in this specification. All costs associated with this work will be considered incidental to the total contract bid amount.

END OF SECTION 01630
SECTION 01700
PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for completing, documenting, and closing out the Project.

1.2 DEFINITIONS

A. Project Closeout

Project closeout is the term used to describe certain collective requirements, indicating completion of the Project, that are to be fulfilled near the end of the Contract Period of Performance in preparation for final acceptance of the Project by METRO, as well as final payment to the Contractor and the normal termination of the Contract.

B. Other Requirements

Specific requirements for individual units of work shall be as included in the appropriate Sections in Divisions 2 through 16 of the Contract Documents.

C. Time

Time of closeout is directly related to "Substantial Completion"; therefore, the time of closeout may be either a single time period for the entire Project or a series of time periods for individual elements of the Project that have been certified as substantially complete at different dates. This time variation, if any, shall be applicable to the other provisions of this Section.

D. Substantial Completion

This milestone shall be the stage of the Project at which when solely determined by METRO, the Project is ready for intended service to the extent required by METRO.

1.3 PREREQUISITES TO SUBSTANTIAL COMPLETION

A. General

Contractor shall complete the following, as applicable, before requesting METRO's
inspection for certification of Substantial Completion, either for the entire Project or for portions of the Project. List known exceptions in the request.

1. In the progress payment request that coincides with, or is the first request following, the date Substantial Completion is claimed, show either 100% completion for the portion of the Project claimed as "substantially complete", or list incomplete items, the value of incomplete work, and reasons for the work being incomplete. Include supporting documentation for completion as indicated in the Contract Documents.

2. Submit a statement showing an accounting of Change Orders to the Contract Sum.

3. Advise METRO of all pending insurance change-over requirements.

4. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.

5. Obtain and submit releases enabling METRO's full, unrestricted use of the Project and access to services and utilities. Where required, include occupancy permits, operating certificates and similar releases.

6. Assemble Record Drawings, maintenance manuals, final photographs, damage or settlement survey, property survey, and similar final record information for turnover after final acceptance.

7. Assemble special tools, spare parts, extra stock of material and similar physical items for turnover after final acceptance.

8. Make the final change-over of locks and transmit the keys to METRO. Advise METRO personnel of the change-over in security provisions.

9. Complete start-up testing of systems, and instruction of METRO operating and maintenance personnel. Discontinue or change over and remove temporary facilities and services from the Project Site, along with construction tools and facilities, mock-ups, and similar elements.

10. Complete final cleaning up requirements, including touch-up painting of marred surfaces. Touch-up and otherwise repair and restore marred exposed finishes.

B. Inspection Procedures

Upon receipt of the Contractor's request for inspection, METRO will either proceed with inspection or advise the Contractor in writing of unfilled prerequisites. Following the initial inspection, METRO will either prepare the Certificate of Substantial Completion, or will advise the Contractor in writing of work which must
be performed before the certificate will be issued. METRO will repeat, or have repeated, the inspection when requested and when assured that the Project has been Substantially Completed. Results of the completed inspection shall form the initial "punch-list" for final acceptance.

1.4 PREREQUISITES TO FINAL ACCEPTANCE

A. General

Contractor shall complete the following, as applicable, before requesting METRO's final inspection for certification of final acceptance, and final payment as required by the Contract Documents. List known exceptions in request.

1. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

2. Submit an updated final cost statement, accounting for final additional Change Orders to the Contract Sum.

3. Submit a certified copy of the final punch-list of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance and has been endorsed and dated by METRO.

4. After receipt of Substantial Completion, Contractor shall transfer potable and irrigation water, sanitary, electrical and phone services over to METRO. Utilities shall address their invoices to:

Director of Accounting
Metropolitan Transit Authority
1900 Main Street, 5th Floor
P. O. Box 61429
Houston, Texas 77208-1429

Upon transfer of utilities to METRO, Contractor shall provide documentation on date of utility transfer along with meter readings for potable and irrigation water and electric services.

5. Submit consent of surety.

6. Submit a final liquidated damages or incentive settlement statement, acceptable to METRO.

7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
B. Reinspection Procedure

1. METRO will reinspect the Project upon receipt of the Contractor's notice that the punch-list items resulting from earlier inspections, have been completed, except for those items whose completion has been delayed because of circumstances that are known to and acceptable by METRO.

2. Upon completion of reinspection, METRO will either prepare a Certificate of Final Acceptance, or will advise the Contractor in writing of work that is incomplete or of obligations that have not been fulfilled, but are required for final acceptance. If necessary, the reinspection procedure shall be repeated until final acceptance.

1.5 RECORD DOCUMENTS REQUIRED AT CLOSEOUT

A. General

1. Requirements for Record Documents shall be as indicated herein. General submittal requirements are indicated in the various "Submittals" Articles and in Section 01340 - Shop Drawings, Product Data, Samples, and Record Documents of these Specifications.

2. Do not use Record Documents for construction purposes; protect from deterioration and loss in a secure, fire-resistant location; provide access to Record Documents for METRO's reference during normal working hours.

B. Record Drawings

1. Maintain a Record Drawings set of blue or black line white-prints of Contract Drawings and Shop Drawings in a clean, undamaged condition. Mark-up the set of Record Drawings to show the actual installation where the installed work varies from the work as originally shown. Mark whichever Drawing is most capable of showing the actual "field" condition fully and accurately; however, where Shop Drawings are used for mark-up, record a cross-reference at the corresponding location on the working drawings. Give particular attention to concealed work that would be difficult to measure and record at a later date.

2. Mark Record Drawing sets with red erasable pencil and where feasible, use other colors to distinguish between variations in separate categories of work.

3. Mark-up new information which is known to be important to METRO, but for some reason was not shown on either Contract Drawings or Shop Drawings.

4. Note related Change Order numbers where applicable.
5. Organize Record Drawing sets into manageable sets, bind with durable paper or cardboard cover sheets, and print suitable titles, dates and other identification on the cover of each set.

C. Record Specifications

Maintain one complete copy of the Contract Documents, including Specifications and Addenda, and one copy of other written documents such as Change Orders and similar modifications issued during construction. Mark these documents to show variations in the actual work performed in comparison with the text of the Specifications and modifications as issued. Give particular attention to substitutions, selection of options and similar information on work where it is concealed or cannot otherwise be readily discerned at a later date by direct observation. Note related Record Drawing information and Record Product Data, where applicable. Upon completion of the Project, submit Record Specifications to METRO for retention.

D. Record Storm Water Pollution Prevention

Maintain inspection reports on storm water pollution prevention, one copy of each revision to the SWPPP and one signed copy of the Notice of Termination, all as specified in Section 01566 - Storm Water Pollution Prevention.

E. Record Product Data

Maintain one copy of each Product Data submittal. Mark these Record Documents to show variations in the actual work performed in comparison with the submitted information. Include both variations in the products as delivered to the Site, and variations from the manufacturer's instructions and recommendations for installation. Give particular attention to concealed products and portions of the Project which cannot otherwise be readily discerned at a later date by direct observation. Note related Change Orders and mark-up of Record Drawings and Specifications. Upon completion of mark-up, submit complete set of Record Product Data to METRO for retention.

F. Record Sample Submittals

Immediately prior to the date of Substantial Completion, the Contractor shall meet at the Site with METRO personnel who so desire, to determine which, if any, of the submitted samples that have been maintained by the Contractor during progress of the Work, are to be transmitted to METRO for retention.

G. Miscellaneous Record Submittals

Refer to other Sections of these Specifications for requirements of miscellaneous record-keeping and submittals in connection with the actual performance of the
Work. Immediately prior to the date of Substantial Completion, Contractor shall complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference and submit to METRO for retention.

H. Maintenance Manuals

Contractor shall organize operating and maintenance data into sets of manageable size. Bind data into individual binders, properly identified and indexed. Bind each set of data in a heavy-duty 2-inch, 3-ring vinyl-covered binder, with pocket folders for folded sheet information. Mark the appropriate identification on both front and spine of each binder in accordance with Section 01730 - Operating and Maintenance Data.

1.6 MEASUREMENT AND PAYMENT

No separate measurement or payment will be made for project closeout. This cost will be considered incidental to the total contract bid amount.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 OPERATING AND MAINTENANCE INSTRUCTIONS AT CLOSEOUT

A. General

1. Contractor shall comply with Section 01730 - Operating and Maintenance Data of these Specifications.

2. Arrange for each Installer of operating equipment and other work that requires regular or continuing maintenance, to meet at the Site with METRO personnel to provide necessary basic instruction in the proper operation and maintenance of the entire Work. Where Installers are not experienced in the required procedures, arrange for instruction by the manufacturer's representatives.

3. As part of this instruction, provide a detailed review of the following items, as appropriate:

- Maintenance manuals
- Record Documents
- Spare parts and materials
- Tools
- Lubricants
- Fuels
- Identification systems
Control sequences
Hazards
Cleaning
Warranties, bonds, maintenance agreements and similar continuing commitments.

4. As part of this instruction, for operating equipment demonstrate the following procedures:

Start-up
Shut-down
Emergency operations
Noise, vibration, control, and flow adjustments
Safety procedures
Economy and efficiency adjustments
Effective energy utilization

3.2 FINAL CLEANING

A. General

1. Contractor shall comply with Section 01560 - Environmental Impact Controls of these Specifications. Provide final cleaning of the Project at the time so directed by METRO in writing. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of work to the condition expected from a normal, commercial cleaning and maintenance program. Comply with the manufacturer's instructions for cleaning and make ready operations.

2. Complete the following cleaning operations before requesting METRO inspection for certification of Substantial Completion:

a. Remove labels which are not required as permanent UL or FM labels.

b. Clean transparent materials, including mirrors and glass, to a polished condition. Remove putty and other substances which are noticeable. Replace chipped or broken glass and other damaged transparent materials.

c. Clean exposed exterior and interim hard-surfaced finishes to a dust-free condition, free of dirt, dust, stains, films and similar noticeable distracting substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors and pavers broom clean. Vacuum interior surfaces.

d. Wipe and clean surfaces of mechanical and electrical equipment.
Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

e. Clean the Project Site, including landscape areas, of rubbish, litter and other foreign substances. Sweep paved areas to a broom clean condition; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

B. Pest Control

When so directed in writing by METRO, Contractor shall engage an exterminator to make a final inspection of the Project, and to rid the Project of rodents, insects and other pests.

C. Removal of Temporary Protection

Contractor shall comply with Section 01510 - Temporary Facilities of these Specifications. Except as otherwise indicated or directed in writing by METRO, remove temporary protection devices and facilities which were installed during the course of the Project to protect previously completed work during the remainder of the construction period.

D. Compliance

Contractor shall coordinate his efforts hereunder with Section 01560 - Environmental Impact Controls of these Specifications. Comply with safety standards and governing regulations for cleaning operations. Do not burn waste materials at the Site. Do not bury debris or excess materials on METRO property. Do not discharge volatile or other harmful or dangerous materials into drainage systems. Remove waste materials from the Site and dispose of in a lawful manner. Where extra materials of value, which remain after completion of associated work, have become METRO property, dispose of these materials as directed in writing by METRO.

PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

A. No separate measurement or payment will be made for the items in this specification. All costs associated with this work will be considered incidental to the total contract bid amount.

END OF SECTION 01700
SECTION 02050

DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for demolition of facilities and structures.

B. Extent of demolition work is shown on Drawings. Demolition may, but not necessarily, require removal and disposal, off of the Work Site, of the following:

1. Adjacent landscape work to limits indicated on Drawings.
2. Pole foundations shall be demolished to their full depth below grade and disposed of off-site.
3. Paving, walkways, and related concrete and asphalt and subgrades.
4. Brick pavers and related base material.
5. Traffic poles to be removed as indicated on Drawings.
6. Traffic signal equipment to be removed to limits indicated on Drawings.
7. Trees to be pruned as indicated on Drawings.

1.2 SUBMITTALS

A. In accordance with Section 01340 - Shop Drawings, Product Data, Samples, and Record Documents of these Specifications, the following shall be submitted:

1. Proposed methods and operations of building demolition to METRO for review and approval prior to start of Work. Include required coordination by agencies for shut-off, capping, and continuation of utility services as required. Provide a detailed sequence of demolition and removal work to ensure uninterrupted progress of METRO's operations.

1.3 QUALITY ASSURANCE/JOB CONDITIONS

A. Reference Standards Applicable to this Section

1. ANSI: American National Standards Institute
a. A10.6 Safety Requirements for Demolition Operations

   a. 30: Flammable and Combustible Liquids Code

B. Regulations

Comply with applicable OSHA and EPA regulations and codes and local ordinances.

C. Occupancy

Structures to be demolished will be discontinued in use prior to start of Work.

D. Condition of Structures and Work Site

METRO assumes no responsibility for actual condition of structures to be demolished. Conditions existing at time of inspection for bidding purposes will be maintained by METRO insofar as practicable. However, variations within structure and Work Site may occur prior to start of demolition work.

E. Partial Removal

Items of value to Contractor may be removed, as directed, as Work progresses. Salvaged items shall become the property of the Contractor and shall be transported from Site as they are removed. Storage or sale of removed items on-site will not be permitted.

F. Explosives

Use of explosives will not be permitted.

G. Traffic

Contractor shall comply with Section 01570 - Traffic Regulation of these Specifications. Conduct demolition operations and removal of debris to ensure minimum interference with METRO’s operations, roads, streets, walks, and adjacent facilities. Do not close or obstruct streets, walks or other facilities without written permission from authorities having jurisdiction. Provide and identify alternate routes around closed or obstructed traffic ways as required by governing regulations.
H. Protection

Contractor shall comply with Section 01510 - Temporary Facilities of these Specifications. Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to persons and adjacent buildings, structures, and facilities. Erect temporary covered passageways as required by authorities having jurisdiction. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

I. Damages

Promptly repair damages caused by demolition operations at no cost to METRO or adjacent property owners.

J. Utility Services

Contractor shall comply with Section 01541 - Maintenance and Protection of Utilities of these Specifications. Maintain existing utilities indicated to remain, keep in like service, and protect against damage during demolition operations. Do not interrupt existing utilities serving facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary service during interruptions to existing utilities, as acceptable to governing authorities. Contractor shall disconnect and seal utilities serving structures to be demolished, prior to start of demolition work, upon written direction of METRO and utility owner.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.1 DEMOLITION

A. General

Contractor shall comply with NFPA 241 and ANSI A 10.6 prior to and during commencement of demolition.

B. Pollution Control

Contractor shall comply with Section 01560 - Environmental Impact Controls of these Specifications. Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing EPA, OSHA, and local regulations pertaining to environmental protection. Do not create hazardous or objectionable conditions such as flooding and water pollution. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations, as directed by METRO.
or governing authorities. Return adjacent areas to condition existing prior to start of Work.

C. Below-Grade Construction

Demolish light pole foundations, fence pillars, METRO monuments, foundation walls or any other structures to a depth of not less than 12 inches below subgrade or lowest foundation element. Demolish and remove below-grade wood, metal construction, floor construction, and concrete and asphalt slabs.

D. Filling Voids

1. Completely fill below-grade areas and voids resulting from demolition. Coordinate with work of Sections 02110 - Site Clearing, and 02200 - Earthwork of these Specifications.

2. Use satisfactory soil materials consisting of stone, gravel, and sand, free from debris, trash, frozen materials, roots and other organic matter.

3. Prior to placement of fill materials, ensure that areas to be filled are free of standing water, frost, frozen material, trash and debris.

4. Place fill materials in horizontal layers not exceeding 8 inches in loose depth. Compact each layer at optimum moisture content of fill material to a density as specified in Section 02200 - Earthwork of these Specifications.

5. After fill placement and compaction as specified, grade surface to meet adjacent contours and to provide flow to surface drainage structures.

3.2 DISPOSAL OF DEMOLISHED MATERIALS

A. General

Remove from Work Site debris, rubbish, and other materials resulting from demolition operations. Burning of removed materials from demolished structures will not be permitted on Site.

B. Removal

Safely transport demolished materials and dispose of legally off Site. Contractor shall comply with NFPA 241, ANSI A 10.6, and NFPA 30, as applicable to the Work of disposal and transport.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT
Main Street Traffic Signal Upgrades

A. Where there is not a separate item listed on the Unit Price Schedule for individual work in this Section, no separate measurement and payment is made. Include cost for work under this Section in the related item listed on the Unit Price Schedule.

1. REMOVE PAVERS shall be measured per Square Yard including all pavers, bedding course and shall include all labor and materials including loading, hauling, unloading and disposal.

2. TRAFFIC SIGNAL POLE ASSEMBLY REMOVAL shall be measured as Each at the location indicated on the drawings and the measurement shall include all equipment, labor and materials required to remove the traffic signal pole. This pay item includes all existing attachments to the traffic signal pole including but not limited to traffic signal heads, signs and mast arms and the cables, conduits, traffic controller cabinets and foundation necessary to complete the removal and salvage as per the coordination with City of Houston.

3. TRAFFIC SIGNAL POLE FOUNDATION REMOVAL shall be measured as Each at the location indicated on the drawings and the measurement shall include all equipment, labor and materials required to remove the traffic signal foundation. This pay item includes shall include all labor and materials including loading, hauling, unloading and disposal.

4. TREE PRUNING shall be measured as Lump Sum including all equipment, labor and materials required to prune trees including loading, hauling, unloading and disposal.

4.2 PAYMENT

A. The work performed and the materials furnished as prescribed by this item and measured as provided under "MEASUREMENT" shall be paid for at the contract unit bid price for each item presented in the bid form for “Demolition”. The unit price bids for each item shall be full compensation for furnishing and placing all materials, and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work in accordance with the drawings and specifications.

END OF SECTION 02050
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation, trenching, foundation, embedment, and backfill for installation of utilities, including manholes and other pipeline structures.

1.2 DEFINITIONS

A. Pipe Foundation: Suitable and stable native soils that are exposed at trench subgrade after excavation to depth of bottom of bedding as shown on Drawings, or foundation backfill material placed and compacted in over-excavations.

B. Pipe Bedding: Portion of trench backfill that extends vertically from top of foundation up to level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.

C. Haunching: Material placed on either side of pipe from top of bedding up to springline of pipe and horizontally from one trench sidewall to opposite sidewall.

D. Initial Backfill: Portion of trench backfill that extends vertically from springline of pipe (top of haunching) up to level line 12 inches above top of pipe, and horizontally from one trench sidewall to opposite sidewall.

E. Pipe Embedment: Portion of trench backfill that consists of bedding, haunching and initial backfill.

F. Trench Zone: Portion of trench backfill that extends vertically from top of pipe embedment up to pavement subgrade or up to final grade when not beneath pavement.

G. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.
4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

H. Suitable Material: Suitable soil materials are those meeting specification requirements. Materials mixed with lime, fly ash, or cement that can be compacted to required density and meeting requirements for suitable materials may be considered suitable materials, unless otherwise indicated.

I. Backfill: Suitable material meeting specified quality requirements placed and compacted under controlled conditions.

J. Ground Water Control Systems: Installations external to trench, such as well points, eductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 01578 - Control of Ground Water and Surface Water.

K. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as part of excavation drainage.

L. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using drainage layer, as defined in ASTM D 2321, placed on foundation beneath pipe bedding or thickened bedding layer of Class I material.

M. Foundation Bedding: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation bedding is placed and compacted as backfill to provide stable support for bedding. Foundation bedding materials may include concrete seal slabs.

N. Vacuum Excavation: An excavation technique performed by an experienced subcontractor in which water or air jetting is used to slough off and vacuum away soil.

O. Emergency Action Plan (EAP): The EAP document should include a discussion of procedures for timely and reliable detection, classification (level of emergency) and response procedure to a potential emergency condition associated with a large diameter water line.

P. Subsurface Utility Exploration (SUE): Non-destructive excavation, unless otherwise approved by project manager.
1.3 REFERENCES


D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.


F. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes.


H. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).


K. TxDOT Tex-110-E - Particle Size Analysis of Soils.


M. ASTM C76- Standard Specification for Reinforced Concrete Culverts, Storm Drain, and Sewer Pipe

1.4 SCHEDULING

A. Schedule work so that pipe embedment can be completed on same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.

B. For proposed utility adjacent to or across existing LDWL:

1. Conduct a meeting between contractor, Drinking Water Operations and Utility Maintenance Branch prior to beginning excavation to coordinate the
EAP in the event a water line shut down becomes necessary.

2. Notify Drinking Water Operations a minimum of 1 week prior to beginning construction activities.

3. Notify Drinking Water Operations a minimum of 48 hours prior to beginning SUE work near LDWL.

4. Unless otherwise approved by City Engineer, perform construction activities between 7 AM and 7 PM, Monday through Friday. No work permitted around a LDWL on weekends or City Holiday.

5. A City Inspector must be present during SUE or construction activities occurring within four feet or one diameter of the LDWL, whichever is greater, from a LDWL or appurtenance.

1.5 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit planned typical method of excavation, backfill placement and compaction including:
   1. Trench widths.
   2. Procedures for foundation and pipe zone bedding placement, and trench backfill compaction.
   3. Procedures for assuring compaction against undisturbed soil when pre-manufactured trench safety systems are proposed.

C. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.

D. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.

E. Submit 11 inch by 17 inch or 12 inch by 18 inch copy of Drawing with plotted utility or obstruction location titled "Critical Location Report" to Project Manager.

1.6 TESTS

A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by City in accordance with requirements of Section 01450 - Testing Laboratory Services and as specified in this Section.
B. Perform backfill material source qualification testing in accordance with requirements of Section 02320- Utility Backfill Materials.

1.7 SPECIAL SHORING DESIGN REQUIREMENTS (NOT USED)

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Perform excavation with hydraulic excavator or other equipment suitable for achieving requirements of this Section.

B. Use only hand-operated tamping equipment until minimum cover of 12 inches is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.

C. Use trench shields or other protective systems or shoring systems which are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.

2.2 MATERIAL CLASSIFICATIONS (NOT USED)

PART 3 - EXECUTION

3.1 STANDARD PRACTICE

A. Install flexible pipe, including "semi-rigid" pipe, to conform to standard practice described in ASTM D 2321, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

B. Install rigid pipe to conform to standard practice described in ASTM C 12 or C76 as applicable, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

3.2 PREPARATION

A. Establish traffic control to conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights for streets and intersections affected by Work, and are considered hazardous to traffic movements.

B. Perform work to conform to applicable safety standards and regulations.
C. Immediately notify agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from Project Manager and agency for any repairs or relocations, either temporary or permanent.

D. Remove existing pavements and structures, including sidewalks and driveways, to conform to requirements of Section 02221 - Removing Existing Pavements and Structures, as applicable.

E. Install and operate necessary dewatering and surface-water control measures to conform to Section 01578 - Control of Ground Water and Surface Water. Provide stable trench to allow installation in accordance with Specifications.

F. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed in accordance with Section 01725 - Field Surveying.

3.3 CRITICAL LOCATION INVESTIGATION

A. Horizontal and vertical location of various underground lines shown on Drawings, including but not limited to water lines, gas lines, storm sewers, sanitary sewers, telecommunication lines, electric lines or power ducts, pipelines, concrete and debris, are based on best information available but are only approximate locations. Unless otherwise approved by Project Manager, at Critical Locations shown on Drawings, perform vacuum excavation to field verify horizontal and vertical locations of such lines within a zone 2 feet vertically and 4 feet horizontally of proposed work exclude water jetting at PCCP water line.

1. Verify location of existing utilities minimum of 7 working days in advance of pipe laying activities based on daily pipe laying rate or prior to beginning installation of auger pit or tunnel shaft. Use extreme caution and care when uncovering utilities designated by Critical Locate.

2. Notify Project Manager in writing immediately upon identification of obstruction. In event of failure to identify obstruction in minimum of 7 days, Contractor will not be entitled to extra cost for downtime including, but not limited to, payroll, equipment, overhead, demobilization and remobilization, until 7 days has passed from time Project Manager is notified of obstruction.

B. Notify involved utility companies of date and time that investigation excavation will occur and request that their respective utility lines be marked in field. Comply with utility or pipeline company requirements that their representative be present during excavation. Provide Project Manager with 48 hours notice prior to field excavation or related work.

C. Survey vertical and horizontal locations of obstructions relative to project baseline and datum and plot on 12 inch by 18 inch copy of Drawings. For large diameter
water lines, submit to Project Manager for approval, horizontal and vertical alignment dimensions for connections to existing lines, tied into project baseline, signed and sealed by R.P.L.S.

3.4 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Section 01562 - Tree and Plant Protection.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.

D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, re-compact, and pave those areas at no additional cost to METRO.

3.5 EXCAVATION

A. Except as otherwise specified or shown on Drawings, install underground utilities in open cut trenches with vertical sides.

B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.

C. Determine trench excavation widths using following schedule as related to pipe outside diameter (O.D.). Excavate trench so that pipe is centered in trench.

<table>
<thead>
<tr>
<th>Nominal Pipe Size, Inches</th>
<th>Minimum Trench Width, Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 18</td>
<td>O.D. + 18</td>
</tr>
<tr>
<td>18 to 30</td>
<td>O.D. + 24</td>
</tr>
<tr>
<td>36 to 42</td>
<td>O.D. + 36</td>
</tr>
<tr>
<td>Greater than 42</td>
<td>O.D. + 48</td>
</tr>
</tbody>
</table>

Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

D. Use sufficient trench width or benches above embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment and backfill, and other materials.
E. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Project Manager and obtain instructions before proceeding.

F. Voids under paving area outside shield caused by Contractor's work will require removal of pavement, consolidation and replacement of pavement in accordance with Contract Documents. Repair damage resulting from failure to provide adequate supports.

G. Place sand or soil behind shoring or trench shield to prevent soil outside shoring from collapsing and causing voids under pavement. Immediately pack suitable material in outside voids following excavation to avoid caving of trench walls.

H. Coordinate excavation within 15 feet of pipeline with company's representative. Support pipeline with methods agreed to by pipeline company's representative. Use small, rubber-tired excavator, such as backhoe, to do exploratory excavation. Bucket that is used to dig in close proximity to pipelines shall not have teeth or shall have guard installed over teeth to approximate bucket without teeth. Excavate by hand within 1 foot of Pipeline Company's line. Do not use larger excavation equipment than normally used to dig trench in vicinity of pipeline until pipelines have been uncovered and fully exposed. Do not place large excavation and hauling equipment directly over pipelines unless approved by Pipeline Company's representative.

I. When, during excavation to uncover pipeline company's pipelines, screwed collar or an oxy- acetylene weld is exposed, immediately notify Project Manager. Provide supports for collar or welds. Discuss with Pipeline Company's representative and determine methods of supporting collar or weld during excavation and later backfilling operations. When collar is exposed, request Pipeline Company to provide welder in a timely manner to weld ends of collar prior to backfilling of excavation.

3.6 HANDLING EXCAVATED MATERIALS

A. Use only excavated materials, which are suitable as defined in this Section and conforming to Section 02320 - Utility Backfill Materials. Place material suitable for backfilling in stockpiles at distance from trench to prevent slides or cave-ins.

B. When required, provide additional backfill material conforming to requirements of Section 02320 - Utility Backfill Materials.

C. Do not place stockpiles of excess excavated materials on streets and adjacent properties. Protect backfill material to be used on site. Maintain site conditions in accordance with Section 01504 - Temporary Facilities and Controls. Excavate trench so that pipe is centered in trench. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.
3.7 TRENCH FOUNDATION

A. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials.

B. When wet soil is encountered on trench bottom and dewatering system is not required, over excavate an additional 6 inches with approval by Project Manager. Place non-woven geotextile fabric and then compact 12 inches of crushed stone in one lift on top of fabric. Compact crushed stone with four passes of vibratory-type compaction equipment.

C. Perform over excavation, when directed by Project Manager, in accordance with Paragraph 3.07B above. Removal of unstable or unsuitable material may be required if approved by Project Manager;
   1. Even though Contractor has not determined material to be unsuitable, or
   2. If unstable trench bottom is encountered and an adequate ground water control system is installed and operating according to Section 01578 - Control of Ground Water and Surface Water.

D. Place trench dams in Class I foundations in line segments longer than 100 feet between manholes and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.8 PIPE EMBEDMENT, PLACEMENT, AND COMPACTION

A. Remove loose, sloughing, caving, or otherwise unsuitable soil from bottoms and sidewalls of trenches immediately prior to placement of embedment materials.

B. Place embedment including bedding, haunching, and initial backfill as shown on Drawings.

C. For pipe installation, manually spread embedment materials around pipe to provide uniform bearing and side support when compacted. Protect flexible pipe from damage during placing of pipe zone bedding material. Perform placement and compaction directly against undisturbed soils in trench sidewalls, or against sheeting which is to remain in place.

D. Do not place trench shields or shoring within height of embedment zone unless means to maintain density of compacted embedment material are used. If moveable supports are used in embedment zone, lift supports incrementally to allow placement and compaction of material against undisturbed soil.

E. Place geotextile to prevent particle migration from in-situ soil into open-graded
(Class I) embedment materials or drainage layers.

F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations. When embedding coated or wrapped pipes, do not use crushed stone or other sharp, angular aggregates.

G. Place haunching material manually around pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside pipe with sand bags or other suitable means.

H. Place electrical conduit, if used, directly on foundation without bedding.

I. Shovel in-place and compact embedment material using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted areas. Compact each lift before proceeding with placement of next lift. Water tamping is not allowed.

J. For water lines construction embedment, use bank run sand, concrete sand, gem sand, pea gravel, or crushed limestone as specified in Section 02320 - Utility Backfill Material. Adhere to the following subparagraph numbers 1 and 2.

1. Class I, II and III Embedment Materials:
   a. Maximum 6 inches compacted lift thickness.
   b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
   c. Moisture content to be within -3 percent to +5 percent of optimum as determined according to ASTM D 698, unless otherwise approved by Project Manager.

2. Cement Stabilized Sand (where required for special installations):
   a. Maximum 6 inches compacted thickness.
   b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
   c. Moisture content to be on dry side of optimum as determined according to ASTM D 698 but sufficient for effective hydration.

K. For Sanitary Sewers adhere to subparagraph number 1 and 2. For Storm Sewers provide cement stabilized sand per paragraph 2. This provision does not apply to Storm Sewers constructed of HDPE pipe installed under pavement.
1. Class I Embedment Materials.
   a. Maximum 6-inches compacted lift thickness.
   b. Systematic compaction by at least two passes of vibrating equipment. Increase compaction effort as necessary to effectively embed pipe to meet deflection test criteria.
   c. Moisture content as determined by Contractor for effective compaction without softening soil of trench bottom, foundation or trench walls.

2. Class II Embedment and Cement Stabilized Sand.
   a. Maximum 6-inches compacted thickness.
   b. Compaction by methods determined by Contractor to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698 for Class II materials and according to ASTM D 558 for cement stabilized materials.
   c. Moisture content of Class II materials within 3 percent of optimum as determined according to ASTM D 698. Moisture content of cement stabilized sands on dry side of optimum as determined according to ASTM D 558 but sufficient for effective hydration.

L. For Storm Sewers constructed of HDPE pipe and installed under pavement provide flowable fill pipe embedment as specified in Section 02322 Flowable Fill.

M. Place trench dams in Class I embedment in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.9 TRENCH ZONE BACKFILL PLACEMENT AND COMPACTION

A. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only minimum length of trench open as necessary for construction.

B. For water lines, under pavement and to within one foot back of curb, use backfill materials described below:
   1. For water lines 20 inches in diameter and smaller, use bank run sand or select backfill materials up to pavement base or subgrade.
   2. For water lines 24 inches in diameter and larger, backfill with suitable on-site material (random backfill) up to 12 inches below pavement base or
subgrade. Place minimum of 12 inches of select backfill below pavement base or subgrade.

C. For sewer pipes (Storm and Sanitary), use backfill materials described by trench limits. For “trench zone backfill” under pavement and to within one foot back of curb, use cement stabilized sand for pipes of nominal sizes 36 inches in diameter and smaller to level 12 inches below the pavement. For sewer pipes 42 inches in diameter and larger, under pavement or natural ground, backfill from 12 inches above top of pipe to 12 inches below pavement with suitable on-site material or select backfill. Use select backfill for rigid pavements or flexible base material for asphalt pavements for 12-inch backfill directly under pavement. For backfill materials reference Section 02320 - Utility Backfill Materials. This provision does not apply where a Storm Sewer is constructed of HDPE pipe.

D. For Storm Sewers constructed of HDPE pipe and installed under pavement provide flowable fill as specified in Section 02322 Flowable Fill. For Storm Sewers constructed of HDPE pipe and not installed under pavement provide cement stabilized sand.

E. Where damage to completed pipe installation work is likely to result from withdrawal of sheeting, leave sheeting in place. Cut off sheeting 1.5 feet or more above crown of pipe. Remove trench supports within 5 feet from ground surface.

F. Unless otherwise shown on Drawings. Use one of the following trench zone backfills under pavement and to within one foot of edge of pavement. Place trench zone backfill in lifts and compact. Fully compact each lift before placement of next lift.

1. Class I, II, or III or combination thereof:
   a. Place in maximum 12-inch thick loose layers.
   b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 698.
   c. Moisture content within zero percent to 5 percent above optimum determined according to ASTM D 698, unless otherwise approved by Project Manager.

2. Cement-Stabilized Sand:
   a. Maximum lift thickness determined by Contractor to achieve uniform placement and required compaction, but do not exceed 12 inches.
   b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 558.
c. Moisture content on dry side of optimum determined according to ASTM D 558 but sufficient for cement hydration.

3. Class IVA and IVB (Clay Soils):
   a. Place in maximum 8-inch thick loose lifts.
   b. Compaction by vibratory Sheepfoot roller to minimum of 95 percent of maximum dry density determined according to ASTM D 698.
   c. Moisture content within zero percent to 5 percent above optimum determined according to ASTM D 698, unless approved by Project Manager.

G. Unless otherwise shown on Drawings, for trench excavations not under pavement, random backfill of suitable material may be used in trench zone. This provision does not apply to HDPE storm sewers.
   1. Fat clays (CH) may be used as trench zone backfill outside paved areas at Contractor’s option. When required density is not achieved, at any additional cost to City, rework, dry out, use lime stabilization or other approved methods to achieve compaction requirements, or use different suitable material.
   3. Compact to minimum of 90 percent of maximum dry density determined according to ASTM D 698.
   4. Moisture content as necessary to achieve density.

H. For electric conduits, remove form work used for construction of conduits before placing trench zone backfill.

3.10 MANHOLES, JUNCTION BOXES AND OTHER PIPELINE STRUCTURES

A. Below paved areas or where shown on Drawings, encapsulate manhole with cement stabilized sand; minimum of 2 foot below base, minimum 2 foot around walls, up to pavement subgrade or natural ground. Compact in accordance with Paragraph 3.09.F.2 of this Section.

B. In unpaved areas, use select fill for backfill. Existing material that qualifies as select material may be used, unless indicated otherwise on Drawings. Deposit
backfill in uniform layers and compact each layer as specified. Maintain backfill material at no less than 2 percent below nor more than 5 percent above optimum moisture content, unless otherwise approved by Project Manager. Place fill material in uniform 8-inch maximum loose layers. Compact fill to at least 95 percent of maximum Standard Proctor Density according to ASTM D 698.

C. For LDWL projects, encapsulate manhole with cement stabilized sand; minimum of 1 foot below base, minimum of 2 feet around walls, up to within 12 inches of pavement subgrade or natural ground. For manholes over water line, extend encapsulation to bottom of trench. Compact in accordance with Paragraph 3.09 F.2 of this Section.

3.11 FIELD QUALITY CONTROL

A. Test for material source qualifications as defined in Section 02320 - Utility Backfill Materials.

B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to METRO.

C. Tests will be performed on minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is noticeable change in material gradation or plasticity, or when requested by Project Manager.

D. At least three tests for moisture-density relationships will be performed initially for backfill materials in accordance with ASTM D 698, and for cement-stabilized sand in accordance with ASTM D 558. Perform additional moisture-density relationship tests once a month or whenever there is noticeable change in material gradation or plasticity.

E. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at following frequencies and conditions.

   1. For open cut construction projects and auger pits: Unless otherwise approved by Project Manager, successful compaction to be measured by one test per 40 linear feet measured along pipe for compacted embedment and two tests per 40 linear feet measured along pipe for compacted trench zone backfill material. Length of auger pits to be measured to arrive at 40 linear feet.

   2. A minimum of three density tests for each full shift of Work.

   3. Density tests will be distributed among placement areas. Placement areas are: foundation, bedding, haunching, initial backfill and trench zone.
4. The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.

5. Density tests may be performed at various depths below fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.

6. Two verification tests will be performed adjacent to in-place tests showing density less than acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.

7. Recompacted placement will be retested at same frequency as first test series, including verification tests.

8. Identify elevation of test with respect to natural ground or pavement.

F. Recondition, re-compact, and retest at Contractor's expense if tests indicate Work does not meet specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at Contractor's expense.

G. Acceptability of crushed rock compaction will be determined by inspection.

3.12 STANDARD PRACTICE

A. The Contractor shall furnish skilled labor, instrument platforms, ladders, temporary structures and lighting necessary for making and maintaining points and lines in connection with the required surveys.

PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

A. No separate measurement or payment will be made for the items in this specification. All costs will be considered incidental to the total contract bid amount.

END OF SECTION 02317
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction of foundations consisting of reinforced concrete drilled shafts.

1.02 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit work plan for each structure with complete written description which identifies details of proposed method of construction and sequence of operations for construction relative to drilled shaft activities. Descriptions, with supporting illustrations, shall be sufficiently detailed to demonstrate to Project Manager that procedures meet requirements of Specifications and Drawings.

C. Submit project record documents under provisions of Section 01785 - Project Record Documents. Record locations of drilled shafts, as installed referenced to survey benchmarks. Include location of utilities encountered or rerouted. Give horizontal dimensions, elevations, inverts and gradients.

1.03 REFERENCE STANDARDS


B. TxDOT Standard Specification Item 416 - Drilled Shaft Foundations
PART 2  P R O D U C T S

2.01  EQUIPMENT
   A. Perform excavation with equipment suitable for achieving requirements of this Specification.

2.02  MATERIAL
   A. For cast-in-place concrete, use Class A concrete. Refer to Section 03310 - Structural Concrete.
   B. For reinforcing steel, refer to Section 03211 - Reinforcing Steel

PART 3  E X E C U T I O N

3.01  PREPARATION
   A. Conduct an inspection to determine condition and locations of existing structures and other permanent installations, prior to commencing work.

3.02  EXCAVATION
   A. Perform excavation required for drilled cylindrical shafts, at locations shown on Drawings through whatever materials encountered, to dimensions and elevations shown or required by site conditions. When satisfactory material is not encountered at plan depth, bottom of shaft will be adjusted or foundation altered, as determined by Project Manager, to satisfactorily comply with design requirements.
   B. Do not make shaft excavations within 3 shaft diameters (edge to edge) of shafts which have been concreted within previous 24 hours.
   C. Inspect drilled shaft excavations for verticality and side sloughing. Verticality is specified at one inch in 10 feet of shaft length. Check to full depth of dry auguring prior to introducing drilling mud. Straighten or add suitable reinforcing steel to shafts not meeting specified tolerance.
   D. Slurry is to contain 4 to 8 percent by weight of bentonite additive and satisfy slurry specifications set forth in ACI 336.1, Section 2.3.5.2e. These requirements are more stringent than TxDOT Standard Specification Item 416.3.1. Stricter slurry specifications are required to assure suspension of detritus from drilling operations, and to ensure adequate cleaning of slurry prior to concreting. Cleaning of slurry is important to prevent deposition of detritus on reinforcement cages and ensure that inclusions of detritus will not be formed within concrete mass.
E. At final bearing elevation, clean bottom of each shaft and remove seepage water for examination by Project Manager before reinforcing steel and concrete is placed. Suitable access and lighting for proper inspection of completed excavation is to be provided. Reinforcing steel and concrete is to be placed in drilled shaft without delay after approval of excavation by Project Manager.

3.03 DRILLED SHAFT CONSTRUCTION

A. Drilled shaft construction and installation is to follow TxDOT Standard Specification Item 416 (with exceptions noted below) and ACI 336.1.

B. Before placing concrete, clean out shaft bottom with drilling bucket in order to remove sediments which may not be displaced by concrete. Clean shaft bottom with "clean-out" bucket until rotation on bottom without crowd (i.e., penetration under force) produces little spoil. Probing after cleaning out is essential to verify condition of base of shaft.

C. Concrete is to conform to requirements of ACI 336.1 Section 2.3.5.5.

D. Concrete is to be placed continuously in shaft to construction joint indicated on Drawings or as directed in TxDOT Standard Specification Item 416.3.3. Concrete is to be placed through suitable tube or tremie to prevent segregation of materials. Tremie pipe diameter is to be at least 8 times as large as largest concrete aggregate size.

E. Computation of final concrete volume for each shaft is to be made. Core and check the integrity of shafts taking an unreasonably high or low volume of concrete.

F. If caving soil conditions or excessive groundwater is encountered, use of temporary casing is permitted to prevent caving of material around shaft and to control seepage of groundwater into excavation.

G. Casing material is to be metal of ample strength to withstand handling stresses, pressure of concrete and of surrounding earth or backfill materials and is to be water-tight. Casing shall be smooth, clean and free of accumulations of hardened concrete. Outside diameter of casing is not to be less than specified diameter of drilled shaft.

H. Elapsed time is not to exceed one hour from beginning of concrete placement in cased portion of shaft, until extraction of casing is begun.

I. Withdraw temporary casings as shaft is filled with concrete, or immediately following concreting operation. Bottom of casing is to always remain at least one foot below level of concrete during placement to overcome hydrostatic pressure. Smoothly extract casing with vibratory hammer. Casing extraction is to be at slow,
uniform rate with pull in line with vertical axis of shaft. Leave no casing in place.

J. If upward movement of concrete or reinforcing steel occurs inside casing at beginning of pulling operation or at anytime during pulling, stop pulling immediately and leave casing in place.

K. If casing must be left in place, Project Manager is to be informed to determine shaft capacity calculations.

3.04 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01450 - Testing Laboratory Services.

3.05 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with requirements of Section 01504 - Temporary Facilities and Control or Section 01576 - Waste Material Disposal.

PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

A. No separate measurement or payment will be made for the items in this specification. All costs associated with this work will be considered incidental to Section 02582.

END OF SECTION 02465
SECTION 02581

STREET LIGHTING CONDUIT

PART 1  GENERAL

1.01  SECTION INCLUDES

A.  Pull box and conduit installation for electrical service to thoroughfare street lights.

1.02  REFERENCES


PART 2  PRODUCTS

2.01  MATERIALS

A.  HL&P furnished material:

1.  Materials Specifications in Paragraph 3.0 of HL&P Specifications Number 007-371-08.

B.  Provide following material:

1.  Materials specified in Paragraphs 7, 8, and 9 of HL&P Specifications number 007-371-08.

PART 3  EXECUTION

3.01  EXAMINATION

A.  Verify lines and grades are correct. Determine if existing underground utilities or other obstructions may conflict with conduit installation shown on Drawings. Notify Project Manager of potential conflicts.

3.02  PREPARATION

A.  Order pull boxes and warning tape from HL&P Customer Relations Representative three working days in advance of need. Verify requirements for "driveway" pull boxes for concrete areas subject to vehicular traffic and confirm total number of pull boxes required with HL&P Customer Relations Representative.
B. Obtain HL&P furnished materials Tuesday through Friday, excluding holidays, from Street Light Office at Magnolia Park Service Center, 104 North Greenwood, Houston.

3.03 INSTALLATION

A. Notify HL&P street lighting Engineer at least 2 working days in advance of scheduled conduit installation.

B. Install conduit in accordance with Paragraphs 7 through 9 and drawings pages 9 through 12 of HL&P Specification Number 700-371-08.

3.04 QUALITY CONTROL

A. Correct nonconforming conduit and pull box installations and obtain written notification from inspector that installation meets HL&P requirements.

B. Forward one copy of notification to HL&P Customer Relations Representative.

3.05 PROTECTION

A. Protect conduits and pull holes from damage or blockage until street light and circuit installation by HL&P.

B. Clear blockage in conduits prior to HL&P circuit installation.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. STREET LIGHTING CONDUITS shall be measured per Linear Foot at the locations indicated on the drawings and the measurement shall include all equipment, labor and materials required to provide a complete and serviceable installation.

4.2 PAYMENT

B. The work performed and the materials furnished as prescribed by this item and measured as provided under "MEASUREMENT" shall be paid for at the contract unit price bid for each item as presented in the bid form for "Traffic Lighting Conduits" or "Extra Work Items". The unit price bid for each item shall be full compensation for furnishing and placing all materials, and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work in accordance with the drawings and specifications.
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Steel traffic signal pole assemblies, including anchor bolts and foundation.

1.2 REFERENCES

1.3 A. Reference standards applicable to this section:

A. AASHTO: American Association of State Highway Transportation Officials
   1. LTS-1: Structural Supports for Highway Signs, Luminaires and Traffic Signals

B. AISC: American Institute of Steel Construction

C. AISI: American Iron and Steel Institute

D. ASTM: American Society for Testing Materials
   1. A36: Structural Steel
   2. A123: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   3. A153: Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   4. A325: High Strength Bolts for Structural Steel Joints
   5. A501: Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
   6. A563: Carbon and Alloy Steel Nuts
   7. A570: Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
   8. A572: High Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality
   9. A595: Steel Tubes, Low-Carbon, Tapered for Structural Use

E. F1554: Hooked, headed and threaded anchor rods
PART 2 PRODUCTS

2.1 MATERIALS

A. All items shall be new materials of the latest product in production to the commercial trade, and shall be of the highest quality as to materials used and workmanship. The manufacturer of these items shall be experienced in design and construction of such items and shall furnish evidence of having supplied similar items, which have been in successful operation, for not less than three (3) years.

2.2 SILENCE OF SPECIFICATIONS

A. The apparent silence of these specifications as to any detail, or the apparent omission from it of a detailed description concerning any point, shall be regarded as meaning that only the best commercial practice shall prevail and that only material and workmanship of the finest quality shall be used. All interpretations of these specifications shall be made on the basis of this statement.

2.3 TRAFFIC SIGNAL POLE ASSEMBLIES

A. The traffic signal poles shall be designed in accordance with the 1994 edition of the AASHTO standard specifications.

B. Anchorage: Included with each pole shall be a minimum of four steel anchor bolts, complete with double hex nuts, lock washers and flat washers. Nuts, washers and threaded areas of anchor bolts shall be hot-dip galvanized to ASTM - A153. Anchor bolts shall meet the requirements of ASTM F1554, Gr. 55. An anchor bolt template shall be included with each pole assembly.

C. Wind Resistance: Entire pole and arm assembly to be rated to withstand AASHTO requirements for 90 mile per hour wind.

D. Welds: All welds shall meet the requirements of AWS D1.1.

E. Material Certification: Material certifications shall be provided for all ASTM numbers referred to in this specification.

F. Complete design drawings and complete technical data must be submitted for approval to the City of Houston prior to starting fabrication. Shop drawings shall be signed and sealed by a Registered Professional Engineer.

G. The pole unit and all materials used in its manufacture shall meet the requirements of the American Association of State Highway and Transportation Officials (AASHTO), specifically LTS-1: Standard Specifications of Structural Supports for Highway Signs, Luminaries and Traffic Signals.
H. Pole shaft and arms shall be circular in cross-section with no transverse joints or welds and no more than one (1) longitudinal welds per pole or arm. Refer to the standard drawings for exact sizes on the pole diameters. They shall be uniform in cross-section and shall uniformly taper from the pole shaft to the end of the arm. The end of the arm shall be at a height above the pavement, as detailed on the standard drawing, with design vertical loadings, when installed on the pole.

2.4 POLE SHAFT

A. The pole shaft for the Type 1 poles shall be fabricated from a minimum of 3-gauge (0.2391 inch) hot rolled commercial steel. The shaft shall have only one (1) longitudinal, automatically, electrically welded joint, and shall have no intermediate horizontal joints nor welds. After forming and welding, the tapered shaft shall be longitudinally cold rolled over a hardened steel mandrel under sufficient hydraulic pressure to flatten the weld and increase the physical characteristics of the shaft. The shaft shall meet the chemical and physical properties of ASTM-A595 GR. A, having a minimum yield strength of 55,000 psi. Only one (1) length of steel sheet shall be used, which shall be formed into a continuously tapered shaft, having a taper of approximately 0.14 inch per foot.

B. The pole shaft for the Type 2 poles shall be fabricated from a minimum 0.375 inch hot rolled commercial steel. The shaft shall have only one (1) longitudinal, automatically, electrically welded joint, and shall have no intermediate horizontal joints nor welds. The shaft shall meet the chemical and physical properties of ASTM-A572 GR. 55, having a minimum yield strength of 55,000 psi. Only one (1) length of steel sheet shall be used, which shall be formed into a continuously tapered shaft, having a taper of approximately 0.14 inch per foot.

C. The base plate shall conform to ASTM-A36 or ASTM A572 steel. It shall telescope the shaft and be attached by means of two continuous welds, one on the inside of the base at the end of the shaft, the other on the outside at the top of base. The base plate shall be arranged to accept four (4) 2-1/4 inch diameter anchor bolts on an 18 inch bolt circle.

D. The pole shaft shall be furnished with a reinforced handhole frame with steel cover and a 1/2 inch - 13 UNC grounding provision. Dimensions shall be as shown on the detail drawings.

E. Each pole shaft shall include a steel pole plate welded to shaft for the mast arm connection. It shall be arranged to accept four (4) connecting bolts. Pole plate material shall conform to the requirements of ASTM-A36 or ASTM A572 Grade 50 steel.

F. As required, each pole shall be provided with an ornamental pole top. The final shaped pole top shall be mechanically attached to the top of the shaft to provide access for wiring signals secured by a J-hook wire support; also provided. Pole top material shall conform to the requirements of AA-319.OF aluminum.
G. The pole shaft shall be drilled in the field at required signal locations.

2.5 MAST ARM

A. The mast arm shall be fabricated from a minimum 7-gauge (0.179 inch) hot rolled commercial steel in accordance with ASTM A595 Grade A and shall have a yield of not less than 55,000 psi. It shall be fabricated and formed into a round shape as required, using the same cold rolling process as the pole shaft and shall have the same physical properties and yield strength. Arm dimensions shall be equivalent in strength for the loads shown in the plans.

B. Mast arm shall be a straight flange plate mounted style and shall include a steel arm plate with four (4) connecting bolts. Arm plate material shall conform to the requirements of ASTM-A36 or ASTM A572 Grade 42 steel. Bolts shall be internally mounted to pole plate and meet the requirements of ASTM-A325.

C. A slip joint shall be permissible for arms forty (40) feet and greater in length. The slip joint shall be made in the shop but may be match marked and shipped disassembled. An automatic submerged arc process shall weld pole shaft and arm. Pole and arm diameters shall be uniform at any cross-section and shall be reasonably straight.

D. Tenons for mounting the vehicle signal head assemblies shall be provided on the mast arm at locations required. Refer to the standard drawings for tenon details.

2.6 2.06 LUMINAIRE ARM

A. The luminaire arm shall be fabricated from 2-inch Schedule 80 pipe.

B. The length of the luminaire arm shall be as shown in the standard drawings or required in the plans.

C. The luminaire arm shall be connected to the pole shaft with simplex fittings, and in accordance with details shown on the standard drawings.

2.7 HOT-DIP GALVANIZING

A. Surface Preparation.

1. Prior to being incorporated into an assembled product, steel plates 3/4 inch or more in thickness may require blast cleaning to remove rolled-in mill scale, impurities, and non-metallic foreign materials. After assembly, all weld flux shall be mechanically removed.

2. The iron or steel product is degreased by immersion in an agitated 4.5%-6% concentrated caustic solution elevated to a temperature ranging from 150 to 190 degrees Fahrenheit. It is then pickled by immersion in a heated
A sulfuric acid solution of 6%-13% concentration, controlling the temperature between 150 and 190-degrees Fahrenheit. It is next rinsed clean from any residual effects of the caustic or acid solutions by immersion in a circulating fresh water bath.

3. Final preparation is done by immersion in a concentrated zinc ammonium chloride flux solution heated to 130-degrees Fahrenheit. The solution's acidity content is maintained between 4.5-5.0 pH. The assembly is air dried to remove any moisture remaining in the flux coat and/or trapped within the product.

B. Pole shaft and arm shall be hot-dip galvanized after fabrication in conformance with ASTM A123 requirements, with a minimum of two (2) ounces per square foot of galvanized coating.

C. All ancillary parts for pole structures shall be hot-dip galvanized after fabrication in conformance with ASTM A153 requirements. The galvanized coating shall be a minimum thickness of two (2) ounces per square foot. All threaded material shall be brushed or retapped after galvanizing. Fabricated products shall be free and clear of teardrop edges, flaking zinc, rough appearance, holes covered with zinc membrane, and similar unattractive finishes. In general, the complete product shall be smooth, clean and unscarred when delivered. Any part of the structures not meeting these requirements shall be rejected.

2.8 POWDER COATING OVER GALVANIZING

A. Surface Preparation. The pole shaft, arm and ancillary parts shall be prepared in accordance with the hot-dip galvanizing requirements of Part 2.06 in this section.

B. Top Coat. All galvanized exterior surfaces visually exposed are to be coated with a Urethane or Triglycidyl Isocyanurate (TGIC) Polyester Powder to a minimum film thickness of 2.0 mils. The galvanized exterior should be etched, preheated, then powder coated. The coating shall be electrostatically applied and cured in a gas-fired convection oven by heating the steel substrate to a minimum of 350-degrees Fahrenheit and a maximum of 400-degrees Fahrenheit.

C. Packaging. In order to protect the finish during transportation, a wrapping of 3/16" U.V. inhibited plastic-backed packing foam must be applied prior to shipment of small poles. Larger poles are cradled in a 1-inch rubberized foam base. A nylon ripcord shall be placed beneath the wrapping the entire length of the pole for removal of the wrapping without the use of knives or any other sharp instrument that may damage the painted surface.
2.9 COLOR
A. Propose pole and mast arm shall be painted with the color listed in Table 1 below.

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Pole</th>
<th>Mast Arm</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main at Leeland</td>
<td>C</td>
<td>Yes</td>
<td>Match METRO OCS poles</td>
</tr>
<tr>
<td>Main at Bell</td>
<td>Existing</td>
<td>Yes</td>
<td>RAL 8012 RED BROWN</td>
</tr>
<tr>
<td>Main at Clay</td>
<td>C</td>
<td>Yes</td>
<td>RAL 6009 FIR GREEN</td>
</tr>
<tr>
<td>Main at Polk</td>
<td>C</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Main at Lamar</td>
<td>Existing</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Main at McKinney</td>
<td>Existing</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Main at Walker</td>
<td>C</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Main at Texas</td>
<td>C</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Main at Prairie</td>
<td>C</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Main at Preston</td>
<td>C</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Main at Congress</td>
<td>C</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Main at Franklin</td>
<td>C</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

2.10 SUBMITTALS
A. Conform to requirements of Section 01330 - Submittal Procedures.
B. Submit certified testing results and certificates of compliance.

PART 3 - MEASUREMENT AND PAYMENT

3.1 MEASUREMENT
A. TRAFFIC SIGNAL POLE ASSEMBLIES (with foundation) shall be measured by each and shall include all equipment, labor and material required to provide a complete and serviceable installation.
B. MAST ARM shall be measured by each and shall include all equipment, labor and material required to provide a complete and serviceable installation.

3.2 PAYMENT
A. The work performed and the materials furnished as prescribed by this item and measured as provided under “MEASUREMENTS” shall be paid for at the contract unit price bid for each item as presented in the bid form for “TRAFFIC SIGNAL POLE ASSEMBLIES (STEEL)” or “Extra Work Items”. The unit price bid for each item shall be full compensation for furnishing and placing all materials, and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work in accordance with the drawings and specifications.
Section 02590

STREETLIGHT LUMINAIRES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Traffic Signal Pole Luminaire
B. Major Thoroughfare Luminaire
C. Collector Street Luminaire
D. Local Street Luminaire

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for luminaires will be measured by each luminaire type.

2. Payment for the work performed and materials furnished in accordance with this specification will be paid for at the unit price bid for "Traffic Signal Pole Luminaire", "Major thoroughfare Luminaire", "Collector Street Luminaire", or "Local Street Luminaire".

1.3 REFERENCES

A. The approved luminaires shall meet the standards referenced below:

1. American National Standards Institute (ANSI) - The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by their basic designation only. Versions listed shall be superseded by updated versions as they become available.

   
   b. C82.77-2002 (or latest), American National Standard for Harmonic Emission Limits - Related Power Quality Requirements for Lighting Equipment
c. 36.2-2014 (or latest), American National Standard for Roadway and Area Lighting Equipment - Dielectric Withstand and Electrical Immunity Requirements

d. C136.10-2010 (or latest), American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles- Physical and Electrical Interchangeability and Testing

e. C136.15-2011 (or latest), American National Standard for Roadway and Area Lighting Equipment - Luminaire Field Identification


g. C136.25-2013 (or latest), American National Standard for Roadway and Area Lighting Equipment - Ingress Protection (Resistance to Dust, Solid Objects and Moisture) for Luminaire Enclosures

h. C136.31-2010 (or latest), American National Standard for Roadway Lighting Equipment - Luminaire Vibration


j. C136.41-2013 (or latest), American National Standard for Roadway and Area Lighting Equipment-Dimming Control Between an External Locking Type Photocontrol and Ballast or Driver
PART 2  PRODUCTS

2.1  The type of luminaire fixtures, and contact information, to be used within this project is listed in Table 1 below.

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Fixture Type</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main at Leeland</td>
<td>Phillips Roadstar GPLM-64L700NW-G2-R3M-UNV-[SRD-001]-PHXL-RCD7-SP2-TLRSR-002-NP</td>
<td>For Phillips Fixtures: CW Lighting &amp; Associates 2937 Overview Drive New Braunfels, TX 78132 David J. Schoch, LC, IESNA 817-637-2979, <a href="mailto:dschoch@cwlighting.com">dschoch@cwlighting.com</a> For Arm (SH12-31 Constellation Mounting Arm) for Phillips Fixtures: S &amp; H Manufacturing 7215 Avenue N, Houston, TX 77011 713-926-8805</td>
</tr>
<tr>
<td>Main at Clay</td>
<td>Phillips Roadstar GPLM-64L700NW-G2-R3M-UNV-[SRD-001]-PHXL-RCD7-SP2-TLRSR-002-NP</td>
<td>StressCrete Group Luke van Vliet 800-268-7809, x-223 <a href="mailto:lukeavanvliet@hotmail.com">lukeavanvliet@hotmail.com</a></td>
</tr>
<tr>
<td>Main at Prairie</td>
<td>Houstonian (See Plan Set &quot;METRO ICON POLE DETAILS&quot; sheet for details)</td>
<td>StressCrete Group Luke van Vliet 800-268-7809, x-223 <a href="mailto:lukeavanvliet@hotmail.com">lukeavanvliet@hotmail.com</a></td>
</tr>
</tbody>
</table>

2.2  MATERIALS

A. All items shall be new materials of the latest product in production to the commercial trade, and shall be of the highest quality as to materials used and workmanship. The manufacturer of these items shall be experienced in design and construction of such items and shall furnish evidence of having supplied similar items, which have been in successful operation, for not less than ten (10) years.
2.3 SILENCE OF SPECIFICATIONS

A. The apparent silence of these specifications as to any detail, or the apparent omission from it of a detailed description concerning any point, shall be regarded as meaning that only the best commercial practice shall prevail and that only material and workmanship of the finest quality shall be used. All interpretations of these specifications shall be made on the basis of this statement.

2.4 LUMINAIRE HOUSING

A. Luminaire shall have cobra head style/shape/aesthetic. An internal bubble level shall be provided with mounting provisions that permit ±5° leveling in 2.5° increments. Color shall be gray.

B. Luminaire finish shall exceed a rating of 6 per ASTM D1654 after 1000 hours & 1500 hours, and shall meet or exceed a rating of 6 after 3000 hours, testing per ASTM B117, surpasses ANSI C136.37. The coating shall exhibit no greater than 30% reduction of gloss per ASTM D523, after 500 hours of QUV testing at ASTM G154 Cycle 6.

C. Vibration shall meet ANSI C136.31, Level 2 (bridge/overpass, 3G)

D. QR Code Label: Luminaire shall be equipped with a unique QR label that is visible on the outside of the luminaire. The QR label shall be supported by a dedicated smartphone app. App shall be able to access detailed product specific information as well as mounting instructions. The QR code label app shall enable product registration on site, after installation, and record GPS location of installed fixture, installed location photo and provision for additional information. Additionally, app shall provide diagnostic support and enable identification of the specific spare parts available for repairs.

2.5 ELECTRICAL, ELECTRONIC DRIVERS AND LED MODULES

A. Luminaire shall have Luminaire Useful Life of 94,500+ hours to 100,000+ hours based on ISMT in-situ thermal testing per UL 1598, LED driver data, LED light source(s) LM-80 and TM-21 data, and system reliability tool data. Luminaire shall start and operate in -40°C to +40°C temperature range.

B. Electronic driver must be able to dim 0-10 volts and operate per the following line voltages noted for each application. All electrical components must be RoHS compliant.

- Traffic Signal Pole Luminaire - 120-277V
- Major Thoroughfare Luminaire - 480V
- Collector Street Luminaire - 120-277V
- Local Street Luminaire - 120-277V
C. LED module shall be composed of distinct, individual high performance LEDs, **No Chip on Board will be accepted.** LED light source(s) shall have **no wire bond**, which prevents open circuit failures in the LED light source(s) and enhances long-term reliability and useful life. If individual LED(s) fail, they shall fail short keeping the rest of the LED light source and the entire LED luminaire operating. LED light engines must be IP66 sealed, UV stabilized surpassing ANSI C136.37. LEDs shall be tested by ISO 17025-2005 accredited lab in accordance with IESNA LM-80 guidelines in compliance with EPA ENERGY STAR, extrapolations in accordance with IESNA TM-21.
D. PERFORMANCE REQUIREMENTS:

TRAFFIC SIGNAL POLE LUMINAIRE:
Luminaire shall have a maximum weight of 12.3 pounds and a maximum effective projected area of 0.523 square feet. Light output must exceed 12,750 lumens with distribution Type III. System wattage must not exceed 106 watts. Color temperature as per ANSI/NEMA bin Neutral White, 4000 Kelvin nominal (3985K +/- 275K or 3710 to 4260K), CRI 70 Minimum. Lumen maintenance shall be 94% minimum of initial output at 60,000 hours operation. BUG Rating shall be B3-U0-G2.

MAJOR THOROUGHFARE LUMINAIRE:
Luminaire shall have a maximum weight of 12.3 pounds and a maximum effective projected area of 0.523 square feet. Light output must exceed 12,750 lumens with distribution Type II. System wattage must not exceed 106 watts. Color temperature as per ANSI/NEMA bin Neutral White, 4000 Kelvin nominal (3985K +/- 275K or 3710 to 4260K), CRI 70 Minimum. Lumen maintenance shall be 94% minimum of initial output at 60,000 hours operation. BUG Rating shall be B3-U0-G2.

COLLECTOR STREET LUMINAIRE:
Luminaire shall have a maximum weight of 12.3 pounds and a maximum effective projected area of 0.523 square feet. Light output must exceed 8,500 lumens with distribution Type II. System wattage must not exceed 75 watts. Color temperature as per ANSI/NEMA bin Neutral White, 4000 Kelvin nominal (3985K +/- 275K or 3710 to 4260K), CRI 70 Minimum. Lumen maintenance shall be 94% minimum of initial output at 60,000 hours operation. BUG Rating shall be B2-U0-G2.

LOCAL STREET LUMINAIRE:
Luminaire shall have a maximum weight of 9.4 pounds and a maximum effective projected area of 0.520 square feet. Light output must exceed 4,950 lumens with distribution Type II. System wattage must not exceed 45 watts. Color temperature as per ANSI/NEMA bin Warm White, 3000 Kelvin nominal (3045K +/- 175K or 2870 to 3220K), CRI 70 Minimum. Lumen maintenance shall be 94% minimum of initial output at 60,000 hours operation. BUG Rating shall be B1-U0-G1.

E. Surge Protection: Integral surge protector tested in accordance with ANSI/IEEE C62.45 per ANSI/IEEE C62.41.2 Scenario 1 Category C High Exposure with elevated 20kV/20kA waveforms for line-ground, line neutral and neutral ground, and in accordance with U.S. Department of Energy & Municipal Solid-State Street Lighting Consortium model specification for LED roadway luminaires electrical
immunity requirements for High Test Level 10kV/10kA.

F. Controls: Provide 7 pin receptacle with photoelectric cell, twist-lock type, "fail on", extended life, input voltage of 120-277 VAC or 480 VAC to match Luminaire driver voltage rating. Operating range 50/60 Hz. Max rated load of 1000W/1800VA. Integrated standard surge protection of 640J. Rated for operation in an ambient temperature of -40°C/-40°F up to +70°C/+158°F. 10-year limited warranty from supplier.

G. Warranty: Luminaire shall come with a 10-year warranty on product and finish.

2.6 SUBMITTALS

A. The Contractor shall furnish six (6) copies of luminaire submittal package to the CITY OF HOUSTON. Submittal package shall include luminaire cut sheet, LED light source cut sheet, LED driver cut sheet, surge protective device cut sheet, LM-79 luminaire photometric report with photometric file in LM-63 format, LM-80 data, ISTMT report, energy star TM-21 calculator, 3G vibration test, UL1598 certification and warranty.

END OF SECTION 02590
SECTION 02780
CLAY UNIT PAVERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the requirement for providing and installing clay unit pavers, setting bed, and base as indicated on drawings and specified herein.

B. This section specifies the requirement for removing, cleaning, and palletizing existing clay unit pavers for reuse as indicated on drawings and specified herein.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price

B. Payment for clay unit pavers, setting bed and base is on a unit price basis for each square foot of concrete unit paver surface installed. Surface preparation, concrete base, filter fabric, and bedding and joint sand are included in the unit price for the installation of clay unit pavers.

C. Payment for removing, cleaning, and palletizing existing clay unit pavers is on a square foot basis.

1.3 SUBMITTALS

A. Submit five (5) samples of each shape and color of clay unit pavers, showing extreme range of color and texture.

B. Submit sieve analysis for grading of bedding and joint sand.

C. Submit test results for compliance of paving unit requirements to ASTM C936 from an independent testing laboratory.

1.4 QUALITY ASSURANCE

A. Installation shall be by an installer with at least three years experience in placing clay unit pavers.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver clay pavers to the site in steel banded, plastic banded, or plastic wrapped cubes capable of transfer by fork lift or clamp lift. Unload pavers at job site in such a manner that no damage occurs to the product.

B. Sand shall be covered with waterproof covering to prevent exposure to rainfall or removal by wind. The covering shall be secured in place.
C. Unused pavers shall be palletized and provided to the Owner. A quantity approximately equal to 1% of the total project area should be provided.

D. During paver removal, remove pavers by hand and clean them of mortar, grout, or sand. Protect pavers at work site from theft, breakage, and damage. Store pavers on site in secure, locked area.

1.6 JOB CONDITIONS

A. Do not install sand or pavers during heavy rain or snowfall.

B. Do not install frozen sand.

C. Protect partially completed paving against weather damage when work is not in progress.

D. Provide temporary barricades and warning lights as required for protection of project work and public safety.

1.7 PROJECT GUARANTEE

A. Finished area shall be free from bumps or depressions, evenly graded to levels shown, and shall be guaranteed against defects of materials and workmanship for a period of one year after date of Substantial Completion.

1.8 MOCK-UPS

A. Contractor shall provide, for approval by Owners Representative, a mock-up of each type of unit paver pattern specified. These are to be approved by Project Manager prior to commencement of whole pattern.

B. Mock-ups shall remain on the jobsite for the duration of the project unless otherwise directed by Project Manager.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Pacific Clay Products, available through Upchurch Kimbrough - Telephone number 832-655-3563.

B. Or approved equal.

2.2 MATERIALS

A. Clay unit pavers
   1. Light duty paving brick shall meet requirements of ASTM C902, Class SX, Type II.
   2. Heavy-traffic paving shall meet requirements of ASTM C2272.
   3. Provide brick without frogs or cores in surfaces exposed to view in the completed work.
4. The paver type, color, and pattern shall be as indicated on plans.

5. When reusing existing pavers, replace pavers, which become damaged or cracked with new pavers that match existing pavers. Remove damaged pavers from site. Provide replacement pavers that match existing pavers in dimension, durability, and color.

B. Bedding and Joint Sand

1. Sand shall be washed sharp and containing not more than 3 percent silt or clay and meeting the sieve analysis gradation listed below and conforming to ASTM C33 Standard Specification for Concrete Aggregates.

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<tr>
<th>Sieve</th>
<th>Percent Passing</th>
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<td>3/8&quot;</td>
<td>100</td>
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<tr>
<td>No. 4</td>
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<td>No. 8</td>
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<table>
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<tr>
<th>Sieve</th>
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<td>No. 100</td>
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2. Limestone screening, stone dust, and masonry sand is not acceptable.

3. Joint Sand: HP polymeric sand or approved equal.

C. Edge restraint in some cases shall be a concrete band with a footer as shown on the drawings. Edge restraint at most areas shall consist of mortaring edge pavers in place as shown on the drawings. Refer to Section 04810 – Stone Unit Paving for materials and installation of mortared edge pavers.

D. Soil Separator or Filter Fabric shall be Polyspun XL Soil Separator; heavy duty, non-woven, with permeability minimum 275 gallons of water per min. per square foot.

E. Temporary Protective Coating: Precoat exposed surfaces of clay pavers with a temporary protective coating that is compatible with brick, mortar, and grout products.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine work in place on which this work is dependent. Notify Contract Administrator of defects or deficiencies of work in place by others. Do not proceed with work until unsatisfactory conditions have been corrected or resolved upon written notification. Commencement shall be construed as work in place being acceptable for satisfying the requirements of this section.

B. Verify that base is dry, uniform, even and ready to support sand, pavers and imposed loads.
C. Verify correctness of gradients and elevations of base.

D. Verify location, type, installation and elevations of edge restraints around the perimeter area to be paved.

3.2 PREPARATION

A. Protect adjacent work from damage, soiling, or staining during paving operations.

3.3 SAND SETTING BED INSTALLATION

A. Spread the sand evenly over the base and screed to 1 inch uncompacted thickness.

B. Sand bed must be of uniform thickness and moisture content, smooth, and without low spots. Do not disturb or compact screeded sand.

C. Do not use bedding sand as a leveling course or to correct deviations in the base course.

3.4 PAVER INSTALLATION

A. Install edge restraint where no restraint such as concrete band, wall, or building exists.

B. Lay the pavers in the pattern(s) that matches the existing pattern as closely as possible, or pattern as indicated on plans. Maintain straight pattern lines.

C. Joints between the pavers shall be between 1/16 inch to 1/8 inch wide.

D. Fill gaps at the edges of the paved area with cut pavers or edge units.

E. Cut pavers with a masonry saw.

F. Use a low amplitude, high frequency plate vibrator capable of 3000 to 5000 lbs. centrifugal compaction force to vibrate the pavers into the sand.

G. Vibrate the pavers, sweeping dry sand into the joints and vibrating until they are full. This will require at least two or three passes with the vibrator. Do not vibrate within three feet of the unrestrained edges of the paving units.

H. All work to within three feet of the laying face must be left fully compacted with sand-filled points at the completion of each day.

I. Sweep off excess sand when the job is complete.

J. The final surface elevations shall not deviate more than 3/8 inch under a 10 foot long straightedge.

K. The surface elevation of pavers shall be 1/8 to 1/4 inch above adjacent drainage inlets,
concrete collars or channels.

L. Pavers over Waterproofing: Exercise care in placing pavers and setting materials over waterproofing so protection materials are not displaced and waterproofing is not punctured or otherwise damaged.

1. Provide joint filler at waterproofing that is turned up on vertical surfaces unless otherwise indicated; where unfilled joints are indicated, provide temporary filler or protection until paver installation is complete.

M. Tolerances: Do not exceed 1/16-inch (1.6-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.

3.5 CLEANING

A. At completion of work, remove rubbish, debris, dirt, equipment and excess material from site. Clean adjoining surfaces, which are soiled by the course of the work. Sweep unit paver surface clean.

B. Wash the pavers using a power washer with a fan spray. Hold sprayer 30 inches from pavers and move across pavers in a sweeping motion until all surface dirt has been removed from pavers.

3.6 ATTIC STOCK

A. Unused pavers shall be palletized and provided to the Owner. A quantity approximately equal to 1% of the total project area for each color, size, and type of paver should be provided to the Owner for attic stock.

END OF SECTION 02780
SECTION 02893

TRAFFIC SIGNAL CONSTRUCTION

PART 1  GENERAL

1.01  SECTION INCLUDES

A. This specification consists of the requirements to construct traffic signals in the City of Houston.

1.02  SPECIAL REQUIREMENTS

The requirements of this contract encompass the construction of new traffic signal installations either installed 1.) concurrent with the street or roadway improvement phases of the work so that the signals will be in operation at the time the intersection is open to traffic, or 2.) as traffic signal or traffic signal related improvements.

The purpose and intent of this specification is for the Contractor to furnish all labor, materials, tools, equipment, tests, adjustments and all other incidentals necessary to install and/or modify a traffic signal system. The Contractor shall also install items furnished by the City of Houston, specified herein. All materials and equipment furnished for installation under this contract shall be new and unused, unless otherwise specified. Contractor shall furnish and install or install materials as specified herein.

All bidders shall visit the job site prior to bidding in order to acquaint themselves with all job site conditions and problems, if any, and all other factors that may affect the bid on all project specific contracts. On work order type projects, all bidders shall thoroughly familiarize themselves with City of Houston requirements and general field conditions. Any discrepancy between drawings and specifications shall be resolved prior to bidding.

These specifications together with the reference Drawings and Contract Documents require the furnishings of all superintendence, labor, tools, equipment and apparatus necessary for the complete working system of the traffic signal installation(s). All submittals need to be pre-approved prior to the job and by the inspector as directed by the Engineer and/or the approved City of Houston Representative.

Email Traffic Signal Engineering and Operations, (citytrafficprojmgr@houstontranstar.org) for coordination and inspection of traffic signal work. Contractor is required to notify daily activities to City...
Traffic Signal Inspector via email
(citytrafficinspector@houstontranstar.org) before 7:30 A.M.

All control equipment shall confirm to ITE and NEMA specifications and in accordance with the drawings and specifications.

All construction will be in accordance with the Texas Manual on Uniform Traffic Control Devices, latest revisions, and in accordance with the drawings and specifications.

All wiring throughout each traffic signal installation shall be in strict accordance with the National Electric Code, all local applicable codes and shall also comply with all requirements of CenterPoint Energy, in order that service may be obtained from them. All costs for code compliance are to be included in the bid for this contract.

1.03 REFERENCES

A. References: References to known standard specifications in the Specification shall mean and intend latest edition of such specification adopted and published at date of invitation to submit Proposals.

B. Reference to technical society, organization or body is made in Specifications in accordance with the following abbreviations:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AASHO</td>
<td>American Association of State Highway Officials</td>
</tr>
<tr>
<td>ACI</td>
<td>American Concrete Institute</td>
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<tr>
<td>* AIEE</td>
<td>American Institute of Electrical Engineers</td>
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<tr>
<td>AISC</td>
<td>American Institute of Steel Construction</td>
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<tr>
<td>AISI</td>
<td>American Iron and Steel Institute</td>
</tr>
<tr>
<td>ASA</td>
<td>American Standards Association</td>
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<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
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<tr>
<td>AWSC</td>
<td>American Welding Society Code</td>
</tr>
<tr>
<td>FS</td>
<td>Federal Specification</td>
</tr>
<tr>
<td>IMSA</td>
<td>International Municipal Signal Association</td>
</tr>
<tr>
<td>IPCEA</td>
<td>Insulated Power Cable Engineers Association</td>
</tr>
<tr>
<td>ITE</td>
<td>Institute of Traffic Engineers</td>
</tr>
<tr>
<td>MUTCD</td>
<td>Manual on Uniform Traffic Control Devices for Streets and Highways</td>
</tr>
<tr>
<td>NBFU</td>
<td>National Board of Fire Underwriters</td>
</tr>
<tr>
<td>NBS</td>
<td>National Bureau of Standards</td>
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</table>
1.04 PERMITS, LAWS, CODES, ETC.

The contractor and subcontractors shall comply with all Federal, State and local Laws, Codes and Ordinances applicable to the work and all requirements of the National board of Fire Underwriters having jurisdiction. If the above laws, codes or ordinances conflict with specification, then the laws, codes or ordinances shall govern except where Specification exceeds them in quality of quantity of materials or labor. Obtain and pay for all permits required in connection with the execution of the work as required. The Engineer and/or the approved City of Houston Representative shall be furnished with certified copies of these permits if requested.

1.05 COOPERATION WITH BUILDING OFFICIALS

Cooperate with local and other governmental officials and inspectors at all times. If such official or inspector deems special inspection necessary, provide assistance and facilities that will expedite their inspection. Any materials and or workmanship which are rejected by the Traffic Signal Inspector by reason of failure to conform to the requirements of the drawings or specifications, shall be removed and replaced by the contractor at their own expense.

1.06 SUBSTITUTIONS

A. Except in special instances, the Technical Sections of these specifications list more than one manufacturer of the products specified. Products of listed manufacturers conform basically to design and performance requirements as indicated on the Drawings and specified herein and Contractor in proposing their use shall indicate by detail drawings and/or descriptive data any modifications of items or assemblies necessary to provide the indicated and/or specified work.

B. Requests for substitutions of materials must be submitted in writing to the Engineer and/or the approved City of Houston Representative by the Contractor. These substitutions will only be considered if fewer than three manufacturers are listed in the Specifications.

C. Under no circumstances will the Engineer and/or the approved City of Houston Representative be required to provide that a product proposed for substitution is, or is not, of equal quality to the product specified. It is mandatory that the
Contractor submit to the Engineer and/or the approved City of Houston Representative, in Writing, all evidence necessary to support this contention that the item proposed for substitution is equal to the item indicated by the Contract Documents. Items submitted for substitution must be submitted one month prior to bid opening.

1.08 MANUFACTURER’S SPECIFICATION AND INSTRUCTIONS

Install all manufactured items, materials and equipment in strict accordance with the manufacturer’s recommended specifications except that the Specifications herein, where more stringent, shall be complied with.

1.09 MEASUREMENTS

Before doing any work or ordering any materials, the Contractor and Subcontractors shall verify all measurements of existing and new work and shall be responsible for their correctness. Any difference which may be found shall be submitted to the Engineer and/or the approved City of Houston Representative for consideration before proceeding with the work. No extra compensation will be allowed because of differences between actual dimensions and measurements indicated on the drawings.

1.10 RECORD DRAWINGS

Provide and maintain in proper order and in good, clean condition at the project sites, one complete set of prints of all project drawings. On this set of drawings, the Contractor shall neatly print and accurately inscribe, in red pencil, any and all changes or deviations from construction and installation as originally indicated in the plans and specifications. This set of prints shall be delivered to City of Houston Traffic Management and Maintenance at TranStar Third Floor, 6922 Old Kay Road, at the time of final acceptance of the work by the City in order to provide the City with an “AS BUILT” set of plans.

1.11 TEMPORARY FACILITIES

A. Weather Protection

1. Contractor shall at all times provide protection against weather, so as to maintain all work, materials, apparatus, and fixtures free from injury and damages. At the end of the day’s work, all new work likely to be damaged shall be covered or otherwise protected.

2. Wet work shall not be performed when temperature is below 40° F, or is likely to go below 40° F, within the ensuing 48 hours, except when sufficient protective heat is provided and the Engineer’s and/or the approved City of Houston Representative’s approval in writing is obtained.
3. Contractor shall construct and maintain all necessary temporary drainage and do all pumping necessary to keep excavations, pits and trenches free of water.

B. Operation of Equipment

When electrical or other equipment is installed, it shall be the responsibility of the Contractor to check out same for a period of time as required by the Engineer and/or the approved City of Houston Representative for proper testing of the equipment. All items of equipment, testing instruments and incidentals necessary for proper testing of equipment shall be furnished by Contractor.

C. When any temporary facility is no longer needed for the proper conduct of the work as determined by the Engineer and/or the approved City of Houston Representative, the Contractor shall completely remove it from the project and shall repair or replace all material, equipment and finished surfaces damaged in doing so.

D. Contractor shall provide a portable toilet as needed.

1.12 PROTECTION

Provide barricades, fences, lights, etc., for protection of property and the public as required by local and/or State Ordinances. Contractor will be held liable for all damage to property and/or persons.

A. All barricades and signs shall conform to Texas MUTCD. Such barricades and protective signs shall be provided by the Contractor at their expense.

B. Flow of traffic shall not be interrupted completely without the approval of the Engineer and/or the approved City of Houston Representative. Restriction and minor diversion will be kept to a minimum. No work will be permitted in the traffic lanes during peak hours from **7:00 to 9:00 AM and 4:00 to 6:00 PM Monday through Friday.** Any open cuts in the intersections during these hours will be covered with steel plates to maintain uninterrupted traffic.

C. Flagmen shall be certified flagmen or off-duty uniformed peace officers of the law. Contractor shall provide flagmen to direct traffic when directed by the Area Engineer and/or the approved City of Houston Representative of the Traffic Management and Maintenance Division. This does not relieve Contractor of responsibility of taking other steps and providing other personnel who he may deem necessary for protection of work and public.
D. Appropriate Personal Protective Equipment shall be worn by all contract personnel when on the job-site.

1.13 RESTORING DAMAGED AREAS

For all work at identified intersections and along communication cable routing, in the event that sidewalks, pavements, curbs, wheelchair ramps, driveways, landscaped areas, areas with special pavement treatment, sprinkler systems, lighting systems, or other items or properties both public and private that are damaged during this construction, shall be restored to their prior condition without expense to the City of Houston. No separate payment will be made for the restoration of these items.

Where signal poles are installed inside the existing 4 foot sidewalk or within 12 inches of either side of the existing sidewalk, the Contractor shall provide a minimum of 4 foot paved sidewalk 12 inches away from edge of the signal pole. The horizontal slope for the sidewalk shall be 2 percent.

PART 2 PRODUCTS

2.01 MATERIALS

Contractor is responsible for furnishing all materials and labor for construction of items as shown on drawings and other incidentals necessary to provide a fully operational traffic control signal. The Contractor shall furnish and install all materials, with exception of materials to be provided by the City of Houston.

Material should be installed according to the technical specifications and standard details under the direction of the City of Houston representative assigned to the project.

In addition to all items to be furnished and installed by the Contractor, the Contractor shall furnish and install all items necessary for the complete signal system including but not limited to the following incidental materials:

All conduit nipples, couplings, grounding bushings, elbows, sweeps and service heads.
All reinforcing steel and ties.
Concrete, sand, cement, gravel, asphalt, earth fill.
Span guy, down guys, anchor rod assemblies.
Sidewalk guy assemblies (if necessary).
Guy guards, three bolts clamps, lag screws.
5/8” Thru-bolts, nuts, washers, thimble-eye nuts and bolts.
5/16” Stranded galvanized steel cable for guys and catenaries.
¼” Stranded galvanized steel cable for messengers.
Strand vises and links as needed.
Meter loop assemblies complete.
Signal mounting hardware.
Copper weld ground rods and clamps furnished and installed in all foundations and each pullbox.

Flexible stainless steel cable strap ties. Cable ties shall be Panduit Part #MLT 4H-LP or equivalent.
#6 or #8 Soft bare copper wire for grounding poles, conduits, etc.
Miscellaneous hardware.

Interconnect cable shall be communications grades as follows:
Type PE-38 or PE-22 (aerial)
Type PE-39 (underground)

All proposed changes in the signalization plan must be submitted to the City of Houston, in writing, for approval.

The Contractor shall be responsible for the protection of all present utilities that have been located by the various utility companies. They shall also maintain and protect the existing traffic signals and their related equipment from damage caused by subcontractors and employees under his Contract but only to the extent of the Contractor's normal work operation, and he shall not be responsible for routine maintenance, normal wear and tear, or an act of God, unless otherwise specified.

The contractor shall bag all newly installed signal heads and/or pedestrian signal heads with burlap until final inspection and acceptance by the City of Houston Representative. The signal shall be wrapped with burlap at least twice so that the entire signal head is covered, and cannot be seen until it is placed in operation. The signal shall be deenergized while not in use. If, in the opinion of the Engineer and/or the approved City of Houston Representative, the new heads would create a hazard condition to motorists and/or pedestrians, the heads shall not be installed until one hour before turning on the new equipment.

All existing traffic signal equipment removed by the Contractor shall be tagged to identify location. A representative of Traffic Signal Engineering and Operations shall be given 24 hour notice before delivery of an approval location by the Engineer and/or the approved City of Houston Representative. Equipment not identified will not be accepted and equipment not returned will result in the withholding of payment to the Contractor. Traffic Signal Engineering and Operations personnel will issue a receipt to Contractor for returned equipment.

When the City Traffic Engineer and/or the approved City of Houston Representative determines that the need for a traffic signal is critical to the public
welfare, early “turn on” of the signal shall be required before the completion of the project. If the need arises, the City of Houston will assume the responsibility for maintenance and liability, or negotiate with the Contractor for maintenance and liability for such a signal.

The City Traffic Engineer and/or the approved City of Houston Representative may, at any time, authorize City of Houston personnel to enter the controller cabinet in order to restore any and all signal equipment to proper operation if the malfunction or nonfunction of such equipment poses a hazard or inconvenience to motorists or pedestrians. Such authorized entry may occur at any time within the period of the Contract and such authorized entry shall in no way relieve the Contractor or manufacture of their respective warranties.

During the burn-in period, the Contractor shall restore operation of the installation within four (4) hours after notification of a malfunction. If the Contractor does not respond within four (4) hours, the City of Houston shall have the option of making the necessary repair and billing the Contractor for the actual time and materials required.

When replacing sidewalks or curb and gutters, it shall be the responsibility of the Contractor to reinstall them to match existing color and/or surface texture.

Materials specified herein shall be installed as per Traffic and Transportation Construction Details drawings-02893 series and the City of Houston Traffic Signal Standard Specifications.

The Contractor shall be responsible for having an authorized manufacturer representative of traffic control equipment present as per the requirements of Specification Section 01755, “STARTING SYSTEMS”. Each work order or intersection shall be a stand alone “Turn Key Job” by the Contractor.

A steel template of the proper dimensions shall be furnished and used by the Contractor to secure anchor bolts while constructing pole foundations.

Flexible stainless steel cable ties for strapping signal cable to messenger shall be min: 13.38 inches long, 120 lb. min. tensile holding strength, 3/16” to 3-1/2” wire bundle range. (Panduit Part #MLT 4H-LP or approved equal).

2.02 PRECONSTRUCTION MEETING

The Traffic & Transportation Division for Traffic Signal Contracts shall schedule a Preconstruction Meeting at TranStar after award of contract and prior to commencement of construction. The Contractor or his authorized representative will be required to attend.
For roadway contracts, the preconstruction meeting for the traffic signal work shall be coordinated by the roadway project manager.

2.03 MATERIALS FURNISHED BY THE CITY

Prior to material pick up, a written notice is required sixty (60) calendar days in advance. This letter shall be addressed to:

City of Houston - Traffic Signal Engineering & Operations
Traffic & Transportation Division
6922 Old Katy Road (Houston TranStar)
Houston, Texas 77024
Materials furnished by the City shall be picked up by the Contractor at the Traffic Operations Center, 2200 Patterson Street, Houston, Texas 77007, after giving a minimum of two (2) working days notice to the City of Houston by emailing to: (citytrafficprojmgr@houstontranstar.org). This is in addition to the written requirements listed above. These materials will be furnished at no cost to the Contractor.

Any and all material furnished by the City to the Contractor which is not used in this contract is the property of the City of Houston and shall be returned to the locations specified by the Traffic Signal Inspector before final payment is made to the contractor.

2.04 PRODUCT DATA, SHOP DRAWINGS, AND SAMPLES

Contractor shall provide three (3) complete bound sets of Product Data, including: illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate materials or equipment for all Contractor furnished equipment.

Contractor shall furnish shop drawings, as required in the standard specifications and standard details, or as required by the Engineer and/or the approved City of Houston Representative. As a minimum, Contractor shall be required to furnish shop drawings for all structural elements, including cabinets, traffic signal poles, traffic signal arms, luminaires, luminaire supports, vehicular traffic signal head mounts, and pedestrian signal head mounts prior to ordering or fabricating these elements. Shop drawing submittals are required for each of the preceding elements. Contractor is not required to furnish shop drawings for any equipment furnished by the City of Houston.

Contractor shall furnish samples, or prototypes, of the following equipment within the specified time frame.
PART 3 EXECUTION

3.01 OPERATION OF NEW & EXISTING TRAFFIC SIGNALS DURING CONTRACT PERIOD

To facilitate construction, the Contractor shall be required to install temporary poles, guys, cables, signals, conduits, wiring and adjustments as needed for temporary traffic signal operation during construction. The Contractor will be responsible for furnishing and installing all materials as directed by the City of Houston Signal Inspector for temporary traffic signal installation. The Contractor shall contact the signal inspector assigned to the project with a daily progress report. The Contractor shall coordinate and obtain approval from the City of Houston signal inspector for all material as well as the configuration of the temporary traffic signal prior to installation. Proposed configurations and materials for the temporary traffic signal installation shall be submitted to the City of Houston Traffic Signal Engineering and Operations no less than five (5) working days prior to implementation. Operational timing and phasing of the temporary traffic signal installation during construction will be the responsibility of the City of Houston Traffic Management & Maintenance Branch personnel. Temporary traffic signal work will not be paid for directly, but shall be considered incidental to Traffic Control during construction. All temporary facilities shall be removed as directed by the signal inspector and remain the property of the Contractor upon operation of the new traffic signal construction.

The Contractor shall maintain existing signal installation(s) operation during construction of the new signal system. The Contractor may be required to photograph the existing signal to document existing status and functionality of all signal hardware and devices before beginning construction. It is the Contractor’s responsibility to maintain all existing signal hardware and devices including signal heads and bulbs, interconnect, pedestrian elements, etc. The Contractor will not be responsible for power consumption of the signal during construction, and for work with the controller or inside the cabinet unless a city representative is onsite or as directed otherwise by the City of Houston. The Contractor shall submit all existing intersection documentation to the city inspector for the project before commencing work. The Contractor shall respond within two (2) hours after notification from appropriate City of Houston personnel. If the Contractor does not respond, the City of Houston will make necessary repairs and bill the contractor at an overtime rate (1.5X) for work performed.
The Contractor shall provide a minimum of five (5) working days notice to City of Houston representative at 713-881-3172 when seeking approval for a change in location, method of operation of traffic signals or traffic lanes, or change in traffic patterns or timing plans.

The Contractor shall provide a minimum of two (2) days notice when seeking approval regarding the replacement of an existing traffic signal installation.

The Signal Contractor shall be billed for any repair work performed on overtime (1.5X) for any repairs required because of Contractor negligence.

Uniformed Police Officers shall be employed by the contractor and are required to be on the job site. It shall be mandatory to have Uniformed Police Officer(s) for traffic signal turn-ons. Certified flagmen or Uniformed Police Officers may be used, as needed, for lane closures. It is the Contractor’s responsibility to use the appropriate personnel for lane closures. The Texas Manual On Uniform Traffic Control Devices will be observed for all lane closures.

All work in this contract, requiring signal outages, or lane closures, shall be performed between the hours of 9:00 A.M. and 4:00 P.M. Monday through Friday, unless prior authorization has been obtained from the Engineer and/or the approved City of Houston Representative.

Down time, if any, shall be kept to an absolute minimum. The switch over from the old system, or signal turn-on, shall be accomplished within the six (6) hours between 9:00 A.M. and 3:00 P.M. Contractor shall furnish and install all temporary traffic control (stop signs, flagmen, uniformed officers, etc.) during any down time, in addition to all required construction signs. Contractor shall inform the city of Houston to schedule a turn-on date a minimum of 72 hours in advance of need.

The Contractor shall hire a traffic engineer approved by the City of Houston to implement the traffic signal timings for the temporary signal system(s) and any modifications to the traffic control plan.

The Contractor shall furnish the City of Houston with a 24-hour telephone number for the purpose of forwarding malfunction calls. In the event that the Contractor cannot be reached at the above mentioned number, the City of Houston will take the necessary action to restore the traffic signal system to normal operation and all expenses incurred will be deducted from the final payment of the work order. All City of Houston labor expense shall be billed at overtime (1.5X) rates.

Contractor will be required to respond immediately and to initiate emergency maintenance operations on the jobsite a maximum of four (4) hours after the call is received from City of Houston. The Contractor shall pursue repairs to the
traffic signal system and have it back in normal operation within a **maximum of six (6) hours** after call is received by the City of Houston, or a representative of the City of Houston.

3.02 CHARACTER OF WORKMEN AND EQUIPMENT

All equipment and workmen provided by the contractor for work hereunder shall be the best available for the kind of work being performed. Any person employed by the Contractor whom the City of Houston may deem temporarily or permanently incompetent or unfit to perform the work, shall under written instruction of the Engineer and/or the approved City of Houston Representative be removed from the job, and such person shall not again be employed on the work. Failure by the Contractor to provide adequate equipment may result in annulment of this contract as herein provided.

3.03 ELECTRICAL WORK

Electrical work is defined as installing cables, electrical terminations, and signal turn-ons. Installation of conduits is EXCLUDED from electrical work. Installation of loop wire in sawcut is EXCLUDED from electrical work.

All Contractor personnel working on City of Houston traffic signals performing duties directly involving setting up or installing signs, signals, pushbuttons, or traffic control shall be International Municipal Signal Association (IMSA) certified Level I, or greater. An IMSA certified Level II technician shall be present on site during all cabinet terminations and during the installation of all signs, pavement markings, signals, pushbuttons, and traffic control.

3.04 SALVAGED MATERIALS

At existing traffic signal installations which are to be updated or modernized by the Contractor, all abandoned wire, cable, signals, poles, pole bases, pole tops, mast arms, signs and other miscellaneous equipment shall be taken down and/or removed. All equipment shall be reduced to simplest form. These salvaged materials are the property of the City of Houston and are to be delivered and unloaded to the location or locations designated by the City of Houston Traffic Signal Inspector assigned to the project.

3.05 ELECTRICAL SERVICE

The Contractor shall notify the City of Houston Traffic Signal Inspector assigned to the project **within seven (7) days of Contractor award** for power at intersection.

3.06 SUBCONTRACTING
If a vendor subcontracts any portion of a contract for any reason, they must include, in writing, the name and address of the subcontractor, name of the person to be contacted including telephone number and extent of work to be performed. This information is to be submitted with bid proposal. In the event of a change during construction, Contractor is required to submit new information to the Engineer and/or the approved City of Houston Representative, for approval, five (5) days prior to using the subcontractor on the job. City of Houston reserves the right to reject a bid of any bidder if the bid names a subcontractor who has previously failed in the proper performance of an award or failed to deliver on time contracts of a similar nature, or who is not in a position to perform properly under this award. City of Houston reserves the right to make determination as to the foregoing.

3.07 SYSTEM GROUNDING

All poles, cabinets, conduits, signal common, and service common shall be bonded with a No. 8 AWG bare copper wire, or equal, to form a continuous system and effectively grounded to 5/8-inch x 8 foot copperweld ground rods.

3.08 STRANDED GALVANIZED STEEL CABLE

Guy, messenger and catenary wires shall be Siemens Martin Grade, seven strand, galvanized, high strength steel cable, 5/16 inch diameter for guy and catenary wires and ¼ inch diameter for messenger wires.

3.9 POLE RAKING

Poles shall be set with a sufficient amount of rake so that they are plumb with the signal load or slightly raked away from the signal load. Cantilever pole structures and 4-1/2" OD steel poles should be plumb, strain poles should have a slight backward rake (1 to 2 inches); wood poles shall utilize down guys to maintain appropriate signal height clearance during construction. The Contractor shall rake the poles to the satisfaction of the Traffic Signal Inspector.

Rake is hereby defined as the inclination to the vertical measured at the top of the structure in the opposite direction of the strain axis.

3.10 ABANDONED FOUNDATIONS

The tops of unused foundations shall be removed to a depth of two feet (minimum) below grade and back-filled according to specifications.
3.11 LOADS AND STRESSES DUE TO CONSTRUCTION OPERATIONS

Contractor shall have full responsibility for preventing over-stresses of any structure, cables, poles or any part of them during construction. This also applies to existing work facilities affected by his operations. The Contractor shall fully check the effect of his operations in this regard, and shall provide temporary supports and connections required to assure safety and stability of both new and existing work to prevent over-stress of any part thereof.

3.12 APPARATUS LOCATION

The locations of all poles, controllers, actuators and signals shown on the plans are diagrammatic only. The specific locations of such devices shall be decided by the appropriate design personnel and shall be staked out under their direction. Vehicular and pedestrian traffic signals shall be placed and aligned as the City of Houston Traffic Signal Inspector directs.

3.13 CONCRETE POUR

The time of day of the concrete pour shall be stipulated by the Contractor.

3.14 SEQUENCE OF WORK

Each new signalized intersection shall be in operable condition including electrical service within fourteen (14) days after the first signal pole is installed, unless conditions caused by a paving contractor or roadway construction contractor prevents the completion of the intersection(s).

The order in which the intersections are to be completed may be specified by the Engineer and/or the approved City of Houston Representative and it shall be the sole responsibility of the Contractor to schedule and coordinate their work. All work shall be coordinated in such a manner as to prevent delays resulting from work to be performed by others and to complete his work within the specified time.

On the day when the intersection is to be turned on or its "Turn On" date, the Contractor will be given a “punch list” from the Signal Inspector for any items that need attention concerning the conditions of signal equipment. These items shall be completed within ten (10) days of the date on the “punch list” given to the contractor.

3.15 UTILITY COORDINATION

The Contractor shall contact the Lone Star Notification Center (713-223-4567, in Houston, 800-669-8344, outside Houston) 72 hours before commencing any work to locate any utility lines in the construction area. It is the Contractor’s
responsibility to physically locate any water and sewer lines and to adjust the location of any foundation(s), for approval by the City of Houston Traffic Signal Engineering and Operations.

3.16 UNDERGROUND UTILITIES

The exact location of underground utilities and pipelines is not certain. The Contractor shall contact the Utility Coordinating Committee (U.C.C.) to determine exact locations of underground utilities prior to drilling for foundations or any other work that might interfere with or damage present facilities. Contractor shall be responsible for keeping the transmittal number from the U.C.C. current during construction.

3.17 LOCAL CONDITIONS

The Contractor shall make any additional investigations he deems necessary to properly bid any and all work related thereto. No additional compensation will be made available to the Contractor for work arising from failure to examine the site and/or subsoil conditions. Staking of specific locations by the Engineer and/or the approved City of Houston Representative shall not remove the Contractor’s responsibility for any damage caused by the Contractor to any underground utility.

3.18 RIGHTS OF VARIOUS INTERESTS

Wherever work being done by the City’s forces or by any other Contractor is contiguous to work covered by this contract, the respective rights of the various interests involved shall be established by Engineer and/or the approved City of Houston Representative, to secure completion of the various portions of the work in general harmony.

3.19 TRENCHING

No trenching shall be allowed within five feet of a tree.

3.20 DIRECTIONAL DRILLING, BORE, AND JACK

No open cutting or trenching of streets, driveways and sidewalks shall be allowed without prior approval of the Engineer and/or the approved City of Houston Representative at each location. All conduit runs under streets, driveways or sidewalks shall be by directional drilling, bore, or jack. Water jetting methods shall not be accepted.
3.21 PUBLIC SAFETY AND CONVENIENCE

All work done under this contract shall be done in compliance with the Texas Manual on Uniform Traffic Control Devices (TMUTCD). Each operation shall be considered a work zone area and shall be treated in accordance with the TMUTCD.

The Contractor shall have a Certified Worksite Traffic Supervisor who will be responsible for initiating, installing, and maintaining all traffic control devices as described in the TMUTCD. The Worksite Traffic Supervisor shall have at least one (1) year of experience directly related to worksite traffic control in a supervisory or responsible capacity and shall be certified by the American Traffic Safety Services Association or International Municipal Signal Association. The Worksite Traffic Supervisor will be incidental to Maintenance of Traffic and will not be measured separately for payment.

The Worksite Traffic Supervisor shall be available on a twenty-four (24) hour day basis and shall review the project on a day to day basis as well as being involved in all changes to traffic control. The Worksite Traffic Supervisor shall have access to all equipment and materials needed to maintain traffic control and handle traffic related situations. The Worksite Traffic Supervisor shall insure that routine deficiencies are corrected with a twenty-four (24) hour period.

The Worksite Traffic Supervisor shall be available on the site within forty-five (45) minutes after notification of an emergency situation, prepared to positively respond to repair the work zone traffic control or to provide alternate traffic arrangements.

Failure of the Worksite Traffic Supervisor to comply with these provisions may be grounds for decertification or removal from the project or both. Failure to maintain a designated Worksite Traffic Signal Supervisor or failure to comply with these provisions will result in temporary suspension of all activities except traffic and such other activities deemed to be necessary for project maintenance and safety.

The Contractor shall at all times so conduct their work as to insure the least possible obstruction to normal pedestrian and vehicular traffic including access to all public and private properties during all stages of construction, and inconvenience to the general public and the residents in the vicinity of the work, and to insure the protection of persons and property, in a manner satisfactory to the City Engineer and/or the approved City of Houston Representative.

The Contractor shall provide all barricades and take all necessary precautions to protect buildings and personnel. All work shall be complete in every respect and
accomplished in a workmanlike manner and contractor shall provide for removal of all debris from City of Houston property.

The successful bidder shall at all times guard against damage or loss to the property of the City of Houston or of other vendors or contractors and shall be held responsible for replacing or repairing any such loss or damage. Any damage to landscaping in the work area, including sod shall be replaced at the Contractor’s expense.

Prior to closing any section of the project to traffic, the Contractor shall furnish, erect and maintain barricades and warning signs at and in the vicinity of all construction projects at all times, both day and night, during the construction period of the contract, and all such barricades and warning signs, shall be in conformance with the requirements of Part 6 Temporary Traffic Control of the Texas Manual on Uniform Traffic Control Devices and as shown on the drawings.

Unless otherwise set forth in these specifications, the Contractor shall receive no direct compensation for furnishing, erecting, and maintaining the necessary barricades, lights, flares, signs, or for any other incidentals necessary for the good and proper safety, convenience, and direction of traffic during the period prior to final inspection and acceptance by the City of Houston.

3.22 SPECIAL REQUIREMENTS

A. **A Steel Template** shall be furnished by and used by the Contractor to secure anchor bolts while constructing pole foundations.

B. **Pole Foundations** shall be capped where needed, in order to provide a smooth, flat, and level surface. Capping shall consist of a one (1) inch thick mortar cap prepared with a 1:3 sand-cement mortar ratio. The cap shall be steel trowel finished.

C. **Extra-length Concrete Pole Foundations** shall be provided when required by site conditions. Reinforcing steel shall be increased by the same length as the increase in foundation length. Rods shown on Foundation Details shall be increased as follows: Each extra foot of foundation shall require on additional foot of length for hooked rods and two additional turns for helix.

D. **All Special Foundations** shall be designated and approved by the appropriate design engineer and/or the approved City of Houston Representative.

E. **Sono Tube** shall be used when the City of Houston Traffic Signal Inspector deems it necessary.
F. Pedestrian Pole

The proposed pedestrian poles shall be 5-ft in height and shall be painted with the colors listed in the table below.

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Pedestrian Pole</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main at Lamar</td>
<td>D, E</td>
<td>Match METRO OCS poles</td>
</tr>
<tr>
<td>Main at McKinney</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Main at Walker</td>
<td>D, E, F</td>
<td></td>
</tr>
<tr>
<td>Main at Prairie</td>
<td>D, E</td>
<td>RAL 6009 FIR GREEN</td>
</tr>
<tr>
<td>Main at Preston</td>
<td>D, E, F</td>
<td></td>
</tr>
<tr>
<td>Main at Congress</td>
<td>D, E</td>
<td></td>
</tr>
</tbody>
</table>

3.23 CONCRETE FINISHING

Honeycombed surfaces or other defects shall be patched with mortar of the same consistency as the mortar from which the concrete is made. Such mortar shall be well trowelled and then floated to remove trowel marks.

A. Finish for Formed Surfaces After patching above specified, exposed formed surfaces shall be finished by removing form marks, fins and other projections.

B. Finish for Uniformed Surfaces
   1. Patches in streets, driveways and walks shall be finished to match adjacent surfaces.
   2. Surfaces not Otherwise Specified – Steel trowel finish.

3.24 CONCRETE CURING

Immediately after placing or finishing, concrete surfaces shall be protected against moisture loss for a minimum of seven (7) days. Wet earth, waterproof paper, vinyl sheets or cotton mats shall be placed over concrete during curing period in order to insure fulfillment of this requirement. Membrane curing method may be used except when concrete surfaces are to receive additional concrete or mortar, or are to be painted.

3.25 CONCRETE/PAVEMENT REPAIR

Repairs to concrete pavement shall be in accordance with Public Works Drawing Numbers 02902-01 and 02902-02 titled, “Pavement Repair Details for Street Cuts”, and Specification Section 02951, “Pavement Repair and Resurfacing”.

3.26 FLEXIBLE BASE PAVEMENT REPAIR
Repairs to flexible base pavement shall be made in accordance with Public Works Drawing Number 02902-01 titled, “Pavement Repair Details for Street Cuts”, and Specification Section 02951, “Pavement Repair and Resurfacing”.

3.27 TRAFFIC SIGNAL TESTING SERVICES

A. PROCEDURES

1. Selection:
   City of Houston shall employ an Independent Testing Laboratory to ensure Contract Document compliance.

2. Test Reports
   Testing laboratory will furnish reports to the Engineer, Structural Engineer, City of Houston and Contractor covering all of its determinations and all of its control services. Reports will show all data customarily listed by the laboratory in reporting such tests including daily reports on quantities and types of materials together with location in the project. Form of reports will be as approved by the Engineer and/or the approved City of Houston Representative.

3. Test Methods
   Tests and inspections will be conducted in accordance with the requirements of these Specifications or, if not herein specified in accordance with the latest standards of the American Society for Testing and Materials or other recognized authorities.

4. Contractor’s Responsibility
   (a) Cooperate with the testing laboratory and:
      (1) Make available, without cost, samples of all materials to be tested.
      (2) Furnish such normal labor as is necessary to obtain samples at the project and to assist in making slump tests and casting and curing cylinders.
      (3) Advise the laboratory of the identity of material sources and instruct these suppliers to allow inspections by the laboratory, and notify the laboratory sufficiently in advance of operations to allow for completion of initial tests and assignment of inspection personnel.
      (4) Contractor shall provide laboratory testing for each different concrete load.

   (b) Rejected Materials and/or Workmanship
      If, after initial tests have been performed, any materials and/or workmanship are rejected by the testing laboratory, Contractor shall (1) pay for any subsequent testing required for materials which have been rejected and/or replaced.
Any materials and/or workmanship which are rejected by the testing laboratory by reason of failure to conform to the requirements of the Drawings and/or Specifications, shall be removed and replaced with new acceptable materials by the Contractor at his own expense.

5. Additional Responsibility
   (a) The testing of all cable furnished shall be properly tested by the manufacturer and data submitted through the Contractor to the Engineer and/or the approved City of Houston Representative.
   (b) All cable furnished to the job site shall be properly tested on the reel use.

3.28 PRELIMINARY WORK

A. PROCEDURES
   1. City Requirements
      (a) City requirements relating to the work of this section shall be ascertained by the Contractor. Contractor shall comply with all such requirements, including those relating to continued maintenance until completion of the project.

         (1) If the City should require that certain portions of the work be performed by City personnel and equipment, all costs in connection therewith which are chargeable against the project shall be paid by the Contractor as an obligation of this Section.
         (2) If re-routing of vehicular and/or pedestrian traffic is necessary to complete work of this Contract, Contractor shall submit a copy of his proposed rerouting plan to the City and the Engineer and/or the approved City of Houston Representative for approval seventy-two (72) hours before proceeding with the work.
         (3) Re-installation and restoration of use of existing public and private installations, which are temporarily and/or permanently removed and/or relocated for work of this Contract, shall be performed as a part of the work of this Section.

   2. Existing Installations of City-Owned Property
      (a) Perform all work relative to removal, storage and/or protection of existing installations of street lights and signs, fire hydrants, manholes, and other existing installations in the way of project construction.
      (b) Provide and maintain approved temporary protection of existing installations until project completion and acceptance. Remove temporary protection when, and as, directed by the City.
(c) Existing facilities which are no longer required shall be disconnected as directed. Comply with the requirements of municipal agencies having jurisdiction over such work.

(d) Unless otherwise directed, all abandoned facilities shall be removed by Contractor and the holes and trenches filled with approved compacted fill.

3.29 GUARANTEES

All items installed under this specification, having a manufacturer’s guarantee shall be installed by or under the direction of the manufacturer or his certified agent, when so required to conform with the manufacturer’s guarantee, and all such manufacturer’s guarantees, warranties and bonds shall be forwarded to the City of Houston representative.

The Contractor, by accepting this contract, guarantees all workmanship, materials and equipment performed or furnished and installed under this specification for a period of one year from date of completion and shall, at their entire expense and within said term of guarantee, repair, replace or adjust all faulty, broken, or maladjusted materials and/or equipment furnished and installed under this specification, including lamp replacement.

PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

A. No separate measurement or payment will be made for the items in this specification. All costs associated with this work will be considered incidental to Section 02582, Section 016711, Section 016715 and Section 016720.

END OF SECTION 02893
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Section includes:

1. Tree root barriers; various depths and combinations may be required.
2. Tree trunk protectors.
4. Staking and guying materials.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for root barrier shall be on a linear foot basis for height noted.
2. Payment for tree trunk protector, water barriers and staking material shall be on a linear foot basis for height noted.
3. Refer to Section 01270-Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). When Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. Standards of the following as referenced:


1.4 DEFINITIONS

A. Terms:
1. Tree root barrier: Mechanical barrier and root deflector to prevent tree roots from damaging hardscapes and landscapes.

2. Tree trunk protector: Material to protect young tree trunks from rodents, string trimmers, and lawn mowers.

3. Water barriers:
   a. Controls run-off, preventing hardscape damage.
   b. Prevents irrigation water from percolating under pavement.
   c. Water corral for planting areas preventing pavement damage and saves water.
   d. Prevents snow, ice, and saltwater run-off from polluting planting areas adjacent to roadways and parking areas.
   e. Liner to separate golf greens and turf.
   f. Bamboo control.

1.5 SUBMITTALS

A. Product data: Manufacturers standard literature defining materials for use on this Project.

B. Shop drawings:
   1. Indicate locations and extent for tree root barrier material.
   2. Indicate trees receiving tree trunk protectors.
   3. Indicate locations and extent of water barriers.
   4. Indicate trees and plants to be staked and guyed.

C. Samples; if required by Architect:
   1. Tree root barrier: One full length panel.
   2. Tree trunk protector: One unit.
   3. Water barrier: One lineal foot of material.

D. Quality control submittals; manufacturer’s instructions: Complete.
installation instructions for each item specified; may be combined with product data.

1.6 QUALITY ASSURANCE

A. Qualifications; manufacturer: Minimum 20 years experience in tree and plant protection and accessories.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping: Provide materials in original unopened containers with manufacturer's labels intact and legible.

B. Acceptance at site:

1. Damaged materials determined by visual inspection will not be accepted.
2. Remove rejected materials from Project site immediately.

C. Storage and protection: Store materials in dry area in manufacturer's protective packaging; in original containers with labels and instruction instructions intact.

PART 2 PRODUCTS

2.1 MATERIALS

A. Acceptable manufacturers:

1. Products of manufacturers meeting indicated standards and specified material properties are acceptable for use, subject to approval of product list and samples.

B. Basic Material Properties of Tree Root Barriers

<table>
<thead>
<tr>
<th>Material and Thickness</th>
<th>ASTM Test Method</th>
<th>Homopolymer Polyethylene Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Stress Yield</td>
<td>D638</td>
<td>3800</td>
</tr>
<tr>
<td>Elongation at Break %</td>
<td>D638</td>
<td>10%</td>
</tr>
<tr>
<td>Tensile Modulus</td>
<td>D638</td>
<td>155,000</td>
</tr>
<tr>
<td>Notched Izod Impact</td>
<td>D256A</td>
<td>0.4 - 0.4</td>
</tr>
<tr>
<td>Flexural Modulus 73 PSI</td>
<td>0790</td>
<td>145,000</td>
</tr>
<tr>
<td>Hardness Shore</td>
<td>D2240</td>
<td>P66</td>
</tr>
</tbody>
</table>

2.2 MANUFACTURED UNITS
A. Tree root barriers:
   a) Shall be produced 12" - 48" depth.
   b) Material: 0.080" wall thickness, nominal, injection molded 50% post-consumer recycled polypropylene panels with UV inhibitors.
   c) Panel Specifics:
      1. 7/16" Wide integral molded 0.08" thickness double top edge with stiffening ribs; bottom edge attached to vertical root deflecting ribs.
      2. Integral molded 0.080" thickness by 2" deep vertical root directing ribs spaced at 6.0" O.C.
      3. Integral molded 0.080" thickness by 2" long by 3/8" wide horizontal anti-lift ground lock tabs; minimum three per panel.
   d) Preassembled joiner system for panel connection to adjacent panel.
   e) Refer to standard details for root barrier installation.

B. Tree trunk protectors:
   1. Material: 0.060" thickness polyethylene with UV inhibitors, recyclable.
   2. Size: 9" high by single length accommodating tree up to 4" dia.
   3. Larger trees indicated for protection: Couple two or more sections together.

C. Water barriers:
   2. Material: 0.030" 0.040" thickness High Density Polyethylene (HPDE).
   3. Sizes: 24", 30", and 36" wide by 300'-0" rolls.
   5. Sealant: Silicone type recommended by water barrier manufacturer for certain applications; applications requiring sealant indicated in manufacturers product data.

D. Staking and guying materials:
   1. Material: Flat, woven polypropylene; 900 lb. break strength.
   2. Size: wide by manufacturers standard roll lengths.

2.3 ACCESSORIES
   A. Provide related materials for complete installation of specified materials.
3.1 EXAMINATION

A. Verification of conditions:

1. Verify other work in other sections, in, at, and around landscaping work is complete to extent that no damage will occur to newly planted materials or, any possible construction related damage will be minimal and replacement plant material is readily available for planting at no additional cost.

2. Obtain verification, in writing, from work required in other Sections directly involving work in this Section regarding correct grades have been provided, coordination of topsoil spreading, and lawns and grasses planting.

3. The contractor shall fulfill the responsibilities below prior to beginning work. Failure to do so will require removal or replanting work in this section.
   a. Provide written notification to Architect of unacceptable conditions
   b. Receive verification of written notice

3.2 PREPARATION

A. Surface protection: Use methods necessary to prevent damage to completed site work performed in other Sections. Protect access to and areas around planted materials. Restore damaged areas to original compaction, grades, and lines; repair damaged grassed areas.

3.3 INSTALLATION

A. Tree root barriers: Install in accord with manufacturers reviewed installation instructions where indicated on reviewed shop drawings with vertical root directing ribs facing inwards towards trees or plants; connect panels together as required.

B. Tree trunk protectors:

1. Install in accord with manufacturers reviewed installation instructions where indicated on reviewed shop drawings.
2. Join two or more segments together for trees over 4" dia.

C. Water barriers:

1. Install where indicated on reviewed shop drawings in accord with
manufacturers reviewed installation instructions using material widths required for conditions encountered.

2. Seal to hardscape surfaces with specified sealant.

1. Join material lengths with manufacturers sealing tape.

B. Staking and guying materials:

1. Immediately after planting, guy and stake designated trees and large plants.

2. Include tightening of guying materials to bring trees and plants to upright position.

END OF SECTION 02912
SECTION 04810

STONE UNIT PAVERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Stone pavers set in mortar setting beds.
   2. Porcelain pavers set in mortar setting bed.
   3. Stone landscape edge set in mortar setting bed.
   4. Stone cobbles in mortar setting bed.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price

   1. Payment for stone unit pavers and cobbles, mortar setting bed and concrete base is on a unit price basis for each square foot of stone and porcelain unit paver surface installed. Surface preparation, concrete base, and mortar

1.3 SUBMITTALS

3  Product Data: For materials other than water and aggregates.

4  Samples for stone and porcelain pavers. Provide 2 stones of each size & color specified.

5  Samples for stone cobbles. Provide 2 stones of each type & color specified.

1.4 QUALITY ASSURANCE

4  The Contractor is responsible for correction of work which does not conform to the specified requirements, including strength, tolerances and colors. Correct deficient materials as directed by the Owner.

5  Installer: a firm with a minimum of (3) three years experience in the successful installation of similar pavers in similar quantities. Firm must provide Owner a list of jobs completed which can be inspected by Owner or Project Manager. A minimum of 2 of these completed jobs must be located in the area similar to this job.

1.5 WARRANTY

A. Warrant the work specified herein for 1 year against becoming unserviceable or causing an objectionable appearance resulting from either defective or non conforming materials and workmanship.

1.6 PRODUCT HANDLING

A. Stone pavers shall be delivered and unloaded at jobsite on pallets and bound in shrink wrap plastics covers to prevent rust staining from steel strapping and in such a manner that no damage occurs to product during hauling, handling or unloading at the jobsite.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Stone Unit Paver manufacturer varies per each sign location. Contractor is to match existing sidewalk finishes in material color, size, texture and pattern at each sign, based on sign type and foundation.

2.2 MORTAR SETTING-BED MATERIALS

A. Portland Cement: ASTM C 150, Type I or II.
B. Hydrated Lime: ASTM C 207, Type S.
C. Sand: ASTM C 144.
D. Latex Additive: Water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by manufacturer for use with field-mixed portland cement mortar bed, and not containing a retarder.
E. Water: Potable.

2.3 MORTAR AND GROUT MIXES

2 General: Comply with referenced standards and with manufacturers' written instructions. Discard mortars and grout if they have reached their initial set before being used.
3 Mortar-Bed Bond Coat: Mix neat cement or cement and sand with latex additive to a creamy consistency.
5 Latex-Modified, Portland Cement Setting-Bed Mortar: Comply with written instructions of latex-additive manufacturer to produce stiff mixture with a moist surface when bed is ready to receive pavers.
6 Latex-Modified, Portland Cement Slurry Bond Coat: Mix portland cement, sand, and latex additive to comply with written instructions of latex-additive manufacturer.
7 Polymer-Modified Grout Mix: Proportion and mix grout ingredients according to grout manufacturer's written instructions.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Mix stone pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
B. Cut stone pavers with motor-driven masonry saw equipment to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible.
C. Joint Pattern: As indicated.

D. Tolerances: Do not exceed 1/16-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches and 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.

E. Expansion and Control Joints: Provide foam filler as backing for sealant-filled joints. Install joint filler before setting pavers. Sealant materials and installation are specified in Division 07 Section "Joint Sealants."

F. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

3.2 MORTAR SETTING-BED APPLICATIONS

A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

B. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing setting bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch thickness for bond coat.

C. Apply mortar bed over bond coat immediately after applying bond coat. Spread and screed to subgrade elevations required for accurate setting of pavers to finished grades indicated.

D. Mix and place only that amount of mortar that can be covered with pavers before initial set. Cut back and discard setting-bed material that has reached initial set before placing pavers.

E. Wet brick pavers before laying if the initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

F. Place pavers before initial set of cement occurs. Immediately before placing pavers, apply uniform 1/16-inch-thick, slurry bond coat to bed or to back of each paver.

G. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.

H. Spaced Joint Widths: Provide 3/8-inch nominal joint width with variations not exceeding plus or minus 1/16 inch.

I. Grout joints as soon as possible after initial set of setting bed.

1. Force grout into joints, taking care not to smear grout on adjoining surfaces.

2. Tool exposed joints slightly concave when thumbprint hard.

J. Cure grout by maintaining in a damp condition for seven days, unless otherwise recommended by grout or liquid-latex manufacturer.

K. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.

1. Remove temporary protective coating from brick pavers as recommended by
3.3 ATTIC STOCK

A. Unused pavers shall be palletized and provided to the Owner. A quantity approximately equal to 1% of the total project area for each color, size, and type of paver should be provided to the Owner for attic stock.

END OF SECTION 04810
SECTION 16709
COMMUNICATIONS CONDUIT

PART 1  GENERAL

1.01  SECTION INCLUDES

A.  Communications conduit with inner ducts.

PART 2  PRODUCTS

2.01  MATERIALS

Provide new materials that comply with the details shown on the plans and the requirements of this specification.

A.  High Density Polyethylene (HDPE) Conduit

Conduit for fiber optic cable shall be Schedule 80 HDPE conduit having a 4 inch internal diameter. The outer HDPE conduit provides a shell of high tensile and compression strength. The outer conduit is orange in color. Conduit shall terminate without bends if possible. Bends shall be rigid steel conduit having a minimum radius of 10 times the nominal diameter of the conduit (30 degree maximum bends - 90 degree bends are prohibited unless approved by City of Houston Engineers). The exterior of the steel bends shall be double wrapped with 10-mil PVC tape.

HDPE conduit shall be joined by solvent-weld method in accordance with the conduit manufacturer’s recommendation. No reducer couplings shall be used unless specifically indicated on the drawings.

All riser conduit shall be Rigid Metal Conduit.

B.  Inner duct

All HDPE Conduit shall be installed with four (4) one inch (1”) polyethylene inner ducts. These inner ducts shall be smooth on both the inside and outside to facilitate pulling the inner duct into the conduit and pulling future fiber optic cable into the inner duct. Each inn duct has a designated purpose and shall be provided in each of the following colors:
blue (City traffic operations)
yellow (public safety)
red (City IT) green (other)
A minimum of one foot of the inner duct shall extend beyond the end of the conduit inside of the communications service box. All inner duct shall have 1,250 lb. pull tape.

C. Marking Tape / Posts

Underground marking tape will be used in all areas where trenching is utilized to install underground conduit. Use marking tape in conjunction with marking posts and marking discs.

The technical specifications of underground marking tape are identified below, along with applicable testing methods necessary to establish that a cable submitted for approval meets these specifications.

<table>
<thead>
<tr>
<th>TEST PROPERTY</th>
<th>THRESHOLD SPECIFICATION</th>
<th>REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Weight</td>
<td>ASTM D2103</td>
<td>20 lbs/100 feet</td>
</tr>
<tr>
<td>Thickness – Overall</td>
<td>ASTM D210</td>
<td>4 mil</td>
</tr>
<tr>
<td>3 in. Tensile Break – MD</td>
<td>ASTM D882</td>
<td>35 lbs/ft</td>
</tr>
<tr>
<td>3 in. Tensile Strength – MD</td>
<td>ASTM D882</td>
<td>4 kpsi</td>
</tr>
<tr>
<td>3 in. Tensile Break – TD</td>
<td>ASTM D882</td>
<td>38 lbs/ft</td>
</tr>
<tr>
<td>3 in. Tensile Strength – TD</td>
<td>ASTM 882</td>
<td>5 kpsi</td>
</tr>
<tr>
<td>Elongation – MD – MD</td>
<td>ASTM 882</td>
<td>530 %</td>
</tr>
<tr>
<td>Elongation – TD – TD</td>
<td>ASTM 882</td>
<td>660 %</td>
</tr>
<tr>
<td>Tear Strength</td>
<td>ASTM D2261</td>
<td>1.5 lbs/ft</td>
</tr>
</tbody>
</table>
Underground marking tape will be a 3-inch wide, tear resistant, corrosion resistant elastic PVC orange tape, imprinted with the legend “CITY OF HOUSTON BURIED CABLE – CALL TRAFFIC OPERATIONS at 311”. This legend will be printed every three (3) feet in black letters.

Underground cable marking posts are required and will be installed everywhere feasible and practical in all areas where fiber optic cable is installed in underground conduit. This is the preferred method of marking, since it is very visible. Marking posts should be placed every 500 feet in urban area, and every 1000 feet in suburban areas, as well as at every intersection corner and every change in direction. Exception would be locations like downtown where all surfaces are paved, where discs would be more practical.

Use marking discs set in concrete or pavement where the use of marking posts is not feasible and practical, i.e., areas such as downtown where everything is paved and for aesthetics.

Technical specifications of underground marking posts are identified below.

1. Line Markers will be made from ultraviolet-stabilized High Density Polyethylene (HDPE)
2. Minimum 3-1/2” O.D. tubular design
3. Text will be hot-stamped into the fittings with an extra u-v clear coat.
4. Crossing casing vents will be used to help maintain atmosphere conditions.
5. Line markers will require no maintenance after installation

PART 3 EXECUTION

3.01 CONSTRUCTION METHODS

A. General

Place conduit in accordance with the lines, grades, and details shown on the plans or as directed. Conduit shall be buried a minimum of 30 inches deep underground unless otherwise shown on the plans. Fit conduit and inner duct terminations with bushings or bell ends.

Prior to installation of inner duct/cables, pull a spherical template of at least 75% of the inside diameter of the conduit/inner duct through the conduit/inner duct to ensure that it is free from obstruction. Cap or plug empty conduit places for future use.

Conduit shall have 30 degree sweeps into communications service boxes or cabinets. Conduit bends shall have a minimum radius of 18 inches.
When installing the multi-duct conduit, the outer shell and inner duct shall be continuous (without splices) up to 800 feet from communication service box to communication service box.

Where existing surfacing is removed for placing conduit, repair by backfilling with material equal in composition and density to the surrounding areas. Immediately repair any damaged infrastructure including sidewalks, driveways, riprap, etc. to equivalent conditions prior to construction.

Any obstructions to the trenching / boring operation such as utilities, structures, sprinkler systems, etc. are to be protected from damage by the contractor during construction and until the work is completed. In the event of damage, the contractor shall be responsible for the repair / replacement at his expense with materials and methods which leave the damaged items in as good or better condition than original. Immediately after installation of conduit, backfill pits, excavation or trenches.

B. Trenching

No trenching shall be allowed within 5 feet of a tree. Where the depth of conduit changes, the trench bottom shall have a slope of 3 / 1 (horizontal / vertical) to accommodate the depth change.

C. Boring / Jacking / Directional Drilling

Boring shall be the preferred method of excavation unless specified otherwise in the plans. When indicated on the plans, conduit crossing existing pavement shall be placed by jacking and boring methods. The boring and jacking method used shall be approved by the Engineer prior to commencing work.

Excavate suitable pits for conducting boring operations (clearly mark/protect excavation to avoid injury by public). Pits shall be kept 2 feet clear outside of the pavement edge. Install conduit so there is no interference with street operation or no structure is weakened or damaged.

Unless otherwise specified in the plans, the method and equipment used in jacking casing or pipe shall be optional with the contractor, provided that the proposed method is approved by the Engineer. Heavy duty jacks suitable for forcing pipe through the embankment shall be provided by the contractor. Uniform pressure shall be applied from all jacks. Pressure shall be transmitted evenly around the ring of the pipe through an approved jacking head.

Once boring / jacking operations have begun, the boring / jacking shall be continuous, without interruption, insofar as practicable, to prevent the pipe from becoming firmly set in the embankment.
Material excavated ahead of the pipe shall be removed through the pipe. Jetting will not be permitted except as approved by the Engineer. The diameter of the excavation shall conform as closely as practicable to the outside diameter and circumference of the pipe being jacked.

D. Tracer Wire

One (1) No. 6 AWG Green, unspliced THW/XHHW wire shall be installed in each conduit. The tracer wire shall be pulled inside of the fiber optic conduit in the voids outside of the inner ducts. All tracer wire shall be continuous – tied together inside communication service boxes with wire nuts. Lubricants used in pulling the tracer wire shall be water soluble. A minimum of 5-feet of wire shall be coiled, taped, labeled, and secured in the communications service box. The ends of all tracer wire, within a communications service box, shall be connected to a common lug to allow for locating multiple segments of conduit run with one setup of the detection equipment. For transition between underground and overhead cabling, coil the wire in the communications service box closest to the riser. Access fittings shall be used on risers without adjacent communication service boxes.

E. Pull Tape

Pull tape is required in all inner ducts. No pull ropes, twine, or pull strings will be used for the purpose of installation. Further, if the plans and specifications indicate pull tape for future use do not substitute pull ropes, twine or pull strings for pull tape.

Pull tape will be prefabricated woven polyester tape made from low friction, high abrasion resistant yarns providing a low coefficient of friction. Pull tapes will be prelubricated. Pull tapes will be printed with sequential footage markings for accurate measurement. Pull tapes will be ½ inch wide and have a minimum tensile strength of 1,250 pounds.

F. Sealing

After installation of cables and wires the conduits shall be sealed / plugged with a suitable compound so as to prevent the entrance of moisture or gases.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. COMMUNICATION CONDUITS shall be measured per Linear Foot at the locations indicated on the drawings and the measurement shall include all equipment, labor and materials required to provide a complete and serviceable installation.
4.2 PAYMENT

A. The work performed and the materials furnished as prescribed by this item and measured as provided under “MEASUREMENT” shall be paid for at the contract unit price bid for each item as presented in the bid form for “TRAFFIC” or “Extra Work Items”. The unit price bid for each item shall be full compensation for furnishing and placing all materials, and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work in accordance with the drawings and specifications.

END OF SECTION 16709
SECTION 16711
TRAFFIC SIGNAL CONDUITS

PART 1  GENERAL

1.01  SECTION INCLUDES

All traffic signal conduit installed above ground shall be rigid steel, hot-dipped, galvanized conduit. Underground conduit installed in unpaved areas may be either rigid steel, hot-dipped galvanized conduit or Schedule 80 polyvinyl chloride (PVC) conduit, unless specified on the plans. Underground conduit installed under paved roadways and shoulders shall be rigid steel, hot-dipped galvanized conduit.

Unless otherwise shown on the drawings, all conductors shall be in conduit except when in metal poles. All conduits and fittings shall be of the sizes and types shown on the drawings. Each section of conduit shall bear evidence of approval of Underwriter's Laboratories.

The contractor may, at his own expense, use conduit of larger size than specified on the drawings providing that the larger size is used for the entire length of the conduit run.

PART 2  PRODUCTS

2.01  MATERIALS

A.  Electrical PVC Conduit - The use of Electrical PVC conduit will be allowed as long as all guidelines set forth in the NEC (National Electrical Code) book are followed. Schedule 80 Electrical PVC will only be used in pertinent applications. In locations above the ground, rigid metal conduit will be used. All grounding procedures set forth in the NEC shall be followed.

PVC conduit shall be joined by solvent-weld method in accordance with the conduit manufacturers recommendation. No reducer couplings shall be used unless specifically indicated on the drawings.

B.  Rigid Steel, Hot-Dipped, Galvanized Conduit

1.  All conduit shall be of mild steel piping, galvanized inside and outside, and shall conform in all respects to the Federal Specification WW-C-581c, American Standard Rigid Steel Conduit Specification C80.1, latest revision, and Underwriters' Laboratories Specifications.
2. **Trade Names** - Conduit manufactured by Clifton, Pittsburg-Standard, Triangle or Youngstown conforms to the provisions of this specification. Other brands of rigid steel, hot dipped, galvanized electrical conduit may be approved by the engineer provided samples and engineering data submitted by the bidder equal the provisions of this specification.

3. **Protective Coating** - The galvanized coat of zinc shall be of uniform thickness, not less than 0.0008 inch, applied by the hot-dipped process to not only the inside and outside surfaces of the conduit, but also to the threads of the conduit.

4. **Threading and Reaming** - Each piece of conduit shall be straight, free from blisters and other defects, cut square and taper reamed, and furnished with coupling in 10 ft. lengths threaded each end. The interior threaded surface of each coupling shall be galvanized to insure 100% galvanic protection when coupled together with lengths of hot-dipped rigid conduit with hot-dipped galvanized threads.

5. **Rigid Elbows** - Rigid standard and special radius elbows shall be made from the same grade of mild steel piping as rigid steel conduit. They shall be galvanized so that not only the exterior and interior surfaces shall have a galvanized coating but also the threaded area, thereby insuring 100% galvanic protection on all surfaces.

6. **Chemical Test for Coating** - The hot galvanized coating shall be of such quality and uniformity that a sample of hot-galvanized conduit will not show a fixed deposit of copper after four (4) immersions or dips in a standard copper sulfate solution.

7. **Bending Test** - The hot-galvanized coating on the inside and outside surfaces shall be sufficiently elastic to prevent cracking or flaking when a sample of finished conduit is bent 90 degrees, at a minimum bend of 60 degrees inner edge of the bend of six (6) times the inside diameter of the conduit. For conduits two (2) inches in diameter, or smaller, special eighteen (18) inch minimum radius sweeps shall be furnished and installed by the contractor.

PART 3  EXECUTION

3.01  CONSTRUCTION METHODS

A. **General** - The contractor shall familiarize himself with the provisions of the General and Special Conditions in regard to permits, codes, laws and ordinances, and these provisions shall be controlling factors, except as specifically noted otherwise or supplemented herein.
All work shall be done in accordance with the latest rules and regulations of the National Board of Fire Underwriters, the National Electrical Safety Code and all local ordinances.

B. **Coordination** - The work shall be carefully coordinated with work of other trades. Wherever work covered under this item, the order of work shall be carefully scheduled and coordinated to secure the completion of the various portions in the best possible manner. The rights of the various interests and the sequence when in dispute, shall be established by the Engineer and his instructions as to priority and scheduling shall be final and binding.

C. **Placement** - All joints in conduit shall be cut square, reamed smooth and drawn up tight. Concealed conduit shall run in as direct a manner as practicable, with maximum radius bends. All bends shall be free from dents or flattening. Not more than the equivalent of three quarter bends (two hundred seventy degrees) shall be used in any run between terminals, outlets and junction or pull boxes. Conduit joints shall be made with approved couplings and unions; where conduit cross expansion joints, expansion fittings shall be installed. Conduit runs underground shall be installed a minimum of 24 inches below finished grade, except where it is impossible or impractical. The Engineer or approved designer shall be the sole judge of the permissible depth of conduit installation. The conduit shall be installed as shown on the plans or as directed by the Engineer. Each conduit run shall be swabbed after installation, and a No. 9 galvanized steel pull wire shall be inserted in each conduit and folded in a manner making it easy to retrieve from each end. The conduit ends shall be capped or plugged until cabling and wiring operations commence.

Upon request of the Engineer, the contractor shall draw a full-time metal brush, attached by swivel joint to a pull tape through "metal conduit" and a special template having a diameter not less than 75 percent of the inside diameter through PVC conduits to insure that the conduit is clean and free from obstructions. A nylon or non-metal pull tape shall be used in pulling cable and conductors through PVC conduit. Metal tapes will not be permitted in PVC conduit. The conduits shall be placed as shown on the drawings or as directed by the Engineer.

Conduit placed for concrete encasement shall be secured and supported in such a manner that the alignment will not be disturbed during placement of the concrete. No concrete shall be placed until all of the conduit ends have been capped and all box openings closed.

PVC conduit which is placed under existing pavement, sidewalks, and driveways shall be placed by first providing a void through which the PVC conduit shall be inserted. Boring is required for placing conduit under pavements. Metal conduit which is to be placed under existing pavement, sidewalks, and driveways shall be placed by boring.
Existing conduit which has been placed in position on the job site by others for this installation shall be checked to see that there are no obstructions in the conduit prior to threading the wire through. Any such obstructions shall be cleared without damage to the conduit, prior to installing cable.

Conduit runs shall be installed in such a manner as to minimize the accumulation of moisture at low points and pockets.

The components parts of conduits systems shall, in general, be of like material. Where dissimilar metals are used together, suitable provisions shall be made to prevent galvanic action.

The ends of all conduit runs shall be closed immediately after installation to prevent the accumulation of water, dirt and other foreign material. Conduit shall be swabbed out where necessary before conductors are pulled in. Bends may be either factory or field made. All 2 inch conduits shall be placed with special radius sweeps with a minimum radius of 18 inches. Standard bends shall not be allowed with 2 inch conduits.

D. Bonding
A No. 8 solid soft bare copper bond wire shall be installed in each conduit. This bond wire shall be firmly attached to the grounding rod installed in each pull box and cabinet. The bond wire shall create a continuous grounding system for the entire conduit system. All conduits, including rigid metal, shall be bonded together with a No. 8 solid bare copper wire and have continuity to every ground rod installed at each signal installation.

E. Pull Rope
A 5/16 inch nylon pull rope shall be installed in each conduit installed. A minimum of three feet of pull rope shall be coiled in each pullbox and cabinet.

F. Sealing
After installation of cables and wires the conduits shall be sealed with a suitable compound so as to prevent the entrance of moisture or gases.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. TRAFFIC SIGNAL CONDUIT shall be measured per Linear Foot at the locations indicated on the drawings and the measurement shall include all equipment, labor and materials required to provide a complete and serviceable installation.

4.2 PAYMENT

A. The work performed and the materials furnished as prescribed by this item and
measured as provided under “MEASUREMENT” shall be paid for at the contract unit price bid for each item as presented in the bid form for “Traffic Signal Conduit”. The price shall be full compensation for furnishing and installing conduit; for directional drilling, boring, excavating, furnishing and placing backfill, replacing pavement structure, sod, riprap, curbs or other surfaces; for marking location of conduit (when required); for furnishing and installing all fittings, junction boxes, special radius sweeps, and expansion joints, conduit straps; and for all labor, tools, equipment and incidentals necessary to complete the work in accordance with the drawings and specifications.

END OF SECTION 16711
SECTION 16715

VEHICLE SIGNAL HEADS (POLYCARBONATE) (ADJUSTABLE, EXPANDABLE TYPE)

PART 1  GENERAL

1.01  SECTION INCLUDES

A. Polycarbonate Vehicle Signal Heads with mounting attachments and light emitting diode (LED) lamp indications, louvered back plates, and Geometrically Programmed Louvers (GPL).

PART 2  PRODUCTS

2.01  MATERIALS

A. The traffic control signal heads shall be in accordance with the latest revision of ITE Technical Report No. 1.

B. Each traffic signal face shall consist of one or more signal sections rigidly fastened together as per manufacturer’s recommendations in such a manner as to present a continuous pleasing appearance.

C. The electric and optical system of the signal head shall, unless otherwise specified, be designed for operation from a power supply of 115 volt, single phase, 60 Hz alternating current and LED displays.

D. Polycarbonate shall be used in fabricating the vehicle signal heads described herein. Structural requirements for polycarbonate materials are described in Paragraphs 2.02 and 2.03

E. All material for the mounting attachments shall be metal.

2.02  HOUSINGS

A. The polycarbonate vehicle signal head housing cases shall be a one-piece polycarbonate resin material with sides, top, and bottom integrally molded. The housing shall be injection molded from ultraviolet and heat stabilized flame retardant, permanently colored polycarbonate resins. The housing shall be a minimum of 0.125 inches (3.18 mm) thick measured anywhere on the housing, and shall be internally ribbed so as to produce the strongest possible assembly consistent with lightweight. The terminal block shall either be securely mounted or integrally molded into the housing.

B. Provision shall be made for accommodation of the particular type of mounting specified and attachment of doors, optical units, and other such accessories as may be specified
for the particular installation. All traffic signal housing cases, together with doors, lenses, and mounting attachments, shall comprise a dust and moisture proof housing for the optical units, connecting wiring, and terminal block. The housing cases shall be of such construction as to assure permanent alignment of the lens in the traffic signal face. Design of door, housing, and visor shall be such that no light is visible in the profile view of the traffic signal face.

C. Vehicle Signal Head housing cases shall be of the sectional, adjustable, expandable type. The assembled housings for each signal face shall consist of three or more individual dual sections, each designed for housing a single complete optical unit. Individual signal sections shall be rigidly attached to form a single head either with at least four machine screws between each section or by the bolt-and-washer conduit method. Complete signal heads shall provide positive locked positioning when used with serrated brackets, mast arm, or span wire fittings.

D. Portions of cases providing for attachment to supporting arms shall be molded with large bosses for the supporting arms. Each housing case shall be so attached to its supporting arm that it will be adjustable by rotation about its vertical axis in such a manner that any pair of adjacent cases may be adjusted individually to give indications in two directions as close as 15 degrees apart and may be rigidly clamped in any position throughout the range of adjustment. Provision shall be made for carrying the traffic signal leads enclosed in the mounting attachment.

E. Both the top and bottom of each traffic signal housing case shall be provided with an opening of two inches (50 mm) in diameter to accommodate 1-1/2" (38 mm) pipe brackets. A locking ring shall be integrally cast or molded around the bottom opening. Around the top opening shall be either an integrally cast or molded locking ring or a separate splined locking ring designed to fit into notches. The locking rings shall have a minimum of 72 evenly spaced teeth and shall be so designed that the top and bottom rings will mate to provide a perfectly aligned signal head with flush connection between the outer circumference of the sections.

F. Any open end of an assembled signal housing shall be plugged with an ornamental cap and gasket of an approved type.

2.03 HOUSING DOOR

A. The housing door of each traffic signal housing shall be a one piece polycarbonate resin material with an approximate 12-inch (300 mm) diameter circular opening for the lens as specified. The housing door shall be a minimum of 0.125 inches (3.18mm) thick measured anywhere on the housing door. The door shall be attached to the housing by means of two stainless steel hinge pins.

B. Two stainless steel wing screws shall be installed on the side of the door to provide for opening and closing the door without the use of special tools. Wing screws shall have a flat-bearing surface or stainless steel flat washer to prevent gouging of the housing
door by the wing screws. Wing screws shall remain captive in the housing door when the door is open.

2.04 VISORS

A. Each traffic signal housing door shall be equipped with an easily detachable standard tunnel visor (unless requested otherwise). The visor shall be a polycarbonate resin to match the housing and door. The visor shall be rigidly attached to the door with rust-resistant connections in a manner that will prevent the leakage of light and moisture throughout the periphery of attachment.

B. Unless requested otherwise, the visor on the front of each door shall:
   1. Be circular in section
   2. Have a downward tilt of 2 to 8 degrees
   3. Encompass approximately 300 degrees of the lens
   4. Extend outward from the face of the lens a minimum of 9-1/2" (240 mm) for 12inch (300 mm) diameter lens, (measured at its outer visible circumference)
   5. Be of such design that the encircled portion of the lens will not be visible in the profile view of the traffic signal face
   6. Be open at the bottom so as to prevent the accumulation of snow, dirt, and rain.

C. Visors shall be easily removed and replaced without damage to visor or signal head.

D. The four (4) tabs used to mount the visor to the signal shall be slotted. It shall not be necessary to completely remove the mounting screws to remove or replace the visor.

2.05 OPTICAL SYSTEM

A. The Vehicular Light Emitting Diode (LED) Indications to be furnished with the Vehicle Signal Head shall meet the requirements of Specification Section 16718, “Vehicular LED Indications”.

2.06 TERMINAL BLOCKS AND ELECTRICAL

A. Terminal blocks shall be either two or seven position and be double row, with each section consisting of two 8-32 x 5/16-in. binding screws and a conducting metal strip between the screws.

B. The terminal blocks shall be a one-piece molded construction using phenolic materials, rated for a minimum 20 amps, 250 volt service
C. Each LED module shall be wired to a two position terminal block located in that signal section. A seven position terminal block shall be furnished in the outermost signal section of any 3 or more section vehicle signal head assembly. All sections of the vehicle signal head assembly shall be wired to the seven position terminal block. All terminal blocks shall be securely mounted in an accessible position and shall be of weatherproof-molded construction, equipped with identified terminals. Binding screws shall be provided for the field and interior wires.

D. Maintain throughout the vehicle signal head the color coding for wires from the LED Module to the main terminal block as shown below:

<table>
<thead>
<tr>
<th>Indication</th>
<th>Color Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Ball / Arrow</td>
<td>Red</td>
</tr>
<tr>
<td>Yellow Ball</td>
<td>Yellow</td>
</tr>
<tr>
<td>Green Ball</td>
<td>Green</td>
</tr>
<tr>
<td>Yellow Arrow</td>
<td>Yellow with Blue or White Tracer Green</td>
</tr>
<tr>
<td>Arrow White</td>
<td>Green with Blue or White Tracer Neutral</td>
</tr>
</tbody>
</table>

2.07 MOUNTING ATTACHMENTS

A. All mounting attachments shall be aluminum. Provision shall be made for carrying the signal leads enclosed in the mounting attachment. The mounting attachment, together with supporting arms and assembled housings, shall comprise a dust-and-moisture-proof enclosure for optical units and lead wiring. Mounting attachments shall be of one of the following types as specified for the particular vehicle signal head required.

1. **Span-Wire Mounting.** The span-wire mounting attachment shall consist of a cable clamp to receive a suspension cable of 3/8" (10 mm) diameter together with a suitable connection to the signal head. The mounting shall provide a "balance adjuster" between the signal head and span wire capable of permitting freedom of movement with reference to the point of suspension. The signal head shall be adjustable by rotation about its vertical axis in a horizontal plane and the mounting attachment shall be so constructed that the head may be firmly clamped in any position throughout the range of adjustment. The mounting shall provide a suitable outlet for wiring from the signal head tilted downward and so constructed as to effectively seal the interior of the head from dust and moisture and prevent undue abrasion of signal wiring. Mountings for signal head units not balanced at the point of support shall be provided with a suitable compensating device to insure that the signal head will assume a normally vertical position. The mast-arm vehicle signal head mounting hardware shall be Astro-Brac Atlas Large Capacity Cable Mount assembly, or approved equal.

2. **Mast-Arm Mounting.** The mast-arm vehicle signal head mounting hardware shall be Astro-Brac Atlas Large Capacity Tenon Mount assembly, or approved equal.

3. **Side-of-Pole Mounting.** Supports for side-of-pole mounting of the signal head in a vertical position shall be 1-1/2" standard pipe bracket arms, attached to the top and bottom of the signal head with pipe nipples, serrated elbows and collared / cast nipples and band-on pole plates. Pole plates shall be provided with a cable guide. The mounting assembly shall consist of two standard pipe sections extending 123/4" from and at right angles to the axis of rotational adjustment of the signal head. Both supports shall have running threads at least 1-1/4" long at the pole connection end. The signal head shall be adjustable, by rotation of the various signal faces about their vertical axis, throughout a radial angle of 360 degrees and shall be capable of being rigidly clamped in any position through the range of adjustment. The wiring from the signal head shall be able to be enclosed in the top or bottom support.

### 2.08 LOUVERED VEHICLE SIGNAL HEAD BACK PLATE

A. The back plate shall be attached to all new vehicle signals. Back plate shall be continuously louvered around its perimeter.

B. Back plates shall be vacuum formed ABS plastic or aluminum.

C. Vacuum formed ABS plastic back plates shall contain ultraviolet inhibitors and stabilizers for protection against UV degradation.

D. The back plate shall extend around the periphery of the signal face a distance of five (5) inches for faces with twelve (12) inch lenses, and shall have a 3" corner radius.

E. ABS vacuum formed back plates shall be black and color consistent throughout the entire piece without varying shades and tones.

F. The louvers shall be evenly spaced around the back plate, including the top and bottom. The number of louvers adjacent to the vehicle signal head shall be nine (9) per signal section per side. Both the top and bottom back plate sections shall have nine (9) louvers each. The louvers shall be at least 3-1/2" long by 5/8" wide with an opening of at least ¼". The back plate shall be pre-drilled to fit the vehicle signal head for which it is designed.

G. ABS vacuum formed back plates shall have a minimum thickness of .125". All outside edges shall be formed with a ½" to 5/8" flange (inside dimension) turned away from the front surface. The back plate shall have a haircell finish on the front side and smooth finish on the back side.

H. Aluminum back plates shall be fabricated from anodized sheet aluminum and be painted dull black.

I. Stainless steel hardware for attaching the back plate to the vehicle signal head shall be provided.
2.09 GEOMETRICALLY PROGRAMMED LOUVER (GPL)

A. The louver shall have the following capabilities:

1. Fit all manufacturers’ 12” vehicle signal heads.
2. Retrofit into existing 12” vehicle signal heads.
3. Provide a full round ball display, with minimum slat effect, throughout the selected view range.
4. Provide an absolute exact visual cut-off.
5. Allow the view angle within each signal section to be adjusted to a designated area.
6. Have minimum glow outside the view range.
7. Allow for controlling either the horizontal or vertical view range within the signal visor.

B. The louver housing shall consist of a two-piece assembly injection molded from black UV inhibited ABS plastic. Two (2) brass inserts shall be molded into the bottom half allowing the assembly to be fastened together with two (2) stainless steel screws.

C. The louver housing O.D. shall be 11-1/2” and have spherical contour which allows the light beam from the signal section to be directed up to 10-degrees in all directions from the centerline of the visor/lens system.

D. The inside surface shall have a multiplicity of grooves for positioning light directing baffles. The remaining inside surface shall be grooved to prevent surface reflections of light.

E. Two (2) sponge neoprene O-rings shall be positioned in grooves on the outside surface to prevent light leakage between the housing and the visor.

F. The louver housing design shall allow the baffle positions to be changed in order to adjust the view angle.

G. The baffles shall be molded from flat black, 10% glass filled UV inhibited virgin polycarbonate.

H. Each baffle shall be thin opaque disc with a multiple of parallel evenly spaced apertures (openings). Each structural member forming the aperture shall have a cross section which allows for good stiffness and structural integrity, but shall have a thin edge to prevent reflection (glow) outside the desired viewing range.
I. All baffles shall be identical in design and interchangeable within the housing. The plane of each baffle shall be 90-degrees to the centerline axis of the housing.

J. The louver shall be supplied with the necessary self-threading screw hardware to attach the louver to the vehicle signal head visor.

K. The louver shall include an installation kit that includes installation instructions, adjustment tool, visor marking template, and all incidentals necessary for attachment and positioning of the louver.

PART 3  MEASUREMENT AND PAYMENT

3.1 MEASUREMENT

A. VEHICLE SIGNAL HEAD ASSEMBLY shall be measured as Each at the locations indicated on the drawings and the measurement shall include all equipment, labor and materials required to provide a complete and serviceable installation.

3.2 PAYMENT

A. The work performed and the materials furnished as prescribed by this item and measured as provided under "MEASUREMENT" shall be paid for at the contract unit price bid for each item as presented in the bid form for “Vehicle Signal Head”. The unit price bid for each item shall be full compensation for furnishing and placing all materials, and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work in accordance with the drawings and specifications.

END OF SECTION  16715
PART 1  GENERAL

1.01  SECTION INCLUDES

This specification describes minimum requirements for traffic signal control cable and/or wire used in City of Houston traffic signal installations. The cables shall conform to specification requirements of the International Municipal Signal Association (IMSA) for the specific type cables included in the bid form, and THW wire shall conform to industry standards. These specifications and standards are included in this specification by reference. An informational copy of IMSA specifications is available for inspection at the Traffic Operations Center, 2200 Patterson, between the hours of 8:00 AM and 3:00 PM, Monday through Friday, except holidays.

1.02  SILENCE OF SPECIFICATIONS

The apparent silence of these specifications as to any detail, or the apparent omission from it of a detailed description concerning any point, shall be regarded as meaning that only the best commercial practice is to prevail and that only material and workmanship of the finest quality are to be used. All interpretations of these specifications shall be made on the basis of this statement. The bidder shall be an established supplier of the items bid.

1.03  UNIT PRICES

A. Measurement
This item will be measured by the linear foot of traffic signal cables, as per the various sizes and types shown on the drawings. Measurement will not be made for cable inside signal heads and controllers and cable coiled pull boxes, in pole bases and coiled on span wires.

B. Payment
The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid for “Traffic Signal Cables” of the various types and sized specified. This price shall be full compensation for furnishing and installing all materials, and for all, tools, equipment and incidentals necessary to complete the work.
PART 2 PRODUCTS

2.01 MATERIALS

The items furnished shall be new, unused of the latest product in production to commercial trade, and shall be of the highest quality as to materials used and workmanship. Manufacturer furnishing these items shall be experienced in design and construction of such items and shall furnish evidence of having supplied similar items which have been in successful operation. The bidder shall be an established supplier of the items bid.

2.02 INSULATION

Insulation compound and thickness for each conductor shall conform to the specification requirements as specified for each item of the bid form.

2.03 JACKET

Jacket compound and thickness for multi-conductor cable shall conform to the specification requirements as specified for each item of the bid form.

2.04 VOLTAGE RATING

All cables and/or wire furnished shall be rated at 600 Volts.

2.05 CONDUCTORS

Copper used to form the conductors shall be soft or annealed copper and shall be formed as solid or stranded conductor(s) as specified for each item of the bid form.

2.06 CONDUCTOR IDENTIFICATION AND CABLE MARKER

Each conductor shall be identified by color-coding conforming with specification requirements specified for each item of the bid form. Each cable shall be identified at maximum 2-foot intervals with manufacturers name and year of manufacture.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Test and Test Methods

All cables and/or wires shall be sampled and tested at the factory to determine their compliance with specification requirements as specified for each item of the bid form.
PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. TRAFFIC SIGNAL CABLE shall be measured per Linear Foot at the locations indicated on the drawings and the measurement shall include all equipment, labor and materials required to provide a complete and serviceable installation.

4.2 PAYMENT

A. The work performed and the materials furnished as prescribed by this item and measured as provided under “MEASUREMENT” shall be paid for at the contract unit price bid for each item as presented in the bid form for “Site Furnishing” or “Extra Work Items”. The unit price bid for each item shall be full compensation for furnishing and placing all materials, and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work in accordance with the drawings and specifications.

END OF SECTION 16720
SECTION 16750
ACCESSIBLE PEDESTRIAN PUSH BUTTON STATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Accessible Pedestrian Push Button Station Assembly with control unit and mounting hardware. The assembly shall be the 2-Wire Navigator Push Button Station and 2-Wire Navigator Central Control Unit (CCU) as manufactured by Polara Engineering, Inc.

PART 2 PRODUCTS

2.01 MATERIALS

Provide new materials that comply with the details shown on the plans and the requirements of this specification.

2.02 ACCESSIBLE PEDESTRIAN PUSH BUTTON STATION

A. The assembly and manufacturing process for all internal electronic components shall be adequately supported to withstand mechanical shock and vibration from high winds and other sources.

B. Weather-proof speaker protected by vandal proof screen.

C. Central Control Unit (CCU) for the pushbutton detector unit that resides in the Traffic Signal Controller Cabinet capable of controlling a minimum of 12 units using no more than one pair of wires for each phase. The CCU must be capable of controlling up to 4 phases and all inputs and outputs shall have Transient Voltage Protection.

1. Pedestrian Walk / Don't Walk inputs: optically isolated 80-150 Volts AC/DC 5 mA maximum.

2. General purpose outputs and pedestrian outputs: optically isolated 36 Volts AC/DC peak 0.3A solid state fused contact closure.
3. Fault Output: normally open and closed relay contacts 125 Volts AC/DC 1A maximum.


5. General Purpose Inputs: 10-36 Volts AC/DC peak 10 mA maximum, optically isolated.

6. Environmental: operating and storage -30°F (-34°C) to 165°F (74°C) 0-100% humidity non-condensing.

D. Each unit will contain a vibrating tactile arrow to provide a tactile representation of the status of the WALK indication. The arrow shall contrast with the background.

E. Confirmation of button push via latching LED, sound, and vibrotactile bounce.

F. Vibrating tactile arrow shall be able to be adjusted for directional indication.

G. Pedestrian push buttons shall be at least 2 inches in diameter or width, contrast visually with the housing, and require 5 lbf (poundforce) maximum force.

H. The pushbutton assembly shall be die-cast aluminum, powder coated from aluminum alloy 319 or equivalent.

I. The unit shall be fabricated free of voids, pits, dents, molding sand and excessive foundry grinding marks. All design radii shall be smooth and intact. Exterior surface finish shall be smooth and cosmetically acceptable by being free of molding fins, cracks and other exterior blemishes.

J. Assembly color shall be yellow.

K. Mounting bolts shall be brass or stainless steel.

L. Push button unit shall have an actuation indication which will activate upon depression of the push button. If actuation indication is a light then it shall remain on until the next walk cycle.

M. All push button assemblies shall be mounted to the poles by drilling and tapping. Stainless Steel ¼ - 20 bolts shall be used to mount the push button assemblies to poles. Self-tapping screws shall not be used. Stainless steel strapping shall not be allowed.
N. Attached crossing signs shall be 9" x 15" R10-3e, as per the Texas Manual on Uniform Traffic Control Devices (TMUTCD).

O. The back panel portion of the push button assembly shall be designed to accommodate pole diameters from 4" to 14".

2.03 AUDIBLE INDICATIONS

A. A push button locator tone shall sound at each push button.

B. Locator tones should be audible 6 to 12 feet from the push button or to the building line, whichever is less.

C. Locator tones shall have a duration of 0.15 seconds or less, and shall repeat at 1-second intervals.

D. Automatic volume adjustments in response to ambient traffic sound level shall be provided up to a maximum of 89 dB. Locator tone and verbal messages shall be no more than 5 dB louder than ambient sound.

E. All sounds must automatically adjust to ambient noise levels over a 60 dB range.

F. Standard locating tone during Don’t Walk (and clearance if desired) and cuckoo, chirp, or standard voice message during walk.

G. Standard locating tone, custom sound, or verbal countdown during PED clearance.

H. Most sounds can have minimum and maximum volume independently set.

I. Extended button push can turn on, boost, volumes, and/or mute all sounds except those on activated crosswalk.

J. The tone or voice volume, measured at 36 inches from the APS, should be 2dB minimum and 5 dB maximum above the ambient noise.

K. Cuckoo - 1250 Hz and 1000 Hz.

L. Chirp - 2700 Hz and 1700 Hz.

M. Substituting Cuckoo and Chirp sounds with "walk" and "don't walk" audible sounds is optional.

N. Push button locator tone different from cuckoo or chirp.
O. Extended button press which can be used to request a louder WALK signal and locator tone for subsequent clearance interval.

P. System shall allow for independent volume control for locate tones, clearance, and walk tones.

Q. All sounds shall be synchronized to reduce sound clutter.

R. Custom message and sound options definable by customer include:
   1. Custom locating tone
   2. Informational Message
   3. Custom walk sounds/message
   4. Custom clearance sound
   5. Multiple languages (up to three, selectable by user)
   6. Street name in Braille on the sign

2.04 ENVIRONMENTAL REQUIREMENTS

A. The Accessible Pedestrian Push Button Station Assembly (pole unit and central control unit) shall be rated for use in the ambient operating temperature range of -40°C to +65°C (-40°F to +150°F).

B. Push button shall be rated for minimum of 20 million operations with >2 lb. actuation force.

2.05 ELECTRICAL REQUIREMENTS

The Accessible Pedestrian Push Button Station Assembly shall operate over a voltage range of 95 to 130 VAC, 60 Hz. E. TRANSIENT

2.06 VOLTAGE PROTECTION

The on-board circuitry of a module shall include voltage surge protection, to withstand high-repetition noise transients and low-repetition high-energy transients.

2.07 INPUT PROTECTION
At the point of entry to the module for each input, provide two 0.5-Ohm, 10-watt wire-wound power resistors with 0.2 micro Henries inductance (one on the AC+ Line & one on the AC- Line). Provide one 20 Joule surge arrestor between AC+ to AC-. A 0.68 microfarad capacitor must be placed between AC+ & AC- (between the resistor & arrestor).

2.01 POWER FAILURES

Whenever there is a loss of power to the "Walk" or "Don't Walk" for a period greater than 2.0 seconds, the sound shall be deactivated.

PART 3 WARRANTY

3.01 A minimum guarantee for both materials and workmanship shall be provided for the products bid as specified. The guarantee (warranty) period shall begin the day the City officially accepts the item. Any guarantee work is to be completed within 15 days after receipt of notice of material deficiencies.

A. WARRANTY AND GUARANTEES

1. All material, workmanship and labor furnished shall be covered by Supplier(s)/Manufacturer(s) guarantee and/or warranty for a minimum period of thirty-six (36) months. Warranty period shall begin the day the item is received by the City of Houston, either as new order or warranty repair. Bidder shall also be required to have resources to complete any required warranty work within fifteen (15) days after receipt of found defective item. The City of Houston's preference is for all non-warranty service to be charged a singular flat-rate. Successful bidder will include flat rate repair cost, if available in bid document for all non-warranty covered repairs. If flat rate repair charge is not available, then Supplier(s)/Manufacturer(s) will provide current hourly labor rate, along with any associated minimum charges that may apply.

2. Successful bidder shall bear all expenses connected with return of any material which the City deems necessary to return for adjustments during guarantee period. Said work shall be done by manufacturer's representative at no cost to the City.

3. The City of Houston may perform random sample testing on all shipments. Random sample testing will be completed within 45 days after delivery. The number of modules tested shall be determined by the quantity of each shipment. The Traffic Operations Division shall determine the sampling parameters to be used for the random testing. Acceptance or rejection of the shipment shall conform to ANSI/ASQC Z1.4 for random
sampled shipments.

4. The City of Houston reserves the right to withhold payments which may be due, should it be discovered that material does not meet specifications and/or claims of bidder.

5. Supplier(s)/Manufacturer(s) shall make all engineering data, diagrams, software changes or improvements, which increases performance of equipment purchased under this bid, available to the City of Houston at no additional cost during guarantee period.

6. Supplier(s)/Manufacturer(s) shall have field engineers or technicians available on request to assure satisfactory initial operation, and to consult with City's Traffic Engineer, or his representative, on any special circuitry that may be required in certain applications.

PART 4 MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. ACCESSIBLE PEDESTRIAN PUSH BUTTON STATIONS shall be measured as Each at the locations indicated on the drawings and the measurement shall include all equipment, labor and materials required to provide a complete and serviceable installation.

4.2 PAYMENT

B. The work performed and the materials furnished as prescribed by this item and measured as provided under “MEASUREMENT” shall be paid for at the contract unit price bid for each item as presented in the bid form for “Accessible Pedestrian Push Button Station.”. The unit price bid for each item shall be full compensation for furnishing and placing all materials, and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work in accordance with the drawings and specifications.

END OF SECTION 16750