

## **Section 15 - Structures**

### **Administrative Requirements**

The Contractor shall design, and construct repairs to the following walls, in accordance with the Contract Requirements.

1. R070A171042LRA
2. R070A182489LRA
3. R070A183086MCA
4. R070A183555LRA
5. R070A184163LRA
6. R070A185113RRA
7. R070A185409RRA
8. R070A186429MCA

The wall repairs shall be designed and constructed in accordance with the project specifications and referenced standards.

### **Standards**

The standards used for design and construction of the structures for this project shall be as listed on the plans, or as specifically referenced in this section.

The requirements of a document version (standard, specification, or other) referenced in this section will take precedent over the requirements of the documents listed on the plans.

Standards referenced by this section include:

All of the documentation found at the following web site address and any documents referenced therein:

<http://www.coloradodot.info/library/bridge/bridge-manuals/lrfd-bridge-design-manual>

<http://www.coloradodot.info/library/bridge/bridge-manuals/bridge-detail-manual>

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AASHTO LRFD Bridge Design Specifications, Customary U.S. Units, 8th Edition, 2014, and any documents referenced therein.

AASHTO Manual for Bridge Evaluation, 2<sup>nd</sup> Edition, 2010 with 2013 Interim Revisions

AASHTO LRFD Bridge Construction Specifications, 3<sup>rd</sup> Edition, 2010 with 2014 Interim Revisions

The 2017 Edition of the Standard Specifications for Road and Bridge Construction as published by the Colorado Department of Transportation and any documents referenced therein. This includes the Standard Special provisions which include revisions to the 2017 Edition of the Standard Specifications for Road and Bridge Construction and any documents referenced therein.

### **Software**

The following software shall be used for this Project:

MicroStation V8i, CDOT drawing standards are provided in this project for use. The contractor shall create a MicroStation Drawing environment that exactly matches the environment used internally at CDOT.

### **Design Requirements**

#### **Structure Concept Memorandum with Preliminary Repair Detail Plans**

The drawings provided in the Referenced Documents document the repair work required at each location and shall be considered preliminary. The Contractor shall submit a Structure Concept Memorandum and Preliminary Repair Detail Plans that depict the following:

- Description of each type of repair and how it meets the project specifications
- Preliminary details of each type of repair including materials and construction notes

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### **MATERIALS**

#### **Concrete**

Concrete shall be in accordance with the Referenced Standards. CDOT Class D is acceptable. Mixes with smaller aggregate will be allowed to facilitate small repairs.

Concrete patching and wall facing shall meet the requirements of Project Special provisions included in this section.

Concrete shall include Structural Concrete Stain as described in CDOT Standard Specification 601.14. Structural Concrete Stain shall match the color of the existing wall concrete.

#### **Reinforcing Steel**

Reinforcing Steel shall be Grade 60 reinforcing steel. All reinforcing steel shall be epoxy coated.

#### **Soil Nails and Ground Anchors**

See Section 10 - Geotechnical

### **DESIGN PARAMETERS**

#### **General**

Design Parameters shall be in accordance with the Referenced Standards and the requirements contained in this section.

All design calculations and plans shall be performed in English (Standard) units.

Structure, quantity estimate, and structural design check calculations shall have pages numbered and include a table of contents. All calculations shall identify which code is utilized and reference the appropriate section in the right-hand column. References shall be included in the calculations to computer programs in the calculations. Computer documentation shall include: name of program, vendor, version and release date; record of software output and verification of output with manual calculations or other recognized program; clear identification of input and output values and meaning; and check of input.

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### **Loads and Forces**

Load and Forces for wall designs shall be in accordance with the Referenced Standards and Documents and Section 10.

### **Geotechnical Data**

See Section 10 – Geotechnical and Roadway Pavements for Geotechnical requirements.

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### **RETAINING WALL REPAIRS:**

#### **General**

The plans depict the required repairs for each of the retaining walls on the project. The plans note allowable types of repairs that are deemed to meet the needs of the project. The contractor is responsible for the design of the repairs. The Contractor shall verify the structural integrity of all structural concrete to remain in place during the design phase. If the existing concrete requires strengthening to meet the requirements of the proposed repairs, the Contractor shall design and construct the strengthening solution.

At the contractor's option, alternative repair methods may be utilized if they are demonstrated to meet the project needs and have equal or greater expected service life.

#### ***Type 1 Repair***

This type of repair includes: Removing portions of the existing post concrete down to sound concrete; Drilling dowels into the remaining post concrete and bonding them; Adding a new concrete structural facing to the post.

Each post that is to be repaired, shall be repaired for its full height. The repair shall meet the aesthetic requirements as depicted in the Aesthetic Requirements in the Plans.

The structural design shall demonstrate that all aspects of the repair have sufficient structural capacity to resist the loads induced to the post.

#### ***Type 2 Repair***

This type of repair includes removing portions of the concrete wall panels down to sound concrete. The cleaned concrete wall panel will then be repaired with concrete patching back to original surface dimensions. The patch may require drilling dowels into the remaining concrete and bonding them.

The repair shall meet the aesthetic requirements as depicted in the Aesthetic Requirements in the Plans.

The structural design shall demonstrate that all aspects of the repair have sufficient structural capacity to resist the loads induced to the panel.

#### ***Type 3 Repair***

This type of repair includes replacing wall panels that are either missing or are damaged to the point where they are not repairable. Remove any portions of the concrete wall panels still in place prior to replacing the panel.

The repair shall meet the aesthetic requirements as depicted in the Aesthetic Requirements in the Plans.

The structural design shall demonstrate that all aspects of the repair have sufficient structural capacity to resist the loads induced to the panel.

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### ***Type 4 Repair***

This type of repair includes drilling holes through the existing wall panels and installing soil nails through the holes into the existing back fill. The soil nail design shall stabilize the existing wall panel.

Nail design methodology and criteria shall be performed utilizing the design publications, methodologies, codes, and specific requirements the anticipated wall repairs as described in Section 10 – Geotechnical.

The repair shall meet the aesthetic requirements as depicted in the Aesthetic Requirements in the Plans.

The structural design shall demonstrate that all aspects of the repair have sufficient structural capacity to resist the loads induced to the panel.

### ***Type 5 Repair***

The metal bin wall at Dowd Junction is showing signs of instability as evidenced by bulging of lower portions of the wall face. This repair includes drilling holes through the face of the metal bin wall in areas of visible bulging and installing ground anchors through the holes and into the retained materials behind the wall. The repair shall stabilize the existing wall and retained slope behind the wall with the intent of stabilizing the existing wall system and achieving the required global stability of the wall and retained highway embankment slope above the wall. The intent is to stabilize the wall as is, and not necessarily to repair/fix the bulges (i.e. straighten the existing wall face).

Ground Anchor methodology and criteria shall be performed utilizing the design publications, methodologies, codes, and specific requirements the anticipated wall repairs as described in Section 10 – Geotechnical.

The structural design shall demonstrate that all aspects of the repair have sufficient structural capacity to resist the loads induced to the existing wall.

### **Wall Facing Requirements**

All walls will have either a Precast Concrete or Cast in Place Concrete facing. No Block Facing will be allowed. The facing of all walls on the project shall match the existing and adjacent walls.

### **Design Requirements**

Retaining Wall design shall be in accordance with the Referenced Standards. The design, details and design check calculations shall be submitted to the Engineer for approval.

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### **Aesthetics**

Retaining Wall aesthetics shall be consistent with the Aesthetic Requirements in the Plans. If the contractor varies from the requirements of the Aesthetic Requirements, the contractor will be responsible to get their proposed aesthetic treatments approved from CDOT and the State Historic Preservation Organization, including the time required for approval and any cost to the Contractor. See Section 5, Environmental for requirements.

### **Design Reviews**

Shop drawings of the retaining walls shall be submitted to the Engineer for review. The Contractor is solely responsible for shop drawing accuracy.

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### **CONSTRUCTION**

#### **General**

Construction of all structures shall be in accordance with the Referenced Standards.

#### **Deliverables**

At a minimum, the Contractor shall submit the following to CDOT for review, Approval and/or Acceptance:

<b>Deliverable</b>	<b>Acceptance or Approval</b>	<b>Schedule</b>
Structure Concept Memorandum	Approval	60 days before submitting RFC plans
RFC Plans, design calculations, independent analysis calculations, & Specifications Package (Structural Plans to be provided in both pdf and dgn formats) (see description below)	Acceptance	Prior to Construction
Shop Drawings	Review	Four weeks prior to construction



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### **RFC Plans, Calculations and Specification Package**

The independent design check shall have been completed, and the original final structural design calculations shall be revised and corrected based on comments from the independent design check. Project aesthetic details shall have been incorporated into the Contractor's Drawings. The summary of quantities of all structures shall be included in structure drawing packages for information only in accordance with the Referenced Standards. All structural drawings shall have been completed and the final independent plan check of all the drawings shall be complete. Project special specifications shall have been completed. All changes or revisions resulting from the in-process design review shall be incorporated into the Final Design Documents. The Final Plans shall include as many Geology sheets as necessary for each retaining wall on the Project.

Contractor Drawings and Contractor Specifications for each structure shall be signed and sealed by the Contractor's designer in accordance with the professional registration laws of Colorado.

All calculations shall be signed and sealed by the Contractor's designer in accordance with the professional registration laws of Colorado. Copies in pdf format shall be made of all design and design check calculations for the Project and then submitted to CDOT.

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### **REVISION OF SECTION 202 REMOVAL OF PORTIONS OF PRESENT STRUCTURE**

Section 202 of the Standard Specifications is hereby revised for this project to include the following:

Subsection 202.01 shall include the following:

Removal of Portions of Present Structure consists of saw cutting, removal and disposal of deteriorating concrete from portions of existing wall posts and wall panels to sound concrete.

Subsection 202.08 shall be removed and replaced with the following:

At least 10 days before start of work, the Contractor shall submit to the Engineer details of the removal operations showing the methods and sequence of removal and equipment to be used. The Contractor's submittal shall also include proposed methods used to determine the locations of deteriorating concrete.

All methods and equipment used to accomplish this item shall be approved by the Engineer.

Sawing of concrete shall be done to a true line, with a vertical face, unless otherwise specified. The approximate depth of a saw cut in concrete shall be 1 inch.

The Contractor shall remove and repair only the amount of work that can be completed and opened to traffic within the designated lane closure times as specified in the Traffic Control Plan.

The Contractor shall take all steps necessary to prevent cutting or otherwise damaging reinforcing steel. All bars damaged by the Contractor's operations shall be repaired or replaced at the Contractor's expense.

Following sandblasting, the Engineer shall inspect the condition of all exposed reinforcing bars. If, in the opinion of the Engineer, the loss of original cross sectional area of the bar due deterioration is 25 percent or more, the Contractor shall add additional bars as approved by the Engineer. New added bars shall be lap spliced as shown in the plans. If the required lap splice length cannot be utilized, a mechanical splice shall be used. The mechanical splice shall develop at least 125 percent of the specified yield strength of the bar. The Mechanical splice shall be per CDOT list of approved products. All minimum clearances shall be maintained. As an alternative, the Contractor may remove additional sound concrete to achieve the

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### **REVISION OF SECTION 202 REMOVAL OF PORTIONS OF PRESENT STRUCTURE**

required lap length. All reinforcing steel shall be secured to adjacent bars as provided in Section 602.

All areas of the prepared surface contaminated by oil or other materials detrimental to good bond shall be thoroughly cleaned by a method approved by the Engineer.

Sandblasting shall be performed in accordance with Revision of Section 202, Sandblasting.

Pneumatic hammers heavier than nominal 15 pound class will not be permitted. Pneumatic hammers and chipping tools shall not be operated at an angle exceeding 60° relative to the surface of the slab. Such tools may be started in the vertical position but must be immediately tilted to 60° operating angle.

Hand tools such as hammers and chisels shall be provided for removal of final particles of loose, unbonded concrete. Only short, one-handed hammers with a maximum head weight of 5 pounds will be allowed.

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### **REVISION OF SECTION 202 SANDBLASTING**

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

Subsection 202.01 shall include the following:

Sandblasting shall consist of cleaning exposed non-epoxy coated reinforcing steel designated to remain in place and roughening the surface and removing all fractured particles from the entire existing concrete surface against which new concrete is to be placed.

Subsection 202.02 shall include the following:

*General* - Following the removal of adjacent concrete, all exposed non-epoxy coated reinforcing steel designated to remain in place shall be cleaned to sound steel by sandblasting. Sound steel is defined as free of oil, dirt, concrete fragments, or laitance, loose rust scale, and other coatings of any character that would destroy or inhibit the bond with the new concrete. Epoxy steel shall not be sandblasted.

Rust that may form on the reinforcing steel within seven calendar days following the accepted sandblasting, will not be cause for rejection of the steel.

When acceptable reinforcing steel is exposed to the elements for more than seven calendar days prior to encasement in concrete, adequate measures shall be taken by the Contractor, as approved by the Engineer, to protect the steel from contamination or corrosion. Reinforcing steel contaminated as a result of the Contractor's failure to provide adequate protection as stipulated herein, shall be re-sandblasted at the Contractor's expense with no allowance for contract time extension.

*Equipment* - Sandblasting equipment shall be capable of removing rust scale and concrete fragments or laitance from reinforcing steel, roughening existing concrete surface, and removing all fractured particles from the existing concrete surface.

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### **REVISION OF SECTION 504 WALL FACING**

Section 504 of the Standard Specifications is hereby revised for this project to include the following:

#### **DESCRIPTION**

This work shall consist of furnishing and installing items to replace, or repair, missing or deteriorated existing retaining wall facing panels to return structure to its original shape.

#### **MATERIALS**

Facing shall conform to the following requirements:

- a. Concrete (Class D) shall be in accordance with Section 601 of the Standard Specifications.
- b. Concrete (Patching) shall be in accordance with Revision of Section 601.
- c. Shotcrete shall be in accordance with Section 641 of the Standard Specifications and Revision of Section 641.
- d. Reinforcing steel shall conform to Section 602 of the Standard Specifications.
- e. Welded wire reinforcement shall conform to ASTM A1064.

#### **CONSTRUCTION REQUIREMENTS**

*Construction Plan.* The Contractor shall submit the Construction Plan to the Engineer a minimum of 10 working days prior to beginning the work. The Construction Plan shall include the following at a minimum:

- (1) Method to access the work location.
- (2) Method to remove existing deteriorated facing concrete within the limits identified by the Engineer without damaging existing soil reinforcement and concrete that are to remain in place.
- (3) Method to connecting existing soil reinforcement and removing any slack in existing soil reinforcement.
- (4) Method to maintain welded wire fabric and reinforcing steel in proper alignment during concrete or shotcrete placement.

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**REVISION OF SECTION 504  
WALL FACING**

- (5) Method to place and contain concrete or shotcrete within the wall repair limits.
- (6) Method of performing patching at existing panels, where applicable.

Existing damaged panel concrete shall be removed by the Contractor to the limits identified by the Engineer. Removal shall conform to Revision of Section 202, Removal of Portions of Present Structure.

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### **REVISION OF SECTION 601 CONCRETE (PATCHING)**

Section 601 of the Standard Specifications is hereby revised for this project to include the following:

#### **DESCRIPTION**

This work consists of furnishing and placing concrete patching material in accordance with these specifications.

#### **MATERIALS**

The concrete patching material may be Pre-Packaged Concrete Patching Material or Class DR concrete.

(a) *Pre-Packaged Concrete Patching Material.* Concrete patching material shall be polymer modified hydraulic cement and shall be one of the following:

- (1) Rapid Set DOT Concrete Mix as manufactured by:  
CTS Cement Manufacturing Company  
11065 Knott Avenue  
Cypress, CA 90630
- (2) HD 50 as manufactured by  
Dayton Superior Corp.  
1125 Byers Road  
Miamisburg, Ohio 45342
- (3) or approved equal

Alternative concrete patching materials shall demonstrate 1/32-inch maximum mid panel and end crack widths, 0 percent delamination, and 0 percent spalling as tested by National Transportation Product Evaluation Program (NTPEP) in a one-year field evaluation. The Contractor shall refer to rapid-set concrete patch materials at [www.ntpep.org](http://www.ntpep.org).

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**REVISION OF SECTION 601  
CONCRETE (PATCHING)**

Before January 1, 2020 equivalent materials may be tested to meet minimum requirements by an independent testing lab or NTPEP. If the product has not been field tested by NTPEP, the Contractor shall submit documentation of a project demonstrating the successful use of the proposed product in Colorado. The submittal shall document the material used, the project location and detailed pictures of the patch after at least 1 year of service.

The Contractor shall obtain and provide to the Engineer documentation from the Concrete patching material supplier of the expiration dates of the material components that will be used on the project.

Concrete patching material shall attain an average compressive strength of at least 2,500 psi prior to placing traffic and 4,500 psi at 28 days. Concrete patching material compressive strengths shall be tested according to ASTM C39 or ASTM C109. The compressive strengths shall be used to develop a strength versus time curve for the material. Three strength data points shall be determined to assess the necessary time to wait before traffic is allowed on the material. Maturity meter data may also be submitted to allow the use of maturity meter to determine when the patching material has gained the required strength for opening to traffic.

Concrete patching material shall provide a minimum bond strength of 2,000 psi at 28 days, as tested by ASTM C882.

Concrete patching material shall have a relative durability factor greater than 90 and a mass loss not to exceed 2.0 percent as tested by ASTM C666.

Concrete patching material shall have a maximum expansion of 0.05 percent, at 28 days as tested by ASTM C157

ASTM C39, C109, C882 and C157 testing shall be from the same lot of concrete patching material being used on the project. A CTR, in accordance with subsection 106.13, shall be submitted to the Engineer for approval at least 2 weeks prior to placement.

Two bags of the concrete patching material, and two bags of the extending aggregate if used, from the same lot to be used on the project shall be submitted to an accredited Lab to verify compressive strength, and set time properties, by the Contractor before the concrete patching material is to be used on the project. Test results shall be submitted to the Engineer for acceptance. Verification of the strength properties will be achieved if the test results are either equal in strength or stronger than those advertised.



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**REVISION OF SECTION 601  
CONCRETE (PATCHING)**

Verification of the set time will be achieved if the set time is equal or less than the advertised value. Testing shall be included in the cost of the materials. Test results from other projects using the same lot may be submitted. If the project uses material from more than one lot, test results are required for each lot used.

When anodes are specified and are to be installed with pre-packaged concrete patching material, the Contractor shall submit test results of ASTM C1760 that the concrete patching material has an electrical resistivity of 15,000 Ohm-centimeters or less. Concrete patching materials that do not meet the electrical resistivity requirements may be used with special anode installation methods recommended by the anode manufacturer and approved by the Engineer. Additional work for special anode installation methods shall be included in the bid price.

- (b) *Class DR Concrete.* Class DR Concrete shall have a minimum cement content of 615 pounds per cubic yard, an air content of 5 to 8 percent, a maximum water to cement ratio of 0.44, a minimum 6 hour compressive strength of 2,500 psi and a minimum 28 day compressive strength of 4,500 psi. The concrete mix shall consist of a minimum of 50 percent AASHTO M 43 Size No. 7 or Size No. 8 coarse aggregate by weight of total aggregate. Lab test results shall show that the unrestrained shrinkage is less than 0.050 percent when tested by CP-L 4103.

ASTM C150 Type III or ASTM C1157 Type HE cement may be used for Concrete Class DR, as approved.

The Contractor shall develop maturity relationships in accordance with CP 69. The Contractor shall provide a multi-channel maturity meter and all necessary wire and connectors. The Contractor shall be responsible for the placement and maintenance of the maturity meter and wire. Placement shall be as directed by the Engineer.

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### **REVISION OF SECTION 601 CONCRETE (PATCHING)**

#### **CONSTRUCTION REQUIREMENTS**

- (a) *Pre-Packaged Concrete Patching Material.* Concrete patching material shall be placed in the repair areas before the expiration date of the material. Proportions of all mix components shall be measured by volume measurement (number of bags of standard weight and quantity of water or liquid component in gallons or quarts). If partial bags are used the bagged mix, extending aggregate, and water shall be weighed on a calibrated scale provided by the Contractor. The Contractor shall submit the Concrete patching material mix design for approval two weeks before any concrete patching material is placed. The Contractor shall also submit a method statement describing what type of equipment will be used to batch the patching material, including the type of mixer, the type of material, volume measures to be used, scales for partial bags, procedures to insure accurate proportioning of the patching material components, and tools to be used in placing and finishing the surface of the patch.

The Contractor shall produce a batch ticket for each mixed batch of concrete patching material with the following information shown on each ticket:

- (1) Project No.
- (2) Wall No.
- (3) Structure Temperature
- (4) Date and Time of batch
- (5) Material Type, name, and manufacturer
- (6) Material expiration date
- (7) Weight or volume of bag mix concrete
- (8) Weight or volume of extending aggregate
- (9) Weight or volume of water or liquid component
- (10) Location of placement (Lane and Station Limits)

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

Each day the Contractor shall provide to the Engineer tickets for each wall in separate envelopes stating Project Number, Wall Number, Date of Paving, Type of Material, Daily Total, and Cumulative Total.

Concrete patching material minimum and maximum thicknesses shall be per recommendation of the material manufacturer.

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**REVISION OF SECTION 601  
CONCRETE (PATCHING)**

Concrete patching material site preparation, batching, extending with aggregate, mixing, placement, placement during cold temperatures, consolidation, and curing shall be in accordance with the manufacturer's recommendations. A mix may be extended up to 90 percent of the manufacturer's maximum extension.

The surface of concrete patching material shall have a similar texture as the adjacent driving surfaces.

The Contractor shall submit a report consisting of the mix proportions and compressive strength vs time curve information to the Engineer at least two weeks before the material is to be used on the project.

Field cast cylinders or cubes shall be taken by a qualified testing representative, with a minimum ACI Field Testing Technician Grade I certification, and test results shall be submitted to the Engineer within 24 hours, the first day and every other subsequent day deck patching material is placed with compressive strength determined at 24 hours according to ASTM C 39 or ASTM C109.

Areas patched with Concrete (Patching) shall not be opened to traffic until concrete patching material has reached a compressive strength of 2,500 psi using the compressive strength versus time curve developed for the material.

- (b) *Class DR Concrete.* Class DR Concrete shall be placed in accordance with Class D concrete with the following changes:

The area to be patched with Class DR Concrete and anodes shall be saturated surface dry before placement and shall be free of standing water at the time of placement.

Portions of decks patched with Concrete Class DR shall not be opened to traffic until the concrete's compressive strength, determined by CP 69, has achieved at least 2500 psi.

Concrete Class DR shall be cured until a compressive strength of at least 2500 psi has been achieved. The curing compound shall conform to ASTM C309, Type 2 applied at a rate of 1 gallon per 100 square feet. The curing compound shall be applied as a fine spray within 10 minutes of discontinuing the finishing operation. Before and during application the curing compound shall be kept thoroughly mixed. Curing blankets with a minimum R-value of 0.5 shall be provided and shall be placed as soon as they can be placed without marring the surface. When the ambient temperature is below 50°F, the Contractor shall maintain the concrete temperature above 50°F during the curing period.

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### **REVISION OF SECTIONS 601 AND 708 STRUCTURAL CONCRETE STAIN**

Section 601 and 708 of the Standard Specifications are hereby revised to include the following:

Subsection 601.01 is revised to include the following:

This work consists of: (1) Class 2 surface finish of concrete to receive Concrete Stain; (2) providing and applying an opaque structural concrete stain to all concrete surfaces previously designated in the Contract to receive a structure concrete stain; and (3) provide up to 5-gallons of pre-mixed touch-up stain.

The color of the structural concrete stain shall be as noted on the plans, and shall be Approved by the Engineer from test panels provided by the Contractor.

The structural concrete stain shall be one of the following products or Approved equals:

1. RAINSTOPPER RS400 - Semi Transparent Stain  
Textured Coatings of America  
Pro-Coat Systems, Inc.  
5775 Stapleton Drive North  
Denver, Colorado 80216  
303-322-9009
2. "Acrylic" Structural Concrete Stain  
Anchor Paint Co. of Denver, Inc.  
641 South Jason  
Denver, Colorado 80223-2305  
303-744-2361
3. Bridge and Highway Concrete Sealer, B97-Series  
The Sherwin-Williams Company  
543A Santa Fe Drive  
Denver, Colorado 80204  
303-893-1303

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### **REVISION OF SECTIONS 601 AND 708 STRUCTURAL CONCRETE STAIN**

Subsection 601.03 is revised to include the following:

Structural Concrete Stain as specified in subsection 708.08

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.

Subsection 601.14 (a), third paragraph, is deleted and replaced with the following:

Structural concrete stain shall be the final finish for all concrete surfaces designated on the plans and in these specifications.

Subsection 601 .14(b) 4 is deleted and replaced with the following:

Unless otherwise shown on the plans, the structural concrete stain shall be applied to all exposed concrete elements of the structure above the ground line, and shall extend 1-foot below the finished ground line.

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.
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.

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### **REVISION OF SECTIONS 601 AND 708 STRUCTURAL CONCRETE STAIN**

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 2 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.
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.

Two applications of stain are required. 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.

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### **REVISION OF SECTIONS 601 AND 708 STRUCTURAL CONCRETE STAIN**

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.

Subsection 708.08 is revised to include the following:

708.08 Structural Concrete Stain: The Stain shall be a one-component, non-vapor barrier, solvent based acrylic resin. No sand or other texturing agents will be permitted.

#### PHYSICAL PROPERTIES

Solid by Weight: 51%, plus or minus 2%

Solids by Volume: 34%, plus or minus 2%

A material safety data sheet (MSDS) prepared in accordance with Federal Standard 313 and a complete set of manufacturers mixing and application instructions shall be submitted to the Engineer before the Contractor begins applying the Stain.

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Project Sub Acct. No: 21897  
Date: October 16, 2018  
**Technical Requirements**

## **Section 15 - Structures**

### **REVISION OF SECTION 641 SHOTCRETE**

Section 641 of the Standard Specifications is hereby revised for this project as follows:

Subsection 641.04 is revised to include the following:

Where shotcrete will be the final exposed wall face, shotcrete shall receive a surface finish that results in a final wall face surface closely matching the adjacent existing wall face surface, as determined by the Engineer.