

**BELFORD AVENUE OVER HAPPY CANYON CREEK**

The Colorado Department of Transportation's (CDOT) Standard Specifications for Road and Bridge Construction, dated 2019, controls construction of this project. The following Special Provisions supplement or modify the Standard Specifications and take precedence over the Standard Specifications and plans. When Specifications or Special Provisions contain both English units and SI units, the English units apply and are the specification requirement.

**PROJECT SPECIAL PROVISIONS**

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**COLORADO  
DEPARTMENT OF TRANSPORTATION**

**STANDARD SPECIAL PROVISIONS**

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**REVISION OF SECTION 201  
CLEARING AND GRUBBING**

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

**201.1 DESCRIPTION**

**Subsection 201.01 is hereby revised to include the following:**

This work consists of removal and disposal of trash of any kind within the limits of the right of way, easement areas, and other areas shown in the contract or required by the work. These items shall be removed and disposed of by the Contractor during construction and prior to final acceptance of the project.

**201.02 CONSTRUCTION REQUIREMENTS**

**Subsection 201.02 is hereby revised to include the following:**

The Contractor shall remove and dispose of all visible abandoned utility appurtenances that are located within the work area or right of way and abandoned as a result of this project. These items shall not be disposed of within the project limits. Removal of utility appurtenances shall not be measured and paid for separately, but shall be included in the work for Item 201, Clearing and Grubbing.

**The Contractor shall not remove any shrubs or trees within the project limits without prior written approval from the Engineer.** All trees and shrubs adjacent to the Project limits, unless otherwise noted, shall be protected. The Contractor shall mark all trees and shrubs that are required to be removed and shall obtain written approval from the Engineer prior to beginning the work. Removal of trees and/or shrubs shall not be measured and paid for separately, but shall be included in the work for Item 201, Clearing and Grubbing.

The Contractor shall remove any temporary concrete barriers and fence posts within the limits of the right of way, easement areas, and other areas shown in the contract or required by the work. These items shall be removed and disposed of by the Contractor during construction and prior to final acceptance of the project. Removal and disposal of temporary concrete barriers and fence posts shall not be measured and paid for separately, but shall be included in the work for Item 201, Clearing and Grubbing.

**201.04 BASIS OF PAYMENT**

**Subsection 201.04 is hereby revised as follows:**

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Clearing and Grubbing	Lump Sum

**REVISION OF SECTION 203  
EXCAVATION AND EMBANKMENT**

**Section 203 of the Standard Specifications is hereby revised for this project as follows:**

**203.02 EXCAVATION DEFINITIONS**

**Subsection 203.02 (c) shall include the following:**

- (c) Material that is free of organics but has excessive moisture shall not be classified as unsuitable for embankment material due to the presence of excessive water. It shall be the Contractor’s responsibility to satisfy the moisture condition specified in the Contract Documents for embankment material. The classification of material as unsuitable for embankment material shall be made by the Engineer.

**In Subsection 203.02, add the following subsection:**

- (g) *Subgrade* is defined as follows:
  - ◆ Top of embankment material in areas not receiving aggregate base course
  - ◆ Bottom of aggregate base course where designated

**203.03 EMBANKMENT**

**Subsection 203.03 (a) Item 1. Soil Embankment is hereby revised to include the following:**

Embankment material for the roadway prism including approach embankments shall consist of approved material from on-site excavations.

The Contractor shall utilize stockpiled material that will be placed in the proximate vicinity of the proposed staging area.

The “Approved Material” to be placed under the Aggregate Base Course (Class 6) for Summerset Lane shall consist of clays, sands, sandstone or siltstone meeting the following criteria:

Percentage Passing No. 200 Sieve	Less than 80 percent
Plasticity Index	Less than 20
Swell Index at 200 psf (Denver Swell Test)	Less than 2 percent
Dry Unit Weight	100 pcf minimum

The material shall be free of debris, organic matter, deleterious material, and frozen material. The material shall consist of predominantly fine-grained material.

If additional embankment is required, the Town will provide a total of two (2) compliance tests for the proposed Contractor’s import source(s). Any testing required beyond the provided two (2) compliance tests provided shall be completed by the Contractor as directed by the Town. Any additional testing will not be paid for separately, but shall be included in the work.

**203.05 CONSTRUCTION REQUIREMENTS - EXCAVATION**

**In Subsection 203.05, (g) *Potholing*, add the following to the second paragraph:**

Records of the potholed and surveyed utilities shall be submitted to the Engineer.

**REVISION OF SECTION 203  
EXCAVATION AND EMBANKMENT  
- Continued -**

**203.07 CONSTRUCTION OF EMBANKMENT AND TREATMENT OF CUT AREAS WITH MOISTURE AND DENSITY CONTROL**

**Subsection 203.07 shall include the following:**

The amount of water to be used in compacting the roadway subgrade shall range from optimum to 2 percentage points above optimum as determined by ASTM D1557 – 95%.

**203.11 METHOD OF MEASUREMENT**

**Subsection 203.11 shall include the following:**

Items paid for by volume will not be remeasured but will be the quantities designated in the Contract. Exceptions will be made when field changes are ordered or when it is determined that there are discrepancies on the plans in an amount of at least plus or minus fifteen percent (15%) of the plan quantity.

***Proof rolling will not be measured and paid for separately, but shall be included in the work.***

The Contractor shall be responsible for verifying existing cross sections prior to construction and identifying any discrepancies and shall notify the Engineer. Failure to do so indicates acceptance of the existing ground line as shown in the cross sections and quantities.

The shrinkage factor shown on the plans is an approximation, and it is the Contractor's responsibility to construct the project to the lines and grades as shown on the plans. Additional embankment and excavation may be necessary and shall include import, export or hauling required to complete the work. This additional work will not be paid for separately but shall be included in the cost of the Embankment Material (Complete-in-place).

The Contractor shall notify the Engineer of areas of concern where muck excavation and/or over-excavation may be warranted. The limits of removal for muck excavation and over-excavation shall be based on limits defined by the Engineer. The Contractor shall request in writing and obtain written approval of the limits of muck excavation and over-excavation from the Engineer prior to commencing the work. Any muck excavation or over excavation completed without prior written approval of the Engineer shall not be measured and paid for. **Muck shall not be defined as soil with excessive moisture for material that would otherwise be acceptable fill if dried.**

The contract unit price for Embankment Material (Complete-in-place) shall be full compensation for all work necessary to complete the item including construction of embankments, unclassified excavation, compaction, moisture control, compaction of bases of cuts and fills, proof rolling, haul, and exporting excess material.

**203.12 BASIS OF PAYMENT**

**Subsection 203.12 shall include the following:**

Payment for Muck Excavation shall include but is not limited to all excavation, transportation, drying/wetting, grading, furnishing and placing imported material, compaction and disposal of unsuitable or excess material onsite. Payment shall be made at the applicable contract unit price for Muck Excavation, which shall include full compensation for all labor, equipment, supervision, tools, materials, transportation, and all other appurtenant items to complete the work. Any additional excavation and backfill made by the Contractor below or above the design subgrade elevation, without the prior acceptance of the Engineer will be at the responsibility and expense of the Contractor.

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**REVISION OF SECTION 206  
EXCAVATION AND BACKFILL FOR STRUCTURES**

**Section 206 of the Standard Specifications is hereby revised for this project as follows:**

**206.01 DESCRIPTION**

**Subsection 206.01 is hereby revised to include the following:**

The Contractor should anticipate the need to accommodate water flowing into and out of the project site during construction and shall provide a dry, stable condition. Any equipment or excavation required for dewatering shall be located within the project limits as defined by the project boundary defined on the plans.

**206.06 METHOD OF MEASUREMENT**

**Delete Subsection 206.06 (b) and replace with the following:**

- (b) For pipes and inlets, materials excavated will not be measured for payment, but shall be included in the bid price for the pipe and inlet.

**206.07 BASIS OF PAYMENT**

**Subsection 206.07 is hereby revised to include the following:**

Structure excavation and backfill for culverts, conduits, end sections, check dams, inlets, manholes, riprap and grouted riprap installation shall not be measured and paid for separately, but shall be included in the work. Structure excavation and backfill shall be done in accordance with the CDOT, M & S Standards, and as detailed in the plans (when applicable).

No separate measurement and payment will be made for work, equipment and materials, including rock stabilization, diversions, erosion bales, pumping and well-points, required to control the surface and subsurface water within the project limits and in the area of culverts and pipes being removed or installed.

If ground water is encountered, the Contractor shall submit a dewatering plan to the Town at least one week prior to beginning the work. The Contractor shall procure all permits necessary to complete this work.

**REVISION OF SECTION 207  
TOPSOIL**

**Section 207 of the Standard Specifications is hereby revised for this project as follows:**

**207.01 DESCRIPTION**

**Subsection 207.01 is hereby revised to include the following:**

This work consists of removing existing on-site topsoil material, stockpiling the existing topsoil material and redistributing the existing topsoil material onto the regraded slopes at a minimum depth of 4 inches. The topsoil material shall be generally evenly distributed throughout the project limits for the areas to be seeded and mulched. Any excess topsoil generated from this project shall be placed at the direction of the Engineer.

**207.04 METHOD OF MEASUREMENT**

**Subsection 207.04 is hereby revised to include the following:**

Topsoil will not be remeasured, but payment shall be based on the quantity identified in the bid tabulation, unless the quantity of Topsoil is significantly changed during construction by an approved Change Order.

Haul required to redistribute stockpiled topsoil uniformly throughout the project limits shall not be measured and paid for separately, but shall be included in the work.

**207.05 BASIS OF PAYMENT**

**Subsection 207.05 is hereby revised to include the following:**

The contract unit price for topsoil shall be full compensation for all work necessary to complete the item including removing existing on-site topsoil material, stockpiling the existing topsoil material, haul, and redistributing the existing topsoil material onto the regraded slopes. Excess topsoil shall be uniformly re-distributed over the slopes requiring topsoil.

Payment will be made under:

**Pay Item**  
Topsoil

**Pay Unit**  
Cubic Yard

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**REVISION OF SECTION 208  
EROSION CONTROL**

**Section 208 of the Standard Specifications is hereby revised for this project as follows:**

**Subsection 208.02 is hereby revised to include the following:**

Materials used for the construction of all erosion and sediment control **Construction Best Management Practices (CBMPs)** shall conform to the materials specified in the Town of Parker CBMP Standard notes and Details, as shown in the plans.

**Subsection 208.03 is hereby revised to include the following:**

The Contractor shall anticipate the need to accommodate surface water flowing into and out of the project site during construction and the need to provide dewatering for excavation operations. Any equipment or excavation required for dewatering shall be located within the Project limits as defined by the limits of construction on the plans.

The work of this section includes controlling groundwater, site drainage and storm flows during construction. The Contractor is cautioned that the work may involve construction in and around drainage channels, local rivers and areas of local drainage. These areas are subject to frequent periodic inundation. All work required accommodating surface water, ground water and control erosion shall be in conformance with the requirements of all applicable federal, State, and local regulations and permits, including any applicable permits listed in Section 107.25 of these special provisions.

**Surface Water Control.** This Project is subject to a permit with the Colorado Department of Public Health and Environment (CDPHE) for Stormwater Discharges Associated with Construction Activities. The permit shall be obtained by the Contractor. The Contractor shall prepare all applications required and submit them to the CDPHE. The Contractor shall submit a copy of certification of the permit to the Engineer prior to the start of construction. The Contractor is responsible for all application permit fees. Surface water control generally falls into the following categories:

- (1) Normal low flows along the channel.
- (2) Storm/flood flows along the channel.
- (3) Flows from existing storm drain pipelines.
- (4) Local surface inflows not conveyed by pipelines.

At a minimum, the Contractor shall be responsible for diverting the quantity of surface flow around the construction area, so that the excavations will remain free of surface water for the time it takes to install these materials and the time required for curing of any concrete or grout.

The Contractor is cautioned that the minimum quantity of water to be diverted is for erosion control and construction purposes and not for general protection of the construction site. It shall be the Contractor's responsibility to determine the quantity of water which shall be diverted and control measures needed to protect the work from damage caused by storm water.

The Contractor shall, at all times, maintain a flow path for all channels. Temporary structures such as berms, sandbags, pipeline diversions, etc., may be permitted for the control of channel flow, as long as such measures are not a major obstruction to flood flows, do not worsen flooding or alter pre-project flow routes.

The Contractor shall conduct operations in such a manner that storm or other waters may proceed uninterrupted along their existing drainage courses. **By submitting a bid**, the Contractor acknowledges that he has investigated the risk arising from such waters, has prepared his bid accordingly and assumes all of said risk.

**REVISION OF SECTION 208  
EROSION CONTROL  
- Continued -**

**Groundwater Control.** This Project may be subject to a "Construction Dewatering Permit" with the CDPHE for dewatering associated with construction activities. The permit shall be obtained by the Contractor. The Contractor shall prepare all applications required and submit them to the CDPHE. The Contractor shall submit a copy of certification of the permit to the Engineer at least three (3) days prior to the start of any dewatering activities. The Contractor is responsible for all application permit fees.

The Contractor shall install adequate measures to maintain the level of groundwater a minimum of two (2) feet below the foundation subgrade elevation and maintain sufficient bearing capacity for all structures, pipelines, utilities, earthwork and rock work. Such measures may include, but are not limited to, installation of perimeter subdrains, pumping from drilled holes or by pumping from sumps excavated below the subgrade elevation. Dewatering from within the foundation excavations shall not be allowed. The foundation bearing surfaces are to be kept dewatered and stable until the structures or other types of work are complete and backfilled. Disturbance of foundation subgrade by Contractor operations shall not be considered as originally unsuitable foundation subgrade and shall be repaired at Contractor's expense. Any temporary dewatering trenches, settlement ponds or well points shall be restored following dewatering operations to reduce permeability in those areas as approved by the Engineer.

All excavations made as part of dewatering operations shall be backfilled with the same type material as was removed and compacted to ninety five percent (95%) of Maximum Standard Proctor Density (ASTM D698), except where replacement by other materials and/or methods are required and have been approved by the Engineer.

At no time during construction shall the Contractor affect existing surface or subsurface drainage patterns of adjacent property. Any damage to adjacent property resulting from the Contractor's alteration of surface or subsurface drainage patterns shall be the Contractor's responsibility and shall be repaired by the Contractor at no additional cost to owner.

The Contractor shall remove all temporary water control facilities when they are no longer needed or at the completion of the Project. Pumps and generators used for dewatering and water control shall be quiet equipment enclosed in sound deadening devices, unless the Engineer agrees that the quieter equipment isn't needed in isolated instances.

**Subsection 208.03(c) is hereby revised to include the following:**

**The first paragraph shall include the following:**

The ECS shall read, be familiar with, and use the information provided in the Town of Parker CBMP Standard notes and Details and the CDPS-SCP.

**208.04 BEST MANAGEMENT PRACTICES FOR STORMWATER**

**Subsection 208.04(b) is hereby revised to include the following:**

The Project is subject to inspections by CDPHE, U.S. Army Corps of Engineers (USACE) and the Environmental Protection Agency (EPA) at any time. **The Contractor shall immediately notify the Engineer when an inspection is scheduled.** If and when the CDPHE, the USACE or the EPA reviews the project site and requires additional measures to prevent and control erosion, sediment or pollutants, **then** the Contractor shall cease and desist activities resulting in pollutant discharge; and the Contractor shall immediately inform the Engineer of what transpired and ask for additional direction on implementing the additional measures requested by one or more of these agencies mentioned above.

REVISION OF SECTION 208  
EROSION CONTROL  
- Continued -

Subsection 208.04 (f) is revised to include the following:

Debris control and removal shall be completed to the requirements as set forth by the Removal and Disposal of Sediment.

208.12 BASIS OF PAYMENT

Subsection 208.12 is revised to include the following:

Work to furnish, install, maintain, remove, and dispose of erosion and sediment control features specified in the Contract will be paid for at the contract unit price.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Check Dam	Each
Concrete Washout Area	Each
Culvert Protection	Linear Foot
Diversion Ditch	Linear Foot
Erosion Control Blanket (Straw/Coconut)	Square Yard
Inlet Protection	Each
Rough Cut Street Control	Linear Foot
Portable Toilet Protection	Each
Sediment Control Log (12 Inch)	Linear Foot
Silt Fence	Linear Foot
Stabilized Staging Area	Square Yard
Temporary Sediment Basin	Each
Temporary Stream Control	Each
Vehicle Tracking Control	Each

The Contractor is responsible for removal of temporary erosion control features as directed by the Engineer. The Contractor shall anticipate this removal work to likely occur at the end of construction. Any remobilization expenses to remove erosion control features and perform general maintenance activities, will not be measured and paid separately, but shall be included in the Contract Unit Price for the items listed above.

**REVISION OF SECTION 209  
WATERING AND DUST PALLIATIVES**

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

**209.05 DUST PALLIATIVE**

**Subsection 209.05 is hereby revised to include the following:**

The Contractor shall apply water as a dust palliative as directed by the Engineer. It is the Contractor's responsibility to obtain the necessary water needed for this project and provide the necessary on-site storage in order to meet the requirements deemed necessary by the Engineer.

**209.08 BASIS OF PAYMENT**

**Subsection 209.08 is hereby revised to include the following:**

Water required for all items of work, including dust palliative, will not be measured and paid for separately, but shall be included in the work.

REVISION OF SECTION 212  
SEEDING

Section 212 of the Standard Specifications is hereby revised for this project as follows:

**212.02 MATERIALS – SEED, FERTILIZER, AND SOD**

In Subsection 212.02 (a) is hereby revised to include the following:

The Contractor shall refer to the Town of Parker Construction Best Management Practices (CBMP) for the required seed mix and seeding rate for this project. ***The Contractor shall utilize Seed Mix No. 2 from the CBMP.*** Seeding shall be performed according to the Town of Parker CBMP details and text.

**REVISION OF SECTION 304  
AGGREGATE BASE COURSE**

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

**304.02 AGGREGATE**

**Subsection 304.02 is hereby revised to include the following:**

The minimum allowable R-value for Aggregate Base Course shall be 78. The specific gravity for the aggregates shall be greater than 2.0 at the source. The use of crushed reclaimed concrete material may be substituted for natural aggregate for use in roadbed stabilization upon review and written approval of the Engineer. Aggregate base course for use in shouldering and all-weather surfaces shall be natural and approved by the Town of Parker.

**304.07 METHOD OF MEASUREMENT**

**Subsection 304.07 is hereby revised to include the following:**

The measurement of Aggregate Base Course (Class 6) installed for the project will be based on the volume of the Aggregate Base Course as identified in the plans. No separate measurement or payment will be made for processing and distributing the Aggregate Base Course as directed.

**304.08 BASIS OF PAYMENT**

**Subsection 304.08 is hereby revised to include the following:**

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Aggregate Base Course (Class 6)	Cubic Yard

The contract unit price shall be full compensation for all labor, equipment and material needed to complete the work, (including furnish, placement, compaction, fine grading, stockpile and redistribute as required during construction and to remove and incorporate this material into the roadway embankment and maintenance access).

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**REVISION OF SECTION 501  
STEEL SHEET PILING**

**Section 501 of the Standard Specifications is revised as follows:**

**Subsection 501.04 shall be modified to include the following:**

Steel Sheet Piling includes the installation of the steel sheet piling and trimming of the sheet pile to the lines and grades shown on the Contract Drawings.

Steel sheet piles required for the project shall be the type and weight shown on the Contract Drawings. Sheet piling shall be constructed with a weathering finish.

Steel sheet piling shall meet the requirements of ASTM A328, (grade 50). Steel corners, tees, wyes, and crosses (as required) shall meet the requirements of ASTM A328 or ASTM A690.

Steel sheet piling shall be new and unspliced material throughout, unless otherwise reviewed and accepted by the Project Engineer. Steel sheet piles and special fabricated shapes shall be of a design that ensures continuous interlock throughout the entire length when in place. All fabricated connections shall be made with the use of angles or bent plates, as necessary, and shall be adequately welded or connected with high strength bolts as accepted by the Project Engineer. Additional length beyond those indicated on the Contract Drawings may be required to provide for trimming of tops of sheet piling.

The interlocks between steel sheet pile sections shall be configured such that the average width of the annular space between all contact points of the interlocks shall be a maximum of one-eighth (1/8) inch, as determined by the project engineer. Steel sheet piles and interlocks shall not have excessive kinks, camber or twist that would prevent the pile from reasonably free sliding to grade.

If handling holes are provided, they shall be two (2) standard two and nine-sixteenth (2-9/16) inch diameter handling holes located six (6) inches from one end. The holes shall be plugged by welding a piece of steel over the hole prior to installing any riprap, backfill or grout. The plated hole shall be watertight.

Do not subject piles to damage by impact bending stresses in transporting to and storing piles onsite. Store and handle piles such that corrosion protection coating will not be damaged.

Sheet pile installation shall not be started until the earthwork in the areas where the piles are to be driven has been completed to the extent that the grade elevation is at no more than twelve (12) inches above or below the top of the piling elevation as indicated on the Contract Drawings.

Any fill along the alignment of the sheet pile must be in place to sub-grade elevations and compacted prior to driving the sheet pile. Fill material (except riprap, boulders, bedding and grout) is not to be placed around the sheet pile after the sheet pile is in place.

All welding or gas cutting shall be in accordance with the current standards of the American Welding Society.

Steel sheet piling shall be driven to the depths shown on the Contract Drawings or to virtual refusal. Virtual refusal is defined as ten (10) blows per inch with an approved pile hammer. A pile hammer shall be used determine virtual refusal. The hammer shall be operating at the manufacturer's recommended stroke and speed when virtual refusal is measured.

Steel sheet piling shall be assembled before driving and then driven as a continuous wall, progressively in stages to keep the piles aligned correctly and minimize the danger of breaking the interlock between the sheets. Steel sheet piling shall be driven to form a tight bulkhead. A driving head shall be used and any piling which is damaged in driving or which has broken interlocks between sections shall be pulled and replaced at the Contractor's expense.

**REVISION OF SECTION 501  
STEEL SHEET PILING  
- Continued -**

The alignment of the sheet pile shall be driven to form a relatively straight line between the termini points shown of the Contract Drawings. Horizontal deviation of any point from a straight line connecting the two ends of the wall section shall be a maximum of six (6) inches. Each individual sheet pile sections shall be driven vertical, within a horizontal tolerance of two percent (2%) of any vertical length measured along the pile.

Tops of sheet pile sections shall be within a tolerance of one (1) inch from plan elevations. The Contractor shall not be paid for excess sheet pile trimmed off the end of the pile to meet final grade. Sheet pile cut off greater than 10 square feet will not be paid for. A steel cap is required and shall be in accordance with the detail in the plans.

The Contractor shall brace and or provide soil grading as necessary during construction operations to provide lateral stability for the sheet pile wall. The sheet pile wall has been designed the soil grades of the final configuration denoted on the Contract Drawings only. Other temporary configurations during the construction period shall not be allowed.

Care shall be taken during driving to keep from causing deformations of the top of the piles, splitting of section, or breaking of the interlock between sections. Care shall also be taken during driving to prevent and correct any tendency of steel sheet piles to twist or get out of plumb.

Steel Z piling shall be driven with the ball-end leading. Proper care and planning shall be used to allow for this construction procedure in both immediate and possible future walls.

Alternate Z piles shall be reversed end for end for proper interlocking in the "normal" position. Piles shall also be aligned properly to maintain a "normal" driving width.

For sheet piles driven into the native soils, pre-drilled soils, or excavated soils a vibratory driver may be used if the required depth is obtained. For sheet piles being driven into bedrock, an approved hammer utilizing a minimum hammer energy of 19,000 foot-pounds per square inch of steel section shall be used to obtain the required depth or virtual refusal. The hammer shall be clearly marked so that it can be identified at the job site.

Steel sheet pile that is full length as shown on the Contract Drawings and is required to be driven below the specified cutoff elevation shall be spliced with additional steel sheet piling with a full penetration butt weld.

**Subsection 501.06 shall include the following:**

<u>Pay Item</u>	<u>Pay Unit</u>
Steel Sheet Piling (Type II)	Square Foot

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**REVISION OF SECTIONS 503 & 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-drilled-holes, or cast-in-situ piles) in accordance with the Contract Documents and this Specification.

**SUBMITTALS AND MEETINGS**

**503.02 Submittals.**

*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.

*Drilled Shaft Installation Plan.* At least 10 days prior to the start of drilled shaft construction, the Contractor shall submit a method statement narrative in a "Drilled Shaft Installation Plan". In preparing the narrative, the Contractor shall reference the available subsurface geotechnical data 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). These details shall include the Contractor's 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. The details shall include 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.

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- (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.

*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 7 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.

*CDOT Form 1333 – Inspector's Report of Caisson Installation (or equivalent form)*, completely documenting each shaft's 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.

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In addition to the information required on the CDOT 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 CDOT 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 each 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 Contractor's Drilled Shaft Installation Plan for conformance with the Contract within five working days after receipt of the submission. A Shaft Installation Plan Submittal meeting may be scheduled following the Engineer's 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 structures 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 Authority's project personnel involved with the structural, geotechnical, and construction review of the Drilled Shaft Installation Plan together with Authority's consultant 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 five working days after receipt of the submission.

A drilled shaft pre-work meeting shall be held at least five working days prior to the Contractor beginning any shaft construction work to discuss investigative boring information, construction procedures, personnel, and equipment to be used, safety 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 structures superintendent, on-site supervisors, and other key personnel identified by the Contractor as being in charge of the drilled caisson operation. 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 Authority. 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 of 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.

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**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 as 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 structural 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.

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

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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, when used shall be 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.** CSL testing is not required on this project.

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**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 the caisson 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 meets the following conditions: 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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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.

- (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 casings, 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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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

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- (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 Engineer shall be notified 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 shall 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. The Contractor shall provide safe access for the Engineer's inspection, including proper fall protection.

**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 working 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 (100%) 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.

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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. 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 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"	4"
5'-0" or larger	6"

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. 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).

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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.

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 Authority or an extension of the completion date of the project. Redesign drawings and computations submitted by the Contractor shall be signed by a Professional Engineer actively licensed in the State of Colorado.

**REVISION OF SECTIONS 503 & 601  
DRILLED SHAFTS  
- Continued -**

**TESTING AND VERIFICATION**

**503.21 Integrity Testing.** Crosshole Sonic Log (CSL) testing is not required on this project.

**503.22 Drilled Shafts Load Tests.** Test shafts are not required on this project.

**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 directed by the Engineer.

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; 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:

<b>Pay Item</b>	<b>Pay Unit</b>
Drilled Caisson (24 Inch)	LF
Drilled Caisson (48 Inch)	LF

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

(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:

<b>Additional Length</b>	<b>Compensation</b>
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

**REVISION OF SECTION 506  
GROUTED RIPRAP**

**Section 506 of the Standard Specifications is hereby revised for this Contract as follows:**

**DESCRIPTION**

**Subsection 506.01 is hereby revised to include the following:**

This work shall consist of installing grouted riprap at the locations shown on the Contract Drawings.

**MATERIALS**

**Subsection 506.02 is hereby revised to include the following:**

The materials used shall conform to the following:

For riprap sizes designated in the Contract Drawings, the minimum dimension of 18 Inch Grouted Boulders shall be 24 inches in accordance with Urban Drainage & Flood Control District classifications. Prior to any riprap placement, the Contractor shall provide the Project Engineer samples of all specified materials and submit certified laboratory test certificates for all items required in this section.

Rhyolite rock shall not be used for any grouted riprap and shall be free of any calcite intrusions.

Each load of riprap shall conform to the dimensions specified on the Contract Drawings. Control of gradation will be by visual inspection by the Project Engineer. In the event the Project Engineer determines the riprap to be unacceptable, the Project Engineer will pick two random truckloads to be dumped and checked for gradation.

Mechanical equipment and labor needed to assist in checking gradation shall be provided by the Contractor at no additional cost to the project if the riprap does not meet the specified gradation. If the riprap does meet the gradation specified, the project will pay for the equipment and labor required for checking.

The color of the riprap shall be gray with gray/blue hues or other approved color and match the color of the grout.

The Contractor shall submit a mix design in writing to the Project Engineer for approval prior to placement of any grout. All grout shall have a minimum twenty-eight (28) day compressive strength equal to 3,200 psi. One cubic yard of grout shall contain a minimum of six (6) sacks of Type II Portland cement. A maximum of 25% Type F Fly Ash may be substituted for the Portland cement. Aggregate for the grout shall consist of 70% natural sand (fines) and 30% 3/8-inch rock (coarse). Slump shall be four (4) inches to six (6) inches. Grout shall contain on and on-half (1-1/2) pounds of Fibermesh, or approved equivalent, per cubic yard of grout.

Air entrainment shall be 5.5% - 7.5%.

The specific gravity of the riprap shall be two and one-half (2½) or greater. The specific gravity shall be according to the bulk-saturated, surface-dry basis, AASHTO T85.

The bulk density for the riprap shall be 1.3 ton/cy or greater.

**REVISION OF SECTION 506  
GROUTED RIPRAP  
- Continued -**

The riprap shall have a percentage loss of not more than forty percent (40%) after five hundred (500) revolutions when tested in accordance with AASHTO T96. The riprap shall have a percentage loss of not more than ten percent (10%) after five (5) cycles when tested in accordance with AASHTO T104 for ledge rock using sodium sulfate. The riprap shall have a percentage loss of not more than ten percent (10%) after twelve (12) cycles of freezing and thawing when tested in accordance with AASHTO T103 for ledge rock, procedure A.

**CONSTRUCTION REQUIREMENTS**

**Subsection 506.03 is hereby revised to include the following:**

Grouted Riprap shall be placed at the locations as shown on the Contract Drawings and installed with the following requirements:

The subgrade to receive riprap shall be excavated and any unstable material shall be removed. Riprap shall be placed on subgrade without granular bedding unless approved by the Project Engineer. Material approved by the Project Engineer shall be placed and compacted in a maximum of four-inch (4") lifts to ninety-five percent (95%) of Maximum Standard Proctor Density (ASTM D698) to re-establish the subgrade of the riprap. Unstable material shall be removed from the project site and disposed of by the Contractor. Removal and replacement of unstable material shall only be completed at the direction of the Project Engineer and shall be paid for under Muck Excavation.

Subgrade shall be excavated a minimum of 6" to a maximum of 12" behind the riprap. Backfill behind the riprap shall be compacted to ninety-five percent (95%) Maximum Standard Proctor Density (ASTM D698). Care shall be taken during compaction to avoid disturbing and or damaging the integrity of the riprap edge.

Finished grades and subgrade for riprap shall be determined from the height of each boulder used.

The top of all riprap shall be as indicated in the Contract Drawings. The boulders shall be carefully picked and arranged so that adjacent rock surfaces match within two (2) inches in top elevation and two (2) inches along the vertical exposed face or channel side of rock. Riprap shall be placed such that adjacent riprap "touch" each other and voids do not exceed four (4) inches. It is the intent of construction to minimize voids and grout placed between boulders.

The Contractor shall, if deemed necessary, support the boulders from falling over before and during the placement of grout, backfill, and completing compaction work on either side of the boulder. Smaller rocks or riprap shall be "chinked in" to fill all voids behind the riprap. Smaller rocks shall also be used to "chink in" gaps larger than four (4) inches. Placement shall be approved by the Project Engineer prior to grouting.

Prior to placing the grout, any type of debris, fines, smaller rock, or silt shall be removed from around or under and on the riprap.

Dewatering shall be implemented to guarantee that the grout will not be placed in water and for a period of twenty-four (24) hours after the grout has been placed. Keep boulder receiving grout wet at all times prior to receiving grout.

**REVISION OF SECTION 506  
GROUTED RIPRAP  
- Continued -**

The concrete grout shall be placed by injection methods by pumping under low pressure, through a two (2") inch maximum diameter hose to ensure complete penetration of the grout in to the void area as detailed on the Contract Drawings. The grout mix shall be stiffened and other measures taken to retain the grout between the boulders. Grout placement shall begin at the bottom of the lowest boulder and proceed upward to ensure no air voids exist between the grout, subbase, and riprap.

Grout shall be placed up to a height of one-half (1/2) of the diameter of the top row of boulders or as directed by the Project Engineer and shall be placed in the voids and behind the boulders and not on the surface of the rocks. A "pencil" vibrator shall be used to make sure all voids are filled between the boulders from the subgrade and around the boulders to a depth as shown of the Contract Drawings. The "pencil" vibrator may be used to smooth the appearance of the surface, but the Contractor shall use a wood float to smooth and grade the grout around the riprap. Grout between boulders shall be recessed one-third (1/3) the diameter of the riprap on the side facing the channel.

Grout shall be troweled out and finished to minimize visibility. Clean and wash any spillage before the grout sets so the visual surfaces of boulders will be free of grout to provide a clean natural appearance, or if washing does not clean off grout residue, the Contractor shall wash off any grout residue with muriatic acid and water, using a brush to scrub off the residue.

Grout shall receive cold or hot weather protection in accordance with the Standard Specifications.

**METHOD OF MEASUREMENT**

**Subsection 506.04 is hereby revised to include the following:**

No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The price will include all of Contractor's costs including, but not limited to:

- Excavating, removing and replacing material
- Backfilling and compacting
- Preparing/stabilizing foundation and bedding
- Placing Riprap
- Placing grout and vibrating
- Furnishing and installing weep drains inclusive of pipe, filter material and fabric
- Cleaning up
- Providing all other related and necessary labor, equipment, and materials

**BASIS OF PAYMENT**

**Subsection 506.05 is hereby revised to include the following:**

The accepted quantities measured as provided above will be paid for at the contract unit price per cubic yard for each of the pay items listed below that appear in the bid schedule. 18 Inch Grouted Boulders shall be paid for as Grouted Riprap (24 Inch).

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Grouted Riprap (24 Inch)	Cubic Yard

**REVISION OF SECTION 506  
SOIL RIPRAP**

**Section 506 of the Standard Specifications is revised as follows:**

**Subsection 506.02 shall be modified to include the following:**

Existing riprap removed during construction may be reused for "soil riprap" if it is free from deleterious materials and satisfies the specifications herein as determined by the Engineer.

Soil Riprap includes excavation, grading, and installation of Soil Riprap and Filter Material (Class A) and (Class C) and shall be installed at the locations shown on the Contract Drawings.

**Subsection 506.03 shall be modified to include:**

Elevation tolerance for the soil riprap shall be 0.10 feet. Thickness of soil riprap shall be no less than thickness shown and no more than 2-inches greater than the thickness shown.

Adjacent stockpiles of riprap and soil shall be created and minimizing done at the stockpile location, not at the locater where soil riprap is to be placed.

Mix thirty-five percent (35%) soil by volume with stockpiled riprap, using additional moisture and control procedures that ensure a homogenous mixture; where the soil fills the inherent voids in the riprap without displacing riprap.

With prior approval of the Project Engineer, layering the riprap and soil instead of premixing may be allowed in the native soil is granular.

Place a first layer of smaller soil riprap of approximate  $d_{50}$  thickness. Then place the top layer with surface rocks that are largely  $d_{50}$  or greater, filling voids as necessary with smaller planted riprap and create a smooth plane. The mixture shall be consolidated by large vibratory equipment or backhoe bucket to create a tight, dense interlocking mass.

The soil shall be further wetted to encourage void filling with soil. Any large voids shall be filled with rock and small voids filled with soil. Excessively thick zones of soil prone to washing away shall not be created, no thicknesses greater than six (6) inches. For buried soil riprap, the top surface shall be covered with six (6) inches of topsoil such that no rock points are protruding.

The final surface shall be thoroughly wetted for good compaction, smoothed and compacted by vibrating equipment; the surface shall then be hand raked to receive seeding.

The Contractor shall install a test section of at least 60 square feet of soil riprap for the review and approval of the Engineer prior to installation of the remaining soil riprap.

**Subsection 506.04 shall be modified to include:**

Excavation, grading, mixing and installation for soil riprap and soil material used in riprap voids shall not be paid for separately but will be considered part of the work.

**Subsection 506.05 shall include the following:**

<u>Pay Item</u>	<u>Pay Unit</u>
Soil Riprap (12 Inch)	Cubic Yard
Soil Riprap (18 Inch)	Cubic Yard

**REVISION OF SECTION 514  
PEDESTRIAN RAILING (STEEL)**

**Section 514 of the Standard Specifications is hereby deleted in its entirety and replaced with the following:**

**514.01 DESCRIPTION**

This work shall consist of furnishing all equipment, labor, fabrication and materials to do all work necessary to construct the Pedestrian Railing (Steel) as indicated on the Drawings and as specified herein.

**514.02 MATERIALS**

Steel shall conform to the requirements of Section 509 and the following:

1. Tubes shall conform to the requirements of ASTM A-500 Grade B.
2. Steel pipe shall conform to ASTM A53 Grade B.
3. Steel plates and bars shall comply with the requirements of ASTM A36.
4. Zinc coating shall conform to the requirements of ASTM A123, A153, A385 and A386.

Welding shall conform to the American Welding Society Structural Weld Code - Steel D1.1.

Fabrication shall not begin until Engineer's approval of submittals has been completed.

**514.06 CONSTRUCTION REQUIREMENTS**

Shop Drawings: Shop drawings shall be submitted to the Engineer in accordance with Sections 101 and 105 for all metal railing fabrications, showing sizes and thickness of all members, types of materials, methods of connection and assembly, complete dimensions, clearances, anchorage, relationship to surrounding work by other trades, shop paint and protective coatings, and other pertinent details of fabrication and installation. The submittal shall include:

1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, openings, size and type of fasteners and any accessories.
2. Include erection drawings, elevations, applicable details and field dimensions.
3. Indicate welded connection using standard AWS welding symbols. Indicate net weld lengths.

Steel elements shall be galvanized and coated in accordance with Revision of Section 522 – Duplex Coating System.

The powder coating color shall be equivalent to Tnemec Endura Shield, "Parker Brown" (F073D3884A).

The Contractor shall submit a one foot by one foot (1'x1') minimum sample, for approval by the Engineer, of all coating colors.

Materials shall be carefully handled and stored under cover in manner to prevent deformation and damage to the materials and to shop finishes, and to prevent rusting and the accumulation of foreign matter on the metal work. All such work shall be repaired and cleaned both prior to and after erection.

Work shall be erected square, plumb and true, accurately fitted, and with tight joints and intersections. All anchors, inserts and other members to be set into the concrete parapet wall shall be furnished loose by this trade to be built-into the concrete by those trades as the work progresses. Later cutting or drilling shall be avoided wherever possible.

Materials shall be new stock, free from defects impairing strength, durability or appearance, and of best commercial quality for each intended purpose.

**REVISION OF SECTION 514  
PEDESTRIAN RAILING (STEEL)  
- Continued -**

All steel members, hardware, and fasteners shall be fabricated of structural steel conforming to the ASTM designations herein. All embedded plates with anchor studs shall be hot-dip galvanized steel bar.

Connections shall be continuous-welded type for rigid construction, with weld ground smooth. Welding shall conform to applicable requirements of AWSW D1.1.

Provide all anchors, bolts, sockets, sleeves, and other parts required for securing each item of work. Furnish required anchors, bolts, and other items required for installation in concrete.

Exposed fastenings shall be of the same material and finish as the metal to which applied, unless otherwise noted.

Metal surfaces shall be cleaned and free from mill scale, flake, rust and rust pitting; well formed and finished to shaped and size, true to details with straight, sharp lines and angles and smooth surfaces. Curved work shall be to true radii. Exposed sheared edges shall be eased.

Weld all permanent connections. Weld shall be continuous on all exposed surfaces; exposed weld shall be ground flush and smooth with voids filled with metallic filling compound. Tack welding will be permitted where specifically called for. Do not use screws or bolts, unless specifically indicated or welding is not possible. Where used, bolt heads shall be countersunk, screwed up right and threads nicked to prevent loosening.

Fastening shall be concealed where practical, unless otherwise indicated. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Joints exposed to weather shall be formed to exclude water.

Pedestrian rail shall be rigidly braced and secured to surrounding construction, and shall be tight and free of rattle, vibration, or noticeable deflection during and after construction.

Electrolytic Isolation: Where dissimilar metals are to come into contact with one another, isolate by application of a heavy coat of bituminous paint on contact surfaces in addition to shop coat specified above. Do not permit the bituminous paint in any way to remain on surfaces to be exposed or to receive sealant.

Rail shall be of Architectural Quality. Exceptional care shall be taken in welding and grinding, filing and surface sanding to provide truly smooth, clean, neat, and flush construction throughout, free of all surface defects and defacements.

Rail which is improperly located, or is not true to line and plumb within tolerances or as indicated, shall be removed and replaced at no additional cost to the project.

Repair damaged components and finishes as recommended by the manufacturer and as indicated herein.

**514.07 METHOD OF MEASUREMENT**

Pedestrian Railing (Steel) shall be measured and paid for by the linear foot from end to end of the supporting concrete parapet, as shown on the plans. Payment will be full compensation for all work and materials required to complete the installation including fabrication, galvanizing, powder coating, anchors, anchor bolts, and installation.

**REVISION OF SECTION 514  
PEDESTRIAN RAILING (STEEL)  
- Continued -**

**514.08 BASIS OF PAYMENT**

The accepted quantities of the rail measured as provided above will be paid for at the Contract unit price per linear foot, which shall be compensation for all labor, equipment and materials including embedded anchorages, brackets, coating, installation and adjustment required to complete the item.

Payment will be made under:

<b>Pay item</b>	<b>Pay Unit</b>
Pedestrian Railing (Steel)	Linear Foot

**SECTION 522  
DUPLEX COATING SYSTEM**

Section 522 of the standard specifications is hereby added to the Standard Specifications for this project as follows:

**DESCRIPTION**

**522.01** This work consists of hot dip galvanizing and duplex coating steel elements as shown in the plans.

**MATERIALS AND CONSTRUCTION REQUIREMENTS**

**522.02**

- (a) *General.* The Contractor shall provide, install, and repair if necessary, all steel items that are prepared and coated in conformance with this Section. All repair and replacement of the finished coating necessary for final acceptance shall be at the Contractor's expense.

Steel products to be galvanized and coated shall be cleaned of weld spatter and bevel finished at exposed corners, edges and points. Areas having welds, cuts, bores, notches, or grooves shall also be beveled unless otherwise noted in the Contract or directed by the Engineer. Bevel work shall produce a uniform, smooth finish for galvanizing. Bevel size to be used is based on steel thickness and other criteria as follows:

Steel Thickness/Type	Bevel Size (inches)
Less than 1/2" thick	1/32" to 1/16"
Over 1/2" thick	1/16" to 1/8"
Bores, notches & grooves	root face of 1/32" to 1/16"

Welds shall be cleaned and finished per AWS standards.

All coating measurements shall be taken with a Type 2 fixed probe Dry Film Thickness (DFT) gauge. The gauge shall be calibrated, and measurements shall be taken, according to the Society for Protective Coatings (SSPC) Standard PA-2.

- (b) *Galvanizing.* Galvanizing shall be done in accordance with the Contract requirements and AASHTO M 111 (ASTM A123) for the type of material being galvanized, except that items shall only be quenched with ambient air. Chromate treatment of any type will not be permitted. Zinc-phosphate pretreatment or acrylic passivation pretreatments shall be as described in (d) below.

The Contractor shall submit a certificate of compliance (COC), conforming to subsection 106.12, confirming that all materials meet or exceed the galvanizing requirements described herein.

All galvanized surfaces shall be free from drips, slag or surface irregularities.

Spot areas not requiring galvanizing shall be marked and cleanly patched with material that prevents galvanization but does not weaken the adjacent spelter coating. Repair of patched areas shall be achieved by metallizing as described in (c) below.

Prior to galvanizing, the Contractor's galvanizer shall notify the Engineer in writing that the galvanized order is chromate free and air quenched. Products not certified chromate free by the Contractor's galvanizer shall be tested prior to galvanizing. The Contractor shall provide the Engineer with certification from an independent ASTM accredited laboratory listing all individual items that test chromate free. Testing shall comply with ASTM D-2092 Appendix X2. Test results shall be provided to the Engineer prior to galvanizing.

**SECTION 522**  
**DUPLEX COATING SYSTEM**  
**- Continued -**

- (c) *Repair of Galvanized Products.* Uncoated areas or damaged coating exceeding applicable specification limits shall be re-galvanized to meet the original specification requirements. Cuts made after galvanizing shall be ground, beveled, and smoothed before repair. Damaged galvanized areas shall be re-galvanized or metallized.

Re-galvanizing shall conform to ASTM A-780, Annex A1. Metalizing shall conform to ASTM A-780, Annex A3, except that minor repair areas shall be cleaned per SSPC method SP-3. SSPC Method SP-2 may be used to clean difficult access areas. Thickness of the repair coat shall match adjacent galvanizing, as measured by a calibrated DFT gauge.

Coating imperfections such as burring, runs or drips, high spots, heavy dross, or ash inclusion shall be removed and cleaned at the Contractor's expense. Areas of re-work falling below zinc thickness limits shall be repaired at the Contractor's expense.

Printed Technical Data Sheets (PTDS) shall be provided to the Engineer for repair materials used.

- (d) *Preparing Galvanized Surfaces for Coating.* Products shall be inspected for shipping and handling damage before surface preparation begins. Damage shall be reported to the Contractor's galvanizer and to the Engineer prior to repair. The Engineer will determine whether damaged items are to be repaired or replaced. Minor repair of galvanizing shall conform to (c) above, and shall be at the Contractor's expense.

The Contractor shall prepare each surface to be coated so that it has a slightly roughened profile without removing over 1.0 mil of the galvanized coating. Minimum ASTM zinc thickness specifications shall still apply after preparation.

Surfaces of fasteners to be coated shall be lightly brushed or sanded in a manner that will remove the least amount of zinc.

Surfaces that become soiled after pretreatment shall be cleaned prior to coating by low pressure, mild detergent wash and rinse. Stained or oiled surfaces may also be mildly scrubbed with a soft bristle nylon brush. Stubborn stains may be mildly scrubbed with a mix of 1 to 2 percent ammonia solution and thoroughly rinsed. Wash and rinse pressure shall not exceed 100 psi at 185° F temperature.

Surface preparation work shall be done according to one of the following methods:

1. *Zinc-Phosphate Pretreatment.* This treatment may be used only on new galvanizing less than 48 hours of age.

Items shall be immersed in a bath of acidic zinc-phosphate solution for 3 to 6 minutes, rinsed with clean water, and dried. The first epoxy coat shall be applied within 48 hours after immersion treatment.

If treated items are shipped to a different coating facility they shall be rewashed, rinsed and dried to remove surface soiling. The first epoxy coat must still be applied within 48 hours after immersion treatment.

**SECTION 522**  
**DUPLEX COATING SYSTEM**  
**-Continued-**

2. *Acrylic Passivation Pretreatment.* This treatment may be used only on fresh hot galvanizing or new galvanizing less than 48 hours of age. Only chrome-free solutions shall be used, applied by a method that ensures complete coverage of all surfaces to be coated. The Contractor shall provide the Engineer with treatment dates for each item and the PTDS for the solutions used.

The Contractor's galvanizer may apply solution to fresh hot galvanizing that is less than 6 hours of age, still clean, and dry and that has cooled to treatment application temperature guidelines.

If newly galvanized items are shipped to another treatment facility they shall be washed, rinsed and dried to remove surface soiling. The solution shall then be applied and cured according to the supplier's instructions.

Fully cured and treated items shall be rewashed, rinsed, and dried again just before coating. Items not coated within 100 days of treatment shall be abrasive blasted in conformance with subsection (d) 3.

3. *Abrasive Blasting.* This treatment may be used on galvanized items of any age if beveling requirements as listed in the third and fourth paragraphs of subsection (a) have been met.

The Contractor shall notify the Engineer in writing at least five working days before blasting begins. Zinc thickness shall be measured and recorded immediately after blasting and provided to the Engineer within 48 hours of blasting. Thickness limits and measurement frequency shall comply with the original applicable ASTM specification. Blast operations shall reasonably conform to ASTM Standard Practice D-6386, Subsection 5.4.1 except for small areas falling below required zinc thickness. These areas shall be repaired in accordance with subsection (c). No single area shall exceed 2 inches at its largest width or 12 inches at its longest dimension. The total repair area shall not exceed 1 percent of the coatable surface of the item; if limits are exceeded or zinc thickness is below the specification requirement, the item shall be re-galvanized in conformance with the original specification.

The Contractor shall measure and record the size, location and repair method used for all repairs. This information shall be included on the report of thickness measurements.

The first epoxy coat shall be applied within 24 hours of abrasive blasting. Items shall be cleaned free of blast debris before coating. Compressed air used to clean items shall be free of oil, residue, oil and other harmful contaminants.

Thickness measurement is not required after surface preparation work has been completed.

- (e) *Coating and Paint Systems.* Prepared items shall be coated with a two or three coat system described in this subsection. Alternative coating systems shall be pre-approved in writing by the Engineer. Manufacturer's PTDS for each coating type shall state test values for ASTM requirements of this subsection. Prior to product use the coating supplier shall provide the PTDS and certify to the Engineer in writing that all furnished coating materials meet applicable requirements of this subsection.

Faying surfaces shall not be painted unless written approval is given by the Engineer. All shop fabrication, including welds and attachments, shall be completed prior to coating unless otherwise specified in the Contract or directed in writing by the Engineer.

**SECTION 522**  
**DUPLEX COATING SYSTEM**  
**-Continued-**

Inorganic zinc coatings shall not be used. Combined DFT of all coats applied over the galvanizing shall range from 6.5 to 10 mils with a topcoat DFT of 3 mils minimum. Dried color of the base coat and topcoat shall be visually contrasting. Finished color shall not vary more than 4  $\Delta E^*_{ab}$  units from the specified color determined in accordance with ASTM D 2244. A 3" x 3" plate shall be used as a test sample for Engineer approval prior to coating of all railing elements.

Volatile Organic Compound (VOC) levels shall not exceed 3.5 pounds per gallon for each applied coat. Dry films shall contain less than 1 percent lead and other toxic heavy metals. The zinc concentration of each epoxy coat shall not exceed 40 percent. Top coats shall have a semi-gloss value of 50 to 75.

All coatings shall be able to withstand temperatures up to 180° F without sag, blister, or peel damage. Topcoat formulation shall provide weathering, chemical, and ultraviolet (UV) resistance. All coatings shall meet the following ASTM requirements as amended:

- (1) Corrosion Weathering. ASTM D-5894, minimum 6-cycles of exposure:  
Corrosion rating of 8 or higher according to ASTM D-1654.  
Blistering rating of 8 or higher according to ASTM D-714.
- (2) Impact Resistance. ASTM D-2794, 30 day test:  
Epoxies – Minimum 40 inch-pounds  
All Topcoats – Minimum 90 inch-pounds
- (3) Adhesion Testing. ASTM D-4541, 30 day test, Minimum 500 psi for either: Method B - flat surface or Method E - curved surface.
- (4) Abrasion Resistance. ASTM D-4060, 30 day test: Maximum 90 mg loss after 1000 cycles with a CS10 or CS17 wheel.
- (5) Flexibility. ASTM D-522, 30 day test - Method B: Epoxies shall pass a 180 degree bend over a ¾ inch mandrel. All Topcoats shall pass a 180 degree bend over a 3/8 inch mandrel.

Each coat shall be applied uniformly to provide an appearance free of laps, streaks, sags, drips, pinholes, and other discontinuities; all such defects shall be repaired prior to product shipment.

The Contractor's coater shall measure the DFT of each applied coat according to SSPC, Guide PA-2, except that measurements shall be taken with a calibrated Type 2 fixed probe gauge. Thickness records shall be provided to the Engineer prior to project shipment. The following two coating systems do not require pre-approval:

1. Powder Coating. The Contractor's coater shall oven preheat the articles to abate out-gassing potential. The Contractor's coater shall use compatible materials and coating processes to obtain proper coat to coat adhesion.

The epoxy powder base coat shall measure 2 to 6 mils DFT and be applied by electrostatic or airstatic spray. The powder formulation shall be a non-hybrid epoxy of anti-gassing grade.

The powder topcoat shall be electrostatic or airstatic spray applied and measure 3 to 6 mils DFT. The powder formulation shall be a non-acrylic, high-build, aliphatic-based, enhanced polyester or urethane polyester of anti-gassing grade.

**SECTION 522**  
**DUPLEX COATING SYSTEM**  
**-Continued-**

2. Liquid Coating. The Contractor's coater shall apply coats by conventional or airless spray according to the supplier's guidelines. Minimal striping at difficult work areas is permissible. The Contractor's Coater shall use proper work methods and compatible materials to obtain proper coat adhesion. Thinning of paints shall be done according to the manufacturer's instructions so that thinned products conform to the solids content and VOC limits of this subsection.

The epoxy base coat shall measure 2 to 6 mils DFT. Paint shall be a low-blush epoxy polyamide, or a low-blush cycloaliphatic bisphenol-A polyamine. Minimum solids by weight of all epoxies used shall be 68 percent.

The topcoat shall measure 3 to 6 mils DFT. Paint shall be an aliphatic-based urethane polyester or aliphatic-based polyurea urethane. Specially formulated aliphatic-based polyaspartic polyureas may also be used over compatible epoxy bases.

- (f) *Repair of Coated Products.* The Contractor shall repair damage from shipment, installation, field welding, or other activity during the construction. Damage shall be reported to the Engineer prior to repair. Repairs shall be as directed by the Engineer.

Significant repair procedures require written submittal of a proposed repair process from the Contractor. The Engineer shall approve the proposal in writing before repairs begin. Significant repairs are classified as:

- (1) Any damaged area to the base coat material over 1 square inch
- (2) Total repair areas exceeding 5 percent of the coating per item
- (3) Any single topcoat repair area over 64 square inches

Minor and touchup repair of topcoats shall be done as follows:

A UV rated, aliphatic-based liquid topcoat paint shall be used. The paint shall be compatible with the existing topcoat material and closely match existing color. The paint shall meet the requirements of subsection (e). The paint supplier shall provide the Engineer with PTDS for the products used.

Single areas smaller than 8 square inches requiring repair shall be scuffed with 220 grit sandpaper or equivalent scuff material. Larger areas up to 64 square inches may be cleaned according to SSPC, Method SP-2. All border areas at the undamaged topcoat shall be scuffed with 220 grit material.

Cleaned, scuffed areas shall be bordered and coated by airless or conventional spray. Work areas shall be adequately shielded to contain errant spray. Fresh repair areas shall be protected as necessary during the initial cure. Repair thickness shall reasonably match the adjacent coating.

The repair coat shall provide an appearance free of sags, runs, streaks, drips, pinholes, or other discontinuities. Spray can paint repair shall not be used.

**SECTION 522  
DUPLEX COATING SYSTEM  
-Continued)**

- (g) *Conditions for Final Acceptance of Coating.* Within six weeks immediately prior to final project acceptance, the Engineer will conduct a final inspection of the coating. The Contractor's Superintendent shall also attend the inspection. Before final project acceptance, the Contractor shall repair the following defects found during the inspection:
- a. Peeling on any portion of the coatings.
  - b. Blistering on any portion of the coatings.
  - c. Color fading below a 35 gloss rating, in accordance with ASTM D523.
  - d. Mottling defects that exceed 3 percent of the topcoat surface.
  - e. Visible cracking of the topcoat material.
  - f. Visible rusting discoloration on the coating.
  - g. Sag or other evidence of coating adhesion loss.

**METHOD OF MEASUREMENT AND BASIS OF PAYMENT**

Duplex Coating System will not be measured and paid for separately, but shall be included in the cost of Bridge Rail (Special).



**REVISION OF SECTION 601  
HAND STAINED STONE FORMLINER  
- Continued -**

The Engineer will designate an area near the project for the mock-up. The mock up shall be reviewed and approved by the Engineer at least 30 days in advance of the planned start of construction of similar construction. Mock-up is to remain in place throughout the term of the project and shall be used as a reference standard for quality. Contractor will be required to remove and properly dispose of the mock-up at the completion of construction as directed by the Engineer.

Form oil shall be a non-staining petroleum distillate free from water, asphaltic and other insoluble residue or equivalent product. The form oil shall be worked into all areas, especially pattern recesses.

**Subsection 601.09(f) is revised to include the following:**

All concrete forms shall be treated with a water based concrete form release agent prior to placing reinforcement for surfaces to which structural concrete stain is to be applied.

In areas where form liners are to be seamed to accommodate dimensions of the forms or intent of the design, the seam shall be placed in areas that will be less noticeable. Clean, straight cuts are required on all edges.

The Contractor shall comply with the form liner manufacturer's recommendations for the methods of securing liners to supporting formwork and the use of form liner releasing agents. Twisted wire ties shall not be allowed for securing liners to form work. It is intended that the form liners be re-utilized multiple times. All form liners may be re-used multiple times. All joint material, fasteners and care and cleaning of liners shall be per manufacturer's instructions.

Fabricate formwork to support the form liners and the related accessories with minimum deflection. Provide method of sealing form joints to prevent loss of water from wet concrete based on manufacturer's recommendations.

**Subsection 601.09(h) is revised to include the following:**

Remove forms using manufacturer's recommended method to reduce the risk of damaging surfaces and textural impressions that are part of the liners.

Handle, clean and store forms and form liners for re-use so as not to damage form liner edges or surfaces.

Remove ties immediately after form removal. Do not remove tie cones until concrete has reached full strength in accordance with the specifications.

Notify Engineer if any surface defects are found upon removal of forms. Patch only as directed by the Engineer.

Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing materials are not to be re-used. Repair and replace form liners as recommended by manufacturer.

**REVISION OF SECTION 601  
HAND STAINED STONE FORMLINER  
- Continued -**

**Subsection 601 .14(b) is revised to include the following:**

Structural Concrete Stain shall be applied to the raised "stone" impressions created by the form liner pattern only, and shall be randomly applied using a method that will provide a variable, blended look to achieve the appearance of natural stone. The stain shall be applied to individual raised stone impressions in the following ratios:

1. 40% of individual raised stone impressions "Beige", similar to Federal Color 33722
2. 30% of individual raised stone impressions "Tan", similar to Federal Color 33448
3. 20% of individual raised stone impressions "Flesh", similar to Federal Color 30313
4. 10% of individual raised stone impressions "Light Blue-Gray", similar to Federal Color 16329

Structural Concrete Stain shall not be applied to the "grout line" impressions created by the form liner pattern. Grout line impressions shall be the natural concrete color.

The color of the Structural Concrete Stain shall have the written approval of the Engineer prior to final batching and application on the project. The final color of the approved structural concrete stain shall be determined as follows:

1. 2 foot by 2 foot samples of the colors required by the Contract, shall be submitted to the Engineer for Approval. The Stain samples shall be applied to a surface similar in texture to the concrete surface on which the stain will be applied on the project. The Stain samples shall be applied by the same methods to be used in field application. There shall be at least one raised stone impression stained each of the specific colors shown above.
2. At least three weeks prior to beginning of the application of the structural concrete stain, 100 sf test panels shall be prepared for final color Approval. The test panels shall be produced on the actual concrete surface on which the final product will be placed, at a location recommended by the Contractor and approved by the Engineer. The stain shall be applied to the test panels by the same methods to be used in the final field application. The Engineer will be allowed three business days for the stain to dry after stain application to the test panels and to issue Approval.

Concrete finishing and curing shall be completed in accordance with the specification prior to the application of the Stain. The concrete finish to which the structural concrete stain is to be applied shall be a Class 1 Finish, except as modified below:

1. Following curing of the concrete in accordance with Subsection 601.13, all projections and bulges shall be removed and the surface sandblasted. Sandblasting shall profile the concrete surface, remove all form release agents, and all other deleterious materials that would inhibit the bond of the Structural Concrete Stain. The profile of the sandblasted concrete surface shall be equivalent to Concrete Surface Profile Three (CSP 3) as defined in Technical Guideline No. 03732, "Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays" by the International Concrete Repair Institute. The Contractor shall provide a CSP 3 chip for use on the project.

**REVISION OF SECTION 601  
HAND STAINED STONE FORMLINER  
- Continued -**

2. A mortar mix, proportioned by volume, consisting of one part portland cement, two to three parts sand (conforming to the requirements of ASTM C 144), and an approved bonding agent shall be used to patch all holes produced by form ties, honeycombing, voids 1/2 inch or larger in any dimension, broken corners and edges, and other defects. The mortar mix shall include an approved bonding agent. The quantity and application procedure of the bonding agent shall be in accordance with the recommendations of the manufacturer of the bonding agent. Areas to be patched shall be moistened with water before the mortar is applied, and the patched area, shall be float finished and left flush with the concrete surface without checking or cracking of patches. Patching shall be done when the ambient temperature is at least 40°F. Holes deeper than 3/4 inch shall be filled in layers that do not exceed 1/2 inch in thickness.
  
3. Within 24 hours prior to applying structural concrete stain, the concrete surface to be stained shall be cleaned by water blasting at a minimum pressure of 3,000 psi and at a rate of 4 to 14 gallons/minute, to remove dust, dirt, and other materials that would inhibit penetration of the stain. If the surface is contaminated before application of the stain, it shall be re-cleaned as required prior to application of the stain.

New concrete shall be at least 28 Days old or as approved in writing by the stain manufacturer before the stain is applied.

Each application shall be applied at a rate of 200 to 250 square feet per gallon. (Approximately 3 mils dry film thickness.) The second application shall not be made within 12 hours of the first application.

If the surface is contaminated between applications, it shall be re-cleaned as stated above prior to the making the second application.

The stain shall be mixed mechanically and applied by spraying. Workmanship shall be such that the final stained surface is colored uniformly and presents a pleasing appearance. Any areas determined by the Engineer to be insufficiently stained shall be re-stained.

The stain shall be applied only when the ambient temperature is between 40°F and 90°F, and is anticipated to remain above 40°F for a minimum of twenty-four hours. The surface to be stained shall be dry and free of frost. The Contractor shall protect the areas to be treated from inclement weather before and after staining at no cost to the project.

**Subsection 601.19 is revised to include the following:**

The quantity of Hand Stained Stone Formliner to be paid for will not be measured, but will be the quantities shown on the plans in square feet, completed and accepted by the Engineer in compliance with the plans and specifications. Plan quantity exceptions will be: (1) when field changes are ordered, or (2) when it is determined that there are discrepancies on the plans in an amount plus or minus 5 percent of the plan quantity for the structure.

**REVISION OF SECTION 601  
HAND STAINED STONE FORMLINER  
- Continued -**

**Subsection 601.20 is revised to include the following:**

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Hand Stained Stone Formliner	Square Foot

Payment for Hand Stained Stone Formliner will be full compensation for all work and materials necessary to complete the item and shall include, but is not limited to: water-based form release agent; sample preparation; abrasive blasting; patching materials and application; structural concrete stain and application; labor, equipment, tools, and materials necessary to complete the work.

**REVISION OF SECTION 604  
VANE GRATE INLET SPECIAL**

**Section 604 of Standard Specification is hereby revised for this project as follows:**

**Subsection 604.01 shall include the following:**

Vane Grate Inlet Special is required as part of this project for the Belford Avenue Over Happy Canyon Creek. This work shall include the cost of fabricating and constructing the approach slab drainage inlets as shown on the plans.

**Subsection 604.07 shall include the following:**

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Vane Grate Inlet Special	Each

Payment will be full compensation for all labor, material, and equipment necessary to completely construct the vane grate inlets as shown on the plans and as required by these specifications, including, but not limited to: concrete and reinforcing steel, fabrication, steel members, vane grate, plates, bolts and connections, and installation.

**REVISION OF SECTION 606  
BRIDGE RAIL (SPECIAL)**

**Section 606 of the Standard Specifications is hereby revised for this project as follows:**

**606.01 DESCRIPTION**

**Section 606.01 is hereby revised to include the following:**

This work shall include the construction of concrete bridge railing for the bridge structure in conformance with the details, lines, grades and locations shown on the plans.

**606.05 METHOD OF MEASUREMENT**

**Section 606.05 is hereby revised to include the following:**

Bridge Rail (Special) will be measured and paid for by the linear foot. Measurement will be along the outside face of the bridge rail from end to end of the railing.

**606.06 BASIS OF PAYMENT**

**Section 606.06 is hereby revised to include the following:**

The accepted quantity will be paid for at the contract unit price per unit of measurement for the pay item listed below, and shall include all concrete, reinforcing steel and all other work and material necessary to complete the item.

Hand Stained Stone Formliner as specified by Revision of Section 601, Hand Stained Stone Formliner, will be paid for separately.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Bridge Rail (Special)	Linear Foot

Payment will be full compensation for all materials, equipment and labor necessary to furnish and install the Bridge Rail (Special).

**REVISION OF SECTION 607  
FENCES**

Section 607 of the Standard Specifications is hereby revised for this project as follows:

**607.01 DESCRIPTION**

Subsection 607.01 is hereby revised to include the following:

This work includes the installation of construction fence to define the limits of work as shown in the plans and to delineate and protect areas that are not to be disturbed.

**607.03 CONSTRUCTION REQUIREMENTS**

Subsection 607.03 is hereby revised to include the following:

The Contractor shall install construction fence in accordance to the Town of Parker's Construction Best Management Practices (CBMP) details and as detailed in the plans prior to clearing and grubbing.

**607.04 METHOD OF MEASUREMENT**

Subsection 607.04 is hereby revised to include the following:

All fence fabric types and special instructions as indicated within these plans and specifications shall be included in this measurement as full compensation. No separate measurement and payment will be made for wire gates, end posts, corner posts, line brace posts, fabric types, or special instructions as indicated on the plans.

**607.05 BASIS OF PAYMENT**

Subsection 607.05 is hereby revised to include the following:

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Construction Fence	Linear Foot

Payment for the above pay items shall be full compensation for all work and materials to complete the item.

**REVISION OF SECTION 613  
LUMINAIRE (SPECIAL)**

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

**613.01 DESCRIPTION**

**Section 613.01 is hereby revised to include the following:**

This work shall include furnishing and installing Niland Company Luminaires on the proposed bridge, as shown in the plans.

**613.03 CONSTRUCTION REQUIREMENTS**

**Section 613.03 is hereby revised to include the following:**

All work shall be in accordance with the supplier's recommendations.

**613.11 METHOD OF MEASUREMENT**

**Section 613.11 is hereby revised to include the following:**

Luminaire (Special) will be measured by the actual number installed and accepted.

**613.12 BASIS OF PAYMENT**

**Section 613.12 is hereby revised to include the following:**

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Luminaire (Special)	Each

Payment will be full compensation for all materials, equipment and labor necessary to furnish and install the Luminaire (Special).

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**REVISION OF SECTION 625  
CONSTRUCTION SURVEYING**

**Subsection 625 of the Standard Specifications shall include the following:**

**625.11 SURVEY RECORDS**

**Subsection 625.11 shall include the following:**

The Contractor shall maintain on the project a current set of storm sewer "*as constructed*" plans. Upon completion of the work, the "*as constructed*" plans shall be turned over to the Engineer.

These "*as constructed*" plans shall show the actual location of pipe, correct lengths of pipe, inlets, manholes, invert and rim elevations, and other work items on modified plan sheets. All modifications shall also be shown on the "*As Constructed*" plans. Locations will be indicated by ties to property lines. Location ties shall be to an accuracy of within 0.5 inch.

Locations will be indicated by ties to features easily identified in the field, such as curb lines, edge of pavement, pole lines, etc. Location ties shall be of an accuracy suitable to field locate pipes in the future, typically  $\pm 12$  inches.

"*As constructed*" plans for storm sewer work shall be sealed by a Colorado Registered Professional Engineer (P.E.) or Professional Land Surveyor (P.L.S.).

**625.13 BASIS OF PAYMENT**

**Subsection 625.13 shall include the following:**

Payment for the above requirements will not be made separately, but shall be included in the contract unit price bid for construction surveying.

**REVISION OF SECTION 626  
MOBILIZATION**

**Section 626 of the Standard Specifications is hereby revised for this project as follows:**

**626.01 DESCRIPTION**

**Subsection 626.01 is hereby revised to include the following:**

Multiple mobilizations are anticipated for several items including but not limited to grading, paving, top soil, and erosion control.

No separate measurement and payment shall be made for mobilization(s) required for utility relocations and phasing required to complete the work.

**FORCE ACCOUNT ITEMS**

**DESCRIPTION**

This Special Provision contains the Town’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.

<u>Item No.</u>	<u>Force Account Item</u>	<u>Quantity</u>	<u>Est. Amount</u>
F/A 01	Minor Contract Revisions	F/A	\$ 50,000
F/A 02	Erosion Control	F/A	\$ 10,000

*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 this Contract.

F/A 02 Erosion Control – This work is for additional items at the request of the Engineer beyond what is described in the project plans and specifications.

**UTILITIES****The known utilities within the limits of this project are:**

Jarod Baylie

Parker Water and Sanitation District

303-841-4627

The work described in these plans and specifications will require full cooperation between the Contractor and the utility companies in accordance with Subsection 105.11 in conducting their respective operations, so the utility work can be completed with minimum delay to all parties concerned. The Contractor shall be responsible for coordinating the adjustment and/or relocation of all utilities on this project, per the plans and specifications, and as directed by the Engineer. Also, in accordance with the plans and specifications, and as directed by the Engineer, the Contractor shall keep the utility company(s) advised of any work being done to their facility, so that the utility company(s) can coordinate their inspections for final acceptance of the work with the Engineer.

The Contractor will be required to provide traffic control for any utility work expected to be coordinated with construction, as directed by the Engineer.

**NOTE:**

The Contractor will be required to provide written notice to each utility company, with a copy to the Engineer, 7 days prior to any utility work expected to be coordinated with construction unless otherwise noted.

**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. Contact the Utility Notification Center of Colorado (UNCC) at phone number 1-800-922-1987, to have locations of UNCC registered lines marked by member companies. All other underground facilities shall be located by contacting the respective company. Utility service laterals shall also be located prior to beginning excavation or grading.

The location of utility facilities as shown on the plan and profile sheets, and herein described, were obtained from the best available information.

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

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**SPECIAL NOTICE TO CONTRACTORS****1. SCOPE**

- 1.1 It is the intent of this chapter to provide guidelines to the Contractor or Subcontractor, so that they can properly present their materials for inclusion at the construction project.
- 1.2 The Contractor shall follow the procedures listed below to ensure the proper inspection, sampling, testing and certification of materials and products incorporated into all construction projects.
- 1.3 The words "Prequalification of Bidders" (102.01 Standard Specifications) has occasionally been confused with "Prequalification of Manufacturers / Supplier" or with "Pre-Approval of Products or Materials". These terms are not interchangeable.
- 1.4 Two information sources that can provide assistance and clarification are: Business Center - Project Bidding (<http://www.dot.state.co.us/BusinessCenter/Bidding/>) and Design Support – Manuals (<http://www.dot.state.co.us/DevelopProjects/DesignSupport/>).

**2. PROVIDE NOTIFICATION OF MATERIALS SOURCES AND SUPPLIERS.**

- 2.1 In accordance with subsection 106.01 of the Standard Specifications:

The Contractor shall submit a list of material sources and suppliers to the Engineer. The list shall include company name and address, item to be supplied, and contact person where material can be inspected.

**3. DESIGNATED PRODUCTS AND ASSEMBLIES.**

- 3.1 The majority of materials submitted for inclusion on CDOT projects will fall within one of four levels of product acceptance for the sampling and testing. CDOT always retains the right through its Quality Assurance (QA) Program to obtain samples for additional testing and require supplemental documentation.
- 3.2 If the material or product is not referenced within the four levels of product acceptance then the materials or products must be fabricated or supplied in accordance with the requirements of the applicable CDOT specifications, plans, and standards. Examples of materials and products not found in the following four levels are Aggregate Base Course, Hot Bituminous Pavement, and Concrete.

**A. PRE-INSPECTED:**

Pre-Inspection is when representatives from CDOT visit a manufacturer's facility to perform an initial review of the company's quality control plan and employee certifications, as well as subsequent inspection visitations during the manufacturing of the product.

**Products needing Pre-Inspection:**

- Bearing Devices (Type III) - Bridge<sup>A</sup>
- Expansion Device - Bridge<sup>A</sup> (0-6", through, 0-24")
- Prestressed Concrete Units - Bridge<sup>A</sup>
- Structural Steel - Bridge<sup>A</sup>

**SPECIAL NOTICE TO CONTRACTORS**  
**- Continued -**

**B. CERTIFIED TEST REPORT (CTR):**

The Certified Test Report level of acceptance is when a manufacturer is required to submit actual test results performed on the material being provided. A CTR shall contain the actual results of tests for the chemical analysis, heat treatment, and/or mechanical properties of the drawing and/or specification. The contract will designate products and assemblies that can be incorporated in the work, if accompanied by Certified Test Reports. The word preceding the Test Report may vary between different industries, such as Certified, Mill, Metallurgical, and Laboratory.

In accordance with Subsection 106.10 of the Standard Specifications and the requirements of this document, the report shall include:

- 1) The Department's project number
- 2) Manufacturer's name
- 3) Address of manufacturing facility
- 4) Laboratory name & address
- 5) Name of product or assembly
- 6) Complete description of the material
- 7) Model, catalog, stock no. (if applicable)
- 8) Lot, heat, or batch number identifying the material delivered
- 9) Date(s) of the laboratory testing
- 10) All test results are required to verify that the material furnished conforms to all applicable Department specifications. Test results shall be from tests conducted on samples taken from the same lot, heat, or batch.

The Certified Test Reports must be an original document, not a facsimile, with an original signature (including corporate title) by a person having legal authority to act for the manufacturer or the independent testing laboratory. It shall state that the test results show that the product or assembly to be incorporated into the project has been sampled and tested, and the samples have passed all specified tests. One copy of the Certified Test Report shall be furnished to the Engineer at the time of material delivery. Failure to comply may result in delays to the project and/or rejection of the materials. Products or assemblies furnished on the basis of CTRs may be sampled and tested by the Department. If it is determined that the material does not meet the applicable specifications, the material may be rejected or may be accepted according to Subsection 105.03 of the Standard Specifications.

Below is a partial list of products or categories that require a Certified Test Report:

Bearing Devices (Type III) - Bridge<sup>A</sup>  
Cribbing  
Mechanical Fasteners (Field) <sup>A</sup>  
Glass Beads (for pavement marking)  
Overhead Sign Structures <sup>A</sup>  
Top Soil  
Traffic Signal Structures <sup>A</sup>

**SPECIAL NOTICE TO CONTRACTORS**  
- Continued -

**C. CERTIFICATE OF COMPLIANCE (COC):**

The Certificate of Compliance level of acceptance is when a manufacturer is required to submit a document certifying that the material being provided meets all required Department specifications. A COC shall contain a reference to the actual tests for the chemical analysis, heat treatment, and/or mechanical properties of the drawing and/or specification. The contract will designate products and assemblies that can be incorporated in the work, if accompanied by Certificates of Compliance.

In accordance with Subsection 106.09 of the Standard Specifications and the requirements of this document, the certificate shall include:

- 1) The Department's project number
- 2) Manufacturer's name
- 3) Address of manufacturing facility
- 4) Laboratory name & address
- 5) Name of product or assembly
- 6) Complete description of the material
- 7) Model, catalog, stock no. (if applicable)
- 8) Lot, heat, or batch number identifying the material delivered
- 9) Date(s) of the laboratory testing
- 10) Listing of all applicable specifications required by the Department for this particular product or assembly. Certificates shall reference the actual tests conducted on samples taken from the same lot, heat, or batch.

The Certificate of Compliance must be an original document, not a facsimile, with an original signature (including corporate title) by a person having legal authority to act for the manufacturer. It shall state that the product or assembly to be incorporated into the project has been sampled and tested, and the samples have passed all specified tests. One copy of the Certificate of Compliance shall be furnished to the Engineer at the time of material delivery. Failure to comply may result in delays to the project and/or rejection of the materials. Products or assemblies furnished on the basis of COCs may be sampled and tested by the Department. If it is determined that the material does not meet the applicable specifications, the material may be rejected or may be accepted according to Subsection 105.03 of the Standard Specifications. (An example of what is required on a Certificate of Compliance is on page 11 of this chapter.)

Below is a partial list of products or categories that require a Certificate of Compliance:

**Note 2:** If the Plans do not specifically reference a Certified Test Report (Mill Test Report) and the product category is not depicted on the Approved Products List within the Pre-Approved level of acceptance, then a COC will be required.

Bearing Devices (Type I, II, IV and V <sup>A B</sup>)  
 Bridge Deck Forms, Permanent Steel <sup>A</sup>  
 Bridge Rail, Steel <sup>A</sup>  
 Concrete Box Culverts, Precast  
 Dampproofing, Asphalt  
 Dust Palliative - Asphaltic – Magnesium Chloride  
 Emulsified Asphalt for Tack Coat  
 Erosion Bales <sup>D</sup>  
 Expansion Joint Material, Preformed Filler  
 Flumes (all types)  
 Gabions and Slope Mattress  
 Gaskets  
 Guard Rail - End Anchors

**SPECIAL NOTICE TO CONTRACTORS**  
**- Continued -**

Guard Rail Metal <sup>A</sup>  
 Guard Rail Posts - Metal <sup>A</sup>  
 Guard Rail - Precast  
 Guard Rail Posts - Timber Blocks and Posts <sup>A</sup>  
 Hay <sup>D</sup>  
 Headgates  
 Inlets, Grates and Frames (Prefab)  
 Interior Insulation  
 Lighting  
 Light Standards, High Mast  
 Light Standards, Metal  
 Luminaires (Inclusive)  
 Manholes, Rings and Covers (Prefab)  
 MC-70 - Prime Coat (Liquid Asphalt)  
 MSE Wall - Elements<sup>A,C</sup>  
 Pedestrian Bridge <sup>A</sup>  
 Piling <sup>A</sup>  
 Pipes - all material compositions  
 Rest Area Materials  
 Seed <sup>C</sup>  
 Sign Panels  
 Sprinkler System(s)  
 Steel Sign Posts  
 Structural Plate Structures <sup>A</sup>  
 Structural Steel Galvanized <sup>A</sup>  
 Steel Sheet Piling <sup>A</sup>  
 Straw <sup>D</sup>  
 Treated Timber  
 Wood Cellulose Mulch

**D. PRE-APPROVED:**

The Pre-Approved level of acceptance is when a manufacturer is required to submit all relevant documentation on their product in advance of any specific project. A primary requirement to be considered for the Approved Products List (APL) is that the material retains a very high level of uniformity and consistency in its production quality.

The submittal of Certified Test Reports, Certificates of Compliance, product literature, etc., as well as product samples for evaluation combine all previous levels of acceptance into one.

In accordance with CDOT's Procedural Directive 3.1, a manufacturer's product is evaluated within CDOT to determine its acceptability on CDOT construction projects, as defined by CDOT specifications, plans and standards. For additional information on the APL or the web site contact the Product Evaluation Coordinator within the Central Laboratory at 303-757-9421.

**Note 3:** Web Site Address, Internal to CDOT:  
<http://internal/infoexchg/organizations.htm>

Web Site Address, External to CDOT:  
<http://www.dot.state.co.us/APL/>

**SPECIAL NOTICE TO CONTRACTORS**  
**- Continued -**

- Note 4:** <sup>A</sup> A Mill Test Report shall be included.
- <sup>B</sup> A Certified Test Report(s) on components must accompany the material or product.
- <sup>C</sup> A Certified Test Report shall be included.
- <sup>D</sup> The Contractor may obtain a current list of Weed Free Forage Crop Producers by contacting the Colorado Department of Agriculture at (303) 239-4149.

**DISCLAIMER:** CDOT does not have the obligation to use any of the products listed in the Approved Products List (APL). The APL simply documents that the listed products have been tested, evaluated, and/or examined under CDOT standards, and were found to be acceptable to be used in CDOT projects. The product shall be removed from the APL if Product Performance comments indicate field performance that is unacceptable to CDOT quality standards or if the product varies from the data as originally submitted. Additional disclaimer information can be found within the APL web site.