City Project No. 22-104
CDOT Project No. SHO M286-051 / 24697

February 28, 2026


The scope of my authority, with respect to these plans, is limited to the following Civil disciplines – Quantities/Tabulations, Removals, Roadway, and SWMP.

**CITY OF THORNTON**
**DEPARTMENT OF PUBLIC WORK**
**104th AVENUE AND WASHINGTON PL**
**TRAFFIC SIGNAL**


The scope of my authority, with respect to these plans, is limited to the following Traffic discipline.

The 2025 Standard Specifications for Road and Bridge Construction controls construction of this project. The following special provisions supplement or modify the Standard Specifications and take precedence over the Standard Specifications and Plans.

## PROJECT SPECIAL PROVISIONS


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**CITY OF THORNTON**
**DEPARTMENT OF PUBLIC WORKS**
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**CITY OF THORNTON**
**DEPARTMENT OF PUBLIC WORKS**
**104th AVENUE AND WASHINGTON PLAZA**
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## COMMENCEMENT AND COMPLETION OF WORK

The Contractor shall commence work under the Contract on or before the 15th day following Contract execution or the 30th day following the date of award, whichever comes later, unless such time for beginning the work is changed by the Chief Engineer in the "Notice to Proceed." The Contractor shall commence work under the Contract 90 days following the date of award, unless such time for beginning the work is changed by the City in the "Notice to Proceed." The Contractor shall complete all work within 75 working days per the "Notice to Proceed."

Subsection 108.08 shall include the following:

A winter shut down period from October 1 through February 28 shall be included in the Contractor's critical path schedule for 2026 and 2027. This time is defined as free time and work may continue if conditions permit and as approved by the Engineer.

**Section 108 of the Standard Specifications is hereby revised for this project as follows:**

**In Subsection 108.03 (b) delete the first paragraph and replace with the following:**

The Contractor shall develop and manage a CPM Project Schedule to plan, schedule, and report the progress of the work. The Department will not allow use of bar charts for the Project Schedule.

**Subsection 108.03 (b), second paragraph shall include the following:**

An electronic copy of the Project Schedule shall be given to the Project Engineer.

**Subsection 108.03 (b), third paragraph shall include the following:**

All Contractor pay items shall be included in the Contractor's schedule.

**ON THE JOB TRAINING CONTRACT GOAL**

The Department has determined that On the Job Training shall be provided to trainees with the goal of developing full journey workers in the types of trade or classification involved. The contract goal for On the Job Trainees working in an approved training plan in this Contract has been established as follows:

Minimum number of total hours required for On the Job Training is 0.

**REVISION OF SECTION 101**
**DEFINITIONS AND TERMS**

Section 101 of the Standard Specifications is hereby revised for this project as follows:

Section 101.09 of the Standard Specifications is hereby revised for this project as follows:

101.09 CDOT Resident Engineer.
Unless otherwise provided in the Contract, reference to the CDOT Resident Engineer shall refer to the City Project

Delete Subsection 101.16 and replace with the following:

101.16 Contract. As defined in the General Conditions of the Contract for Construction.

Delete Subsection 101.18 and replace with the following:

101.18 Contract Modification Order. This term shall be interpreted to mean “Change Order” or “Construction Change Directive” as appropriate, and as defined in the General Conditions of the Contract for Construction.

Delete Subsection 101.22 and replace with the following:
101.22 Contractor. As defined in the General Conditions of the Contract for Construction.

Delete Subsection 101.28 and replace with the following:
101.28 Department. Unless otherwise provided in the Contract, references to the Department shall refer to the City

Delete Subsection 101.29 and replace with the following:
101.29 Engineer. Unless otherwise provided in the Contract, references to the ENGINEER shall refer to the C3 Project Manager or designated representative.

**REVISION OF SECTION 105**
**COOPERATION BETWEEN CONTRACTORS**

Section 105 of the Standard Specifications is hereby revised for this project as follows:

Subsection 105.12 shall include the following:

Other contractors will be working within or near the project limits. The Contractor for this project shall coordinate the work with these contractors as required, insuring an orderly completion of work. The Contractor shall contact all contractors working within the project limits and assign contact personnel between them. The Contractor shall notify the Engineer in writing of these contacts and of what arrangements have been made.

**REVISION OF SECTION 105**
**CONTROL OF WORK**

**Section 105 of the Standard Specifications is hereby revised for this project as follows:**

**Subsection 105.20 shall include the following:**

The Contractor shall provide timely response and complete all traffic signal maintenance for traffic signals that are included in the contract work within the project limits. The Contractor shall respond to the project site within one hour of notification for urban highway projects, and within four hours of notification for rural highway projects. These services shall be available upon notice, and provided at all times, including holidays and seasonal no work periods. The Contractor shall provide these services beginning when time count starts for the project through final acceptance. The Contractor shall submit a Traffic Signal Maintenance Plan (TSMP) to the Engineer for acceptance at the Pre-Construction Conference. The TSMP shall include the following:

(a) *Contact Information*. The Contractor shall designate a single contact person to be responsible for coordination and execution of the project TSMP. TSMP shall contain the Contractor's TSMP coordinator's contact information, including name and phone number, and additional contact information for all personnel assigned to perform Traffic Signal Maintenance.

(b) *Plan Requirements*. The TSMP shall establish a specific communications process to coordinate and manage Traffic Signal Maintenance. The TSMP shall document the project's response time to confirm the requirements stated above. The TSMP coordinator shall be responsible for all communications during an incident, including notification of the Engineer, and communications with concerned stakeholders regarding when the maintenance operations are started, the estimated time frame of the repair or maintenance, the time repair has been completed, and the time normal traffic operations are resumed. A post-incident evaluation report shall be submitted to the Engineer within 48 hours of the initial incident notification. The report shall summarize the incident timeline, the repair and maintenance required, and the communication efforts made during the incident.

(c) *Certification Documentation*. The Contractor shall adhere to the following requirements regarding Traffic Signal construction and maintenance personnel certifications. Current Certificates showing qualifications shall be documented in the TSMP to be submitted at the Pre-Construction Conference.

(1) A licensed Journeyman Electrician shall be on site at all times that signalization work is taking place to ensure proper construction. This shall include conduit and caisson installation.
(2) For work inside the traffic signal cabinet, Signal and Signal Bench Technicians shall be minimum IMSA Level II certified. This includes the completion of training in construction, corrective maintenance and signal turn-on.
(3) For all work external to the signal cabinet, a minimum IMSA Level I Traffic Signal Field Technician/Electrician, or Traffic Signal Bench Technician/Signal Technician, is required. A Journeyman Electrician and an IMSA Level II Traffic Signal Electrician shall be on the job site at all times that signalization work is taking place to ensure proper construction. For each Journeyman Electrician present, a maximum of 3 Apprentice Electricians will be allowed for work.

(d) *Traffic Control*. The Contractor shall perform traffic control as required until completion of the TSMP. All required traffic control contact information shall be provided in the TSMP.

The Contractor shall complete Traffic Signal Maintenance in accordance with the TSMP, and all other applicable project standard specifications or special provisions. Traffic Signal Maintenance as described above will not be measured and paid for separately, but shall be included in the work.

**REVISION OF SECTION 106**

**CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT**

**Section 106 of the Standard Special Provisions is hereby revised for this project as follows:**

**Subsection 106.05 shall include the following:**

For this project, Contractor process control testing of hot mix asphalt is mandatory.

**REVISION OF SECTION 107**
**LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC**

Section 107 of the Standard Specifications is hereby revised for this project as follows:

**Subsection 107.06 shall be revised to include the following:**

The Contractor and any subcontractor shall not require any laborer or mechanic employed in performance of the Contract to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health or safety, as determined under construction safety and health standards (Rules and Regulations of the Federal Occupational Safety and Health Act of 1970 (OSHA) and as amended).

All facilities and work conditions shall comply with Colorado and local Health Department Regulations and with OSHA requirements.

Subsection 107.07, Public Convenience and Safety, add the following:

The Contractor is to notify fire department, sheriff department, residents and businesses within the work area, one week in advance, concerning the hours and dates of the work.

The Contractor will be responsible for coordinating with the property owner/tenants adjacent the project site. Owners/tenants must be kept up to date on the construction schedule and any inconvenience to their driveways, ingress, egress, etc. Full closures of driveway access shall not be allowed.

Subsection 107.12 shall include the following:

The Contractor shall perform all the work in such a manner that the least environmental damage will result. Any questionable areas or items shall be brought to the attention of the Engineer for approval prior to vegetation removal or any damaging activity. Damaged or destroyed trees, shrubs, or wetlands, which could have been saved, shall be replaced at the expense of the Contractor.

Subsection 107.17, Contractor’s Responsibility for Work, add the following:

The Contractor shall be responsible for any damage to their work arising from running water from either a natural source or from landscape watering at no additional cost to the contract.

The Contractor shall be responsible for any damages done by the contractor including to irrigation facilities, landscaping or private property.

**REVISION OF SECTION 107**
**PERFORMANCE OF SAFETY CRITICAL WORK**

**Section 107 of the Standard Specifications is hereby revised as follows:**

**Add subsection 107.061 immediately following subsection 107.06 as follows:**

**107.061 Performance of Safety Critical Work**. The following work elements are considered safety critical work for this project:

(1) Traffic signal mast arm construction
(2) Work requiring the use of cranes or other heavy lifting equipment to set mast arms or to make overhead repairs, and when construction materials are being lifted that may fall onto active traffic lanes.

The Contractor shall submit, for record purposes only, an initial detailed construction plan that addresses safe construction of each of the safety critical elements. When the specifications already require an erection plan, a bridge removal plan, or a removal of portion of bridge plan, it shall be included as a part of this plan. The detailed construction plan shall be submitted two weeks prior to the safety critical element conference described below. The construction plan shall be stamped "Approved for Construction" and signed by the Contractor. The construction plan will not be approved by the Engineer.

The Construction Plan shall include the following:

(1) Safety Critical Element for which the plan is being prepared and submitted.
(2) Contractor or subcontractor responsible for the plan preparation and the work.
(3) Schedule, procedures, equipment, and sequence of operations, that comply with the working hour limitations
(4) Temporary works required: falsework, bracing, shoring, etc.
(5) Additional actions that will be taken to ensure that the work will be performed safely.
(6) Names and qualifications of workers who will be in responsible charge of the work:
    A. Years of experience performing similar work
    B. Training taken in performing similar work
    C. Certifications earned in performing similar work
(7) Names and qualifications of workers operating cranes or other lifting equipment:
    A. Years of experience performing similar work
    B. Training taken in performing similar work
    C. Certifications earned in performing similar work
(8) The construction plan shall address how the Contractor will handle contingencies such as:
    A. Unplanned events (storms, traffic accidents, etc.)
    B. Structural elements that don't fit or line up
    C. Work that cannot be completed in time for the roadway to be reopened to traffic
    D. Replacement of workers who don't perform the work safely
    E. Equipment failure
    F. Other potential difficulties inherent in the type of work being performed
(9) Name and qualifications of Contractor's person designated to determine and notify the Engineer in writing when it is safe to open a route to traffic after it has been closed for safety critical work.
(10) Erection plan when submitted as required elsewhere by the specifications. Plan requirements that overlap with above requirements may be submitted only once.

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**REVISION OF SECTION 107**
**PERFORMANCE OF SAFETY CRITICAL WORK**

A safety critical element conference shall be held two weeks prior to beginning construction on each safety critical element. The Engineer, the Contractor, the safety critical element subcontractors, and the Contractor's Engineer shall attend the conference. Required pre-erection conferences or bridge removal conferences may be included as part of this conference.

After the safety critical element conference, and prior to beginning work on the safety critical element, the Contractor shall submit a final construction plan to the Engineer for record purposes only. The Contractor's Engineer shall sign and seal temporary works, such as falsework, shoring, etc. related to construction plans for the safety critical elements, (1) through (6) listed on the previous page. The final construction plan shall be stamped "Approved for Construction" and signed by the Contractor.

The Contractor shall perform safety critical work only when the Engineer is on the Project site. The Contractor's Engineer shall be on site to inspect and provide written approval of safety critical work for which he or she provided signed and sealed construction details. Unless otherwise directed or approved, the Contractor's Engineer need not be on site during the actual performance of safety critical work but shall be present to conduct inspection for written approval of the safety critical work.

When ordered by the Engineer, the Contractor shall immediately stop safety critical work that is being performed in an unsafe manner or will result in an unsafe situation for the traveling public. Prior to stopping work, the Contractor shall make the situation safe for work stoppage. The Contractor shall submit an acceptable plan to correct the unsafe process before the Engineer will authorize resumption of the work.

When ordered by the Engineer, the Contractor shall remove workers from the project that are performing the safety critical work in a manner that creates an unsafe situation for the public in accordance with subsection 108.05.

Should an unplanned event occur, or the safety critical operation deviate from the submitted plan, the Contractor shall immediately cease operations on the safety critical element, except for performing any work necessary to ensure worksite safety, and provide proper protection of the work and the traveling public. If the Contractor intends to modify the submitted plan, he/she shall submit a revised plan to the Engineer prior to resuming operations.

All costs associated with the preparation and implementation of each safety critical element construction plan will not be measured and paid for separately, but shall be included in the work.

Nothing in this section shall be construed to relieve the Contractor from ultimate liability for unsafe or negligent acts or to be a waiver of the Colorado Governmental Immunity Act on behalf of the Department.

**REVISION OF SECTION 107**
**FIRE PROTECTION PLAN**

Section 107 of the Standard Specifications is hereby revised as follows:

**Subsection 107.18 shall be deleted and replaced with the following:**

107.18 Fire Protection Plan. The following work elements are considered safety critical work for this project:

(a) *Fire Protection Plan.* Prior to start of work, the Contractor shall submit a Fire Control Plan in writing to the Engineer and Local Fire Authority for approval. The plan shall include the following:

(1) The name and contact information of a Fire Control Coordinator who shall be assigned to the project.

(2) A 24-hour Emergency Contact List which, at a minimum, includes Project Superintendent, Project Foreman and Project Traffic Control Supervisor.

(3) A complete list, including storage locations, of all tools and equipment the Contractor will use in the event of an emergency within project limits.

(4) Methods that will be employed if a fire is encountered or started during construction activities within the project limits.

(5) Specific fire prevention precautions, and the required fire mitigation equipment, for every activity which has the potential for starting a fire. At a minimum the plan shall address prevention planning related to use of heavy equipment, vehicles, hand tools, storage and parking areas.

(6) Specific precautions for fueling operations.

(7) Provisions for field safety meetings. The Contractor shall conduct field safety meetings (also known as toolbox or tailgate meetings) at least once per week to include a local Fire Authority Representative. The Contractor shall encourage participation by all persons working at the project site. Participants shall discuss specific fire prevention precautions for construction activities.

(b) *Open Burn Exemption*. A BURN EXEMPTION may be requested by the Contractor if current fire restrictions are in place. The fire restrictions prohibit:

(1) Building, maintaining, attending, or using an open fire, campfire or stove fire (including charcoal barbecues and grills) on public land;

(2) Use of all personal fireworks;

(3) Shooting or discharging firearms for recreational purposes, except for hunting with a valid and current hunting license on public land;

(4) Smoking, except in an enclosed vehicle or building, a developed recreation site, or while stopped in an area at least three feet in diameter that is barren or cleared of all flammable materials;

(5) Operating a chainsaw without a USDA or SAE-approved spark arrester properly installed and in effective working order. A chemical, pressurized fire-extinguisher must be kept with the operator, and at least one round-point shovel with an overall length of at least 35 inches must be readily available for use;

(6) Welding or operating acetylene or other open-flame torches, except in cleared areas of at least 10 feet in diameter, and with a chemical, pressurized fire-extinguisher immediately available for use; and

(7) Using an explosive.

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**REVISION OF SECTION 107**
**FIRE PROTECTION PLAN**

(c) *Equipment and Procedures*.

Fire Boxes. If required by the local Fire Authority shall contain tools and equipment that shall be used exclusively for controlling or suppressing fires which occur due to construction activities on project sites. Each fire box shall contain, as a minimum, the following:

(1) Five round-pointed shovels,

(2) Two double-bitted axes,

(3) Three Pulaskis or mattocks,

(4) Two backpack pumps, and

(5) Four large fire extinguishers as prescribed by the local Fire Authority.

Welding/Torching/Cutting/Drilling. If work at field locations is required, the work shall be done at a location where all flammable material has been cleared within a 30-foot radius and approved by the local Fire Authority.

Spark Arrestors. All diesel and gasoline powered engines, both mobile and stationary, shall be equipped with serviceable spark arrestors each gasoline power saw shall be provided with a spark screen and a muffler in good condition. Spill-proof metal safety cans shall be used for refueling. Approved and inspected by the local Fire Authority.

Storage and Parking Areas. Batch plant areas, equipment service areas, parking areas, gas and oil drum storage areas, and explosive storage areas shall be cleared of all flammable materials for a distance of 50 feet. Small stationary engine sites shall be cleared of all flammable material for distance of 20 feet. Other mitigation methods may be used as approved by the Engineer and applicable codes.

(d) *Fire Control Coordinator Responsibilities*. The Fire Control Coordinator shall:

(1) Be the primary contact for the local Fire Authority and Project Engineer

(2) Implement the Fire Control Plan.

(3) Monitor, manage, and adjust the Fire Control Plan as needed as construction work progresses.

(4) Document in a letter to the Engineer and Local Fire Authority changes to the Fire Control Plan.

(5) Contact local firefighting authorities 3 days in advance when a hazardous operation is scheduled. Inspection due to construction activities within project limits may be required.

(6) Coordinate fire control, mitigation and possible suppression activities until authorities arrive, including the evacuation of staff.

When the Fire Control Coordinator cannot be on the project site, he shall designate a person who is on site to serve as the Fire Control Coordinator. The Fire Control Coordinator, or his designee, shall always be on site while work is performed.

(e) *Open Burning During Weather Events*. During any of the following weather events, open burning is not permitted on the project site from time of issuance until midnight in which the event expires: Red Flag

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**REVISION OF SECTION 107**
**FIRE PROTECTION PLAN**

Warning, High Wind Warning, High Wind Watch and Fire Danger Warning. Check the local forecast for up to date information issued by the National Weather Service.

The National Weather Service issues weather statements to inform area firefighting and land use management agencies that conditions are ideal for wildland fire ignition and propagation (Red Flag Warning, High Wind Warning, High Wind Watch, Fire Danger Warning).

For this standard special provision, smoking is an open flame and shall be included in the definition of open burning, which is not permitted for the above listed weather events. Any smoking or lighting of items outside or within a vehicle with open windows is not permitted on the project site or within 500 feet of the project's limits of disturbance. With the approval of the Engineer, who consults with the local Fire Authority, a designated smoking area may be established.

No additional payment or compensation will be paid to the Contractor during any weather events associated with open burning and include Red Flag Warning, High Wind Warning, High Wind Watch, Fire Danger Warning. Delays may be counted as an excusable delay per Standard Specification 108.08 or at the discretion of the Engineer.

(f) *Costs.* All costs associated with the preparation and implementation of the Plan and compliance with all fire protection provisions and requirements will not be measured and paid for separately but shall be included in the work.

**REVISION OF SECTION 107**
**PROTECTION OF EXISTING VEGETATION**

**Section 107 of the Standard Specifications is hereby revised for this project as follows:**

**Subsection 107.12 shall include the following:**

The Contractor shall protect all existing vegetation (including trees, shrubs, ground cover, grasses, wetland and riparian vegetation) in this area, except for vegetation which must be removed to accommodate construction of the project. Specific areas of vegetation to be protected shall be as directed by the Engineer and shall be delineated with orange construction fencing, wire fencing with metal posts, or silt fence. Fencing shall be installed at the drip lines of trees or as designated by the Engineer. Equipment shall not be installed or material stock piled within 15 feet of existing trees designated to remain.

The Contractor shall perform all the work in such a manner that minimizes environmental damage. Questions about specific areas or vegetation shall be directed to the Engineer for resolution prior to any removal or activity damaging the vegetation in question.

The Contractor shall promptly report any vegetation within protected areas that is damaged by construction activities to the Engineer for assessment of damages. If vegetation within fenced areas is damaged or destroyed, it shall be replaced at the Contractor's expense. Vegetation of replaceable size shall be replaced. The determination as to whether a plant is of replaceable size will be made by the Department's Landscape Architect. If trees or shrubs larger than replaceable size are damaged or destroyed, the Contractor shall be liable for the appraised value, based upon the current official publication of the International Society of Arboriculture, Guide for Plant Appraisals. A consulting Arborist retained by the Department will determine the value of the trees and shrubs. This value will be deducted from any money due to the Contractor. The value of such trees or shrubs will be based upon tree size, species, location, and condition.

If the delineating fence is knocked down or destroyed by the Contractor, the Engineer may suspend the work, wholly or in part, until the fence is repaired to the Engineer's satisfaction at the Contractor's expense. Time lost due to such suspension of work will not be considered a basis for adjustment of time charges, but will be charged as contract time.

**REVISION OF SECTION 108**
**PROSECUTION AND PROGRESS**

**Section 108 of the Standard Specifications is hereby revised for this project as follows:**

**Subsection 108.05 shall include the following:**

The Contractor shall provide and maintain traffic on the existing, temporary, or permanent hard paved surface during the duration of the project unless otherwise approved by the Project Engineer.

Delays or impacts to the Contractor due to the requirements of this provision shall not be a basis for an extension of time or additional compensation, or both.

Any denial or revocation of prior approval for traffic-handling requests shall not be the basis for any claim for additional time or compensation.

All costs incidental to the foregoing requirements will not be paid for separately, but shall be included in the work.

**In subsection 108.08, delete the 2nd paragraph and replace with the following:**

The Contractor shall not work on the following holiday dates:

There shall be no construction work and no portions of the roadway shall be closed:

- Holidays

Work can commence the following working day after these restricted no construction work.

**REVISION OF SECTION 201**
**CLEARING AND GRUBBING**

Section 201 of the Standard Specifications is hereby revised for this project as follows:

**In Subsection 201.02 delete the second paragraph and replace with the following:**

Clearing and grubbing shall be within the limits of the project, as identified in the plans. All other areas of clearing and grubbing shall be as directed by the Engineer. No tree removal will be permitted without approval of the Engineer.

**In Subsection 201.02 delete the sixth paragraph and replace with the following:**

No material or debris shall be disposed of within the project limits. All debris and unused material shall be legally disposed of off-site or, if applicable, to a recycling center. The Contractor shall make all arrangements to obtain written permission from property owners for disposal locations outside the limits of the project. Copies of this written agreement shall be furnished to the Engineer before the disposal area is used.

**REVISION OF SECTION 202**
**REMOVAL OF ASPHALT MAT**

**Section 202 of the Standard Specifications is hereby revised for this project as follows:**

**Subsection 202.01 shall include the following:**

This work includes removal and disposal of existing asphalt mat within the project limits as shown on the plans or at locations directed by the Engineer.

**In subsection 202.02 delete the seventh paragraph and replace with the following:**

The existing asphalt mat, which varies in thickness, shall be removed in a manner that minimizes contamination of the removed mat with underlying material. The removed mat shall become the property of the Contractor and be disposed of by any one or more of the following described methods:

1. Use in embankment construction in accordance with subsection 203.07(c).
2. Place material in bottom of fills as approved by the Engineer.
3. Place material in subgrade soft spots outside of the roadway prism as directed by the Engineer.
4. Recycled into the Hot Mix Asphalt.

**Subsection 202.11 shall include the following:**

The removal of the existing asphalt mat will be measured by the area, in square yards, completed to the required depth and accepted.

**Subsection 202.12 shall include the following:**

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| Removal of Asphalt Mat | Square Yard |

Unless otherwise specified in the Contract, the disposal of the asphalt mat or its use in other locations on the project will not be measured and paid for separately, but shall be included in the work.

**REVISION OF SECTION 202**
**REMOVAL OF ASPHALT MAT (PLANING)**

Section 202 of the Standard Specifications is hereby revised for this project as follows:

**Delete subsection 202.09, and replace it with the following:**

202.09 Removal of Asphalt Mat (Planing). Prior to beginning planing operations, the Contractor shall submit a planing plan and a Process Control Plan (PCP) for approval by the Engineer. The planing plan shall include at a minimum:

(1) The number, types and sizes of planers to be used.
(2) The width and location of each planing pass.
(3) The number and types of brooms to be used and their locations with respect to the planers.
(4) The proposed method for planing and wedging around existing structures such as manholes, valve boxes, and inlets.
(5) The longitudinal and transverse typical sections for tie-ins at the end of the day.
(6) If requested by the Engineer, a plan sheet showing the milling passes.

The PCP shall include as a minimum:

(1) The schedule for replacing the cutting teeth.
(2) The daily preventive maintenance schedule and checklist.
(3) Proposed use of automatic grade controls.
(4) The surface testing schedule for smoothness.
(5) The process for filling distressed areas.
(6) The schedule for testing macrotexture of the milled surface.
(7) Corrective procedures if the milled surface does not meet the minimum macrotexture specification.
(8) Corrective procedures if the milled surface does not meet the minimum transverse or longitudinal surface finish when measured with a 10 foot straightedge.

The Contractor shall not start the planing operation until the hot mix asphalt (HMA) mix design has been approved and a Form 43 has been signed by the Engineer.

The existing pavement shall be milled to the cross-slope as shown on the plans, and shall have a surface finish that does not vary longitudinally or transversely more than ⅜ inch from a 10 foot straightedge. A 10 foot straightedge shall be supplied by the Contractor.

All milled surfaces shall be broomed with a pick-up broom, unless otherwise specified, before being opened to traffic. A sufficient number of brooms shall be used immediately after planing to remove all milled material remaining in the roadway.

If the Contractor fails to adequately clean the roadway, work shall cease until the Engineer has approved the Contractor's revised written proposal to adequately clean the roadway.

The milled surface shall have a macrotexture equal to or less than 0.170 inches for single-lift overlays and 0.215 inches for multiple-lift overlays as tested in accordance with CP 77. Milled surfaces that do not meet these criteria shall require corrective action in accordance with the PCP. The Contractor shall be responsible for testing the macrotexture of the milled surface at the location directed by the Engineer in accordance with CP 77 at a stratified random frequency of one test per 10,000 square yards or a minimum of once per work day.

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**REVISION OF SECTION 202**
**REMOVAL OF ASPHALT MAT (PLANING)**

At the completion of each day's work, longitudinal vertical edges greater than 1 inch shall be tapered. No transverse vertical edges will be allowed. Longitudinal milled surface tie-ins to existing pavement shall be tapered to not less than a 3:1 slope, transverse milled surface tie-ins to existing pavement shall be tapered to not less than a 50:1 slope. Transverse tapered joints may be tapered with the planing machine, a temporary asphalt ramp, or other methods approved by the Engineer. No longitudinal joint between the milled and existing surfaces shall fall between 1 to 5 feet of any lane line.

If the transverse joint is tapered with a temporary asphalt ramp, the milled surface at the joint shall be constructed as a butt joint the full depth of the lift of asphalt to be placed on the milled surface. The Contractor shall be responsible for maintaining this asphalt ramp until all corresponding HMA is placed. All work associated with this joint will not be paid for separately, but shall be included in the cost of planing.

If the transverse joint is tapered with a planing machine, a butt joint shall be cut into the taper the full depth of the lift of asphalt to be placed on the milled surface prior to commencement of resurfacing. All work associated with this joint will not be paid for separately, but shall be included in the cost of planing.

Other approved transverse joint tapers shall be maintained at the expense of the Contractor, and at a minimum shall incorporate a butt joint the full depth of the lift of asphalt to be placed on the milled surface prior to commencement of resurfacing.

Distressed or irregular areas identified in the planed surface by the Engineer shall be patched.

The roadway shall be left in a safe and usable condition at the end of each work day. The Contractor shall take appropriate measures to ensure that the milled surface does not trap or hold water. All required pavement markings removed by the planing shall be restored before the roadway is opened to traffic.

All milled surfaces to be overlaid with HMA shall be covered with new asphalt within 7 working days. All areas on this project that are not overlaid within the specified working days will be assessed a lane rental fee of $500 per occurrence for each day or fraction thereof and any required surface repairs shall be paid for by the Contractor.

All planing shall be completed full width and parallel to the travel lanes before resurfacing commences unless otherwise directed by the Engineer.

All material generated by the planing operation shall become the property of the Contractor unless otherwise noted in the Contract.

Each planer shall conform to the following:

The planer shall have sufficient power, traction and stability to maintain an accurate depth of cut. The propulsion and guidance system of the planer shall be maintained in such condition that the planer may be operated to straight and true lines.

The planer shall be capable of operating with automatic grade controls (contact or non-contact) on both sides of the machine using a 30 foot averaging system or other approved grade control systems. The use of such controls shall be described in the Contractor's PCP.

The planer shall be capable of picking up the removed material in a single operation. A self-loading conveyor shall be an integral part of the planer. Windrows will not be allowed.

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**REVISION OF SECTION 202**
**REMOVAL OF ASPHALT MAT (PLANING)**

**Subsection 202.12 shall include the following:**

Macrotexture testing, macrotexture corrective actions, planers, brooms, and all other work necessary to complete the item, Removal of Asphalt Mat (Planing), will not be measured and paid for separately, but shall be included in the work.

**REVISION OF SECTION 202**
**REMOVAL OF PAVEMENT MARKING**

**Section 202 of the Standard Specifications is hereby revised for this project as follows:**

**Subsection 202.05 shall include the following:**

Pavement markings designated for removal and replacement shall be removed to a depth of 35 mils +/- 5 mils. The contractor shall use **gang stacked diamond tip blades or equivalent** to create a smooth application surface to the satisfaction of the project engineer and have a vacuum machine on site to control dust paid for within the pay item.

The contractor shall not perform any more removals than can be applied by the pavement marking truck during the same working day or working period.

If a rain event occurs during removal and marking application, the contractor shall halt the removal operation and raised flexible pavement markers shall be placed at locations that have been removed but not marked while the pavement is drying prior to the marking application. Marking application shall resume then pavement is dry and has had no moisture for a minimum of 24 hours. Raised flexible pavement markers shall be installed with one marker at 40-foot centers.

Grooves shall be clean, dry and free of laitance, oil, dirt, grease, paint or other foreign contaminants. The Contractor shall prevent traffic from traversing the grooves, and re-clean grooves, as necessary, prior to application of the epoxy pavement markings.

**Subsection 202.12 shall include the following:**

Removal of pavement markings and removal of temporary pavement markings will not be paid for separately but shall be included in the work. The work to groove the asphalt or concrete and clean the grooving residual or debris will not be measured and paid for separately but shall be included in the work.

Temporary markings will not be measured and paid for separately but shall be included in the work.

**REVISION OF SECTION 208**
**EROSION CONTROL**

**Section 208 of the Standard Specification is hereby revised as follows:**

**Subsection 208.02 (k) shall include the following:**

Prior to the initial arrival onto the project site, all equipment shall be thoroughly power washed, including the undercarriages and tires. Equipment must be clean of mud, vegetative matter, and other debris to prevent importation of non-native and noxious weed seeds from other project sites.

**REVISION OF SECTION 209**
**DUST PALLIATIVES**

**Section 209 of the Standard Specifications is hereby revised for this project as follows:**

**Subsection 209.05 shall include:**

The contractor shall be responsible for controlling vehicle and equipment speeds within the project site to keep dust to a minimum. The Contractor shall monitor activities daily for dust. If excessive dust is being generated by construction vehicles or equipment, the contractor shall immediately take corrective action to ensure operators and drivers control speeds, thereby, assisting in dust suppression.

**REVISION OF SECTION 304**
**AGGREGATE BASE COURSE**

**Section 304 of the Standard Specifications is hereby revised for this project as follows:**

**Subsection 304.02 shall include the following:**

Materials for the base course shall be Aggregate Base Course (Class 6) as shown in subsection 703.03.

The aggregate base course (Class 6) must meet the gradation requirements and have a resistance value of at least 78 when tested by the Hveem Stabilometer method.

Subsection 304.08 shall include the following:

| **Pay Item** | **Pay Unit** |
|---|---|
| Aggregate Base Course (Class 6) | CY |

Compaction, water, impervious membrane, excavation, and removal of unsuitable material and all other work necessary to complete this item will not be measured and paid for separately but shall be included as part of the work.

**REVISION OF SECTION 401**
**TOLERANCES FOR HOT MIX ASPHALT (VOIDS ACCEPTANCE)**

Section 401 of the Standard Specifications is hereby revised for this project as follows:

In subsection 401.02(b) delete Table 401-1, including the footnotes, and replace with the following:

**Table 401-1**
**Tolerances for Hot Mix Asphalt**

| Element | Tolerance |
|---|---|
| Asphalt Cement Content | ± 0.3 % |
| Voids in the Mineral Aggregate (VMA) | ± 1.2 % |
| Air Voids | ± 1.2 % |
| Asphalt Recycling Agent | ± 0.2 % |
| **[1]Hot Mix Asphalt – Item 403, Gradations** | |
| [2]Passing the 9.5 mm (3/8 inch) and larger sieves | ± 6 % |
| [2]Passing the 4.75 mm (No. 4) and 2.36 mm (No. 8) sieves | ± 5 % |
| [2]Passing the 600µm (No. 30) sieve | ± 4 % |
| [2]Passing the 75µm (No. 200) sieve | ± 2 % |
| [1]When 100% passing is designated, there shall be no tolerance. When 90-100% passing is designated, 90% shall be the minimum; no tolerance shall be used.<br>[2]These tolerances apply to the Contractor's Process Control Testing | |

**REVISION OF SECTION 403**
**HOT MIX ASPHALT**

**Section 403 of the Standard Specifications is hereby revised for this project as follows:**

**Subsection 403.02 shall include the following:**

The design mix for hot mix asphalt shall conform to the following:

**TABLE 403-1**

| Property | Test Method | Value For Grading | | | |
|---|---|---|---|---|---|
| | | S (100) | SX (100) | | Patching |
| Air Voids, percent at:<br>N (design) | CPL 5115 | 3.5 – 4.5 | 3.5 – 4.5 | | 3.5 – 4.5 |
| Lab Compaction (Revolutions):<br>N (initial) [for information only]<br>N (design) | CPL 5115 | 8<br>100 | 8<br>100 | | 8<br>100 |
| Stability, minimum | CPL 5106 | 30 | 30 | | 30 |
| Aggregate Retained on the 4.75 mm (No. 4) Sieve for S, SX and SG, and on the 2.36mm (No. 8) Sieve for ST and SF with at least 2 Mechanically Induced fractured faces, % minimum* | CP 45 | 60 | 60 | | 60 |
| Accelerated Moisture Susceptibility Tensile Strength Ratio (Lottman), minimum | CPL 5109 Method B | 80 | 80 | | 80 |
| Minimum Dry Split Tensile Strength, kPa (psi) | CPL 5109 Method B | 205 (30) | 205 (30) | | 205 (30) |
| Grade of Asphalt Cement, Top Layer | | | PG 76-28 | | PG 76-28 |
| Grade of Asphalt Cement, Layers below Top | | PG 64-22 or PG 76-28 | | | PG 64-22 or PG 76-28 |
| Voids in the Mineral Aggregate (VMA) % minimum | CP 48 | See Table 403-2 | See Table 403-2 | | See Table 403-2 |
| Voids Filled with Asphalt (VFA), % | AI MS-2 | 65-75 | 65-75 | | 65-75 |
| Dust to Asphalt Ratio<br>Fine Gradation<br>Coarse Gradation | CP 50 | 0.6 – 1.2<br>0.8 – 1.6 | 0.6 – 1.2<br>0.8 – 1.6 | | 0.6 – 1.2<br>0.8 – 1.6 |

Note: AI MS-2 = Asphalt Institute Manual Series 2

Note: Mixes with gradations having less than 40% passing the 4.75 mm (No. 4) sieve shall be approached with caution because of constructability problems.

Note: Gradations for mixes with a nominal maximum aggregate size of one-inch or larger are considered a coarse gradation if they pass below the maximum density line at the #4 screen.
Gradations for mixes with a nominal maximum aggregate size of 3/4" to 3/8" are considered a coarse gradation if they pass below the maximum density line at the #8 screen.
Gradations for mixes with a nominal maximum aggregate size of #4 or smaller are considered a coarse gradation if they pass below the maximum density line at the #16 screen.

*Fractured face requirements for SF may be waived by RME depending on project conditions.

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**REVISION OF SECTION 403**
**HOT MIX ASPHALT**

All mix designs shall be run with a gyratory compaction angle of 1.25 degrees and properties must satisfy Table 403-1. Form 43 will establish construction targets for Asphalt Cement and all mix properties at Air Voids up to 1.0 percent below the mix design optimum. CDOT will establish the production asphalt cement and volumetric targets based on the Contractor's mix design and the relationships shown between the hot mix asphalt mixture volumetric properties and asphalt cement contents on the Form 429. CDOT may select a different AC content other than the one shown at optimum on the Contractor's mix design in order to establish the production targets as contained on the Form 43. Historically, Air Voids adjustments typically result in asphalt cement increases from 0.1 to 0.5 percent. Contractors bidding the project should anticipate this change and factor it into their unit price bid.

**Table 403-2**

| **Nominal Maximum Size*, mm (inches)** | ***Design Air Voids ** | | | |
|---|---|---|---|---|
| | **3.5%** | **4.0%** | **4.5%** | **5.0%** |
| 37.5 (1½) | 11.6 | 11.7 | 11.8 | N/A |
| 25.0 (1) | 12.6 | 12.7 | 12.8 | |
| 19.0 (¾) | 13.6 | 13.7 | 13.8 | |
| 12.5 (½) | 14.6 | 14.7 | 14.8 | |
| 9.5 (⅜) | 15.6 | 15.7 | 15.8 | |
| 4.75 (No. 4) | 16.6 | 16.7 | 16.8 | 16.9 |
| | * The Nominal Maximum Size is defined as one sieve larger than the first sieve to retain more than 10%.<br>** Interpolate specified VMA values for design air voids between those listed.<br>*** Extrapolate specified VMA values for production air voids beyond those listed. | | | |

The Contractor shall prepare a quality control plan outlining the steps taken to minimize segregation of HMA. This plan shall be submitted to the Engineer and approved prior to beginning the paving operations. When the Engineer determines that segregation is unacceptable, the paving shall stop and the cause of segregation shall be corrected before paving operations will be allowed to resume.

Hot mix asphalt for intermediate and bottom lifts of paving or patching used below the roadway surface shall conform to the gradation requirements for Hot Mix Asphalt (Grading S) (100) (PG 64-22) or (Grading SX) (100) (PG 76-28). Hot mix asphalt for top lifts of paving or patching used on the roadway surface shall conform to the gradation requirements for Hot Mix Asphalt (Grading SX) (100) (PG 76-28).

CDOT approved Warm Mix Asphalt (WMA) may be allowed on this project in accordance with CP 59. Unique requirements for WMA design, production and acceptance testing as documented during CDOT WMA approval shall be submitted and approved prior to creation of the Form 43 and before any WMA production on the project. Delays to the project due to WMA submittal and review will be considered within the Contractor's control and will be non-excusable.

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**REVISION OF SECTION 403**
**HOT MIX ASPHALT**

Contractors proposing to use WMA shall supply detailed design, production and acceptance testing requirements prior to completion of the Form 43. Approved WMA submittals shall contain all of this information prior to CDOT approval. Only CDOT Approved WMA incorporating additives from the Approved Products List (APL) will be allowed for use on the project.

A minimum of 1 percent hydrated lime by weight of the combined aggregate shall be added to the aggregate for all hot mix asphalt.

Subsection 403.03 shall include the following:

If liquid anti-stripping additive is added at the plant, an approved in-line blender must be used. The blender shall be in the line from the storage tank to the drier drum or pugmill. The blender shall apply sufficient mixing action to thoroughly mix the asphalt cement and anti-stripping additive.

The Contractor shall construct the work such that all roadway pavement placed prior to the time paving operations end for the year, shall be completed to the full thickness required by the plans. The Contractor's Progress Schedule shall show the methods to be used to comply with this requirement.

Delete subsection 403.05 and replace with the following:

**403.05** The accepted quantities of hot mix asphalt will be paid for in accordance with subsection 401.22, at the contract unit price per ton for the bituminous mixture.

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| Hot Mix Asphalt (Grading SX) (100) (PG 76-28) | Ton |
| Hot Mix Asphalt (Grading S) (100) (PG 64-22) | Ton |
| Hot Mix Asphalt (Patching) (Asphalt) | Ton |

Aggregate, asphalt recycling agent, additives, hydrated lime, and all other work necessary to complete each hot mix asphalt item will not be paid for separately, but shall be included in the unit price bid. When the pay item includes the PG binder grade, the asphalt cement will not be measured and paid for separately, but shall be included in the work. When the pay item does not include the PG binder grade, asphalt cement will be measured and paid for in accordance with Section 411. Asphalt cement used in Hot Mix Asphalt (Patching) (Asphalt) will not be measured and paid for separately, but shall be included in the work.

Historically, typical asphalt cement increases reflected on the Form 43 are from 0.1 to 0.5 percent. However, the Contractor should anticipate the AC increases typical of his mixes. Contractors bidding the project should anticipate this change and factor it into their unit price bid.

When the pay item does not include the PG binder grade, asphalt cement will be measured and paid for in accordance with Section 411. Asphalt cement used in Hot Mix Asphalt (Patching) will not be measured and paid for separately, but shall be included in the work.

Excavation, preparation, and tack coat of areas to be patched will not be measured and paid for separately, but shall be included in the work.

**REVISION OF SECTION 403**
**HOT MIX ASPHALT TICKET COLLECTION**

**Section 403 of the Standard Specifications is hereby revised for this project as follows:**

**Subsection 403.05 shall include the following:**

The Contractor shall collect the scale ticket on each load when it is delivered to the project site, and ensure that the information required in subsection 109.01 is shown on each ticket. The Contractor's ticket collector shall add the placement location to each scale ticket using stationing or mileposts and sign it.

The scale tickets shall be available on site for CDOT personnel to inspect.

Each day the Contractor shall provide to the Engineer envelopes which contain the previous day's signed tickets and the following:

1. On each envelope: Project number, date of paving, type of material, daily total and cumulative total.

2. One of the following:

   A. Two adding machine tape tabulations of the weight tickets with corresponding totals run and signed by different persons,
   B. One signed adding machine tape tabulation of the weight tickets that has been checked and signed by a second person,
   C. Signed check tape of computer scale tickets that have a cumulative total. These scale tickets must be consecutive and without voids adjustments.

3. A listing of any overweight loads on the envelope, including ticket numbers and amount over legal limit.

4. A comparison of the actual yield for each day's placement to the theoretical yield. Theoretical yield shall be based on the actual area paved, the planned thickness, and the actual density of the mixture being placed. Any variance greater than +2.5% shall be indicated on the envelope and a written explanation included.

The Contractor shall provide a vehicle identification sheet that contains the following information for each vehicle:
(1) Vehicle number
(2) Length
(3) Tare weight
(4) Number of axles
(5) Distance between extreme axles
(6) All other information required to determine legal weight.
(7) Legal weight limit.

**REVISION OF SECTION 503 and 601**
**DRILLED SHAFTS**

**Sections 503 and 601 of the Standard Specifications are hereby revised for this project as follows:**

**Delete Section 503 and replace with the following:**

## DESCRIPTION

**503.01** This work consists of furnishing all materials, labor, tools, equipment, services and incidentals necessary to construct the drilled shafts (also referred to as drilled caissons, drilled piers, cast-in-place-drilled-holes, or cast-in-situ piles) in accordance with the Contract Documents and this Specification.

## SUBMITTALS AND MEETINGS

**503.02 Submittals**. At least 30 days prior to the start of drilled shaft construction, the Contractor shall submit to the Engineer an electronic file of a project reference list verifying the successful completion by the Contractor of at least three separate foundation projects within the last five years with drilled shafts of similar size (diameter and depth) and construction difficulty to those shown on the Plans in similar subsurface geotechnical conditions. A brief description of each project and the project owner's contact name and current phone number shall be included for each project listed. Work shall not begin until all required submittals have been received by the Engineer.

(a) *Experience and Personnel.* The personnel assigned to the project shall have the following minimum experience:

1. On-site supervisors shall have a minimum of two years of experience in supervising construction of drilled shaft foundations of similar size (diameter and depth) and installation method to those shown on the Plans and similar geotechnical conditions to those described in the geotechnical report. The work experience shall be direct supervisory responsibility for the on-site drilled shaft construction operations. Project management level positions indirectly supervising on-site drilled shaft construction operations are not acceptable for this experience requirement.

2. Drill rig operators shall have a minimum of one year experience in construction of drilled shaft foundations.

The Engineer may request a list identifying on-site supervisors and drill rig operators assigned to the project for review. The list shall contain a detailed summary of each individual's experience in drilled shaft excavation operations. The Contractor shall inform the Engineer in writing of changes to field personnel.

(b) *Drilled Shaft Installation Plan.* At least 30 days prior to the start of drilled shaft construction the Contractor shall submit an electronic file of a Drilled Shaft Installation Plan narrative. In preparing the narrative, the Contractor shall reference the available subsurface geotechnical data provided in the Contract and any geotechnical reports prepared for this project. This narrative shall provide at a minimum the following information:

(1) Description of overall construction operation sequence and the sequence of drilled shaft construction when in groups or lines.

(2) A list, description and capacities of proposed equipment including but not limited to cranes, drills, augers, bailing buckets, final cleaning equipment and drilling unit. As appropriate, the narrative shall describe why the equipment was selected and suitability to the anticipated site and subsurface conditions.

(3) Details of drilled shaft excavation methods, including proposed drilling methods, methods for cleanout of the bottom of the excavation hole and a disposal plan for excavated material including drilling slurry (if applicable). This shall include means and methods to address subsurface geotechnical conditions including boulder and obstruction removal techniques if such are indicated in the Contract subsurface geotechnical information or Contract Documents.

Details of the methods to be used to ensure drilled shaft hole stability (i.e., prevention of caving, bottom heave, etc. using temporary casing, slurry, or other means) during excavation and concrete placement.

(4) Detailed procedures for mixing, using, maintaining, storing, and disposing of the slurry shall be provided if applicable. A detailed mix design (including all additives and their specific purpose in the slurry mix) and a discussion of its suitability to the anticipated subsurface geotechnical and site conditions shall also be provided for the proposed slurry.

(5) The submittal shall include a detailed plan for process control of the selected slurry including property tests, test methods, and minimum and/or maximum property requirements which must be met to ensure that the slurry functions as intended for the anticipated subsurface conditions and shaft construction methods in accordance with the slurry manufacturer's recommendations and these Specifications.

(6) When casings are proposed or required, casing dimensions and detailed procedures for casing installation, removal, advancing the casing, and excavating the drilled shaft hole in accordance with subsection 503.13(b) shall be provided. When removing casing, detail the method to extract the casing to maintain shaft reinforcement in proper alignment and keep concrete workable during casing extraction.

(7) Details of concrete placement including proposed equipment and procedures for delivering concrete to the drilled shaft, placement of the concrete into the shaft, placement and raising of the tremie or pump line during placement, size of tremie and pump lines, operational procedures for pumping, and a sample uniform yield form to be used by the Contractor for plotting the volume of concrete placed versus the depth of shaft for all shaft concrete placement. Describe the method to be used to form a horizontal construction joint during concrete placement. Include details of procedures to prevent loss of slurry or concrete into waterways, and other areas to be protected.

(8) Describe the method and materials that will be used to fill or eliminate all voids below the top of shaft between the plan shaft diameter and excavated shaft diameter, or between the shaft casing and surrounding soil if permanent casing is specified.

(9) Details of any required load tests or shaft integrity tests including equipment, instrumentation, procedures, calibration data for test equipment, calculations and drawings.

(10) Details and procedures for protecting existing structures, utilities, roadways and other facilities during drilled shaft installation.

(c) *Slurry Technical Assistance.* If slurry is to be used to construct the drilled shafts, the Contractor shall provide or arrange for technical assistance from the slurry manufacturer as specified in subsection 503.13(b)5(1). The Contractor shall submit three copies of the following to the Engineer at least 14 days prior to the start of drilled shaft construction:

(1) The name and current phone number of the slurry manufacturer's technical representative assigned to the project.

(2) The names of the Contractor's personnel assigned to the project and trained by the slurry manufacturer's technical representative in the proper use of the slurry. The submittal shall include a signed training certification letter from the slurry manufacturer for each individual including the date of the training.

(d) *Logs of Shaft Construction.* The Contractor's Quality Control staff shall prepare inspection logs using CDOT Form 1333 – Inspector's Report of Caisson Installation documenting each shaft construction activity. In addition, the Contractor shall prepare and submit the logs documenting any subsurface investigation borings or rock core holes performed by the Contractor at drilled shaft foundation locations.

In addition to the information required on the Form 1333, the Contractor shall provide the following information: type and dimensions of tools and equipment used, any changes to the tools and equipment; type of drilling fluid if used, the results of slurry tests, any problems encountered, and method used for bottom cleaning.

In addition to the information required on the Form 1333, concrete placement records shall include at least the following information: tremie tip elevation during concrete placement, and concrete yield curve (volume versus concrete elevation, actual and theoretical).

A complete set of shaft inspection logs for an individual drilled shaft shall be submitted to the Engineer within 48 hours of the completion of concrete placement at the shaft.

**503.03 Meetings.** The Engineer will evaluate the Drilled Shaft Installation Plan for conformance with the Contract within ten working days after receipt of the submission. At the option of the Department, a Shaft Installation Plan Submittal Meeting may be scheduled following review of the Contractor's initial submittal of the Plan. Those attending the Shaft Installation Plan Submittal Meeting, if held, shall include the following:

(1) The superintendent, on-site supervisors, and other Contractor personnel involved in the preparation and execution of the Drilled Shaft Installation Plan.

(2) The Project Engineer and Owner's personnel involved with the structural, geotechnical, and construction review of the Drilled Shaft Installation Plan together with Owner's personnel who will provide inspection and oversight during the drilled shaft construction phase of project.

The Contractor shall submit to the Engineer updates or modifications to the Drilled Shaft Installation Plan whenever such updates or modifications are proposed. The Engineer will evaluate the new information for conformance with the Contract Plans and Specifications and respond within ten working days after receipt of the submission.

A shaft preconstruction meeting shall be held at least five working days prior to the Contractor beginning any shaft construction work at the site to discuss investigative boring information, construction procedures, personnel, and equipment to be used, and other elements of the accepted Shaft Installation Plan as specified in subsection 503.02(b). If slurry is used to construct the shafts, the frequency of scheduled site visits to the project site by the slurry manufacturer's representative shall be discussed. Those attending shall include:

(1) The superintendent, on-site supervisors, and other key personnel identified by the Contractor as being in charge of excavating the shaft, placing the casing and slurry as applicable, placing the steel reinforcing bars, and placing the concrete. If slurry is used to construct the shafts, the slurry manufacturer's representative and a Contractor's employee trained in the use of the slurry, as identified to the Engineer in accordance with subsection 503.04(c)4(1), shall also attend.

(2) The Engineer, key inspection personnel, and appropriate representatives of the Department. If the Contractor's key personnel change, or if the Contractor proposes a significant revision of the approved Drilled Shaft Installation Plan, an additional conference may be held at the request of the Engineer before any additional shaft construction operations are performed.

**503.04 Control and Disposal of Materials.** The Contractor shall collect and properly dispose offsite all slurry and water displaced during final cleaning and concrete placement. Open pits for collection of materials may be allowed during construction activities for later disposal. Control all excavated material, slurry, water, and other matter so that at no time it enters or encroaches upon the adjacent travel lanes, railroad, water ways, and environmentally sensitive or restricted areas as shown on the plans. All environmental regulations for handling, discharge, and disposal of all construction materials shall be followed.

## MATERIALS

**503.05 Concrete.** Concrete used in the construction of drilled shafts shall be Class BZ in accordance with Section 601. If the concrete does not meet the requirements of Section 601, price reductions shall be applied to the drilled caisson pay item. The Contractor may elect to use Self Consolidating Concrete (SCC) Class BZ.

**503.06 Reinforcing Steel.** Reinforcing steel shall be in accordance with Section 602. When necessary, vertical bars shall be bundled in order to maximize clear space between vertical reinforcement. Rolled hoops or bundled spirals shall be used in order to maximize the clear space between horizontal reinforcement. Reinforcing steel cages for drilled shafts with varying shaft and socket diameters shall be designed with a single, uniform diameter. At all times, the reinforcing bars and fabricated steel reinforcing cage shall be supported off the ground surface and shall be protected from contamination of mud, oils and solvents, and other deleterious materials. The steel shall be free of excessive rust (flaking, peeling, and thick coating) at the time of cage placement into the hole. Any contamination or excessive rust shall be cleaned and removed by the Contractor to the Engineer's acceptance prior to placement.

**503.07 Casings.** All permanent structural casing shall be of steel conforming to ASTM A36/A36M or ASTM A252 Gr 2 unless specified otherwise on the Plans. All splicing of permanent structural casing shall be in accordance with Section 6.13.3, "Welded Connections," of the AASHTO LRFD Bridge Design Specifications, which includes AASHTO/AWS D 1.5M/ D 1.5 Bridge Welding Code. All casing shall be watertight and clean prior to placement in the excavation. Where the minimum thickness of the casing is specified on the Plans, it is specified to satisfy structural design requirements only. The Contractor shall increase the casing thickness from the minimum specified thickness, as necessary and accepted by the Engineer, to satisfy the construction installation requirements.

All permanent casing shall be of ample strength to resist damage and deformation from transportation and handling, installation stresses, and all pressures and forces acting on the casing. For permanent nonstructural casing, corrugated casing may be used. The diameter of permanent casing shall be as shown on the Plans unless a larger diameter casing is approved by the Engineer. When a larger size permanent casing is approved by the Engineer, no additional payment will be made for the increased weight of casing steel or the increased quantity of drilled shaft excavation and concrete.

All temporary casing shall be a smooth wall structure steel except where corrugated metal pipe is shown on the Plans as an acceptable alternative material. All temporary casing shall be of ample strength to resist damage and deformation from transportation and handling, installation and extraction stresses, and all pressures and forces acting on the casing. The casing shall be capable of being installed and removed without deforming and causing damage to the completed shaft and without disturbing the surrounding soil. Temporary casing shall be completely removed, unless otherwise shown on the Plans or approved by the Engineer. The outside diameter of temporary casing shall not be less than the specified diameter of the shaft.

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**REVISION OF SECTION 503 and 601**
**DRILLED SHAFTS**

**503.08 Mineral Slurry.** Mineral Slurry shall be used in accordance with the quality control plan specified in subsection 503.02(b)(5).

Mineral slurry shall conform to the following requirements:

| Property | Test | Requirement |
|---|---|---|
| Density (pcf) | Mud Weight (Density) API 13B-1, Section 1 | 64.3 to 72 |
| Viscosity (seconds/quart) | Marsh Funnel and Cup API 13b-1, Section 2.2 | 28 to 50 |
| pH | Glass Electrode, pH Meter, or pH Paper | 8 to 11 |
| Sand Content (%) | API 13B-1, Section 5 | 4.0 max immediately prior to placing concrete |

**503.09 Polymer Slurry.** Polymer slurries, either natural or synthetic, shall be used in accordance with the manufacturer's recommendations, and shall conform to the quality control plan specified in subsection 503.02(b)(5). The polymer slurry shall conform to the following requirements:

| Property | Test | Requirement |
|---|---|---|
| Density (pcf) | Mud Weight (Density) API 13B-1, Section 1 | 64.3 max |
| Viscosity (seconds/quart) | Marsh Funnel and Cup API 13b-1, Section 2.2 | 32 to 135 |
| pH | Glass Electrode, pH Meter, or pH Paper | 8 to 11.5 |
| Sand Content (%) | API 13B-1, Section 5 | 1.0 max immediately prior to placing concrete |

The sand content of polymer slurry prior to final cleaning and immediately prior to placing concrete shall be less than or equal to 1.0 percent, in accordance with American Petroleum Institute API 13B-1, Section 5. Slurry temperature shall be at least 40 °F when tested.

**503.11 Water Slurry.** Water may be used as slurry when casing is used for the entire length of the drilled hole, or to stabilize the bedrock below the temporary casing provided that the method of drilled shaft installation maintains stability at the bottom of the shaft excavation. Water slurry shall conform to the following requirements:

| Property | Test | Requirement |
|---|---|---|
| Density (pcf) | Mud Weight (Density) API 13B-1, Section 1 | 64 max |
| Sand Content (%) | API 13B-1, Section 5 | 1.0 max |

**503.12 Access Tubes for CSL Testing.** Access tubes for CSL testing shall not be installed in the traffic signal pole drilled shafts detailed in the plans or for structures in the S-Standard drawings except as noted on the plans.

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**REVISION OF SECTION 503 and 601**
**DRILLED SHAFTS**

**CONSTRUCTION REQUIREMENTS**

**503.13 Drilled Shaft Excavation.** The excavation and drilling equipment shall have adequate capacity, including power, torque and down pressure to excavate a hole of both the maximum diameter and to a depth of 20 feet or 20 percent beyond the maximum shaft length shown on the Plans, whichever is greater. Blasting will only be permitted if specifically stated on the Plans or authorized in writing by the Engineer. Once the excavation operation has been started, the excavation shall be conducted in a continuous operation until the excavation of the shaft is completed except for pauses and stops. Pauses or interruptions during this excavation operation will not be allowed except for casing installation, casing splicing and removal of materials or obstructions. Drilled shaft excavation operation interruptions not conforming to this definition shall be considered stops. The Contractor shall provide temporary casing at the site in sufficient quantities to meet the needs of the construction method.

If the drilled shaft excavation is not complete at the end of the shift or series of continuous shifts, the drilled shaft excavation operation may be stopped provided the Contractor protects the shaft as indicated in subsection 503.13(b) before the end of the work day.

If slurry is present in the shaft excavation, the Contractor shall conform to the requirements of subsection 503.13 (b)5(2) regarding the maintenance of the minimum level of drilling slurry throughout the stoppage of the shaft excavation operation, and shall recondition the slurry to the required slurry properties in accordance with subsections 503.09, 503.10, and 503.11 prior to recommencing shaft excavation operations.

Sidewall over-reaming shall be performed when the time for shaft excavation exceeds 24 hours (measured from the beginning of excavation below the casing when casing is used). Sidewall over-reaming shall also be performed when the sidewall of the hole is determined by the Engineer to have softened due to the excavation methods, swelled due to delays in the start of concrete placement, or degraded because of slurry cake buildup. Over-reaming thickness shall be a minimum of 1/2-inch or as directed by the Engineer. Over-reaming may be accomplished with a grooving tool, over-reaming bucket, or other equipment approved by the Engineer. If over-reaming is required as a result of the excavation time exceeding the time limit specified herein, the Contractor shall bear the costs associated with both sidewall over-reaming and additional drilled shaft concrete related to over-reaming.

Excavation to the foundation cap elevation shall be completed before drilled shaft construction begins unless otherwise noted in the Contract Documents or approved by the Engineer. Any disturbance to the foundation cap area caused by shaft installation shall be repaired by the Contractor prior to placing the cap concrete. When drilled shafts are to be installed in conjunction with embankment construction, the Contractor shall construct drilled shafts after placement of the embankment fill unless otherwise shown on the Contract Documents or approved by the Engineer. Drilled shafts installed prior to the completion of the embankment fill shall not be capped until the fill has been placed to the bottom of cap level.

(a) *Drilled Shaft Excavation.* The dry construction method consists of drilling the shaft excavation, removing accumulated water and loose material from the excavation, placing the reinforcing cage, and concreting the shaft in relatively dry excavation. The dry construction method may only be used if the shaft excavation demonstrates that the following conditions are met: less than 12 inches of water accumulates above the base of excavation over a period of one hour when no pumping is performed, the sides and bottom of the hole remain stable without detrimental caving, sloughing, or swelling between the completion of excavation and concrete placement, all loose material and water can be satisfactorily removed prior to inspection and concrete placement (no more than 2 inches of water will be permitted in the bottom of the shaft excavation at the time of concrete placement), and the Engineer can visually inspect the sides and bottom of the shaft prior to placing the concrete. The drilled shaft excavations shall not be left open overnight unless cased full depth or otherwise protected against sidewall instability.

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**DRILLED SHAFTS**

An open excavation is defined as a drilled shaft that has not been filled with concrete, or temporarily backfilled with a material approved by the Engineer in accordance with subsection 503.02(b) or protected in accordance with subsection 503.13(b). The use of slurry to protect a drilled shaft during a drilling stoppage or overnight shutdown shall be approved by the Engineer. The excavation shall be protected with a suitable cover which will prevent persons or materials from falling into the hole. Casing of drilled shafts in stable rock formations during stoppages is not required if accepted by the Engineer unless shown on the Plans or specified herein.

(b) *Drilled Shaft Excavation Protection Methods.* The Contractor bears full responsibility for selection and execution of the methods of stabilizing and maintaining the drilled shaft excavation. The walls and bottom of the drilled shaft excavation shall be protected so that sidewall caving and bottom heaves are prevented from occurring. For shafts where the soils above the bedrock do not contribute to the bearing calculations as shown on the Plans, the soils surrounding the temporary casing may be disturbed during the installation of temporary casing using uncontrolled in-situ slurries.

Acceptable protection methods include the use of casing, drilling slurry, or both:

1. Temporary Casing Construction Method

   The Contractor shall conduct casing installation and removal operations and drilled shaft excavation operations such that the adjacent soil outside the casing and drilled shaft excavation for the full height of the drilled shaft is minimally disturbed. For shafts where the soils above the bedrock do not contribute to the bearing calculations as shown on the Plans, the soils surrounding the temporary casing may be disturbed during the installation of temporary casing using uncontrolled in-situ slurries.

   If the Contractor is utilizing casing that is sealed into the underlying bedrock, water may infiltrate the shaft below the casing. Excavation of the bedrock may continue without the use of casing or slurry if the shaft remains stable.

   The Contractor shall remove all temporary casings from the excavation as concrete placement is completed, unless approval has been received from the Engineer to leave specified temporary casings in place. As the temporary casing is withdrawn, sufficient head of fluid concrete must be maintained to ensure that water or slurry outside the temporary casing will not breach the column of freshly placed concrete. Casing extraction shall be at a slow, uniform rate with the pull in line with the shaft axis. Excessive rotation of the casing shall be avoided to limit deformation of the reinforcing steel cage.

2. Permanent Casing Construction Method

   After the casing has been filled with concrete, all void space occurring between the casing and drilled shaft excavation shall be filled with a material which approximates the geotechnical properties of the in-situ soils, in accordance with the Drilled Shaft Installation Plan specified in subsection 503.02(b).

   Tops of permanent casings for the drilled shafts shall be removed to the top of the drilled shaft or finished ground line, whichever is lower, unless the top of permanent casing is shown in the Plans at a different elevation. For those drilled shafts constructed within a permanent body of water, tops of permanent casings for drilled shafts shall be removed to the low water elevation unless otherwise shown on the Plans or directed by the Engineer. Casing used for forming shafts installed through a body of water shall not be removed.

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**DRILLED SHAFTS**

3. Alternative Casing Methods

When approved by the Engineer, installation of casing using rotating or oscillating methods will be permitted. Use of this alternative casing method shall be in accordance with the equipment and procedures shown in the approved Drilled Shaft Installation Plan, and shall comply with all other requirements specified herein. Drilled shaft casing shall be equipped with cutting teeth or a cutting shoe and installed by either rotating or oscillating the casing.

4. Uncontrolled In-Situ Slurry

The uncontrolled in-situ slurry consists of in-situ soils from the drilled shaft mixed with water. For shafts where the soils above the bedrock do not contribute to the bearing calculations as shown on the Plans, the Contractor may use uncontrolled in-situ slurry to install temporary casing. For shafts where the soils above the bedrock do contribute to the bearing calculations, the use of uncontrolled in-situ slurry to install temporary casing shall not be allowed. Slurry in accordance with subsections 503.09, 503.10, and 503.11 or temporary casing in accordance with subsection 503.13 is required if the drilled shaft does not remain stable using uncontrolled in-situ slurry.

5. Slurry

The Contractor may use slurry in accordance with subsections 503.09, 503.10, and 503.11 to maintain a stable excavation during drilled shaft excavation and concrete placement operations once water begins to enter the drilled shaft excavation and remain present.

The Contractor may use slurry to maintain stability during drilled shaft excavation and concrete placement operations in the event that water begins to enter the drilled shaft excavation at a rate of greater than 12 inches per hour, or if the Contractor is not able to restrict the amount of water in the drilled shaft to less than 3 inches prior to concrete placement, or to equilibrate water pressure on the sides and base of the drilled shaft excavation when groundwater is encountered or anticipated based on the available subsurface data.

A. Slurry Technical Assistance

If slurry is used, the manufacturer's representative, as identified to the Engineer in accordance with subsection 503.02(c), shall provide technical assistance for the use of the slurry.

The manufacturer’s representative or the Contractor’s employee trained in the use of the slurry, as identified to the Engineer in accordance with subsection 503.02(c), shall be present at the site throughout the shaft slurry operations for this project to perform the duties specified above.

B. Minimum Level of Slurry in the Excavation

When slurry is used to maintain a stable excavation, the slurry level in the excavation shall be maintained to obtain hydrostatic equilibrium throughout the construction operation at a height required to provide and maintain a stable hole, but not less than 5 feet above the water table.

Slurry levels shall be as follows:

(1) not less than five feet above the water table for mineral slurries

(2) not less than ten feet above the water table for water slurry and uncontrolled in-situ slurries

(3) not less than ten feet above the water table for polymer slurries, except when a lesser dimension is specifically recommended by the slurry manufacturer for the site conditions and construction methods.

The Contractor shall provide casing, or other means, as necessary to meet these requirements.

The slurry level shall be maintained above all unstable zones a sufficient distance to prevent bottom heave, caving, or sloughing of those zones.

Throughout all stops in drilled shaft excavation operations, the Contractor shall monitor and maintain the slurry level in the excavation the greater of the following elevations:

(1) no lower than the groundwater level elevation outside the drilled shaft

(2) elevation as required to provide and maintain a stable hole

C. Cleaning Slurry

The Contractor shall clean, re-circulate, de-sand, or replace the slurry, as needed, in order to maintain the required slurry properties. Sand content will only be required to be within specified limits immediately prior to concrete placement.

**503.14 Obstructions.** When obstructions are encountered, the Contractor shall notify the Engineer promptly. An obstruction is defined as a specific object not identified on the Plans or Geotechnical Report in accordance with subsection 102.05 (including, but not limited to, boulders, logs, and manmade objects) encountered during the drilled shaft excavation operation which prevents or hinders the advance of the drilled shaft excavation. When efforts to advance past the obstruction to the design drilled shaft tip elevation result in the rate of advance of the drilled shaft drilling equipment being significantly reduced relative to the rate of advance for the portion of the drilled shaft excavation in the geological unit that contains the obstruction, then the Contractor shall remove, bypass or break up the obstruction under the provisions of subsection 503.24. Blasting will not be permitted unless approved in writing by the Engineer.

Drilling tools that are lost in the excavation will not be considered obstructions, and shall be promptly removed by the Contractor. All costs due to lost tool removal will be borne by the Contractor including, but not limited to, costs associated with the repair of hole degradation due to removal operations or an excessive time that the hole remains open.

**503.15 Protection of Existing Structures and Drilled Holes.** The Contractor shall control operations to prevent damage to existing structures and recently drilled holes, utilities, roadways and other facilities. Preventative measures shall include, but are not limited to, selecting construction methods and procedures that will prevent excessive caving of the drilled shaft excavation and monitoring and controlling the vibrations from the driving of casing or sheeting, drilling of the shaft, or from blasting, if permitted.

**503.16 Slurry Sampling and Testing.** Mineral slurry and polymer slurry shall be mixed and thoroughly hydrated in slurry tanks, lined ponds, or storage areas. The Contractor shall draw sample sets from the slurry storage facility and test the samples for conformance with the appropriate specified material properties before beginning slurry placement in the drilled hole. Slurry shall conform to the quality control plan included in the Drilled Shaft Installation Plan in accordance with subsection 503.02(b)(5) and approved by the Engineer. A sample set shall be composed of samples taken at mid-height and within 2 feet of the bottom of the storage area.

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The Contractor shall sample and test all slurry in the presence of the Engineer, unless otherwise approved by the Engineer. The date, time, names of the persons sampling and testing the slurry, and the results of the tests shall be recorded. A copy of the recorded slurry test results shall be submitted to the Engineer at the completion of each drilled shaft, and during construction of each drilled shaft when requested by the Engineer.

Slurry samples shall be taken at mid-height and within 2 feet of the bottom of the drilled shaft and tested during drilling as necessary to verify the control of the properties of the slurry. As a minimum, sample sets of polymer slurry shall be taken and tested at least once every four hours after beginning its use during each shift. Sample sets of all slurry shall be taken and tested immediately prior to placing concrete.

**503.17 Drilled Shaft Excavation Inspection.** The Contractor shall use best methods such as a cleanout bucket, air lift, or hydraulic pump to clean the bottom of the excavation of all drilled shafts. For wet drilled shaft excavation in soils, the base of the excavation shall be covered with not more than 3 inches of sediment or loose or disturbed material just prior to placing concrete. For dry drilled shaft excavations in soils, the base of excavation shall be covered with not more than 1.5 inches of sediment or loose or disturbed material just prior to placing concrete. For wet and dry drilled shaft excavations in rock, the base of the excavation shall be covered with not more than 0.5 inch for 50 percent of the base area of sediment or loose or disturbed material just prior to placing concrete.

The excavated drilled shaft will be inspected and approved by the Engineer prior to proceeding with construction. The bottom of the excavated drilled shaft shall be sounded with an airlift pipe, a tape with a heavy weight attached to the end of the tape, a borehole camera with visual sediment depth measurement gauge, or other means acceptable to the Engineer to determine that the drilled shaft bottom meets the requirements in the Contract. The Contractor shall supply all needed equipment required to inspect the drilled shaft excavation.

**503.18 Assembly and Placement of Reinforcing Steel.** The Contractor shall show bracing and any extra reinforcing steel required for assembling, transportation, or placement of the cage on the shop drawings. The Contractor shall be responsible for engineering the temporary support and bracing of the reinforcing cages to ensure that they maintain their planned configuration during assembly, transportation, and installation.

The reinforcing cage shall be rigidly braced to retain its configuration during handling and construction. Individual or loose bars will not be permitted. All intersections of vertical and horizontal bars shall be tied. At least four vertical bars of each cage, equally spaced around the circumference, shall be tied at all reinforcement intersections with double wire ties. The remaining reinforcement intersections in each cage shall be tied with single wire ties.

The reinforcement shall be carefully positioned and securely fastened to provide the minimum clearances specified or shown on the Plans, and to ensure that no displacement of the reinforcing steel cage occurs during placement of the concrete. Splicing of the reinforcement cage during placement of the cage in the shaft excavation will not be permitted unless otherwise shown on the Plans or approved by the Engineer. If the reinforcing cage is spliced during placement of the cage into the drilled shaft excavation, the splice details and location of the splices shall be in accordance with the Plans and the accepted Drilled Shaft Installation Plan. In addition, the work shall be performed within the time limits specified in subsection 503.13.

The steel reinforcing cage shall be securely held in position throughout the concrete placement operation. The reinforcing steel cage shall be supported from the top during the placement of the concrete to achieve the clearances shown on the Plans. Setting the cage on the bottom of the hole will not be permitted. The support system shall be concentric to prevent racking and displacement of the cage. The reinforcing steel in the drilled shaft shall be tied and supported so that the location of the reinforcing steel will remain within allowable tolerance. Concrete spacers or other approved non-corrosive spacing devices shall be used at sufficient intervals (near the bottom, the top, and at intervals not exceeding 10 feet vertically) to ensure concentric spacing for the entire cage length.

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**REVISION OF SECTION 503 and 601**
**DRILLED SHAFTS**

The number of spacers required at each level will be one spacer for each foot of excavation diameter, with a minimum of four spacers at each level. The spacers shall be of adequate dimension to ensure an annular space between the outside of the reinforcing cage and the side of the excavation along the entire length of the drilled shaft as shown on the Plans. Acceptable feet made of plastic or concrete (bottom supports) shall be provided to ensure that the bottom of the cage is maintained at the proper distance above the base of the excavation unless the cage is suspended from a fixed base during the concrete pour.

Minimum concrete cover to reinforcing steel for traffic signal pole caissons shall be as follows:

| Drilled Shaft Diameter | Minimum Concrete Cover |
|---|---|
| Less than or equal to 3'-0” | 3” |
| Greater than 3’-0” and less than 5’-0” | 3” |
| 5'-0” or larger | 3” |

If concrete placement does not immediately follow the cage placement, the Engineer may order the steel to be removed from the excavation so that the integrity of the excavation, including the presence of loose material in the bottom of the hole, and the surface condition of the reinforcing steel may be determined by inspection.

Bracing steel which constricts the interior of the reinforcing cage shall be removed after lifting the cage if freefall concrete or wet tremie methods of concrete placement are to be used.

The elevation of the top of the steel cage shall be checked before and after the concrete is placed. If the upward displacement of the rebar cage exceeds 2 inches, or if the downward displacement exceeds 6 inches, the drilled shaft shall be considered defective. No additional drilled shafts shall be constructed until the Contractor has modified the rebar cage support in a manner satisfactory to the Engineer.

**503.19 Concrete Placement, Curing and Protection.** Concrete placement shall be in accordance with Section 601 and shall commence as soon as possible after completion of drilled shaft excavation by the Contractor and inspection by the Engineer. Immediately prior to commencing concrete placement, the drilled shaft excavation and the properties of the slurry (if used) shall be in accordance with subsections 503.09, 503.10, and 503.11. The CSL access tubes shall be filled with potable water before concrete placement and the top watertight threaded caps shall be reinstalled. Concrete placement shall be one continuous placement to the top of the drilled shaft, or as shown on the Plans.

If water is not present the concrete shall be deposited through the center of the reinforcement cage by tremie, pump or free-fall preventing segregation of aggregates. The concrete shall be placed such that the free-fall is vertical down the center of the drilled shaft without hitting the sides or steel reinforcing cage.

If water exists in amounts greater than 2 inches in depth or enters at a rate of more than 12 inches per hour then the drilled shaft concrete shall be placed in accordance with subsection 601.12(f).

Before placing any fresh concrete against concrete deposited in water or slurry (construction joint), the Contractor shall remove all scum, laitance, loose gravel, and sediment on the surface of the concrete deposited in water or slurry, and chip off any high spots on the surface of the existing concrete that would prevent any steel reinforcing bar cage from being placed in the position as shown on the Plans.

The Contractor shall not perform foundation piling driving or casing installation using oscillation method within a radius of 20 feet, or drilled shaft excavation operations within a clear distance of 3 diameters of a newly poured drilled shaft until a minimum of 24 hours has passed after the placement of concrete and the concrete has reached a minimum compressive strength of 1800 psi.

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**DRILLED SHAFTS**

For any portion of the caisson socketed in fine grained bedrock susceptible to slaking and degradation such as, but not limited to, claystone, siltstone, or shale and provided the proper slurry properties have been achieved. If the concrete is not placed within four hours of drilling, the Contractor shall drill into the bedrock an additional 1/3 of the plan specified rock socket prior to placing the concrete. The reinforcing cage shall extend to the new tip elevation. For the use of polymer slurry this requirement will be waived.

**503.20 Drilled Shaft Construction Tolerances.** Drilled shafts shall be constructed so that the center of the poured shaft at the top of the drilled shaft or mudline, whichever is lower, is within the following horizontal tolerances:

| Drilled Shaft Diameter | Tolerance |
|---|---|
| Less than or equal to 2'-0" | 3" |
| Greater than 2'-0" and less than 5'-0" | 4" |
| 5'-0" or larger | 6" |

Caissons for structures as shown in the CDOT S-Standard drawings shall be excluded from these tolerances, except as noted on the plans.

Drilled shafts in soil and rock shall be within 1.5 percent of plumb. Plumbness shall be measured from the top of poured drilled shaft elevation or mudline, whichever is lower. During drilling or excavation of the drilled shaft, the Contractor shall make frequent checks on the plumbness, alignment, and dimensions of the drilled shaft. Any deviation exceeding the allowable tolerances shall be corrected with a procedure approved by the Engineer.

Drilled shaft steel reinforcing bars shall be no higher than 6 inches above or 3 inches below the plan elevation.

The reinforcing cage shall be concentric with the drilled shaft excavation within a horizontal tolerance of 1-1/2 inches.

The top elevation of the completed drilled shaft shall have a tolerance of plus 1 inch or minus 3 inches.

The diameter of the drilled shaft shall not be less than the diameter shown on the Plans.

Tolerances for casings shall be in accordance with American Pipe Institute tolerances applicable to regular steel pipe.

Drilled shaft excavations and completed drilled shafts not constructed within the required tolerances will be considered defective. The Contractor shall be responsible for correcting all defective drilled shafts to the satisfaction of the Engineer. Materials and work necessary, including engineering analysis and redesign, to complete corrections for out-of-tolerance drilled shafts shall be furnished without cost to the Owner or an extension of the completion date of the project. Redesign drawings and computations submitted by the Contractor shall be signed by a registered Professional Engineer licensed in the State of Colorado.

**TESTING AND VERIFICATION**

**503.21 Integrity Testing.** Crosshole Sonic Log (CSL) testing is not required for traffic signal pole drilled shafts detailed in the plans or for structures in the S-Standard drawings except as noted on the plans.

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**REVISION OF SECTION 503 and 601**
**DRILLED SHAFTS**

**METHOD OF MEASUREMENT**

**503.23** Drilled caisson will be measured by the linear foot from the elevation shown on the Plans to the bottom of the hole as drilled.

Each approved splice of the reinforcing cage for additional length of caisson will be measured as ½ linear foot of additional length of drilled caisson.

**BASIS OF PAYMENT**

**503.24** The unit price of drilled shafts shall be full compensation for making all excavations; hauling and disposal of excavated material; provision and disposal of slurry, performing all necessary pumping; furnishing and placing required concrete and reinforcement steel, including the reinforcement projecting above the tops of the drilled shafts necessary for splicing and any intermediate reinforcement splices; furnishing and placing of CSL tubes; all backfilling; furnishing, placing, and removing temporary casings; furnishing permanent casing if required to complete the work; and for furnishing all tools, labor, equipment, and incidentals necessary to complete the work. Costs associated with repairing defects found in the drilled shaft shall be included in the cost of the drilled shaft.

(a) *Payment.* The accepted quantities for drilled caissons will be paid for at the Contract unit price per linear foot except for price adjustments allowed in (b) below.

Payment will be made under:

| Pay Item | Pay Unit |
|---|---|
| Drilled Caisson (18 Inch) | Linear Foot |
| Drilled Caisson (36 Inch) | Linear Foot |
| Drilled Caisson (48 Inch) | Linear Foot |

Obstruction Encounter and Removal will not be measured, and will be paid for in accordance with subsection 109.04 under Force Account Item, Obstruction Encounter and Removal.

(b) *Price Adjustments.* When the Engineer orders holes to be drilled to a lower elevation than shown on the Plans, compensation for additional depth will be as follows:

| Additional Length | Compensation |
|---|---|
| 0 to 5 feet | Contract Unit Price |
| Over 5 feet to 15 feet | Contract Unit Price plus 15% |
| Over 15 feet | As provided in subsection 109.04 |

Additional compensation will not be paid for the portions of a caisson that are extended due to the Contractor's method of operation, as determined by the Engineer.

In subsection 601.02, delete the requirements for "Class BZ concrete" and replace with the following:

**Class BZ** concrete is concrete for drilled shafts. Additional requirements are: Entrained air is not required unless specified in the Contract. When entrained air is specified in the Contract, the air content shall be 5 to 8 percent. Slump shall be a minimum of 6 inches and a maximum of 9 inches. The coarse aggregate size shall be AASHTO M43 size #8 unless otherwise approved by the Engineer. A minimum of 6 inches slump shall be maintained during the anticipated pour period. The use of retarders and mid-range water reducers is allowed to extend the slump life of the concrete. When the Contractor elects to use SCC, the slump requirement for Class BZ Concrete does not apply.

## REVISION OF SECTION 613
## ELECTRICAL CONDUIT

**Section 613 of the Standard Specifications is hereby revised for this project to include the following:**

### DESCRIPTION

This work includes furnishing and installing new High-Density Polyethylene (HDPE) and Polyvinyl Chloride (PVC) electrical conduit and fittings for use with fiber optic cable, electrical conductors, and communications cabling.

For locations where conduit is installed into asphalt, concrete, or slope pavement, patching with asphalt, concrete or slope pavement will be required and shall be included in the cost of the conduit.

### MATERIALS

All materials furnished, assembled, fabricated, or installed under this item shall be new, Underwriters Laboratories (UL) listed, corrosion resistant and National Electric Code (NEC) compliant. Materials shall be submitted to the Project Engineer for approval.

Electrical conduit shall be Schedule 80 in the diameters, quantities and depths shown on the plans. Electrical conduit and fittings shall be UL listed.

HDPE conduit and fittings shall be certified by the manufacturer as meeting American National Standards Institute (ANSI) ANSI/UL 651A. PVC conduit and fittings shall be certified by the manufacturer as meeting ANSI/UL 651. The manufacturers shall be International Organization for Standards (ISO) ISO 9001 compliant.

All HDPE conduit shall be factory lubricated, low-friction, high-density conduit constructed of virgin high-density polyethylene resin. HDPE conduit shall be capable of being coiled on reels in continuous lengths, transported, stored outdoors, and subsequently used for installation, without affecting its properties or performance.

Each conduit shall be equipped with a pull tape. The pull tape shall have a minimum tensile strength of 1800 pounds and be of a design and manufacture that prevents cutting or burning into the conduit during cable installation. The pull tape shall include a continuous 22 gauge tracer wire. The tracer wire shall be orange and stranded. Splices in the pull tape and tracer wire may occur inside manholes and pull boxes and shall not be permitted inside conduit.

A minimum 12 gauge tracer will shall be included in conduits containing fiber optic cable in addition to the pull tape.

### CONSTRUCTION REQUIREMENTS

All conduit and fittings installation shall conform to the NEC.

Electrical Conduit (Bored) shall be HDPE and installed using a trenchless technology such as directional boring.

Electrical Conduit (Plastic) shall be PVC or HDPE and installed by direct burial methods such as plowing, open trenching, or other excavation methods.

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**REVISION OF SECTION 613**
**ELECTRICAL CONDUIT**

Prior to construction, the Contractor shall submit a trenching and boring plan to the Engineer for approval. The plan shall show the limits of the planned work areas and the areas of anticipated disturbance. All disturbances outside the planned work areas created by Contractor's operations shall be restored to their original condition at the Contractor's expense.

During construction operations, the contractor shall maintain boring logs that include the depth at specific distances along the bore. Boring logs shall be submitted on a weekly basis.

Excavations and conduit installation shall be performed in a continuous operation. All trenches shall be backfilled by the end of each shift. Material from trenching operations shall be placed in a location that will not cause damage or obstruction to vehicular or pedestrian traffic or interfere with surface drainage.

The Contractor shall be responsible for damage due to over-excavating a trench and heaving damage to the existing asphalt and concrete mat, caused by equipment directly and by dislodging rocks or boulders. All damage from over-excavation and heaving shall be repaired at the Contractor's expense. The Contractor shall bear the cost of backfilling all over-excavated areas with the appropriate backfill material approved by the Engineer.

The Contractor shall restore all surface materials to their original condition or better, including but not limited to pavement, sidewalks, sprinkler systems, landscaping, shrubs, sod, and native vegetation that is disturbed by the conduit installation operation. All repairs shall be included in the cost of the conduit.

The Contractor shall use UL listed splice couplings that comply with the NEC. All associated work to splice the conduit shall be included in the cost of the item. The coupling technology used to connect conduit ends shall require no special tools and form a watertight, airtight seal. The breaking force between segments shall exceed 250 pounds. Conduit splices shall be kept to a minimum and all such locations shall be approved and inspected by the Engineer and the authority having jurisdiction. Additional pull boxes shall not be substituted for conduit splices.

Conduit plugs that are watertight, removable, mechanical and equipped with a fitting for connection to a pull rope and pull tape shall be supplied and installed in all open conduit ends as soon as the conduit is installed. Conduit shall be plugged at termination points such as pull boxes, manholes, controller cabinets and node buildings. Conduits should be plugged immediately after installation and also after any wiring or cabling is installed, which may require two separate plug types. Conduits containing cable shall be plugged with durable and reusable split type plugs, fabricated without metallic parts. The plugs shall allow easy removal and reinstallation around in-place cables. Split type plugs shall provide a watertight and airtight seal of at least 22 pounds per square inch. They shall be installable by hand without using tools and without damaging the cable. All plugs shall be correctly sized to fit the conduit being plugged.

All conduits shall use sweeps to elevate the buried conduits to the final grade within a pull box or manhole, as shown on the plans. The sweeps shall be terminated within the pull boxes and manholes to allow for easy installation and removal of conduit plugs. The sweeps shall be set above the ground surface of the inside of the pull box at a height that does not interfere with coiling of the fiber optic cable.

All conduit runs containing fiber optic cable shall have a limited number of bends. The sum of the individual bends on a single conduit run between any two pull points shall not exceed 270 degrees. No individual bend shall exceed 90 degrees. All conduit bends shall have a minimum acceptable radius of 48 inches for 90 degree bends and for conduit containing fiber optic cable and 24 inches for all other bends. HDPE conduit minimum bending radius shall conform to Table 354.24 in the NEC.

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## REVISION OF SECTION 613
## ELECTRICAL CONDUIT

New conduits may be installed into existing pull boxes, manholes and cabinet bases, and the Contractor shall carefully excavate around the existing facility and install the new conduit as shown on the plans. The Contractor shall not damage the existing facility or its contents. If the existing conduit, pull box, lid and concrete collars are damaged during conduit installation, the Contractor shall restore the damaged item or section to current CDOT requirements at no additional cost to the project. For locations where conduit is installed into existing pull boxes, manholes, and cabinet bases that are located in asphalt, concrete, or slope pavement, patching with asphalt, concrete, or slope pavement will be required and shall be included in the cost of the conduit. The Contractor shall reseal all new conduit entries into an existing manhole with grout.

Conduit shall always enter a pull box, manhole, cabinet base and all other structure types from the direction of the run only. Conduit shall be installed at the proper depth so as not to need notching or cutting.

All conduits ends shall be free from sharp edges and burrs prior to any wire installation.

### METHOD OF MEASUREMENT

Electrical Conduit will be measured by the actual linear foot of conduit installed and accepted.

Conduit shall also include all groundwork, lubricants, anchors, bands, skids, sweeps, pull rope, pull tape, copper tracer wire, tracer wire splicing, adaptors, fittings, splice couplings, conduit plugs, foam sealant, installation equipment, mounting brackets and hardware, structure anchors, adhesives, labor and all other items necessary to complete the work.

### BASIS OF PAYMENT

Electrical Conduit unit prices shall be full compensation for the work shown on the plans and described above.

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| 2 Inch Electrical Conduit (Bored)* | Linear Foot |
| 3 Inch Electrical Conduit (Bored)* | Linear Foot |
| 2 Inch Electrical Conduit (Plastic)* | Linear Foot |
| 3 Inch Electrical Conduit (Plastic)* | Linear Foot |

**Conduit will not be paid for without proper plugs installed.*

Electrical Conduit contract unit price shall be full compensation for work described above, specified in the plans, and complete and in place.

Any asphalt, concrete, or slope pavement removals or patching required during the installation of the conduit to tie into existing pull boxes or cabinets will not be measured and paid for separately but shall be included in the cost of the conduit.

# REVISION OF SECTION 613
# PULL BOXES

Section 613 of the Standards Specifications is hereby revised for this project as follows:

## DESCRIPTION

The Contractor shall provide all materials on this project in accordance with the City of Northglenn standards and specifications

## CONSTRUCTION

For this project pull boxes provided by the contractor shall be as follows:

| | |
|---|---|
| Type One Pull Box | 18” X 30” X 12” |
| Type Two Pull Box | 12” X 18” X 12” |

Pull boxes shall be installed so that the covers are level with the curb and / or sidewalk grade or surrounding grade. The bottom of the pull boxes shall be embedded in crushed rock 6” thick minimum.

Type On Pull Box shall be used at the traffic signal controller cabinet and the two pull boxes shall be used for the remainder of the intersection traffic signal construction.

## MATERIALS

Pull boxes shall be 20k polymer type with open bottoms.

## METHOD OF MEASUREMENT

**Subsection 613.13 shall include the following:**
Pull Box Type ONE and Pull Box Type Two will be measured by the number of each pull box installed and shall include all hardware necessary for the operation of the item.

## BASIS OF PAYMENT

Subsection 613.14 shall include the following:

| Pay Item | Pay Unit |
|---|---|
| Type One Pull Box | Each |
| Type Two Pull Box | Each |

## REVISION OF SECTION 613
## LUMINAIRE

**Section 613 of the Standard Specifications is hereby revised for this project as follows:**

Luminaire fixture shall be approved LED type. Any existing streetlights shall not be removed until new luminaires are operational. Luminaires shall meet electrical utility company requirements and comply with all requirements identified in the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction or any Revised Standard Special Provision that apply to Sections 613 and 715 LED Roadway Luminaire.

### METHOD OF MEASUREMENT

The Luminaire shall be measured by the number of Luminaires installed and accepted.

### BASIS OF PAYMENT

Luminaire prices shall be full compensation for the work shown on the plans and described above.

**REVISION OF SECTION 613**
**ELECTRICAL CONDUCTOR IDENTIFICATION**

**Section 613 of the Standard Specifications is hereby revised for this project as follows:**

**Section 613.08 shall include the following:**

All electrical conductors shall be tagged as follows:

Electrical conductor cable tags shall be located below the termination in the base of the street light, in the pull box, in the pedestal and at the point of termination to existing facilities of the Local Utility Company supplying electrical service. The tags shall be attached with a cable tie. The information written on the tag shall include the direction, approximate length of cable, and where the cable feeds to and from, etc.

Each incoming conductor shall be individually color coded with 1 tape mark, while outgoing conductors shall have 2 tape marks.

Example:

| FEEDS TO PULL BOX |
|---|
| 50' NORTH & 75' WEST |
| THEN TO HIGHWAY SIGN |

| FEEDS FROM XFMR |
|---|
| 250' SOUTH & 75' EAST |
| 200' WEST |

Uniform tags are available in a Tag Kit. The Tag Kit consists of: 100 tags, 3 part yellow with 1 hole, 100 black nylon ties and 1 black sharpie pen.

| | |
|---|---|
| Size | 2-1/2" X 5" |
| Standard Package | Kit |
| Weight, Kit, Approx. | 1.5 Pounds |
| Color | Yellow |

Electrical conductor tagging will not be paid for separately, but shall be included in the cost of the Electrical Conduit and all associated equipment installation.

## REVISION OF SECTION 613
## WIRING

**Section 613 of the Standard Specifications is hereby revised for this project as follows:**

### DESCRIPTION

This work includes furnishing and installing copper conductor cable with terminations for power source feeds between the traffic signal cabinet and the electrical power source.

Wiring shall also include coiling of cable at utility poles and appropriate pole riser hardware as required by each utility company.

### METHOD OF MEASUREMENT

Copper conductor cable unit price shall be full compensation for work described above, complete and in place. Furnishing and installing wire, and all associated fittings, terminations, attachment hardware and all other hardware, labels, tools, and test equipment necessary for a complete installation

All labor, materials, equipment, labels, attachment/pole riser hardware, and permits necessary for the wiring of the electric services, cabinets, disconnect pedestals, meter/disconnect pedestals, and any materials or equipment necessary for testing shall be measured and paid for as a lump sum.

### BASIS OF PAYMENT

Payment will be made under:

| Pay Item | Pay Unit |
|---|---|
| Wiring | Lump Sum |

**REVISION OF SECTION 613**
**SERVICE METER CABINET**

**Section 613 of the Standard Specifications is hereby revised for this project as follows:**

**Subsection 613.01 shall include the following:**

This work consists of the installation of a Service Meter Cabinet including the preformed polymer concrete footing, meter cabinet, mounting hardware, cabinet mounting base, power cables, UV-resistant cables and connection to the power source, and all required wires and wiring to facilitate a fully functioning Service Meter Cabinet at locations as shown on the plans.

**CONSTRUCTION REQUIREMENTS**

**Add Subsection 613.03(a), Service Meter Cabinet:**

The Contractor shall go through the Colorado State Electrical Board to acquire the electrical installation permit prior to the installation of the Service Meter Cabinet equipment for all CDOT owned and maintained traffic signal and lightning.

Installation shall conform to the latest edition of the National Electrical Code (NEC) and the Authority Having Jurisdiction.

The Service Meter Cabinet foundation shall be polymer concrete with fiberglass reinforcement. The pad shall be continuous cloth reinforcement on the inside and outside perimeters.

The Service Meter Cabinet shall be factory wired and inspected by the Engineer prior to installation.

Construction methods shall conform to the requirements of Section 614.10 (c), Section 614.10 (d) and Section 614.10 (j).

The Contractor shall certify the records of the testing including grounding, voltage drop (within 3 percent) and other required tests as meeting specification requirements and submit the records to the Engineer.

At the completion of the work and prior to final acceptance, all parts of the work installed under this specification, including the Electric Meter installation, shall be to the satisfaction of the Engineer, the Power Source Provider, and the Colorado State Electrical Board inspector.

**Add subsection 613.09 (a) as follows:**

*(a) Service Meter Cabinet*

The Service Meter Cabinet shall be NEMA 3R and shall be UL 508 listed as industrial control panel service equipment. It shall have the ability to be padlocked at the location shown on the Service Meter Cabinet detail.

Utility metering compartment shall be protected with a hinged, pad lockable hood.

Service conductor terminations shall be accessible by a removable cover.

The Service Meter main shall be 100 amp minimum, with voltage range of 120V – 480V.

## REVISION OF SECTION 613
## SERVICE METER CABINET

The Service Meter Cabinet shall be compatible with both ringless and ring-type meter sockets, and with 4-7 terminals.

Exterior of the Service Meter Cabinet shall be a gray powder-coated aluminum, with a thickness of 0.125 inches which is rain and dust impermeable and electrically welded and reinforced where required.

The Service Meter Cabinet shall have a swing dead front door compartment with distribution and control equipment that is secured with both a latch and a pad lockable draw latch outer door.

All nuts, bolts, screws and hinges shall be stainless steel and not visible from outside the meter Cabinet.

Service Meter Cabinet and polymer concrete foundation shall have a divider to separate the service and load conduits/ conductors.

The Service Meter Cabinet shall provide accommodation for six, single branch circuit breakers at a minimum, not including the main breaker. Circuit breakers shall be cable-in, cable-out with line on top, and load on bottom. Handle position shall be up = ON, down = OFF.

The polymer concrete foundation shall have 1/2 inch-13 unified course (UNC) through bolt inserts for mounting the Service Meter Cabinet.

The polymer foundation shall pass the most recent addition of the ANSI/SCTE 77 6.0, 6.1, 6.2, 6.3, 6.4 & 6.5 environmental test, including a five percent solution of magnesium chloride.

The divider plate between the service conduit and load conduit shall be full depth of foundation and be made of preformed polymer concrete.

All materials furnished, assembled, fabricated or installed shall be new, corrosion resistant and in strict accordance with the details shown on the Service Meter Cabinet detail and in these Technical Specifications.

**Functional Characteristics:**
The Service Meter Cabinet shall provide a viewing window in which the meter shall be readable while providing a vandalism resistant enclosure. Viewing window shall be comprised of bullet resistant polycarbonate resin thermoplastic.

**Physical Characteristics:**
Refer to the Service Meter Cabinet detail for specific dimensions and tolerances.

## METHOD OF MEASUREMENT

**Subsection 613.11 shall include the following:**

Service Meter Cabinet will be measured by the actual number of Service Meter Cabinets installed and accepted.

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**REVISION OF SECTION 613**
**SERVICE METER CABINET**

**BASIS OF PAYMENT**

**Subsection 613.12 shall include the following:**

| **Pay Item** | **Pay Unit** |
|---|---|
| Service Meter Cabinet | Each |

Service Meter Cabinet payment will include the foundation, all internal wiring, hardware, polymer foundation, excavation, back fill, disposal of excess excavation, crushed rock, UNC inserts and everything shown on Service Meter Cabinet detail excluding the conduit.

**REVISION OF SECTION 614**
**CITY STANDARDS AND SPECIFICATIONS**

Section 614 of the Standard Specifications is hereby revised for this project as follows:

**DESCRIPTION**

The Contractor shall provide all materials on this project for the proposed intersection traffic sign in accordance with the City of Northglenn standards and specifications. The City of Northglenn standards and specifications can be found at the following web site:

https://cms7files.revize.com/northglennco/Departments/Public%20Works/right%20of%20way/ROW%202018/Chapter%206%20-%20Roadway.pdf

All other work for this project shall be completed per the City of Thornton standards and specifications and can be found at the following web site:

Microsoft Word - 2012 Standards and Specs Cover Sheet (thorntonco.gov)

The project specifications as part of this project package shall be followed in lieu of the City of Northglenn and City of Thornton specifications.

Project work required to be in accordance with CDOT specifications shall be constructed in accordance with the latest edition of the Colorado Department of Transportation, (CDOT) 2023 Standard Specifications for Road and Bridge Construction and the most recent versions of the CDOT M&S Standard Plans.

## REVISION OF SECTION 614
## CONTROLLER CABINET FOUNDATION

**Section 614 of the Standard Specifications is hereby revised for this project as follows:**

Controller Cabinet Foundation shall be provided per the City of Northglenn standards and specifications.

### METHOD OF MEASUREMENT

The Controller Cabinet Foundations shall not be measured by the number of Controller Cabinet Foundations installed and accepted at traffic signal controller cabinet locations.

### BASIS OF PAYMENT

The Controller Cabinet Foundation will not be measured and paid for separately but shall be included in the Traffic Signal Controller Cabinet pay item.

REVISION OF SECTION 614

TRAFFIC SIGNAL CONTROLLER CABINET

Section 614 of the Standard Specifications is hereby revied for this project:

DESCRIPTION

The traffic signal controller cabinet shall be a full 16 phases for vehicles, 4 phases for pedestrians, and 4 phases for overlaps. The type of cabinet used will be an Econolite TS2 type 1-P44 model. Econoloite will build cabinet to CDOT specs, The UPS cabinet shall include the generator panel.

## REVISION OF SECTION 614
## TRAFFIC SIGNAL POLES

**Section 614 of the Standard Specifications is hereby revised for this project as follows:**

All traffic signal poles, and mast arms shall have hot dipped galvanizing inside and outside to ASTM A124. The painted finish for all traffic signal poles, mast arms, and pedestal poles shall be federal green (No. 34108). Use CDOT standard S-614-40/40a for signal poles and S-614-44 for ped poles.

### METHOD OF MEASUREMENT

Traffic Signal Poles shall be measured by the number of Traffic Signal Poles installed and accepted.

### BASIS OF PAYMENT

Traffic Signal Poles prices shall be full compensation for the work shown on the plans and described above.

## REVISION OF SECTION 614
## TRAFFIC SIGNAL AND PEDESTRIAN SIGNAL HEADS

**Section 614 of the Standard Specifications is hereby revised for this project as follows:**

All overhead mounted vehicle signal heads on mast arms shall have a louvered aluminum backplate, black in color, with a 2-inch wide fluorescent yellow, diamond grade retro-reflective border.

Signal head housings shall be polycarbonate type and yellow in color. Mast arm mounted signal heads and signs shall use pelco Astro-brac or sky-brac type mounting brackets.

ADA compliant pedestrian push button stations with R10-3e signs are required. Push button signs shall be aluminum type panels.

All traffic signal indications (vehicle and pedestrian) shall be industry standard solid state LED type, all vehicle indications shall be 12-inch in diameter. All pedestrian indications shall be 16-inch with a countdown timer and a clamshell type mount.

### METHOD OF MEASUREMENT

Traffic Signal Heads and Pedestrian Heads shall be measured by the number of heads installed and accepted.

### BASIS OF PAYMENT

Traffic Signal Heads and Pedestrian Heads prices shall be full compensation for the work shown on the plans and described above.

## REVISION OF SECTION 614
## VEHICLE DETECTORS - VIDEO

**Section 614 of the Standard Specifications is hereby revised for this project as follows:**

Cameras on all approaches shall be Trafisense2 Dual model 645 camera.

### METHOD OF MEASUREMENT

Vehicle Detectors - Video shall be measured by the number of Traffic Signal Poles installed and accepted.

### BASIS OF PAYMENT

Vehicle Detectors - Video prices shall be full compensation for the work shown on the plans and described above.

## REVISION OF SECTION 614
## TELEMETRY (FIELD)

**Section 614 of the Standard Specifications is hereby revised for this project as follows:**

DESCRIPTION

Each intersection shall have an Axiom wireless radio from Intuicom Inc for communication to Centracs. The device shall be installed as shown on the plans with the wireless signal sent to the existing traffic signal at 104th Avenue and Washington Street.The Contractor shall provide all materials on this project in accordance with the City of Northglenn standards and specifications.

## METHOD OF MEASUREMENT

Wireless Radio shall be measured by the number of Telemetry (Field) units installed and accepted.

## BASIS OF PAYMENT

For this project Telemetry (Field) shall be an Axiom wireless radio.

Payment will be made under:

| Pay Item | Pay Unit |
|---|---|
| Telemetry (Field) | Each |

Payment will be full compensation for all labor, materials and equipment required to complete the work.

## REVISION OF SECTION 614
## FIRE PREEMPT UNIT + TIMER

**Section 614 of the Standard Specifications is hereby revised for this project as follows:**

Each approach shall include an Opticom (GTT) 700 series detection system in accordance with the latest CDOT traffic signal standards and specifications. Optical detectors for emergency vehicle pre-emption shall be the Global Traffic Technologies (GTT) Model 752 Optical Detector. Placement of the detectors shall be determined by the City. Two GTT Model 752 Phase Selectors shall be provided in every cabinet.

### METHOD OF MEASUREMENT

Fire Preempt Unit + Timer shall be measured by the number of preempt units installed and accepted.

### BASIS OF PAYMENT

Fire Preempt Unit + Timer prices shall be full compensation for the work shown on the plans and described above.

## REVISION OF SECTION 614
## TRAFFIC SIGNAL CONTROLLER CABINET

**Section 614 of the Standard Specifications is hereby revised for this project as follows:**

The controller cabinet shall be a full 16 phase cabinet with 8 phases for vehicles, 4 phases for peds, and 4 phases for overlaps. The type of cabinet used will be an Econolite TS2 type 1-P44 model. Econolite will build cabinet to CDOT specs. The UPS cabinet shall include the generator panel.

### METHOD OF MEASUREMENT

Traffic Signal Controller Cabinet shall be measured by the number of cabinets installed.

### BASIS OF PAYMENT

The Controller Cabinet Foundation will not be measured and paid for separately but shall be included in the Traffic Signal Controller Cabinet pay item.

**REVISION OF SECTION 614**
**PEDESTRIAN PUSH BUTTONS**

**Section 614 of the Standard Specifications is hereby revised for this project as follows:**

**DESCRIPTION**

ADA compliant pedestrian button stations with R10-3e signs are required. Push button signs shall be aluminum type panels.

## REVISION OF SECTION 614
## TRAFFIC SIGNAL CONTROLLER

**Section 614 of the Standard Specifications is hereby revised for this project as follows:**

Econolite Cobalt controller

Econolite MMU2-16Eip smart monitor with ethernet port

## METHOD OF MEASUREMENT

Traffic Signal Controller shall be measured by the number of traffic signal controllers installed and accepted.

## BASIS OF PAYMENT

Traffic Signal Controller prices shall be full compensation for the work shown on the plans and described above.

## REVISION OF SECTION 614

## AS-BUILT DOCUMENTATION

**Section 614 of the Standard Specifications is hereby revised for this project to include the following:**

### DESCRIPTION

The Contractor shall complete and transmit to the Project Engineer the ITS as-built documentation as part of the final submittals on the project.

### MATERIALS

There are no materials requirements associated with this special provision.

### CONSTRUCTION REQUIREMENTS

The Contractor shall document the as-built device, communications, and power infrastructure placement and material information. The Contractor shall clearly mark the plan sheets with red ink describing the as-built condition of all elements installed, including all changes made to fiber optic splicing. The as-built markups shall include the following information related to location markers:

(1) Final location of traffic signal mast arm poles
(2) Conduit installations for both luminare and traffic signal electrical.
(3) Distances between pull boxes
(4) The distance and location to the utility point of service connection source point which the local utility companies have provided, including electrical power, transformer source, and telephone pedestals.

At the end of the project, the contractor shall create a legible PDF scan of the marked up as-built drawings, and submit the hard copy and PDF to the Project Engineer.

### METHOD OF MEASUREMENT

As-Built Documentation will not be measured separately but will be considered incidental to the pay item being installed. This work shall include all labor, materials and equipment required to complete the work.

### BASIS OF PAYMENT

As-Built Documentation will not be paid for separately, but will be considered incidental to the pay item being installed.

# REVISION OF SECTION 614
# GROUNDING AND BONDING

**Section 614 of the Standard Specifications is hereby revised for this project as follows:**

## DESCRIPTION

This work consists of grounding and bonding requirements at project locations for all Traffic related structures, poles, service pedestals and cabinets. The work covered in this section consists of labor, materials, and services required for a functional and unobtrusive grounding system.

(a) General. Provide comprehensive grounding and bonding for Traffic or ITS-related equipment. CDOT's target resistance to ground value is equal to or less than 10 Ω.

(b) Applicable Documents. Work performed in this section shall comply with the most current edition of the following codes and/or standards:

1. IEEE 81 – Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System
2. IEEE C2 – National Electrical Safety Code
3. NEMA GR 1 – Grounding Rod Electrodes and Grounding Rod Electrode Couplings
4. NFPA 70 – National Electrical Code
5. NFPA 70E – Standard for Electrical Safety in the Workplace
6. NFPA 780 – Standard for the Installation of Lightning Protection Systems
7. TIA-607 – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
8. UL 96 – Lightning Protection Components
9. UL 96A – Installation Requirements for Lightning Protection Systems
10. UL 467 – Grounding and Bonding Equipment

(c) Identify to the Engineer any conflicts between the requirements of codes/standards development organizations and the plans and specifications for this project.

(d) Submittals.

1. Provide cut-sheets of each type of product proposed for approval by the Engineer prior to commencement of work.
2. Provide a system plan, conductor routing, supports, connectors and ground rods along with connection, mounting and splicing details.

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## REVISION OF SECTION 614
## GROUNDING AND BONDING

### MATERIALS

(a) Components.

1. Grounding electrodes (driven rods). Provide ground rods that meet or exceed the following requirements:

    A. Preferred. Copper-clad steel ground rods (pointed) shall not be less than 0.625 inch diameter and a minimum of eight feet in length. It shall be UL certified and have a minimum plating thickness of 10 mil copper cladding.

    B. Other Alternatives. Other ground rod types, such as chemical ground electrodes, may be considered based on site soil chemistry, adjacent electrically bonded structures, or if the installation must occur in a corrosive area, but must be approved by the Engineer in writing.

2. Grounding Electrode Conductor. The grounding electrode conductor shall be solid or stranded copper with a minimum size of #6 AWG, unless otherwise specified. The Contractor shall size the grounding electrode conductor in accordance with Article 250.66 of the NEC. Bare and insulated grounding electrode conductors shall be permitted, as approved by the Engineer. Insulated grounding electrode conductors shall be Type THWN and conform to the requirements of Article 310 of the NEC. Insulated grounding electrode conductors shall utilize a green jacket color. The grounding electrode conductor run shall be installed in one continuous run without a splice or joint, except as permitted in accordance with Article 250.64(C) of the NEC.

    A. For bonding between a cabinet frame and busbar, a braided ground strap shall be utilized. The braided ground strap shall consist of non-insulated tinned copper flat braid wire with a minimum width of 0.5 inches and a thickness of 0.07 inches (based on estimated #6 AWG equivalence).

3. Grounding Connectors. Grounding connectors shall be provided for attachment to grounding electrodes, ground bus and ground lugs. Grounding and bonding connections shall be made by means of a compression connector, a mechanical connector, or an exothermic weld. Mechanical and compression connectors shall have only one conductor installed unless designed or UL-listed for more conductors. Mechanical connections shall only be permitted when a compression or exothermic connection cannot be made.

4. Ground Bus. Provide copper bar stock grounding busbar as shown on plans. If the dimensions of the busbar are not shown on the plans, the minimum size shall be 0.25 inch thick by 2 inches high by 6 inches wide and positions for five lugs, unless otherwise specified by the Engineer. Hole patterns on the busbar shall accommodate two-hole lugs in accordance with TIA-607 and hole spacing should not be less than 0.75 inch. Busbar must be wall mountable and UL certified. Stand-off brackets shall also be included and brackets shall be manufactured from 300 series stainless steel with stainless steel bolts and lock washers.

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## REVISION OF SECTION 614
## GROUNDING AND BONDING

### CONSTRUCTION REQUIREMENTS

(a) General. Install equipment, materials and devices in accordance with equipment manufacturer's written instructions and in compliance with applicable installation standards.

1. Connections.

   A. Provide exothermically welded connections below grade and in areas exposed to visible moisture.

   B. Provide heavy duty bolted clamped connections, UL listed, above grade and in areas where safety to personnel and structures dictate.

2. Installation.

   A. Install one grounding electrode. Each grounding electrode shall be installed such that at least the entire length is in contact with the soil. Where a rock bottom is encountered, the grounding electrode installation shall conform to the requirements of Article 250.53(G) of the NEC. The grounding electrode system shall be installed within CDOT right-of-way.

   B. Leave top of grounding electrode exposed for testing and for verifying quantities.

   C. Measure the resistance of the installed grounding electrode with respect to the surrounding soil using an earth ground resistance tester.

   D. If the results exceed 10 Ω, install a second grounding electrode a minimum of one electrode length away from the first grounding electrode. The bonding jumper used to connect grounding electrodes shall be installed and sized in accordance with Article 250.53(C) of the NEC.

   E. Measure the resistance of the installed grounding electrode system with respect to the surrounding soil using an earth ground resistance tester.

   F. Record and report results to Engineer in writing. CDOT's target resistance to ground is equal to or less than 10 Ω, however after installing two grounding electrodes, a resistance to ground value equal to or less than 25 Ω will be accepted by CDOT. The Contractor shall be responsible for confirming the resistance to ground requirements with the various manufacturers of the equipment it procures for this project. Where manufacturers have more stringent resistance to ground requirements for operational performance and warranties, the Contractor shall be required to adhere to the manufacturer's requirements for acceptance by CDOT.

   G. In the absence of low resistance soil conditions, the Engineer, at his/her sole discretion, may allow the use of the following: bentonite to fill the ground rod hole; chemical electrodes; or ground enhancement material. The Contractor shall obtain written permission from the Engineer prior to using the previously mentioned materials.

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**REVISION OF SECTION 614**
**GROUNDING AND BONDING**

3. Surface Preparation
   A. Ground Bus. An abrasive pad shall be used to remove any dirt, grease, oil and oxidation from the ground bus. A thin coating of antioxidant compound shall be applied to the connection point on the ground bus. Using stainless steel hardware, the Contractor shall tighten and torque to the value specified for the hardware grade, material and size. Only one lug shall be installed per a two-hole mounting on a bonding surface. Lugs shall not overlap or use the same mounting holes on a bonding surface. Due to thermal cycling anticipated in the field environment, the lock washer shall be substituted with flat washers and a cupped spring washer (i.e., Belleville washer), with the cup against the head of the bolt.

   B. Other Surfaces. Clean the surface thoroughly where the grounding lug is to be connected. The grounding surface shall be clean of any paint, dirt, grease, oil, rust and other oxidation. A thin coating of antioxidant compound shall be applied to the connection point on the surface. Using stainless steel or silicon bronze hardware, the Contractor shall tighten and torque to the value specified for the hardware material and size. Lugs shall not overlap or use the same mounting holes on a bonding surface. The lock washer shall be substituted with flat washers and a cupped spring washer, with the cup against the head of the bolt.

   C. Ground Attachment to Structures and Poles. The grounding electrode conductor shall be connected to the ground stud on a structure or within a pole using stainless steel nuts and cupped spring washers. The connector type for the grounding electrode conductor shall be a full circle connector sized appropriately for the diameter of the ground stud and the wire gauge of the conductor.

      Where a ground stud does not exist on a structure or within a pole, the Contractor shall install a tapped and threaded hole to accommodate the grounding electrode conductor and screw. The connector type for the grounding electrode conductor shall be a full circle connector sized appropriately for the diameter of the screw and the wire gauge of the conductor. Stainless steel screws and cupped spring washers shall be included.
   D. Grounding Connectors. The lug size, configuration and material for compression connectors shall be selected based on the grounding electrode conductor size and fastening conditions. The insulation shall be trimmed back so that the bared grounding electrode conductor is slightly longer than the barrel. After applying an antioxidant compound on the exposed grounding electrode conductor, insert the conductor so that is touches the end of the barrel as viewed through the inspection port. Ensure the grounding electrode conductor remains at the end of the barrel before making the first crimp nearest the tongue end and working toward the conductor with the remaining crimps. The lug manufacturer's instructions shall be followed for the number of crimps and their location on the barrel. For exothermic welds to the grounding electrode conductor, select the mold and weld metal applicable to the conductor size and lug configuration. Clean and dry (using a torch) the grounding electrode conductor and the mold. Insert the conductor and lug into the mold. Close the handle clamp, lock the mold and then insert the disk into the mold. Pour the weld metal into the mold and apply the starting material over the

weld metal and on the lip of the mold. Close the cover and ignite using a flint igniter.

After the reaction is complete, wait a minimum of 15 seconds and then open the mold and remove the finished lug connection. Clean any slag from the finished lug connection.

4. Testing.

   A. Testing shall be performed prior to connecting to utility ground in an effort to eliminate ground loops.

   B. When the grounding electrodes are installed, they shall be measured for their effectiveness using the three-point, fall of potential method per IEEE 81 to measure the resistance of the installed grounding electrode configuration with respect to the surrounding soil using an earth ground resistance tester. The final measurement must be performed in the presence of the Engineer or CDOT's designated representative. Provide documentation to the Engineer of ground grid measurement results for each ITS site location tied to a single grounding system.

   C. Contractor shall furnish its own earth ground resistance tester including stakes, clamps, cabling, transformers, and other required accessories needed to perform the testing. A copy of the earth ground resistance tester's NIST certification shall be provided to the Engineer as verification that the unit has been calibrated using standards and instruments traceable to international standards.

## METHOD OF MEASUREMENT

Grounding and bonding will not be measured or paid for separately but will be considered subsidiary to the ITS field device, structure, pole, service pedestal and cabinet items, and shall include all labor, materials, equipment, testing and documentation required to complete the work.

## PREFORMED THERMO-PLASTIC PAVEMENT MARKING

**Section 627 of the Standard Specifications is hereby revised for this project as follows:**

**In subsection 627.09, first paragraph, delete the first sentence and replace with the following:**

The markings shall consist of a resilient white, yellow, or other color thermoplastic product with **glass beads and anti-skid elements** uniformly distributed throughout the entire cross sectional area to ensure that skid resistance and retro-reflectivity is maximized.

**Section 627 of the Standard Specifications is hereby revised for this project to include the following:**

**Subsection 627.09 (c) shall be added and shall include the following:**

*Inlaid (Word-Symbol) (X-walk/Stop-bar) (Shield).* All Preformed Thermo-Plastic Pavement Marking surfaces shall be ground before placement of proposed marking. Depth of grinding shall be such as to completely remove any existing pavement markings and to have a nominal depth of 125 mils +/- 10 mils. The inlaid area for the new Preformed Thermo-Plastic Pavement Marking shall be in the same shape or pattern as the Preformed Thermo-Plastic Pavement Marking that is being installed. Grinding of existing preformed thermoplastic pavement marking and existing asphalt shall not be measured and paid for separately, but shall be included in the work.

Colorado epoxy glass beads and anti-skid elements applied to the surface of the material to ensure the required skid resistance and retroreflectivity will not be measured and paid for separately, but shall be included in the work.

Surface shall be dry and free of dirt, dust, chemicals, and/or significant oily substances. Existing pavement markings shall be removed prior to installation of preformed thermoplastic pavement marking in areas where markings overlap. Application procedures for Portland concrete pavement shall be as described above except a compatible primer sealer shall be applied before application of marking to assure proper adhesion.

The contractor shall require the stencil manufacture to provide on-site training prior to installation of the first stencil. All crew members on the work site shall be certified by the stencil manufacture. The training shall include surface preparation and stencil installation for both hot bituminous pavement and concrete pavement. The training shall be coordinated with and attended by CDOT project engineers and inspectors. Training shall be incidental to the work.

1. **USE:** A durable, high skid resistant, retroreflective pavement marking material suitable for use as interstate shields, route shields, bike path, roadway, intersection, airport, commercial or private pavement delineation and markings.

    1.1. The markings must be a resilient white, yellow or other color thermoplastic product, the surface of which must contain glass beads and abrasives in an alternating pattern. The markings must be resistant to the detrimental effects of motor fuels, lubricants, hydraulic fluids etc. Lines, legends and symbols are capable of being affixed to bituminous and/or Portland cement concrete pavements by the use of the normal heat of a propane torch.

    1.2. The markings must be capable of conforming to pavement contours, breaks and faults through the action of traffic at normal pavement temperatures. The markings shall have resealing characteristics, such that it is capable of fusing with itself and previously applied thermoplastic when heated with the torch.

1.3. The markings shall not have minimum ambient and road temperature requirements for application, without any preheating of the pavement, special storage, handling, preheating or treatment of the material before application.

2. **MANUFACTURING LOCATION, CONTROL AND ISO CERTIFICATION:** The marking material must be produced in the United States, and the manufacturer must be ISO 9001:2008 certified for design, development and manufacturing of preformed thermoplastic pavement markings, and provide proof of current certification.

3. **MATERIAL:** Must be composed of an ester modified rosin resistant to degradation by motor fuels, lubricants etc. in conjunction with aggregates, pigments, binders, abrasives, and glass beads which have been factory produced as a finished product, and meets the requirements of the current edition of the Manual on Uniform Traffic Control Devices for Streets and Highways. The thermoplastic material conforms to AASHTO designation M249, with the exception of the relevant differences due to the material being supplied in a preformed state.

3.1. Graded Glass Beads:

3.1.1. The material must contain a minimum of thirty percent (30%) intermixed graded glass beads by weight. The intermixed beads shall conform to AASHTO designation M247, with minimum 80% true spheres and minimum refractive index of 1.50.

3.1.2. The material must have factory applied coated surface beads and abrasives at a rate of 1/2 lb. (.23 kg) [± 20%] per 11 sq. ft. (1 sq. m) each in addition to the intermixed beads. The surface beads and abrasives must be applied evenly across the surface of the material so that the surface is covered completely with glass beads and abrasive materials. The abrasive material must have a minimum hardness of 9 (Mohs scale). The factory applied coated surface beads shall have a minimum of 80% true spheres, minimum refractive index of 1.50, and meet the following gradation:

| Size Gradation | | | |
|---|---|---|---|
| US Mesh | Um | Retained, % | Passing, % |
| 12 | 1700 | 0 - 2% | 98 - 100% |
| 14 | 1400 | 0 - 6% | 94 - 100% |
| 16 | 1180 | 1 - 21% | 79 – 99% |
| 18 | 1000 | 28 - 62% | 38 - 72% |
| 20 | 850 | 62 - 71% | 29 – 38% |
| 30 | 600 | 67 - 77% | 23 - 33% |
| 50 | 300 | 86 - 95% | 5 – 14% |
| 80 | 200 | 97-100% | 0 - 3% |

**REVISION OF SECTION 627 and 713**
**PREFORMED THERMO-PLASTIC PAVEMENT MARKING**

3.2. Pigments:

3.2.1. White: The material shall be manufactured with sufficient titanium dioxide pigment to meet FHWA Docket No. FHWA-99-6190 Table 5 and Table 6 as revised and corrected.

3.2.2. Red, Blue, and Yellow: The material shall be manufactured with sufficient pigment to meet FHWA Docket No. FHWA-99-6190 Table 5 and Table 6 as revised and corrected. The yellow pigments must be organic and must be heavy-metal free.

3.2.3. Other Colors: The pigments must be heavy-metal free.

3.3. Heating indicators: The top surface of the material (same side as the factory applied surface beads/abrasives) shall have regularly spaced indents. The closing of these indents during application, shall act as a visual cue that the material has reached a molten state allowing for satisfactory adhesion and proper bead embedment, and as a post-application visual cue that the application procedures have been followed.

3.4. Skid Resistance: The surface of the preformed thermoplastic (anti-skid material) items shall contain factory applied anti-skid material with a minimum hardness of 9 (Mohs scale). Upon application the material shall provide a minimum skid resistance value of 60 BPN when tested according to ASTM E 303. The surface beads and abrasives must be applied evenly across the surface of the material so that the surface is covered completely with glass beads and abrasive materials.

3.5. Thickness: The material must be supplied at a minimum thickness of 125 mils (3.15 mm).

3.6. Retroreflectivity: The material, when applied in accordance with manufacturer's guidelines, must demonstrate a uniform level of sufficient nighttime retroreflection when tested in accordance to ASTM E 1710. The applied material must have an initial minimum intensity reading of 275 $mcd \cdot m^{-2} \cdot lx^{-1}$ for white, as measured with a Delta pavement marking retroreflectometer.

3.7. Environmental Resistance: The material must be resistant to deterioration due to exposure to sunlight, water, salt or adverse weather conditions and impervious to oil and gasoline.

Only preformed thermoplastic pavement marking material listed on the Department's approved products list may be used.

**BASIS OF PAYMENT**

Subsection 627.13 shall include the following:

| **Pay item** | **Pay unit** |
|---|---|
| Preform Thermoplastic Pavement Marking (Word-Symbol) | SF |
| Preform Thermoplastic Pavement Marking (Xwalk-Stop Line) | SF |

**REVISION OF SECTION 630**
**TRAFFIC CONTROL MANAGEMENT**

**Section 630 of the Standard Specifications is hereby revised as follows:**

**Subsection 630.10 shall include the following:**

The Contractor's Superintendent and Traffic Control Manager (TCM) shall be equipped with a mobile telephone unit at all times that has a local number for contact with one another, the Project Engineer, or emergency response dispatchers when emergency services are required.

The Traffic Control Supervisor and each flagger shall be equipped with a hand held radio, 5-watt, FM band capable of transmitting and receiving on three frequencies. The radios shall be equipped with battery chargers and rechargeable batteries.

**Subsection 630.14 shall include the following:**

Mobile telephone units and hand-held radios will not be measured and paid for separately, but shall be included in the work.

**REVISION OF SECTION 630**
**PORTABLE MESSAGE SIGN PANEL**

**Section 630 of the Standard Specifications is hereby revised for this project as follows:**

**Subsection 630.01 shall include the following:**

This work includes furnishing, operating, and maintaining a portable message sign panel.

**Add subsection 630.031 immediately following subsection 630.03 as follows:**

**630.031 Portable Message Sign Panel.** Portable message sign panel shall be furnished as a device fully self contained on a portable trailer, capable of being licensed for normal highway travel, and shall include leveling and stabilization jacks. The panel shall display a minimum of three - eight character lines. The panel shall be a dot-matrix type with an LED legend on a flat black background. LED signs shall have a pre-default message that activates before a power failure. The sign shall be solar powered with independent back-up battery power. The sign shall be capable of 360 degrees rotation and shall be able to be elevated to a height of at least five feet above the ground measured at the bottom of the sign. The sign shall be visible from one-half mile under both day and night conditions. The message shall be legible from a minimum of 750 feet. The sign shall automatically adjust its light source to meet the legibility requirements during the hours of darkness. The sign enclosure shall be weather tight and provide a clear polycarbonate front cover.

Solar powered message signs shall be capable of operating continuously for 10 days without any sun. All instrumentation and controls shall be contained in a lockable enclosure. The sign shall be capable of changing and displaying sign messages and other sign features such as flash rates, moving arrows, etc.

Each sign shall also conform to the following:

(1) In addition to the onboard solar power operation with battery back-up, each sign shall be capable of operating on a hard wire, 100-110 VAC, external power source.

(2) All electrical wiring, including connectors and switch controls necessary to enable all required sign functions shall be provided with each sign.

(3) Each sign shall be furnished with an operating and parts manual, wiring diagrams, and trouble-shooting guide.

(4) The portable message sign shall be capable of maintaining all required operations under Colorado mountain-winter weather conditions.

(5) Each sign shall be furnished with an attached license plate and mounting bracket.

(6) Each sign shall be wired with a 7-prong male electric plug for the brake light wiring system.

**Subsection 630.13 shall include the following:**

The portable message sign panel shall be on the project site at least 7 calendar days prior to the start of active roadway construction. Maintenance, storage, operation, relocation to different sites during the project, and all repairs of portable message sign panels shall be the responsibility of the Contractor.

**Subsection 630.15 shall include the following:**

Portable message sign panels will be measured one of the two following ways:

(1) By the actual number of days each portable message sign is used on the project as approved by the Engineer.

(2) By the maximum number of approved units in use on the project at any one time.

**REVISION OF SECTION 630**
**PORTABLE MESSAGE SIGN PANEL**

**Subsection 630.16 shall include the following:**

| **Pay Item** | **Pay Unit** |
|---|---|
| Portable Message Sign Panel | Each |

**REVISION OF SECTION 703**
**AGGREGATES**

**Section 703 of the Standard Specification is hereby revised for this project as follows:**

**Subsection 703.00 shall include the following:**

No crushed slag, crushed reclaimed concrete or recyclced asphalt material may be used as a substitute for aggregates when used for aggregate material that is exposed to the elements.

**Subsection 703.03 shall include the following:**

Aggregates for bases used for shoulder material shall be crushed stone, crushed gravel or natural gravel and shall not be crushed slag, crushed reclaimed concrete or asphalt material unless otherwise approved by the Engineer.

## FORCE ACCOUNT ITEMS

## DESCRIPTION

This special provision contains the Division's estimate for force account items included in the Contract. The estimated amounts marked with an asterisk will be added to the total bid to determine the amount of the performance and payment bonds. Force Account work shall be performed as directed by the Engineer.

## BASIS OF PAYMENT

Payment will be made in accordance with subsection 109.04. Payment will constitute full compensation for all work necessary to complete the item.

Force account work valued at $5,000 or less, that must be performed by a licensed journeyman in order to comply with federal, state, or local codes, may be paid for after receipt of an itemized statement endorsed by the Contractor.

| Force Account Item | Quantity | Estimated Amount |
|---|---|---|
| F/A 01 – Minor Contract Revisions | F.A. | $ 15,000 |
| F/A 02 – On-The-Job Trainee | F.A. | $ 5,000 |
| F/A 03 – Furnish & Install Electrical Service | F.A. | $ 7,500 |
| F/A 04 – Landscaping | F.A. | $ 8,000 |
| F/A 05 – Erosion Control | F.A. | $ 5,000 |
| F/A 06 – Environmental Health & Safety Management | F.A. | $ 7,500 |

**Force Account Descriptions:**

F/A 01 Minor Contract Revisions - This work consists of minor work authorized and approved by the Engineer, which is not included in the Contract drawings or specifications and is necessary to accomplish the scope of work of the Contract.-

F/A 02 On-The-Job Trainee - This item consists of that noted in the “ON THE JOB TRAINING CONTRACT GOAL” in these specifications.

F/A 03 Furnish & Install Electrical Service-
The Contractor shall coordinate with Xcel Energy for electrical connections to the existing electrical transformer at approximately Project Station 102+00 right on 104th Avenue for power to the proposed traffic signal.

F/A 04 Landscaping – This Force Account is to pay for any items needed to replace damaged landscape, including but not limited to, topsoil, grass, irrigation system components, trees, shrubs, ground covers and mulch to its original condition. All items shall be pre-approved by the Engineer prior to installation or they will be at no cost to the project.

F/A 05 Erosion Control - This Force Account is to pay for any other erosion control items the TECS will need during the duration of this project. All items shall be pre-approved by the Engineer prior to installation or they will be at no cost to the project.

F/A 06 Environmental Health & Safety Management – This work will be made in accordance with Sections 250 and 170.25 (b) of the Standard Specification for Road and Bridge Construction.

## TRAFFIC CONTROL PLAN - GENERAL

The key elements of the Contractor's method of handling traffic (MHT) are outlined in subsection 630.10(a).

The components of the Traffic Control Plan for this project are included in the following:

(1) Subsection 104.04 and Section 630 of the specifications.

(2) Standard Plan S-630-1, Traffic Controls for Highway Construction.

(3) Standard Plan S-630-2, Barricades, Drums, Concrete Barriers (Temp) & Vertical Panels.

(4) Schedule of Construction Traffic Control Devices and Tabulaton of Traffic Control Pay Items.

(6) The Manual on Uniform Traffic Control Devices (MUTCD), latest edition.

This project includes restrictions to work times and days that affect traffic during peak traffic times and days, holidays, holiday evenings, holiday weekends, and other circumstances as described in this special provision. Wherever other laws, ordinances, regulations, or orders are more restrictive, they shall take precedence over these requirements.

The Contractor shall coordinate and cooperate fully with the City, utility owners, and other contractors, to assure adequate and proper traffic control is provided at all times.

The Contractor shall coordinate and cooperate fully with any others providing traffic control for other operations to assure that work or traffic control devices do not interfere with the free flow of traffic except as allowed by the Traffic Control Plan.

RESTRICTED WORK TIMES FOR PEAK TRAFFIC TIMES

Except in cases of emergency, maintenance, or protection of work already completed, all work including lane closures, shoulder closures or sidewalk closures Monday through Friday from 8:30 AM to 3:30 PM. only. No work will be permitted outside of those hours. No work shall be allowed on Saturday, Sunday, or legal holidays unless approved by the City of Thornton Development Engineering in each case.

The Contractor shall maintain one (1) lane of traffic in each direction at all times.

During the execution of the work, it may be necessary for nighttime construction activities to take place. The project will not pay separately for any lighting used during these construction activities, the cost of which shall be borne as part of the work.

Prior to the installation of any type of traffic control, the Contractor shall obtain a traffic control permit from the City of Thornton and City of Northglenn.

RESTRICTED WORK TIMES FOR HOLIDAYS

Work that interferes with traffic on any day of a holiday shall not be permitted. Holidays shall be as defined in subsection 101.36. Section 108.08 of Standard Specifications places additional restrictions on work occurring on weekends, holidays and extended holiday weekends.

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**TRAFFIC CONTROL PLAN – GENERAL**

CONSTRUCTION

The Contractor shall submit an MHT, all appropriate Traffic Control Supervisor and Flagger documentation to the City Project Engineer prior to approval of the setting any traffic control device,

All costs incidental to the foregoing requirements shall be included in the original contract prices for the project, including any additional traffic / pedestrian control.

During the construction of this project, traffic shall use the present traveled roadway.

The Contractor shall not have construction equipment or materials in the lanes open to traffic at any time, unless otherwise approved by the City Project Engineer.

All personnel vehicle parking is prohibited where it conflicts with safety, access or flow of traffic.

The Contractor shall maintain open communication with the City Project Engineer about all aspects of the daily and weekly work and submit a week look ahead schedule to the City Project Engineer.

All construction traffic control devices, including signs installed as part of this project shall be installed, as stated in the Traffic Plans and CDOT's M & S Standards. Construction signing shall be removed unless work is in progress or devices have been left on the job site. This work shall be included in the price of the traffic control devices. All portable signs shall be removed at the end of each working day and shall not block or impede other existing traffic control devices, or sidewalks for pedestrians, disabled persons or bicycles.

The Contractor shall equip its construction vehicles with flashing amber lights. Flashing lights on vehicles shall be visible from all directions.

The Contractor shall maintain access to all roadways, side streets, walkways, bike paths and driveways at all times unless otherwise directed by the City Project Engineer.

The Contractor shall maintain continuous access through the project for pedestrians, bicycles and disabled persons, except where such access is prohibited prior to construction. When the existing access route is disrupted by construction or construction related activities, a temporary access shall be provided. All pedestrian access shall be delineated through the work area using proper channelizing devices.

Traffic control devices shall not be stored on project site.

Excavations or holes shall be filled in or fenced at the City Project Engineers direction when unattended. During non-construction periods (nights, weekends, holidays, etc.), all work shall be adequately protected to ensure the safety of vehicular and pedestrian traffic, as detailed in the Contractor's MHT. Excavations near the roadway shall be filled or shouldered up at the end of each work day.

Unless otherwise approved by the City Project Engineer, the Contractor's equipment shall follow normal and legal traffic movements. The Contractor's ingress and egress of the work area shall be accomplished with as little disruption to traffic as possible. Traffic control devices shall be removed by picking up the devises in a reverse sequence to that used for installation. This may require moving backwards through the work zone. When located behind barrier or at other locations shown on approved traffic control plans, equipment may operate in a direction opposite to adjacent traffic.

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**TRAFFIC CONTROL PLAN – GENERAL**

The City may have entered into operating agreements with one or more law enforcement organizations for cooperative activities. Under such agreements, at the sole discretion of the City, law enforcement personnel may enter the work zone for enforcement purposes and may participate in the Contractor's traffic control activities. The responsibility under the Contract for all traffic control resides with the Contractor, and any such participation by law enforcement personnel in Contractor traffic control activities will be referenced in either the Special Provisions or General Notes of the plans depending on whether the contractor is to hire local law enforcement or if the City is contracting with Colorado State Patrol for uniformed traffic control. Nothing in this Contract is intended to create an entitlement, on the part of the Contractor, to the services or participation

## UTILITIES

The known utilities within the limits of this project are:

| UTILITY COMPANY<br>ADDRESS | CONTACT NAME<br>EMAIL | TELEPHONE |
|---|---|---|
| Adams 12 5-Star Schools –<br>1500 E 128th Ave Thornton, CO 80241<br>Fiber, Telco | Kenneth Dixon<br>kdixon@henkelswest | (720)-972-4000<br>(303)-862-8237 |
| Lumin–<br>5325 Zuni St Denver, CO 80221<br>Fiber Optic, Telco | Philip Martin<br>philip.p.martan@lumin.com | (720)-329-3170 |
| City of Northglenn –<br>12301 Claude Ct Northglenn, CO 80241<br>Water, Sewer | Jason Hensel<br>Jhensel@northglenn.org | (303)-450-4050 |
| City of Thornton –<br>12450 Washington St Thornton, CO 80241<br>Warter, Sewer, Storm Sewer, Irrigation | Antinio Dominguez<br>info@utilisyn.com | (720)-977-6210 |
| Comcast –<br>6850 S Tucson Way Englewood,CO 80112<br>CATV, Fiber Optic | Charlie Parks<br>charlieparks@usicllc.com | (800)778-9140 |
| Crown Castle –<br>116 Inverness Dr E<br>Englewood, CO 80112<br>Fiber Optic | Rod Kirby<br>Rod.kirbt@<br>crowncastle.com | (801)-364-1063<br>(724)-416-2957 |
| MCI / Verizon<br>10000 Park Meadows Dr<br>Lone Tree, CO 80124<br>Fiber Optic | Lane Grady<br>lane.grady@verizon.com | (303)-827-9756<br>(800)-289-3427 |
| United Power Inc –<br>9586 E. I-25 Frontage Road Longmont, CO 80504<br>Electric | Kasey Pfeil<br>kpfeil@unitedpower.com | (303)-637-1227<br>(303)-827-4497 |
| Xcel Energy –<br>1800 Larimer St., Denver, CO 80202<br>Electric | Aaron Geppert<br>aaron.geppert@excelenergy.com | (612)330-5746<br>(855)-286-4227 |

The work described in these plans and specifications requires full cooperation between the Contractor and the utility owners in accordance with Subsection 105.11 in conducting their respective operations, to complete the utility work with minimum delay to the project.

All new underground facilities, including laterals up to the structure or building being served, installed as part of this project must be electronically locatable when installed, in compliance with Colorado Revised Statutes, Title 9, Article 1.5.

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## UTILITIES

**PART 1 - CONTRACTOR SHALL PERFORM THE WORK LISTED BELOW:**

Provide each utility owner with weekly updates to the schedule. Conduct detailed utility coordination meetings prior to each construction phase to coordinate all requirements and schedules and provide other necessary accommodations as directed by the Engineer. Notify each utility owner in writing, with a copy to the Engineer, prior to the time each utility work element is to be performed by the utility owner. Provide the notice with the number of days specified in Part 2 immediately prior to the time the utility work must begin to meet the project schedule.

Provide traffic control, as directed by the Engineer, for any utility work performed by the utility owner within the project limits expected to be coordinated with construction. However, traffic control for utility work outside of typical project work hours shall be the responsibility of the utility owner.

Notify each utility owner in advance of any work being done by the Contractor around its facility, so that the utility owner can coordinate its inspections for final acceptance of the work with the Engineer. Obtain written acceptance from the utility owner for work performed by Contractor. The Contractor shall provide the utility owner written notice at least thirty days immediately prior to each utility work element expected to be coordinated with construction.

Verify the location and depth of existing facilities at potential utility conflicts, and coordinate with the utility owner if a relocation or adjustment to raise/lower lines is needed. If a conflict is determined the Contractor shall expose the utility owner's line if requested by the utility owner so that the utility owner can relocate or adjust to raise/lower as needed. For relocations/adjustments that are expected to be done prior to construction, the Contractor shall coordinate with the utility owner regarding the status of the work and receive as-built information from the utility owner upon completion.

Xcel Energy – Electrical

The Contractor shall coordinate with Xcel Energy for electrical connections to the existing electrical transformer at approximately Project Station 102+00 right on 104th Avenue for power to the proposed traffic signal. **All costs and charges for this work shall be completed through the project Force Account: Furnish and Install Electrical Service.**

**GENERAL:**

The Contractor shall comply with Article 1.5 of Title 9, CRS ("Excavation Requirements") when excavating or grading is planned in the area of underground utility facilities. The Contractor shall notify all affected utilities at least two (2) business days, not including the actual day of notice, prior to commencing such operations. The Contractor shall contact Colorado 811 at phone no. 811 or co811.org, to have locations of Colorado 811 registered lines marked by member companies. All other underground facilities shall be located by contacting the respective owner. Utility service laterals shall also be located prior to beginning excavation or grading.

The locations of utility facilities as shown on the plan and profile sheets were obtained from the best available information. No warranty is made for the adequacy or accuracy of subsurface information provided. The Contractor shall cooperate with the utility owners in their relocation operations as provided in subsection 105.11 of the Standard Specifications for Road and Bridge Construction. No guarantee is made that utility conflicts will be resolved prior to construction activities and any delays resulting from utility relocation work shall be dealt with in accordance with subsection 108.08 of the Standard Specifications for Road and Bridge Construction as amended.