

REVISION OF SECTIONS 206 AND 601
MATURITY METER AND CONCRETE
FORM AND FALSEWORK REMOVAL

In subsection 601.11, delete (e) and replace with the following:

(e) *Falsework Removal.* Unless specified in the plans or specifications, falsework shall remain in place until concrete has attained a minimum compressive strength of 0.80f'c.

Falsework supporting any span of a simple span bridge shall not be released until after all concrete, excluding concrete above the bridge deck, has attained a compressive strength of at least 0.80f'c.

Falsework supporting any span of a continuous or rigid frame bridge shall not be released until after all concrete, excluding concrete above the bridge deck, has been placed in all spans and has attained the compressive strength of at least 0.80f'c.

Falsework for arch bridges shall be removed uniformly and gradually, beginning at the crown, to permit the arch to take its load slowly and evenly.

Falsework supporting overhangs and deck slabs between girders shall not be released until the deck concrete has attained a compressive strength of at least 0.80f'c.

Falsework for pier caps which will support steel or precast concrete girders shall not be released until the concrete has attained a compressive strength of at least 0.80f'c. Girders shall not be erected onto such pier caps until the concrete in the cap has attained the compressive strength of at least 0.80f'c.

Falsework for cast-in-place prestressed portions of structures shall not be released until after the pre-stressing steel has been tensioned.

Concrete compressive strength shall be determined by maturity meters. At the pre-pour conference, the Contractor shall submit the location that maturity meters will be placed.

The Contractor shall provide maturity meters and all necessary wires and connectors. The Contractor shall be responsible for the placement and maintenance of the maturity meters and wires. At a minimum a maturity meter will be placed at the mid-span of beams and at support locations. Placement shall be as directed by the Engineer.

For structures with multiple maturity meters, the lowest compressive strength shall determine when the falsework can be removed.

Acceptance cylinders shall not be used for determining compressive strength to remove falsework.

Subsection 601.12 (l) shall include the following after the first paragraph:

Concrete compressive strength shall be determined by maturity meters.

Subsection 601.12 shall include the following:

(o) *Backfilling Structures that Support Lateral Earth Pressure.* Concrete compressive strengths shall reach f'c before backfilling operations can begin with heavy equipment, such as skid-steers or self-powered riding compactors. Concrete compressive strengths shall reach 0.8 f'c before backfilling operations can begin with hand operated equipment. Concrete compressive strength shall be determined by maturity meters.

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Delete subsections 601.13 (2) and 601.13 (3) and replace with the following:

- (2) The minimum curing period shall be from the time the concrete has been placed until the concrete has met a compressive strength of 80 percent of the required field compressive strength. The Contractor shall develop a maturity relationship for the concrete mix design in accordance with CP 69. The Contractor shall provide the maturity meter and all necessary thermocouples, thermometers, wires and connectors. The Contractor shall place, protect and maintain the maturity meters and associated equipment. Locations where the maturity meters are placed shall be protected in the same manner as the rest of the structure.

Subsection 601.17 shall include the following:

- (f) *Maturity Meter Strength.* When maturity meters are specified for determining strength for removing forms, removing false work, backfilling against structures or loading the structure, the Contractor shall provide the Engineer a report of maturity relationships in accordance with CP 69 prior to placement of concrete.

If a maturity meter fails, is tampered with, is destroyed or was not placed, the following shall apply:

The minimum curing time or waiting time for removing forms, removing false work, backfilling against structures or loading the structure shall be 28 days.

The Contractor may choose at his own expense to core the structure represented by the maturity meter. Cores will be obtained and tested according to CP 65. Cores will be a minimum of 4 inches in diameter. A minimum of three cores in a two square foot area will be obtained. If the compressive strength of any one core differs from the average by more than 10 percent that compressive strength will be deleted and the average strength will be determined using the compressive strength of the remaining two cores. If the compressive strength of more than one core differs from the average by more than 10 percent the average strength will be determined using all three compressive strengths of the cores. The average compressive strength of the cores shall be achieve the specified compressive strength of the structure. A structure may only be cored once.

January 30, 2014

REVISION OF SECTION 107
WARNING LIGHTS FOR WORK VEHICLES AND EQUIPMENT

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

Subsection 107.06 (b) shall include the following:

All work vehicles and mobile equipment shall be equipped with one or more functioning warning lights mounted as high as practicable, which shall be capable of displaying in all directions one or more flashing, oscillating, or rotating lights for warning roadway traffic. The lights shall be amber in color. The warning lights shall be activated when the work vehicle or mobile equipment is operating within the roadway, right of way or both. All supplemental lights shall be SAE Class 1 certified.

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REVISION OF SECTION 109
MEASUREMENT OF QUANTITIES

Section 109 of the Standard Specifications is hereby revised for this project as follows:

In subsection 109.01, delete the 17th paragraph and replace it with the following:

Vehicles used to haul material being paid for by weight shall bear a plainly legible identification mark. Each of these vehicles shall be weighed empty daily at times directed by the Engineer. The Contractor shall furnish to the Engineer, in writing, a vehicle identification sheet that lists the following for each delivery vehicle to be used on the project:

- (1) identification mark
- (2) vehicle length
- (3) tare weight
- (4) number of axles
- (5) the distance between extreme axles
- (6) information related to legal weight, including the Permit No. and permitted weight of each vehicle for which the State has issued an overweight permit.

This information shall be furnished prior to time of delivery of the material and at any subsequent time the Contractor changes vehicles, combination vehicles, axle length relationships, or overweight permitting of vehicles.

October 29, 2015

REVISION OF SECTION 109
SCALES

Section 109 of the Standard Specifications is hereby revised for this project as follows:

In subsection 109.01, delete the 11th paragraph and replace with the following:

Materials measured or proportioned by weight shall be weighed on accurate scales. Scales shall be accurate within the allowable tolerances as prescribed by State law. The scales shall be tested for accuracy by the Colorado Department of Agriculture or an approved Colorado Department of Agriculture vendor (<https://www.colorado.gov/pacific/aginspection/scale-companies>) as least once each year, each time the scales are relocated, and as often as the Engineer may deem necessary. Scales shall be furnished by the Contractor or the Contractor may utilize commercial scales.

November 10, 2016

REVISION OF SECTION 201
CLEARING AND GRUBBING

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

In subsection 201.02, delete the third paragraph and replace with the following:

All surface objects, trees, stumps, roots, and other protruding obstructions not designated to remain shall be cleared and grubbed. In areas to be rounded at the tops of backslopes, stumps shall be removed to at least 2 feet below the surface of the final slope line.

In subsection 201.02, delete the ninth paragraph and replace with the following:

The Contractor shall clear and grub the areas within the excavation or embankment grading limits and shall include the removal from the ground of brush, roots, sod, grass, residue of agricultural crops, sawdust, and other vegetable matter. See subsection 208.04(e) for disturbed area limits.

REVISION OF SECTION 203
EXCAVATION AND EMBANKMENT

Section 203 of the Standard Specifications is hereby deleted for this project and replaced with the following:

DESCRIPTION

203.01 General. This work consists of excavation, hauling, disposal, placement, and compaction of all material encountered within the limits of the work, including construction of dikes and the excavation for ditches and channels, necessary for the construction of the roadway in accordance with the Contract.

MATERIALS

203.02 Definitions. All excavation will be defined as, "unclassified excavation", "stripping", "removal of unsuitable material", "rock excavation", "borrow", or "potholing" as described below:

- (a) *Unclassified Excavation.* Unclassified Excavation shall consist of the excavation of all materials of whatever character required for the work, obtained within the right of way, including surface boulders and excavation for ditches and channels that is not removed under some other item.
- (b) *Stripping.* Stripping shall consist of removing overburden or other specified material from borrow pits, and the replacement of overburden or other specified material over the disturbed area of the site or pit after the underlying material has been removed.
- (c) *Removal of Unsuitable Material.* Removal of Unsuitable Material shall consist of the removal of soils or mixtures of soil and organic matter identified in the Contract or as directed by the Engineer that would be detrimental to the roadway or embankment if left in place in its existing condition.
- (d) *Rock Excavation.* Rock Excavation shall consist of igneous, metamorphic, and sedimentary rock which cannot be excavated without blasting or with the use of rippers, including all boulders or other detached stones having a volume of $\frac{1}{2}$ cubic yard or more. Unless specified in the Contract, Rock Excavation is material that meets one of the following field test criteria to be conducted by the Contractor:
 - 1. Ripping Test: Material that cannot be broken down by one pass with a single tooth ripper mounted on a crawler type tractor in low gear with a minimum net flywheel power rating of 235 horsepower; or material that cannot be broken down with a 48000 pound tracked excavator utilizing a bucket with rock teeth.
 - 2. Seismic Test: Material that has a seismic velocity of 6,000 feet per second or greater. The Contractor shall submit the qualifications of the individual performing or interpreting the seismic testing to the Engineer a minimum of 14 days prior to testing. The ripping test will be used to resolve differences if seismic velocities fall below 6,000 feet per second.
 - 3. Handling Test: Any boulder or detached stone having a volume of $\frac{1}{2}$ -cubic yard or more that cannot be readily broken down with the excavation equipment described above in 1.
- (e) *Borrow.* Borrow shall consist of approved material obtained from outside the right of way, required for the construction of the project.
- (f) *Potholing.* Potholing consists of exposing and verifying the location of existing utilities at locations as directed.

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203.03 Embankment Materials. Embankment Material shall consist of approved material acquired from excavations or borrow pits, and hauled and placed in embankments. Approval of Embankment Material shall be contingent on the material meeting the Atterberg Limit and gradation requirements specified in the Contract. Approval of the embankment material in the upper 2 feet of embankment below the subgrade elevation is contingent on the material meeting one of the following as specified in the Contract:

- (1) the specified resistance value when tested by the Hveem Stabilometer, or equivalent resilient modulus
- (2) the specified Atterberg Limit and gradation requirements
- (3) the specified resistance value when tested by the Hveem Stabilometer, or equivalent resilient modulus, and the specified Atterberg Limit and gradation requirements

Non-durable bedrock shall be identified and classified using Colorado Procedure CP-L 3104. Any material that classifies as Soil-like Non-durable (S-N) as defined in the procedure shall be pulverized, broken down and processed to 6-inch maximum particle sizes before incorporation into embankment fill. These materials shall be placed and compacted as "Soil Embankment" in accordance with subsection 203.07 (a). Non-durable bedrock particles in excess of 6 inches shall not be placed into embankment fill.

If recycled concrete or asphalt are to be incorporated into embankment fill; the maximum dimension permitted for concrete is 24 inches and the maximum dimension permitted for asphalt is 12 inches.

Embankment Material imported onto the project will be tested for water soluble sulfates using CP-L 2103 Method B. The average of three consecutive tests shall show that the sulfate content is not greater than that corresponding to the sulfate exposure level specified in the Contract. No single test shall have a sulfate content more than 20 percent greater than that corresponding to the sulfate exposure level specified in the Contract. A single failing test shall have the remaining sample split into four equal portions. CDOT Region Lab shall receive one portion, the Contractor shall receive one portion and the remaining two portions shall go to the CDOT Central lab. The CDOT Region Lab, CDOT Central Lab and the Contractor's Lab shall retest the sample. If the results from the three Labs are within 10 percent of each other, the results will be averaged. The averaged result will be used for determining Contract compliance. If the results from the Labs are not within 10 percent of each other, the remaining split sample will be sent to an independent laboratory for testing using CP-L 2103. The independent laboratory will be mutually agreed upon by the Department and the Contractor. The Independent Lab's test result will be used for determining Contract compliance.

If the water soluble sulfate content is less than that corresponding to the sulfate exposure level specified in the Contract, CDOT will bear all costs associated with the independent lab test. If the soluble sulfate content is greater than that corresponding to the sulfate exposure level specified in the Contract, all costs associated with independent lab testing shall be at the Contractor's expense. Embankment represented by failing tests shall be removed from the project and replaced at the Contractor's expense.

Imported Material used for backfilling pipes (storm sewer, cross culverts, side drains, etc) shall be tested for compatibility with the selected pipe material. When Non-reinforced Concrete Pipe or Reinforced Concrete Pipe is used, the imported material shall be tested for sulfate and pH. When Corrugated Steel Pipe, Bituminous Coated Corrugated Steel Pipe or Pre-coated Corrugated Steel Pipe is used, the imported material shall be tested for sulfates, chlorides, pH and resistivity. When Aramid Fiber Bonded Corrugated Steel Pipe or Corrugated Aluminum Pipe is used, the imported material shall be tested for pH and resistivity. When Plastic pipe is selected, the imported material does not need to be tested for sulfates, chlorides, pH or resistivity.

Sulfates, chlorides, pH and resistivity shall be determined by the following procedures:

- (1) Water soluble sulfates using CP-L 2103 Method B
- (2) Chlorides using CPL 2104
- (3) Resistivity using ASTM G57
- (4) pH using ASTM G51

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The average of three consecutive tests shall show the imported material's sulfate, chloride, pH and resistivity is not greater than the limits corresponding to the Pipe Class in Table 203-1 or 203-2 for the pipe class specified in the Contract. No single test shall have a result more than 20 percent greater than that corresponding to the limit in Table 203-1 or Table 203-2 for sulfates, chlorides and resistivity. No single test shall have a result more than 5 percent outside the limit in Table 203-1 for pH. The remaining sample material from a single failing test shall be split into three equal portions. CDOT shall receive one portion, the Contractor shall receive one portion and the remaining portion shall be retained by the Project. CDOT and the Contractor's Lab shall retest the failed sample; if the results from those tests are within 10 percent of each other, the results will be averaged. The averaged result will be used for Contract compliance. If the results from the Labs are not within 10 percent of each other, the remaining sample portion will be sent to an independent laboratory for testing using the testing requirements specified above. The independent laboratory will be mutually agreed upon by the Department and the Contractor. The Independent Lab's test result will be used for Contract compliance.

If the imported material's sulfates, chlorides, and resistivity are less than the limits and the pH is within the limits in Table 203-1 or 203-2, CDOT will bear all costs associated with the independent lab test. If the imported material's sulfates, chlorides, and resistivity is greater than the limits and the pH is outside the limits in Table 203-1 or 203-2, all costs associated with independent lab testing shall be at the Contractor's expense.

Embankment represented by failing tests shall be removed from the project and replaced at the Contractor's expense.

**Table 203-1
SULFATE, CHLORIDE AND PH OF IMPORTED MATERIAL**

Pipe Class	SOIL		
	Sulfate	Chloride	pH
	(SO ₄)	(Cl)	
% max	% max		
0, 7	0.05	0.05	6.0-8.5
1, 7	0.10	0.10	6.0-8.5
2, 8	0.20	0.20	6.0-8.5
3, 9	0.50	0.50	6.0-8.5
4, 9	1.00	1.00	5.0-9.0
5, 10	2.00	2.00	5.0-9.0
6, 10	>2.00	>2.00	<5 or >9

**Table 203-2
RESISTIVITY AND PH OF IMPORTED MATERIAL**

SOIL SIDE	
Resistivity, R (Ohm – cm)	pH
≥1,500	5.0-9.0
≥250	3.0-12.0

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Embankment Material shall be classified into one of the material groups listed below, and placed and compacted in accordance with the appropriate methods specified in subsection 203.07. If any material does not meet the criteria for one of the following classifications, it shall be processed on site to meet the requirements for one of the material groups listed below, or disposed of at the Contractor's expense.

(a) *Soil Embankment.* Soil Embankment shall have all particle sizes less than 6 inches. The material shall be classified in accordance with AASHTO M 145 and placed and compacted in accordance with subsection 203.07 (a).

(b) *Rock Embankment.* Rock Embankment shall meet all of the following requirements:

- (1) Contains 50 percent or more retained on the 4.75 mm (No. 4) sieve.
- (2) Contains > 30 percent retained on the 19.0 mm (¾-inch) sieve.
- (3) Classifies as an AASHTO A-1 soil type.
- (4) All particle sizes shall be less than 6 inches.
- (5) Particles retained on the 4.75mm (No. 4) sieve shall not be composed of non-durable bedrock types.

Rock Embankment can be placed without moisture density control as described in subsection 203.07 (b).

(c) *Rock Fill.* Rock Fill shall meet all of the following requirements:

- (1) A minimum of 50 percent of the material shall be retained on a 100 mm (4-inch) sieve.
- (2) Maximum dimension of any particle permitted is 36 inches.
- (3) Shall be well-graded by visual inspection.
- (4) Shall contain less than 20 percent by volume of material passing the 75 µm (No. 200) sieve based on visual inspection. This requirement shall be at the discretion of the Engineer.
- (5) Particles retained on the 4.75 mm (No. 4) sieve shall not be composed of non-durable bedrock types.

Rock Fill can be placed without moisture density control as described in subsection 203.07 (c).

CONSTRUCTION REQUIREMENTS

203.04 General. The excavations and embankments shall be finished to smooth and uniform surfaces conforming to the typical sections specified. Variation from the subgrade plan elevations specified shall not be more than 0.08 foot. Where asphalt or concrete surfacing materials are to be placed directly on the subgrade, the subgrade plane shall not vary more than 0.04 foot. Materials shall not be wasted without written permission of the Engineer. Excavation operations shall be conducted so material outside of the slope limits will not be disturbed. Prior to beginning grading operations, all necessary clearing and grubbing in that area shall have been performed in accordance with Section 201.

The Contractor shall notify the Engineer not less than five working days prior to beginning excavation so the necessary cross sections may be taken. The Contractor shall not excavate beyond the dimensions and elevations established.

Archaeological and paleontological materials encountered during the work shall be dealt with in accordance with subsection 107.23.

All excavation activities in areas where asbestos is encountered or expected to be encountered shall conform to the Colorado Department of Public Health and Environment's Asbestos-Contaminated Soil Guidance Document or the State of Colorado's Asbestos Contaminated Soil Statewide Management Plan (ACS), whichever is more recent at the time of advertisement and in accordance with subsection 250.07(d) and the Air Quality Control Commission Regulation No. 8 Part B or Section 5.5 of the solid Waste Regulation 6 CCR 1007-2, as applicable.

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203.05 Excavation. Excavation shall be one or more of the following:

- (a) *Rock.* Unless otherwise specified, rock shall be excavated to a minimum depth of 0.5 foot and a maximum depth of 1 foot below subgrade, within the limits of the roadbed. Rock removed in excess of 1 foot below subgrade will not be paid for. Backfilling of the depth in excess of 1 foot below subgrade shall be at the Contractor's expense. Approved embankment material shall be used to bring the rock-excavated areas to subgrade elevations within the tolerances specified in subsection 203.04.

Undrained pockets shall not be left in the rock surface and depressions shall be drained at the Contractor's expense.

Any change to cut slopes by the Department will be made prior to the next drilling operations.

When required for rock excavation, controlled blasting shall be conducted in accordance with the Contract.

- (b) *Unclassified.* Excess or unsuitable excavated material, including rock and boulders, that cannot be used in embankments may be placed on the side slopes of the nearest fill as approved.

Unless otherwise specified by the Engineer, intercepting ditches shall be made above the top of cut slopes and carried to outlets near the ends of the cuts. In order to blend the intersection of cut slopes with the slope of the adjacent natural ground surfaces in a uniform manner, the tops of all cut slopes, except those in solid rock, shall be flattened and rounded in accordance with typical sections and details specified. Earth overburden lying above solid rock cuts shall be treated in the same manner as earth cuts.

The Department reserves the right to change cut slopes during the progress of excavation.

- (c) *Unsuitable Material.* Unsuitable materials encountered in the subgrade that are determined to be detrimental to the roadway or embankment shall be removed to the depth and extents as directed by the Engineer. The excavated area shall be backfilled to the finished graded section with approved material. Materials that contain organics or that cannot be dried or moisture conditioned, then compacted to the required density will be disposed of and cannot be reused as embankment fill. Materials not containing organics and that can be dried or moisture conditioned and compacted to the required density can be reused as embankment fill as approved by the Engineer.
- (d) *Borrow.* If the Contractor places more borrow than is specified or approved and causes a waste of roadway excavation, the quantity of waste will be deducted from the borrow volume. All borrow areas shall be bladed and shaped to permit accurate measurements after excavation is completed. The finished borrow areas shall be graded to a smooth and uniform surface and shall be finished so water will not collect or stand therein, unless otherwise specified.
- (e) *Stripping.* Overburden shall be removed to the depth required for the production of acceptable material, and at least 5 feet beyond the working limits of the area being excavated.
- (f) *Potholing.* All necessary potholing as determined by the Contractor and agreed to by the Engineer shall be completed under this item with appropriate equipment as approved.

The Contractor shall acquire necessary permits, locate utilities, excavate all materials of whatever character required to expose the utilities, survey the location of the utilities, and backfill the excavation to existing grade lines with the excavated or other approved materials. Backfilling shall be accomplished in accordance with subsection 206.03.

The Contractor shall use extreme caution during this work. All damage to existing utility lines or adjacent facilities shall be repaired promptly at the Contractor's expense.

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203.06 General Embankment Construction Requirements. When Contractor Process Control is required, the Contractor's Process Control Representative shall be certified for WAQTC Embankment and Base Testing and CDOT's Excavation, Embankment, and Soil Inspection certification course.

Embankment construction shall include preparation of the areas upon which embankments are to be placed, construction of dikes, placing and compacting of approved material within roadway areas including holes, pits, and other depressions within the roadway area. Only approved materials shall be used in the construction of embankments and fills.

All sod, vegetable and other organic matter, stumps, and roots shall be removed from the surface upon which the embankment is to be placed in accordance with Section 201. Unless a thickness is otherwise specified in the Contract, the upper 4 inches of the ground surface will be considered top soil and shall be removed in accordance with Section 207 prior to placement of Embankment Fill.

The cleared surface shall be completely broken up by plowing or scarifying to a minimum depth of 6 inches or as specified in the Contract, the moisture content increased or reduced as necessary, and compacted to the specified embankment density for the material type present.

When embankment is placed on a slope that is steeper than 4H:1V, as measured in the steepest direction, the existing slope shall be benched as the embankment is placed in layers. A 2-foot deep key shall be excavated at the base of the existing slope and backfilled with approved and compacted material. The embankment shall be placed in layers from that key. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous bench. Excavated material from benching may be placed and compacted with the embankment material at the Contractor's expense.

During the course of construction, embankment side slopes shall be built a minimum of 12 inches beyond the final grade indicated in the Contract to allow for compaction equipment to compact the outer edges of the embankment. Once the specified level of compaction is achieved, the side slopes shall be trimmed back to final grade. Excess material placement and removal to satisfy this requirement shall be at the Contractor's expense.

If embankment can be placed on only one side of structures such as retaining walls, abutments, wing walls, piers, or culvert headwalls, compaction shall be accomplished without initiating movement or deformation of the structure and without placing excessive pressure against the structure. When noted in the Contract, the fill adjacent to the abutment of a bridge shall not be placed higher than the bottom of the backwall until the superstructure is in place. When embankment is placed on both sides of a concrete wall or box type structure, the embankment shall be brought up equally on both sides of the structure.

Where embankment is to be placed and compacted and end dumping is permitted, the slopes of the original ground or embankment shall be deeply plowed or scarified before starting end dumping.

Embankment fill other than A-1 soil types shall not be placed within standing water, unless otherwise noted in the Contract. During the construction of the embankment, the top surface shall be maintained so that it is well drained at all times.

Frozen materials shall not be used in construction of embankments. Frozen material will be identified by the visual observation of ice crystals within the foundation or embankment material, or by measuring the surface temperature of the ground surface.

203.07 Embankment Placement and Compaction Requirements. Materials incorporated into embankment fill shall be placed and compacted according to the following requirements:

- (a) *Soil Embankment.* All Soil Embankment shall be placed in horizontal layers not to exceed 8 inches in loose lift thickness. Each layer shall be compacted prior to the placement of subsequent layers. Spreading equipment shall be used to obtain uniform thickness prior to compaction. As the compaction progresses, continuous mixing, leveling, and manipulating shall be done to assure uniform moisture and density. Additional work involved in drying Soil Embankment to the required moisture content shall be included in the contract price paid for excavating or furnishing the material with no additional compensation.

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Soil Embankment that classifies as A-1 material can be used to bridge across standing water or swampy ground within the embankment foundation, and can be placed in lift thicknesses greater than 8 inches if used for this purpose as approved by the Engineer.

Soil Embankment with less than or equal to 30 percent retained on the 19mm ($\frac{3}{4}$ -inch) sieve shall be tested for compaction using CP 80. Materials that classify as AASHTO A-1, A-2-4, A-2-5, and A-3 soils shall be compacted at ± 2 percent of Optimum Moisture Content (OMC) and to at least 95 percent of maximum dry density determined in accordance with AASHTO T 180 as modified by CP 23. All other soil types will be compacted to 95 percent of the maximum dry density determined in accordance with AASHTO T 99 as modified by CP 23. Soils with 35 percent fines or less shall be compacted at ± 2 percent of OMC. Soils with greater than 35 percent fines shall be compacted at a moisture content equal to or above OMC to achieve stability of the compacted lift. Stability is defined as the absence of rutting or pumping as observed and documented by the Contractor's Process Control Representative and as approved by the Engineer. If the soils cannot be compacted and prove to be unstable at a moisture content equal to or above OMC, then the required moisture content for compaction can be reduced below OMC as approved by the Engineer.

Prior to placing any Soil Embankment with greater than 30 percent retained on the 19 mm ($\frac{3}{4}$ -inch) sieve, the Contractor will be required to construct a test strip to the dimensions specified in the Contract or as directed by the Engineer. The test strip can be incorporated into the final embankment. The Contractor will be responsible for determining the moisture conditioning necessary to achieve compaction, and will determine the equipment and number of passes necessary to achieve adequate compaction. The Contractor is required to use compression-type or vibratory rollers on granular materials and sheepsfoot rollers on cohesive soils. Adequate compaction will be demonstrated by the absence of rutting, pumping, or deflection following a proof roll of the test strip using any piece of construction equipment that exerts a minimum 18-kip per axle load. The proof roll will be observed and accepted by the Engineer. Once the test strip passes a proof roll, the Contractor can resume embankment construction with the same moisture conditioning and compaction methods as the test strip was constructed.

Placement, moisture conditioning, and compaction of every lift of soil embankment with greater than 30 percent retained on the 19 mm ($\frac{3}{4}$ -inch) sieve will be observed by the Contractor's Process Control Representative, and accepted by the Engineer. Adequate compaction of each lift will be demonstrated as the absence of rutting, pumping, or deflection as construction equipment is routed over a lift following the compactive efforts that were used and accepted for the respective test strip. The Engineer may request a proof roll at any time to document the condition of a lift.

Significant changes in the material being hauled for soil embankment with greater than 30 percent retained on the 19 mm ($\frac{3}{4}$ -inch) sieve will require construction of a new test strip, and demonstration of adequate compaction methods using a proof roll. The Contractor's Process Control representative shall be authorized to require additional test strips at their discretion. However, the requirement for an additional test strip shall not be waived without the written approval of the Engineer.

Non-durable bedrock shall be watered to promote slaking and break down, and pulverized/processed to a maximum particle size of 6 inches. These materials shall be placed and compacted as Soil Embankment; except they shall be compacted with a heavy tamping foot roller, weighing at least 30 tons. Each tamping foot shall protrude from the drum a minimum of 4 inches. Each embankment layer shall receive a minimum of four passes with the tamping foot roller. The roller shall be operated at a uniform speed not exceeding 3 miles per hour. No additional compensation will be made for additional roller passes to achieve specified density requirements.

Non-durable Bedrock shall not be used to bridge over standing water or swampy ground within an embankment foundation. Non-durable bedrock shall also not be placed within 2 feet of the final subgrade elevation.

- (b) *Rock Embankment and Rock Fill.* Rock Embankment shall be placed in horizontal layers not to exceed 8 inches in loose lift thickness. The lift thickness can be increased when bridging over standing water or

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swampy ground in the embankment foundation as directed by the Engineer. Each layer shall be compacted prior to the placement of subsequent layers. Spreading equipment shall be used to obtain uniform thickness prior to compaction.

Rock Fill shall be placed in horizontal layers not to exceed a loose lift thickness equivalent to the average particle size up to a maximum permitted lift thickness of 18 inches. Particles with a maximum dimension of 36 inches are permitted; however, rocks larger than the lift thickness shall be separated enough to allow compaction equipment to operate in between. Material shall be placed to fill in voids between larger stones with finer particle sizes and to avoid nesting. Spreading equipment shall be used to obtain uniform thickness prior to compaction. If the use of leveling equipment is not practical, the Engineer may permit rock fill material to be cast or end dumped. In such cases sufficient hand or machine work will be required to construct a compact, stable fill and to finish the slopes to a neat and smooth appearance. Rock Fill shall not be placed within 2 feet of the final subgrade elevation. When a Rock Fill is placed over any structure, the structure shall be covered with a minimum of 2 feet of compacted Soil or Rock Embankment material before the Rock Fill is placed.

The Contractor will be responsible for determining the moisture conditioning necessary to achieve compaction for Rock Embankment or Rock Fill. Vibratory or compression-type rollers will be used to compact these materials. At a minimum, compression-type rollers weighing 20 tons shall complete 4 passes over the entire width of a lift at a speed not to exceed 3 miles per hour. Vibratory rollers shall exert a minimum dynamic force of 30,000 pounds of impact per vibration, and achieve a minimum 1,000 vibrations per minute. Vibratory rollers shall complete a minimum of 4 passes over the entire width of a lift at a speed not to exceed 1.5 miles per hour.

Prior to placing Rock Embankment or Rock Fill, the Contractor will be required to construct a test strip to the dimensions specified in the Contract, or as directed by the Engineer. The test strip can be incorporated into the final embankment. Adequate compaction of the Rock Embankment or Rock Fill test strip will be demonstrated by the absence of rutting, pumping, or deflection following a proof roll of the test strip using any piece of construction equipment that exerts a minimum 18-kip per axle load. The proof roll will be observed and accepted by the Engineer. Once the test strip passes a proof roll, the Contractor can resume Rock Embankment or Rock Fill construction with the same moisture conditioning and compaction methods as the test strip was constructed. Placement, moisture conditioning, and compaction of every lift of Rock Embankment and Rock Fill will be observed by the Contractor's Process Control Representative, and accepted by the Engineer. Adequate compaction of each lift will be demonstrated as the absence of rutting, pumping, or deflection as construction equipment is routed over a lift following the compactive efforts that were used and accepted for the respective test strip. The Engineer may request a proof roll at any time to document the condition of a lift.

Significant changes in the characteristics of material being hauled for Rock Embankment or Rock Fill will require construction of a new test strip, and demonstration of adequate compaction methods using a proof roll. The Contractor's Process Control representative shall be authorized to require additional test strips at their discretion. However, the requirement for an additional test strip shall not be waived without the written approval of the Engineer.

If the Contractor wishes to deviate from the minimum equipment and compactive efforts specified above for Rock Embankment or Rock Fill, the Contractor must first demonstrate the adequacy of their proposed methods with a test strip and passing proof roll. In addition, a proof roll will be required for every lift placed for the first 2,000 cubic yards of Rock Embankment or Rock Fill placed. The proof rolls used to demonstrate adequate compaction of the first 2,000 cubic yards placed will not be measured and paid separately, but will be performed at the Contractor's expense.

Recycled concrete and asphalt can be incorporated into embankment material, and shall be processed, placed, and compacted in accordance with 203.07 (a) or (b); depending on the overall classification of the embankment material once the recycled material is incorporated. Rebar shall not extend more than one inch beyond the edges of recycled concrete particles. Recycled concrete or asphalt shall not be permitted in the upper 2 feet of the final subgrade elevation or within 2 feet of the final finished side slopes unless otherwise noted in the Contract.

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REVISION OF SECTION 203
EXCAVATION AND EMBANKMENT

203.08 Proof Rolling. Proof rolling with pneumatic tire equipment shall be performed using a minimum axle load of 18 kips per axle. A weigh ticket from an approved scale shall be furnished by the Contractor to substantiate this weight.

The subgrade shall be proof rolled after the required compaction has been obtained and the subgrade has been shaped to the required cross section.

The proof roller shall be operated in a systematic manner so that a record may be readily kept of the area tested and the working time required for the testing. Areas that are observed to have soft spots in the subgrade, where deflection is not uniform or is excessive as determined by the Engineer, shall be ripped, scarified, dried or wetted as necessary and recompacted to the requirements for density and moisture at the Contractor's expense. After recompaction, these areas shall be proof rolled again and all failures again corrected at the Contractor's expense.

Upon approval of the proof rolling, the sub base, base course, or initial pavement course shall be placed within 48 hours. If the Contractor fails to place the sub base, base course, or initial pavement course within 48 hours or the condition of the subgrade changes due to weather or other conditions, proof rolling and correction shall be performed again at the Contractor's expense.

203.09 Blading. Blading shall consist of furnishing motor graders of the specified horsepower rating, with operators, for shaping roadway, shoulders, or other areas as designated by the Engineer.

When scarifying is specified the motor grader shall be equipped with an independently operated "V" type scarifier and attachments.

203.10 Dozing. Dozing shall consist of furnishing crawler-type tractors of the specified horsepower rating, complete with operators and bulldozer blades. Rippers, if specified, will not be measured and paid for separately, but shall be included in the work.

METHOD OF MEASUREMENT

203.11 Items paid for by volume 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 in the Contract in an amount of at least plus or minus two percent of the plan quantity.

(a) *Excavation.* The original cross-sections will be used for determination of volumes of excavated material removed, unless changes have been directed. These measurements will include authorized excavation of rock, shale, or other unsuitable material. All accepted stripping will be measured in stockpiled locations by cross-sectioning.

When the excavation conforms to the staked lines and grades, the original cross-sections and the staked sections shall be used for the determination of volumes excavated. Volumes will be computed from the cross-sections by the average end area or other acceptable method.

When topsoil or wetland topsoil is included as an additional pay item and is specified, the measured volume of excavation will be reduced by the volume of topsoil or wetland topsoil removed from the area shown as excavation in the Contract.

Measurements will include over-breakage in rock excavation from the back slopes to an amount not to exceed, in any half station of 50 feet, 10 percent of the actual quantity required for that half station.

Costs associated with ripping tests or seismic tests to evaluate if a material meets the criteria for "Rock Excavation" shall not be measured or paid separately, but shall be incurred by the Contractor and included in the cost for excavation.

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REVISION OF SECTION 203
EXCAVATION AND EMBANKMENT

- (b) *Embankment.* If provided in the Contract, embankment material will be measured in its final compacted position in the roadway. Measurement will be made upward from the original ground line without any allowance for subsidence due to compaction of the base under the embankment. The original cross-sections will be used for determination of volumes of embankment material placed, unless changes have been directed.

The measured volume of embankment material will be increased by the volume of topsoil or wetland topsoil removed from the area below the original ground line and under the embankment

- (c) *Rock Fill.* Rock fill will be measured as the volume in cubic yards in its final position, unless otherwise specified, and shall be limited to the elevations specified.
- (d) *Blading and Dozing.* The quantity measured under blading and dozing will be the number of hours that each motor grader or bulldozer is actually used as ordered. A minimum of four hours for any half shift or part thereof will be paid for unless the equipment is inoperative due to breakdown or other causes determined to be the Contractor's responsibility. Time involved in moving onto or off the project will not be measured and paid for.

Time will be paid for moving motor graders or bulldozers from one location on the project to another, if directed; but time will not be allowed for moves which are made for the convenience of the Contractor.

Payment for a minimum of four hours will not be allowed in cases where the motor grader, bulldozer, or operator is assigned to work on other pay items connected with the project.

- (e) *Potholing.* Potholing will be measured by the total number of hours that excavation and backfilling equipment is actually used as directed. All other related work, including removal of existing pavement, backfilling, shoring, and labor will not be measured and paid for separately, but shall be included in the work.
- (f) *Proof Rolling.* Proof rolling will be measured by the actual number of hours that the pneumatic equipment is used as a proof roller.

The time to be measured under this item will be the number of hours that each piece of equipment is actually used as ordered.

Proof rolling will be measured and paid for only once for each test strip required during construction; for final verification of subgrade prior to placement of subbase, base coarse, or pavement; or for each incident where the Engineer directs it through the course of construction. Additional proof rolling that is required due to failure of embankment fill; due to the Contractor's failure to place sub base, base course, or initial pavement course within 48 hours of the initial proof roll; or due to the condition of the subgrade changing due to weather; or additional proof rolls deemed necessary due to the Contractor's choice to deviate from minimum equipment and compaction efforts specified herein, shall be at the Contractor's expense.

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REVISION OF SECTION 203
EXCAVATION AND EMBANKMENT

BASIS OF PAYMENT

203.12 The accepted quantities will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule.

Payment will be made under:

Pay Item	Pay Unit
Rock Excavation	Cubic Yard
Rock Fill	Cubic Yard
Unclassified Excavation	Cubic Yard
Unclassified Excavation (Complete in Place)	Cubic Yard
Unsuitable Materials	Cubic Yard
Borrow	Cubic Yard
Borrow (Complete in Place)	Cubic Yard
Embankment Material (Complete in Place)	Cubic Yard
Stripping	Cubic Yard
Blading	Hour
Dozing	Hour
Potholing	Hour
Proof Rolling	Hour

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

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

Payment for replacement of Unsuitable Material shall be as follows: If excavated material can be re-used as embankment fill by moisture conditioning and compaction, replacement shall be included in the cost for Removal of Unsuitable Material. If the material cannot be re-used as embankment fill, payment for replacement of Unsuitable Material shall be for the volume that is placed in the excavated area at the respective unit price for the material that is approved by the Engineer and used.

Payment for Unclassified Excavation (Complete in Place), Embankment Material (Complete in Place), and Borrow (Complete in Place) shall be full compensation for all work necessary to complete the item including construction of embankments, rework of existing materials to satisfy benching requirements, unclassified excavation, borrow, compaction, compaction of bases of cuts and fills, all work in available materials pits, and disposal of excess excavated material.

All costs associated with reducing the size of the claystone particles, removing the oversized particles, and disposal of the oversized particles will not be paid for separately but shall be included in the work.

Pavement replacement if required due to potholing, shall be accomplished, measured, and paid for in accordance with appropriate sections of the specifications.

Pneumatic tire equipment and load required to achieve the desired weight of proof rolling equipment will not be measured and paid for separately, but shall be included in the work.

REVISION OF SECTIONS 206, 304 AND 613
COMPACTION

Sections 206, 304 and 613 of Standard Specifications are hereby revised for this project as follows:

In subsection 206.03, delete the fourth and fifth paragraphs and replace with the following:

Backfill shall consist of approved materials uniformly distributed in layers brought up equally on all sides of the structure. Each layer of backfill shall not exceed 6 inches and shall be compacted to the required density before successive layers are placed. Structure backfill (Class 1) shall be compacted to a density of not less than 95 percent of maximum dry density determined in accordance with AASHTO T 180 as modified by CP 23. Backfill shall be compacted at ± 2 percent of Optimum Moisture Content (OMC).

Structure backfill (Class 2) shall be compacted to a density of not less than 95 percent of maximum dry density. The maximum dry density and OMC for A-1, A-2-4, A-2-5 and A-3 materials will be determined in accordance with AASHTO T 180 as modified by CP 23. The maximum dry density and OMC for all other materials will be determined in accordance with AASHTO T 99 as modified by CP 23. Materials shall be compacted at ± 2 percent of Optimum Moisture Content (OMC). Materials having greater than 35 percent passing the 75 μm (No. 200) sieve shall be compacted at 0 to 3 percent above OMC.

In subsection 304.06, delete the first paragraph and replace with the following:

304.06 Shaping and Compaction. Compaction of each layer shall continue until a density of not less than 95 percent of the maximum density determined in accordance with AASHTO T 180 as modified by CP 23 has been achieved. The moisture content shall be at ± 2 percent of optimum moisture content. The surface of each layer shall be maintained during the compaction operations so that a uniform texture is produced, and the aggregates are firmly keyed. Moisture conditioning shall be performed uniformly during compaction.

In subsection 613.07, delete the 15th paragraph and replace with the following:

Trenching shall be backfilled and compacted as follows: Backfill shall be deposited in uniform layers. The thickness of each layer shall be 6 inches or less thick prior to compaction. The space under the conduit shall be completely filled. The remainder of the trench and excavation shall be backfilled to the finished grade. The backfill material shall be compacted to the density of not less than 95 percent of maximum dry density. The maximum dry density and optimum moisture content (OMC) for A-1, A-2-4, A-2-5 and A-3 materials will be determined in accordance with AASHTO T 180 as modified by CP 23. The maximum dry density and OMC for all other materials will be determined in accordance with AASHTO T 99 as modified by CP 23. Materials shall be compacted at ± 2 percent of Optimum Moisture Content (OMC). Materials having greater than 35 percent passing the 75 μm (No. 200) sieve shall be compacted at 0 to 3 percent above OMC. Each layer shall be mechanically compacted by tamping with power tools approved by the Engineer. Compaction methods or equipment that damage the conduit shall not be used.

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REVISION OF SECTION 206
IMPORTED MATERIAL FOR STRUCTURE BACKFILL

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

Subsection 206.02 (a) shall include the following:

Imported Material used as structure backfill for pipes (storm sewer, cross culverts, side drains, etc) shall be tested for compatibility with the selected pipe material.

When Nonreinforced Concrete Pipe or Reinforced Concrete Pipe is used, the imported material shall be tested for sulfate and pH.

When Corrugated Steel Pipe, Bituminous Coated Corrugated Steel Pipe or Precoated Corrugated Steel Pipe is used, the imported material shall be tested for sulfates, chlorides, pH and resistivity.

When Aramid Fiber Bonded Corrugated Steel Pipe or Corrugated Aluminum Pipe is used, the imported material shall be tested for pH and resistivity.

When Plastic pipe is selected, the imported material does not need to be tested for sulfates, chlorides, pH and resistivity.

Sulfates, chlorides, pH and resistivity shall be determined by the following procedures:

- (1) Water soluble sulfates using CP-L 2103 Method B.
- (2) Chlorides using CPL 2104
- (3) Resistivity using ASTM G57
- (4) pH using ASTM G51.

The average of three consecutive tests shall show the imported material's sulfate, chloride, pH and resistivity is not greater than the limits corresponding to the Pipe Class in Table 206-1 or 206-2 for the pipe class specified on the plans. No single test shall have a result more than 20 percent greater than that corresponding to the limit in Table 206-1 or Table 206-2 for sulfates, chlorides and resistivity. No single test shall have a result more than 5 percent outside the limit in Table 206-1 for pH. The remaining sample material from a single failing test shall be split into three equal portions. CDOT shall receive one portion, the Contractor shall receive one portion and the remaining portion shall be retained by the Project. CDOT and the Contractor's Lab shall retest the failed sample; if the results from those tests are within 10 percent of each other, the results will be averaged. The averaged result will be used for Contract compliance. If the results from the Labs are not within 10 percent of each other, the remaining sample portion will be sent to an independent laboratory for testing using the testing requirements specified above. The independent laboratory will be mutually agreed upon by the Department and the Contractor. The Independent Lab's test result will be used for Contract compliance.

If the imported material's sulfates, chlorides, and resistivity are less than the limits and the pH is within the limits in Table 203-1 or 203-2, CDOT will bear all costs associated with the independent lab test. If the imported material's sulfates, chlorides, and resistivity is greater than the limits and the pH is outside the limits in Table 206-1 or 206-2, all costs associated with independent lab testing shall be at the Contractor's expense.

Embankment represented by failing tests shall be removed from the project and replaced at the Contractor's expense.

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 REVISION OF SECTION 206
 IMPORTED MATERIAL FOR STRUCTURE BACKFILL

**Table 206-1
 SULFATE, CHLORIDE AND PH OF IMPORTED MATERIAL**

	SOIL		
Pipe Class	Sulfate	Chloride	
	(SO ₄)	(Cl)	pH
	% max	% max	
0 , 7	0.05	0.05	6.0-8.5
1, 7	0.10	0.10	6.0-8.5
2, 8	0.20	0.20	6.0-8.5
3, 9	0.50	0.50	6.0-8.5
4, 9	1.00	1.00	5.0-9.0
5, 10	2.00	2.00	5.0-9.0
6, 10	>2.00	>2.00	<5 or >9

**Table 206-2
 RESISTIVITY AND PH OF IMPORTED MATERIAL**

SOIL SIDE	
Resistivity, R (Ohm – cm)	pH
≥1,500	5.0-9.0
≥250	3.0-12.0

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REVISION OF SECTION 206
SHORING

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

Delete subsections 206.08, 206.09, 206.10, and 206.11 and replace with the following:

DESCRIPTION

206.08 This work consists of shoring specific areas designated in the Contract.

MATERIALS AND CONSTRUCTION REQUIREMENTS

206.09 The Contractor shall locate, size, design, and construct shoring which provides all necessary rigidity, and supports the loads imposed to facilitate construction as shown on the plans. Shoring used to facilitate construction is considered temporary and shall have a design life 1-1/2 times the expected construction service life, with a maximum design life of 3 years.

When the height of shoring exceeds 5 feet above the base of the excavation, the Contractor shall submit working drawings in accordance with subsection 105.02. The drawings shall be submitted to the Engineer for information only. The drawings shall be signed and sealed by the Contractor's Engineer. The Contractor shall design for internal and external stability of temporary shoring such as but not limited to bearing capacity, settlement, sliding, overturning, internal compound stability, and global stability. All proof and verification testing of the shoring elements shall be the responsibility of the Contractor and results shall be reported to the Engineer the day after the testing was performed.

All proof and verification testing of the shoring elements shall be the responsibility of the Contractor. For soil nail walls, a minimum of one proof test shall be performed in accordance with the Revision of Section 504, Soil Nail Wall, and test results shall be reported to the Engineer the day after the testing was performed.

The Contractor shall conduct additional proof and verification testing at the Engineer's request. Sufficient corrosion protection shall be provided in consideration of the temporary shoring design life and is the responsibility of the Contractor. Temporary shoring shall be designed for actual construction-related loads, such as phasing, stockpiles, and operation of large cranes or other large equipment near the area of the shoring. These drawings shall be signed by the Contractor, and provided to the Engineer at least ten days prior to start of work. Shoring construction shall conform with the shoring drawings provided to the Engineer. The Contractor shall conduct any necessary site-specific evaluation necessary to ensure shoring design, construction and performance.

The Contractor shall have performed and documented an independent review of their shoring design and drawings at designated areas prior to submittal. The independent review shall be stamped and sealed by a Professional Engineer licensed in the State of Colorado.

The shoring plans shall detail the methods to control site drainage during the life of the shoring. The Contractor shall actively control drainage and surface runoff during the duration of construction to direct run off away from the shoring areas above and behind the shoring. A shoring site drainage quality control plan shall be included as part of the Contractor's Engineer's shoring plans and shall be part of the submittal to the Engineer. The plan shall include measures to prevent ponding water near the shoring area and maintenance of drainage to convey water away from and around the shoring excavation vicinity.

If the embankment, construction, traffic, or any other surcharge is in excess of what the original shoring was designed for and is to be placed adjacent to the shoring, the Contractor shall provide a signed letter from the Contractor's Engineer prior to the load placement stating that the shoring will support the additional load.

Shoring shall be designed and constructed in accordance with the requirements listed in this specification along with requirements in current AASHSTO and FHWA design manuals including, but not limited to:

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 REVISION OF SECTION 206
 SHORING

- (1) AASHTO Construction Handbook For Bridge Temporary Works including Division I
- (2) Section 5 of the AASHTO Standard Specifications for Highway Bridges for allowable stress or load factor design, or
- (3) AASHTO LRFD Bridge Design Specifications including current interims for load and resistance factor design.

If a shoring type is to be used that is not detailed in these three documents, the shoring type design method will need to be submitted to the Engineer. The Contractor's Engineer shall be on-site and perform construction inspection of the shoring during the first two days of active shoring construction, during any shoring element verification testing, and at the completion of shoring construction. Shoring drawings shall include the following information:

- (1) The size and grade of all structural materials
- (2) Design notes, including design assumptions, including loading, and construction details
- (3) Detailed plans for managing and maintaining shoring surface and subsurface drainage conditions for the project duration
- (4) Where applicable, restrictions on heavy equipment placement at specific locations adjacent to the shoring
- (5) Areas determined by the Contractor's Engineer where dewatering of the shored excavation will be required, and a description of the requirements (i.e., head added by the pump, flow rate, minimum pump size, etc.) and methods to be used for dewatering.
- (6) All other information determined by the Contractor's Engineer to be pertinent to the design and successful construction of the shoring.

In addition, drawings for temporary shoring that requires structural designs shall include the following information:

- (1) Individual site-specific geotechnical properties for each shoring location based on the plan, review of the Geotechnical Report in accordance to subsection 102.05, or from a geotechnical evaluation performed by the Contractor at their own expense.
- (2) Global stability analysis showing that the shoring will be stable under the loads placed on it and construction conditions encountered during construction.

The Contractor's Engineer may assign an onsite representative, to perform construction field oversight, by submitting documentation of experience to the Engineer 10 days prior to starting shoring construction for review and the Engineer's acceptance. Prior to placing construction or traffic loads on or immediately adjacent to the supported earth, the Contractor's Engineer for the shoring shall certify in a stamped and signed letter that shoring materials and construction have been inspected and that all shoring, materials, and construction are in conformity with the shoring drawings. A copy of this certification shall be submitted to the Engineer.

METHOD OF MEASUREMENT

206.10 Shoring will not be measured, but will be paid for as a single lump sum for each Area described on the plans. Incidental shoring work or shoring in locations other than those described on the plans will be as determined by the Contractor and will not be measured and paid for separately, but shall be included in the work.

BASIS OF PAYMENT

206.11 The accepted quantities of shoring measured as provided above will be paid for at the contract unit price bid.

Payment will be made under:

Pay Item	Pay Unit
Shoring (Area _____)	Lump Sum

Payment for shoring will be full compensation for all labor, materials, and equipment required to design, construct, test, maintain, and dewatering.

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REVISION OF SECTION 206
SHORING

Removal of the shoring shall include removal of all shoring elements. The removal area shall be specified in the plans.

Removal of shoring will not be measured and paid for separately, but shall be included in the work.

The Department will pay for additional proof and verification testing, as requested by the Engineer, in accordance with subsection 109.04.

Other incidental shoring that is not included as a pay item will not be measured and paid for separately, but shall be included in the work.

1
 REVISION OF SECTION 206
 STRUCTURE BACKFILL (FLOW-FILL)

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

Delete subsection 206.02 (a) and replace with the following:

- (a) *Structure Backfill.* Class 1 and Class 2 structure backfill shall be composed of non-organic mineral aggregates and soil from excavations, borrow pits, or other sources. Material shall conform to the requirements of subsection 703.08. Class of material shall be as specified in the Contract or as designated.

Structure backfill (Flow-Fill) meeting the following requirements shall be used to backfill bridge abutments. The Contractor may substitute structure backfill (Flow-Fill) for structure backfill (Class 1) or structure backfill (Class 2) to backfill culverts and sewer pipes.

Flow-Fill is a self-leveling low strength concrete material composed of cement, fly ash, aggregates, water, chemical admixtures and/or cellular foam for air-entrainment. Flow-fill shall have a slump of 7 to 10 inches, when tested in accordance with ASTM C143 or a minimum flow consistency of 6 inches when tested in accordance with ASTM D6103. Flow-Fill shall have a minimum compressive strength of 50 psi at 28 days, when tested in accordance with ASTM D4832. Flash fill is a rapid setting Flow-Fill that may be used when approved by the Engineer and will be tested, accepted, and paid for as Flow-Fill.

Flow-Fill placed in areas that require future excavation, such as utility backfill shall have a Removability Modulus (RM) of 1.5 or less.

Removability Modulus, RM, is calculated as follows:

$$RM = \frac{W^{1.5} \times 104 \times C^{0.5}}{10^6}$$

where : W = unit weight (pcf)
 C = 28-day compressive strength (psi)

Materials for structure backfill (Flow-Fill) shall meet the requirements specified in the following subsections:

Fine Aggregate ^{1, 4}	703.01
Coarse Aggregate ^{2, 4}	703.02
Portland Cement	701.01
Fly Ash ^{3, 4}	701.02
Water	712.01
Air Entraining Admixture	711.02
Chemical Admixtures	711.03

¹ Fine aggregate not meeting the requirements of subsection 703.01 may be used if testing indicates acceptable results for strength and air content.

² Coarse aggregate not meeting the requirements of subsection 703.02 may be used if testing indicates acceptable results for strength and air content.

³ Fly ash not meeting the requirements of subsection 701.02 may be used if testing indicates acceptable results for strength and air content.

⁴ Industrial by-product aggregates (foundry sand, bottom ash, etc..) and fly ash not meeting the requirements of subsection 701.02 shall submit a report from the supplier documenting the results of testing in accordance with the Toxicity Characteristic Leaching Procedure (TCLP) described in 40 CFR 261. The report shall include the results of TCLP testing for heavy metals and other contaminants. Materials shall not exceed the TCLP limits of 40 CFR 261.24 for heavy metals

Cellular foam shall conform to ASTM C869 and ASTM C796

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REVISION OF SECTION 206
STRUCTURE BACKFILL (FLOW-FILL)

Recycled broken glass (glass cullet) is acceptable as part or all of the aggregate. Aggregate including glass must conform to the required gradations. All containers used to produce the cullet shall be empty prior to processing. Chemical, pharmaceutical, insecticide, pesticide, or other glass containers containing or having contained toxic or hazardous substances shall not be allowed and shall be grounds for rejecting the glass cullet. The maximum debris level in the cullet shall be 10 percent. Debris is defined as any deleterious material which impacts the performance of the structure backfill (Flow-Fill) including all non-glass constituents.

The Contractor may use aggregate which does not meet the above specifications if the aggregate conforms to the following gradation:

Sieve Size	Percent Passing
25.0 mm (1 inch)	100
75 µm (No. 200)	0-10 ¹

¹ The amount of material passing the 75 µm (No. 200) screen may exceed 10 percent if testing indicates acceptable results for strength and air content.

The Contractor shall submit a structure backfill (Flow-Fill) mix design for approval prior to placement. The mix design shall include the following laboratory test data:

- (1) ASTM C231, Air content
- (2) ASTM D6023, Unit Weight
- (3) ASTM C143, Slump or ASTM D6103 flow consistency
- (4) ASTM D4832 28-day Compressive Strength
- (5) Removability Modulus (RM)

The Contractor shall submit a Process Control (PC) Plan with the mix design to the Engineer. The PC plan shall address the batching, mixing, testing and placement of the structure backfill (Flow-Fill).

In subsection 206.03, delete the thirteenth through fifteenth paragraphs and replace with the following:

Compaction of structure backfill (Flow-Fill) shall not be performed.

The maximum layer thickness for structure backfill (Flow-Fill) shall be 3 feet unless otherwise approved by the Engineer. The Contractor shall not place structure backfill (Flow-Fill) in layers that are too thick to cause damage to culverts, pipes and other structures, or that will cause formwork or soil failures during placement. Structure backfill (Flow-Fill) shall have an indentation diameter less than 3 inches and the indentation shall be free of visible water when tested in accordance with ASTM D6024 by the Contractor prior to placing additional layers of structure backfill (Flow-Fill). Testing structure backfill (Flow-Fill) in accordance with ASTM D6024 will be witnessed by the Engineer. Damage resulting from placing structure backfill (Flow-Fill) in layers that are too thick or from not allowing sufficient time between placements of layers shall be repaired at the Contractor's expense.

The Contractor shall secure culverts, pipes and other structures to prevent floating and displacement of these items during the placement of the structure backfill (Flow-Fill).

When Flash Fill is used, it shall be batched with a volumetric mixing truck. Volumetric mixing trucks to produce Flow-Fill and Flash Fill shall have a computer batching system, capable of producing the approved mix design and printing tickets. For Flash Fill, the batch weights of cement and/or fly ash per cubic yard shall be within 2 percent of the mix design batch weights and the batch weight of water per cubic yard shall be within 2 percent of the mix design batch weight.

Prior to the placement of structure backfill (Flow-Fill), the Contractor shall sample the structure backfill (Flow-Fill) in accordance with ASTM D5971. The Contractor shall test the structure backfill (Flow-Fill) unit weight in accordance with ASTM D6023. For Flash Fill, the measured unit weight shall be within 5.0 percent or 5.0 pcf, whichever is larger, of the approved mix design unit weight. The Contractor shall test the structure backfill (Flow-Fill) for slump in accordance with ASTM C143 or flow consistency according to ASTM D6103.

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REVISION OF SECTION 206
STRUCTURE BACKFILL (FLOW-FILL)

The Contractor shall sample and test the first three loads of structure backfill (Flow-Fill) for each placement and then randomly once every 50 cubic yards. Sampling and testing will be witnessed by the Engineer

When structure backfill (Flow-Fill) is placed in areas that require future excavation, the unit weight of the placed structure backfill (Flow-Fill) shall not exceed the unit weight of the approved mix design by more than 2.0 pcf.

Structure backfill (Flow-Fill) shall not be allowed to freeze during placement and until it has set sufficiently according to ASTM D6024. Frozen structure backfill (Flow-Fill) shall be removed and replaced at the Contractor's expense.

When the Contractor substitutes Structure Backfill (Flow-Fill) for Structure Backfill (Class 1) or (Class 2), the trench width may be reduced to provide a minimum 6 inch clearance between the outside diameter of the culvert and the trench wall.

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Section 208 is hereby deleted from the Standard Specifications for this project and replaced with the following:

DESCRIPTION

208.01 This work consists of constructing, installing, maintaining, and removing when required, Best Management Practices (BMPs) during the life of the Contract to prevent or minimize erosion, sedimentation, and pollution of any State waters as defined in subsection 107.25, including wetlands.

The Contractor shall coordinate the construction of temporary BMPs with the construction of permanent BMPs to assure economical, effective, and continuous erosion and sediment control throughout the construction period.

When a provision of Section 208 or an order by the Engineer requires that an action be immediate or taken immediately, it shall be understood that the Contractor shall at once begin effecting completion of the action and pursue it to completion in a manner acceptable to the Engineer, and in accordance with the Colorado Discharge Permit System Stormwater Construction Permit (CDPS-SCP) requirements.

MATERIALS

208.02 Erosion control materials are subject to acceptance in accordance with subsection 106.01. Erosion control materials shall be subject to the following approval process:

Material	Approval Process	Notes:
Erosion Bales (Weed Free)	COC	The Contractor shall provide a transit certificate number or a copy of the transit certificate as supplied from the producer.
Silt Fence	COC	
Silt Berm	APL	
Erosion Log (Type 1 and 2)	COC	
Silt Dikes	COC	
Pre-fabricated Concrete Washout Structures (above ground)	APL	
Pre-fabricated Vehicle Tracking Pad	APL	
Aggregate Bag	COC	
Storm Drain Inlet Protection (Type I, II and III)	APL	

The material for BMPs shall conform to the following:

- (a) *Erosion Bales.* Material for erosion bales shall consist of Certified Weed Free hay or straw. The hay or straw shall be certified under the Colorado Department of Agriculture Weed Free Forage Certification Program and inspected as regulated by the Weed Free Forage Act, Title 35, Article 27.5, CRS. Each certified weed free erosion bale shall be identified by blue and orange twine binding the bales.

The Contractor shall not place certified weed free erosion bales or remove their identifying twine until the Engineer has inspected and accepted them.

The Contractor may obtain a current list of Colorado Weed Free Forage Crop Producers who have completed certification by contacting the Colorado Department of Agriculture, Weed Free Forage Program, 305 Interlocken Pkwy, Broomfield, CO 80021, Contact: Weed Free Forage Coordinator at (303) 869-9038. Also available at www.colorado.gov/ag/csd.

Bales shall be approximately 5 cubic feet of material and weigh at least 35 pounds. Stakes shall be wood and shall be 2 inch by 2 inch nominal.

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- (b) *Silt Fence*. Silt fence posts shall be wood with a minimum length of 42 inches. Wood posts shall be 1.5 inch by 1.5 inch nominal. Geotextile shall be attached to wood posts with three or more staples per post.

Silt fence geotextile shall conform to the following requirements:

Physical Requirements for Silt Fence Geotextiles

Property	Wire Fence Supported Requirements	Self-Supported Requirements Geotextile Elongation <50%	Test Method
Grab Strength, lbs	90 minimum	124 minimum	ASTM D 4632
Permittivity sec-1	0.05	0.05	ASTM D 4491
Ultraviolet Stability	Minimum 70% Strength Retained	Minimum 70% Strength Retained	ASTM D 4355

Silt Fence (Reinforced). Silt fence posts shall be metal "studded tee" T-post with a minimum length of 66 inches. Metal posts shall be "studded tee" with .095 inch minimum wall thickness. Wire fabric reinforcement for the silt fence geotextile shall be a minimum of 14 gauge, with a maximum mesh spacing of 6 inches. Geotextile shall be attached to welded wire fabric with ties or nylon cable ties 12 inch O.C. at top, mid and bottom wire. Welded wire fabric shall be attached to the post with a minimum three 12 gauge wire ties per post. Vinyl or rubber safety caps shall be installed on all T-post.

- (c) *Temporary Berms*. Temporary berms shall be constructed of compacted soil.
- (d) *Temporary Slope Drains*. Temporary slope drains shall consist of fiber mats, plastic sheets, stone, concrete or asphalt gutters, half round pipe, metal or plastic pipe, wood flume, flexible rubber or other materials suitable to carry accumulated water down the slopes. Outlet protection riprap shall conform to section 506. Erosion control geotextile shall be a minimum Class 2, conforming to subsection 712.08.
- (e) *Silt Berm*. Silt berm shall consist of an ultraviolet (UV) stabilized high-density polyethylene, shall be triangular in shape, and shall have the following dimensions:

Width	6 - 11 inches
Height	6 - 10 inches
Weight	0.3 - 1.4 lbs./sq. ft.
Percent Open Area	30 – 50%

Securing spikes shall be 10 to 12 inch x 0.375 inch diameter (minimum).

- (f) *Rock Check Dam*. Rock Check dams shall be constructed of stone. Stone shall meet the requirements of Section 506.
- (g) *Sediment Trap*. In constructing an excavated Sediment Trap, excavated soil may be used to construct the dam embankment, provided the soil meets the requirements of subsection 203.03. Outlet protection riprap shall be the size specified in the Contract and shall conform to Section 506. Erosion control geotextile shall be a minimum Class 1, conforming to subsection 712.08.
- (h) *Erosion log*. Shall be one of the following types unless otherwise shown on the plans:

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- (1) Erosion Log (Type 1) shall be curled aspen wood excelsior with a consistent width of fibers evenly distributed throughout the log. The casing shall be seamless, photo-degradable tube netting and shall have minimum dimensions as shown in Table 208-1, based on the diameter of the log called for on the plans. The curled aspen wood excelsior shall be fungus free, resin free, and free of growth or germination inhibiting substances.
- (2) Erosion Log (Type 2) shall consist of a blend of 30-40 percent weed free compost and 60-70 percent wood chips. The compost/wood blend material shall pass a 50 mm (2 inch) sieve with a minimum of 70 percent retained on the 9.5 mm (3/8 inch) sieve and comply to subsection 212.02 for the remaining compost physical properties. The compost/wood chip blend may be pneumatically shot into a geotextile cylindrical bag or be pre-manufactured. The geotextile bag shall consist of material with openings of 1/8 to 3/8 inches of HDPE or polypropylene mesh (knitted, not extruded), and contain the compost/wood chip material while not limiting water infiltration.

Erosion log (Type 1 and Type 2) shall have minimum dimensions as shown in Table 208-1, based on the diameter of the log.

**Table208-1
 NOMINAL DIMENSIONS OF EROSION LOGS**

Diameter Type 1 (Inches)	Diameter Type 2 (Inches)	Length (feet)		Weight (minimum) (pounds/foot)	Stake Dimensions (Inches)
		Min.	Max.		
9	8	10	180	1.6	1.5 by 1.5 (nominal) by 18
12	12	10	180	2.5	1.5 by 1.5(nominal) by 24
20	18	10	100	4.0	2 by 2 (nominal) by 30

Stakes to secure erosion logs shall consist of pinewood or hardwood.

- (i) *Silt Dikes.* Silt dikes shall be pre-manufactured triangular shaped urethane foam covered with a woven geotextile fabric. The fabric aprons shall extend a minimum of two feet beyond each side of the triangle.

Each silt dike shall have the following dimensions:

Dimension	Length
Center height	8 to 10 inches
Base	16 to 21 inches
Section length	3 to 7 feet
Section width including fabric extensions	5.6 feet

Staples shall be 6 gauge and at least 8 inches long.

- (j) *Concrete Washout Structure.* The Contractor shall construct a washout structure that will contain washout from concrete placement and construction equipment cleaning operations. Embankment required for the concrete washout structure may be excavated material, provided that this material meets the requirements of Section 203 for embankment.

A pre-fabricated concrete washout structure shall only be used when specified in the Contract. It shall consist of a watertight container designed to contain liquid and solid waste from concrete washout.

- (k) *Vehicle Tracking Pad.* Aggregate for the vehicle tracking pad shall be crushed natural aggregate with at least two fractured faces that meets the following gradation requirements:

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(l)

Sieve size	Percent by weight Passing Square Mesh Sieves
75 mm (3 inch)	100
50 mm (2 inch)	0-25
19.0 mm (¾ inch)	0-15

Recycled crushed concrete or asphalt shall not be used for vehicle tracking pads.

Erosion Control Geotextile shall be Class 2 and conform to the requirements of subsection 712.08.

Pre-fabricated vehicle tracking pads if specified in the Contract shall have the following properties.

Minimum overall dimensions of the modular systems shall be:

Width of pad along edge of roadway	14 feet
Length of pad	30 feet

Weight (min.) (lbs./sq. ft.)	8
Crush strength (min.) (psi)	400

(m) *Aggregate Bag.* Aggregate bags shall consist of crushed stone or recycled rubber filled fabric with the following properties:

Diameter (inches)	Weight (minimum) (pounds per foot)
6-8	6
10	10
12	15

Rubber used in bags shall be clean, 95 percent free of metal and particulates.

Crushed stone contained in the aggregate bags shall conform to subsection 703.09, Table 703-7 for Class C.

The aggregate bag shall consist of a woven geotextile fabric with the following properties:

Property	Requirement	Test Method
Grab Tensile Strength	90 lbs. min.	ASTM D 4632
Trapezoid Tear Strength	25 lbs. min.	ASTM D 4533
Mullen Burst	300 psi	ASTM D 3786
Ultraviolet Resistance	70%	ASTM D 4355

(n) *Storm Drain Inlet Protection.* Storm drain inlet protection shall consist of aggregate filled fabric with the following dimensions:

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(o)

Storm Drain Inlet Protection Properties	Protection Types		
	¹ Type I	Type II	³ Type III
Diameter	4 in.	4 in.	N/A
Minimum Section Length	7 ft.	5 ft.	5 ft.
Apron Insert	---	30 in. or sized to grate	30 in or sized to grate
¹ Type I protection shall be used with Inlet Type R. ² Type II protection shall be used with Combination Inlet. Option A or B ³ Type III protection Inlet Vane Grate only. Option A or B			

The storm drain inlet protection (Type I, II and III) shall consist of a woven geotextile fabric with the following properties:

Property	Test Method	Unit	Requirement
Grab tensile strength	ASTM D 4632	lbs.	minimum 350X280
Mullen Burst Strength	ASTM D 3786	lbs.	600
Trapezoid Tear Strength	ASTM D 4533	lbs.	minimum 110X95
Percent Open Area	COE-22125-86	%	28
Water Flow Rate	ASTM D 4491	gal./min./sq. ft.	250
Ultraviolet Resistance	ASTM D 4355	%	70

Curb roll for storm drain inlet protection (Type I and II) shall have an approximate weight of 7 to 10 pounds per linear foot of device. The device shall be capable of conforming to the shape of the curb. Aggregate contained in the storm drain inlet device shall consist of gravel or crushed stone conforming to Table 703-7 for Class C.

Storm drain inlet protection (Type III) shall have insert containment (option A) or insert without storage capacity (option B).

CONSTRUCTION REQUIREMENTS

208.03 Project Review, Schedule, and Transportation Erosion Control Supervisor. Prior to construction, an on-site Environmental Pre-construction Conference shall be held. The conference shall be attended by:

- (1) The Engineer,
- (2) The Superintendent,
- (3) The Contractor's SWMP Administrator
- (4) Supervisors or Foremen of subcontractors working on the project,
- (5) The Region Water Pollution Control Manager (RWPCM), and

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- (6) CDOT personnel (e.g., CDOT Landscape Architect) who prepared or reviewed the Stormwater Management Plan (SWMP).

At this conference, the attendees shall discuss the SWMP, CDPS-SCP, sensitive habitats on site, wetlands, other vegetation to be protected, and the enforcement mechanisms for not meeting the requirements of this specification.

Prior to beginning construction the Contractor shall evaluate the project site for storm water draining into or through the site. When such drainage is identified, BMPs (i.e., Control Measures) shall be used if possible to divert stormwater from running on-site and becoming contaminated with sediment or other pollutants. The diversion may be accomplished with a temporary pipe or other conveyance to prevent water contamination or contact with pollutants. Run-on water that cannot be diverted shall be treated as construction runoff and adequate BMPs shall be employed.

The SWMP Administrator shall evaluate all non-stormwater coming onto the site, such as springs, seeps, and landscape irrigation return flow. If such flow is identified, BMPs shall be used to protect off-site water from becoming contaminated with sediment or other pollutants.

The SWMP Administrator shall review existing inlets and culverts to determine if inlet protection is needed due to water flow patterns. Prior to beginning construction, inlets and culverts needing protection shall be protected and the location of the implemented BMP added to the SWMP site map.

Prior to construction, the Contractor shall implement appropriate BMPs for protection of wetlands, sensitive habitat and existing vegetation from ground disturbance and other pollutant sources, in accordance with the approved project schedule as described in subsection 208.03(b).

When additional BMPs are required and approved by the Engineer, the Contractor shall implement the additional BMPs and the SWMP Administrator shall record and describe them on the SWMP site map. The approved BMPs will be measured and paid for in accordance with subsections 208.11 and 208.12.

- (a) *Project Review.* The Contractor may submit modifications to the Contract's BMPs in a written proposal to the Engineer. The written proposal shall include the following information:

- (1) Reasons for changing the BMPs.
- (2) Diagrams showing details and locations of all proposed changes.
- (3) List of appropriate pay items indicating new and revised quantities.
- (4) Schedules for accomplishing all erosion and sediment control work.
- (5) Effects on permits or certifications caused by the proposed changes.

The Engineer will approve or reject the written proposal in writing within 5 working days after the submittal. The Engineer may require additional control measures prior to approving the proposed modifications. Additional modifications and additional BMPs will be paid for at the Contract Unit Price for the specific items involved. If no items exist, they will be paid for as extra work in accordance with subsection 109.04.

- (b) *Erosion and Sediment Control Activities.* The erosion and sediment control activities shall be included in the weekly meeting update. The project schedule shall specifically indicate the sequence of clearing and grubbing, earthwork operations, and construction of temporary and permanent erosion control features and stabilization. Project schedule shall include erosion and sediment control work for haul roads, borrow pits, storage and asphalt or concrete batch sites, and all areas within the project limits. If during construction the Contractor proposes changes which would affect the Contract's BMPs, the Contractor shall propose revised BMPs to the Engineer for approval in writing. If necessary, the SWMP Administrator shall update proposed sequencing of major activities in the SWMP. Revisions shall not be implemented until the proposed measures have been approved in writing by the Engineer.
- (c) *Erosion Control Management (ECM).* Erosion Control Management for this project shall consist of Erosion Control Inspection and the Administration of the Stormwater Management Plan (SWMP). All ECM staff shall have working knowledge and experience in construction, and shall have successfully completed the Transportation Erosion Control Supervisory Certificate Training (TECS) as provided by the Department. The Superintendent will not be permitted to serve in an ECM role. The Erosion Control Inspector and the Stormwater Administrator may be the same person in projects involving less than 40 acres of disturbed area.

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1. Stormwater Management Plan (SWMP) Administration. The SWMP Plan shall be maintained by a SWMP Administrator. The SWMP Administrator shall have completed the TECS certification training as provided by the Department. In the case of a project requiring only one TECS, the SWMP Administrator may also be the Erosion Control Inspector for the project. The name of the SWMP Administrator shall be recorded on SWMP Plan Section 3. B. The SWMP Administrator shall have full responsibility to maintain and update the SWMP Plan and identify to the Superintendent critical action items needed to conform to the CDPS-SCP as follows:
 - (1) Complete the SWMP Notebook as described in subsection 208.03 (d).
 - (2) Participate in the Environmental Pre-construction Conference
 - (3) Attend weekly meetings
 - (4) Attend all Headquarter and Region water quality control inspections. The Contractor and the Contractor's SWMP Administrator will be notified a minimum of five days in advance of each inspection by the CDOT region or headquarter water quality staff.
 - (5) Coordinate with the Superintendent to implement necessary actions to reduce anticipated or presently existing water quality or erosion problems resulting from construction activities.
 - (6) Coordinate with the Superintendent to ensure that all labor, material, and equipment needed to install, maintain, and remove BMPs are available as needed.
 - (7) During construction, update and record the following items on the SWMP site map as changes occur:
 - (i) Limits of Construction (LOC).
 - (ii) Areas of disturbance (AD)
 - (iii) Limits of Disturbance (LDA)
 - (iv) Limits of cut and fill.
 - (v) Areas used for storage of construction materials, equipment, soils, or wastes.
 - (vi) Location of any dedicated asphalt or concrete batch plants.
 - (vii) Location of construction offices and staging areas.
 - (viii) Location of work access routes during construction.
 - (ix) Location of borrow and waste.
 - (x) Location of temporary, interim and permanent stabilization.
 - (xi) Location of outfall(s)
 - (xii) Arrows showing direction of surface flow
 - (xiii) Structural and non-structural BMPs
 - (xiv) LDA and LOC lines as defined in subsection 107.25
 - (8) Amend the SWMP whenever there are: additions, deletions, or changes to BMPs. SWMP revisions shall be recorded immediately. Items shall be dated and initialed by the SWMP Administrator. Specifically, amendments shall include the following:
 - (i) A change in design, construction, operation, or maintenance of the site which would require the implementation of new or revised BMPs; or

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- (ii) Changes when the SWMP proves to be ineffective in achieving the general objectives of controlling pollutants in stormwater discharges associated with construction activity.
 - (iii) Changes when BMPs are no longer necessary and are removed.
- (9) Complete vegetative survey transects when required in accordance with CDOT Erosion Control and Stormwater Quality Guide.
- (10) Start a new site map before the current one becomes illegible. All site maps shall remain in the SWMP notebook.
- (11) Document all inspection and maintenance activities. The SWMP and documentation shall be kept on the project site.
- (12) When adding or revising BMPs on the SWMP, add a narrative explaining what, when, where, why, and how the BMP is being used, and add a detail to the SWMP notebook.
- (i) How to install and inspect the BMP
 - (ii) Where to install the BMP
 - (iii) When to maintain the BMP
- (13) If using existing topography, vegetation, etc. as a BMP, label it as such on the SWMP site map; add a narrative as to when, where, why, and how the BMP is being used.
- (14) Indicate BMPs in use or not in use by recording on Standard Plans M-208-1, M-216-1, and M-615-1 in the SWMP notebook
- (15) Record on the SWMP, the approved Method Statement for Containing Pollutant Byproducts.
- (16) Update the potential pollutants list in the SWMP notebook and Spill Response Plan throughout construction.
2. Erosion Control Inspection.
- Erosion control inspection shall be performed by TECS certified staff assigned as Erosion Control Inspector (ECI) to the project. One ECI is required for every 40 acres of total disturbed area which is currently receiving temporary and interim stabilization measures as defined in subsection 208.04 (e). An ECI shall not be responsible for more than 40 acres in the project. Accepted permanent stabilization methods as defined in subsection 208.04 (e) will not be included in the 40 acres.
- ECI duties shall be as follows:
- (1) Coordinate with the SWMP Administrator on reporting the results of inspections
 - (2) Review the construction site for compliance with the Stormwater Construction Permit.
 - (3) Inspect with the Superintendent and the Engineer (or their designated representatives) the stormwater management system at least every seven calendar days. Post storm event inspections shall be conducted within 24 hours after the end of any precipitation or snow melt event that may cause surface erosion. If no construction activities will occur following a storm event, post-storm event inspections shall be conducted prior to commencing construction activities, but no later than 72 hours following the storm event. The occurrence of delay in inspections shall be documented in the inspection report. Form 1176 shall be used for all 7 day inspections and inspections following storm events. The Contractor shall notify the Erosion control inspector when a storm event occurs. Failure to perform inspections on time will result in liquidated damages in accordance with subsection 208.09.

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Inspections are not required at sites when construction activities are temporarily halted, when snow cover exists over the entire site and melting conditions do not pose a risk of surface erosion. This exception shall be applicable only during the period where melting conditions do not exist, and applies to the routine 7 day, Headquarters and Region inspections, as well as the post-storm event inspections. The following information shall be documented on Form 1176 for use of this exclusion: dates when snow cover occurred, date when construction activities ceased, and date melting conditions began.

The order of precedence for required inspections shall be as follows:

- (i) Headquarter water quality inspections
- (ii) Region water quality inspections
- (iii) Post-storm event inspections
- (iv) 7 day inspections

When one of the listed inspections is performed, the inspections listed below it need not be performed on that day if the required CDOT and Contractor personnel participated in the inspection.

For example: A 7 day inspection is not required on the same day a headquarters or Region inspection is conducted. A sheet shall be placed in the inspections area of the SWMP Notebook to refer to the date inspection performed.

- (4) Follow all other agency Stormwater requirements and inspections unless a waiver or other agreement has been made.
 - (5) The ECI shall immediately report to the Contractor's Superintendent and the SWMP Administrator the following instances of noncompliance:
 - (i) Noncompliance which may endanger health or the environment.
 - (ii) Spills or discharge of hazardous substance or oil which may cause pollution of waters of the State.
 - (iii) Discharge of stormwater which may cause an exceedance of a water quality standard.
 - (iv) Upset conditions that occur on site.
 - (6) Spills, leaks, or overflows that result in the discharge of pollutants shall be documented on the Form 1176 by the ECI. The ECI shall record the time and date, weather conditions, reasons for spill, and how it was remediated.
- (d) *Documentation Available on the Project.* The following Contract documents and references will be made available for reference at the CDOT field office during construction:
1. SWMP Notebook. The Engineer will provide a SWMP Notebook at the Preconstruction Conference, which is and shall remain the property of CDOT. CDOT will initially provide the documentation for the first four items when available. The Contractor shall provide the contents required for items (5) through (18). The notebook shall be stored in the CDOT field office or at another on-site location approved by the Engineer. The SWMP Administrator shall modify and update the notebook as needed to reflect actual site conditions, prior to or as soon as practicable but in no case more than 72 hours after the change. The following Contract documents and reports shall be kept, maintained, and updated in the notebook under the appropriate items by the SWMP Administrator:

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- (1) SWMP Plan Sheets - Notes, tabulation, sequence of major activities, area of disturbance, existing soil data, existing vegetation percent cover, potential pollutant sources, receiving water, non-stormwater discharges and environmental impacts.
- (2) Site Map and Plan Title Sheet - Construction site boundaries, ground surface disturbance, limits of cut and fill, flow arrows, structural BMPs, non-structural BMPs, Springs, Streams, Wetlands and surface water. Also included on the sheets is the protection of trees, shrubs and cultural resources.
- (3) Specifications - Standard and Project special provisions related to Stormwater and Erosion Control.
- (4) Standard Plans M-208-1, M-216-1 and M-615-1
- (5) BMP Details not in Standard Plan M-208-1 - Non-standard details.
- (6) Weekly meeting sign in sheet.
- (7) Calendar of Inspections -Calendar of inspections marking when all inspections take place.
- (8) Form 1176 – Weekly meeting notes and inspection report
- (9) Region and Headquarter Water Quality Reports and Form 105(s) relating to Water Quality.
- (10) Description of Inspection and Maintenance Methods - Description of inspection and maintenance methods implemented at the site to maintain all BMPs identified in the SWMP and Items not addressed in the design
- (11) Spill Response Plan - Reports of reportable spills submitted to CDPHE
- (12) List and Evaluation of Potential Pollutants - List of potential pollutants as described in subsection 107.25 and approved Method Statement for Containing Pollutant Byproducts.
- (13) Other Correspondence e.g., agreements with other MS4s, approved deferral request, CDPHE audit documentation, Water Quality Permit Transfer to Maintenance Punch List and other miscellaneous documentation.
- (14) TECS Certifications of the SWMP Administrator and all ECIs, keep current through the life of the project.
- (15) Environmental Pre-construction Conference – Conference agenda with a certification of understanding of the terms and conditions of the CDPS-SCP and SWMP. The certification shall be signed by all attendees. A certification shall also be signed by all attendees of meetings held for new subcontractors beginning work on the project that could adversely affect water quality after the Environmental Pre-construction Conference has been held.
- (16) All Project Environmental Permits - All project environmental permits and associated applications and certifications, including, CDPS-SCP, Senate Bill 40, USACE 404, temporary stream crossings, dewatering, biological opinions and all other permits applicable to the project, including any separate CDPS-SCP obtained by the Contractor for staging area on private property, asphalt or concrete plant, etc.
- (17) Photographs Documenting Existing Vegetation – Project photographs shall be time stamped on paper with a maximum of four colored images per 8 ½ inch by 11 inch sheet and/or a digital copy of all photographs on CD-ROM/Flash Drive in (JPG format), documenting existing vegetation prior to construction commencing. On the bottom of each photograph shall be a description using Station Number or Mile Post of where the photograph was taken.

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- (18) Permanent Water Quality Plan Sheets - Plan sheets and specifications for permanent water quality structures, riprap.

The Engineer will incorporate the documents and reports available at the time of award. The Contractor shall provide and insert all other documents and reports as they become available during construction. The SWMP Administrator shall finalize the SWMP for CDOT Maintenance use upon completion of the project. SWMP completeness shall be approved by the Engineer, corrections to the SWMP shall be at the Contractor's expense. The following Reference materials shall be used:

- (1) CDOT Erosion Control and Stormwater Quality Guide.
- (2) CDOT Erosion Control and Stormwater Quality Field Guide.

- (e) *Weekly Meetings.* The Engineer, Superintendent and the SWMP Administrator shall conduct a weekly meeting with supervisors involved in construction activities that could adversely affect water quality. The meeting shall follow an agenda prepared by the Engineer or a designated representative, and have a sign in sheet on which the names of all attendees shall be recorded. The SWMP Administrator shall take notes of water quality comments and action items at each weekly meeting, and place the agenda and sign in sheet in the SWMP notebook. At this meeting the following shall be discussed and documented on Form 1176:

- (1) Requirements of the SWMP.
- (2) Problems that may have arisen in implementing the site specific SWMP or maintaining BMPs.
- (3) Unresolved issues from inspections and concerns from last inspection
- (4) BMPS that are to be installed, removed, modified, or maintained.
- (5) Planned activities that will effect stormwater in order to proactively phase BMPs.
- (6) Recalcitrant inspection findings

All subcontractors who were not in attendance at the Environment Pre-construction conference shall be briefed on the project by the Engineer, Superintendent, and the SWMP Administrator prior to start of work. The SWMP Administrator shall record the names of these subcontractors as an addendum to the list of attendees, and added the SWMP Notebook.

208.04 Best Management Practices (BMPs) for Stormwater.

The SWMP Administrator shall modify the SWMP to clearly describe and locate all BMPs implemented at the site to control potential sediment discharges.

Vehicle tracking control shall be used at all vehicle and equipment exit points from the site to prevent sediment exiting the Limits of Construction (LOC) of the project site. Access shall be provided only at locations approved by the Engineer. The SWMP Administrator shall record vehicle tracking control pad locations on the SWMP site map.

New inlets and culverts shall be protected during their construction. Appropriate protection of each culvert and inlet shall be installed immediately. When riprap is called for at the outlet of a culvert, it shall be installed within 24 hours of completion of each pipe. The Contractor shall remove sediment, millings, debris, and other pollutants from within the newly constructed drainage system in accordance with the CDPS-SCP, prior to use, at the Contractor's expense. All removed sediment shall be disposed of outside the project limits in accordance with all applicable regulations.

Concrete products wasted on the ground during construction shall include, but shall not be limited to: excess concrete removed from forms, spills, slop, and all other unused concrete are potential pollutants that shall be contained or protected by an approved BMP at a pre-approved containment area. The concrete shall be picked up and recycled in accordance with 6 CCR 1007-2 (CDPHE Regulations Pertaining to Solid Waste Sites and Facilities) at regular intervals, as directed. The uses of recycled concrete from approved recycling facilities shall be in accordance with Section 203.

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- (a) *Unforeseen Conditions.* The Contractor shall design and implement erosion and sediment BMPs for correcting conditions unforeseen during the design of the project, or for emergency situations, that develop during construction. The Department's "Erosion Control and Stormwater Quality Guide" shall be used as a reference document for the purpose of designing erosion and sediment BMPs. Measures and methods proposed by the Contractor shall be reviewed and approved in writing by the Engineer prior to installation.
- (b) *Other Agencies.* If CDPHE, US Army Corps of Engineers (USACE), or the Environmental Protection Agency (EPA) reviews the project site and requires additional measures to prevent and control erosion, sediment, or pollutants, the Contractor shall cease and desist activities resulting in pollutant discharge and immediately implement these measures. If the work may negatively affect another MS4, the Contractor shall cease and desist activities resulting in the discharge and shall implement appropriate measures to protect the neighboring MS4, including installing additional measures. . Implementation of these additional measures will be paid for at contract unit price.
- (c) *Work Outside the Right of Way.* Disturbed areas, including staging areas, which are outside CDOT ROW and outside easements acquired by CDOT for construction, are the responsibility of the Contractor. These areas may be subject to a separate CDPS-SCP or other permits. The Contractor shall acquire these permits and submit copies to the Engineer prior to any disturbance. These permits, shall be acquired and all erosion and sediment control work performed at the Contractor's expense. These areas are subject to inspections by CDOT or any other agency, as agreed upon in writing.
- (d) *Construction Implementation.* The Contractor shall incorporate BMPs into the project as outlined in the accepted schedule.
- (e) *Stabilization.* Once earthwork has started, the Contractor shall continue erosion BMPs until permanent stabilization of the area has been completed and accepted. Clearing, grubbing and slope stabilization measures shall be performed regularly to ensure final stabilization. Failure to properly maintain erosion control and stabilization methods, either through improper phasing or sequencing will require the Contractor to repair or replace sections of earthwork at his expense. The Contractor shall schedule and implement the following stabilization measures during the course of the project:
- (1) *Temporary Stabilization.* At the end of each day, the Contractor shall stabilize disturbed areas by surface roughening, vertical tracking, or a combination thereof. Disturbed areas are locations where actions have been taken to alter the existing vegetation and/or underlying soil of a site, such as clearing, grading, road bed preparation, soil compaction, and movement and stockpiling of top soils. Other stabilization measures may be implemented, as approved. The maximum area of temporary stabilization shall not exceed 20 acres.
 - (2) *Interim Stabilization.* Stockpiles and disturbed areas as soon as known with reasonable certainty that work will be temporarily halted for 14 days or more shall be stabilized using one or more of the specified following methods:
 - (i) Application of 1.5 tons of mechanically crimped certified weed free hay or straw in combination with an approved organic mulch tackifier.
 - (ii) Placement of bonded fiber matrix in accordance with Section 213.
 - (iii) Placement of mulching (hydraulic) wood cellulose fiber mulch with tackifier, in accordance with Section 213.
 - (iv) Application of spray-on mulch blanket in accordance with Section 213. Magnesium Chloride, Potassium Chloride and Sodium Chloride, or other salt products, will not be permitted as a stabilization method.

Protection of the interim stabilization method is required. Reapplication may be required as approved.

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- (3) Summer and Winter Stabilization. Summer and winter stabilization is defined as months when seeding will not be permitted. As soon as the Contractor knows shutdown is to occur, interim stabilization shall be applied to the disturbed area. Protection of the interim stabilization method is required. Reapplication of interim stabilization may be required as directed.
- (4) Permanent Stabilization. Permanent stabilization is defined as the covering of disturbed areas with seeding, mulching with tackifier, soil retention coverings, and such non-erodible methods such riprap, road shouldering, etc., or a combination thereof as required by the Contract. Other permanent stabilization techniques may be proposed by the Contractor, in writing, and shall be used when approved in writing by the Engineer. Permanent stabilization shall begin within 48 hours after topsoil placement, soil conditioning, or combination thereof starts and shall be pursued to completion.
- (5) Final Stabilization. Final stabilization is defined as when all ground disturbing activities at the site have been completed, and uniform vegetative cover has been established with an individual plant density of at least 70 percent of pre-disturbance levels, or equivalent permanent physical erosion reduction methods have been employed.
- (f) *Maintenance.* Erosion and sediment control practices and other protective measures identified in the SWMP as BMPs for stormwater pollution prevention shall be maintained in effective operating condition until the CDPS-SCP has been transferred to CDOT. BMPs shall be continuously maintained in accordance with good engineering, hydrologic and pollution control practices, including removal of collected sediment when silt depth is 50 percent or more of the height of the erosion control device. When possible, the Contractor shall use equipment with an operator rather than labor alone to remove the sediment.

Maintenance of erosion and sediment control devices shall include replacement of such devices upon the end of their useful service life as recommended by the Contractor and approved by the Engineer. Maintenance of rock check dams and vehicle tracking pads shall be limited to removal and disposal of sediment or addition of aggregate. Damages resulting from failure to maintain BMPs shall be paid at the contractors expense.

Complete site assessment shall be performed as part of comprehensive inspection and maintenance procedures, to assess the adequacy of BMPs at the site and the necessity of changes to those BMPs to ensure continued effective performance. Where site assessment results in the determination that new or replacement BMPs are necessary, the BMPs shall be installed to ensure continuous effectiveness. When identified, BMPs shall be maintained, added, modified or replaced as soon as possible, immediately in most cases.

Approved new or replaced BMPs will be measured and paid for in accordance with subsections 208.11 and 208.12. Devices damaged due to the Contractor's negligence shall be replaced at Contractor's expense.

From the time seeding and mulching work begins until the date the Contract work is accepted, the Contractor shall maintain all seeded areas. Damage to seeded areas or to mulch materials shall be immediately restored. Damage to seeded areas or to mulch materials due to Contractor negligence shall be immediately restored at the Contractor's expense. Restoration of other damaged areas will be measured and paid for under the appropriate bid item.

Temporary BMPs may be removed upon completion of the project, as determined by the Water Quality Partial Acceptance walk-through. If removed, the area in which these BMPs were constructed shall be returned to a condition similar to that which existed prior to its disturbance. Removed BMPs shall become the property of the Contractor.

If a project delay occurs, the Contractor shall be responsible to continue erosion and sediment control operations beyond the original contract time.

Sediment removed during maintenance of BMPs and material from street sweeping may be used in or on embankment, provided it meets conditions of Section 203 and is distributed evenly across the embankment.

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Whenever sediment collects on the paved surface, the surface shall be cleaned. Street washing will not be allowed. Storm drain inlet protection shall be in place prior to shoveling, sweeping, or vacuuming. Sweeping shall be completed with a pickup broom or equipment capable of collecting sediment. Sweeping with a kick broom will not be allowed.

Material from pavement saw cutting operations shall be cleaned from the roadway surface during operations using a vacuum. A BMP, such as a berm, shall be placed to contain slurry from joint flushing operations until the residue can be removed from the soil surface. Aggregate bags, erosion logs or other permeable BMPs shall not be used. Residue shall not flow into driving lanes. It shall be removed and disposed of in accordance with subsection 107.25(b) 13. Material containment and removal will not be paid for separately, but shall be included in the work.

208.05 Construction of BMPs. BMPs shall be constructed in accordance with Standard Plans M-208-1, M-216-1 and with the following.

- (a) *Seeding, Mulching, Sodding, Soil Retention Blanket.* Seeding, mulching, sodding, and soil retention blanket shall be performed in accordance with Sections 212, 213, and 216.
- (b) *Erosion Bales.* The bales shall be anchored securely to the ground with wood stakes.
- (c) *Silt Fence.* Silt fence shall be installed in locations specified in the Contract prior to any grubbing or grading activity.
- (d) *Temporary Berms.* Berms shall be constructed to the dimensions shown in the Contract, and sufficiently compacted to prevent erosion or failure. If the berm erodes or fails, it shall be immediately repaired or replaced at the Contractor's expense.
- (e) *Temporary Diversion.* Diversions shall be constructed to the dimensions shown in the Contract, and graded to drain to a designated outlet. The berm shall be sufficiently compacted to prevent erosion or failure. If the diversion erodes or fails, it shall be immediately repaired or replaced at the Contractor's expense.
- (f) *Temporary Slope Drains.* Temporary slope drains shall be installed prior to installation of permanent facilities or growth of adequate ground cover on the slopes. All temporary slope drains shall be securely anchored to the slope. The inlets and outlets of temporary slope drains shall be protected to prevent erosion.
- (g) *Silt Berm.* Prior to installation of silt berms, the Contractor shall prepare the surface of the areas in which the berms are to be installed such that they are free of materials greater than 2 inches in diameter and are suitably smooth for the installation of the silt berms, as approved. Silt berms shall be secured with spikes. The Contractor shall install the silt berm in a manner that will prevent water from going around or under the silt berm. Silt berms shall be installed on top of soil retention blanket.
- (h) *Rock Check Dam.* Rock shall be installed at locations shown on the plans. Rock check dams shall conform to the dimensions shown on the plans.
- (i) *Riprap Outlet Protection.* Geotextile used shall be protected from cutting or tearing. Overlaps between two pieces of geotextile shall be 1 foot minimum. Riprap size shall be as shown on the plans.
- (j) *Storm Drain Inlet Protection.* Prior to installation, the Contractor shall sweep the surface of the area in which the storm drain inlet protection devices are to be installed such that the pavement is free of sediment and debris. The ends of the inlet protection Type 1 and Type 2 shall extend a minimum of 1 foot past each end of the inlet.

The Contractor shall remove all accumulated sediment and debris from the surface surrounding all storm drain inlet protection devices after each rain event or as directed. The Contractor shall remove accumulated sediment from Type II and III containment area when it is more than a maximum one third full of sediment, or as directed.

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The Contractor shall protect storm drain facilities adjacent to locations where pavement cutting operations involving wheel cutting, saw cutting, sand blasting, or abrasive water jet blasting are to take place.

- (k) *Sediment Trap*. Sediment traps shall be installed to collect sediment laden water and to minimize the potential of pollutants leaving the project site. Locations shall be as shown on the plans or as directed.

Sediment traps shall be constructed prior to disturbance of upslope areas and shall be placed in locations where runoff from disturbed area can be diverted into the trap.

The area under the embankment shall be cleared, grubbed and stripped of any vegetation and roots.

Fill material for the embankment shall be free of roots or other vegetation, organic material, large stones, and other objectionable material.

Sediment shall be removed from the trap when it has accumulated to one half of the wet storage depth of the trap and shall be disposed of in accordance with subsection 208.04(f).

- (l) *Erosion Logs*. Erosion logs shall be embedded 2 inches into the soil. Stakes shall be embedded to a minimum depth of 12 inches. At the discretion of the Engineer, a shallower depth may be permitted if rock is encountered.

The Contractor shall maintain the erosion logs during construction to prevent sediment from passing over or under the logs.

- (m) *Silt Dikes*. Prior to installation of silt dikes, the Contractor shall prepare the surface of the areas in which the silt dikes are to be installed such that they are free of materials greater than two inches in diameter and are suitably smooth for the installation of the silt dikes, as approved by the Engineer.

- (n) *Concrete Washout Structure*. The concrete washout structure shall meet or exceed the dimensions shown on the plans or be used in accordance with manufacturer's recommendations. Work on this structure shall not begin until written acceptance is provided by the Engineer.

Concrete washout structure shall conform to standard plan M-208-1 and shall meet the following requirements:

- (1) Structure shall contain all washout water.
- (2) Stormwater shall not carry wastes from washout and disposal locations.
- (3) The site shall be located a minimum of 50 horizontal feet from State waters and shall meet all requirements for containment and disposal as defined in subsection 107.25.
- (4) The site shall be signed as "Concrete Washout".
- (5) The site shall be accessible to appropriate vehicles.
- (6) Freeboard capacity shall be included into structure design to reasonably ensure the structure will not overtop during or because of a precipitation events.
- (7) The Contractor shall prevent tracking of washout material out of the washout structure.
- (8) Solvents, flocculents, and acid shall not be added to wash water.
- (9) The structure shall be surrounded on three sides by a compacted berm.

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- (10) The structure shall be fenced with orange plastic construction fencing to provide a barrier to construction equipment and to aid in identification of the concrete washout area.
- (11) Concrete waste, liquid and solid, shall not exceed 2/3 the storage capacity of the washout structure.

Pre-fabricated concrete washout structures shall meet the following requirements:

- (1) Structure shall contain all washout water.
- (2) Structure shall be located 50 horizontal feet away from State waters, and shall be confined so that no potential pollutants will enter State waters and other sensitive areas are as defined in the Contract. Locations shall be as approved by the Engineer. The site shall be delineated with orange plastic fence or other means and signed as "Concrete Washout".
- (3) The site shall be accessible to appropriate vehicles.
- (4) Freeboard capacity shall be included into structure design to reasonably ensure the structure will not overtop during or because of a precipitation event.
- (5) Solvents, flocculants, and acid shall not be added to wash water.
- (6) Concrete waste, liquid and solid, shall not exceed 2/3 the storage capacity of the washout structure.
- (7) Prefabricated structures cannot be moved when they contain liquid, unless otherwise approved.
- (8) The concrete washout structure shall be completed and ready for use prior to concrete placement operations.
- (9) Washout areas shall be checked and maintained as required. On site permanent disposal of concrete washout waste is not allowed.

All liquid and solid wastes, including contaminated sediment and soils generated from concrete washout shall be hauled away from the site and disposed of properly at the Contractor's expense.

- (o) *Vehicle Tracking Pad (VTP)*. Vehicle tracking pads shall be constructed to the minimum dimensions shown in the Contract, unless otherwise directed by the Engineer. Construction of approved vehicle tracking pads shall be completed before any disturbance of the area.

The Contractor shall maintain each vehicle tracking pad during the entire time that it is in use for the project. The vehicle tracking pad shall be removed at the completion of the project unless otherwise directed by the Engineer. Additional aggregate may be required for maintenance and will be paid for under Pay Item, Maintenance Aggregate (Vehicle Tracking Pad).

- (p) *Detention Pond*. Permanent detention ponds shown on the construction plans may be used as temporary BMPs if all the following conditions are met:
 - (1) The pond is designated as a construction BMP in the SWMP.
 - (2) The pond outfall and outlet are designed and implemented for use as a BMP during construction in accordance with good engineering, hydrologic, and pollution control practices. The stormwater discharges from the outfall shall not cause degradation or pollution of State waters, and shall have BMPs, as appropriate.
 - (3) All silt shall be removed and the pond returned to the design grade and contour prior to project acceptance

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- (q) *Aggregate Bag.* Aggregate bags shall be placed on a stable surface, consisting of pavement, grass or gravel. Aggregate bags shall be placed to conform to the surface without gaps. Discharge water shall not cause erosion.
- (r) *Surface Roughening.* Surface roughening creates horizontal grooves along the contour of the slope. Roughening may be accomplished by furrowing, scarifying, ripping or disking the soil surface to create a 2 to 4 inch minimum variation in soil surface. Surface roughening will not be paid for separately, but shall be included in the work.
- (s) *Vertical Tracking.* Vertical tracking involves driving a tracked vehicle up and down the soil surface and creating horizontal grooves and ridges along the contour of the slope. Sandy soils or soils that are primarily rock need not be tracked. Vertical tracking will not be paid for separately, but shall be included in the work.

208.06 Materials Handling and Spill Prevention. The SWMP Administrator shall clearly describe and record on the SWMP, all practices implemented at the site to minimize impacts from procedures or significant material that could contribute pollutants to runoff. Areas or procedures where potential spills can occur shall have a Spill Response Plan in place as specified in subsections 107.25(b) 6 or 208.06(c). Construction equipment, fuels, lubricants, and other petroleum distillates shall not be stored or stockpiled within 50 horizontal feet of any State waters or more if the Contractor determines necessary. Equipment fueling and servicing shall occur only within approved designated areas.

- (a) *Bulk Storage Structures.* Bulk storage structures for petroleum products and other chemicals shall have impervious secondary containment or equivalent adequate protection so as to contain all spills and prevent any spilled material from entering State waters. Secondary containment shall be capable of containing the combined volume of all the storage containers plus at least 10 percent freeboard. For secondary containment that is used and may result in accumulation of stormwater within the containment, a plan shall be implemented to properly manage and dispose of all accumulated stormwater which is deemed to be contaminated (e.g., has an unusual odor or sheen).
- (b) *Lubricant Leaks.* The Contractor shall inspect equipment, vehicles, and repair areas daily to ensure petroleum, oils, and lubricants (POL) are not leaking onto the soil or pavement. Absorbent material or containers approved by the Engineer shall be used to prevent leaking POL from reaching the soil or pavement. The Contractor shall have onsite approved absorbent material or containers of sufficient capacity to contain any POL leak that can reasonably be foreseen. The Contractor shall inform all Spill Response Coordinators in accordance with the Spill Response Plan if unforeseen leakage is encountered. All materials resulting from POL leakage control and cleanup shall become the property of the Contractor and shall be removed from the site. Control, cleanup, and removal of by-products resulting from POL leaks shall be performed at the Contractor's expense.
- (c) *Spill Response Plan.* A spill Response Plan shall be developed and implemented to establish operating procedures for handling potential pollutants and preventing spills.

The Response Plan shall contain the following information:

- (1) Identification and contact information of each Spill Response Coordinator
- (2) Locations of areas on project site where equipment fueling and servicing operations are permitted.
- (3) Location of cleanup kits.
- (4) Quantities of chemicals and locations stored on site.
- (5) Label system for chemicals and Safety Data Sheets (SDS) for products.
- (6) Clean up procedures to be implemented in the event of a spill that does not enter State waters or ground water.

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- (7) Procedures for spills of any size that enter surface waters or ground water, or have the potential to do so. CDOT's Erosion Control and Stormwater Quality Guide contains Spill notification contacts and phone numbers required in the Spill Response Plan.
- (8) A summary of the employee training provided.

Information in items (1) through (8) shall be updated in the SWMP Notebook when they change.

208.07 Stockpile Management. Material stockpiles shall be located 50 horizontal feet away from State waters, and shall be confined so that no potential pollutants will enter State waters and other sensitive areas as defined in the Contract. Locations shall be approved by the Engineer.

Erodible stockpiles (including topsoil) shall be contained with acceptable BMPs at the toe (or within 20 feet of the toe) throughout construction. BMPs shall be approved by the Engineer. The SWMP Administrator shall describe, detail, and record the sediment control devices on the SWMP.

208.08 Limits of Disturbance. The Contractor shall limit construction activities to those areas within the limits of disturbance shown on the plans and cross-sections. Construction activities, in addition to the Contract work, shall include the on-site parking of vehicles or equipment, on-site staging, on-site batch plants, haul roads or work access, and all other action which would disturb existing soil conditions. Staging areas within the LDA shall be as approved by the Engineer. Construction activities beyond the limits of disturbance due to Contractor negligence shall be restored to the original condition by the Contractor at the Contractor's expense. The SWMP Administrator shall tabulate additional disturbances not identified in the CDPS_SCP application and indicate changes to locations and quantities on the SWMP. The Contractor shall report the changes and additional disturbances to the Engineer, Water Quality Control Division of CDPHE and all other involved agencies.

The Contractor shall pursue and stabilize all disturbances to completion.

208.09 Failure to Perform Erosion Control. Failure to implement the Stormwater Management Plan is a violation of the CDPS – SCP and CDOT specifications. CDOT is obligated to implement enforcement mechanisms in accordance with CDOT's MS4 Permit COS000005 for Stormwater Management and erosion control Best Management Practices. Penalties may be assessed to the Contractor by the appropriate agencies. Penalties will be assessed by the Department as liquidated damages for failure to meet the Permit. All fines assessed to the Department for the Contractor's failure to implement the SWMP will be deducted from moneys due the Contractor in accordance with subsection 107.25(c) 2.

The Contractor will be subject to liquidated damages for incidents of failure to perform erosion control as required by the Contract. Liquidated damages will be applied for failure to comply with the CDPS-SCP and these specifications, including the following:

- (1) Failure to include erosion control in the project schedule or failure to include erosion control in each schedule update as specified in subsection 208.03(b).
- (2) Failure of the Contractor to perform the inspections required by subsection 208.03(c) 2.
- (3) Failure of the Contractor to implement necessary actions required by the Engineer as required by subsection 208.03(c).
- (4) Failure to amend the SWMP and implement BMPs as required by subsection 208.04.
- (5) Failure to keep documentation and records current.
- (6) Failure to construct or implement erosion control or spill containment measures required by the Contract, or failure to construct or implement them in accordance with the Contractor's approved schedule as required by subsection 208.06(c).
- (7) Failure to limit temporary stabilization to 20 or fewer acres as required by subsection 208.04 (e).

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- (8) Failure to replace or perform maintenance on an erosion control feature after notice from the Engineer or from a water quality inspection as required by subsection 208.04(f).
- (9) Failure to remove and dispose of sediment from BMPs as required.
- (10) Failure to install and properly utilize a concrete washout structure for containing washout from concrete placement operations.
- (11) Failure to perform stabilization as required by subsection 208.04 (e).
- (12) Failure of the Superintendent or designated representative to attend inspections as required by subsection 208.03(c) and record findings in the appropriate form.
- (13) Failure to prevent discharges not composed entirely of stormwater from leaving the Construction Site.
- (14) Failure to provide the survey of Permanent Water Quality BMPs when required on the project in accordance with 208.10.

The Engineer will immediately notify the Contractor of each incident of failure to perform erosion control in accordance with the CDPS-SCP and these specifications, including items (1) through (14) above by issuing the Form 105. Correction shall be made as soon as possible but no later than 48 hours from the date of notification to correct the failure. The Contractor will be charged liquidated damages in the amount of \$970 for each day after the 48 hour period has expired, that one or more of the incidents of failure to perform the requirements for each Form 105 remains uncorrected. Liquidated damages will begin at Midnight of the date the 48 hours has expired.

This deduction will not be considered a penalty, but will be considered liquidated damages based on estimated additional construction engineering costs. The liquidated damages will accumulate, for each cumulative day that one or more of the incidents remain uncorrected. The number of days for which liquidated damages are assessed will be cumulative for the duration of the project; that is: the damages for a particular day will be added to the total number of days for which liquidated damages are accumulated on the project. The liquidated damages will be deducted from any monies due the Contractor.

If all other failures are not corrected within 48 hours after liquidated damages have begun to be assessed, the Engineer will issue a Stop Work Order in accordance with subsection 105.01. Work shall not resume until the Engineer has approved a written corrective action plan submitted by the Contractor that includes measures to prevent future violations and a schedule for implementation.

If the Contractor requires more than 96 hours to perform the corrective work from the date on the Form 105, the Contractor shall submit a request for deferment. The deferment request shall be in writing and shall include the specific failure, temporary measures until final correction is made, the methodology which will be employed to make the correction and interim milestones to completing the work. The Region Water Pollution Control Manager (RWPCM), Engineer, the SWMP Administrator and the Contractor shall concur on this deferral and set a proposed date of completion. If approved, the Contractor shall complete the corrective measures by Midnight of the proposed completion date. If corrective work is not corrected by the completion date the Engineer will issue a Stop Work Order. Liquidated Damages will apply retroactively back to the 48 hours after the 105 date of notification. Liquidated Damages will be assessed until the corrective work has been completed and accepted.

Deferment of work to correct failures to perform erosion control will not affect the Contractor's other contractual responsibilities, notifications for other non-compliance, nor the final completion date of the project. Liquidated Damages for other non-compliance notifications will continue to apply during the deferment period in addition to liquidated damages associated with the deferment.

Based on the submittal date of the approved deferment Liquidated Damages and a Stop Work Order may not be mandated to the Contractor.

Disagreements regarding the suggested corrective action for a BMP compliance issue between the Project Engineer, SWMP Administrator, and Superintendent, shall be discussed with the Resident Engineer and Region Water Pollution Control Manager. If after the discussions, the Project Engineer and the Contractor are still in disagreement and feel that additional compensation is owed, the Contractor will follow the decision of the Project

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Engineer, keep track of the costs and negotiate further with the Project Engineer. If after pursuing the issue, the Contractor is unable to reach agreement with the Project Engineer, then the Contractor can follow the dispute process outlined in subsection 105.22.

If the Contractor's corrective action plan and schedule are not submitted and approved within 96 hours of the initial notice, the Engineer will issue a Stop Work Order and have an on-site meeting with the Superintendent, SWMP Administrator, and the Superintendent's supervisor. This meeting will also be attended by the Resident Engineer, the Region Water Pollution Control Manager, and the Region Program Engineer. This meeting will identify and document needed corrective actions and a schedule for completion. If after the meeting, the unacceptable work is not remedied within the schedule as agreed to in the meeting, the Engineer will take action to effect compliance with the CDPS-SCP and these specifications by utilizing CDOT Maintenance personnel or other non-Contractor forces and deduct the cost from any moneys due or to become due to the Contractor pursuant to subsection 105.17. Delays due to these Stop Work Orders shall be considered non-excusable. The Stop Work Order shall be in place until the project is in CDPS-SCP compliance.

If the Contractor remains non-responsive to requirements of the on-site meeting, the Engineer will start default or Contract termination procedures in accordance with subsections 108.09 and 108.10. CDOT will proceed with corrective or disciplinary action in accordance with the Rules for Prequalification, Debarment, Bidding and Work on Transportation, Road, Highway and Bridge Public Projects.

When a failure meets any one of the following conditions, the Engineer will immediately issue a Stop Work Order in accordance with subsection 105.01 irrespective of any other available remedy:

- (1) It may endanger health or the environment.
- (2) It consists of a spill or discharge of hazardous substances or oil which may cause pollution of the waters of the state.
- (3) It consists of a discharge which may cause a violation of a water quality standards.

208.10 Items to Be Completed Prior to Requesting Partial Acceptance of Water Quality Work.

- (a) *Reclamation of Washout Areas.* After concrete operations are complete, washout areas shall be reclaimed in accordance with subsection 208.05(n) at the Contractor's expense.
- (b) *Survey.* When Permanent Water Quality BMPs (Permanent BMP) are required on the project, the Contractor shall survey the BMPs to confirm that they conform to the configuration and grade shown on the Plans. The survey shall conform to Section 625. The results of the survey shall be submitted as Microstation or AutoCad drawing files and PDF files, showing both designed and final elevations and configurations. Paper versions of the drawings shall be submitted with the stamp and seal of the Contractor's Surveyor.

The Engineer and the CDOT Hydraulics Engineer for the region will perform a walkthrough of the Permanent BMPs to confirm conformance to material requirements, locations and dimensions of the Permanent BMPs. Permanent BMPs not meeting the Contract requirements will be identified in writing by the Engineer, and shall be repaired or replaced at the Contractor's expense. Correction surveys shall be performed at the Contractor's expense to confirm the locations and dimensions of each Permanent BMP. Final as-built plans of the Permanent BMPs shall be provided to the Engineer and the CDOT Region and Headquarter Permanent Water Quality Control Specialist for their records.

- (c) *Locations of Temporary BMPs.* The Engineer will identify locations where modification, cleaning or removal of temporary BMPs are required, and will provide these in writing to the Contractor. Upon completion of work required, the SWMP Administrator shall modify the SWMP to provide an accurate depiction of BMPs to remain on the project site.

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METHOD OF MEASUREMENT

208.11 Erosion Control Management will be measured as the actual number of days of ECM work performed onsite, regardless of the number of ECIs required, including erosion control inspections, documentation, meeting participation, SWMP Administration, and the preparation of the SWMP notebook.

Erosion bales will be measured by the actual number installed and accepted.

Silt fence, silt berms, erosion logs, aggregate bags, silt dikes, temporary berms, rock check dams, temporary diversions, and temporary slope drains, will be measured by the actual number of linear feet that are installed and accepted. Measured length will not include required overlap.

Concrete washout structure will be measured by the actual number of structures that are installed and accepted.

Storm drain inlet protection will be measured by linear foot or actual number of devices that are installed and accepted.

Sediment trap quantities will be measured by the actual number installed and accepted.

Removal of trash that is not generated by construction activities will be measured by the actual number of hours that Contractor workers actively remove trash from the project. Each week the Contractor shall submit to the Engineer a list of workers and the hours spent collecting such trash.

Removal of accumulated sediment from traps, basins, areas adjacent to silt fences and erosion bales, and other clean out excavation of accumulated sediment, and the disposal of such sediment, will be measured by the number of hours that equipment, labor, or both are used for sediment removal.

Vehicle tracking pads will be measured by the actual number constructed and accepted.

Additional aggregate required for maintaining vehicle tracking pads will be measured as the actual number of cubic yards installed and accepted.

BASIS OF PAYMENT

208.12 ECM and BMPs will be paid for at the Contract unit price for each of the items listed below that appear in the bid schedule.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Aggregate Bag	Linear Foot
Concrete Washout Structure	Each
Erosion Bales (Weed Free)	Each
Erosion Control Management	Day
Erosion Log (Type 1) (____ Inch)	Linear Foot
Erosion Log (Type 2) (____ Inch)	Linear Foot
Pre-Fabricated Concrete Washout Structure	Each
Pre-Fabricated Vehicle Tracking Pad	Each
Maintenance Aggregate (Vehicle Tracking Pad)	Cubic Yard
Removal and Disposal of Sediment (Equipment)	Hour
Removal and Disposal of Sediment (Labor)	Hour
Removal of Trash	Hour
Rock Check Dam	Each
Sediment Basin	Each
Sediment Trap	Each
Silt Berm	Linear Foot
Silt Dike	Linear Foot
Silt Fence	Linear Foot
Silt Fence (Reinforced)	Linear Foot
Storm Drain Inlet Protection (Type__)	Linear Foot

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<u>Pay Item</u>	<u>Pay Unit</u>
Storm Drain Inlet Protection (Type__)	Each
Sweeping (Sediment Removal)	Hour
Temporary Berm	Linear Foot
Temporary Diversion	Linear Foot
Temporary Slope Drains	Linear Foot
Vehicle Tracking Pad	Each

Payment for Erosion Control Management (ECM) will be full compensation for all labor, materials and equipment necessary for the SWMP Administrator and Erosion Control Inspectors to perform all the work described in this specification. This includes assembling items 5-19 and required updates to the SWMP Notebook on site.

The SWMP Administrator and ECI's commute times will not be measured and paid for separately, but shall be included in the work.

Modifications to the SWMP Notebook due to construction errors or survey errors by the contractor shall be at the Contractor's expense.

Temporary erosion control will be measured and paid for by the BMPs used. Surface roughening and vertical tracking will not be measured and paid for separately but shall be included in the work. Payment for each BMP item will be full compensation for all work and materials required to furnish, install, maintain and remove the BMP when directed.

Payment for Removal and Disposal of Sediment (Equipment) will be full compensation for use of the equipment, including the operator. Payment for Removal and Disposal of Sediment (Labor) will be full compensation for use of the labor.

Payment for concrete washout structure, whether constructed or prefabricated, will be full compensation for all work and materials required to install, maintain, and remove the item. Maintenance and relocation, as required, of these structures throughout the duration of the project will not be measured and paid for separately, but shall be included in the work.

Silt berm spikes will not be measured and paid for separately, but shall be included in the work. When required, soil retention blankets will be measured and paid for in accordance with Section 216. Silt dike staples will not be measured and paid for separately, but shall be included in the work.

Spray-on mulch blankets required by the Contract, including those used in both interim and final stabilization, will be measured and paid for in accordance with Section 213.

Payment for storm drain inlet protection will be full compensation for all work, materials, and equipment required to complete the item, including surface preparation, maintenance throughout the project, and removal upon completion of the work. Aggregate will not be measured and paid for separately, but shall be included in the work.

Sweeping, when used as a BMP as shown in the Contract, will be measured by the number of hours that a pickup broom or equipment capable of collecting sediment, authorized by the Engineer, is used to remove sediment from the roadway or other paved surfaces. Each week the Contractor shall submit to the Engineer a statement detailing the type of sweeping equipment used and the number of hours it was used to pick up sediment. Operator will not be measured and paid for separately, but shall be included in the work.

Stakes, anchors, connections, geotextile, riprap and tie downs used for temporary slope drains will not be measured and paid for separately, but shall be included in the work.

REVISION OF SECTION 208
EROSION CONTROL

Payment for vehicle tracking pad will be full compensation for all work, materials and equipment required to construct, maintain, and remove the entrance upon completion of the work. Aggregate and geotextile will not be measured and paid for separately, but shall be included in the work. If additional aggregate for maintenance of vehicle tracking pads is required, it will be measured by the cubic yard in accordance with Section 304 and will be paid for under this Section.

Seeding, sod, mulching, soil retention blanket, and riprap will be measured and paid for in accordance with Sections 212, 213, 216, and 506.

Geotextile (Erosion Control) (Class 2) will be measured and paid for in accordance with Section 420.

All work and materials required to perform the permanent BMP survey and furnish the electronic files shall be included in the original unit price bid for surveying. Surveying will be measured and paid for in accordance with Section 625.

Payment will be made for BMPs replaced as approved by the Engineer. Temporary erosion and sediment BMPs required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or ordered by the Engineer or for the Contractor's convenience, shall be performed at the Contractor's expense. If the Contractor fails to complete construction within the contract time, payment will not be made for Section 208 pay items for the period of time after expiration of the contract time. These items shall be provided at the Contractor's expense.

REVISION OF SECTION 212
SEED

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

In subsection 212.02 (a), delete the first paragraph and replace with the following:

- (a) *Seed.* All seed shall be furnished in bags or containers clearly labeled to show the name and address of the supplier, the seed name, the lot number, net weight, origin, the percent of weed seed content, the guaranteed percentage of purity and germination, pounds of pure live seed (PLS) of each seed species, and the total pounds of PLS in the container. All seeds shall be free from noxious weed seeds in accordance with current state and local lists and as indicated in Section 213. The Contractor shall furnish to the Engineer a signed statement certifying that the seed is from a lot that has been tested by a recognized laboratory for seed testing within thirteen months prior to the date of seeding. The Engineer may obtain seed samples from the seed equipment, furnished bags or containers to test seed for species identification, purity and germination. Seed tested and found to be less than 10 percent of the labeled certified PLS and different than the specified species will not be accepted. Seed which has become wet, moldy, or damaged in transit or in storage will not be accepted.

1
 REVISION OF SECTION 213
 MULCHING

Section 213 of the Standard Specifications is hereby revised for this project as follows:

In subsection 213.01, delete the last paragraph and replace with the following:

This work includes furnishing and applying spray-on mulch blanket or bonded fiber matrix on top of rock cuts and slopes after seeding or as temporary stabilization as shown on the plans or as directed by the Engineer.

In subsection 213.02, delete the eighth paragraph and replace with the following:

The hydromulch material for hydraulic mulching shall consist of virgin wood fibers manufactured expressly from clean whole wood chips. The chips shall be processed in such a manner as to contain no growth or germination inhibiting factors. Fiber shall not be produced from recycled materials such as sawdust, paper, cardboard, or residue from pulp and paper plants. The wood cellulose fibers of the mulch must maintain uniform suspension in water under agitation. Upon application, the mulch material shall form a blotter like mat covering the ground. This mat shall have the characteristics of moisture absorption and percolation and shall cover and hold seed in contact with the soil. The Contractor shall obtain certifications from suppliers that laboratory and field testing of their product has been accomplished, and that it meets all of the foregoing requirements pertaining to wood cellulose fiber mulch.

In subsection 213.02, delete the eleventh paragraph and replace with the following:

Material for mulch tackifier shall consist of a free-flowing, noncorrosive powder produced either from the natural plant gum of *Plantago Insularis* (Desert Indianwheat) or pre-gelatinized 100 percent natural corn starch polymer. The powders shall possess the following properties:

Plantago Insularis (Desert Indianwheat):

Property	Requirement	Test Method
(1) pH 1% solution	6.5 - 8.0	
(2) Mucilage content	75% min.	ASTM D7047

Pre-gelatinized 100 percent natural corn starch polymer:

(1) Organic Nitrogen as protein	5.5-7%
(2) Ash content	0-2%
(3) Fiber	4-5%
(4) pH 1% solution	6.5 – 8.0
(5) Size	100% thru 850 microns (20 mesh)
(6) Settleable solids	<2%

All fibers shall be colored green or yellow with a biodegradable dye.

Delete the last paragraph in subsection 213.02 and replace with the following:

- (a) *Spray-on Mulch Blanket.* Spray on mulch blanket shall be one of the following, unless otherwise shown on the plans:
 - (1) Spray-on Mulch Blanket (Type 1) shall be a hydraulically applied matrix containing organic fibers, water soluble cross-linked tackifier, reinforcing natural and/or synthetic interlocking fibers. Mulch Blanket (Type 1) shall conform to the following:

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REVISION OF SECTION 213
MULCHING

Properties	Requirement	Test Method
Organic Fibers	71% Min.	ASTM D 2974
Cross linked Tackifiers	10% +/- 2% Min.	
Reinforcing Interlocking Fibers	10% +/- 1% Min.	
Biodegradability	100%	ASTM D 5338
Ground Cover @ Application Rate	90% Min.	ASTM D 6567
Functional Longevity	12 Months Min.	
Cure Time	< 8 hours	
Application		
Application Rate	3,000 lb./acre	

The organic fiber shall not contain lead paint, printing ink, varnish, petroleum products, seed germination inhibitors, or chlorine bleach. The organic fibers and reinforcing interlocking fibers cannot be produced from sawdust, cardboard, paper, or paper by-products.

- (2) Spray-on Mulch Blanket (Type 2) shall be a hydraulically applied matrix pre-packaged in 50 pound bags containing both a soil and fiber stabilizing compound and thermally processed wood fiber.

The sterilized weed-free wood fiber mulch shall be manufactured through a thermo-mechanical defibrating process containing a specific range of fiber lengths averaging 0.25 inches or longer.

Mulch Blanket (Type 2) shall meet the following requirements:

Property	Requirement	Test Method
Fiber Retention On 28-Mesh Screen	≥ 40%	Tyler Ro-Tap Method
Moisture Content	12% ± 2%	Total Air Dry Weight Basis
Organic Matter	99.2% ± 0.2%	Oven Dry Weight Basis
Ash Content	0.8% ± 0.2%	Oven Dry Weight Basis
pH At 3% Consistency In Water	4.5-7.0 ± 0.5%	
Sterilized Weed-Free	Yes	
Non-Toxic To Plant Or Animal Life	Yes	

The soil and fiber stabilizing compound shall be composed of linear anionic copolymers of acrylamide pre-packed within the bag having a minimum content of 1.0 percent. The compound shall conform to the following:

Property	Requirement
Molecular Weight	≥ 12x10 ⁶
Charge Density	> 25%
Non-Toxic To Plant Or Animal Life	Yes

- (b) *Bonded Fiber Matrices (BFM)*. BFM shall consist of hydraulically-applied matrix with a minimum of 70 percent non-toxic thermally processed or refined long strand organic fibers and water soluble tackifier to provide erosion control and designed to be functional for a minimum of 9 months. BFMs form an erosion-resistant blanket that promotes vegetation and prevents soil erosion. The BFM shall be 100 percent biodegradable. The binder in the BFM should also be biodegradable.

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 REVISION OF SECTION 213
 MULCHING

(c) Biodegradable BFMs should not be applied immediately before, during, or immediately after rainfall if the soil is saturated. BFM shall conform to the following requirements:

(d)

Property	Requirement	Test Method
Ground Cover (%)	95	ASTM 6567
Bio-degradability (%)	100	ASTM 5338
Functional Longevity (months)	9 month minimum	
Cure Time (hours)	24-48	
Cross-linked tackifier	10% minimum	

Application

Application Rate (lbs./Acre)	3000
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The fibers shall not contain lead paint, printing ink, varnish, petroleum products, seed germination inhibitors, or chlorine bleach. Fiber shall not be produced from sawdust, cardboard, paper, or paper by-products.

In subsection 213.03 (b) 2, delete the second paragraph and replace with the following:

Application Rate: Apply this as an overspray at the following rate or as approved by the Engineer.

Powder	Fiber	Water
200 lbs./Acre	300 lbs./Acre	2000 gal./Acre

In subsection 213.03, delete (f) and replace with the following:

(f) *Spray-on Mulch Blanket*. Spray-on Mulch Blanket shall strictly comply with the Manufacturer's mixing recommendations and installation instructions. No chemical additives with the exception of fertilizer, soil pH modifiers, extended-term dyes and bio nutrients will be permitted. Apply Spray-on mulch blanket in a uniform application using a minimum 22 degree arc type nozzle. Apply hydro slurry in two direction (from top of slope down and from toe of the slope up, as well as, be applied at a minimum of two layers).

Hydromulching vessel shall be filled with water to at least 1/3 capacity (high enough to cover agitators) prior to adding any material. Continue to fill vessel with water and slowly add the fibers while agitators are in motion. Run agitators at ¾ speed. Continue to mix tank a minimum of 10 minutes prior to application.

Co-polymer shall not be used use in channels, swales, or other areas where concentrated flows are anticipated and should not be used on saturated soils that have groundwater seeps.

Subsection 213.03 shall include the following:

(g) *Bonded Fiber Matrices (BFM)*. Bonded fiber matrices shall strictly comply with the Manufacturer's mixing recommendations and installation instructions. No chemical additives with the exception of fertilizer, soil pH modifiers, extended-term dyes and bio stimulant materials shall be permitted. BFM shall be applied in a uniform application using a minimum 22 degree arc type nozzle. Apply BFM in two direction (from top of slope down and from toe of the slope up, as well as, be applied at a minimum of two layers).

Biodegradable BFMs should not be applied immediately before, during, or immediately after rainfall if the soil is saturated.

Product shall not be used use in channels, swales, or other areas where concentrated flows are anticipated and should not be used on saturated soils that have groundwater seeps.

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 REVISION OF SECTION 213
 MULCHING

Foot traffic, mechanical traffic or grazing shall not be permitted on treated areas until vegetated. Treated areas damaged due to circumstances beyond Contractor's control shall be repaired or re-applied as ordered. Payment for corrective work, when ordered, shall be at contract rates.

In subsection 213.04, delete the first paragraph and replace with the following:

The quantity of hay and straw mulch, wood chip mulch, wood fiber and, spray-on mulch tackifier, bonded fiber matrix and tackifier will not be measured but shall be the quantity designated in the Contract, except that measurements will be made for revisions requested by the Engineer, or for discrepancies of plus or minus five percent of the total quantity designated in the Contract. Measurement for acres will be by slope distances.

In subsection 213.04, delete the fourth paragraph and replace with the following:

Spray-on Mulch Blanket and Bonded Fiber Matrix will be measured by the acre or by the actual pounds of product applied, as shown on the plans. The area will be calculated on the basis of actual or computed slope measurements. The Contractor shall verify prior to application, weight of spray on mulch blanket and bonded fiber matrix bags for certification of materials and application rate.

Subsection 213.05 shall include the following:

Payment will be made under:

Pay Item	Pay Unit
Bonded Fiber Matrix	Acre
Bonded Fiber Matrix	Pound
Spray on Mulch Blanket	Pound

Payment for spray-on mulch blanket and bonded fiber matrix will be full compensation for all work and materials necessary to complete this item.

REVISION OF SECTION 216
SOIL RETENTION COVERING

Section 216 of the Standard Specifications is hereby deleted for this project and replaced with the following:

DESCRIPTION

216.01 This work consists of furnishing, preparing, applying, placing, and securing soil retention blankets and turf reinforcement mats for erosion control on roadway slopes or channels as designated in the Contract.

MATERIALS

216.02 Soil retention covering shall be either a soil retention blanket or a turf reinforcement mat as specified in the Contract. It shall be one of the products listed on CDOT's Approved Products List and shall conform to the following:

- (a) *Soil Retention Blanket.* Soil retention blanket shall be composed of degradable natural fibers mechanically bound together between two slowly degrading synthetic or natural fiber nettings to form a continuous matrix and shall conform to the requirements of Tables 216-1 and 216-2. The blanket shall be of consistent thickness with the fiber evenly distributed over the entire area of the mat.

When specified lightweight polypropylene netting shall be 1.5 pounds per 1000 square feet; heavyweight netting shall be 2.9 pounds per 1000 square feet.

When biodegradable blanket is specified, the thread shall be 100 percent biodegradable; polypropylene thread is not allowed.

When photodegradable netting is specified the thread shall be polyester, biodegradable or photodegradable.

Blankets and nettings shall be non-toxic to vegetation and shall not inhibit germination of native seed mix as specified in the Contract. The materials shall not be toxic or injurious to humans. Class 1 blanket shall be an extended term blanket with a typical 24 month functional longevity. Class 2 blanket shall be a long term blanket with a typical 36 month functional longevity. The class of blanket is defined by the physical and performance characteristics.

1. *Soil Retention Blanket (Straw-Coconut).* Soil Retention Blanket (Straw-Coconut) shall be a machine produced mat consisting of 70 percent certified weed free agricultural straw or Colorado native grass straw and 30 percent coconut fiber. The blanket shall be either biodegradable or photodegradable. Blankets shall be sewn together on a maximum 2 inch centers.

Netting shall be as follows:

When biodegradable netting is specified, the top and bottom netting shall be 100 percent biodegradable organic jute fiber. Netting shall be constructed using a weave unattached at intersections which allows the strands of the net to move independently of each other.

When photodegradable netting is specified, the bottom side shall be lightweight polypropylene. The top side shall be heavyweight or lightweight polypropylene.

2. *Soil Retention Blanket (Excelsior).* Soil Retention Blanket (Excelsior) blanket shall consist of a machine produced mat of 100 percent curled wood excelsior, 80 percent of which shall be 6 inches or longer in fiber length. It shall be either biodegradable or photodegradable. Blankets shall be sewn together at a maximum of 4 inch centers.

Netting shall be as follows:

When biodegradable netting is specified, the top and bottom netting shall be 100 percent biodegradable organic jute fiber. Netting shall be constructed using a weave unattached at intersections which allows the strands of the net to move independently of each other.

When photodegradable netting is specified, the bottom side shall be lightweight polypropylene. The top side shall be heavyweight or lightweight polypropylene.

3. *Soil Retention Blanket (Coconut).* Soil Retention Blanket (Coconut) shall be a machine produced mat consisting of 100 percent coconut fiber. It shall be either biodegradable or photodegradable.

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 REVISION OF SECTION 216
 SOIL RETENTION COVERING

Netting shall be as follows:

When biodegradable netting is specified, the top and bottom netting shall be 100 percent biodegradable organic jute fiber. Netting shall be constructed using a weave which is unattached at the intersections, and which allows the strands of the net to move independently of each other.

When photodegradable netting is specified, the bottom and top side shall be heavyweight polypropylene.

**Table 216-1
 PHYSICAL REQUIREMENTS FOR SOIL RETENTION BLANKET –
 PHOTODEGRADABLE OR BIODEGRADABLE BLANKETS**

Photo/Bio Degradable Class	Minimum Roll Width	Minimum Thickness ASTM D 6525	Acceptable Matrix Fill Material	Min. Mass per Unit Area ASTM D 6475	Size of Net Opening	
					Photo-degradable	Bio-degradable
1	6.5 ft.	250 mils	Straw/Coconut	8 oz/sy	Minimum: 0.50"x0.50" Maximum: 0.75"x0.75"	Minimum: 0.50"x0.50" Maximum: 0.5"x1.0"
1	6.5 ft.	250 mils	Excelsior	8 oz/sy	Minimum: 0.50"x0.50" Maximum: 1.0"x2.0"	NONE
2	6.5 ft.	200 mils	Coconut	8oz/sy	Minimum: 0.50" x0.5" Maximum: 0.75"x0.75"	Minimum: 0.50"x0.50" Maximum: 0.5"x1.0"

**Table 216-2
 PERFORMANCE REQUIREMENTS FOR SOIL RETENTION BLANKET –
 PHOTODEGRADABLE OR BIODEGRADABLE BLANKETS**

Photo/Bio Degradable Class	Slope Application "C" Factor ¹ ASTM D 6459	Minimum Tensile Strength MD ² ASTM D 6818
1	< 0.10@3:1	8.33 lb/in
2	< 0.10@3:1	10.42 lb/in
Notes: ¹ "C" Factor calculated as ratio of soil loss from soil retention blanket protected slope (tested at specified or greater gradient, 3H:1V) to ratio of soil loss from unprotected (control) plot in large-scale testing. ² MD is for machine direction testing (along the length of the roll).		

Blankets shall be tested for physical properties and have published data from an independent testing facility. Large scale testing of Slope Erosion Protection ("C" factor) shall be performed by an independent testing facility.

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 REVISION OF SECTION 216
 SOIL RETENTION COVERING

(b) *Turf Reinforcement Mat*. Turf reinforcement mat (TRM) shall be a rolled mat consisting of UV stabilized, corrosion resistant, non-degradable synthetic fibers, filaments, or nets processed into a permanent three-dimensional matrix of the thickness specified in Tables 216-3 and 216-4. TRMs shall provide sufficient thickness, strength and void space to permit soil filling and retention, and the development of vegetation within the matrix. The class of TRM is defined by the physical and performance characteristics as specified in the following tables.

**Table 216-3
 PHYSICAL REQUIREMENTS¹ FOR TURF REINFORCEMENT MAT**

Product Class	Minimum Roll Width	Minimum Thickness ASTM D 6525	Acceptable Matrix Fill Material ²	Size of Net Opening ²
1	6.5 ft.	250 mils	Excelsior, Straw/Coconut, Coconut, or Polymer fibers	Minimum: 0.50"x0.50" Maximum: 0.75"x0.75"
2	6.5 ft.	250 mils	100% UV Stabilized Synthetic or Coconut Fibers	Maximum 0.50"x 0.50"
3	6.5 ft.	250 mils	100% UV Stabilized Synthetic Fibers	Maximum 0.50"x 0.50"
Notes:				
1 For TRMs containing degradable components, all property values shall be obtained on the non-degradable portion of the matting alone.				
2 For TRMs with nets and fill material. Netted TRMs shall be sewn together on a maximum 2 inch centers.				

**Table 216-4
 PERFORMANCE REQUIREMENTS FOR TURF REINFORCEMENT MAT**

Product Class	Tensile Strength MD ASTM D 6818	Minimum UV Stability @ 500 Hours ASTM D 4355	Minimum Permissible Shear Stress ¹ (Unvegetated) ASTM D 6460
1	125 lbs/ft	80%	1.8 lbs/sf
2	150 lbs/ft	80%	2.5 lbs/sf
3	175 lbs/ft	80%	3.1 lbs/sf
Notes:			
1 Permissible shear stress is the minimum shear stress that a product must be able to sustain when placed on a channel un-vegetated without physical damage or excess soil loss. Failure is defined as 1/2 inch of soil loss during a 30 minute flow event in large scale testing.			

TRMs shall be tested for physical properties and have published data from an independent testing facility. Large scale testing of Permissible Shear Stress will be performed by an independent testing facility.

(c) *Staples*. Staples shall be made of ductile steel wire, 0.165 inches in diameter, 8 inches long and have a 1 inch crown. "T" shaped staples will not be permitted.

REVISION OF SECTION 216
SOIL RETENTION COVERING

A sample of the staples and a Certificate of Compliance (COC) including the manufacturer's product data showing that the product meets the Contract requirements shall be submitted for approval at the environmental preconstruction conference. Installation of the blanket will not begin until approval has been received from the Engineer in writing.

- (d) *Earth Anchors*. The mechanical earth anchor shall be composed of a load bearing face plate, a tendon rod or wire rope, and a locking head or percussion anchor. Each element of the anchor shall be composed of corrosion resistant materials. The anchor and wire rope shall have a breaking strength of 9,500 pounds utilizing standard tensile testing and ASTM A1007 - 07. The anchor shall have a minimum 1,000 pounds ultimate holding strength in normal soil and a manufacturer's recommended minimum driven depth of 3.5 feet.

A sample of the anchors and a Certificate of Compliance (COC) including the manufacturer's product data showing that the product meets the Contract requirements shall be submitted for approval at the environmental preconstruction conference. Installation of the blanket will not begin until approval has been received from the Engineer in writing.

CONSTRUCTION REQUIREMENTS

216.03 The Contractor shall install soil retention coverings in accordance with Standard Plan M-216-1 and the following procedure:

- (1) Prepare soil in accordance with subsection 212.06 (a).
- (2) Apply topsoil or soil conditioning as directed in the Contract to prepare seed bed.
- (3) Place seed in accordance with the Contract.
- (4) Unroll the covering parallel to the primary direction of flow.
- (5) Ensure that the covering maintains direct contact with the soil surface over the entirety of the installation area.
- (6) Do not stretch the material or allow it to bridge over surface inconsistencies.
- (7) Staple the covering to the soil such that each staple is flush with the underlying soil.
- (8) Ensure that staples or earth anchors are installed full depth to resist pull out. No bent over staples will be allowed. Install anchor trenches, seams, and terminal ends as shown on the plans.

The Contractor shall install TRMs using the following procedure:

- (1) Place 3 inches of topsoil or soil amended with soil conditioning.
- (2) Apply half of the specified seed at the broadcast rate and rake into soil.
- (3) Install TRM
- (4) Place 1 inch of topsoil or soil amended with soil conditioning into the matrix to fill the product thickness.
- (5) Apply the remaining half of the specified seed at the broadcast rate and rake into soil.
- (6) Install soil retention blanket (Photodegradable or Biodegradable Class 1) over the seeded area and TRM.

When applicable, the covering shall be unrolled with the heavyweight polypropylene netting on top and the lightweight polypropylene netting shall be in contact with the soil.

216.04 Slope Application. Soil retention coverings shall be installed on slopes as follows:

The upslope end shall be buried in a trench 3 feet beyond the crest of the slope if possible. Trench depth shall be a minimum of 6 inches unless required by the manufacture to be deeper. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil, compacted by foot tamping, and seeded. Fabric shall be brought back over trench and secured with staples or earth anchors at 1 foot on center.

There shall be an overlap wherever one roll of fabric ends and another begins with the uphill covering placed on top of the downhill covering. Staples shall be installed in the overlap.

There shall be an overlap wherever two widths of covering are applied side by side. Staples shall be installed in the overlap.

REVISION OF SECTION 216
SOIL RETENTION COVERING

Staple checks shall be installed on the slope length at a maximum of every 35 feet. Each staple check shall consist of two rows of staggered staples.

The down slope end shall be buried in a trench 3 feet beyond the toe of slope. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil, compacted by foot tamping, and seeded. Fabric shall be brought back over trench and secured with staples or earth anchors. If a slope runs into State waters or cannot be extended 3 feet beyond the toe of slope, the end of covering shall be secured using a staple check as described above.

Coverings shall be securely fastened to the soil by installing staples or earth anchors at the minimum rate shown on the Standard Plan M-216-1. Staple or earth anchor spacing shall be reduced where required due to soil type or steepness of slope.

216.05 Channel Application. Soil retention coverings shall be installed as follows on a channel application:

Coverings shall be anchored at the beginning and end of the channel across its entire width by burying the end in a trench. Trench depth shall be a minimum of 6 inches, unless a larger depth is specified by the manufacturer recommendations. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil and compacted by foot tamping, and seeded. Fabric shall be brought back over the trench and stapled.

Covering shall be unrolled in the direction of flow and placed in the bottom of the channel first. Seams shall not be placed down the center of the channel bottom or in areas of concentrated flows when placing rolls side by side.

There shall be an overlap wherever one roll of covering ends and another begins with the upstream covering placed on top of the downstream covering. Two rows of staggered staples shall be placed.

There shall be an overlap wherever two widths of covering are applied side by side. Staples shall be placed in the overlap.

The covering shall have a channel check slot every 30 feet along the gradient of the flowline. Check slots shall extend the entire width of the channel. The covering shall be buried in a trench. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil, compacted by foot tamping, and seeded. Fabric shall be brought back over trench and continued down the channel.

Coverings shall be securely fastened to the soil by installing staples at the minimum rate shown on the plans. Staple spacing shall be reduced where needed due to soil type or high flows.

216.06 Maintenance. The Contractor shall maintain the soil retention coverings until all work on the Contract has been completed and accepted. Maintenance shall consist of the repair of areas where damage is due to the Contractor's operations. Maintenance shall be performed at the Contractor's expense. Repair of those areas damaged by causes not attributable to the Contractor's operations shall be repaired by the Contractor and will be paid for at the contract unit price. Areas shall be repaired to reestablish the condition and grade of the soil and seeding prior to application of the covering.

METHOD OF MEASUREMENT

216.07 Soil retention coverings, including staples, complete in place and accepted, will be measured by the square yard of finished surface, excluding overlap, which is installed and accepted. Earth Anchors will be measured by the actual number of earth anchors complete in place and accepted.

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 REVISION OF SECTION 216
 SOIL RETENTION COVERING

BASIS OF PAYMENT

216.08 The accepted quantities of soil retention coverings will be paid for at the contract unit price per square yard. The accepted quantities of earth anchors will be paid for at the contract unit price per each installed.

Payment will be made under:

Pay Item	Pay Unit
Soil Retention Blanket () (Photodegradable Class _)	Square Yard
Soil Retention Blanket () (Biodegradable Class _)	Square Yard
Turf Reinforcement Mat (Class _)	Square Yard
Earth Anchors	Each

Preparation of seedbed, fertilizing, and seeding will be measured and paid for in accordance with Section 212.

Placing and preparation of seedbed, fertilizing, and seeding of soil under the TRM layer will be measured and paid for in accordance with Section 212.

Topsoil or amended soil and seed placed on the TRM will be measured and paid for in accordance with Sections 207 and 212.

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

REVISION OF SECTION 250
ENVIRONMENTAL, HEALTH AND SAFETY MANAGEMENT

Section 250 of the Standard Specifications is hereby deleted for this project and replaced with the following:

DESCRIPTION

250.01 This work consists of protection of the environment, persons, and property from contaminants that may be encountered on the Project. This includes monitoring the work for encounters with contaminants or suspected soil and groundwater contaminants; the management of solid, special, and hazardous waste; and management of visual emissions associated with hazardous waste, when encountered on the project.

250.02 The Contractor shall furnish all personnel, materials, equipment, laboratory services and traffic control necessary to perform the contamination monitoring, testing, and site remediation when required. Traffic control shall be in accordance with the requirements of Section 630.

Monitoring equipment used to detect flammable gas, oxygen level, and toxic gas shall be capable of detection to meet the following standards:

Instrument Detection		
Constituent	Threshold Limit	Increments
Flammable Gas	1% LEL	1%
Oxygen	19%	0.1%
Toxic Gas	1 PPM	1 PPM
LEL = lower explosive limit PPM = parts per million		

CONSTRUCTION REQUIREMENTS

250.03 General. Prospective bidders, including subcontractors, are required to review the environmental documents available for this project. These documents are listed in subsection 102.05 as revised for this project.

This project may be in the vicinity of property associated with petroleum products, heavy metal based paint, landfill, buried foundations, abandoned utility lines, industrial area or other sites which can yield hazardous substances or produce dangerous gases. These hazardous substances or gases can migrate within or into the construction area and could create hazardous conditions. The Contractor shall use appropriate methods to reduce and control known landfill, industrial gases, and visible emissions from asbestos encounters and hazardous substances which exist or migrate into the construction area. The Contractor shall follow CDOT's *Regulated Asbestos-Contaminated Soil Management Standard Operating Procedure, dated October 18, 2016* for proper handling of asbestos-contaminated soil, and follow all applicable Solid and Hazardous Waste Regulations for proper handling of soils encountered that contain any other substance mentioned above.

Encountering suspected contaminated material, including groundwater, old foundations, building materials, demolition debris, or utility lines that may contain asbestos or be contaminated by asbestos, is possible at some point during the construction of this project. When suspected contaminated material, including groundwater, is encountered or brought to the surface, the procedures under subsection 250.03(d) and 250.05 shall be followed.

Transportation of waste materials on public highways, streets and roadways shall be done in accordance with Title 49, Code of Federal Regulations (CFR). All labeling, manifesting, transportation, etc. of waste materials generated on this project shall be coordinated with the Engineer. All hazardous waste manifests for waste materials generated on this project shall list the Colorado Department of Transportation as the generator of the waste materials except as otherwise noted. If the Contractor contaminates the site, the Contractor shall be listed as the generator on the hazardous waste manifests, permits, and other documents for such material. If the project is not on a State Highway or frontage road, then the appropriate local governmental entity having jurisdiction over the transportation system facility shall be listed as the hazardous waste generator.

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If waste materials must be handled in a permitted treatment, storage and disposal (TSD) facility, the facility shall be designated in writing by the Engineer. If the waste materials are the result of the Contractor's actions, the Contractor shall designate the facility.

The hazardous waste transportation phase of the work involves insurance required by law and regulations. If the waste materials are determined to be hazardous, the Contractor must submit proof that the transportation company is covered by the appropriate type and amount of insurance required by laws and regulations governing the transportation of hazardous waste.

The Contractor alone bears the responsibility for determining that the work is accomplished in strict accordance with all applicable federal, state and local laws, regulations, standards, and codes governing special waste, petroleum and hazardous substance encounters and releases.

The Contract will list known or suspected areas of contamination. Health and Safety Officer, Monitoring Technician, and Health and Safety Plan shall be required when so stated in the Contract.

(a) *Health and Safety Officer (HSO)*. The Contractor shall designate a HSO, not the project superintendent, who shall have at least two years field experience in chemical related health and safety. The HSO shall be either a certified industrial hygienist (CIH), certified hazardous materials manager (CHMM), professional engineer (PE) licensed in the State of Colorado, certified safety professional (CSP), or registered environmental manager (REM) meeting the criteria set forth in 29 CFR 1926.

When regulated asbestos contaminated soil (RACS) is present or is suspected to be present on or near a project, the HSO shall have knowledge of RACS regulations. The HSO shall meet the minimum training and medical surveillance requirements established by the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA) for a supervisory Site Safety Official per 29 CFR 1962.65. The Contractor shall furnish documentation to the Engineer, at the preconstruction conference, that the above requirements have been met. Certification as an Asbestos Building Inspector in accordance with subsection 250.03 (b) is recommended.

The HSO shall *be* equipped with the following:

- (1) Communication equipment as required in subsection 250.03(d) 2.A. and a vehicle.
- (2) Monitoring and detection equipment for flammable gas, oxygen sufficiency, toxic gas, radiological screening and other hazards. This includes, as required, a combustible gas indicator, flame ionization or photo ionization detector, oxygen meter, radiation monitor with Geiger Mueller detector and other foreseeable equipment.
- (3) Depth gauging equipment, sampling equipment and sampling containers.
- (4) Personal protective equipment (levels C and D) when required.

The HSO shall recommend and supervise those actions which will minimize the risk of hazardous substance related injury to the workers, Department personnel, the general public, property and the environment. Hazardous substance is defined in 29 CFR 1926.32. The HSO shall prepare written procedures for the monitoring of confined space entry and working in or near excavations, including but not limited to trenches and drill holes associated with this project. The HSO shall conduct or supervise all hazardous substance and solid waste related testing, sampling, monitoring and handling for this project to ensure compliance with applicable statutes and regulations, and other applicable environmental requirements under subsections 107.01 and 107.02.

The HSO shall be available for consultation and assistance with contaminated materials related testing, sampling, and field monitoring as required by the Engineer.

The HSO shall prepare and submit a bound and indexed final site report to the Engineer at the end of the project. This site report shall include a detailed summary of all contaminated materials and contaminated water that were encountered and their final disposition.

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During each week the HSO is utilized, the HSO shall prepare a daily diary which shall be submitted to the Contractor and the Engineer. This diary shall be submitted at the end of the week and shall become a part of the Department's records. The diary shall contain a chronological log of activities on the project including: dates and times on site, equipment used and calibrations, field monitoring results, visual observations, conversations, directives both given and received, and disposition of suspected hazardous substances. The Engineer will review this submittal and approve the actual number of hours to be paid.

- (b) *Monitoring Technician (MT)*. The Contractor shall designate a monitoring technician to be responsible for monitoring of hazardous substances during work on the project. The MT shall have a minimum of two years of actual field experience in assessment and remediation of hazardous substances that may be encountered during highway construction projects. When asbestos is present or is suspected to be present on or near a project, the MT shall have additional 40 hours experience in RACS project management and certification as an Asbestos Building Inspector in accordance with the Colorado Air Quality Control Commission Regulation No. 8 Part B. The MT shall be experienced in the operation of monitoring devices, identifying substances based upon experience and observation, and field sampling (for testing) of all media that may be found on the site. Completion of the 40 hour hazardous waste and 8 hour supervisory training required by OSHA and U.S. EPA rules and regulations which complies with the accreditation criteria under the provisions of the proposed 29 CFR 1910.121 is required prior to beginning work. The Contractor shall furnish documentation at the Preconstruction Conference that demonstrates these requirements have been met.

The MT shall be equipped with the following:

- (1) Communication equipment as required in subsection 250.03(d) 2.A. and a vehicle.
- (2) Monitoring and detection equipment for flammable gas, oxygen sufficiency, toxic gas, radiological screening and other hazards. This includes, as required, a combustible gas indicator, flame ionization or photo ionization detector, oxygen meter, radiation monitor with Geiger Mueller detector and other foreseeable equipment.
- (3) Depth gauging equipment, sampling equipment and sampling containers.
- (4) Personal protective equipment (levels C and D) when required.

The MT shall be present on site and perform monitoring as required by 250.03(d) when work is being performed in areas of suspected contamination and on a predetermined basis throughout other work on the project.

The MT shall monitor for compliance with regulations, the project Health and Safety Plan and the Materials Management Plan (if they exist for the project), the Contract, and the environmental documents for the project. The MT shall immediately notify the Contractor, the Engineer and the HSO of any hazardous condition.

During each week the MT is utilized, the MT shall prepare a daily monitoring diary which shall be submitted to the Contractor, HSO and the Engineer. This diary shall be submitted at the end of the week and shall become a part of the Department's records. The diary shall contain a chronological log of activities on the project including: dates and times on site, equipment used and calibrations, field monitoring results, visual observations, conversations, directives both given and received, and disposition of suspected hazardous substances. The Engineer will review this submittal and approve the actual number of hours to be paid.

- (c) *Health and Safety Plan (HASP)*. The HSO shall prepare a written HASP for the project, formatted as shown in Appendix B, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, DHHS (NIOSH) Publication Number 85-115, available from the Superintendent of Documents, U.S. Government Printing Office. The Contractor and the HSO shall review the environmental documents listed prior to preparation of the HASP.

Four signed copies of the HASP shall be furnished to the Engineer for acceptance. The Engineer shall have seven calendar days to review and accept or reject the proposed HASP. Within five calendar days after acceptance, the HSO shall distribute signed and stamped (or sealed) copies of the accepted HASP to each emergency response agency servicing the project area, the HASP designated emergency hospital, and five

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copies to the Engineer. Earth or demolition work shall not occur until after the HASP is accepted and the HASP has been distributed. The HASP shall also be available to the Contractor's employees, their representatives, and officials of OSHA, EPA, Colorado Department of Public Health and Environment (CDPHE), local government health department, Federal Highway Administration, and other appropriate agencies and officials as may be designated by the Engineer. The Engineer will distribute the accepted HASP to appropriate Department personnel. The HASP shall be kept current and shall be revised by the HSO as warranted by changes in the field conditions.

All on-site workers (Contractor's, Department's, Utilities', and others) shall be briefed by the HSO on the contents of the HASP and any revisions thereof. The HSO shall conduct briefings (group or individual) to inform new employees, subcontractors, utility companies and other on-site workers of the HASP contents prior to their entry on site. All personnel involved in excavation or other soil disturbing activities shall receive the required two-hour Asbestos Awareness training by a Certified Asbestos Inspector, when asbestos discoveries are anticipated, or discoveries are made. A signature log of all briefing attendees shall be kept and furnished to the Engineer. The Contractor shall provide, as required, eye wash equipment and stations, emergency showers, hand and face washing facilities and first aid equipment.

The Contractor shall provide, as required, decontamination facilities for personnel and equipment employed in the work. The exact procedure for decontamination and frequency shall be included in the accepted HASP. Decontamination facilities shall meet the criteria set forth in the Code of Federal Regulations (29 CFR and 40 CFR).

- (d) *Precautions and Procedures.* The following minimum precautions and procedures shall be followed during the construction of the project:
1. General construction precautions:
 - A. All monitoring and piezometer wells and test borings shall be established or abandoned by the Contractor as regulated by the State Engineer's Office. Copies of all required permits, notification, and abandonment documents shall be submitted to the Engineer prior to payment approval.
 - B. Hazardous substance related activities shall have a work plan for each work phase which shall be coordinated with the Engineer at least three working days prior to commencement of each phase of the work.
 - C. The Contractor shall properly handle all investigation derived waste generated by this project. Documentation shall be submitted to the Engineer of all tests performed for Treatment, Storage and Disposal (TSD) determination; classification of waste; hauling records; TSD acceptance; manifest (if required); etc. in accordance with applicable laws and regulations.
 - D. When the work may involve air emissions, the Contractor shall contact the Colorado Department of Public Health and Environment (CDPHE), Air Pollution Control Division to ascertain if an air pollution emission notice (APEN) or permit is required for this operation. The Contractor shall be responsible for filing the APEN and obtaining said permit, if required. The processing of air pollution permits, if required, in non-attainment areas or where public hearings are required, likely will take more than 90 days.
 2. For construction on a known or potentially contaminated site, the following conditions shall apply, in addition to those listed in subsection 250.03(d)1:
 - A. The HSO shall be on site or readily available by radio, telephone or pager at all times during the work. When on site, the HSO shall have an operational portable or mobile cellular telephone available for immediate use in areas where such service is available. When on site in cellular telephone non-service areas, the HSO shall have available, for immediate use, radio access to a site with telephone service. The HSO shall be notified at least 24 hours prior to the start of confined space entry, storage tank removal, drilling, excavation, trenching, or dewatering operations.

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- B. The HSO shall designate the onsite monitoring equipment for flammable gases, oxygen deficient or enriched atmosphere, and toxic gases, such as but not limited to, a flame ionization detector, photoionization detector, combustible gas indicator, and oxygen meter. This designated equipment shall be on site during all construction operations and be utilized during trenching, drilling, excavating, confined space entry, underground storage tank removal, and other appropriate construction operations. The exact equipment to fulfill this requirement shall be specified in the accepted HASP. The HSO shall conduct or supervise the monitoring. The monitoring equipment shall be calibrated as recommended by the manufacturer.
- C. When drilling, trenching, or excavating in the presence of detectable concentrations of explosive gases, the soil shall be wetted and the operating equipment shall be provided with spark proof exhausts.
- D. The Contractor, through the HSO, is responsible for ensuring that 29 CFR 1926 is fully complied with during the construction of the project.
- E. Affected excavation operations shall be discontinued and personnel shall be removed from the affected excavation sites where any of the following levels are detected:
- (1) 20.0 percent or more LEL flammable gas, or 10.0 percent in an underground or confined space,
 - (2) Permissible Exposure Limit (PEL) of any toxic gas,
 - (3) 19.5 percent or less oxygen,
 - (4) 25.0 percent or more oxygen,
 - (5) Greater than 2 mrem/hr. (Beta particle & photon radioactivity),
 - (6) Greater than 15 pCi/L (Gross alpha particle activity), or
 - (7) Other action levels as determined by the HSO.
 - (8) Uncovering of suspect Asbestos Containing Material (ACM), including but not limited to, buried facility components, active or abandoned utility lines, buried foundations and demolition debris, or miscellaneous ACM dispersed in the soil. The Contractor shall follow the procedures outlined in the HASP and 29 CFR 1926 to address these conditions. Work shall resume in these areas when approved by the Engineer.
- F. Personnel shall be issued and utilize appropriate Health and Safety equipment as determined by the HSO, who shall provide the Engineer with a written explanation of what personal protective equipment (PPE) shall be worn, when, and by which personnel. Except in emergency cases, the Engineer shall be advised by the HSO of changes in the degree of PPE prior to implementation.
- G. Personnel shall avoid the area immediately downwind of any excavation unless the excavation is monitored and declared safe.
- H. The operators of excavating, trenching, or drilling equipment shall wear appropriate PPE as required in the HASP.
- I. Exhaust blowers shall be present at the location where required in the accepted HASP.
- J. The Contractor shall accomplish the work with employees who have been trained and equipped as required by the HASP and applicable provisions of 29 CFR 1910 and 29 CFR 1926.
- K. Fire extinguishers, electrical equipment and wiring shall conform to the applicable requirements of 29 CFR 1926 and 49 CFR.
- L. Smoking shall not be permitted within 50 feet of any excavation.
3. For construction within 1000 feet of a known or potentially contaminated site, the following conditions, in addition to those listed in subsection 250.03(d) 1. shall apply:
- A. The areas under construction shall be checked with a combustible gas indicator before excavation begins to determine if flammable or combustible gas is in the area.

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- B. Excavations, trenches and drill holes shall be monitored by the HSO for flammable gas, toxic gas and oxygen deficiency or enrichment. This shall be carried out continuously unless the presence of flammable, combustible or toxic gas, or oxygen deficiency or enrichment in the area can be ruled out by the HSO. The recommendation to discontinue monitoring must be agreed to by the Engineer and the Contractor. Prior to implementation, this agreement shall be written, and shall contain specific conditions that will require re-evaluation of the area.
 - C. When flammable or toxic gas is found in the area, those precautions and procedures in subsection 250.03(d)2 shall apply.
4. The following procedures shall be followed if the level of contamination as documented in the environmental documents referenced in subsection 102.05 as revised for this project is exceeded, or if previously unidentified contaminated air, soil or water, is encountered during the construction of the project:
- A. Work in the immediate area of the release or discovery of contamination shall cease. The Engineer shall be immediately notified.
 - B. If no HSO is required by the Contract, the Contractor shall designate an HSO as directed, in accordance with subsection 250.03(a).
 - C. The Engineer may direct the HSO to evaluate the material for potential hazardous substance or other contamination or unsafe conditions. This evaluation may include, but is not limited to, on site field monitoring, on site testing, and on or off site laboratory analysis. Removal of storage tanks and surrounding contaminated soils shall be in accordance with applicable laws, regulations and established procedures. If the contaminated material cannot be placed in the embankment or remediated on site, it must be removed to an appropriate TSD facility, as designated in writing by the Engineer. The HSO shall supervise the necessary testing required to make appropriate TSD determinations. Disposal of the unsuitable material shall be considered as remediation work as described in subsection 250.03(d)4.D and 250.03(d)4.E.
 - D. If this site is determined to be contaminated with petroleum products, hazardous substances or other solid waste in excess of that indicated in the above listed site investigation documents, a thorough Site Investigation and Waste Management Plan shall be accomplished under the supervision of the HSO. The Site Investigation and Waste Management Plan shall be submitted to the Engineer for approval and shall determine the extent of contamination and propose at least three types of remedial action for the contaminated area as required by applicable statutes and regulations. The HSO shall be available to assist the Engineer in explaining this study to the regulatory agencies. When requested by the Engineer, the Contractor shall prepare a Remediation Plan based on the selected remedial method, and shall submit this to the Engineer for approval. The time required for the Engineer's review of the Remediation Plan, including all necessary drawings, calculations, specifications, and other documentation will not exceed four weeks after a complete submittal is received. This work shall not be done unless authorized in writing by the Engineer.
 - E. If the site is determined to be contaminated with petroleum products; hazardous chemicals, materials, or wastes; or other solid wastes, and is required to be remediated, the HSO or other qualified individuals will supervise the Remediation Plan implementation as concurred to by the regulatory agencies, as directed. Hazardous Waste generated by remedial activities shall list the Colorado Department of Transportation as the hazardous waste generator on the required paperwork for projects on State Highways and their associated frontage roads. If this project is not on a State Highway or frontage road, then the appropriate local governmental entity having jurisdiction over the transportation system facility shall be listed as the hazardous waste generator. If the waste disturbed or produced was caused by Contractor negligence, the Contractor shall be listed as the hazardous waste generator. Remediation work shall be done only when authorized by the Engineer in writing.

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250.04 Heavy Metal Based Paint Management. When the work includes the removal of paint or items covered with paint which may contain lead, chromium or other heavy metals, the requirements of this subsection shall apply in addition to the requirements of subsection 250.03.

The requirements of the HASP shall be in accordance with OSHA Publication Number 3142, *Working with Lead in the Construction Industry*.

Paint Removal and Waste Disposal work shall be performed in accordance with 29 CFR 1926.62, State and local air quality regulations, the Steel Structures Painting Council (SSPC) Guide for Containing Debris Generated During Paint Removal Operations, the *Industrial Lead Paint Removal Handbook* (SSPC 91-18), and the references contained therein.

The following minimum precautions and procedures shall be followed unless modified in the approved HASP or its updates:

- (a) The Contractor shall contact the CDPHE, Air Pollution Control Division to ascertain if an air pollution permit is required for the cleaning or demolition work. If an air pollution permit is required, the Contractor shall obtain the permit. The Contractor shall furnish the Engineer with a copy of the permit application and the permit issued prior to starting cleaning or demolition activities. A copy of the Air Pollution Emission Notice [APEN] shall be provided to the Engineer, if such notice is required under the Colorado Air Quality Control Commission's regulations. The processing of air pollution permits in non-attainment areas, or where public hearings are required, likely will take more than 90 days.
- (b) The Contractor shall contain paint chips, corrosion residues, and spent abrasives, herein referred to as waste materials, resulting from the cleaning or demolition operations. The Contractor shall not deposit or release waste material into the water, air or onto the ground below or adjacent to the structure. The Contractor shall conduct cleaning operations to minimize the waste materials produced. Prior to beginning the work, the Contractor shall submit to the Engineer for acceptance, a detailed methods statement for capturing, testing, and disposing of the removed materials. The Engineer will have seven calendar days to review, and accept or reject this methods statement.
- (c) Abrasives utilized for blast cleaning shall be low-dusting and low waste. Unless approved otherwise, vacuum blasting or wheel blasting shall be used.
- (d) The HSO shall sample and test the waste material for lead, chromium, and other paint associated heavy metals using the Toxicity Characteristic Leaching Procedure (TCLP) Test, Method 1311 of the EPA publication, Test Methods for Evaluating Solid Waste 846. Sample collection methodology and frequency shall be recommended by the HSO and accepted by the Engineer with an adequate number of samples taken to be representative of all waste material collected. If the waste material does not pass the TCLP test, it shall be disposed of in a permitted TSD facility as designated in writing by the Engineer. The waste materials handling decision shall be documented by a report (five copies) submitted to the Engineer. This documentation shall include a description of sample collection methodology, testing performed, test results and comparison of test results with hazardous waste requirements. The waste material shall not be held at an unpermitted TSD facility site in excess of Resource Conservation and Recovery Act (RCRA) temporary storage time limits.
- (e) When an item coated with paint is removed, all loose paint shall be removed and collected from the item within 24 hours of the time it is removed or placed onto the ground. All loose paint shall be removed and collected from a painted item before it is removed from the site. The Contractor shall contain loose paint until it is removed and collected. Loose paint is defined as that which can be removed by manual scraping methods. Over waterways, the Contractor shall capture all paint debris by the method specified in the methods statement. The paint debris shall be collected on a daily basis and shall be stored in a properly labeled, tightly sealed container and placed in a secured location at the end of each working day.

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- (f) All painted steel components which are not designated to be salvaged shall be recycled. Contractor possession of the steel for future use shall be considered a form of recycling. Prior to transport of the components off-site, the Contractor shall obtain a letter from the recipients of the painted steel components stating that they have been fully informed of the contents of the paint and are capable of handling the paint. If the Contractor is to maintain future possession of the steel, the Contractor shall supply this letter. If there will be more than one recipient of the painted material, one letter shall be obtained from each recipient. The Contractor shall provide a copy of each letter to the Engineer. If the painted steel components will be recycled by melting, the letter from the recipient is not required. The Contractor shall submit a letter stating the destination of the painted steel components and that they will be melted.
- (g) When the work consists of the removal of a bridge or components of a bridge coated with paint which has been assumed to contain lead, chromium, other heavy metals, or a combination thereof the Contractor shall capture paint debris which is dislodged during removal operations. The Contractor may choose any method for dismantling the bridge, subject to the following required construction sequence limitations:
- (1) The concrete deck shall be removed prior to removal of the steel superstructure.
 - (2) If the methods statement indicates that girders will be dropped to the ground during dismantling, all debris from the concrete deck removal operation shall be removed from the area below the bridge before any girders are dropped into this area.
 - (3) Girders may be cut and dropped only if the span is located entirely over land.

250.05 Material Handling. This work consists of the additional handling of groundwater and soils to be excavated for construction of the project which are suspected or known to be contaminated. This work also includes stockpiling or containerization, analytical sampling and testing, and final disposition of contaminated groundwater and soils requiring special handling.

The Contractor shall maintain vertical trench walls for the work in the specified areas of known or potential contamination, as shown on the plans. Shoring may be necessary to meet this requirement. The Contractor shall confine the removal of contaminated groundwater and soils encountered as a result of the excavation activities in the specified areas to the vertical and horizontal limits of structure excavation specified in the Contract. The Contractor shall be responsible for any contaminated materials generated beyond the limits of excavation. This shall include any sampling, analysis, and disposal required, and the costs thereof. The Contractor shall be listed as the generator of any such material. The limits of excavation shall be determined as 18 inches outside of structures, including sewers, water lines, inlets, manholes, and other underground structures to be constructed, or as directed.

Specific areas of known or potential contamination have been identified in the project plans. There is the potential of encountering contaminated groundwater and soil, which has not been summarized in the plans or specifications, at unknown locations on the site. Suspected contaminated soil and groundwater shall be handled by one of three methods as follows:

- (a) *Materials Handling (Stockpile & Containerization).* When recommended by the HSO and authorized by the Engineer, material shall be stockpiled or containerized for analysis and characterization for proper handling and, disposal, or both. Sampling and testing of materials shall be as described in the Contract. If analysis indicates that soil samples are designated as uncontaminated, as determined by the criteria shown in the Contract or as determined by the CDPHE, the associated soils will not require any special handling and will become the property of the Contractor and may be used on site, subject to other requirements of the Contract. Health and safety monitoring and strict fugitive dust control shall be conducted during the placement of these soils. If analysis indicates that groundwater samples are designated as uncontaminated, as determined by the criteria shown in the Contract or as determined by the CDPHE, the groundwater shall be handled in accordance with subsection 107.25.

Stockpiled and containerized materials shall be secured in compliance with the following provisions until they are determined to be uncontaminated:

1. The Contractor shall not store the material for more than 90 days.

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2. The Contractor shall prevent any runoff from infiltrating the ground or running out of the containment area.
 3. Soils and groundwater containing different contaminants shall be placed in separate containers or stockpiles.
 4. The Contractor shall prevent the dispersion of materials or the dilution or mixing of containers and stockpiles.
 5. The ground surface on which the contaminated soils will be placed shall be covered with plastic sheeting which will withstand the placement and removal of stockpiled materials without breaching.
 6. The ground surface shall be graded to drain toward the edge of the soil piles and the berm or trench around them shall be covered by plastic sheeting.
 7. Proper security shall be provided in accordance with 40 CFR.
- (b) *Solid Waste Disposal.* Soils determined to be contaminated, but not hazardous, as established by criteria in the Contract or as determined by CDPHE or other regulatory agencies having jurisdiction, shall be handled and disposed of, or both as recommended by the HSO and approved by the Engineer. The Contractor shall haul this material to a solid waste disposal facility.
- (c) *Contaminated Groundwater Disposal.* Groundwater determined to be contaminated, but not hazardous, as established by criteria in the Contract or as determined by CDPHE or other regulatory agencies having jurisdiction, shall be handled and disposed of, or both as recommended by the HSO and approved by the Engineer. The Contractor shall prepare a dewatering plan proposing at least three types of treatment and/or disposal options of contaminated groundwater as required by applicable statutes and regulations. One of the treatment options shall include permitting and onsite treatment prior to discharge or disposal. The dewatering plan shall be submitted to the Engineer for approval four weeks before dewatering activities begin.
- (d) *Hazardous Waste Disposal.* Soils and groundwater that are designated or suspected to be hazardous shall be containerized *immediately* upon excavation or upon discovery. Hazardous material shall be labeled and transported to a permitted treatment, storage and disposal (TSD) facility or to a hazardous waste disposal facility approved by the Engineer.
- (e) *Additional Requirements.* Stockpiled or containerized material characterized as uncontaminated, contaminated or hazardous shall be stored and disposed of in a manner consistent with current established federal, state, and local regulations for waste materials.

Materials with contaminants not specifically regulated shall be disposed of by the Contractor as directed, in consultation with CDPHE. All areas where wastes are generated shall be reviewed by the HSO to identify potential contaminant sources that may result in a contaminated waste stream.

Contaminated groundwater and soils, which have been identified as solid waste or hazardous waste, requiring disposal according to federal, state, and local regulations, shall be transported in accordance with 49 CFR by the Contractor to an appropriately permitted treatment facility, landfill, incinerator or asphalt plant or other facility approved to accept the waste. CDPHE and the landfill or other treatment or disposal facility shall be notified by the HSO of the material to be disposed of and the corresponding analytical test results prior to shipment. Potentially contaminated water collected from the lined trench of a stockpile shall be treated as required by Colorado Wastewater Discharge Permit System (CDPS) permits, 29 CFR and 40 CFR and reimbursed separately in accordance with Contract requirements.

250.06 Sample delivery. This work consists of the collection, containerization and delivery of material samples for analysis to the testing facility designated in the Contract.

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Environmental Protection Agency (EPA) protocol and standards shall be followed in the collection, containerization and transport of samples to be analyzed, including the documentation of the proper chain of custody of all samples. The Contractor shall collect sufficient sample material to perform the required analysis and is responsible for ensuring that appropriate climate control has been provided for sample transport. Sample delivery shall be made within the maximum allowable holding time for each sample type, not to exceed 24 hours, excluding weekends. The time period required for sample collection and delivery to the testing facility will not be considered an excusable delay. The analysis to be completed and turnaround time shall be approved by the Engineer.

The Contractor shall provide the Engineer with a copy of documentation indicating that proper chain of custody requirements have been followed for all samples.

Quality control samples shall be provided by the Contractor in accordance with the quality control requirements of the testing facility designated in the Contract (quality control requirements are available from the Engineer). The Contractor shall prepare, label and transport these samples to the testing facility in conjunction with the delivery of other samples authorized for analysis by the Engineer, at no additional cost.

The Engineer may request splits of samples, in advance of collection, which shall be provided at no additional cost by the Contractor.

250.07 Regulated Asbestos Contaminated Soils (RACS) Management . Environmental documents or plans listed in the special provisions should include known or suspected locations that could involve encounters with RACS during excavation and other soil disturbing construction activities. Unexpected discoveries of RACS may occur during excavation and soil disturbing construction activities. RACS shall be properly managed or remediated, in accordance with subsection 250.07(a).

All asbestos related activities shall be performed by CDPHE certified asbestos professionals, contractors, or consultants. Certifications are issued by the CDPHE, Indoor Air Quality Unit. A Colorado Certified Asbestos Building Inspector shall manage the assessment and disposal of RACS and other ACM. The Indoor Air Quality Unit within CDPHE is the only unit that certifies such professionals. The Contractor shall furnish a copy of the certification to the Engineer.

- (a) *Regulatory Compliance*. RACS management is governed by 6 CCR 1007-2, Section 5.5, which includes and references regulatory compliance with Colorado Air Quality Control Commission *Regulation* No. 8 Part B-Asbestos. Colorado Regulation No. 8 governs all asbestos activities, demolition, permitting, and certification of Certified Asbestos Professionals in the State of Colorado. The Contractor shall conform to all current regulations, policy directives, or both, issued by the CDPHE, and the Department.
- (b) *Asbestos Management and Visual Inspections* Asbestos management shall be performed by a CDPHE certified asbestos building inspector. All inspections of the area of asbestos contaminated soil removal shall be performed by a CDPHE certified Asbestos Building Inspector to determine what, if any, controls must be instituted to allow future activity in the excavation area.
- (c) *Permitting and Notification*. The CDPHE requires notification of any soil disturbing activity where asbestos is known, suspected, or discovered. A 24-hour notification to CDPHE is required after any soil disturbing activity of an unplanned asbestos discovery. A 10 working day notification to CDPHE is required prior to any soil disturbing activity in an area with known or potential RACS. Removal of asbestos-containing material on a facility component, that is located on or in soil that will be disturbed, with asbestos quantities above the following trigger levels shall be permitted and abated in accordance with the requirements of Colorado Air Quality Control Commission Regulation No. 8 (5 CCR 1001-10, Part B):
 - (1) 260 linear feet on pipes,
 - (2) 160 square feet on other surfaces, or
 - (3) The volume of a 55-gallon drum.

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ENVIRONMENTAL, HEALTH AND SAFETY MANAGEMENT

All permit applications shall be submitted to the Colorado Department of Public Health and Environment a minimum of 10 days prior to start of work for approval. The permit application and notification shall be submitted simultaneously. A CDPHE certified General Abatement Contractor shall obtain all required State and local permits and shall be responsible for all associated fees. Permit application, notification, and waiver request forms shall be submitted to:

Colorado Department of Public Health and Environment Permit Coordinator/APCD - SS - B1 4300
Cherry Creek Drive South Denver, CO 80246-1530 Phone: (303) 692-3100 Fax: (303) 782-0278

Application and waiver forms are available on the CDPHE website: asbestos@state.co.us

- (d) *CDOT's Regulated Asbestos-Contaminated Soil Management Standard Operating Procedure, dated October 18, 2016.* Asbestos contaminated soil shall be managed in accordance with 6 CCR 1007-2, Part 1, Section 5.5, Management of RACS. . . Regulations apply only upon unexpected discovery of asbestos materials during excavation and soil disturbing activities on construction projects, or when asbestos encounters are expected during construction. The Contractor shall comply with procedures detailed in the *CDPHE's Management of Regulated Asbestos Contaminated Soil Regulation* and *CDOT's CDPHE approved Regulated Asbestos-Contaminated Soil Management Standard Operating Procedure, dated October 18, 2016*, including the following minimum requirements:
- (1) Immediate actions and implementation of interim controls to prevent visible emissions, exposure, and asbestos contamination in surrounding areas.
 - (2) Soil Characterization.
 - (3) Training required for all personnel involved in excavation and other soil disturbing activities, once asbestos is encountered during construction or on projects where asbestos encounters are expected. Asbestos Awareness Training shall be given by a qualified and certified Asbestos Building Inspector with a minimum of six months experience inspecting asbestos contaminated soil.
 - (4) Assessment for the presence and extent, within the proposed area of disturbance, of asbestos discoveries, whether expected or unexpected, by a CDPHE Certified Asbestos Building Inspector.
 - (5) Investigation and sampling required for risk assessment and management. Investigation, if required, shall be conducted by a CDPHE Certified Asbestos Building Inspector.
 - (6) Risk assessment and determinations for further management or abatement.
 - (i) Risk assessment and determinations must be made by a CDPHE Certified Asbestos Building Inspector, and coordinated with the Engineer.
 - (ii) Soil remediation is not necessarily required, depending on the circumstances.
 - (7) Submit CDPHE 24-hour Notification form for unexpected RACS discovery included in Attachment 1 of the CDOT Regulated Asbestos-Contaminated Soil Management Standard Operating Procedure
 - (8) Submit CDPHE 10-day Notification form for planned RACS management included in Attachment 1 of the CDOT Regulated Asbestos-Contaminated Soil Management Standard Operating Procedure.
- (e) *Risk Assessment and Determinations for Further Management Or Remediation.* Risk assessment and determinations for further management or remediation must be closely coordinated with the Project Engineer and Project Manager of the Statewide Management Plan.

250.08 Methamphetamine Lab Sites. Demolition of former Methamphetamine (meth) labs is enforced by the Governing Authority, which varies from county to county. The Contractor shall demolish all buildings that are identified as former meth labs, as listed in public listings by the Governing Authority. The Contractor shall provide evidence of demolition to the Governing Authority, obtain receipt of such evidence by the Governing Authority, and shall submit these to Engineer immediately following demolition.

REVISION OF SECTION 250
ENVIRONMENTAL, HEALTH AND SAFETY MANAGEMENT

Septic tank removal at known meth lab sites shall undergo preliminary assessment by an Industrial Hygienist or Certified Industrial Hygienist to determine proper removal and disposal. Work shall proceed in accordance with the recommendations of the Hygienist.

METHOD OF MEASUREMENT

250.09 Environmental Health and Safety Management will not be measured, but will be paid for on a lump sum basis. This will include all work, materials, and hourly time charges by the HSO and other personnel required to accomplish the following:

- (1) Preparation, submittal and briefing of the initial HASP
- (2) Preparation and submittal of the Waste Management Plan
 1. Preparation and Submittal of the Dewatering Plan
 2. Preparation and Submittal of the Remediation Plan
- (3) Procedures and equipment specified in subsections 250.03 - 250.07
- (4) PPE (Levels C and D) for Contractor's personnel for any contamination identified in the preconstruction investigations
- (5) Preparation and submittal of the final site report

The quantity to be measured for Health and Safety Officer will be the total number of hours that the Health and Safety Officer is actually used, as authorized, for the following work:

- (1) Field monitoring necessary to ensure the safety of workers on the site;
- (2) Hours in excess of the items listed under Environmental Health and Safety Management;
- (3) Hours that are necessary due to unforeseen site conditions; and
- (4) Hours of additional consultation or field work that is requested by the Engineer.

Equipment specified in subsection 250.03(a), preparation and submittal of the daily HSO diary, travel to and from the project site, and PPE (Levels C and D) required for use by the HSO will not be measured and paid for separately, but shall be included in the hourly cost of the HSO.

The quantity to be measured for Monitoring Technician will be the total number of hours that Monitoring Technician is actually used as authorized. Equipment specified in subsection 250.03(b), supervision of the MT, preparation and submittal of the daily monitoring diary, travel to and from the project site, and PPE required for use by the MT (Levels C & D) will not be measured and paid for separately, but shall be included in the hourly cost of the MT.

Solid stockpiled materials will be measured by the cubic yard computed from cross sections by the average end area or other requirements acceptable method. Disposal of solid waste and solid hazardous waste materials will be measured by the cubic yard in the disposal container.

Materials Sampling and Delivery will be measured by the actual number of samples collected, containerized and transported to the testing facility indicated in the Contract.

Additional environmental health and safety management work required and authorized by the Engineer, but not included in the items listed above, will be considered extra work to be paid for in accordance with subsection 109.04, unless such work is caused by the Contractor's action.

BASIS OF PAYMENT

250.10 Partial payment for Environmental Health and Safety Management, as determined by the Engineer, will be made as the work progresses. The Contractor shall submit a schedule of environmental related Health and Safety Management work before the first partial payment is made. The schedule shall indicate the environmental related Health and Safety Management time for each work item that requires Contractor environmental related Health and Safety Management effort and the total time for the project.

REVISION OF SECTION 250
ENVIRONMENTAL, HEALTH AND SAFETY MANAGEMENT

The accepted quantity for Health and Safety Officer will be the number of hours actually used and approved for payment by the Engineer and will be paid for at the contract unit bid price.

The accepted quantity for Monitoring Technician will be the number of hours of onsite monitoring as approved by the Engineer and will be paid at the Contract unit price.

Environmental Health and Safety Management, Health and Safety Officer and Monitoring Technician bid items shall include vehicles, phone charges, supplies, printing, postage, office support, and all other miscellaneous costs associated with the work.

Payment for Groundwater Handling (Containerization & Analysis) will be paid for in accordance with subsection 109.04. Payment for Soil Handling (Stockpile) will be made at the contract unit price for all excavated material required to be stockpiled for analysis. The contract unit price will be full compensation for furnishing all materials, labor, equipment and incidentals necessary to complete this work, and all handling of the material prior to disposal. This includes haul, stockpile, and security. Payment for this work will be in addition to any payment made under other bid items for excavation, embankment or backfill on the project, or waste disposal of this material.

Payment for Solid Waste Disposal and Solid Hazardous Waste Disposal will be made at the appropriate contract unit price for the disposal of material determined to be either solid waste or solid hazardous waste. The contract unit prices will be full compensation for furnishing all materials, labor, equipment, tools, storage containers for transport, containerization of material for up to 60 days, and incidentals necessary to complete this work. This includes all handling of the material, loading for disposal, unloading for disposal, and borrow material required for replacement of excavated material disposed of offsite. It does not include stockpiling or containerization required for analysis which is included in the item Materials Handling (Stockpile & Containerization) paid for as described above. Payment for waste disposal fees and transport of hazardous waste will be made as shown below. Payment for this work will be in addition to any payment made under other bid items for excavation, embankment, backfill or material handling (stockpile & containerization) on the project.

- (1) *Solid Waste*. Transport costs to the disposal facility and disposal fees will be included in the contract unit price for this work.
- (2) *Solid Hazardous Waste*. Transport, Disposal and /or Treatment costs will be paid for by planned force account in accordance with subsection 109.04.
- (3) *Liquid Hazardous Waste*. Transport, Disposal and /or Treatment costs will be paid for by planned force account in accordance with subsection 109.04.

The cost of shoring required to limit the removal of contaminated materials to the specified limits shall be included in the bid unit prices for any excavation to be performed. Such shoring ordered by the Engineer in areas other than the specified areas of known or potential contamination, as shown in the plans, will be paid for in accordance with subsection 109.04.

Payment for Materials Sampling and Delivery will be made at the contract unit price for each material sample collected, containerized and transported to the laboratory testing facility as designated in the Contract. The Contract unit price will be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary to complete this work including required sampling kits, containers, sample splits and quality control samples.

The Contractor shall be responsible for damage caused by Contractor negligence to the environment, persons, or property. Expenditures associated with actions of the Contractor shall be borne by the Contractor at no cost to the project.

Contaminated groundwater containerized, treated or disposed under the requirements of this specification will be paid for by planned force account in accordance with subsection 109.04.

The accepted quantities will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule.

REVISION OF SECTION 250
ENVIRONMENTAL, HEALTH AND SAFETY MANAGEMENT

<u>Pay Item</u>	<u>Pay Unit</u>
Environmental Health and Safety Management	Lump Sum
Health and Safety Officer	Hour
Monitoring Technician	Hour
Materials Sampling and Delivery	Each
Materials Handling (Stockpile)	Cubic Yard
Solid Waste Disposal	Cubic Yard

REVISION OF SECTION 401
COMPACTION OF HOT MIX ASPHALT

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

In subsection 401.17, delete the first paragraph and replace with the following:

401.17 Compaction. The hot mix asphalt shall be compacted by rolling. Both steel wheel and pneumatic tire rollers will be required. The number, weight, and type of rollers furnished shall be sufficient to obtain the required density while the mixture is in a workable condition. Compaction shall begin immediately after the mixture is placed and be continuous until the required density is obtained. When the mixture contains unmodified asphalt cement (PG 58-28 or PG 64-22) or modified (PG 58-34), and the surface temperature falls below 185 °F, further compaction effort shall not be applied unless approved, provided the Contractor can demonstrate that there is no damage to the finished mat. If the mixture contains modified asphalt cement (PG 76-28, PG 70-28 or PG 64-28) and the surface temperature falls below 230 °F, further compaction effort shall not be applied unless approved, provided the Contractor can demonstrate that there is no damage to the finished mat.

Warm Mix Asphalt compaction requirements shall conform to CP 59.

In subsection 401.17, delete the third paragraph and replace with the following:

SMA shall be compacted to a density of 93 to 97 percent of the daily theoretical maximum specific gravity, determined according to CP 51. All other HMA shall be compacted to a density of 92 to 96 percent of the daily theoretical maximum specific gravity, determined according to CP 51. If more than one theoretical maximum specific gravity test is taken in a day, the average of the theoretical maximum specific gravity results will be used to determine the percent compaction. Field density determinations will be made in accordance with CP 44 or 81.

In subsection 401.17, second to last paragraph, delete the first sentence and replace with the following:

After production paving work has begun, a new Roller Pattern shall be demonstrated when a change in the compaction process is implemented.

REVISION OF SECTION 401
COMPACTION PAVEMENT TEST SECTION (CTS)

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

In subsection 401.17, delete the fifteenth paragraph and replace with the following:

Two sets of random cores shall be taken within the last 200 tons of the CTS. Each set shall consist of seven random cores. The Engineer will determine the coring locations using a stratified random sampling process. The locations of these cores will be such that one set can serve as a duplicate of the other. One set of these cores shall be immediately submitted to the Engineer. This set will be used for determining acceptance of the CTS and determining density correction factors for nuclear density equipment. Densities of the random samples will be determined by cores according to CP 44. Density correction factors for nuclear density equipment will be determined according to CP 81. Coring shall be performed under CDOT observation. Coring will not be measured and paid for separately but shall be included in the work. For SMA, a CTS is not used. The Contractor shall follow the requirements for the demonstration control strip in accordance with the Revision of Section 403, Stone Matrix Asphalt Pavement.

REVISION OF SECTION 401
COMPOSITION OF MIXTURES – VOIDS ACCEPTANCE

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

Subsection 401.02(a) shall include the following:

On projects with voids acceptance of hot mix asphalt, mix designs based on a theoretical rejection of baghouse fines may be used when necessary to meet CDOT mix design requirements if the following additional requirements are met. Written approval for use of theoretical rejection of baghouse fines mixture design shall be obtained before production of project material.

- (1) Price adjustment for the hot mix asphalt shall be made based on voids acceptance criteria as prescribed in the latest version of the Standard Special Provision, Revision of Sections 105 and 106, Conformity to the Contract of Hot Mix Asphalt (Voids Acceptance). All costs associated with theoretical rejection of baghouse fines mix design, production, and acceptance shall be at the Contractor's expense.
- (2) The Contractor shall submit a separate Quality Control (QC) plan for handling the rejection of baghouse fines. The plan shall identify the plan, equipment, and procedures that will be used for the rejection of baghouse fines. The plan shall include detailed information on baghouse control systems and actual data demonstrating consistent system functionality. The QC plan shall be approved in writing prior to production.
- (3) The Contractor shall demonstrate that the material can be produced in accordance with one of the two procedures listed below. The Contractor shall supply project aggregate material for use in establishing acceptance testing equipment correction factors. Aggregate samples that have been produced according to CP-L 5117 to represent plant-produced material shall be provided by the mix design lab.
 - (i) The Contractor shall produce a minimum of 3000 tons of material. This material shall be placed on non thru lanes or offsite in locations approved by the Engineer. A minimum of 3 samples will be tested for AC content, air voids and VMA. QL's for each element will be determined in accordance with the contract documents. If the QL is equal to or greater than 65 for VMA and Asphalt Cement Content and the QL for the element of air voids is equal to or greater than 70, full production may commence. This material may be considered a separate process and price adjustment will be in accordance with subsection 105.05 or;
 - (ii) The Contractor shall construct a 500-ton test strip on the main line on the project. Tonnage other than 500 tons may be produced only if approved. Three samples in the last 200 tons will be tested for volumetric properties. After construction of the test section, production shall be halted until the testing is complete and element QL's are calculated. If the QL is equal to or greater than 65 for VMA and Asphalt Cement Content and the QL for the element of air voids is equal to or greater than 70, full production may commence. If the TQL is less than 65 or the QL for the element of air voids is less than 70, the material shall be removed and replaced at the Contractor's expense.

February 3, 2011

REVISION OF SECTION 401
PLANT MIX PAVEMENTS

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

Subsection 401.02(b) shall include the following:

After the Form 43 is executed, and all ingredients are available on the project, the Contractor shall notify the Engineer a minimum of one working day in advance of beginning production of the hot mix asphalt. Any changes in the Form 43 will require the same notification unless otherwise approved by the Engineer.

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 REVISION OF SECTION 401
 RECLAIMED ASPHALT PAVEMENT

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

Subsection 401.02(b) shall include the following:

Reclaimed Asphalt Pavement (RAP) is allowed in hot mix asphalt (HMA) up to a maximum binder replacement of 23 percent for all lifts, provided all specifications for HMA are met. Fine Aggregate Angularity requirements shall apply only to the virgin fraction of the fine aggregate. The RAP shall not contain clay balls, vegetable matter, or other deleterious substances, and must meet the uniformity requirements as outlined below.

HMA Project Verification Testing for asphalt content and gradation will be performed at the frequencies listed in the Field Materials Manual in accordance with CP-L 5120.

The Contractor shall have an approved mix design for the amount of RAP to be used. The AC content of the RAP utilized in the Contractor RAP mix design shall be the average AC content determined in accordance with 1B or 1C, below, or alternatively, a minimum of five samples of the Contractors RAP stockpile may be sampled and the average AC content of the RAP be determined using AASHTO T-164, Method A or B, or in accordance with 1C below. The Contractor shall determine the total binder replaced by the binder in the RAP pursuant to the following equation:

$$\text{Total Binder Replaced} = (A \times B) \times 100/E$$

Where:

A = RAP % Binder Content *

B = RAP % in Mix *

E = Total Effective Binder Content *

* in decimal format (i.e. 2% is 0.02)

The Total Binder Replaced by the binder in the RAP shall not exceed 23 percent of the effective binder content of either the mix design or the produced mix.

The use of RAP shall be controlled in accordance with subsections 105.05 and 106.05. If the Contractor elects to use RAP, the following additional conditions shall apply:

1. The Contractor shall have an approved Quality Control (QC) Plan that details how the RAP will be processed and controlled. The QC plan shall address the following:
 - A. RAP Processing Techniques. This requires a schematic diagram and narrative that explains the processing (crushing, screening, and rejecting) and stockpile operation for this specific project.
 - B. Control of RAP Asphalt Binder Content (AASHTO T-164, Method A or B). RAP Asphalt Binder Content may also be determined in accordance with CP-L 5120, provided an RAP AC content correction factor is determined through correlation testing with AASHTO T-164, Method A or B. The correction factor shall be determined by performing correlation testing on the first five samples of the RAP AC content, then at a frequency of one for every five AC content tests thereafter. The correction factor shall be determined by calculating the average difference in AC content between CP-L 5120 and AASHTO T-164, Method A or B, and applying the correction to the AC content determined in accordance with CP-L 5120 :
 Frequency: 1/1000 tons of processed RAP material (minimum five tests)
 - C. (Alternate) The Contractor may propose a RAP asphalt content correction factor to be used in conjunction with CP-L 5120. The proposed CP-L 5120 RAP asphalt content correction factor shall be used with all RAP asphalt contents tested for the mixture design and quality control sampling and testing. The methodology of the proposed CP-L 5120 RAP asphalt content correction factor shall be outlined in detail in the approved RAP QC Plan. At a minimum, the proposed CP-L 5120 correction factor shall identify the principal source locations of the RAP aggregate, gradation of the material tested, and specific ignition oven serial number used in all the RAP asphalt content testing. The RAP source locations, material gradation, and specific equipment used shall substantiate the CP-L 5120 asphalt

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 REVISION OF SECTION 401
 RECLAIMED ASPHALT PAVEMENT

content correction factor used for the testing. The substantiation must be from data gathered from historical information or specific asphalt content correction data obtained from tests performed on similar virgin aggregate sources, virgin material gradations, and the specific equipment used.

- D. Control of RAP Gradation (CP31 or AASHTO T-30):
 Frequency: 1/1000 tons of processed RAP material (minimum three tests)
 - E. Process Control Charts shall be maintained for binder content and each screen listed in subsection 401.02(b), during addition of any RAP material to the stockpile. The Contractor shall maintain separate control charts for each RAP stockpile. The control charts shall be displayed and shall be made available, along with RAP AC extraction testing laboratory reports to the Engineer upon request
2. The processed RAP must be 100 percent passing the 31.5 mm (1¼ inch) sieve. The aggregate obtained from the processed RAP shall be 100 percent passing the 25.0 mm (1 inch) sieve. The aggregate and binder obtained from the processed RAP shall be uniform in all the measured parameters in accordance with the following:

UNIFORMITY*

Parameter	Standard Deviation
Binder Content	0.5
Percent Passing 19 mm (¾")	4.0
Percent Passing 12.5 mm (½")	4.0
Percent Passing 9.5 mm (⅜")	4.0
Percent Passing 4.75 mm (#4)	4.0
Percent Passing 2.36 mm (#8)	4.0
Percent Passing 600 µm (#30)	3.0
Percent Passing 75 µm (#200)	1.5
*Uniformity is the Maximum allowable Standard Deviation of test results of processed RAP.	

- 3. If RAP millings generated are incorporated in the same project, in accordance with CPL 5145 the Contractor shall pave with a virgin mix design until sufficient amount of processed RAP has been stockpiled and tested to allow full production of a RAP HMA mix.

REVISION OF SECTION 401
TEMPERATURE SEGREGATION

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

In subsection 401.16 delete the twelfth (last) paragraph and replace it with the following:

The Engineer may evaluate the HMA for low density due to temperature segregation any time industry best practices, as detailed on Form 1346, are not being followed or the Engineer suspects temperature segregation is occurring. The Engineer will first meet with the Contractor to discuss the paving practices that are triggering the temperature investigation. Areas across the mat, excluding the outside 1 foot of both edges of the mat, that are more than 25 °F cooler than other material across the width may be marked for density testing. Material for temperature comparison will be evaluated in 3-foot intervals behind the paver across the width of the mat. The material shall be marked and tested in accordance with CP 58. If four or more areas within a lot of 500 tons have densities of less than 93 percent of the material's maximum specific gravity for SMA mixes or less than 92 percent of the material's maximum specific gravity for all other HMA mixes, a 5 percent price disincentive will be applied to the 500 ton lot. The 500 ton count begins when the Engineer starts looking for cold areas, not when the first cold area is detected. This price disincentive will be in addition to those described in Sections 105 and 106. Only one area per delivered truck will be counted toward the number of low density areas. Temperature segregation checks will be performed only in areas where continuous paving is possible.

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

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

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

Table 401-1
Tolerances for Hot Bituminous Pavement

Element	Tolerance
Asphalt Cement Content	$\pm 0.3 \%$
Voids in the Mineral Aggregate (VMA)	$\pm 1.2 \%$
Air Voids	$\pm 1.2 \%$

REVISION OF SECTIONS 412, 601 AND 711
LIQUID MEMBRANE-FORMING COMPOUNDS
FOR CURING CONCRETE

Sections 412, 601 and 711 of the Standard Specifications are hereby revised for this project as follows:

In subsection 412.14, first paragraph, delete the second sentence and replace with the following:

The impervious membrane curing compound shall meet the requirements of ASTM C 309, Type 2 and shall be volatile organic content (VOC) compliant.

In subsection 601.13 (b), first paragraph, delete the second sentence and replace with the following:

A volatile organic content (VOC) compliant curing compound conforming to ASTM C 309, Type 2 shall be used on surfaces where curing compound is allowed, except that Type 1 curing compound shall be used on exposed aggregate or colored concrete, or when directed by the Engineer.

In subsection 601.16 (a) 1., delete the first sentence and replace with the following:

1. Membrane Forming Curing Compound Method. A volatile organic content (VOC) compliant curing compound conforming to ASTM C 309, Type 2 shall be uniformly applied to the surface of the deck, curbs and sidewalks at the rate of 1 gallon per 100 square feet.

Delete subsection 711.01 and replace with the following:

711.01 Curing Materials. Curing materials shall conform to the following requirements:

Burlap Cloth made from Jute or Kenaf	AASHTO M 182
Liquid Membrane-Forming Compounds for Curing Concrete	ASTM C 309
Sheet Materials for Curing Concrete	AASHTO M 171*
*Only the performance requirements of AASHTO M171 shall apply.	

Straw used for curing shall consist of threshed straw of oats, barley, wheat, or rye. Clean field or marsh hay may be substituted for straw when approved by the Engineer. Old dry straw or hay which breaks readily in the spreading process will not be accepted.

REVISION OF SECTION 412
PORTLAND CEMENT CONCRETE PAVEMENT FINISHING

Section 412 of the Standard Specifications is hereby revised for this project as follows:

Delete subsection 412.12(a) and replace it with the following:

- (a) *Hand Finishing.* Hand finishing should be minimized wherever possible. The Engineer shall be notified prior to hand finishing work and the proposed hand finished work shall be addressed in the Quality Control Plan for concrete finishing. Unless otherwise specified, hand finishing methods will be permitted only under the following conditions. Hand finished concrete shall be struck off and screeded with a portable screed that is at least 2 feet longer than the maximum width of the slab to be struck off. It shall be sufficiently rigid to retain its shape. Concrete shall be thoroughly consolidated by hand vibrators. Hand finishing shall not be allowed after concrete has been in-place for more than 30 minutes or when initial set has begun unless otherwise approved by the Engineer. Finishing tools made of aluminum shall not be used.

The Contractor shall provide a Quality Control Plan (QCP) to ensure that proper hand finishing is accomplished in accordance with current Industry standards in the concrete pavement placement. It shall also identify the Contractor's method for ensuring that the provisions of the QCP are met. The QCP shall be submitted to the Engineer at the Preconstruction Conference. Paving operations shall not begin until the Engineer has approved the QCP. The QCP shall identify and address issues affecting the quality of finished concrete pavement including but not limited to:

- (1) Timing of hand finishing operations
- (2) Methodology to place and transport concrete
- (3) Equipment and tools to be utilized
- (4) Qualifications and training of finishers and supervisors

When the Engineer determines that any element of the approved QCP is not being implemented or that hand finished concrete is unacceptable, work shall be suspended. The Contractor shall supply a written plan to address improperly placed material and how to remedy future hand finishing failures and bring the work into compliance with the QCP. The Engineer will review the plan for acceptability prior to authorizing the resumption of operations.

REVISION OF SECTIONS 412 AND 705
PERFORMED COMPRESSION SEALS

Sections 412 and 705 of the Standard Specifications are hereby revised for this project as follows:

Subsection 412.13 shall include the following:

Transverse and untied longitudinal joints shall be sawed and sealed as shown in the following diagram for preformed compression seals. Installation shall conform to subsection 412.18, as revised for this project, and the compression seal and lubricant materials shall conform to subsection 705.01, as revised for this project.

Subsection 412.18 shall include the following:

Before installation of the preformed compression seal the following shall be completed:

- (1) Repair of defective pavement slabs and repair and proper curing of cracks or spalls in accordance with subsection 412.16.
- (2) Corrective work for tining.
- (3) Corrective work for smoothness in accordance with subsection 412.17(c).

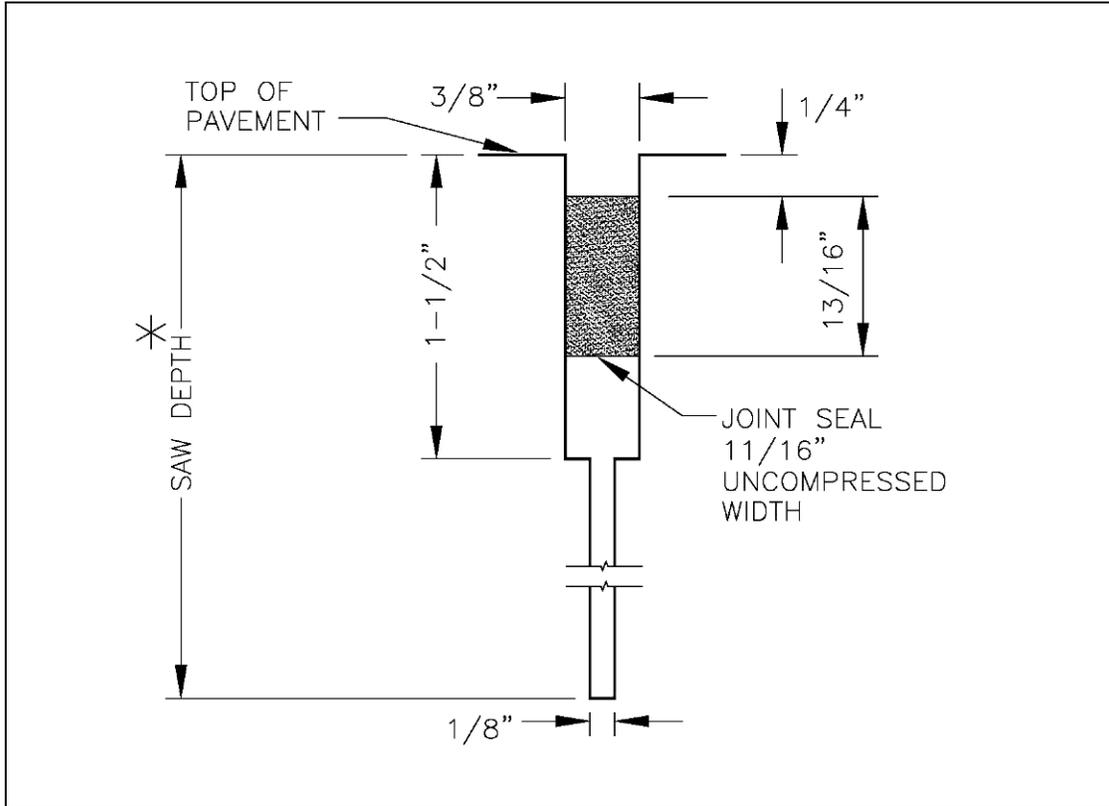
Air temperature at the time of installation shall be from 40 to 80 °F or as recommended by the manufacturer. The joint shall be air cleaned with oil free air at 100 psi minimum just before seal installation. The preformed compression seal shall have an uncompressed width of $1\frac{1}{16}$ inch. Installation shall be in conformance with the following diagram and shall follow the manufacturers recommendations. A machine shall be used for installation which results in proper depth of the seal without damage or twisting of the seal. Elongation during installation shall not exceed 5 percent.

Subsection 705.01 shall include the following:

- (c) *Preformed Compression Seals.* Preformed compression seals shall conform to AASHTO M 220. The lubricant adhesive used for installation of the preformed compression seal shall conform to ASTM D 2835. The Contractor shall provide the Engineer with certified test reports that indicate conformance of the preformed compression seals and lubricant adhesive with these specifications before installation begins.

REVISION OF SECTIONS 412 AND 705
 PREFORMED COMPRESSION SEALS

**JOINT SHAPE AND JOINT FILLER DETAILS FOR
 TRANSVERSE SAWED CONTRACTION JOINT AND
 UNTIED LONGITUDINAL CONTRACTION JOINT**



* Saw Depth
 T/4 for transverse sawed contraction joint
 T/3 for untied longitudinal contraction joint
 Where:
 T = pavement thickness

Tolerances of all joint width dimensions: 0 to +1/16 inch

Installation of preformed compression joint seals shall be in accordance with manufacturer's recommendations.

The joint locations, spacing, and general notes on the standard for concrete pavement joints for this project shall apply.

All materials and installation required for compression joint seals will be included in the work.

All other joints shall be constructed in accordance with standard specifications.

REVISION OF SECTIONS 106 AND 412
 SURFACE TEXTURE OF PORTLAND CEMENT CONCRETE PAVEMENT

Sections 106 and 412 of the Standard Specifications are hereby revised for this project as follows:

Subsection 106.06 (a) shall include the following:

The Contractor shall submit the proposed method of PCCP texturing at the Pre-Construction conference for approval by the Engineer. The Contractor shall perform process control (PC) testing for the pavement surface texture depth in accordance with CP 77 Method B. All PC results for surface texture depth measurements shall be included in the Contractor’s QC notebook. The start of PC testing for texturing depth shall be completed within 24 hours after the first 500 linear feet of textured pavement is placed for each lane. Paving shall not proceed until results are accepted by the Engineer.

Surface texture will be considered acceptable when the average texture depth (ATD) of the panel is greater than 0.05 inch. When the ATD is less than 0.05 inches, the Contractor shall determine the area represented by this test. The area shall be determined by taking additional tests at 15 foot intervals parallel to the centerline in each direction from the affected location until two consecutive tests are found to be within the specified limits. Any surface with unacceptable texturing exceeding 25 linear feet in any lane or shoulder greater than 8 feet wide shall be diamond ground full width of the lane. Upon the second unacceptable test result, the Contractor shall notify the Engineer, in writing, the action taken to provide an acceptable surface texture.

Subsection 106.06 (b) shall include the following

The Department will perform surface texture acceptance testing in accordance with CP 77 Method B. The Department will determine the panel locations where acceptance test measurements are to be taken. One stratified random acceptance test per 2,500 linear feet or fraction thereof in each lane and shoulder wider than 8 feet shall be taken with a minimum of one test per day when the Contractor is paving.

When the Department locates areas of surface texture that do not meet the minimum ATD, the Contractor will be notified and the Contractor shall be responsible for identifying the limits of the deficient texture depth. After the Engineer approves the limits, the Contractor shall correct the deficient surface texture by diamond grinding full lane width to provide an ATD greater than 0.05 inch at no additional cost to the project. Correcting surface texture deficiencies shall occur prior to pavement smoothness testing and pavement thickness determinations.

In subsection 106.06, delete the Tining Depth element from Tables 106-2 and 106-3 and replace with the following:

Table 106-2

Element	Minimum Testing Frequency Contractor’s Quality Control
Average Texture Depth	1 per 528 linear feet in each lane and shoulder wider than 8 feet.

Table 106-3

Element	Minimum Testing Frequency Contractor’s Quality Control
Average Texture Depth	1 per 528 linear feet in each lane and shoulder wider than 8 feet.

Delete subsection 412.07 (c)

Delete subsection 412.12 (c) and (d) and replace with the following:

- (c) *Final Finish and Stationing.* The final surface of the pavement shall be uniformly textured with a broom, burlap drag, artificial turf or diamond ground in order to obtain the specified texture depth. Surface imperfections resulting from the texturing operation shall be corrected by the Contractor at no additional cost.

REVISION OF SECTIONS 106 AND 412
SURFACE TEXTURE OF PORTLAND CEMENT CONCRETE PAVEMENT

Broom, burlap drag or artificial turf texture shall be installed within 15 minutes after strike-off, or as pavement conditions allow

Diamond grinding shall be performed using diamond blades mounted on a self-propelled machine designed for diamond grinding and texturing concrete pavement. The equipment shall have a positive means of vacuuming the grinding residue from the pavement surface, leaving the surface in a clean, near-dry condition. Diamond grinding shall not occur until the concrete has attained strength of at least 2,500 psi.

The diamond grinding process shall produce a pavement surface that is true to grade and uniform in appearance. The grooves shall be evenly spaced. Any ridges on the outside edge next to the shoulder, auxiliary, or ramp lanes greater than 3/16 inch high shall be feathered out to the satisfaction of the Engineer in a separate, feather pass operation.

The pavement surface after diamond grinding shall have no depressions or misalignment of slope in the longitudinal direction exceeding 1/8 inch in 12 feet when measured with a 12 foot straightedge placed parallel to the centerline. All areas of deviation shall be reground at no additional cost.

Stationing shall be stamped into the outside edge of the pavement, as shown on the plans.

Delete subsection 412.14 and replace with the following:

412.14 Curing. Immediately after the finishing operations have been completed the entire surface and exposed sides of the newly placed concrete, shall be sprayed uniformly with a curing compound meeting the requirements of ASTM C309, Type 2. The ASTM C309 Type 2 curing compound shall be volatile organic content (VOC) compliant.

The curing compound shall be applied within 10 minutes after the final finish has been applied. Failure to cover the surface of the concrete within 10 minutes shall be cause for immediate suspension of the paving operations.

An initial application of curing compound shall be applied under pressure by mechanical sprayers at the rate of not less than 1 gallon per 180 square feet of pavement surface. A second application of curing compound shall be applied within 30 minutes after the initial application. The second application rate shall be not less than 1 gallon per 180 square feet of pavement surface. Alternatively, the Contractor may apply the curing compound in one application of not less than 1 gallon per 120 square feet. Additional curing compound shall be applied as needed to ensure that 100 percent of the pavement is covered. The spraying equipment shall be fully automated, equipped with a tank agitator, and a wind guard. During application, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle and the compound shall be stirred continuously by effective mechanical means. Hand spraying of irregular widths or shapes and surfaces exposed by removal of forms will be permitted. Curing compounds shall not be applied to the inside faces of joints to be sealed.

Should the curing film become damaged from any cause, within 72 hours after concrete placement, except for Class E concrete open to traffic, the damaged portions shall be repaired immediately with additional curing compound, payment for which shall be at the Contractor's expense.

The sides of pavement slabs shall be immediately sprayed with curing compound when the forms are removed.

Delete subsection 412.18(2) and replace with the following:

(2) Corrective work for texturing.

Delete subsection 412.22 and replace with the following:

412.22 Opening to Traffic. The pavement shall not be opened to traffic until the concrete has achieved a compressive strength of 3000 psi. Concrete compressive strength shall be determined by maturity meters. Prior to opening the pavement to traffic the roadway shall be cleaned, as approved.

REVISION OF SECTIONS 106 AND 412
SURFACE TEXTURE OF PORTLAND CEMENT CONCRETE PAVEMENT

Prior to placement of concrete whose strength will be determined with maturity meters, the Contractor shall provide the Engineer a report of maturity relationships in accordance with CP 69. The Contractor shall provide maturity meters and all necessary wires and connectors. The Contractor shall be responsible for the placement and maintenance of the maturity meters and wires. At a minimum a maturity meter will be placed at a minimum of once per day and then once per 5,000 square yards. Placement shall be as directed by the Engineer.

For placements with multiple maturity meters, the lowest compressive strength shall determine when the pavement may be opened to traffic.

If a maturity meter fails, is tampered with, is destroyed or was not placed, the section of pavement represented by the maturity meter shall remain closed to traffic for a period of 28 days. The Contractor may choose at his own expense to core the section of pavement represented by the maturity meter. Cores will be obtained and tested according to CP 65. Cores will be a minimum of 4 inches in diameter. A minimum of three cores in a two square foot area will be obtained. If the compressive strength of any one core differs from the average by more than 10 percent that compressive strength will be deleted and the average strength will be determined using the compressive strength of the remaining two cores. If the compressive strength of more than one core differs from the average by more than 10 percent the average strength will be determined using all three compressive strengths of the cores. To open the section of pavement, the average compressive strength of the cores shall be a minimum of 3,000 psi.

In subsection 412.24 (a) delete the second paragraph and replace with the following:

The price per square yard of Concrete Pavement shall be full compensation for furnishing and placing all materials, including any dowels, tie bars, joint materials, texturing, sawing, finishing, and rumble strips.

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REVISION OF SECTION 503
DRILLED SHAFTS

Section 503 of the Standard Specifications is hereby deleted for this project and replaced with the following:

DESCRIPTION

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

SUBMITTALS AND MEETINGS

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

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

1. On-site supervisors shall have a minimum of two years of experience in supervising construction of drilled shaft foundations of similar size (diameter and depth) and installation method to those shown in 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 one year experience in construction of drilled shaft foundations.

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

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

- (1) Description of overall construction operation sequence and the sequence of drilled shaft construction when in groups or lines.
- (2) A list, description and capacities of proposed equipment including but not limited to cranes, drills, augers, bailing buckets, final cleaning equipment and drilling unit. As appropriate, the narrative shall describe why the equipment was selected and suitability to the anticipated site and subsurface conditions.
- (3) Details of drilled shaft excavation methods, including proposed drilling methods, methods for cleanout of the bottom of the excavation hole and a disposal plan for excavated material including drilling slurry (if applicable). This shall include means and methods to address subsurface geotechnical conditions including boulder and obstruction removal techniques if such are indicated in the Contract subsurface geotechnical information or Contract Documents.

REVISION OF SECTION 503
DRILLED SHAFTS

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

- (4) Detailed procedures for mixing, using, maintaining, storing, and disposing of the slurry shall be provided if applicable. A detailed mix design (including all additives and their specific purpose in the slurry mix) and a discussion of its suitability to the anticipated subsurface geotechnical and site conditions shall also be provided for the proposed slurry.
 - (5) The submittal shall include a detailed plan for process control of the selected slurry including property tests, test methods, and minimum and/or maximum property requirements which must be met to ensure that the slurry functions as intended for the anticipated subsurface conditions and shaft construction methods in accordance with the slurry manufacturer's recommendations and these Specifications.
 - (6) When casings are proposed or required, casing dimensions and detailed procedures for casing installation, removal, advancing the casing, and excavating the drilled shaft hole in accordance with subsection 503.13 (b) of this Specification shall be provided. When removing casing, detail the method to extract the casing to maintain shaft reinforcement in proper alignment and keep concrete workable during casing extraction.
 - (7) Details of concrete placement including proposed equipment and procedures for delivering concrete to the drilled shaft, placement of the concrete into the shaft, placement and raising of the tremie or pump line during placement, size of tremie and pump lines, operational procedures for pumping, and a sample uniform yield form to be used by the Contractor for plotting the volume of concrete placed versus the depth of shaft for all shaft concrete placement. Describe the method to be used to form a horizontal construction joint during concrete placement. Include details of procedures to prevent loss of slurry or concrete into waterways, and other areas to be protected.
 - (8) Describe the method and materials that will be used to fill or eliminate all voids below the top of shaft between the plan shaft diameter and excavated shaft diameter, or between the shaft casing and surrounding soil if permanent casing is specified.
 - (9) Details of any required load tests or shaft integrity tests including equipment, instrumentation, procedures, calibration data for test equipment, calculations and drawings.
 - (10) Details and procedures for protecting existing structures, utilities, roadways and other facilities during drilled shaft installation.
- (c) *Slurry Technical Assistance.* If slurry is to be used to construct the drilled shafts, the Contractor shall provide or arrange for technical assistance from the slurry manufacturer as specified in subsection 503.13 (b).5.(1) of this Specification. The Contractor shall submit three copies of the following to the Engineer at least 14 days prior to the start of drilled shaft construction:
- (1) The name and current phone number of the slurry manufacturer's technical representative assigned to the project.
 - (2) The names of the Contractor's personnel assigned to the project and trained by the slurry manufacturer's technical representative in the proper use of the slurry. The submittal shall include a signed training certification letter from the slurry manufacturer for each individual including the date of the training.
- (d) *Logs of Shaft Construction.* The Contractor's Quality Control staff shall prepare inspection logs using CDOT Form 1333 – Inspector's Report of Caisson Installation documenting each shaft construction activity. In addition, the Contractor shall prepare and submit the logs documenting any subsurface investigation borings or rock core holes performed by the Contractor at drilled shaft foundation locations.

REVISION OF SECTION 503
DRILLED SHAFTS

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

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

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

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

- (1) The superintendent, on-site supervisors, and other Contractor personnel involved in the preparation and execution of the Drilled Shaft Installation Plan.
- (2) The Project Engineer and Owner's personnel involved with the structural, geotechnical, and construction review of the Drilled Shaft Installation Plan together with Owner's personnel who will provide inspection and oversight during the drilled shaft construction phase of project.

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

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

- (1) The superintendent, on site supervisors, and other key personnel identified by the Contractor as being in charge of excavating the shaft, placing the casing and slurry as applicable, placing the steel reinforcing bars, and placing the concrete. If slurry is used to construct the shafts, the slurry manufacturer's representative and a Contractor's employee trained in the use of the slurry, as identified to the Engineer in accordance with Subsection 503.04.(c).4.(1) of this Specification, shall also attend.
- (2) The Engineer, key inspection personnel, and appropriate representatives of the Department. If the Contractor's key personnel change, or if the Contractor proposes a significant revision of the approved Drilled Shaft Installation Plan, an additional conference may be held at the request of the Engineer before any additional shaft construction operations are performed.

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

REVISION OF SECTION 503
DRILLED SHAFTS**MATERIALS**

503.05 Concrete. Concrete used in the construction of drilled shafts shall be Class BZ and shall conform to the requirements of Section 601. If the concrete does not meet the requirements of Section 601, reductions shall be applied to the Subsection 503.24 drilled caisson pay item. The concrete slump shall be between 6 in. and 9 in. and the coarse aggregate size shall not exceed 0.375 in. A minimum of 6 in. slump shall be maintained during the period equal to the anticipated pour period plus 2.0 hours. The use of retarders and mid-range water reducers is allowed to extend the slump life of the concrete.

503.06 Reinforcing Steel. Reinforcing steel used in the construction of drilled shafts shall conform to 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 with mud, oils and solvents, and other deleterious materials. The steel should 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 in 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 in the Plans, it is specified to satisfy structural design requirements only. The Contractor shall increase the casing thickness from the minimum specified thickness, as necessary and accepted by the Engineer, to satisfy the construction installation requirements.

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

All temporary casing shall be a smooth wall structure steel except where corrugated metal pipe is shown in 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 shall be used in conformance with the quality control plan specified in Subsection 503.02.(b).(5)

Mineral slurry shall conform to the following requirements:

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REVISION OF SECTION 503
DRILLED SHAFTS

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 (percent)	API 13B-1, Section 5	4.0 max immediately prior to placing concrete

503.09 Polymer Slurry. Polymer slurries, either natural or synthetic, shall be used in conformance with the manufacturer's recommendations, and shall conform to the quality control plan specified in Subsection 503.02.(b).(5) of this Specification. 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 1.5
Sand Content (percent)	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 (percent)	API 13B-1, Section 5	1.0 max

503.12 Access Tubes for CSL Testing. Access tubes for CSL testing shall be steel pipe of 0.145 inches minimum wall thickness and at least 1-1/2 inch inside diameter. The access tubes shall have a round, regular inside diameter free of defects and obstructions, including all pipe joints, in order to permit the free, unobstructed passage of 1.3 inch maximum diameter source and receiver probes used for the CSL tests. The access tubes shall be non-galvanized, watertight, free from corrosion, and with clean internal and external faces to ensure good bond between the concrete and the access tubes. The access tubes shall be fitted with watertight threaded caps on the bottom and the top. Grout for filling the access tubes at the completion of the CSL tests shall be a neat cement grout with a minimum water/cement ratio of 0.45.

CONSTRUCTION REQUIREMENTS

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

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DRILLED SHAFTS

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) of this Specification 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) of this Specification 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 Sections 503.09, 503.10 and 503.11 of this Specification prior to recommencing shaft excavation operations.

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

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

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

REVISION OF SECTION 503
DRILLED SHAFTS

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

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

1. Temporary Casing Construction Method

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

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

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

2. Permanent Casing Construction Method

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

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 otherwise by the Engineer. Casing used for forming shafts installed through a body of water shall not be removed.

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 can use uncontrolled in-situ slurry to install temporary casing.

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REVISION OF SECTION 503
DRILLED SHAFTS

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 will be 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 of this Specification 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 twelve inches per hour, or if the Contractor is not able to restrict the amount of water in the drilled shaft to less than three 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) of this Specification, 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) of this Specification, shall be present at the site throughout the shaft slurry operations for this project to perform the duties specified above.

B. Minimum Level of Slurry in the Excavation

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

Slurry levels shall be as follows:

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

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

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

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

- (1) no lower than the groundwater level elevation outside the drilled shaft,
- (2) elevation as required to provide and maintain a stable hole.

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DRILLED SHAFTS

C. Cleaning Slurry

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

503.14 Obstructions. When obstructions are encountered, the Contractor shall notify the Engineer promptly. An obstruction is defined as a specific object not identified in 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 of this Specification. 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) of this Specification and approved by the Engineer. A sample set shall be composed of samples taken at mid-height and within two feet of the bottom of the storage area.

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 two 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 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.

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 REVISION OF SECTION 503
 DRILLED SHAFTS

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

503.18 Assembly and Placement of Reinforcing Steel. The contractor shall show bracing and any extra reinforcing steel required for fabrication of the cage on the shop drawings. The contractor will 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 must be tied. At least 4 vertical bars of each cage, equally spaced around the circumference, shall be tied at all reinforcement intersections with double wire ties. The remaining reinforcement intersections in each cage shall be tied with single wire ties.

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

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

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REVISION OF SECTION 503
DRILLED SHAFTS

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 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 conform to subsections 503.09, 503.10 and 503.11 of this Specification. The CSL access tubes shall be filled with potable water before concrete placement and the top watertight threaded caps shall be reinstalled. Concrete placement shall continue in one operation to the top of the drilled shaft, or as shown in the Plans.

If water is not present (a dry shaft), the concrete shall be deposited through the center of the reinforcement cage by tremie 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, the steel reinforcing bars, or the steel reinforcing bar cage bracing.

If water exists in amounts greater than two inches in depth or enters at a rate of more than twelve inches per hour then the drilled shaft excavation must be filled with slurry to at least the level specified in Subsection 503.13 (b).5.(2) and concrete placed by tremie methods outlined in this section.

The elapsed time for concrete placement shall not exceed the time limit defined in the accepted Drilled Shaft Installation Plan and demonstrated by a successful technique shaft or test shaft. The concrete placement time shall commence at the mixing of the concrete and extend through to the completion of placement of the concrete in the drilled shaft excavation, including removal of any temporary casing. For wet placement methods, the placement time shall start at the batching of the initial load of concrete to be placed in the shaft. Prior to concrete placement, the Contractor shall provide test results of both a trial mix and a slump loss test conducted by an approved testing laboratory using approved methods to demonstrate that the concrete meets this defined placement time limit. The concrete mix shall maintain a slump of 4 inches or greater over the defined placement time limit as demonstrated by trial mix and slump loss tests. The trial mix and slump loss tests shall be conducted at ambient temperatures appropriate for site conditions. Ambient air temperature at the time of concrete placement shall not be greater than the ambient temperature at the time of the concrete trial tests and slump loss tests.

All admixtures, when approved for use, shall be adjusted for the conditions encountered on the job so the concrete remains in a workable plastic state throughout the defined placement time limit.

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 required by the Plans.

The Contractor shall not perform foundation piling driving or casing installation using oscillation method within a radius of 20 feet, nor drilled shaft excavation operations within a clear distance of three diameters of a newly poured drilled shaft 24 hours of the placement of concrete and only when 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 can be waived.

Throughout the underwater concrete placement operation, the discharge end of the tube shall remain submerged in the concrete at least five feet and the tube shall always contain enough concrete to prevent water from entering. The concrete placement shall be continuous until the work is completed, resulting in a seamless, uniform shaft. If the concrete placement operation is interrupted, the Engineer may require the contractor to prove by core drilling or other tests that the drilled shaft contains no voids or horizontal joints. If testing reveals voids or joints, the Contractor shall repair them or replace the drilled shaft at no expense to the Owner.

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REVISION OF SECTION 503
DRILLED SHAFTS

Responsibility for coring and testing costs, and calculation of time extension, shall be in accordance with Section 503.21 of this Specification. The Contractor shall use a concrete pump or gravity tremie. A tremie shall have a hopper at the top that empties into a watertight tube at least eight inches in diameter. If a pump is used, a watertight tube shall be used with a minimum diameter of four inches. The discharge end of the tube on the tremie or concrete pump line shall include a device to seal out water or slurry while the tube is first filled with concrete. In lieu of a seal at the discharge end of the pipe, the Contractor may opt to place a "Pig" or "Rabbit" in the hopper prior to concrete placement which moves through the tremie when pushed by the concrete, forcing water or slurry from the tremie pipe. The Contractor shall complete a concrete yield plot for each wet shaft poured by tremie methods. This yield plot will be submitted to the Engineer within 24 hours of completion of the concrete pour.

The hopper and tubes shall not contain aluminum parts that will have contact with the concrete. The inside and outside surfaces of the tubes shall be clean and smooth to allow both flow of concrete and the unimpeded withdrawal of the tube during concrete placement.

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"

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 six inches above or three 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 one inch or minus three inches.

The diameter of the drilled shaft shall not be less than the diameter 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 either cost to the Owner or an extension of the completion date of the project. Redesign drawings and computations submitted by the Contractor shall be signed by a registered Professional Engineer licensed in the State of Colorado.

TESTING AND VERIFICATION

503.21 Integrity Testing. CSL testing shall be performed in accordance with ASTM D6760. The minimum number of shafts tested shall be indicated in the plans. CSL testing shall be performed on shafts constructed using tremie concrete placement methods and drilled shafts selected by the Engineer. The Engineer may increase the number of shafts tested as deemed necessary. The Contractor shall accommodate the CSL testing by furnishing and installing access tubes in accordance with Subsection 503.12 of this Specification.

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REVISION OF SECTION 503
DRILLED SHAFTS

The Contractor shall install access tubes for CSL testing in drilled shafts as shown on the plans selected by the Engineer to permit access for the CSL test probes. If, in the opinion of the Engineer, the condition of the drilled shaft excavation permits drilled shaft construction in the dry, the Engineer may specify that the testing be omitted.

The Contractor shall securely attach the access tubes to the interior of the reinforcement cage of the drilled shaft. One access tube shall be furnished and installed for each foot of drilled shaft diameter, rounded up to the nearest whole number, unless otherwise shown in the Plans. A minimum of three tubes will be required. The access tubes shall be placed around the drilled shaft, inside the spiral or hoop reinforcement and three inches clear of the vertical reinforcement, at a uniform spacing measured along the circle passing through the centers of the access tubes. If these minimums cannot be met due to close spacing of the vertical reinforcement, then the access tubes shall be bundled with the vertical reinforcement.

If trimming the cage is required and access tubes for CSL testing are attached to the cage, the Contractor shall either shift the access tubes up the cage, or cut the access tubes provided that the cut tube ends are adapted to receive the watertight cap as specified.

The access tubes shall be installed in straight alignment and as near to parallel to the vertical axis of the reinforcement cage as possible. The access tubes shall extend from the bottom of the drilled shaft to at least two feet above the top of the drilled shaft. Couple tubes as required with threaded couplers, such that inside of tube remains flush. The Contractor shall clear the access tubes of all debris and extraneous materials before installing the access tubes. Care shall be taken to prevent damaging the access tubes during reinforcement cage installation and concrete placement operations in the drilled shaft excavation.

The access tubes shall be filled with potable water before concrete placement, and the top watertight threaded caps shall be reinstalled.

Prior to performing any crosshole sonic log testing operations specified in this subsection, the Contractor shall remove the concrete at the top of the drilled shaft down to sound concrete.

The Contractor shall engage a qualified Specialty Engineer to perform the CSL testing. The qualified CSL Specialty Engineer must have a minimum three years of experience of CSL testing and have a Colorado Licensed Professional Engineer supervising the collection and interpretation of data. The contractor shall provide all necessary assistance to the CSL Specialty Engineer to satisfactorily perform the testing.

The testing shall be performed after the drilled shaft concrete has cured at least 96 hours. Additional curing time prior to testing may be required if the drilled shaft concrete contains admixtures, such as set retarding admixture or water reducing admixture. The additional curing time prior to testing required under these circumstances shall not be grounds for additional compensation or extension of time to the Contractor. No subsequent construction shall be performed on the completed drilled shaft until the CSL tests are approved and the drilled shaft accepted by the Engineer.

After placing the drilled shaft concrete and before beginning the CSL testing of a drilled shaft, the Contractor shall inspect the access tubes. Each access tube that the test probe cannot pass through shall be replaced, at the Contractor's expense, with a two inch diameter hole cored through the concrete for the entire length of the drilled shaft. Unless directed otherwise by the Engineer, cored holes shall be located approximately six inches inside the reinforcement and shall not damage the drilled shaft reinforcement. Descriptions of inclusions and voids in cored holes shall be logged and a copy of the log shall be submitted to the Engineer. Findings from cored holes shall be preserved, identified as to location, and made available for inspection by the Engineer.

The Engineer may approve the continuation of drilled shaft construction prior to approval and acceptance of the first shaft if the Engineer's observations of the construction of the first shaft are satisfactory, including, but not limited to, conformance to the Drilled Shaft Installation Plan as approved by the Engineer, and the Engineer's review of Contractor's daily reports and inspector's daily logs concerning excavation, steel reinforcing bar placement, and concrete placement.

Drilled shafts with velocity reduction exceeding 30% are not acceptable without additional offset CSL testing and Three Dimensional (3-D) Tomography analysis

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REVISION OF SECTION 503
DRILLED SHAFTS

If subsequent testing at a drilled shaft indicates the presence of a defect(s) in the drilled shaft, the testing costs and the delay costs resulting from the additional testing shall be borne by the Contractor. If this additional testing indicates that the drilled shaft has no defect, the testing costs and the delay costs resulting from the additional testing will be paid by the Owner, and, if the drilled shaft construction is on the critical path of the Contractor's schedule, a time extension equal to the delay created by the additional testing will be granted.

If the Engineer determines a drilled shaft is unacceptable based on the CSL tests and tomographic analyses, or observes problems during drilled shaft construction, coring of the shaft to allow further evaluation and repair is required, or the shaft has to be replaced. If coring to allow further evaluation of the shaft and repair is chosen, one or more core samples shall be taken from each unacceptable shaft for full depth of the shaft or to the depth directed by the Engineer. The Engineer will determine the number, location, and diameter of the cores based on the results of 3-D tomographic analysis of offset and horizontal CSL data. An accurate log of cores has to be kept. Properly mark and place the cores in a crate showing the shaft depth at each interval of core recovery. Transport the cores, along with five copies of the coring log to the Engineer. Perform strength testing by an AASHTO certified lab on portions of the cores that exhibit questionable concrete as determined by the Engineer. If the drilled shaft offset CSL testing, 3-D tomographic analyses and coring indicate the shaft is defective, propose remedial measures for approval by the Engineer. Such improvement may consist of, but is not limited to correcting defective portions of the shaft, providing straddle shafts to compensate for capacity loss, or providing a replacement shaft. Repair all detected defects and conduct post repair integrity testing using horizontal and offset CSL testing and 3-D tomographic imaging as described in this Section. Perform all work described in this Section at no additional cost to the Department, and with no increase in Contract Time.

All access tubes and cored holes shall be dewatered and filled with a 4000 psi grout after tests are completed and the drilled shaft is accepted. The access tubes and cored holes shall be filled using grout tubes that extend to the bottom of the tube or hole or into the grout already placed.

503.22 Drilled Shafts Load Tests. Test shafts shall be installed at the locations shown on the Plans unless otherwise directed or approved by the Engineer.

Test shafts shall be installed to the same dimensions, details and elevations shown on the Plans, and shall be installed using the same equipment and installation procedures proposed for installation of the foundation drilled shafts.

If the methods or procedures are changed following the completion of load testing, the Contractor shall install additional load test shafts, and conduct additional load tests as directed by the Engineer at no additional cost to the Owner.

A stamped report of load test results within five business days of the testing completion is required. Load testing results will be evaluated by the Engineer before installing any production drilled shafts, unless otherwise authorized by the Engineer, to allow for design modifications based on the load test results. Load test data as reported shall conform to the Drilled Shaft Foundation Testing (Dshaft) and be available in electronic form at the project website (<http://srg.cce.iastate.edu/shaft>).

- (a) *Static Load Tests.* Static load tests shall be performed in accordance with the procedures specified in ASTM D 1143.
- (b) *Force Pulse (Rapid) Load Tests.* Force pulse (rapid) load tests shall be performed in accordance with the procedures specified in ASTM D 7383.

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DRILLED SHAFTS

METHOD OF MEASUREMENT

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

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

BASIS OF PAYMENT

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

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

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Drilled Caisson (XX Inch dia.)	Linear Foot
Load Tests	Each
CSL Testing	Each

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

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

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REVISION OF SECTION 503
DRILLED SHAFTS

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

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

REVISION OF SECTION 507
GROUTED RIPRAP SLOPE AND DITCH PAVING

Section 507 of the Standard Specifications is hereby revised for this project as follows:

In subsection 507.05 delete the first paragraph and replace with the following:

507.05 Grouted Riprap Slope and Ditch Paving. Concrete mortar for grouted riprap slope and ditch paving shall meet the requirements of Section 601 and the following:

Field Compressive Strength (28 days) (Not a specification requirement)	2000 psi
Minimum Cement Content	560 lbs./cu. yd.
Air Content	6-9%
Slump, AASHTO Designation T-119	5-9 inches
Fine Aggregate, AASHTO M-6	65-75%
Coarse Aggregate, AASHTO M-43	3/8" nominal maximum size
Polypropylene Fibers (1" fiber length or equivalent)	1.5 lbs./cu. yd.

REVISION OF SECTIONS 507, 601 AND 606
MACRO FIBER-REINFORCED CONCRETE

Sections 507, 601 and 606 of the Standard Specifications are hereby revised for this project as follows:

Delete subsection 507.02 and replace with the following:

507.02 Concrete, Slope and Ditch Paving. Concrete shall conform to the requirements of Section 601. Concrete shall be Macro Fiber-Reinforced Class B Concrete.

Preformed joint filler shall conform to AASHTO M 213

In subsection 507.08, first paragraph, delete the second sentence.

Subsection 507.14 shall include the following:

Polyolefin fiber reinforcement will not be measured and paid for separately, but shall be included in the work.

Subsection 601.05 shall include the following:

Concrete for Bridge Sidewalk shall be Macro Fiber-Reinforced Class D Concrete

Subsection 606.02 shall include the following:

Concrete for bridge rail shall be Macro Fiber-Reinforced Class D Concrete and conform to the requirements of Section 601

Subsection 606.06 shall include the following:

Polyolefin fiber reinforcement will not be measured and paid for separately, but shall be included in the work.

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 REVISION OF SECTION 601
 CLASS B, BZ, D, DT AND P CONCRETE

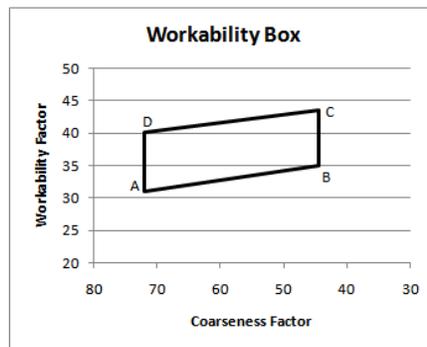
Section 601 of the Standard Specifications is hereby revised for this project as follows:

Subsection 601.02 shall include the following:

Deviations from the Standard Class B, Class BZ, Class D, DT and P concrete may be made under the following conditions:

- (1) The minimum cement content may be reduced from that specified in Table 601-1 if lab test results show that the permeability of the mix does not exceed 2,500 Coulombs at an age of not more than 56 days as determined by ASTM C1202.
- (2) The maximum cement content may be increased from that specified in Table 601-1 if lab test results show that the unrestrained shrinkage is less than 0.050 percent when tested by CP-L 4103.
- (3) The maximum amount of fly ash substituted for ASTM C150 cement or the maximum pozzolan content when ASTM C595 or C1157 cement is used may exceed the limits in subsection 601.05 if lab test results show that the permeability of the mix does not exceed 2,500 Coulombs at an age of not more than 56 days as determined by ASTM C1202 and the salt scaling resistance is less than 3 as determined by ASTM C672.
- (4) Except for Class DT, the concrete mix may use an Optimized Gradation (OG). When an OG is used aggregate proportions must be a result of an optimized combined aggregate gradation (CAG) developed by an approved mix design technique such as Shilstone or KU Mix. The amount of aggregate in the CAG passing the 19 mm (¾ inch) sieve and retained on the 12.5 mm (½ inch) sieve shall be a minimum of 8 percent for the trial mix design. The coarseness factor (CF) and workability factor (WF) must plot within the workability box (ABCD) depicted graphically by the following 4 coordinate points:
 - a. Point A > (CF,WF) 72, 31
 - b. Point B > (CF,WF) 44.5, 35
 - c. Point C > (CF,WF) 44.5, 43.5
 - d. Point D > (CF,WF) 72, 40

Figure 601-1



$$CF = (S / T) \times 100$$

Where:

S = Percent Cumulative Retained on 9.5 mm (3/8 inch) Sieve

T = Percent Cumulative retained on 2.36 mm (No. 8) Sieve

WF is the percent passing the 2.36 mm (No. 8) sieve. Increase workability factor by 2.5 percentage points for every 94 pounds per cubic yard of cementitious material used in excess of 564 pounds per cubic yard in the mix design. Decrease workability factor by 2.5 percentage points for every 94 pounds per cubic yard of cementitious material used below 564 pounds per cubic yard in the mix design. The Contractor shall not adjust the workability factor if the amount of cementitious material is 564 pounds per cubic yard.

REVISION OF SECTION 601
CLASS B, BZ, D, DT AND P CONCRETE

- (5) Aggregate gradings not obtained through an OG may be used if lab test results show that the unrestrained shrinkage is less than 0.050 percent when tested by CP-L 4103.

Concrete with any of the above deviations shall be known as Class () Non Standard concrete (Class _-NS concrete). For example Class B-NS. Non Standard concrete may be substituted for the equivalent standard concrete. Non Standard concrete shall be tested, accepted, measured and paid for as standard concrete or the pay item specifying standard concrete.

Subsection 601.05 shall include the following in the second paragraph:

- (8) Concrete with an OG shall indicate the gradation proportions that results in a combined aggregate gradation corresponding to compliance within the specified CF and WF box and shall include the following charts used to perform aggregate gradation analysis:
- (i) Coarseness Factor
 - (ii) Workability Factor
 - (iii) 0.45 power
 - (iv) Combined gradation

Delete Subsection 601.06 (10) and (11) and replace with the following:

- (10) Weights of fine and coarse aggregates or combined weight when an OG is pre-blended
(11) Moisture of fine and coarse aggregates or combined moisture when an OG is pre-blended

Subsection 601.17 shall include the following:

(g) *Water to cementitious material content (w/cm) ratio.* When a Non Standard concrete is used the maximum w/cm ratio is the w/cm ratio that was used in the in the laboratory trial mix for the Concrete Mix Design. The w/cm ratio shall be determined for each batch of Non Standard concrete by the Contractor and provided to the Engineer for approval prior to placement. If an adjustment to the mix is made after the Engineer's approval, the w/cm shall be determined and submitted to the Engineer prior to the continuation of placement. Any Non Standard concrete that is placed without the Engineer's approval shall be removed and replaced at the Contractor's expense.

February 3, 2011

REVISION OF SECTION 601
CONCRETE BATCHING

Section 601 of the Standard Specifications is hereby revised for this project as follows:

In subsection 601.06, delete (13) and (17) and replace with the following:

- (13) Gallons of water added by truck operator, the time the water was added and the quantity of concrete in the truck each time water is added.
- (17) Water to cementitious material ratio.

REVISION OF SECTIONS 601
CONCRETE FINISHING

Section 601 of the Standard Specifications are hereby revised for this project as follows:

In subsection 601.12 (a) delete the fifth paragraph and replace it with the following:

Water shall not be added to the surface of the concrete to assist in finishing operations.

Hand finishing should be minimized wherever possible. The hand finishing methods shall be addressed in the Quality Control Plan for concrete finishing. Hand finished concrete shall be struck off and screeded with a portable screed that is at least 2 feet longer than the maximum width of the surface to be struck off. It shall be sufficiently rigid to retain its shape. Concrete shall be thoroughly consolidated by hand vibrators. Hand finishing shall not be allowed after concrete has been in-place for more than 30 minutes or when initial set has begun. Finishing tools made of aluminum shall not be used.

The Contractor shall provide a Quality Control Plan (QCP) to ensure that proper hand finishing is accomplished in accordance with current Industry standards. It shall identify the Contractor's method for ensuring that the provisions of the QCP are met. The QCP shall be submitted to the Engineer at the Preconstruction Conference. Concrete placement shall not begin until the Engineer has approved the QCP. The QCP shall identify and address issues affecting the quality finished concrete including but not limited to:

- (1) Timing of hand finishing operations
- (2) Methodology to place and transport concrete
- (3) Equipment and tools to be utilized
- (4) Qualifications and training of finishers and supervisors

When the Engineer determines that any element of the approved QCP is not being implemented or that hand finished concrete is unacceptable, work shall be suspended. The Contractor shall supply a written plan to address improperly placed material and how to remedy future hand finishing failures and bring the work into compliance with the QCP. The Engineer will review the plan for acceptability prior to authorizing the resumption of operations.

In subsection 601.14(a) delete the fourth paragraph.

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 REVISION OF SECTION 601
 CONCRETE SLUMP ACCEPTANCE

Section 601 of the Standard Specifications is hereby revised for this project as follows:

Delete the fifth paragraph of Subsection 601.05 and replace with the following:

Except for Class BZ concrete, the slump of the delivered concrete shall be the slump of the approved concrete mix design plus or minus 2.0 inch. The laboratory trial mix must produce an average compressive strength at least 115 percent of the required field compressive strength specified in Table 601-1. When entrained air is specified in the Contract for Class BZ concrete, the trial mix shall be run with the required air content.

Delete Subsection 601.17 (b), 601.17 (d) and Table 601-3 and replace with the following:

(b) *Slump*. Slump acceptance, but not rejection, may be visually determined by the Engineer. Any batch that exceeds the slump of the approved concrete mix design by 2.0 inches will be retested. If the slump is exceeded a second time, that load is rejected. If the slump is greater than 2 inches lower than the approved concrete mix design, the load can be adjusted with a water reducer, or by adding water (if the w/cm allows) and retested.

Portions of loads incorporated into structures prior to determining test results which indicate rejection as the correct course of action shall be subject to reduced payment or removal as determined by the Engineer.

(d) *Pay Factors*. The pay factor for concrete which is allowed to remain in place at a reduced price shall be according to Table 601-3 and shall be applied to the unit price bid for Item 601, Structural Concrete.

If deviations occur in air content and strength within the same batch, the pay factor for the batch shall be the product of the individual pay factors.

**Table 601-3
 PAY FACTORS**

Percent Total Air		Strength		
Deviations From Specified Air (Percent)	Pay Factor (Percent)	Below Specified Strength (psi) [< 4500 psi Concrete]	Pay Factor (Percent)	Below Specified Strength (psi) [≥ 4500 psi Concrete]
0.0-0.2	98	1-100	98	1-100
0.3-0.4	96	101-200	96	101-200
0.5-0.6	92	201-300	92	201-300
0.7-0.8	84	301-400	84	301-400
0.9-1.0	75	401-500	75	401-500
Over 1.0	Reject	Over 500	Reject	
			65	501-600
			54	601-700
			42	701-800
			29	801-900
			15	901-1000
			Reject	Over 1000

REVISION OF SECTION 601
MATURITY METERS

Subsection 601.05 shall include

The Contractor shall provide the Engineer a report of maturity relationships in accordance with CP 69 with the mix design submittal.

Subsection 601.17 (c) Shall include:

The Department is in the process of investigating the use of maturity meters for accepting structural concrete. Maturity meter strength determinations made in accordance with this subsection will be used for research and will not be used alone for acceptance or rejection of concrete. These maturity meter strength determinations may be used by the Engineer to supplement concrete cylinder compressive strength determinations.

When strength is specified for bridge elements, concrete box culverts, and specified structures, concrete compressive strength shall be determined by maturity meters in accordance with attached CP 69. A maturity meter shall be placed randomly for every 100 cubic yards of concrete placed in a structure. A minimum of 2 maturity meters shall be placed per mix design per structure per day. Placement shall be as directed by the Engineer. Maturity meters may be removed from the structure once the concrete has achieved the specified strength or after 29 days, whichever occurs first.

The Contractor shall provide maturity meters. The Contractor shall also provide maturity meter readers and/or cloud access to maturity meter data. The Contractor shall use maturity meters that wirelessly transmit maturity meter data to hand held readers or to cloud based internet storage. The meters shall be capable of collecting maturity data for a minimum of 28 days. The Contractor shall supply the Engineer with two identical hand held readers or access to the cloud based data for the duration of the project. Hand held readers will be returned at the end of the project. The Contractor shall provide all needed software and training for accessing the maturity meter data. The Contractor shall submit the make and model of the maturity meters to the Engineer for approval at least two weeks prior to placement of any concrete.

The Engineer will cast a set of 3 cylinders for maturity curve validation. The cylinders will be 6 inches in diameter and 12 inches in height. A maturity meter will be placed at the center of mass of one cylinder. All 3 cylinders shall be stored together in identical conditions. Cylinders may be field or lab cured. At the time that the compressive strength of the cylinders has achieved the specified strength, the compressive strength of the 2 cylinders without the maturity meter will be determined according to ASTM C39. If the average compressive strength of the 2 cylinders is greater than the compressive strength of the maturity meter or within 10 percent below the compressive strength of the maturity meter, the maturity meter curve will be considered acceptable. If the average compressive strength of the 2 cylinders is more than 10 percent below the compressive strength of the maturity meter, the maturity meter curve will be considered unacceptable and the Contractor shall create a new curve. The new curve will be applied to the data and the compressive strength will be recalculated for the structure.

Subsection 601.20 shall include the following:

All costs associated with maturity meters and their use in testing structural concrete will not be measured and paid for separately but shall be included in the work.

REVISION OF SECTION 601
MATURITY METERS

Colorado Procedure 69-17

Standard Method for

Estimating the In-Place Concrete Strength by a Maturity Method

(This procedure modifies ASTM C 1074-11. The current ASTM C 1074 is to be used in conjunction with this procedure.)

1. SCOPE

1.1 This provides a procedure for estimating in-place concrete strength by means of the maturity method. The maturity index is expressed either in terms of the temperature-time factor or in terms of the equivalent age at a specified temperature.

1.2 This procedure is identical to ASTM C 1074 Estimating Concrete Strength by the Maturity Method, with the following exceptions:

8. PROCEDURE TO DEVELOP STRENGTH-MATURITY RELATIONSHIP

Delete Subsection 8.4 from ASTM C 1074 and replace with the following Subsections:

8.4 Test the cylinders in pairs at times that yield compressive strengths in which at least three sets are at or below 3000 psi (17 MPa), at least two set are between 3000 psi and 4500 psi and at least one set is above 4500 psi (17 MPa). Perform compression tests in accordance with ASTM C 39. When the specified compressive strength of the concrete is greater than 4500 psi, at least two sets shall have a compressive strength between 4500 psi and the specified compressive strength. If the range of the compressive strength of the two cylinders exceeds 10% of their average strength, test another cylinder and compute the average of three tests. If a test result is due to an obviously defective specimen, discard the test result.

8.4.1 When a strength other than 3000 psi is specified for opening a structure, at least three sets of cylinders shall be tested below the specified strength, and at least one set of cylinders shall be tested above the specified strength.

8.8 Testing to determine datum temperature or activation energy will not be required.

9. PROCEDURE TO ESTIMATE IN-PLACE STRENGTH

Delete Subsections 9.5 to 9.5.4 from ASTM C 1074 and replace with the following Subsections:

9.5 Verification of the Strength Maturity Relationship. Verification of the Strength Maturity Relationship is performed when safety critical elements are identified by the Engineer.

9.5.1 Cast at least three field-molded cylinders. The size of the cylinders shall be 6" by 12". A maturity meter will be placed in the center mass of one cylinder. The maturity meter will be activated when concrete comes in contact the meter.

9.5.2 These cylinders shall be cured together in identical conditions.

9.5.3 When the compressive strength of the cylinder as indicated by the maturity meter is 90 to 110 percent of the target compressive strength, the compressive strength of at least two of the remaining cylinders will be determined and averaged. If the average compressive strength of the cylinders deviates by more than 10 percent from the compressive strength of the maturity meter, the Strength Maturity Relationship is no longer valid. A new Strength Maturity Relationship shall be developed.

Pilot project special provision: 601mm
date: February 9, 2017

REVISION OF SECTION 601
QC TESTING REQUIREMENTS FOR STRUCTURAL CONCRETE

Section 601 of the Standard Specifications is hereby revised for this project as follows:

Delete the first paragraph of subsection 601.17 and subsection 601.17(a) and replace with the following:

601.17 Acceptance and Pay Factors. These provisions apply to all concrete. The Contractor shall sample 601 pay items for both QC and QA in accordance with CP 61. The Engineer will witness the sampling and take possession of the QA samples at a mutually agreed upon location. The Contractor shall be responsible for Quality Control (QC) testing for 601 pay items. QC testing shall be performed at least once per day and then once per 50 cubic yards for concrete slump, unit weight and concrete temperature for each 601 pay item.

- (a) *Air Content.* The first three batches at the beginning of each day's production for each 601 pay item shall be tested by the Contractor's QC and CDOT's QA for air content. When the QC and QA air content measurements differ by more than 0.5 percent, both the QC and QA air meters shall be checked in accordance with ASTM C 231. When air content is below the specified limit, it may be adjusted in accordance with subsection 601.08. Successive batches shall be tested by the Contractor's QC and witnessed by the Engineer until three consecutive batches are within specified limits. After the first three batches, CDOT will follow the random minimum testing schedule. After the first three batches the Contractor shall perform QC testing at a frequency of one random sample per 50 cubic yards. Air content shall not be adjusted after a CDOT QA test.

Subsection 601.19 shall include the following:

The Contractor's QC testing will not be measured and paid separately, but shall be included in the work.

REVISION OF SECTION 601
STRUCTURAL CONCRETE STRENGTH ACCEPTANCE

Section 601 of the Standard Specifications is hereby revised for this project as follows:

In subsection 601.17 (c), delete the first paragraph and replace with the following:

- (c) *Strength (When Specified)*. The concrete will be considered acceptable when the running average of three consecutive strength tests per mix design for an individual structure is equal to or greater than the specified strength and no single test falls below the specified strength by more than 500 psi. A test is defined as the average strength of three test cylinders cast in plastic molds from a single sample of concrete and cured under standard laboratory conditions prior to testing. If the compressive strength of any one test cylinder differs from the average by more than 10 percent that compressive strength will be deleted and the average strength will be determined using the compressive strength of the remaining two test cylinders.

REVISION OF SECTIONS 206 AND 601
MATURITY METER AND CONCRETE
FORM AND FALSEWORK REMOVAL

Sections 206 and 601 of the Standard Specifications are hereby revised for this project as follows:

In subsection 206.03, delete the ninth paragraph and replace with the following:

Backfill material shall not be deposited against newly constructed masonry or concrete structures, until the concrete has developed a compressive strength of $0.8 f'_c$, except in cases where the structures support lateral earth pressure. Concrete compressive strength for structures supporting lateral earth pressure shall conform to subsection 601.12 (o). Concrete compressive strength shall be determined by maturity meters.

In subsection 601.09, delete (h) and replace with the following:

(h) *Removal of Forms.* The forms for any portion of the structure shall not be removed until the concrete is strong enough to withstand damage when the forms are removed.

Unless specified in the plans, forms shall remain in place for members that resist dead load bending until concrete has reached a compressive strength of at least 80 percent of the required 28 day strength, $0.80f'_c$. Forms for columns shall remain in place until concrete has reached a compressive strength of at least 1,000 psi. Forms for sides of beams, walls or other members that do not resist dead load bending shall remain in place until concrete has reached a compressive strength of at least 500 psi.

Forms and supports for cast-in-place concrete box culverts (CBCs) shall not be removed until the concrete compressive strength exceeds $0.6 f'_c$ for CBCs with spans up to and including 12 feet, and $0.67 f'_c$ for CBCs with spans exceeding 12 feet but not larger than 20 feet. Forms for CBCs with spans larger than 20 feet shall not be removed until after all concrete has been placed in all spans and has attained a compressive strength of at least $0.80f'_c$.

Concrete compressive strength shall be determined by maturity meters. At the pre-pour conference, the Contractor shall submit the location where maturity meters will be placed.

The Contractor shall provide maturity meters and all necessary wires and connectors. The Contractor shall be responsible for the placement and maintenance of the maturity meter and wire. . At a minimum a maturity meter will be placed at the mid-span of beams and at support locations. Placement shall be as directed by the Engineer.

For structures with multiple maturity meters, the lowest compressive strength shall determine when the forms can be removed.

Acceptance cylinders shall not be used for determining compressive strength to remove forms.

When field operations are controlled by maturity meters, the removal of forms, supports and housing, and the discontinuance of heating and curing may begin when the concrete is found to have the required compressive strength.

Forms for median barrier, railing or curbs, may be removed at the convenience of the Contractor after the concrete has hardened.

All forms shall be removed except permanent steel bridge deck forms and forms used to support hollow abutments or hollow piers when no permanent access is available into the cells. When permanent access is provided into box girders, all interior forms and loose material shall be removed, and the inside of box girders shall be cleaned.

REVISION OF SECTIONS 206 AND 601
MATURITY METER AND CONCRETE
FORM AND FALSEWORK REMOVAL

In subsection 601.11, delete (e) and replace with the following:

- (e) *Falsework Removal.* Unless specified in the plans or specifications, falsework shall remain in place until concrete has attained a minimum compressive strength of 0.80f'c.

Falsework supporting any span of a simple span bridge shall not be released until after all concrete, excluding concrete above the bridge deck, has attained a compressive strength of at least 0.80f'c.

Falsework supporting any span of a continuous or rigid frame bridge shall not be released until after all concrete, excluding concrete above the bridge deck, has been placed in all spans and has attained the compressive strength of at least 0.80f'c.

Falsework for arch bridges shall be removed uniformly and gradually, beginning at the crown, to permit the arch to take its load slowly and evenly.

Falsework supporting overhangs and deck slabs between girders shall not be released until the deck concrete has attained a compressive strength of at least 0.80f'c.

Falsework for pier caps which will support steel or precast concrete girders shall not be released until the concrete has attained a compressive strength of at least 0.80f'c. Girders shall not be erected onto such pier caps until the concrete in the cap has attained the compressive strength of at least 0.80f'c.

Falsework for cast-in-place prestressed portions of structures shall not be released until after the pre-stressing steel has been tensioned.

Concrete compressive strength shall be determined by maturity meters. At the pre-pour conference, the Contractor shall submit the location that maturity meters will be placed.

The Contractor shall provide maturity meters and all necessary wires and connectors. The Contractor shall be responsible for the placement and maintenance of the maturity meters and wires. At a minimum a maturity meter will be placed at the mid-span of beams and at support locations. Placement shall be as directed by the Engineer.

For structures with multiple maturity meters, the lowest compressive strength shall determine when the falsework can be removed.

Acceptance cylinders shall not be used for determining compressive strength to remove falsework.

Subsection 601.12 (l) shall include the following after the first paragraph:

Concrete compressive strength shall be determined by maturity meters.

Subsection 601.12 shall include the following:

- (o) *Backfilling Structures that Support Lateral Earth Pressure.* Concrete compressive strengths shall reach f'c before backfilling operations can begin with heavy equipment, such as skid-steers or self-powered riding compactors. Concrete compressive strengths shall reach 0.8 f'c before backfilling operations can begin with hand operated equipment. Concrete compressive strength shall be determined by maturity meters.

REVISION OF SECTIONS 206 AND 601
MATURITY METER AND CONCRETE
FORM AND FALSEWORK REMOVAL

Delete subsections 601.13 (2) and 601.13 (3) and replace with the following:

- (2) The minimum curing period shall be from the time the concrete has been placed until the concrete has met a compressive strength of 80 percent of the required field compressive strength. The Contractor shall develop a maturity relationship for the concrete mix design in accordance with CP 69. The Contractor shall provide the maturity meter and all necessary thermocouples, thermometers, wires and connectors. The Contractor shall place, protect and maintain the maturity meters and associated equipment. Locations where the maturity meters are placed shall be protected in the same manner as the rest of the structure.

Subsection 601.17 shall include the following:

- (f) *Maturity Meter Strength.* When maturity meters are specified for determining strength for removing forms, removing false work, backfilling against structures or loading the structure, the Contractor shall provide the Engineer a report of maturity relationships in accordance with CP 69 prior to placement of concrete.

If a maturity meter fails, is tampered with, is destroyed or was not placed, the following shall apply:

The minimum curing time or waiting time for removing forms, removing false work, backfilling against structures or loading the structure shall be 28 days.

The Contractor may choose at his own expense to core the structure represented by the maturity meter. Cores will be obtained and tested according to CP 65. Cores will be a minimum of 4 inches in diameter. A minimum of three cores in a two square foot area will be obtained. If the compressive strength of any one core differs from the average by more than 10 percent that compressive strength will be deleted and the average strength will be determined using the compressive strength of the remaining two cores. If the compressive strength of more than one core differs from the average by more than 10 percent the average strength will be determined using all three compressive strengths of the cores. The average compressive strength of the cores shall be achieve the specified compressive strength of the structure. A structure may only be cored once.

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 REVISION OF SECTIONS 614 AND 713
 SIGN PANEL SHEETING

Sections 614 and 713 of the Standard Specifications are hereby revised for the project as following:

Delete subsection 614.04 and replace with the following:

614.04 Sign Panels. Sign panel materials shall conform to Section 713 and to the details shown on the plans. Sign panels shall be produced in accordance with the retroreflective sheeting manufacturer’s recommendations. Layout and font design shall conform to the “Standard Highway Signs” published by FHWA. Font selection for guide sign legends shall conform to the most recent version of the “CDOT Sign Design Manual”. Sign layouts for special signs shall be in accordance with the detailed sign layouts proved in the plans or by the Engineer.

Silk screen and digital process figures shall be in accordance with the plans and series figures described in the current editions of “Standard Highway Signs”, published by the FHWA, and the “Colorado Supplement to Standard Highway Signs”.

All exposed lockbolt fastener heads on the faces of the sign panels shall be covered with material matching the background of the panel.

All sign panels shall be identified with the month and year that the sign was manufactured. The date shall be located on the lower right side of the back of the sign panel and shall be approximately ¼ inch high. The date shall be stamped or adhered onto the sign panel material for a permanent record. This work will be paid for as part of the Item.

In subsection 713.01, delete Table 713-1 and replace with the following:

Table 713-1

Application	Aluminum		Steel
	ASTM Designation	Allow No.	ASTM Designation
Sign panels	B 449 ¹ B 921 ¹	6061-T6 5052-H36 5052-H38	A 653 ²
Traffic controller cabinets	B 209	6061-T6	A 709 Grade 36
Clip bolts	B 211	2024-T4	
Locknuts or steel nuts and bolts	B 211	2014-T4	A 307
Clips and backing angles	B 221	6061-T6	
¹ In lieu of ASTM treatment, aluminum sign blanks shall receive a Class 2 anodized coating prior to the placement of retroreflective sheeting. ² Steel sheets shall have a Z600 zinc coating in accordance with ASTM A 653 and a light phosphate coating. Phosphate coating of 3.5 oz./sq. ft. will be required for application with reflective sheeting. Nuts and bolts shall be galvanized or cadmium plated.			

Delete subsection 713.04 and replace with the following:

713.04 Sign Message Materials. The legend, border, and overlay shall be used in accordance with the sheeting manufacturer’s recommendation. Retroreflective sheeting background material shall be approved in the Department’s Approved Product List; and the retroreflective sheeting background material shall be the type as specified on the plans. At a minimum, ASTM 4956 Type IV shall be used for ground mount signs. ASTM D4956 Type XI shall be used for Class III overhead signs.

REVISION OF SECTIONS 614 AND 713
SIGN PANEL SHEETING

For Class III overhead signs, the legend and borders shall be ASTM D4956 Type XI sheeting.

All reflective sheeting shall be sealed at the seams and edges as recommended by the manufacturer.

Delete subsection 713.06 and replace with the following:

713.06 (unused)

REVISION OF SECTIONS 627 AND 713
MODIFIED EPOXY PAVEMENT MARKING

Sections 627 and 713 of the Standard Specifications are hereby revised for this project as follows:

In subsection 627.05, delete the seventh paragraph and replace with the following:

Modified epoxy pavement marking shall be applied to the road surface according to the modified epoxy manufacturer's recommended methods at the application rate or coverage shown below. Glass beads shall be applied into the modified epoxy pavement marking by means of a low pressure, gravity drop bead applicator.

In subsection 627.05, delete the last paragraph and replace with the following:

Modified epoxy pavement marking and beads shall be applied within the following limits:

	Application Rate or Coverage Per Gallon of Modified Epoxy Pavement Marking	
	Minimum	Maximum
18 mil marking	85 sq. ft.	90 sq. ft.
Beads	23 lbs.	

Subsection 627.05 shall include the following:

Modified epoxy Pavement Marking shall conform to subsection 713.17.

Subsection 627.13 shall include the following:

Pay Item	Pay Unit
Modified Epoxy Pavement Marking	Gallon

Delete subsection 713.17 and replace with the following:

713.17 Modified Epoxy Pavement Marking Material. Only modified epoxy pavement marking material that is on the Department's Approved Products List may be used. Batches or lots of approved products will be accepted on the project by Certificate of Compliance (COC) in accordance with subsection 106.12. The COC shall confirm that the material meets all CDOT requirements and is the same material that was preapproved in the product evaluation process.

(a) *Formulation.* Modified epoxy pavement marking material shall be a two component, 100 percent solids, material formulated to provide simple volumetric mixing ratio of two volumes of component A and one volume of component B unless otherwise recommended by the material manufacturer.

(b) *Composition.* The component A of both white and yellow shall be within the following limits:

Resin / Pigment Components (% by Weight)		
Pigment	WHITE:	YELLOW:
TiO ₂ , ASTM D476, Type II	18-25	10-17
Organic Yellow		6-10
Epoxy Resin	75-82	73-84

The pigment for yellow modified epoxy shall contain no lead or other material such that the cured epoxy could be considered a hazardous waste under EPA or CDPHE regulations. The Contractor shall submit to the Engineer a manufacturer's certification of compliance with this requirement.

(c) *Epoxide Number.* The epoxide number of the modified epoxy's resin shall be the manufacturer's target value ± 50 as determined by ASTM D 1652 for white and yellow component A on pigment free basis.

(d) *Amine Number.* The amine number on the curing agent (component B) shall be the manufacturers target value ± 50 per ASTM D 2071.

REVISION OF SECTIONS 627 AND 713
MODIFIED EPOXY PAVEMENT MARKING

(e) *Toxicity.* Upon heating to application temperature, the material shall not produce fumes which are toxic or injurious to persons or property.

(f) *Color.* The modified epoxy material, without drop-on beads, shall correspond following requirements:

White – Federal Standard No. 595B-17925. The Yellowness Index (YI) of white shall not exceed 8.0 per ASTM E-313-10 initially.

After 72 QUV exposure per ASTM G-154 with a UVA-340 Lamp at an irradiance of 0.89 W/m²/nm with alternating cycles of 4 hours U.V @ 140° F, and 4 hours humidity @ 122° F the YI shall not exceed 15 when measured per ASTM E-313.

The YI, after 500-hour QUV testing as above, shall not exceed 27.

Yellow – Materials for pavement markings shall meet the initial daytime chromaticity that fall within the box created by the following corner points:

Initial Daytime Chromaticity Coordinates (Corner Points)

	1	2	3	4
x	0.530	0.510	0.455	0.472
y	0.456	0.485	0.444	0.400

After 72-hour QUV exposure per ASTM G-154 with a UVA-340 Lamp at an irradiance of 0.89 W/m²/nm with alternating cycles of 4 hours U.V @ 140° F, and 4 hours humidity @ 122° F the Yellow shall fall within the initial chromaticity coordinates stated above.

(g) *Drying Time.* The modified epoxy pavement marking material shall have a setting time to a no-tracking condition of not more than 25 minutes at a temperature of 73° F and above.

(h) *Curing.* The modified epoxy material shall be capable of fully curing under the constant surface temperature condition of 35° F and above.

(i) *Adhesion to Concrete.* The catalyzed modified epoxy pavement marking material, when tested according to ACI Method 503, shall have such a high degree of adhesion to the specified (4000 psi minimum) concrete surface that there shall be a 100 percent concrete failure in the performance of this test

(j) *Hardness.* The modified epoxy pavement marking materials, when tested according to ASTM D 2240, shall have a minimum Shore D Hardness value of 80. Samples shall be allowed to cure at room temperature, 75 ± 2 °F for a minimum of 72 hours and a maximum of 168 hours prior to performing the indicated test.

(k) *Abrasion Resistance.* The abrasion resistance shall be evaluated on Taber Abrader with a 1000 gram load and CS-17 wheels. The duration of the test shall be 1000 cycles. The wear index shall be calculated based on ASTM test method C-501 and the wear index for the catalyzed material shall not be more than 60. The tests shall be run on cured samples of material which have been applied at film thickness of 15 ± ½ mils to code S-16 stainless steel plates. The samples shall be allowed to cure at 75 ± 2 °F for a minimum of 72 hours prior to performing the indicated tests.

(l) *Tensile Strength.* When tested according to ASTM D 638, the modified epoxy pavement marking materials shall have a tensile strength of not less than 6000 psi. The Type IV Specimens shall be cast in a suitable mold and pulled at the rate of ¼ inch per minute by a suitable dynamic testing machine. The samples shall be allowed to cure at room temperature (75 ± 2 °F) for a minimum of 72 hours and a maximum of 168 hours prior to performing the indicated tests.

(m) *Compressive Strength.* When tested according to ASTM D 695, the catalyzed modified epoxy pavement marking materials shall have a compressive strength of not less than 12,000 psi. The cast sample shall be conditioned at room temperature, 75 ± 2 °F, for a minimum of 72 hours and a maximum of 168 hours prior to performing the tests. The rate of compression of these samples shall be no more than ¼ inch per minute.

REVISION OF SECTIONS 202, 627 AND 708
PAVEMENT MARKING PAINT

Sections 202, 627 and 708 of the Standard Specifications are hereby revised for this project as follows:

In subsection 202.05, delete the third paragraph and replace with the following:

- (a) *Removal of temporary pavement marking on final alignment.* Temporary pavement marking paint on the approved final alignment shall be removed completely from the roadway surface at locations of permanent pavement markings as shown on the plans. The ground location shall be clean, dry and free of laitance, oil, dirt, grease, paint or other foreign contaminants prior to application of final pavement marking. The Contractor shall not remove more pavement marking paint than what can be replaced with permanent pavement marking during the same working day or working period. If an event occurs that precludes the contractor from completing the work during the placement of permanent marking, the Contractor shall halt the removal operation and raised flexible pavement markers shall be placed at locations that have been removed but not marked while the pavement is drying prior to the marking application. Marking application shall resume when pavement is dry and has had no moisture for a minimum of 24 hours. Raised flexible pavement markers shall be installed with one marker at 40-foot centers.

- (b) *Removal of temporary pavement marking on transitions.* Removal of pavement marking paint on temporary transitional alignments shall be performed by grinding or water-blasting. The removal shall result in 100 percent removal of the paint and a wide swath of ground pavement surrounding the former location of the temporary paint. The width of the swath shall be as follows; the center of the swath shall be the location of the paint line:

Width of Pavement Marking to be removed	Width of Swath
≤ 8 inches	12 inches
> 8 inches	15 inches

Subsection 202.11 shall include the following:

Removal of temporary pavement marking on transitions will be measured as the actual square feet of the swath constructed for the required width. Removal of pavement marking for the permanent alignment will be measured as the actual number of square feet removed.

Subsection 202.12 shall include the following:

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Removal of Pavement Marking	Square Foot
Removal of Pavement Marking (12 Inch)	Square Foot
Removal of Pavement Marking (15 Inch)	Square Foot

Raised pavement markings shall be at the Contractor's expense.

In subsection 627.04, delete the first paragraph and replace with the following:

REVISION OF SECTIONS 202, 627 AND 708
PAVEMENT MARKING PAINT

627.04 Pavement Marking with Low Temperature Acrylic Paint and High Build Acrylic Paint.

Striping shall be applied when the air and pavement temperatures are no less than 45 °F for waterborne and high-build paint, and 35°F for low temperature waterborne paint on asphalt or portland cement concrete pavements. The pavement surface shall be dry and clean, and free of all latent materials, in accordance with manufacturer recommendations. Weather conditions shall be conducive to satisfactory results.

Glass beads shall be applied into the paint by means of a low pressure, gravity drop bead applicator.

In subsection 627.04 delete the table and replace it with the following:

Description		Pavement Marking Paint	
		Low Temp	High Build
Alignment	Lateral Deviation	2.0 inch per 200 foot Max	
Coverage Rate	Sq. Ft. per Gallon	89-93	67-70
Thickness	Mil	17-18	23-24
Width	Inches	Per Plans +/- 0.25	Per Plans +/- 0.25
Dry Time	Minutes	5-10	7-12
Beads	Application Rate, lbs./gal	7-8	9-10

Subsection 627.13 shall include the following:

<u>Pay Item</u>	<u>Pay Unit</u>
Pavement Marking Paint (High Build)	Gallon
Pavement Marking Paint (Low Temperature)	Gallon

Delete subsection 708.05 and replace with the following:

708.05 Pavement Marking Materials. All pavement marking materials shall be selected from the Department’s Approved Products List (APL). Prior to start of work, a Certificate of Compliance (COC) for all pavement marking materials shall be submitted in accordance with subsection 106.13.

(a) *Color.* The pavement marking paint, without drop-on beads, shall correspond following requirements:

White – Federal Standard No. 595B-17925. The Yellowness Index (YI) of white shall not exceed 8.0 per ASTM E-313-10 initially. The color after drying shall be a flat-white, free from tint, and shall provide the maximum amount of opacity and visibility under both daylight and artificial light.

Yellow – Materials for pavement markings shall meet the initial daytime chromaticity that fall within the box created by the following corner points:

REVISION OF SECTIONS 202, 627 AND 708
PAVEMENT MARKING PAINT

Initial Daytime Chromaticity Coordinates (Corner Points)

	1	2	3	4
x	0.530	0.510	0.455	0.472
y	0.456	0.485	0.444	0.400

- (b) *Low Temperature Acrylic Waterborne Paint.* Low Temperature Acrylic Waterborne Paint binder (nonvolatile portion of vehicle) shall be 100 percent XSR acrylic polymer, by weight, as determined by infrared analysis or other chemical analysis available to the Department.
- (c) *High Build Acrylic Waterborne Paint.* High build acrylic waterborne paint binder (nonvolatile portion of vehicle) shall be 100 percent HD 21 acrylic cross linking polymer, by weight, as determined by infrared analysis or other chemical analysis available to the Department.

Low Temperature Acrylic Waterborne Paint, and High Build Acrylic Waterborne paint shall meet the following requirements:

Performance Requirements: The paint shall be water resistant and shall show no softening or blistering.

Table 708-1

LOW TEMPERATURE WATERBORNE AND HIGH BUILD ACRYLIC WATERBORNE PAINT

Property	White	Yellow	Test Method
Nonvolatile portion of vehicle (white and yellow), %	43.0 (min)	43.0 (min)	ASTM D 2205
Pigment Composition			
Percent by weight♦	60.0	60.0	ASTM D 4451 ASTM D 3723
Paint			
Titanium Dioxide Content, lb./gal	1.0 (min)		ASTM D 5381
Properties of the Finished Paint			
Total Non-volatiles, (solids) % by weight	77.0 (min)	77.0 (min)	FTMS 141C - Method 4053.1, ASTM D 2369, or ASTM D 4758
Density, lbs./gal	14.0-14.6	13.7-14.3	ASTM D 2205
Consistency (Viscosity) White and Yellow, Krebs-Stormer Units	85-95	85-95	ASTM D 562

Freeze Thaw Stability	Shall complete 5 or more test cycles successfully		ASTM D 2243
Fineness of Grind, Cleanliness Rating B, minimum	3	3	ASTM D 1210
Scrub Resistance	800	800	ASTM D2486
Directional Reflectance: [15 mil Wet Film]	88 (min)	50 (min)	ASTM E 1347
Dry Opacity (Contrast Ratio): [5 mil Wet Film]	0.95 (min)	0.95 (min)	ASTM D 2805
◆Percent by weight shall include percent of organic yellow pigment.			

1
 REVISION OF SECTION 627
 PREFORMED PLASTIC PAVEMENT MARKING

Section 627 of the Standard Special Provisions is hereby revised for this project as follows:

In subsection 627.08, delete the fourth, fifth and sixth paragraphs and replace with the following:

The air and surface temperature shall be a minimum 40 °F or per manufacturer recommendation.

In subsection 627.08, delete the fourteenth paragraph and replace with the following:

The preformed plastic pavement marking shall be inlaid on new and existing pavements as shown in the Contract. The material shall be capable of use for patching worn areas of the same type according to the manufacturer's recommendations.

The Contractor shall not perform wet cutting of pavement unless otherwise directed. Application and removal of temporary pavement marking associated with wet-cutting of pavement shall be at the Contractor's expense.

In subsection 627.08 (a), delete the first paragraph and replace with the following:

- (a) *Inlaid Preformed Plastic Pavement Marking.* The grooved width for inlaid preformed plastic pavement marking is called for in the Contract, grooved width shall be the pavement marking width plus 1 inch, with a tolerance of $\pm \frac{1}{4}$ inch. The depth of the grooves shall be 130 mils \pm 5 mils. Groove position shall be a minimum of 2 inches from the edge of the pavement marking to the longitudinal pavement joint.

Grooving shall not be performed on bridge decks with Polyester Polymer Concrete Overlays.

In subsection 627.13, delete the following pay items

Pay Item	Pay Unit
Preformed Plastic Pavement Marking (___ mils)	Square Foot
Preformed Plastic Pavement Marking (Type ___)	Square Foot
Preformed Plastic Pavement Marking (Word-Symbol) (Type ___)	Square Foot
Preformed Plastic Pavement Marking (Xwalk-Stop Line) (Type ___)	Square Foot

Section 627.13 shall include the following:

Pay Item	Pay Unit
Preformed Plastic Pavement Marking (Word-Symbol) (Type I) (Inlaid)	Square Foot
Preformed Plastic Pavement Marking (Xwalk-Stop Line) (Type I) (Inlaid)	Square Foot

In subsection 627.13 delete the second and third paragraphs.

1
 REVISION OF SECTIONS 630 AND 713
 RETROREFLECTIVE SHEETING

Section 630 and 713 of the Standard Specifications is hereby revised for this project as follows:

In subsection 630.02, delete the sixth and seventh paragraphs, including Table 630-1, and replace them with the following:

Retroreflective sheeting for all signs requiring an orange background shall be Fluorescent.

**Table 630-1
 RETROREFLECTIVE SHEETING TYPES**

Sheeting	Type IV	Type VI (Roll-up sign material)	Fluorescent ¹
Application	Work Zone	Work Zone	Work Zone
All Orange Construction Signs			X
Orange Construction Signs that are used only during daytime hours for short term or mobile operations		X ⁴	X
Barricades (Temporary)	X		X
Vertical Panels	X		X
Flaggers Stop/Slow Paddle	X		X
Drums and Tubular Markers ²	X ⁶		X
Non-orange Fixed Support signs with prefix "W"	X		
Special Warning Signs			X
STOP sign (R1-1) YIELD sign (R1-2) WRONG WAY sign (R5-1a) DO NOT ENTER sign (R5-1) EXIT sign (E5-1a)	X		
DETOUR sign (M4-9) or (M4-10)			X
All other fixed support signs ³	X		X
All other signs used only during working hours	X		X
All other signs that are used only during daytime hours for short term or mobile operations	X	X ⁵	X

1 Fluorescent sheeting shall be of a brand that is on the CDOT Approved Products List.
 2 Drum and Tubular Marker sheeting shall be manufactured for flexible devices, and sheeting materials shall conform to Section 713.
 3 Fixed support signs are defined as all signs that must remain in use outside of working hours. They shall be mounted in accordance with Standard Plan S-630-1.
 4 RS 24 only.
 5 White only.
 6 For projects advertised prior to September 1, 2017, Type IV or Fluorescent sheeting will be permitted. For projects advertised on or after September 1, 2017, only Fluorescent sheeting will be permitted.

2
 REVISION OF SECTIONS 630 AND 713
 RETROREFLECTIVE SHEETING

In subsection 630.07 (b), delete the first sentence of the second paragraph and replace it with the following:

Tubular Markers shall be retroreflectorized as shown in Table 630-1.

Delete Subsection 713.10(b) and replace with the following:

(b) *Retroreflective Sheeting*. Reflective sheeting for traffic control devices shall be listed on the CDOT Approved Products List, and conform to the requirements of ASTM D 4956.

1. Retroreflective Quality Requirements

A. Drums and Tubular Markers. Retroreflective sheeting shall conform to ASTM D4956 Type IV, with the following modifications:

The Minimum Coefficient of Retroreflection (R_A) shall conform to the following minimum values.

Observation Angle	Entrance Angle	Minimum Coefficient of Retroreflection (R_A) [cd/fc/ft ² (cd/lx.m ²)]	
		White	Fluorescent Orange
0.2°	-4°	500	200
0.2°	30°	200	80
0.5°	-4°	225	90
0.5°	30°	85	34

2. Daytime Color

A. Drums and Tubular Markers. All fluorescent orange sheeting shall meet the color requirements of ASTM D4956, with the following modifications:

The chromaticity coordinates and total luminance factor shall conform to the requirements as described in 23 CFR Part 655 Appendix to Subpart F.

The Fluorescence Luminance Factor (Y_F) shall conform to the following minimum values.

Color	Y_F Initial Requirement	Y_F Minimum Requirement
Fluorescent Orange	20	15

1
REVISION OF SECTION 702
BITUMINOUS MATERIALS

Section 702 of the Standard Specifications is hereby deleted for this project and replaced with the following:

702.01 Asphalt Cements.

(a) *Superpave Performance Graded Binders.* Superpave Performance Graded Binders shall conform to the requirements listed in Table 702-1. (Taken from AASHTO M 320)

Asphalt cement shall not be acid modified or alkaline modified.

Asphalt cement shall not contain any used oils that have not been re-refined. Modifiers that do not comply with environmental rules and regulations including 40 CFR Part 261.6(a) (3) (IV), and part 266/Subpart C shall not be added. Modifiers shall not be carcinogenic.

The supplier of the PG binder shall be certified in accordance with CP 11.

REVISION OF SECTION 702
BITUMINOUS MATERIALS

Acceptance Samples of the PG binder will be taken on the project in accordance with the Schedule in the Field Materials Manual.

The Department will test for acid modification and alkaline modification during the binder certification process. Thereafter, the Department will randomly test for acid modification and alkaline modification.

(b) *Damp proofing.* Asphalt for damp proofing shall conform to the requirements of ASTM D 449, and the asphaltic primer shall conform to the requirements of ASTM D 41.

702.02 Emulsified Asphalts. Emulsified asphalts shall conform to AASHTO M 140 or M 208 for the designated types and grades. Emulsified asphalt and aggregate used for surface seals shall be sampled and will be tested for information only in accordance with CP-L 2213.

Emulsified asphalt (HFMS-2S) with a residual penetration greater than 300 dmm shall conform to all properties listed in AASHTO M 140, Table 1 except that ductility shall be reported for information only.

(a) *Emulsion for Tack and Fog Coats.* Emulsions for tack and fog coats shall conform to the requirements listed in Table 702-2 or 702-3, prior to dilution.

4
 REVISION OF SECTION 702
 BITUMINOUS MATERIALS

**Table 702-2
 TACK AND FOG COAT EMULSIONS**

Property	CSS-1h	SS-1h	AASHTO Test No.
Viscosity, at 25 °C, Saybolt-Furol, s	20	20	T 59
min	100	100	
max	1.0	1.0	T 59
Storage stability, 24 hr, % max ¹	1.0	1.0	T 59
Particle charge test	Positive		T 59
Sieve test, % max	0.10	0.10	T 59
Oil Distillate by volume, % max	3.0	3.0	T-59
Residue by distillation/ evaporation, % min ³	57 ³	57 ³	T 59/ CP-L 2212 ²
Tests on residue:			
Penetration, 25 °C, 100g, 5s, min, dmm	40	40	T 49
Penetration, 25 °C, 100g, 5s, max, dmm	120	120	
Ductility, 25 °C, 5 cm/min, cm, min	40	40	T 51
Solubility, in trichloroethylene % min	97.5	97.5	T 44
<p>¹If successful application is achieved in the field, the Engineer may wave this requirement.</p> <p>² CP-L 2212 is a rapid evaporation test for determining percent residue of an emulsion and providing material for tests on residue. CP-L 2212 is for acceptance only. If the percent residue or any test on the residue fails to meet specifications, the tests will be repeated using the distillation test in conformance with AASHTO T-59 to determine acceptability.</p> <p>³ For polymerized emulsions the distillation and evaporation tests will in be in conformance with AASHTO T-59 or CP-L 2212 respectively with modifications to include 205 ± 5 °C (400 ± 10 °F) maximum temperature to be held for 15 minutes.</p>			

(b) *Emulsion for Chip Seals* Polymerized emulsions for chip seals shall conform to the requirements listed in Table 702-3. Emulsion for chip seals shall be an emulsified blend of polymerized asphalt, water, and emulsifiers. The asphalt cement shall be polymerized prior to emulsification and shall contain at least 3 percent polymer by weight of asphalt cement. The emulsion standing undisturbed for a minimum of 24 hours shall show no white, milky separation but shall be smooth and homogeneous throughout. The emulsion shall be pumpable and suitable for application through a distributor.

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 REVISION OF SECTION 702
 BITUMINOUS MATERIALS

**Table 702-3
 POLYMERIZED EMULSIONS FOR CHIP SEALS**

Property	CRS-2	CRS-2P	CRS-2R	HFMS-2P	AASHTO Test No.
Tests on Emulsion:					
Viscosity, at 50 °C, Saybolt-Furol, s	min	50	50	50	T 59
	max	450	450	450	
Storage stability, 24 hr, % max	1.0	1.0	1.0	1.0	T 59
Particle charge test	Positive	Positive	Positive		T 59
Sieve test, % max	0.10	0.10	0.10	0.10	T 59
Demulsibility ¹ , % min	40	40	40		T 59
Oil Distillate by volume, % max or range	3.0	3.0	3.0	3.0	T-59
Residue by distillation/ evaporation, % min ³	65 ³	65 ³	65 ³	65 ³	T 59/ CP-L 2212 ²
Tests on residue:					
Penetration, 25 °C, 100g, 5s, min, dmm	70	70	70	70	T 49
Penetration, 25 °C, 100g, 5s, max, dmm	150	150	150	150	
Ductility, 25 °C, 5 cm/min, cm, min	40			75	T 51
			40		
Ductility, 4 °C, 5 cm/min, cm, min					
Solubility, in trichloroethylene% min ⁴	97.5 ⁴	97.5 ⁴	97.5 ⁴	97.5 ⁴	T 44
Elastic Recovery, 25 °C min				58	T 301
Float Test, 60 °C, s min				1200	T 50
Toughness, in-lbs, min		70	90		CP-L 2210
Tenacity, in-lbs, min		45	45		CP-L 2210
<p>¹If successful application is achieved in the field, the Engineer may waive this requirement.</p> <p>² CP-L 2212 is a rapid evaporation test for determining percent residue of an emulsion and providing material for tests on residue. CP-L 2212 is for acceptance only. If the percent residue or any test on the residue fails to meet specifications, the tests will be repeated using the distillation test in conformance with AASHTO T-59 to determine acceptability.</p> <p>³ For polymerized emulsions the distillation and evaporation tests will in be in conformance with AASHTO T-59 or CP-L 2212 respectively with modifications to include 205 ± 5 °C (400 ± 10 °F) maximum temperature to be held for 15 minutes.</p> <p>⁴ Solubility may be determined on the base asphalt cement prior to polymer modification.</p>					

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 REVISION OF SECTION 702
 BITUMINOUS MATERIALS

(c) *Emulsion for Slurry Seals and Micro-Surfacing.* Emulsions for slurry seals and micro-surfacing shall conform to the requirements listed in Table 702-4. The modified emulsion shall contain a minimum of 3 percent polymer, SBR latex, or natural latex by weight.

Table 702-4
SLURRY SEAL AND MICRO-SURFACING EMULSIONS

Property	CQS-1hL	CQS-1hP	AASHTO Test No.
Viscosity, at 25 °C, Saybolt-Furol, s	15	15	T 59
min	100	100	
max	1.0	1.0	T 59
Storage stability, 24 hr, % max ¹	Positive	Positive	T 59
Particle charge test	0.10	0.10	T 59
Sieve test, % max	0.5	0.5	T-59
Oil Distillate by volume, % max	62 ³	62 ³	T 59/ CP-L 2212 ²
Residue by distillation/ evaporation, % min ³			
Penetration, 25 °C, 100g, 5s, min, dmm	40	40	T 49
Penetration, 25 °C, 100g, 5s, max, dmm	150	150	
Ductility, 25 °C, 5 cm/min, cm, min	50	50	T 51
Solubility, in trichloroethylene% min	97.5	97.5	T 44

¹If successful application is achieved in the field, the Engineer may wave this requirement.

² CP-L 2212 is a rapid evaporation test for determining percent residue of an emulsion and providing material for tests on residue. CP-L 2212 is for acceptance only. If the percent residue or any test on the residue fails to meet specifications, the tests will be repeated using the distillation test in conformance with AASHTO T-59 to determine acceptability.

³ For polymerized emulsions the distillation and evaporation tests will in be in conformance with AASHTO T-59 or CP-L 2212 respectively with modifications to include 205 ± 5 °C (400 ± 10 °F) maximum temperature to be held for 15 minutes.

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 REVISION OF SECTION 702
 BITUMINOUS MATERIALS

- (d) *Emulsion for Prime Coat.* Emulsion for prime coat shall conform to the requirements of Table 702-5. Circulate before use if not used within 24 hours.

**Table 702-5
 ASPHALT EMULSION FOR PRIME COAT (AEP)**

Property	Requirement	AASHTO Test No.
Viscosity, Saybolt Furol, at 50 °C (122 °F), s	20-150	T 59
% Residue	65% min.	T 59 to 260 °C (500 °F)
Oil Distillate by Volume, %	7% max.	T59
Tests on Residue from Distillation:		
Solubility in Trichloroethylene, %	97.5 min.	T 44

- (e) *Recycling Agent.* Recycling Agent for Item 406, Cold Bituminous Pavement (Recycle), shall be either a high float emulsified asphalt (polymerized) or an emulsified recycling agent as follows:

1. High Float Emulsified Asphalt (Polymerized). High Float Emulsified Asphalt (Polymerized) for Cold Bituminous Pavement (Recycle) shall be an emulsified blend of polymer modified asphalt, water, and emulsifiers conforming to Table 702-6 for HFMS-2sP. The asphalt cement shall be polymerized prior to emulsification, and shall contain at least 3 percent polymer.

The emulsion standing undisturbed for a minimum of 24 hours shall show no white, milky separation, and shall be smooth and homogeneous throughout.

The emulsion shall be pumpable and suitable for application through a pressure distributor.

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 REVISION OF SECTION 702
 BITUMINOUS MATERIALS

Table 702-6
HIGH FLOAT EMULSIFIED ASPHALT
(POLYMERIZED) (HFMS-2sP)

Property	Requirement		AASHTO Test
	Minimum	Maximum	
Tests on Emulsion:			
Viscosity, Saybolt Furol at 50 °C (122 °F), sec	50	450	T 59
Storage Stability test, 24 hours, %		1	T 59
Sieve test, %		0.10	T 59
% Residue ¹	65		T 59
Oil distillate by volume, %	1	7	T 59
Tests on Residue:			
Penetration, 25 °C (77 °F), 100g, 5 sec	150	300 ²	T 49
Float Test, 60 °C (140 °F), sec	1200		T 50
Solubility in TCE, %	97.5		T 44
Elastic Recovery, 4 °C (39.2 °F), %	50		T 301
¹ 400 ± 10° F maximum temperature to be held for 15 minutes. ² When approved by the Engineer, Emulsified Asphalt (HFMS-2sP) with a residual penetration greater than 300 dmm may be used with Cold Bituminous Pavement (Recycle) to address problems with cool weather or extremely aged existing pavement. Emulsified Asphalt (HFMS-2sP) with a residual penetration greater than 300 dmm shall meet all properties listed in Table 702-4 except that Elastic Recovery shall be reported for information only.			

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 REVISION OF SECTION 702
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2. *Emulsified Recycling Agent.* Emulsified Recycling Agent for use in Cold Bituminous Pavement (Recycle) shall conform to the requirements in Table 702-7.

Table 702-7
EMULSIFIED RECYCLING AGENT

Property	Requirement		Test
	Minimum	Maximum	
Tests on Emulsion:			
Viscosity @ 25 °C, SFS	20	200	ASTM D 244
Pumping Stability	Pass		GB Method ¹
			ASTM D 244 ²
Sieve Test, %w		0.1	
Cement Mixing, %w		2.0	ASTM D 244
Particle Charge	Positive		ASTM D 244
Conc. Of Oil Phase	64		ASTM D 244 ³
Tests on Residue:			
Viscosity @ 60 °C , CST	2000	4000	ASTM D 2170
Flash Point, COC, °C (° F)	232		ASTM D 92
Maltenes Dist. Ratio ⁴	$\frac{PC+A_1}{S+A_2}$	0.3	ASTM D 2006
PC/S Ratio	0.4		ASTM D 2006
Asphaltenes, % max.		11.0	ASTM D 2006
<p>¹Pumping stability is determined by charging 450 ml of emulsion into a one liter beaker and circulating the emulsion through a gear pump (Roper 29.B22621) having a 6.3 mm (1/4 inch) inlet and outlet. The emulsion passes if there is no significant separation after circulating ten minutes.</p> <p>²Test procedure identical with ASTM D 244 except that distilled water shall be used in place of 2 percent sodium oleate solution.</p> <p>³ASTM D 244 Evaporation Test for percent of residue is modified by heating 50 gram sample to 149°C (300 °F) until foaming ceases, then cooling immediately and calculating results.</p> <p>⁴In the Maltenes Distribution Ratio Test by ASTM Method D 2006.</p> <p>PC = Polar Compounds S = Saturates A₁ = First Acidaffin A₂ = Second Acidaffins</p>			

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 REVISION OF SECTION 702
 BITUMINOUS MATERIALS

(f) Asphalt Rejuvenating Agents. Asphalt rejuvenating agents (ARA) shall be composed of a petroleum resin-oil base uniformly emulsified with water and shall conform to the physical and chemical requirements of Table 702-8 or ASTM D 4552.

Table 702-8
ASPHALT REJUVENATING AGENT

Property	Test Method	Requirement
Viscosity, S.F., @ 25 °C (77 °F), s	ASTM D 244	20-40
¹ Residue, % min.	ASTM D 244	60-65
² Miscibility Test	ASTM D 244	No coagulation
³ Sieve Test, % max.	ASTM D 244	0.10
Particle Charge Test	ASTM D 244	Positive
ASTM D244 (Mod):		
Viscosity, 60 °C (140 °F), mm ² /s	ASTM D 445	100 - 200
Flash Point, COC, °C, min.	ASTM D 92	196
Asphaltenes, % max.	ASTM D2006	1.0
⁴ Maltenes Dist. Ratio $\frac{PC+A_1}{S+A_2}$	ASTM D 2006	0.3-0.6
Saturated Hydrocarbons, %	ASTM D 2006	21-28
<p>¹ ASTM D244 Modified Evaporation Test for percent of residue is made by heating 50-gram sample to 149 °C (300 °F) until foaming ceases, then cooling immediately and calculating results.</p> <p>² Test procedure identical with ASTM D244 except that 0.02 Normal Calcium Chloride solution shall be used in place of distilled water.</p> <p>³ Test procedure identical with ASTM D244 except that distilled water shall be used in place of 2% sodium oleate solution.</p> <p>⁴ In the Maltenes Distribution Ratio Test by ASTM Method D4124:</p> <p>PC = Polar Compounds S = Saturates A₁ = First Acidaffin A₂ = Second Acidaffins</p>		

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 REVISION OF SECTION 702
 BITUMINOUS MATERIALS

For hot-in-place recycling ARA-1P is an acceptable alternative to ARA. ARA-1P shall meet the requirements below:

Emulsified Polymer Modified Asphalt Rejuvenating Agent (ARA-1P) for use in hot-in-place recycling of bituminous pavements shall be modified with a minimum of 1.5 percent styrene-butadiene solution polymer. The finished product shall conform to the physical requirements listed in Table 702-9 below.

**Table 702-9
 ARA-1P**

Property	Test Method	Min	Max
Test on Emulsion			
Viscosity, Saybolt-Furol @ 77 °F, s	ASTM D 244		100
Residue @ 350 °F, %	ASTM D 244 Mod	60	
Sieve Test, %	ASTM D 244		0.10
Oil distillate, %	ASTM D 244		2.0
Test on Residue			
Penetration @ 39.2 °F, 100g, 5s, dmm	ASTM D-5 Modified	150	250
Asphaltenes, %	ASTM D 4124		15

702.03 (unused)

702.04 Hot Poured Joint and Crack Sealant. Hot poured material for filling joints and cracks shall conform to the requirements of ASTM D 6690, Type II or Type IV. The concrete blocks used in the Bond Test shall be prepared in accordance with CP-L 4101.

Sealant material shall be supplied pre-blended, pre-reacted, and prepackaged. If supplied in solid form the sealant material shall be cast in a plastic or other dissolvable liner having the capability of becoming part of the crack sealing liquid. The sealant shall be delivered in the manufacturer’s original sealed container.

Each container shall be legibly marked with the manufacturer’s name, the trade name of the sealer, the manufacturer’s batch or lot number, the application temperature range, the recommended application temperature, and the safe heating temperature.

The sealant shall be listed in CDOT’s Approved Products List prior to use.

1
REVISION OF SECTION 703
AGGREGATE FOR BASES
(WITHOUT RAP)

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

In subsection 703.03, delete the first paragraph and replace with the following:

703.03 Aggregate for Bases. Aggregates for bases except Aggregate Base Course (RAP) shall be crushed stone, crushed slag, crushed gravel, natural gravel, or crushed reclaimed concrete. Aggregate Base Course (RAP) shall be 100 percent crushed recycled asphalt pavement material. All materials except Aggregate Base Course (RAP) shall conform to the quality requirements of AASHTO M 147 except that the requirements for the ratio of minus 75 μm (No. 200) sieve fraction to the minus 425 μm (No. 40) sieve fraction, stated in 3.2.2 of AASHTO M 147, shall not apply.

The requirements for the Los Angeles wear test (AASHTO T 96 & ASTM C535) shall not apply to Class 1, 2, and 3. Aggregates for bases shall meet the grading requirements of Table 703-3 for the class specified for the project, unless otherwise specified.

REVISION OF SECTION 703
AGGREGATES FOR HOT MIX ASPHALT

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

Delete subsection 703.04 and replace with the following:

703.04 Aggregates for Hot Mix Asphalt. Aggregates for hot mix asphalt (HMA) shall be of uniform quality, composed of clean, hard, durable particles of crushed stone, crushed gravel, natural gravel, or crushed slag. Excess of fine material shall be wasted before crushing. A percentage of the aggregate retained on the 4.75 mm (No. 4) sieve for Gradings S, SX and SG— and on the 2.36 mm (No. 8) sieve for Gradings SF and ST—shall have at least two mechanically induced fractured faces when tested in accordance with Colorado Procedure 45. This percentage will be specified in Table 403-1, as revised for the project in Section 403. The angularity of the fine aggregate shall be a minimum of 45.0 percent when determined according to AASHTO T 304. Grading SF mixes, when determined by RME, may not require fine aggregate angularity of 45.0 percent. Aggregate samples representing each aggregate stockpile shall be non-plastic if the percent of aggregate passing the 2.36 mm (No. 8) sieve is greater than or equal to 10 percent by weight of the individual aggregate sample. Plasticity will be determined in accordance with AASHTO T 90. The material shall not contain clay balls, vegetable matter, or other deleterious substances.

The aggregate for Gradings ST, S, SX and SG shall have a percentage of wear of 45 or less when tested in accordance with AASHTO T 96.

**Table 703-4
MASTER RANGE TABLE FOR HOT MIX ASPHALT**

Sieve Size	Percent by Weight Passing Square Mesh Sieves				
	Grading SF**	Grading ST	Grading SX	Grading S	Grading SG
37.5 mm (1½")					100
25.0 mm (1")				100	90 – 100
19.0 mm (¾")			100	90 – 100	
12.5 mm (½")		100	90 – 100	*	*
9.5 mm (⅜")	100	90 – 100	*	*	*
4.75 mm (#4)	90 – 100	*	*	*	*
2.36 mm (#8)	*	28 – 58	28 – 58	23 – 49	19 – 45
1.18 mm (#16)	30 – 54				
600 μm (#30)	*	*	*	*	*
300 μm (#50)					
150 μm (#100)					
75 μm (#200)	2 – 12	2 – 10	2 – 10	2 – 8	1 – 7

* These additional Form 43 Specification Screens will initially be established using values from the As Used Gradation shown on the Design Mix.
**SF applications are limited and the CDOT Pavement Design Manual should be referenced, prior to use.

Aggregates for stone matrix asphalt (SMA) shall be of uniform quality, composed of clean, hard, durable particles of crushed stone, crushed gravel, or crushed slag. A minimum of 90 percent of the particles retained on the 4.75 mm (No. 4) sieve shall have at least two mechanically induced fractured faces when tested in accordance with Colorado Procedure 45. The particles passing the 4.75 mm (No. 4) sieve shall be the product of crushing rock larger than 12.5 mm (½ inch) and shall be non-plastic when tested in accordance with AASHTO T 90.

REVISION OF SECTION 703
AGGREGATES FOR HOT MIX ASPHALT

Additionally, each source of aggregate for SMA shall meet the following requirements:

- (1) No more than 30 percent when tested in accordance with AASHTO T 96 Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- (2) No more than 12 percent when tested in accordance with AASHTO T 104 Soundness of Aggregate by Use of Sodium Sulfate.

The aggregate for Hot Mix Asphalt (HMA) shall meet the requirements of Table 703-4A when tested in accordance with CP-L 4211 Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus. The Contractor shall be assessed a price reduction of \$1000 for each production sample of the combined aggregate with a value greater than 20 according to CP-L 4211.

Table 703-4A
AGGREGATE DEGRADATION BY ABRASION
IN THE MICRO-DEVAL CP-L 4211

	Not to exceed
Combined Aggregate (Mix Design)	18
Combined Aggregate (1/10,000 tons, or fraction thereof during production)	20

July 28, 2011

REVISION OF SECTION 703
CONCRETE AGGREGATES

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

Delete the second paragraph of subsection 703.00 and Table 703-1.

Delete subsections 703.01 and 703.02 and replace with the following:

703.01 Fine Aggregate for Concrete. Fine aggregate for concrete shall conform to the requirements of AASHTO M 6, Class A. The minimum sand equivalent, as tested in accordance with Colorado Procedure 37 shall be 80 unless otherwise specified. The fineness modulus, as determined by AASHTO T 27, shall not be less than 2.50 or greater than 3.50 unless otherwise approved.

703.02 Coarse Aggregate for Concrete. Coarse aggregate for concrete shall conform to the requirements of AASHTO M 80, Class A aggregates, except that the percentage of wear shall not exceed 45 when tested in accordance with AASHTO T 96.

February 18, 2016

REVISION OF SECTION 709
EPOXY COATED REINFORCING BARS

Section 709 of the Standard Specifications is hereby revised for this project as follows:

In subsection 709.01, delete the last row of the table and replace with the following

Epoxy Coated Reinforcing Bars	AASHTO A 775
-------------------------------	--------------

Delete the first sentence of subsection 709.03 and replace with the following:

Tie bars for longitudinal and transverse joints shall conform to AASHTO A 775 and shall be grade 40, epoxy-coated, and deformed.

1
REVISION OF SECTION 712
GEOTEXTILES

Section 712 of the Standard Specifications is hereby revised for this project as follows:

In subsection 712.08, delete the third and fourth paragraphs and replace with the following:

Physical requirements for all geotextiles shall conform to the requirements of AASHTO M-288. Materials shall be selected from the New York Department of Transportation's Approved Products List of Geosynthetic materials that meet the National Transportation Product Evaluation Program (NTPEP) and AASHTO M-288 testing requirements. The current list of products that meet these requirements is located at:

www.dot.ny.gov

The Geotextile Approved Products List may be accessed by clicking on the following tabs once on the NYDOT site to:

- (1) A To Z Site Index
- (2) Approved List
- (3) Approved Products
- (4) Materials and Equipment
- (5) Geosynthetics for Highway Construction
- (6) Geotextiles

In subsection 712.08, delete Table 712-2 and replace with the following

2
REVISION OF SECTION 712
GEOTEXTILES

Table 712-2
TYPICAL VALUES OF PERMEABILITY COEFFICIENTS¹

Turbulent Flow	Particle Size Range Millimeters (inches)		Effective Size	Permeability Coefficient k cm/s
	D max	D min	D 20 mm (inches)	
Derrick STONE	3000 (120)	900 (36)	1200 (48)	100
One-man STONE	300 (12)	100 (4)	150 (6)	30
Clean, fine to coarse GRAVEL	80 (3)	10 (1/4)	13 (1/2)	10
Fine, uniform GRAVEL	8 (3/8)	1.5 (1/16)	3 (1/8)	5
Very coarse, clean, uniform SAND	3 (1/8)	0.8 (1/32)	1.5 (1/16)	3
Laminar Flow				
Uniform, coarse SAND	2 (1/8)	0.5 (1/64)	0.6	0.4
Uniform, medium SAND	0.5	0.25	0.3	0.1
Clean, well-graded SAND & GRAVEL	10	0.05	0.1	0.01
Uniform, fine SAND	0.25	0.05	0.06	40 x 10 ⁻⁴
Well-graded, silty SAND & GRAVEL	5	0.01	0.02	4 x 10 ⁻⁴
Silty SAND	2	0.005	0.01	1.0 x 10 ⁻⁴
Uniform SILT	0.05	0.005	0.006	0.5 x 10 ⁻⁴
Sandy CLAY	1.0	0.001	0.002	0.05 x 10 ⁻⁴
Silty CLAY	0.05	0.001	0.0015	0.01 x 10 ⁻⁴
CLAY (30% to 50% clay sizes)	0.05	0.0005	0.0008	0.001 x 10 ⁻⁴
Colloidal CLAY (-2 µm 50%)	0.01	10	40	10 ⁻⁹

¹ Basic Soils Engineering, R.K. Hough, 2nd Edition, Ronald Pess Co.; 1969, Page 76.

Note: Since the permeability coefficient of the soil will be unknown in most non-critical, non-severe applications for erosion control and drainage, the soil-permeability coefficients listed in Table 712-2 may be used as a guide for comparing the permeability coefficient of the fabric with that of the in-place soil

February 3, 2011

REVISION OF SECTION 712
WATER FOR MIXING OR CURING CONCRETE

Section 712 of the Standard Specifications is hereby revised for this project as follows:

Delete subsection 712.01 and replace it with the following:

712.01 Water. Water used in mixing or curing concrete shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetation, or other substance injurious to the finished product. Concrete mixing water shall meet the requirements of ASTM C1602. The Contractor shall perform and submit tests to the Engineer at the frequencies listed in ASTM C1602. Potable water may be used without testing. Where the source of water is relatively shallow, the intake shall be so enclosed as to exclude silt, mud, grass, and other foreign materials.

REVISION OF SECTIONS 101 AND 630
CONSTRUCTION ZONE TRAFFIC CONTROL

Sections 101 and 630 of the Standard Specifications are hereby revised for this project as follows:

In subsection 101.01 add the following:

MASH Manual for Assessing Safety Hardware

In subsection 630.01, delete the first paragraph and replace with the following:

630.01 This work consists of furnishing, installing, moving, maintaining, and removing temporary traffic signs, advance warning arrow panels, flashing beacon (portable), barricades, channelizing devices, delineators, temporary traffic signals, mobile pavement marking zones, masking and unmasking existing signs in construction zones, and concrete barriers as required by the Manual on Uniform Traffic Control Devices for Streets and Highways and the Colorado Supplement thereto, in accordance with the Contract. Devices shall comply with the performance criteria contained in NCHRP Report 350 (only applicable for devices developed prior to 2011) or MASH (acceptable for all devices). Devices temporarily not in use shall, as a minimum, be removed from the shoulder area. Moving will include devices removed from the project and later returned to use.

In subsection 630.02, delete the second paragraph, and replace with the following:

Temporary sign support assembly shall be timber, perforated square metal tubing inserted into a larger base post or slip base or perforated metal U-channel with a slip base. The temporary sign support assembly shall conform to NCHRP (only applicable for sign support assemblies developed prior to 2011) or MASH (acceptable for all sign support assemblies), and AASHTO requirements regarding temporary sign supports during construction.

Subsection 630.02 shall include the following:

If a timber post is selected, it shall conform to the requirements of subsection 614.02.

In subsection 630.07(a), delete the first paragraph and replace with the following:

(a) *Stackable Vertical Panels.* Stackable vertical panels shall comply with the crash test requirements contained in NCHRP Report 350 (only applicable for vertical panels developed prior to 2011) or MASH (acceptable for all vertical panels) and shall meet MUTCD requirements for vertical panels. Vertical panels shall be retroreflectorized with Type IV sheeting, in accordance with subsection 630.02. The stackable vertical panels shall have the following properties:

In subsection 630.07(b), delete the first paragraph and replace with the following:

(b) *Stackable Tubular Markers.* Stackable tubular markers shall comply with the crash test requirements contained in NCHRP Report 350 (only applicable for stackable tubular markers developed prior to 2011) or MASH (acceptable for all stackable tubular markers) and shall conform to MUTCD requirements for Tubular Markers. The stackable tubular markers shall have the following properties:

In subsection 630.09, delete the second and third paragraphs, and replace with the following:

Work zone devices designated by FHWA as Category I, II, or III, shall comply with the performance criteria contained in NCHRP Report 350 (only applicable for devices developed prior to 2011) or MASH (acceptable for all devices). Devices designated as Category IV, including but not limited to portable or trailer-mounted devices such as flashing arrow panels, temporary traffic signals, area lighting supports, and changeable message signs are not required to meet NCHRP 350 or MASH requirements.

Except for Category IV devices, the Contractor shall obtain and present to the Engineer the manufacturer's written NCHRP 350 (only applicable for devices developed prior to 2011) or MASH (acceptable for all devices) certification for each work zone device before it is first used on the project.

REVISION OF SECTIONS 101 AND 630
CONSTRUCTION ZONE TRAFFIC CONTROL

In subsection 630.10(a) (3) (iii), delete the third paragraph, and replace with the following:

Groups 1 and 2 shall each be equipped with a truck-mounted Advance Warning Flashing or Sequencing Arrow Panel (C Type), and a truck mounted impact attenuator. The impact attenuator shall be located on the rearmost vehicle of each group. A separate vehicle for this attenuator may be used. Each truck-mounted impact attenuator shall be certified by the manufacturer to be able to withstand a 62 MPH impact in accordance with NCHRP 350, Test Level 3 (only applicable for truck-mounted impact attenuators developed prior to 2011) or MASH, Test Level 3 (acceptable for all truck-mounted impact attenuators). The cone setting truck and the cone pickup truck shall not be the same vehicle.

In subsection 630.16, delete the 5th paragraph.

REVISION OF SECTIONS 601 AND 701
CEMENTS AND POZZOLANS

Sections 601 and 701 of the Standard Specifications are hereby revised for this project as follows:

In subsection 601.03, first paragraph, the following shall be added to the table:

High-Reactivity Pozzolans 701.04

Subsection 601.03 shall include the following:

Pozzolans shall consist of Fly Ash, Silica Fume and High-Reactivity Pozzolan.

In subsection 601.04, delete the third and fourth paragraphs and replace with the following

Cementitious material requirements are as follows:

Class 0 requirements for sulfate resistance shall be one of the following:

- (1) ASTM C 150 Type I, II or V
- (2) ASTM C 595 Type IL, IP, IP(MS), IP(HS) or IT
- (3) ASTM C 1157 Type GU, MS or HS
- (4) ASTM C 150 Type III cement if it is allowed, as in Class E concrete

Class 1 requirements for sulfate resistance shall be one of the following:

- (1) ASTM C 150 Type II or V; Class C fly ash shall not be substituted for cement.
- (2) ASTM C 595 Type IP(MS) or IP(HS).
- (3) ASTM C 1157 Type MS or HS; Class C fly ash shall not be substituted for cement.
- (4) When ASTM C 150 Type III cement is allowed, as in Class E concrete, it shall have no more than 8 percent C_3A . Class C fly ash shall not be substituted for cement.
- (5) ASTM C 595 Type IL; having less than 0.10 percent expansion at 6 months when tested according to ASTM C 1012. Class C fly ash shall not be substituted for cement.
- (6) ASTM C 595 Type IT; having less than 0.10 percent expansion at 6 months when tested according to ASTM C 1012.

Class 2 requirements for sulfate resistance shall be one of the following:

- (1) ASTM C 150 Type V with a minimum of a 20 percent substitution of Class F fly ash by weight
- (2) ASTM C 150 Type II or III with a minimum of a 20 percent substitution of Class F fly ash by weight. The Type II or III cement shall have no more than 0.040 percent expansion at 14 days when tested according to ASTM C 452
- (3) ASTM C 1157 Type HS; Class C fly ash shall not be substituted for cement.
- (4) ASTM C 150 Type II, III, or V plus High-Reactivity Pozzolan where the blend has less than 0.05 percent expansion at 6 months or 0.10 percent expansion at 12 months when tested according to ASTM C 1012
- (5) ASTM C 1157 Type MS plus Class F fly ash or High-Reactivity Pozzolan where the blend has less than 0.05 percent expansion at 6 months or 0.10 percent expansion at 12 months when tested according to ASTM C 1012

REVISION OF SECTIONS 601 AND 701
CEMENTS AND POZZOLANS

- (6) A blend of portland cement meeting ASTM C 150 Type II or III with a minimum of 20 percent Class F fly ash by weight, where the blend has less than 0.05 percent expansion at 6 months or 0.10 percent expansion at 12 months when tested according to ASTM C 1012.
- (7) ASTM C 595 Type IP(HS).
- (8) ASTM C 595 Type IL plus Class F fly ash or High-Reactivity Pozzolan where the blend has less than 0.05 percent expansion at 6 months or 0.10 percent expansion at 12 months when tested according to ASTM C 1012
- (9) ASTM C 595 Type IT; having less than 0.05 percent expansion at 6 months or 0.10 percent expansion at 12 months when tested according to ASTM C 1012.

Class 3 requirements for sulfate resistance shall be one of the following:

A blend of portland cement meeting ASTM C 150 Type II, III, or V with a minimum of a 20 percent substitution of Class F fly ash by weight, where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C 1012.

- (1) ASTM C 1157 Type HS having less than 0.10 percent expansion at 18 months when tested according to ASTM C 1012. Class C fly ash shall not be substituted for cement.
- (2) ASTM C 1157 Type MS or HS plus Class F fly ash or High-Reactivity Pozzolan where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C 1012.
- (3) ASTM C 150 Type II, III, or V plus High-Reactivity Pozzolan where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C 1012.
- (4) ASTM C 595 Type 1L plus High-Reactivity Pozzolan where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C 1012.
- (5) ASTM C 595 Type IP(HS) or IT having less than 0.10 percent expansion at 18 months when tested according to ASTM C 1012.
- (6) ASTM C 595 Type IL with a minimum of a 20 percent substitution of Class F fly ash by weight, where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C 1012.

When fly ash or High-Reactivity Pozzolan is used to enhance sulfate resistance, it shall be used in a proportion greater than or equal to the proportion tested in accordance to ASTM C1012, shall be the same source and it shall have a calcium oxide content no more than 2.0 percent greater than the fly ash or High-Reactivity Pozzolan tested according to ASTM C 1012.

In subsection 601.05 delete the first paragraph and replace with the following:

601.05 Proportioning. The Contractor shall submit a Concrete Mix Design for each class of concrete being placed on the project. Concrete shall not be placed on the project before the Concrete Mix Design Report has been reviewed and approved by the Engineer. The Concrete Mix Design will be reviewed and approved following the procedures of CP 62. The Concrete Mix Design will not be approved when the laboratory trial mix data are the results from tests performed more than two years in the past or aggregate data are the results from tests performed more than two years in the past. The concrete mix design shall show the weights and sources of all ingredients including cement, pozzolan, aggregates, water, additives and the water to cementitious material ratio (w/cm). When determining the w/cm, the weight of cementitious material (cm) shall be the sum of the weights of the cement, fly ash, silica fume and High-Reactivity Pozzolan.

REVISION OF SECTIONS 601 AND 701
CEMENTS AND POZZOLANS

In subsection 601.05, delete the 12th, 13th, 14th, 15th, and 16th paragraphs and replace with the following:

The Concrete Mix Design Report shall include Certified Test Reports showing that the cement, fly ash, High-Reactivity Pozzolan and silica fume meet the specification requirements and supporting this statement with actual test results. The certification for silica fume shall state the solids content if the silica fume admixture is furnished as slurry.

For all concrete mix designs with ASTM C150 cements, up to a maximum of 20 percent Class C, 30 percent Class F or 30 percent High-Reactivity Pozzolan by weight of total cementitious material may be substituted for cement.

For all concrete mix designs with ASTM C595 Type IL cements, up to a maximum of 20 percent Class C, 30 percent Class F or 30 percent High-Reactivity Pozzolan by weight of total cementitious material may be substituted for cement.

For all concrete mix designs with ASTM C595 Type IP, IP(MS), IP(HS) or IT cements; fly ash or High-Reactivity Pozzolan shall not be substituted for cement.

For all concrete mix designs with ASTM C1157 cements, the total pozzolan content including pozzolan in cement shall not exceed 30 percent by weight of the cementitious material content.

When the Contractor's use of fly ash or High-Reactivity Pozzolan results in delays to the project, when it is necessary to make changes in admixture quantities, the source, or the Contractor performs, the cost of such delays and corrective actions shall be borne by the Contractor.

The Contractor shall submit a new Concrete Mix Design Report meeting the above requirements when a change occurs in the source, type, or proportions of cement, fly ash, High-Reactivity Pozzolan, silica fume or aggregate. When a change occurs in the source of approved admixtures, the Contractor shall submit a letter stamped by the Concrete Mix Design Engineer approving the changes to the existing mix design. The change will need to be approved by the Engineer prior to use.

In subsection 601.06, second paragraph, delete (9) and replace with the following:

(9) Type, brand, and amount of cement, fly ash and High-Reactivity Pozzolan

In subsection 601.06, delete (a) and replace with the following:

(a) *Portland Cement, Fly Ash, High-Reactivity Pozzolan and Silica Fume.* These materials may be sacked or bulk. No fraction of a sack shall be used in a batch of concrete unless the material is weighed.

All bulk cement shall be weighed on an approved weighing device. The bulk cement weighing hopper shall be sealed and vented to preclude dusting during operation. The discharge chute shall be so arranged that cement will not lodge in it or leak from it.

Separate storage and handling equipment shall be provided for the fly ash, silica fume and High-Reactivity Pozzolan. The fly ash, silica fume, and High-Reactivity Pozzolan may be weighed in the cement hopper and discharged with the cement.

REVISION OF SECTIONS 601 AND 701
CEMENTS AND POZZOLANS

In subsection 701.01 delete and replace the second paragraph with the following:

All concrete, including precast, prestressed and pipe shall be constructed with one of the following hydraulic cements, unless permitted otherwise.

ASTM C 150 Type I

ASTM C 150 Type II

ASTM C 150 Type V

ASTM C 595 Type IL

ASTM C 595 Type IP

ASTM C 595 Type IP(MS)

ASTM C 595 Type IP(HS)

ASTM C 595 Type IT

ASTM C 1157 Type GU, consisting of no more than 15 percent limestone

ASTM C 1157 Type MS, consisting of no more than 15 percent limestone

ASTM C 1157 Type HS, consisting of no more than 15 percent limestone

In subsection 701.02 add the following after the first paragraph:

Blending of pozzolans according to ASTM D5370 is permitted to meet the requirements of ASTM C 618.

Add subsection 701.04 immediately following subsection 701.03 as follows:

701.04 High-Reactivity Pozzolans. High-Reactivity Pozzolans (HRP) shall conform to the requirements of AASHTO M321. HRPs are but not limited to metakaolin, rice hull ash, zirconium fume, ultra-fine fly ash, and fume from the production of 50 percent ferrosilicon (with SiO₂ less than 85 percent).

HRPs shall meet the following optional requirement of AASHTO M321: The sulfate expansion at 14 days shall not exceed 0.045 percent

HRP shall be from a preapproved source listed on the Department's Approved Products List. The HRP intended for use on the project shall have been tested and accepted prior to its use. Certified Test Reports showing that the HRP meets the specification requirements and supporting this statement with actual test results shall be submitted to the Engineer.

The HRP shall be subject to sampling and testing by the Department. Test results that do not meet the physical and chemical requirements may result in the suspension of the use of HRP until the corrections necessary have been taken to ensure that the material conforms to the specifications.

CITY AND COUNTY OF DENVER
STATE OF COLORADO



DEPARTMENT OF PUBLIC WORKS

Plans/**Drawings**

Contract Number: 201840154



Federal Blvd Reconstruction

5th Ave to Howard Place

February 13, 2018

OVERSIGHT / NHS

FHWA PROJECTS OF DIVISION INTEREST (PoDI) OVERSIGHT? NO YES

NATIONAL HIGHWAY SYSTEM? NO YES

DEPARTMENT OF TRANSPORTATION STATE OF COLORADO

HIGHWAY CONSTRUCTION BID PLANS OF PROPOSED
FEDERAL AID PROJECT NO. NHP 2873-172
SUB-ACCOUNT NO. 19957

RELATED PROJECTS:

P. E. UNDER PROJECT: --
PROJECT NUMBER: --
PROJECT CODE: --

R.O.W. PROJECTS:

R.O.W. PROJECT DESCRIPTION
--
--

TABULATION OF LENGTH AND DESIGN DATA

STATION	ROADWAY SH 88		MAJOR STR. LIN FT
	LIN FT	MILES	
BEGIN PROJECT CC 0881-025 = STA. 12+95.40	3,298.91	0.6248	NA
END PROJECT CC 0881-025 = STA. 45+94.31			
SUBTOTAL LENGTH	3,298.91	0.6248	
PROJECT GROSS LENGTH	3,298.91	0.6248	
DESIGN DATA FEDERAL BOULEVARD			
MINIMUM RADIUS OF CURVE	2,024 FT.		
MAXIMUM GRADE	-3.15%		
MINIMUM S.S.D. (HORIZONTAL)	> 300 FT.		
MINIMUM S.S.D. (VERTICAL)	305 FT.		
MAXIMUM DESIGN SPEED	40 MPH (35 MPH POSTED)		
2035 DESIGN TRAFFIC (ADT)			
FEDERAL BOULEVARD	55,000		
COMBINED	5%		
TRUCKS %	5%		

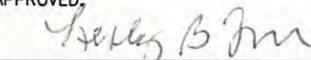
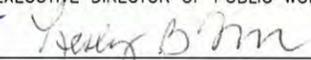
STATE HIGHWAY NO. 88
FEDERAL BOULEVARD RECONSTRUCTION - 5TH AVENUE TO HOWARD PLACE

CITY OF DENVER, DENVER COUNTY
MASTER PROJECT CODE NO. - 2011-PROJMSTR-0000364
CONSTRUCTION PROJECT CODE NO. - 2011-CIP-03640302

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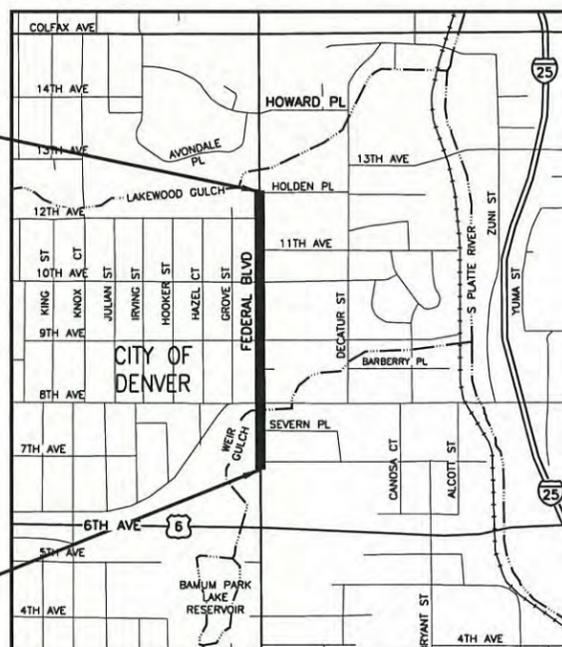
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3	PROJECT SITE PLAN	3
4 - 9	TYPICAL ROADWAY SECTIONS	4 - 9
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CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS

APPROVED:	
	11.30.17
EXECUTIVE DIRECTOR OF PUBLIC WORKS	SIGNATURE DATE
	11/30/17
CITY ENGINEER	SIGNATURE DATE
	11/12/17
DIRECTOR OF ENGINEERING CAPITAL PROJECTS	SIGNATURE DATE
	11/21/17
CITY TRAFFIC ENGINEER	SIGNATURE DATE
	11.29.17
DIRECTOR OF PARKS AND RECREATION	SIGNATURE DATE

END PROJECT
STA. 45+94.31

BEGIN PROJECT
STA. 12+95.40

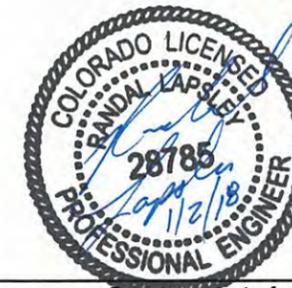


VICINITY MAP

APPROX: 1" = 2000'
SECTION 5
TOWNSHIP 4 SOUTH
RANGE 68 WEST

PROJECT DESCRIPTION

LOCATION: DENVER, COLORADO - FEDERAL BOULEVARD - 5TH AVENUE TO HOWARD PLACE
ROADWAY RECONSTRUCTION INCLUDING PUBLIC AND PRIVATE UTILITY UPGRADES ALONG NORTH FEDERAL BOULEVARD
PROJECT INCLUDES RECONSTRUCTION OF ROADWAY WITH CONCRETE PAVEMENT, TRAFFIC SIGNAL, STREET LIGHTING, GAS AND STORM SEWER UPGRADES, SIDEWALK AND TRANSIT STOP IMPROVEMENTS AND LANDSCAPING AND IRRIGATION.



TSIOUVARAS SIMMONS HOLDERNESS
CONSULTING ENGINEERS

Last Modification Date:	Init.:
Drawing File Name: 1102188-001-Title Sheet.dgn	
Horizontal Scale: 1:2	Vert. Scale: As Noted

Sheet Revisions		
Date:	Comments	Init.

City and County of Denver
Department of Public Works
Engineering Division
201 W. Colfax, Dept 506
Denver, CO. 80202

Colorado Department of Transportation
2000 South Holly Street
Denver, CO 80222
Phone: 303-757-9511 FAX: 303-757-9907
Region 1 JV

As Constructed
No Revisions:
Revised:
Void:

Contract Information	
CONTRACTOR:	CONST. MANAGER:
PROJ. START: -- / -- / --	PROJ. COMPLETE: -- / -- / --
PROJECT ENGINEER:	-- / -- / --
DIRECTOR OF PUBLIC WORKS:	-- / -- / --

Project No./Code
NHP 2873-172
SA 19957
2011-PROJMSTR-0000364
Sheet Number

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M-601-20		WINGWALLS FOR PIPE OR BOX CULVERTS	49
M-603-1	<input type="checkbox"/>	METAL PIPE (4 SHEETS) (REVISED ON OCTOBER 02, 2014)	50-53
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M-603-3		PRECAST CONCRETE BOX CULVERT	55
M-603-4	<input type="checkbox"/>	CORRUGATED POLYETHYLENE PIPE (AASHTO M294) (REVISED ON OCT. 02, 2014)	56
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M-603-6	<input type="checkbox"/>	STEEL REINFORCED POLYETHYLENE RIBBED PIPE (AASHTO MP 20) (NEW ON APRIL 30, 2015)	
M-603-10		CONCRETE AND METAL END SECTIONS (2 SHEETS)	58-59
M-604-10		INLET, TYPE C	60
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M-604-20		MANHOLES (3 SHEETS)	65-67
M-604-25		VANE GRATE INLET (5 SHEETS)	68-72
M-605-1		SUBSURFACE DRAINS	73
M-606-1	<input type="checkbox"/>	GUARDRAIL TYPE 3 W-BEAM (20 SHEETS) (REVISED ON OCTOBER 27, 2014)	74-92
M-606-1	<input checked="" type="checkbox"/>	MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES (20 SHEETS) (REVISED ON DECEMBER 29, 2015)	
M-606-13	<input type="checkbox"/>	GUARDRAIL TYPE 7 F-SHAPE BARRIER (4 SHEETS) (REVISED ON AUGUST 30, 2013)	93-96
M-606-14		PRECAST TYPE 7 CONCRETE BARRIER (3 SHEETS)	97-99

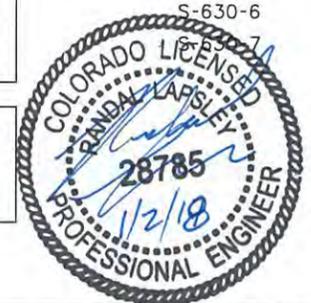
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M-607-1		WIRE FENCES AND GATES (3 SHEETS)	100-102
M-607-2		CHAIN LINK FENCE (3 SHEETS)	103-105
M-607-3		BARRIER FENCE	106
M-607-4	<input type="checkbox"/>	DEER FENCE, GATES, AND GAME RAMPS (5 SHEETS) (REVISED ON APRIL 30, 2015)	107-109
M-607-10		PICKET SNOW FENCE	110
M-607-15		ROAD CLOSURE GATE (9 SHEETS)	111-119
M-608-1	<input type="checkbox"/>	CURB RAMPS (10 SHEETS) (REVISED ON FEBRUARY 23, 2017)	120-125
M-609-1	<input type="checkbox"/>	CURBS, GUTTERS, AND SIDEWALKS (4 SHEETS) (REVISED ON JULY 24, 2012)	126-129
M-611-1		CATTLE GUARD (2 SHEETS)	130-131
M-611-2	<input type="checkbox"/>	DEER GUARD (2 SHEETS) (NEW ON APRIL 30, 2015)	
M-613-1		ROADWAY LIGHTING (4 SHEETS)	132-135
M-614-1		RUMBLE STRIPS (3 SHEETS)	136-138
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M-616-1		INVERTED SIPHON	143
M-620-1		FIELD LABORATORY CLASS 1	144
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M-629-1		SURVEY MONUMENTS (2 SHEETS)	149-150

PLAN NUMBER	NEW OR REVISED	S STANDARD TITLE	PAGE NUMBER
S-612-1	<input type="checkbox"/>	DELINEATOR INSTALLATIONS (7 SHEETS) (REVISED ON DEC. 1, 2016)	151-157
S-614-1	<input checked="" type="checkbox"/>	GROUND SIGN PLACEMENT (2 SHEETS) (REVISED ON DECEMBER 12, 2014)	158-159
S-614-2	<input type="checkbox"/>	CLASS I SIGNS (REVISED ON JUNE 24, 2016)	160
S-614-3		CLASS II SIGNS	161
S-614-4	<input type="checkbox"/>	CLASS III SIGNS (3 SHEETS) (REVISED ON DECEMBER 17, 2014)	162-164
S-614-5	<input type="checkbox"/>	BREAK-AWAY SIGN SUPPORT DETAILS (REVISED ON FEBRUARY 8, 2017) FOR GROUND SIGNS (2 SHEETS)	165-166
S-614-6	<input type="checkbox"/>	CONCRETE FOOTINGS AND SIGN ISLANDS FOR CLASS III SIGNS (2 SHEETS) (REVISED ON SEPTEMBER 16, 2013)	167-168
S-614-8	<input type="checkbox"/>	TUBULAR STEEL SIGN SUPPORT DETAILS (6 SHEETS) (REVISED ON DECEMBER 1, 2016)	169-173
S-614-9	<input type="checkbox"/>	PEDESTRIAN PUSH BUTTON POST ASSEMBLY (REVISED ON MAY 24, 2016)	174
S-614-10		MARKER ASSEMBLY INSTALLATIONS	175
S-614-11		MILEPOST SIGN DETAIL FOR HIGH SNOW AREAS	176
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S-614-14		FLASHING BEACON AND SIGN INSTALLATIONS (3 SHEETS)	178-180
S-614-20		TYPICAL POLE MOUNT SIGN INSTALLATIONS	181
S-614-21	<input type="checkbox"/>	CONCRETE BARRIER SIGN POST INSTALLATIONS (REVISED ON MAY 24, 2016)	182
S-614-22		TYPICAL MULTI-SIGN INSTALLATIONS	183
S-614-40	<input type="checkbox"/>	TYPICAL TRAFFIC SIGNAL INSTALLATION DETAILS (5 SHEETS) (REVISED ON JUNE 17, 2016)	184-188
S-614-40A	<input type="checkbox"/>	ALTERNATIVE TRAFFIC SIGNAL INSTALLATION DETAILS (4 SHEETS) (REVISED ON JUNE 17, 2016)	189-192
S-614-41	<input checked="" type="checkbox"/>	TEMPORARY SPAN WIRE SIGNALS (REVISED ON APRIL 2, 2015)	193
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S-614-43		TRAFFIC LOOP AND MISCELLANEOUS SIGNAL DETAILS (10 SHEETS)	198-207
S-614-44	<input type="checkbox"/>	PEDESTAL POLE SIGNALS (2 SHEETS) (REVISED ON JUNE 17, 2016)	
S-614-50	<input type="checkbox"/>	STATIC SIGN MONOTUBE STRUCTURES (12 SHEETS) (REVISED ON JUNE 17, 2016)	208-219
S-614-60	<input type="checkbox"/>	DYNAMIC SIGN MONOTUBE STRUCTURES (14 SHEETS) (REVISED ON JUNE 17, 2016)	220-233
S-627-1	<input type="checkbox"/>	PAVEMENT MARKINGS (8 SHEETS) (REVISED ON FEBRUARY 8, 2017)	234-238
S-630-1	<input checked="" type="checkbox"/>	TRAFFIC CONTROLS FOR HIGHWAY CONSTRUCTION (24 SHEETS) (REVISED ON JUNE 23, 2016)	239-258
S-630-2	<input checked="" type="checkbox"/>	BARRICADES, DRUMS, CONCRETE BARRIERS (TEMP) AND VERTICAL PANELS (REVISED ON JUNE 23, 2016)	259
S-630-3		FLASHING BEACON (PORTABLE) DETAILS	260
S-630-4		STEEL SIGN SUPPORT (TEMPORARY) INSTALLATION DETAILS (2 SHEETS)	261-262
S-630-5	<input type="checkbox"/>	PORTABLE RUMBLE STRIPS (TEMPORARY) (2 SHEETS) (REVISED ON AUGUST 13, 2015)	263-264
S-630-6		EMERGENCY PULL-OFF AREA (TEMPORARY)	265
		ROLLING ROADBLOCKS FOR TRAFFIC CONTROL (3 SHEETS)	266-268

COLORADO
 DEPARTMENT OF TRANSPORTATION
M&S STANDARDS PLANS LIST
 July 04, 2012
 Revised on August 10, 2017

ALL OF THE M&S STANDARD PLANS, AS SUPPLEMENTED AND REVISED, APPLY TO THIS PROJECT WHEN USED BY DESIGNATED PAY ITEM OR SUBSIDIARY ITEM.

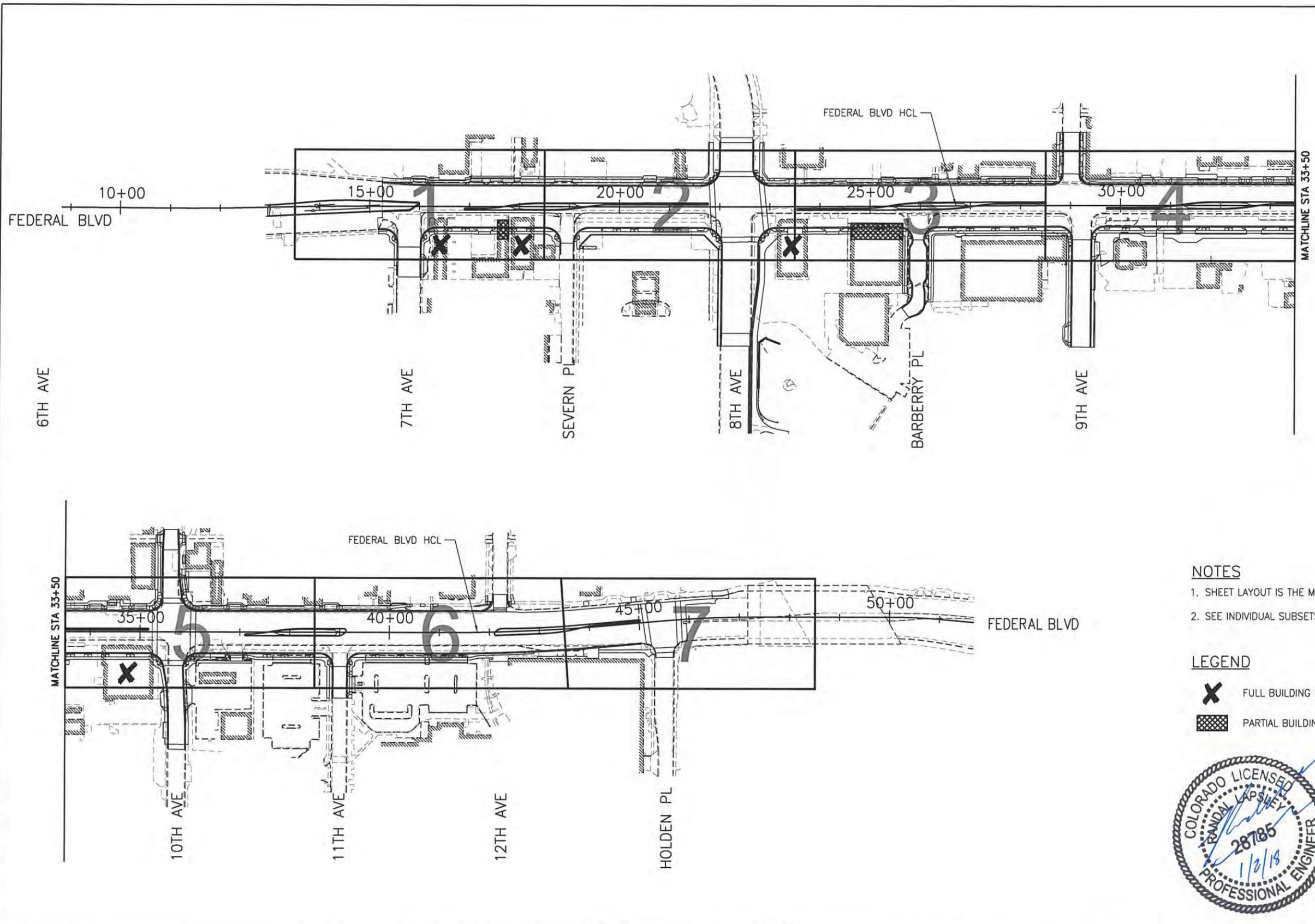
NEW OR REVISED STANDARD PLAN SHEETS APPLICABLE TO THIS PROJECT, INDICATED BY A MARKED BOX , WILL BE ATTACHED TO THE PLANS.



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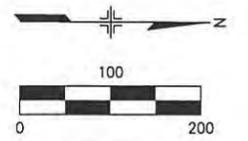


NOTES

1. SHEET LAYOUT IS THE MASTER INDEX FOR ALL PLAN SUBSETS.
2. SEE INDIVIDUAL SUBSETS FOR ADDITIONAL SHEET LOCATIONS.

LEGEND

- FULL BUILDING REMOVAL (BY OTHERS)
- PARTIAL BUILDING REMOVAL (BY OTHERS)



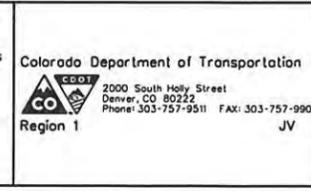
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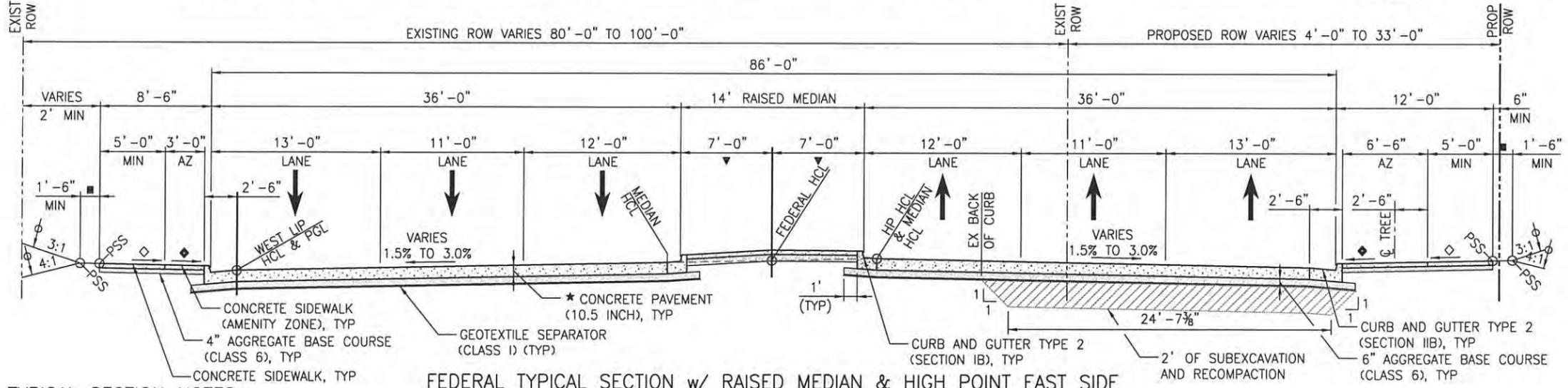
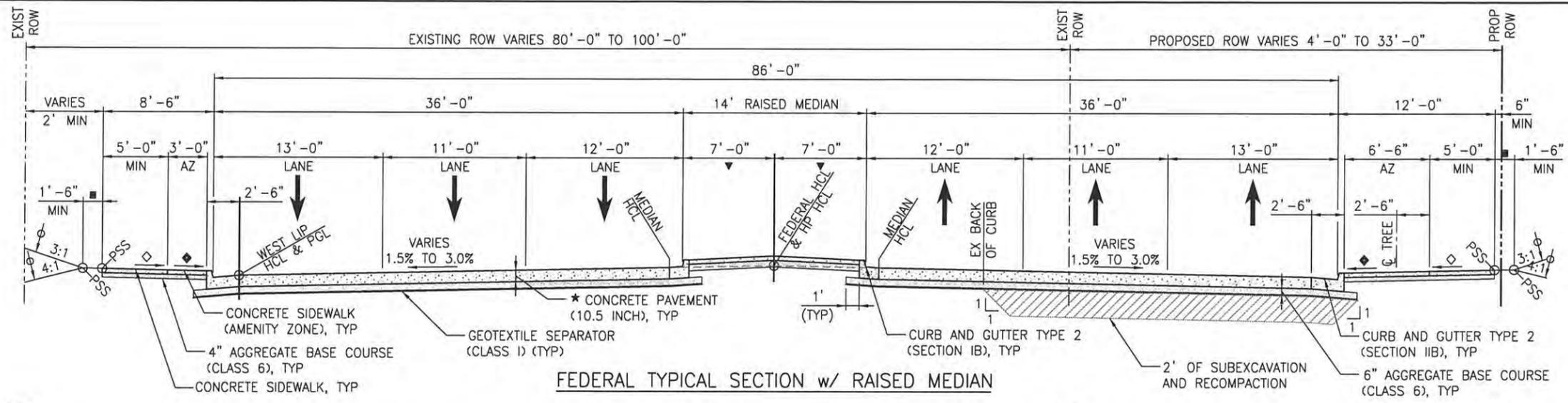
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Designer:	SRF
Detailer:	SRF
Structure Numbers	
Sheet Subset:	SITEPLAN
Subset Sheets:	1 of 1

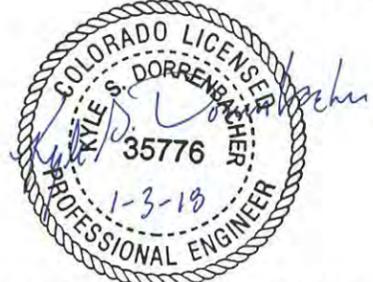
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Sheet Number
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- LEGEND:**
- HCL - HORIZONTAL CONTROL LINE
 - PGL - PROFILE GRADE LINE
 - PSS - POINT OF SLOPE SELECTION
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 - AZ - AMENITY ZONE (SEE HARDSCAPE SUBSET)
 - - VERTICAL ALIGNMENT CONTROL POINTS
 - - VARIABLE SLOPE 2.0% TYP. (0.5% MIN / 8.33% MAX, SEE CROSS SECTIONS) AND MATERIALS (SEE PLANS)
 - ◇ - 1.8% SLOPE TYP. (1.0% MIN/2.0% MAX)
 - ◆ - 2.0% SLOPE TYP. (0.5% MIN/4.0% MAX)
 - ⊗ - THE CONTRACTOR IS REQUIRED TO STRIP AND STOCKPILE (IF APPLICABLE) AND/OR PLACE TOPSOIL (4" MIN) UPON COMPLETION OF FINAL GRADING. SEE LANDSCAPING PLANS FOR DETAILS.
 - * - 11" OF CONCRETE PAVEMENT TO BE CONSTRUCTED AT THE INTERSECTION OF 8TH AVE & FEDERAL, SEE PAVING PLANS FOR LIMITS.
 - △ - NO FORMAL PAVEMENT DESIGN CONDUCTED FOR THESE SECTIONS. PAVEMENT THICKNESS IS EQUIVALENT TO THE MINIMUM REQUIRED BY CITY AND COUNTY OF DENVER STD DWG NO 12.6, WITHOUT A PAVEMENT DESIGN ON SOILS WITH LEAST PAVEMENT SUPPORT.
 - ▼ - MEDIAN COVER MATERIAL (SEE HARDSCAPE PLAN & LANDSCAPE PLANTING PLAN SUBSETS)

TYPICAL SECTION NOTES:

1. BREAK POINTS IN SLOPES AND BOTTOMS OF DITCHES SHALL BE ROUNDED DURING CONSTRUCTION FOR A PLEASING APPEARANCE.
2. HEIGHT OF CURB MAY VARY FROM 6" TO 7-1/2". SEE CONSTRUCTION PLANS FOR LOCATIONS OF TALLER CURB. (PAID FOR AS CURB AND GUTTER TYPE 2 (SECTION II-B)).
3. GUTTER PAN THICKNESS SHALL MATCH THE ADJACENT CONCRETE PAVEMENT THICKNESS, TYP.
4. SEE PAVING PLANS FOR CURB TYPE AND TRANSITION LOCATIONS. SEE CONCRETE PAVING JOINT LOCATIONS FOR SUGGESTED JOINTING LAYOUT, TYPES, AND DETAILS.
5. SEE PAVING PLANS AND CROSS SECTIONS FOR ROADWAY AND SIDEWALK DIMENSIONS AND CROSS SLOPE CONTROL.
6. SEE ROADWAY TYPICAL DETAILS, ROADWAY PLANS, PAVING PLANS, SIGNING AND STRIPING PLANS AND PROJECT TABULATIONS FOR ADDITIONAL INFORMATION.
7. TYPICAL SECTION STATIONING BASED ON FEDERAL HORIZONTAL CONTROL LINE. SEE ROADWAY PROFILES FOR CROSS SLOPE TRANSITION DATA AND GEOMETRIC CONTROL SHEETS FOR ADDITIONAL INFORMATION.
8. MEDIAN LANDSCAPE DETAILS NOT SHOWN IN THE TYPICAL SECTIONS. SEE URBAN DESIGN AND LANDSCAPE PLANS FOR MEDIAN DETAILS.
9. SEE GEOMETRIC, ROADWAY AND PAVING PLANS FOR LEFT TURN LANE AND PARKING LANE EXACT LOCATIONS.
10. ONCE EXISTING PAVEMENT HAS BEEN COMPLETELY REMOVED, EXISTING SUBGRADE MATERIAL SHALL BE THOROUGHLY SCARIFIED TO A DEPTH OF 6" AND BROUGHT TO NEAR OPTIMUM MOISTURE AND RECOMPACTED THEN PROOFROLLED WITH A PNEUMATIC-TYPE VEHICLE.
 - A) AREAS THAT DEFORM MORE THAN 0.5 INCHES UNDER HEAVY WHEEL LOADS SHALL BE REWORKED OR REPLACED TO ACHIEVE STABLE SUBGRADE PRIOR TO PAVING.
 - B) IN THE WIDENING AREAS TO THE EAST OF FEDERAL BLVD, 2 FEET OF SUBEXCAVATION AND RECOMPACTION IS REQUIRED PRIOR TO PLACING NEW AGGREGATE BASE COURSE (CLASS 6). THE REQUIRED PERCENT OF RELATIVE COMPACTION SHALL CONFORM TO SECTION 203.07 OF CDOT'S STANDARD SPECIFICATIONS AND STANDARD SPECIAL PROVISIONS.
11. 4" AGGREGATE BASE COURSE (CL. 6) IS REQUIRED UNDER ALL CONCRETE SIDEWALKS, DRIVEWAYS, AND CURB RAMPS.
12. PAYMENT FOR ITEM 202 - REMOVAL OF ASPHALT MAT SHALL INCLUDE THE REMOVAL OF ANY EXISTING CONCRETE PAVEMENT UNDER ASPHALT PAVEMENT TO BE REMOVED. SEE THE ENGINEERING GEOLOGY SHEETS AND THE POT HOLE DATA TABLES ON THE UTILITY PLANS TO SEE EXISTING CONCRETE PAVEMENT LOCATIONS DISCOVERED DURING BORING AND POT HOLE OPERATIONS. SEE REMOVAL AND RESET PLANS FOR REMOVAL OF ASPHALT LIMITS.
13. SEE GEOMETRIC CONTROL SHEETS FOR HORIZONTAL CONTROL LINE (HCL) DATA. SEE ROADWAY PROFILES FOR PROFILE GRADE LINE (PGL) AND CROSS SLOPE TRANSITION DATA AND NOTES.
14. ANY SWELLING SUBGRADE SOILS ENCOUNTERED WITHIN THE ROADWAY PRISM (INCLUDING SIDE STREETS) SHALL BE REMOVED A MINIMUM OF 2 FEET AND REPLACED WITH GRANULAR, NON-EXPANSIVE MATERIAL.
15. A TACK COAT IS REQUIRED BETWEEN LAYERS OF BITUMINOUS PAVEMENT AND WHERE BITUMINOUS PAVEMENT IS PLACED NEXT TO EDGES OF PAVEMENT. DILUTED EMULSIFIED ASPHALT FOR TACK COAT CONSISTS OF 1-PART EMULSIFIED AND 1-PART WATER. RATES OF APPLICATION SHALL BE AS DETERMINED BY THE ENGINEER AT THE TIME OF APPLICATION. EMULSIFIED ASPHALT WILL NOT BE PAID FOR SEPARATELY AND SHALL BE INCLUDED IN THE COST OF THE HMA.
16. PATCHING SHOULD BE TO THE DEPTH OF THE SURROUNDING EXISTING PAVEMENT OR AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. THE TOP LIFT MUST MATCH THE OVERLAY DEPTH AND UTILIZE HMA (GRADING SX) (100) (PG 76-28). THE THICKNESS OF SUBSEQUENT LIFTS MUST BE EQUAL TO OR GREATER THAN THE LIFT DIRECTLY ABOVE. LOWER LIFTS MAY UTILIZE HMA (GRADING S) (100) (PG 64-22).
17. GEOTEXTILE SEPARATOR FABRIC CONFORMING TO AASHTO M288 CLASS I SHALL BE PLACED BETWEEN THE COMPACTED SUBGRADE AND THE AGGREGATE BASE COURSE (CLASS 6). THE SEPARATOR GEOTEXTILE SHALL BE INSTALLED IN ACCORDANCE WITH SECTION 420.07 OF CDOT'S 2011 STANDARD SPECIFICATION AND SHALL COMPLY WITH SECTION 712.08 OF CDOT'S STANDARD SPECIFICATIONS.



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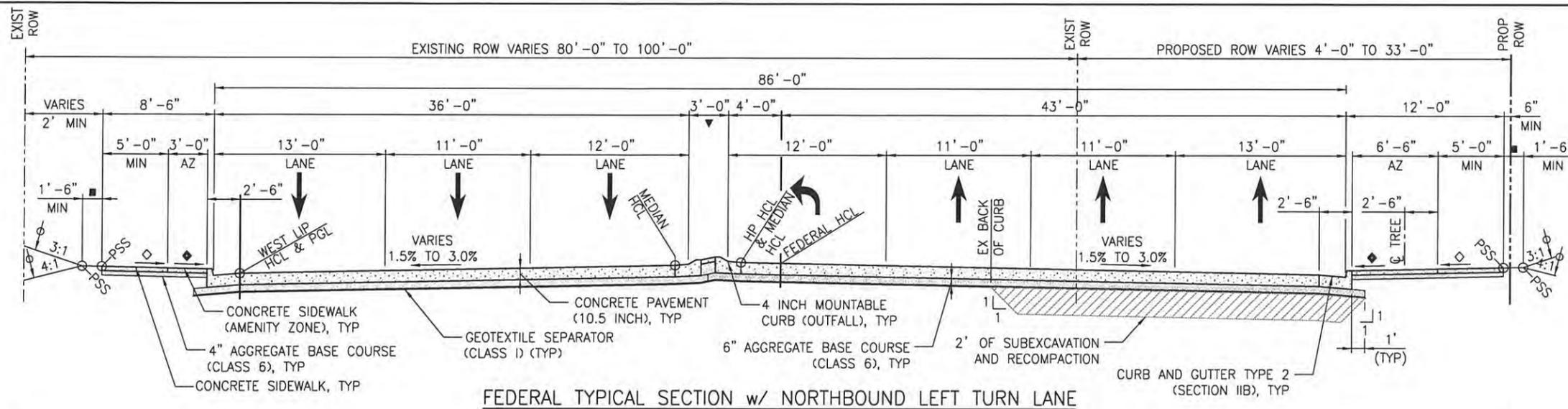
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 Engineering Division
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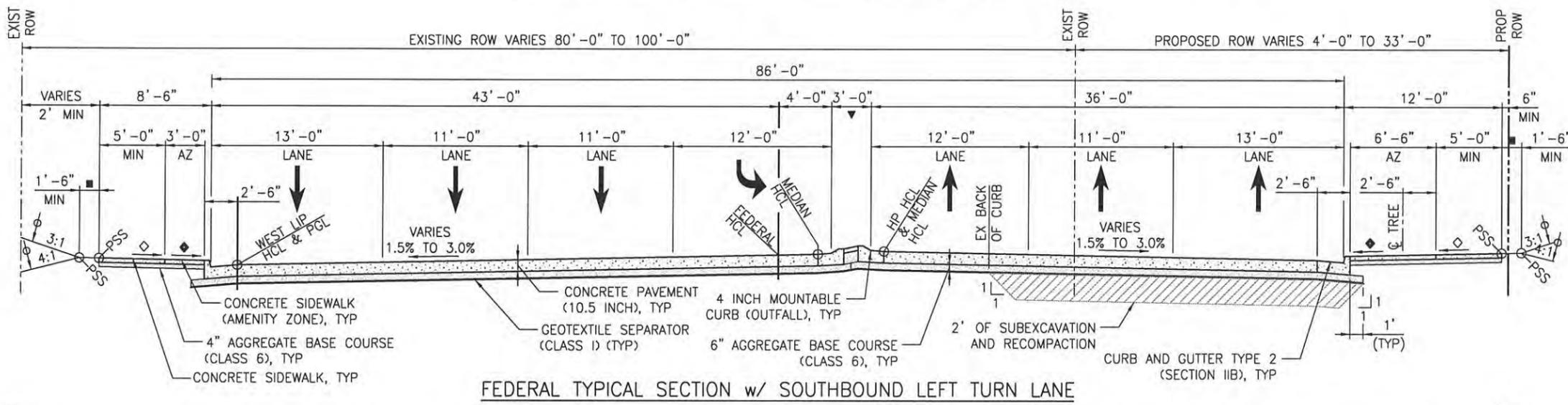
FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE			
TYPICAL ROADWAY SECTIONS			
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Detailer:	SRF	Numbers	
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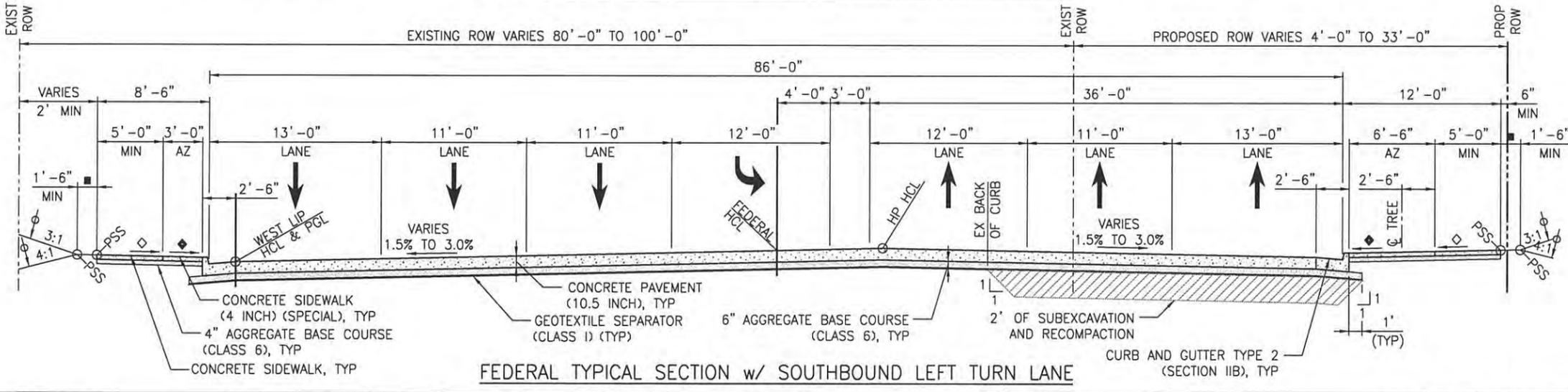
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FEDERAL TYPICAL SECTION w/ NORTHBOUND LEFT TURN LANE



FEDERAL TYPICAL SECTION w/ SOUTHBOUND LEFT TURN LANE



FEDERAL TYPICAL SECTION w/ SOUTHBOUND LEFT TURN LANE

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 - ⚡ - THE CONTRACTOR IS REQUIRED TO STRIP AND STOCKPILE (IF APPLICABLE) AND/OR PLACE TOPSOIL (4" MIN) UPON COMPLETION OF FINAL GRADING. SEE LANDSCAPING PLANS FOR DETAILS.
 - ★ - 11" OF CONCRETE PAVEMENT TO BE CONSTRUCTED AT THE INTERSECTION OF 8TH AVE & FEDERAL, SEE PAVING PLANS FOR LIMITS.
 - △ - NO FORMAL PAVEMENT DESIGN CONDUCTED FOR THESE SECTIONS. PAVEMENT THICKNESS IS EQUIVALENT TO THE MINIMUM REQUIRED BY CITY AND COUNTY OF DENVER STD DWG NO 12.6, WITHOUT A PAVEMENT DESIGN ON SOILS WITH LEAST PAVEMENT SUPPORT.
 - ▼ - MEDIAN COVER MATERIAL (SEE HARDSCAPE PLAN & LANDSCAPE PLANTING PLAN SUBSETS)



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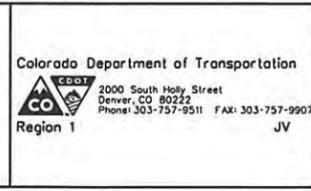
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Department of Public Works
Engineering Division
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Denver, CO. 80202



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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE	
TYPICAL ROADWAY SECTIONS	
Designer:	KSD
Detailer:	SRF
Sheet Subset:	TYPSEC
Structure Numbers	
Subset Sheets:	2 of 6

Project No./Code	NHPP 2873-172 SA 19957
	2011-PROJMSTR-0000364
Sheet Number	5

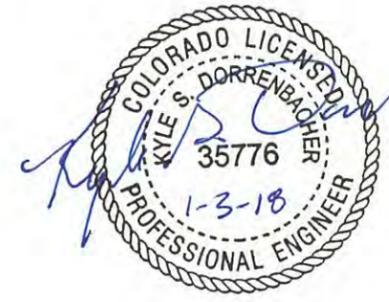
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FEDERAL BOULEVARD PAVEMENT DESIGN PARAMETERS					
DESIGN PARAMETERS	PCCP		HMA		
	MAILLINE FEDERAL BOULEVARD	FEDERAL BLVD./8TH AVENUE INTERSECTION	EAST 8TH AVENUE ARTERIAL	WEST 8TH AVENUE & 10TH AVENUE COLLECTOR	SIDE STREETS AND PATCHING
DESIGN LIFE (YEARS):	30	30	*	*	*
18k ESAL:	10,847,576	12,410,055	*	*	*
% TRUCKS:	40	40	*	*	*
INITIAL SERVICEABILITY:	4.5	4.5	*	*	*
TERMINAL SERVICEABILITY:	2.5	2.5	*	*	*
% RELIABILITY:	95	95	*	*	*
R-VALUE DESIGN:	5	5	*	*	*
SOIL RESILIENT MODULUS (PSI):	3,025	3,025	*	*	*
STRUCTURAL COEFFICIENT:	0.44	0.44	*	*	*
PCC MODULUS OF RUPTURE (PSI):	650	650	*	*	*
PCC MODULUS OF ELASTICITY (PSI):	3,400,000	3,400,000	*	*	*
PCC LOAD TRANSFER COEFFICIENT:	-	-	*	*	*
REQUIRED STRUCTURAL NUMBER (IN):	6.27	6.38	*	*	*
EFFECTIVE MODULUS OF SUBGRADE REACTION, k (PSI/IN):	50	50	*	*	*
OVERLAY STRUCTURE NUMBER:	-	-	*	*	*
DRAINAGE COEFFICIENT:	1.0	1.0	*	*	*
PAVEMENT THICKNESS (IN):	10.5" w/ 1.5" DOWEL BAR & NO. 6 TIE BARS	11" w/ 1.5" DOWEL BAR & NO. 6 TIE BARS	14.5"	13.5"	7"
OVERLAY THICKNESS (IN):	-	-	-	-	-
MILLING THICKNESS (IN):	-	-	-	-	-
BASE THICKNESS (IN):	6" ABC CL 6	6" ABC CL 6	4" ABC CL 6	4" ABC CL 6	4" ABC CL 6
HMA GRADING:	-	-	S(100)(PG 64-22)	S(100)(PG 64-22)	S(100)(PG 64-22)
LIFT THICKNESS (BOTTOM LIFTS):	-	-	3.5" - 4" - 4"	3" - 3.5" - 4"	4"
HMA GRADING:	-	-	SX(100)(PG 76-28)	SX(100)(PG 76-28)	SX(100)(PG 76-28)
LIFT THICKNESS (TOP LIFTS):	-	-	3"	3"	3"

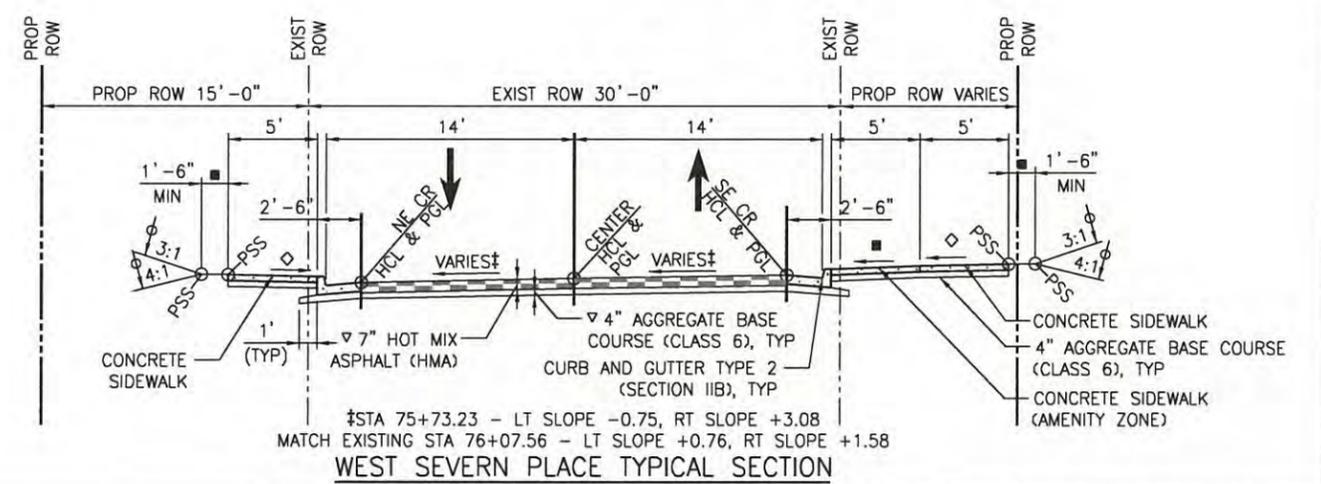
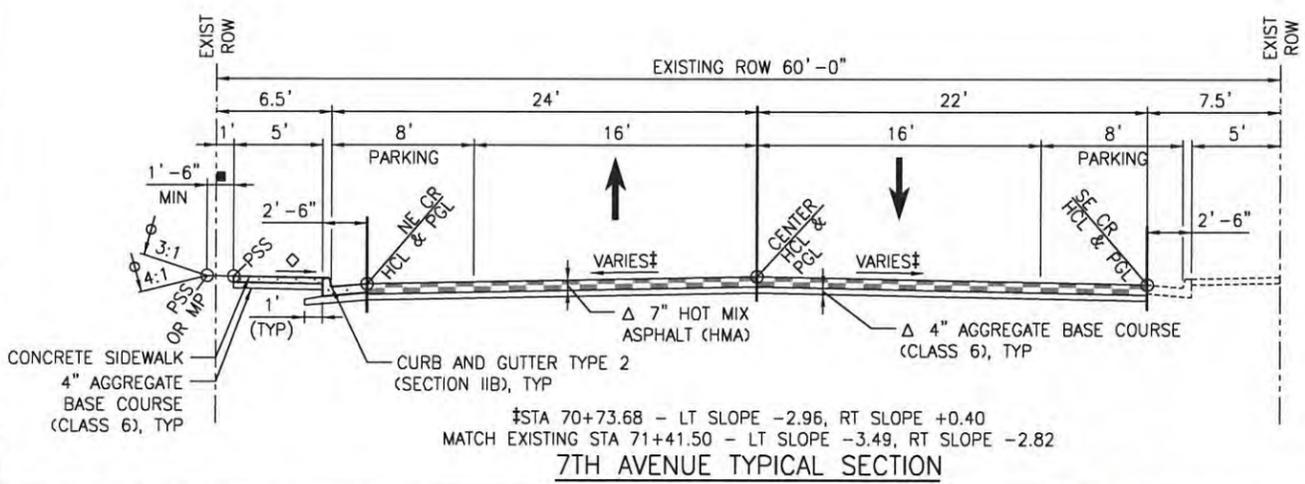
* NO FORMAL PAVEMENT DESIGN CONDUCTED FOR THESE SECTIONS. PAVEMENT THICKNESS IS EQUIVALENT TO MINIMUM REQUIRED BY CITY AND COUNTY OF DENVER STA. DWG. NO. 12.6



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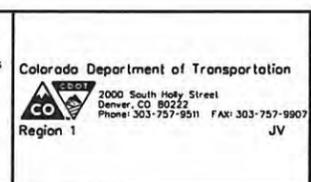
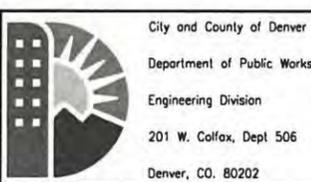


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Last Modification Date: 10/21/2012 Init.: SRF
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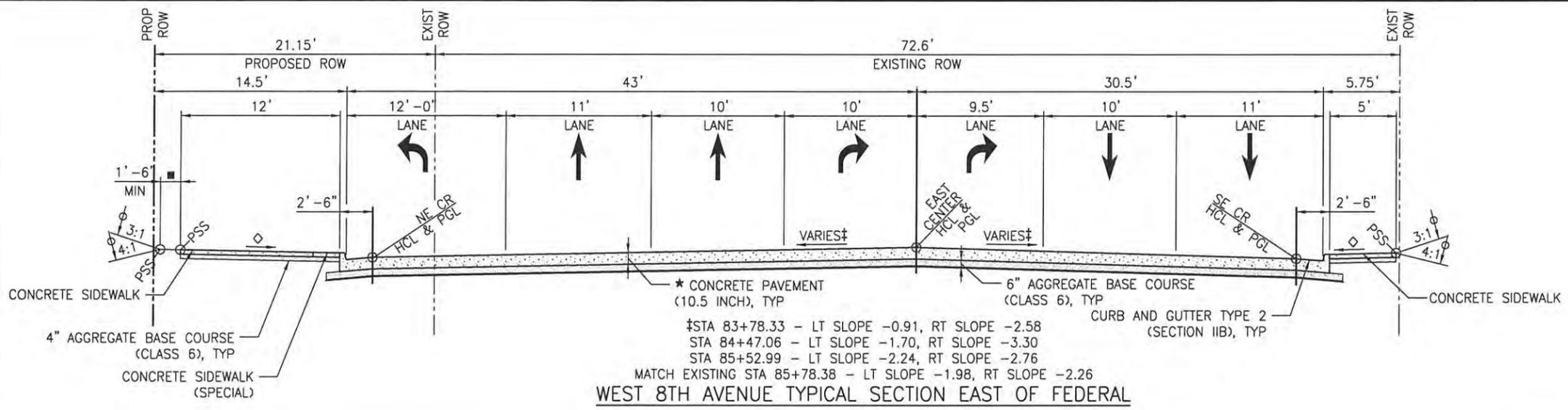


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No Revisions:	TYPICAL ROADWAY SECTIONS	
Revised:	Designer: SRF	Structure Numbers
Void:	Detailer: SRF	Subset Sheets: 3 of 6
	Sheet Subset: TYPSEC	

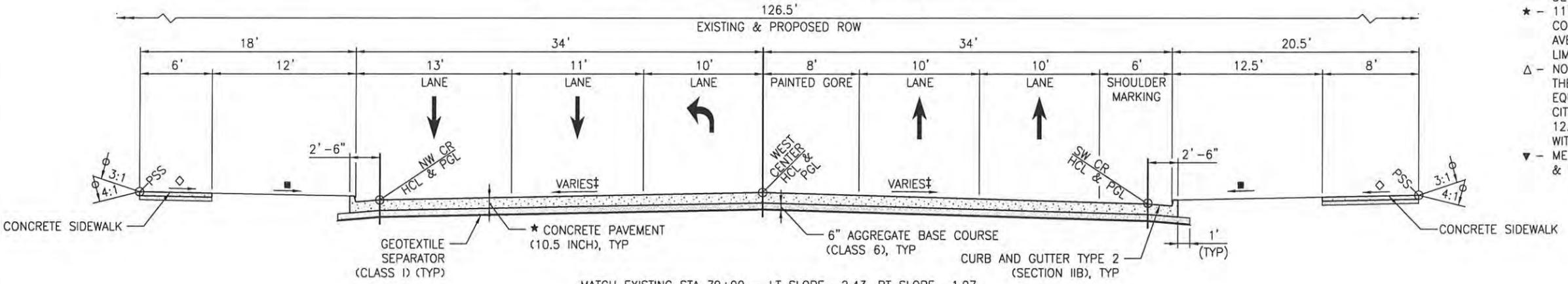
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 SA 19957
 2011-PROJMSTR-0000364
 Sheet Number **6**

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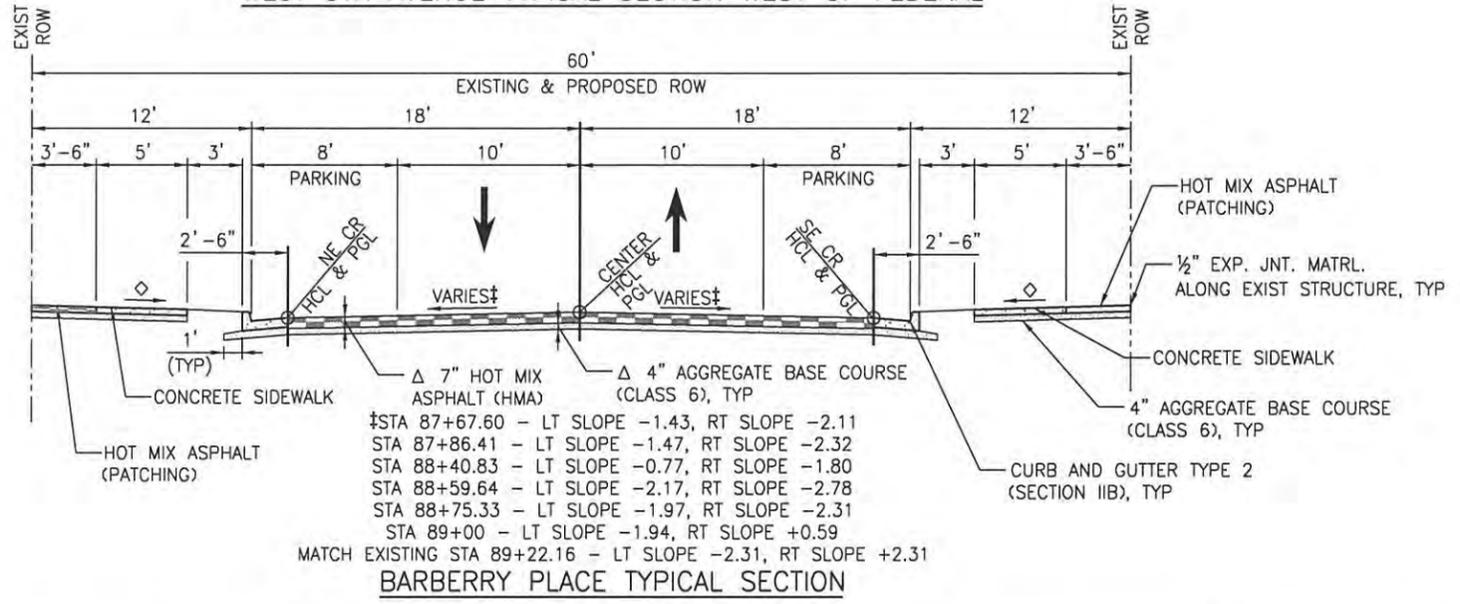
FINAL REVIEW SUBMITTAL - MARCH 6, 2017



WEST 8TH AVENUE TYPICAL SECTION EAST OF FEDERAL



WEST 8TH AVENUE TYPICAL SECTION WEST OF FEDERAL



BARBERRY PLACE TYPICAL SECTION

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 - ▼ - MEDIAN COVER MATERIAL (SEE HARDSCAPE PLAN & LANDSCAPE PLANTING PLAN SUBSETS)



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Sheet Revisions		
Date:	Comments	Init.



City and County of Denver
 Department of Public Works
 Engineering Division
 201 W. Colfax, Dept 506
 Denver, CO. 80202

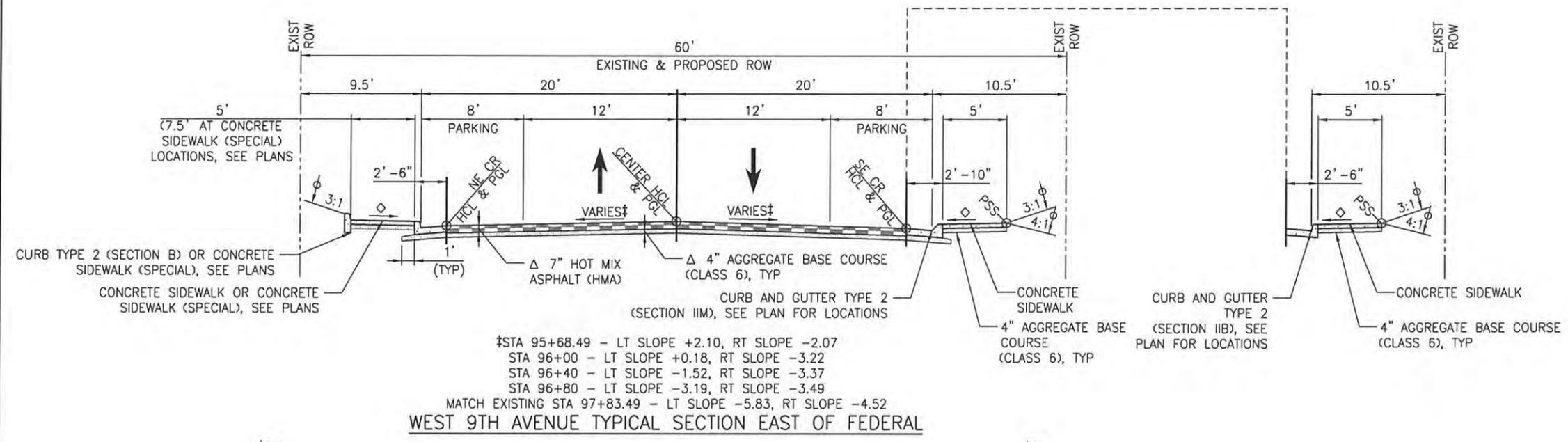
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
 TYPICAL ROADWAY SECTIONS
 Designer: KSD
 Structure Numbers:
 Detailer: SRF
 Sheet Subset: TYPSEC
 Subset Sheets: 4 of 6

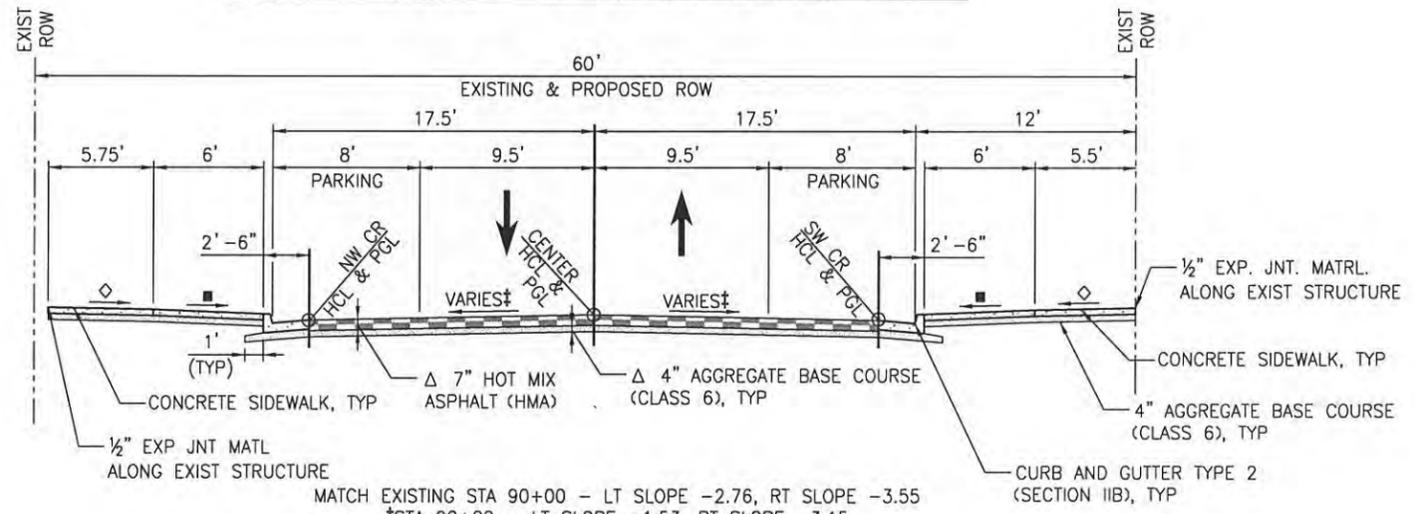
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 2011-PROJMSTR-0000364
 Sheet Number 7

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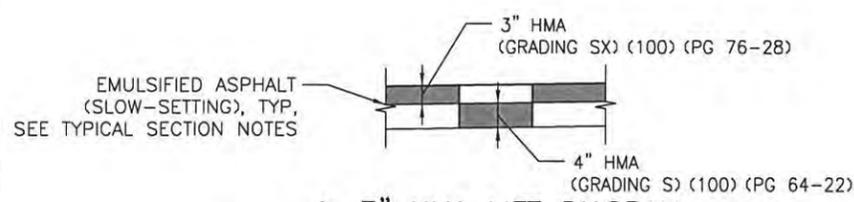
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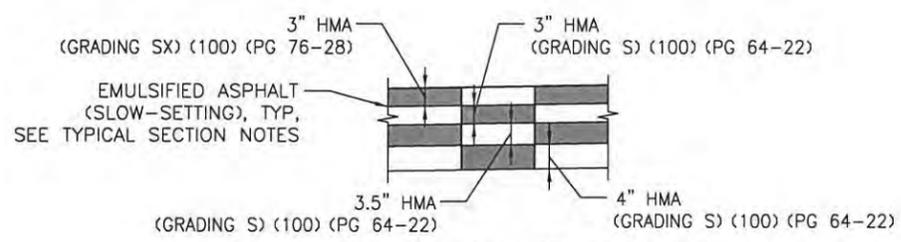
WEST 9TH AVENUE TYPICAL SECTION EAST OF FEDERAL



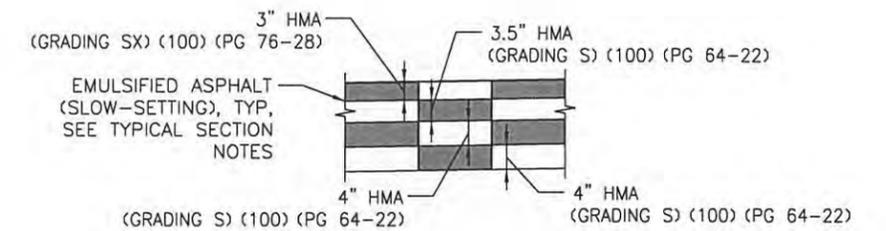
WEST 9TH AVENUE TYPICAL SECTION WEST OF FEDERAL



**△ 7" HMA LIFT DIAGRAM
SIDE STREETS AND ASPHALT PATCHING**



**△ 13.5" HMA LIFT DIAGRAM
WEST 8TH AVENUE & 10TH AVENUE**



**△ 14.5" HMA LIFT DIAGRAM
EAST 8TH AVENUE**



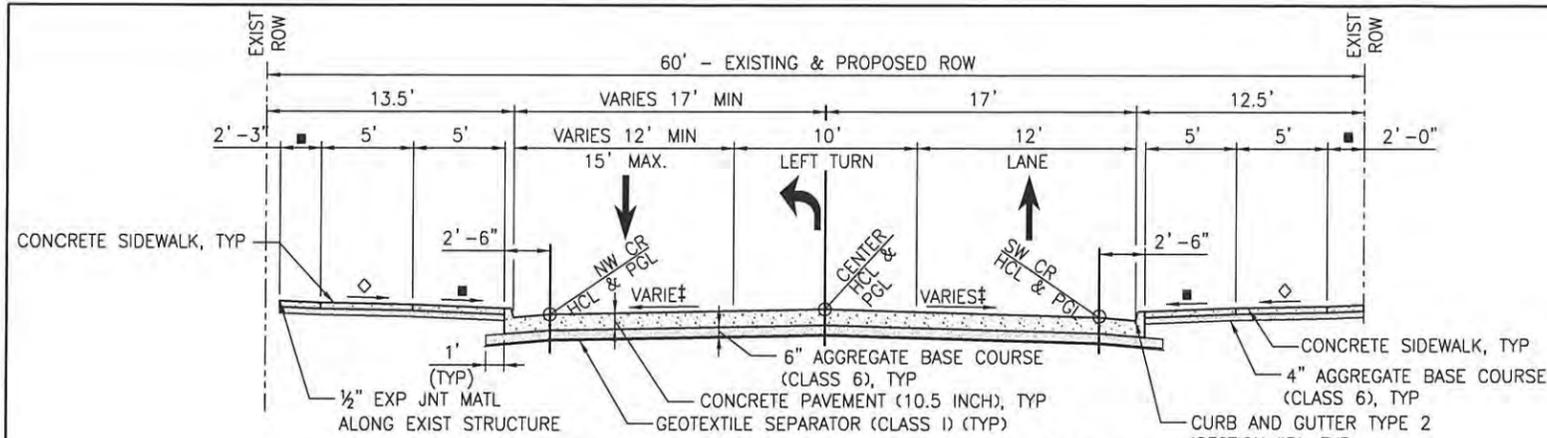
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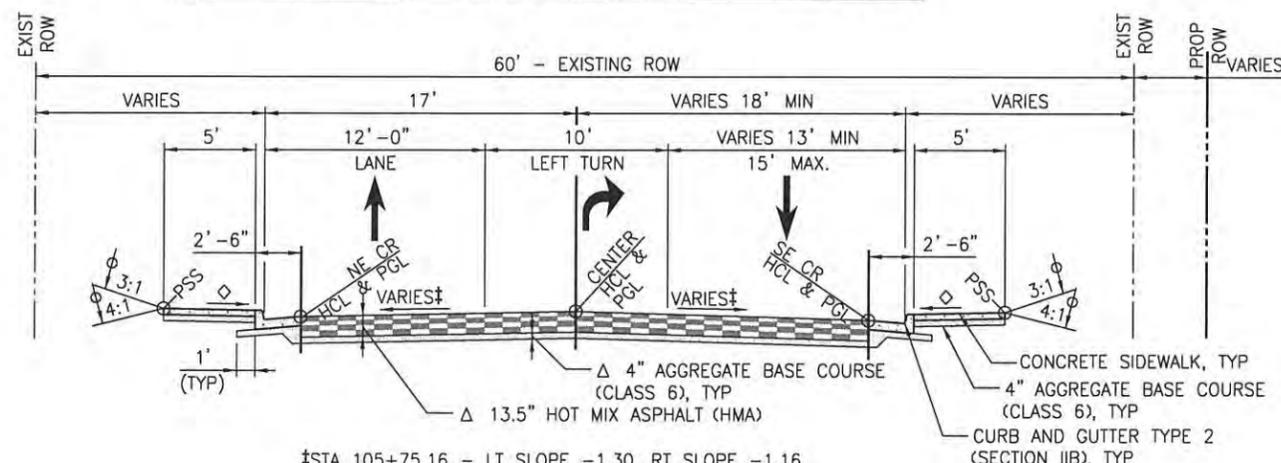
Last Modification Date: Init.: Drawing File Name: 1102188-004-Typical Sections.dgn Horizontal Scale: 1:10 Vert. Scale: As Noted		Sheet Revisions <table border="1"> <thead> <tr> <th>Date:</th> <th>Comments</th> <th>Init.</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table>			Date:	Comments	Init.										City and County of Denver Department of Public Works Engineering Division 201 W. Colfax, Dept 506 Denver, CO. 80202		Colorado Department of Transportation 2000 South Holly Street Denver, CO 80222 Phone: 303-757-9511 FAX: 303-757-9907 Region 1 JV		As Constructed No Revisions: Revised: Void:		FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE TYPICAL ROADWAY SECTIONS Designer: KSD Structure Numbers Detailer: SRF Sheet Subset: TYPSEC Subset Sheets: 5 of 6		Project No./Code NHPP 2873-172 SA 19957 2011-PROJMSTR-0000364 Sheet Number 8	
Date:	Comments	Init.																								

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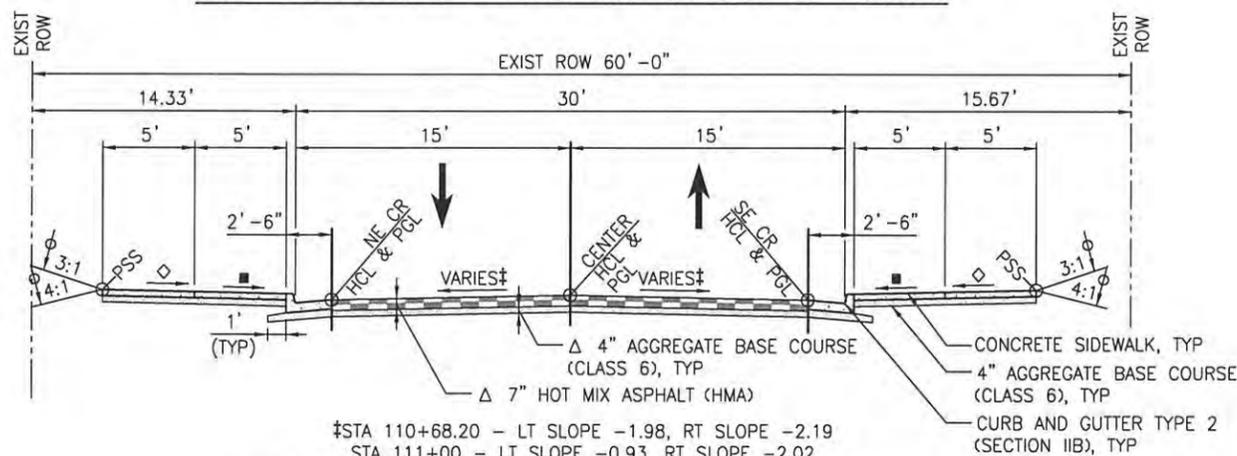
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MATCH EXISTING STA 100+00 - LT SLOPE -1.49, RT SLOPE -2.15
 ‡STA 100+40.88 - LT SLOPE -1.61, RT SLOPE -1.97
 STA 100+84.88 - LT SLOPE -2.18, RT SLOPE -2.55
 STA 101+34.93 - LT SLOPE -1.39, RT SLOPE -1.77
WEST 10TH AVENUE TYPICAL SECTION WEST OF FEDERAL



‡STA 105+75.16 - LT SLOPE -1.30, RT SLOPE -1.16
 STA 106+10.18 - LT SLOPE -0.96, RT SLOPE -2.23
 STA 106+61.19 - LT SLOPE -1.83, RT SLOPE -3.66
 STA 106+80.90 - LT SLOPE -2.41, RT SLOPE -3.71
 MATCH EXISTING STA 107+24.34 - LT SLOPE -3.12, RT SLOPE -4.49
WEST 10TH AVENUE TYPICAL SECTION EAST OF FEDERAL



‡STA 110+68.20 - LT SLOPE -1.98, RT SLOPE -2.19
 STA 111+00 - LT SLOPE -0.93, RT SLOPE -2.02
 MATCH EXISTING STA 111+31.20 - LT SLOPE -0.06, RT SLOPE -2.03
EAST 11TH AVENUE TYPICAL SECTION

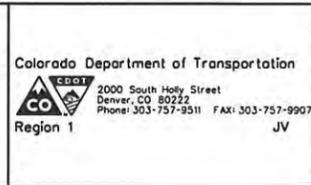


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No Revisions:	TYPICAL ROADWAY SECTIONS
Revised:	
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Designer:	KSD	Structure Numbers	
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Sheet Subset:	TYPSEC		

Project No./Code	NHPP 2873-172 SA 19957
	2011-PROJMSTR-0000364
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AD SUBMITTAL - JANUARY 2, 2018

GENERAL NOTES

GENERAL

1. SEE REQUIREMENTS IN THE TRAFFIC CONTROL PLAN - GENERAL SECTION OF THE PROJECT SPECIAL PROVISIONS FOR SPECIAL TRAFFIC CONTROL PLAN REQUIREMENTS AND ALLOWABLE HOURS THAT WORK SHALL BE PERMITTED.
2. ALL EQUIPMENT IS TO REMAIN ON THE ROAD SURFACE, PAVED PARKING AREAS, OR AREAS OF DISTURBANCE AS SHOWN IN THE PLANS. ANY OFF-ROAD STAGING AREAS MUST BE PRE-APPROVED BY THE ENGINEER. IF THE ENGINEER APPROVES A STAGING AREA, IT MUST BE RETURNED TO ITS EXISTING CONDITION AFTER IT IS NO LONGER NEEDED AT NO ADDITIONAL COST TO THE PROJECT.
3. NO CLEATED OR TRACKED EQUIPMENT MAY WORK IN OR MOVE OVER PAVED SURFACES WITHOUT MATS.
4. UNLESS OTHERWISE NOTED, ALL DIMENSIONS SHALL BE TO THE CONTROL LINE. ELEVATIONS ON THE CURB PROFILES ARE ALONG LIP OF PAN.
5. THE CONTRACTOR IS RESPONSIBLE FOR BEING AWARE OF, NOTIFYING, COORDINATION, AND SCHEDULING ALL INSPECTIONS REQUIRED FOR FINAL APPROVALS AND PROJECT ACCEPTANCE.
6. ALL WORK SHALL BE PROPERLY BACKFILLED PRIOR TO THE END OF THE WORKDAY OR PROTECTED WITH TRAFFIC BARRIER AND TEMPORARY FENCE OR BY OTHER APPROVED MEANS AT NO ADDITIONAL COST TO THE PROJECT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SAFETY OF THE WORK SITE AT ALL TIMES.
7. IN THE EVENT AN EMERGENCY REPAIR TO EXISTING FACILITIES IS NECESSARY, THE PROJECT ENGINEER SHALL IMMEDIATELY BE NOTIFIED BY THE CONTRACTOR OF POSSIBLE TRAFFIC HAZARDS. EMERGENCY PROCEDURES SHALL BE COORDINATED BEFOREHAND, WHERE POSSIBLE. EMERGENCY TELEPHONE NOTIFICATION MUST BE FOLLOWED UP WITH A LETTER AS SOON AS POSSIBLE.
8. PRIOR TO FINAL ACCEPTANCE, ALL DISTURBED PORTIONS OF THE ROADWAY RIGHT-OF-WAY SHALL BE CLEANED AND RESTORED TO THE ORIGINAL CONDITION AT NO ADDITIONAL COST TO THE PROJECT, SUBJECT TO THE ENGINEER'S APPROVAL.
9. ALL EROSION/SEDIMENT CONTROL AND STORMWATER RESPONSIBILITIES STATED IN THE STORMWATER MANAGEMENT PLAN AND IN SECTION 208 SHALL BE FOLLOWED OR AMENDED AS APPROVED BY THE ENGINEER.
10. IF CONSTRUCTION IS TO OCCUR DURING THE NESTING SEASON FOR MIGRATORY BIRDS BETWEEN APRIL 1 AND AUGUST 31, THE CONTRACTOR SHALL KNOCK DOWN ALL NESTS PRIOR TO APRIL 1 AND THEN EVERY 3 DAYS UNTIL CONSTRUCTION BEGINS TO PREVENT COMPLETION OF THE NESTS. COMPLETED NESTS CANNOT BE REMOVED. THIS INCLUDES SWALLOW NESTS ON STRUCTURES AND NESTS IN BRUSH AND TREES THAT ARE SCHEDULED TO BE REMOVED. BIRDS THAT BUILD NESTS DURING CONSTRUCTION DO SO OF THEIR OWN ACCORD AND THOSE NESTS DO NOT NEED TO BE KNOCKED DOWN. IF CONSTRUCTION BEGINS OUTSIDE OF THIS NESTING SEASON, NESTS DO NOT NEED TO BE KNOCKED DOWN. THIS WORK SHALL BE INCLUDED IN THE COST OF ITEM 240 REMOVAL OF NESTS AND WILL NOT BE PAID FOR SEPARATELY.
11. IF TREE TRIMMING OR VEGETATION REMOVAL FOR DEMOPLATION ACTIVITIES OCCUR BETWEEN FEBRUARY 15 AND AUGUST 31, THEN THE CONTRACTOR SHALL CONDUCT A PRE-CONSTRUCTION SURVEY FOR NESTING BIRDS. SURVEY FOR NESTING BIRDS IS VALID FOR FIVE DAYS. IF WORK IS NOT COMPLETED WITHIN FIVE DAYS, THE CONTRACTOR SHALL COMPLETE A NEW SURVEY. THIS WORK SHALL BE INCLUDED IN THE COST OF ITEM 240 WILDLIFE BIOLOGIST AND WILL NOT BE PAID FOR SEPARATELY.
12. IF CONSTRUCTION RELATED ACTIVITIES OCCUR BETWEEN FEBRUARY 15 AND AUGUST 31, THE CONTRACTOR SHALL CONDUCT A PRE-CONSTRUCTION SURVEY FOR NESTING RAPTORS WITHIN A HALF-MILE BUFFER OF THE PROJECT LIMITS. IF NESTING RAPTORS OCCUR WITHIN THE BUFFER AREA, THEN THE COLORADO PARKS AND WILDLIFE (CPW) "RECOMMENDED BUFFER ZONES AND SEASONAL RESTRICTIONS FOR COLORADO RAPTORS" GUIDELINES SHALL BE FOLLOWED. THE CPW MAY REDUCE THE BUFFER REQUIREMENT BASED UPON SITE CONDITIONS AND TYPE OF WORK BEING DONE, BUT THE CONTRACTOR MUST CONSULT CPW FOR APPROVAL PRIOR TO CONSTRUCTION WITHIN THE BUFFER ZONE OF AN ACTIVE NEST. THIS WORK SHALL BE INCLUDED IN THE COST OF ITEM 240 WILDLIFE BIOLOGIST AND WILL NOT BE PAID FOR SEPARATELY.
13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR TAKING AND KEEPING MINUTES OF ALL CONSTRUCTION MEETINGS. THE CONTRACTOR SHALL DISTRIBUTE THE MEETING MINUTES TO ALL RELEVANT PARTIES WITHIN 4 WORKING DAYS OF THE MEETING. ALL OF THE CONTRACTOR'S COSTS TO SATISFY THESE REQUIREMENTS SHALL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE PAYMENT OF ITEM 626, "MOBILIZATION". PROGRESS PAYMENTS FOR THIS PAY ITEM WILL BE WITHHELD IF THIS REQUIREMENT IS NOT SATISFIED.
14. THE CONTRACTOR SHALL PROVIDE PUBLIC INFORMATION SERVICES AS DESCRIBED IN THE REVISIONS TO SECTION 626 OF THE SPECIFICATIONS.
15. MAINTENANCE OF THE SANITARY FACILITY SHALL INCLUDE A CLEANING AT LEAST TWICE A WEEK. THIS WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN PAYMENT FOR ITEM 620, "SANITARY FACILITY".
16. ALL DESIGN DRAWINGS PROVIDED AS PART OF THIS CONTRACT ARE FORMATTED FOR PRINTING ON STANDARD 11 X 17 PAPER SIZE. IT IS THE USER'S RESPONSIBILITY TO ENSURE THAT HARD COPIES OF PLANS UTILIZED FOR BIDDING OR CONSTRUCTION ARE PRINTED ON THE PROPER MEDIA SIZE AND THAT SCALES PROVIDED WITHIN THE DRAWINGS ARE CORRECTLY INTERPRETED.
17. THE CITY SHALL ISSUE TICKETS TO THE CONTRACTOR FOR ALL MATERIALS TO BE HAULED TO THE DENVER ARAPAHOE DISPOSAL SITE (DADS).
18. AT THE ENGINEER'S DISCRETION, AND AT NO ADDITIONAL COST TO THE PROJECT, THE CONTRACTOR MAY BE REQUIRED TO PROVIDE ENGINEERING CALCULATIONS AND PLANS AND SPECIFICATIONS, ALL STAMPED BY A COLORADO REGISTERED PROFESSIONAL ENGINEER, FOR CONTRACTOR INITIATED CHANGES TO THE WORK.

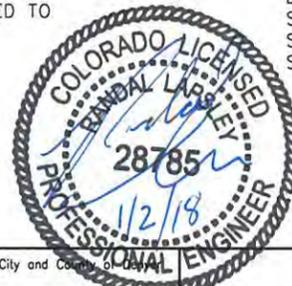
SURVEYING

1. PRIOR TO BEGINNING WORK ON THE PROJECT, THE CONTRACTOR'S SURVEYOR SHALL PERFORM A SURVEY TO VERIFY ALL SURVEY CONTROL POINTS, CITY OF DENVER RANGE POINTS, SECTION CORNERS, AND BENCHMARKS AS SHOWN ON THE SURVEY CONTROL DIAGRAM. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPLACING ALL LAND SURVEY MONUMENTS DISRUPTED BY CONSTRUCTION ACTIVITIES OR BY NEGLIGENCE ON THE PART OF THE CONTRACTOR. THE CONTRACTOR IS REQUIRED TO FOLLOW COLORADO STATE LAW REGARDING SURVEY MONUMENTS. THE CONTRACTOR SHALL RETAIN A COLORADO LICENSED PROFESSIONAL LAND SURVEYOR TO RESET ANY AFFECTED SURVEY MONUMENTS. THIS WILL NOT BE PAID SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK UNLESS SPECIFIED OTHERWISE IN SECTION 629. FOR FURTHER INFORMATION CONTACT:

PUBLIC WORKS - SURVEY DEPARTMENT
ATTN: CITY SURVEYOR
201 W. COLFAX AVE.
DENVER, CO 80202
720-865-3121
2. AFTER COMPLETION OF THE PAVING OPERATIONS, THE CONTRACTOR SHALL UPGRADE TEMPORARY RANGE POINTS WITH PERMANENT RANGE POINT MONUMENTS AT THE LOCATIONS AS INDICATED ON THE LAND SURVEY CONTROL DIAGRAM. SEE RANGE POINT NOS. 27550-27560 (11 TOTAL). THE CONTRACTOR SHALL REPLACE WITH PERMANENT MONUMENTS AT THE LOCATIONS AS INDICATED ON THE LAND SURVEY CONTROL DIAGRAM ANY PROPERTY BOUNDARY MONUMENTS IF DESTROYED. SEE PROPERTY PIN NOS. 1121-1129 AND 1132 (10 TOTAL). MONUMENTS SHALL MEET CURRENT CITY AND COUNTY OF DENVER STANDARDS AND COLORADO STATE STATUTE STANDARDS. SEE SECTION 629 OF THE SPECIAL PROVISIONS FOR MORE INFORMATION. SEE C.R.S. 38-51-104 AND 38-51-105 FOR PROPERTY BOUNDARY MONUMENTATION INFORMATION.
3. A SURVEY SHALL BE DEPOSITED WITH THE CITY AND COUNTY OF DENVER PER STATE STATUTE. CITY MONUMENT TIE OUT SHEETS SHALL BE PREPARED FOR ALL RANGE POINTS WITHIN THE PROJECT AND DEPOSITED WITH THE CITY SURVEYOR.
4. ANY PERSON WHO KNOWINGLY REMOVES, ALTERS, OR DEFACTS ANY PUBLIC LAND SURVEY MONUMENT AND/OR BOUNDARY MONUMENT OR ACCESSORY, COMMITS A CLASS TWO (2) MISDEMEANOR PURSUANT TO STATE STATUTE C.R.S. SECTION 18-4-508.
5. ALL STATIONS AND OFFSETS SHOWN ON THE PLANS ARE TO THE CONTROL LINES UNLESS OTHERWISE NOTED. THE USE OF CONTROL MONUMENTS FOR CONSTRUCTION STAKING OTHER THAN THOSE SHOWN ON THE PLANS OR APPROVED BY THE PW DEPT. IS PROHIBITED, AND USE OF SUCH MONUMENTS IS AT THE CONTRACTOR'S SOLE RISK.
6. PROPOSED FINISHED GROUND ELEVATIONS FOR ITEMS TO BE ADJUSTED, RESET OR MODIFIED SHALL BE FIELD VERIFIED BY THE CONTRACTOR.
7. ALL OF THE CONTRACTOR'S COSTS OF ANY NATURE REQUIRED TO SATISFY THE REQUIREMENTS CONTAINED IN SURVEY NOTES 1 THROUGH 6 SHALL BE INCLUDED IN THE WORK, AND NO ADDITIONAL PAYMENT WILL BE MADE TO THE CONTRACTOR TO ENSURE COMPLIANCE.

REMOVALS, EXISTING ITEMS & SAW CUTTING

1. ALL ITEMS TO BE REMOVED AND NOT RESET OR DESIGNATED FOR STOCKPILING SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM THE SITE OR DISPOSED OF PROPERLY.
2. SIGNS AND SIGNAL EQUIPMENT DESIGNATED AS REMOVAL ITEMS SHALL BE CAREFULLY REMOVED AND DELIVERED BY THE CONTRACTOR TO THE CITY YARD AT 5440 ROSLYN STREET, BUILDING E. ANY MATERIAL DESIGNATED FOR SALVAGE THAT IS DAMAGED AFTER REMOVAL SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR AT THE CONTRACTOR'S SOLE COST TO THE SATISFACTION OF THE ENGINEER. NO SEPARATE PAYMENT SHALL BE MADE FOR LOADING, HAULING, UNLOADING, OR PLACING SALVAGED MATERIALS IN THE CITY YARD.
3. WHERE IT IS REQUIRED TO REMOVE EXISTING CONCRETE OR ASPHALT, CUTTING SHALL BE DONE TO A NEAT WORK LINE TO FULL DEPTH USING A SAW, CUTTING WHEEL, OR OTHER METHOD APPROVED BY THE ENGINEER. THIS WORK WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE COST OF REMOVAL ITEMS. ALL SAW WATER SHALL BE PROPERLY CONTAINED AND NOT ALLOWED TO ENTER ANY STORM DRAINS OR SURFACE WATER.
4. REMOVAL OF EXISTING CURB AND GUTTER, SIDEWALK, DRIVEWAYS, CURB CUTS, AND OTHER CONCRETE ITEMS THAT ARE ATTACHED OR ADJACENT TO OTHER CONCRETE ITEMS SHALL BE REMOVED TO THE NEAREST JOINT, AS NEEDED TO AVOID DAMAGING THE REMAINING CONCRETE ITEMS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DAMAGE TO ADJACENT SIDEWALK DURING CURB AND GUTTER REMOVAL AND SHALL REPLACE DAMAGED SECTIONS AT NO ADDITIONAL COST TO THE PROJECT.
5. THE CONTRACTOR SHALL USE AGGREGATE BASE COURSE CLASS 6 TO FILL AREAS LEFT BY REMOVAL OF DRIVEWAY OR CURB RAMP PRIOR TO PLACEMENT OF NEW SIDEWALK, DRIVEWAY OR CURB RAMP.
6. RELOCATING EXISTING ITEMS NOT SPECIFIED IN THESE PLANS FOR CONSTRUCTION PURPOSES SHALL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.
7. THE CONTRACTOR SHALL TAKE SUFFICIENT PRECAUTION TO AVOID DAMAGING BUILDING FOUNDATIONS WHEN CONSTRUCTION ACTIVITIES REQUIRE WORK IMMEDIATELY ADJACENT TO EXISTING BUILDINGS THAT ARE TO REMAIN. THE CONTRACTOR SHALL DOCUMENT THE EXISTING CONDITIONS PRIOR TO THE WORK INCLUDING ADEQUATE PHOTO DOCUMENTATION, WHICH SHALL BE SUBMITTED TO THE ENGINEER PRIOR TO THE WORK OCCURRING. THE COST OF THIS WORK WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE COST OF THE WORK. ANY DAMAGE CAUSED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED AT THE CONTRACTOR'S SOLE EXPENSE.



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Sheet Revisions		
Date:	Comments	Init.



City and County of Denver
 Department of Public Works
 Engineering Division
 201 W. Colfax, Dept 506
 Denver, CO. 80202

As Constructed
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE			
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Detailer:	SRF	Numbers	
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Sheet Number
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AD SUBMITTAL - JANUARY 2, 2018

GENERAL NOTES (CONT.)

EARTHWORK

1. DEPTH OF RECONDITIONING AND MOISTURE-DENSITY CONTROL FOR THIS PROJECT SHALL BE 6 INCHES FOR BASES OF CUTS AND FILLS AND FULL DEPTH FOR ALL EMBANKMENTS. EXCAVATION AND COMPACTION FOR BASES OF CUTS AND FILLS WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF UNCLASSIFIED EXCAVATION OR EMBANKMENT MATERIAL. RECONDITIONING SHALL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF UNCLASSIFIED EXCAVATION OR EMBANKMENT MATERIAL.
2. PAYMENT FOR UNCLASSIFIED EXCAVATION (COMPLETE IN PLACE), SHALL BE FULL COMPENSATION FOR ALL WORK NECESSARY TO COMPLETE THE ITEM INCLUDING CONSTRUCTION OF EMBANKMENTS, UNCLASSIFIED EXCAVATION, BORROW, COMPACTION, COMPACTION OF BASES OF CUTS AND FILLS AND DISPOSAL OF EXCESS EXCAVATED MATERIAL.
3. RECONDITIONING OF THE EXISTING SUBGRADE WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK.
4. COMPACTION FOR THIS PROJECT SHALL BE IN CONFORMANCE WITH SECTION 203.07 OF THE CDOT STANDARD SPECIFICATIONS.
5. SUBGRADE MATERIALS DEEMED UNSUITABLE BY THE ENGINEER SHALL BE EXCAVATED, DISPOSED OF AND REPLACED WITH CLASS 6 AGGREGATE BASE COURSE OR APPROVED MATERIALS. EXCAVATION OF SUCH MATERIALS SHALL BE PAID FOR AS MUCK EXCAVATION.
6. WATER SHALL BE USED AS A DUST PALLATIVE WHEN REQUIRED AND WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE COST OF THE WORK.
7. ALL EMBANKMENT MATERIAL SHALL BE R-5 OR HIGHER.
8. DISPOSAL OF MATERIAL, OFF-SITE, REGARDLESS OF PROPERTY OWNERSHIP, MUST BE DONE IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS AND THE CDOT PRAIRIE DOG POLICY. IF THE CONTRACTOR HAS ANY QUESTIONS ABOUT WHETHER OR NOT THEY ARE IN COMPLIANCE, THEY SHOULD CALL CAROL COATES OF CDOT ENVIRONMENTAL, AT 303-757-9936 PRIOR TO REMOVAL AND DISPOSAL OF THE MATERIAL.
9. THE CONTRACTOR SHALL PROOF ROLL ALL PAVEMENT SUBGRADE IN ACCORDANCE WITH SPECIFICATION 203. PROOF ROLLING WILL NOT BE MEASURED OR PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK.

CONCRETE PAVEMENT

1. THE JOINT LAYOUT SHOWN IS INTENDED TO BE USED AS A STANDARD FOR THE JOINT LAYOUT FOR THE PROJECT. IF THE CONTRACTOR PROPOSES VARIATIONS FROM THE STANDARDS, OR THE PROJECT HAS UNUSUAL OR IRREGULAR CONDITIONS NOT COVERED HEREIN, THE CONTRACTOR SHALL PREPARE A PAVEMENT JOINT LAYOUT TO ADDRESS THE VARIATIONS OR UNUSUAL CONDITIONS FOR APPROVAL BY THE ENGINEER.
2. THE CONTRACTOR SHALL SELECT AND USE A BOXOUT AT CATCH BASINS, MANHOLES, AND OTHER ROADWAY APPURTENANCES OF SIMILAR AND LARGER SIZE. SMALL APPURTENANCES SUCH AS VALVE AND MONUMENT BOXES WILL NOT REQUIRE A BOXOUT OR BOND BREAKER.
3. ALL TRANSVERSE CONCRETE JOINTS SHALL BE CONTINUOUS ACROSS THE PAVEMENT.
4. LONGITUDINAL JOINTS SHALL COINCIDE WITH TRAFFIC LANES WHEREVER POSSIBLE. ALL LONGITUDINAL JOINTS SHALL BE TIED UNLESS OTHERWISE DIRECTED BY THE ENGINEER. SEE HARDSCAPE PLANS FOR SIDEWALK SCORING PATTERN AND JOINTING DETAILS.
5. ALL CONCRETE MIX DESIGN CRITERIA FOR PORTLAND CEMENT PAVEMENT SHALL MEET THE MOST RESTRICTIVE REQUIREMENTS IN CDOT 412 AND 601 CLASS P SPECIFICATIONS. FAST TRACK PAVEMENT SHALL MEET THE REQUIREMENTS OF CDOT STANDARD SPECIAL PROVISION SECTION 412 AND 601, CLASS E CONCRETE PAVEMENT. CLASS E CONCRETE SHALL ATTAIN A MINIMUM FIELD COMPRESSIVE STRENGTH OF 3000 PSIB BEFORE BEING OPENED TO TRAFFIC.
6. THE SLIP FORM PAVING METHOD SHALL BE REQUIRED IN LOCATIONS WHERE IT IS POSSIBLE TO CONSTRUCT TWO OR MORE LANES AT THE SAME TIME IN ACCORDANCE WITH CDOT STANDARD SPECIFICATIONS SECTION 412, PORTLAND CEMENT CONCRETE PAVEMENT, INCLUDING REVISIONS FOUND IN THE PROJECT SPECIAL PROVISIONS.
7. MAXIMUM TRANSVERSE JOINT SPACING SHALL BE 15 FEET UNLESS OTHERWISE SHOWN ON JOINTING PLANS.
8. BENDER BOARDS (TWO (2) INCH MINIMUM THICKNESS) SHALL BE USED ON ALL CURVES OF LESS THAN 75 FOOT RADIUS.
9. THE CONTRACTOR IS RESPONSIBLE FOR THE PROTECTION OF THE WORK AT ALL TIMES. ANY CONCRETE SUFFERING DAMAGE SUCH AS GRAFFITI, TACK COAT SPRAY, FOOTPRINTS, RAIN DAMAGE, ETC., SHALL BE REMOVED AND REPLACED BY THE CONTRACTOR AT THE CONTRACTOR'S COST PRIOR TO FINAL ACCEPTANCE AND PAYMENT. IF ANY CONCRETE MUST BE REPLACED BECAUSE OF RAVELING AT THE JOINTS, IMPROPER JOINTS, RANDOM CRACKING, FOOTPRINTS, GRAFFITI, ETC., THE ENTIRE SLAB MUST BE REMOVED AND REPLACED AT THE EXPENSE OF THE CONTRACTOR.
10. SIDEWALKS SHALL BE CONSTRUCTED A MINIMUM OF FOUR (4) INCHES THICK AND PAID FOR AS CONCRETE SIDEWALK. SIDEWALK SHALL BE CLASS P CONCRETE.
11. SIDEWALKS SHALL BE WIDENED TO FRONT FACE OF ADJACENT EXISTING BUILDING WHEN BUILDING IS WITHIN EASEMENT. A 3/4" PREFORMED JOINT FILLER MEETING THE REQUIREMENTS OF AASHTO M 213 SHALL BE INSTALLED AT THE ISOLATION JOINT BETWEEN EXISTING BUILDINGS AND CONCRETE SLABS. MATERIALS AND LABOR TO INSTALL THE PREFORMED JOINT FILLER WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE COST OF THE CONCRETE ITEM AS SHOWN ON THE PLANS.
12. CURB RAMPS SHALL BE CONSTRUCTED USING TRUNCATED DOMES AS SHOWN IN THE CITY AND COUNTY OF DENVER STANDARD DETAILS. TRUNCATED DOMES SHALL NOT BE PAID FOR SEPARATELY, BUT INCLUDED IN THE COST OF THE CONCRETE CURB RAMP.
13. CURB RAMPS SHALL BE 5' WIDE UNLESS OTHERWISE INDICATED IN THE PLANS. CURB RAMP STATION AND OFFSET IS AT THE TOP AND MIDPOINT OF RAMP.

14. CURB AND GUTTER ANGLE BREAKS SHALL BE SMOOTHED WITH A 2' RADIUS.
15. CONSTRUCT DRIVEWAYS PER CCD STD. DWG. NO. 6.1. DRIVEWAYS SHALL BE 8" THICK. CONTINUE 8" THICK CONCRETE PAVEMENT TO BACK OF SIDEWALK. IN LOCATIONS NOTED AS TYPE A, APPROACH WIDENING AND CURB TRANSITION WIDTH SHALL BE 11'-0" TOTAL PER THE STANDARD DETAIL. IN LOCATIONS NOTED AS TYPE B, ELIMINATE APPROACH WIDENING AND CONSTRUCT 6'-0" CURB TRANSITION ONLY. SEE PLANS FOR DRIVEWAY WIDTHS.
16. 2' CURB AND GUTTER TRANSITION AT EACH END OF INLETS SHALL BE INCLUDED IN THE COST OF INLET.
17. SECTIONS OF CURB AND GUTTER BETWEEN CURB RAMPS SHALL BE INCLUDED IN THE COST OF CONCRETE CURB RAMP.
18. ALL CONCRETE WASH WATER RESIDUE SHALL BE CONTAINED AND NOT ALLOWED TO ENTER ANY STORM DRAINS OR SURFACE WATER.
19. THE CONCRETE SULFATE EXPOSURE FOR THIS PROJECT IS CLASS 2 FOR ALL CONCRETE EXPOSED TO THE AIR AND DEICER CHEMICALS INCLUDING SIDEWALKS, RAMPS, CURB AND GUTTER, BARRIER CURB, GUTTERS, DRIVEWAYS, AND CONCRETE PAVEMENT. CONCRETE SULFATE EXPOSURE FOR OTHER AREAS IS CLASS 1.

BITUMINOUS PAVEMENT

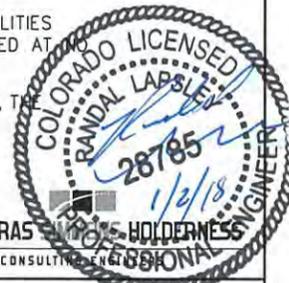
1. A TACK COAT IS REQUIRED BETWEEN LAYERS OF BITUMINOUS PAVEMENT AND WHERE BITUMINOUS PAVEMENT IS PLACED NEXT TO EDGES OF PAVEMENT. DILUTED EMULSIFIED ASPHALT FOR TACK COAT CONSISTS OF 1-PART EMULSIFIED AND 1-PART WATER. RATES OF APPLICATION SHALL BE AS DETERMINED BY THE ENGINEER AT THE TIME OF APPLICATION.
2. ANY CURB AND GUTTER, WHICH IS TO REMAIN AND IS DAMAGED AS A RESULT OF THE CONTRACTOR'S OPERATION, SHALL BE REPLACED TO THE NEAREST JOINT AT THE CONTRACTOR'S EXPENSE.
3. ANY LAYER OF BITUMINOUS PAVEMENT THAT IS TO HAVE A SUCCEEDING LAYER PLACED THEREON SHALL BE COMPLETED FULL-WIDTH BEFORE A SUCCEEDING LAYER IS PLACED ANY AREAS THAT THIS REQUIREMENT CAN NOT BE ACHIEVED DUE TO PHASING SHALL BE APPROVED BY THE ENGINEER PRIOR TO CONSTRUCTION.
4. FOR PRELIMINARY PLAN QUANTITIES OF PAVEMENT MATERIAL, THE FOLLOWING RATES OF APPLICATION WERE USED:
 AGGREGATE BASE COURSE (CLASS 6) @ 133 LBS/CY
 HMA @ 110 LBS/SQ. YD./INCH
 TACK COAT DILUTED EMULSIFIED ASPHALT (SLOW SETTING) @ 0.10 GAL/SQ. YD. (DILUTED)
5. PRIOR TO PLACING BITUMINOUS PAVEMENT, THE CONTRACTOR SHALL REMOVE DEBRIS BY SWEEPING DIRT AND GRAVEL FROM THE EXISTING MATERIAL. THIS WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF WORK. THE OVERLAY SHALL BE FEATHERED TO MATCH EXISTING SURFACES AS SHOWN IN THE TYPICAL SECTIONS AND AS DIRECTED BY THE ENGINEER.

LIMITS OF WORK

1. THE CONTRACTOR SHALL LIMIT CONSTRUCTION ACTIVITIES TO THOSE AREAS WITHIN THE LIMITS OF DISTURBANCE AND/OR TOES OF SLOPE AND WITHIN EASEMENTS AS SHOWN ON THE PLANS AND/OR CROSS SECTIONS. ANY DISTURBANCE BEYOND THESE LIMITS SHALL BE RESTORED TO THE ORIGINAL CONDITION BY THE CONTRACTOR TO THE SATISFACTION OF THE ENGINEER AT THE CONTRACTOR'S SOLE EXPENSE. CONSTRUCTION ACTIVITIES, IN ADDITION TO NORMAL CONSTRUCTION PROCEDURES, SHALL INCLUDE THE PARKING OF VEHICLES AND EQUIPMENT, DISPOSAL OF LITTER, AND ALL OTHER ACTIONS THAT WOULD ALTER EXISTING CONDITIONS.
2. THE CONTRACTOR IS REQUIRED TO RESET, ADJUST, OR REPLACE ANY UTILITIES, LANDSCAPING, SPRINKLER SYSTEMS, SIGNS, SIDEWALKS, ETC. THAT ARE IMPACTED BY CONSTRUCTION AND ARE NOT DESIGNATED TO BE REMOVED. THIS SHALL BE DONE AT THE CONTRACTOR'S SOLE EXPENSE, AND THE CONTRACTOR WILL NOT BE COMPENSATED FOR WORK OUTSIDE THE PROJECT LIMITS.
3. VEHICULAR AND PEDESTRIAN ACCESS TO ADJACENT PROPERTIES MUST BE MAINTAINED BY THE CONTRACTOR THROUGHOUT CONSTRUCTION. IF THE CONTRACTOR WISHES TO DEVIATE FROM THESE REQUIREMENTS, THE CONTRACTOR MUST OBTAIN WRITTEN PERMISSION FROM THE PROPERTY OWNER AND PRESENT IT TO THE ENGINEER PRIOR TO DEVIATING FROM THESE REQUIREMENTS. SEE SPECIAL PROVISIONS FOR ALLOWABLE TIME CONSTRAINTS. ANY COSTS INCURRED BY THE CONTRACTOR TO ADHERE TO THESE REQUIREMENTS SHALL BE INCLUDED IN THE WORK, AND NO SEPARATE PAYMENT WILL BE MADE FOR ANY SUCH COSTS.
4. THE CONTRACTOR SHALL COORDINATE AND MODIFY THE CONSTRUCTION AS DIRECTED BY THE ENGINEER TO ACCOMMODATE CITY APPROVED IMPROVEMENT PLANS THAT ANY ADJACENT PROPERTY OWNERS HAVE, OR ARE IN THE PROCESS OF COMPLETING, FOR THEIR PROPERTIES. IF THE ENGINEER INFORMS THE CONTRACTOR THAT A PROPERTY OWNER IS IN THE PROCESS OF PLANNING OR MAKING SUCH IMPROVEMENTS, THE CONTRACTOR SHALL PERFORM NO CONSTRUCTION ADJACENT TO THAT PROPERTY WITHOUT FIRST CONSULTING THE ENGINEER AND OBTAINING APPROVAL. IF THE CONTRACTOR FAILS TO OBTAIN SUCH APPROVAL FROM THE ENGINEER, AND SOME ITEMS WHICH ARE CONSTRUCTED SUBSEQUENTLY NEED TO BE REMOVED, THE COSTS FOR THE INITIAL CONSTRUCTION AND SUBSEQUENT REMOVAL OF THE ITEMS SHALL BE BORNE SOLELY BY THE CONTRACTOR.

PROTECTION OF WORK

1. THE CONTRACTOR SHALL PROTECT ALL WORK AREAS AND FACILITIES FROM WATER AT ALL TIMES. AREAS AND FACILITIES SUBJECT TO FLOODING, REGARDLESS OF THE SOURCE OF WATER, SHALL BE PROMPTLY DEWATERED AND RESTORED AT THE CONTRACTOR'S COST TO THE CITY.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SAFETY OF THOSE ASSOCIATED WITH THE WORK, PEDESTRIANS, TRAVELING PUBLIC, VEHICULAR TRAFFIC, AND THE GENERAL PUBLIC THROUGHOUT THE DURATION OF THE CONTRACT.



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Sheet Revisions		
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City and County of Denver
 Department of Public Works
 Engineering Division
 201 W. Colfax, Dept 506
 Denver, CO. 80202

Colorado Department of Transportation
 2000 South Holly Street
 Denver, CO 80222
 Phone: 303-757-9511 FAX: 303-757-9907
 Region 1 JV

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GENERAL NOTES			
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GENERAL NOTES (CONT.)

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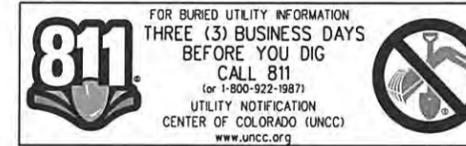
1. WEEDS IN JOINTS IN EXISTING SIDEWALK, CURB, AND GUTTER SHALL BE REMOVED BY THE CONTRACTOR WITHIN THE PROJECT LIMITS. THIS WORK SHALL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK. ANY WEED REMOVAL DONE BY HERBICIDE APPLICATION SHALL BE APPLIED BY A LICENSED HERBICIDE APPLICATOR.
2. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING, IDENTIFYING, AND PROTECTING EXISTING IRRIGATION SYSTEMS AT NO COST TO THE PROJECT.
3. THE CONTRACTOR IS RESPONSIBLE FOR REMOVING, RELOCATING OR REPAIRING ANY EXISTING IRRIGATION ITEMS THAT HAVE BEEN DAMAGED DURING CONSTRUCTION AT THE CONTRACTOR'S EXPENSE.
4. ALL IRRIGATION MATERIALS USED ON THIS PROJECT ARE TO BE SUBMITTED TO THE ENGINEER FOR APPROVAL. ANY ITEM INSTALLED WITHOUT APPROVAL SHALL BE REMOVED AND REPLACED AT THE CONTRACTOR'S EXPENSE.

PROJECT PLANS, SPECIFICATIONS & PERMITS

1. CITY AND COUNTY OF DENVER WILL OBTAIN CASDP PERMIT PRIOR TO CONSTRUCTION AND TRANSFER TO CONTRACTOR UPON AWARD. THE CONTRACTOR SHALL OBTAIN, AT HIS EXPENSE, ANY OTHER LICENSES AND PERMITS WHICH ARE NECESSARY FOR THE WORK, UNLESS OTHERWISE SPECIFIED IN THE CONTRACT DOCUMENTS, INCLUDING BUT NOT LIMITED TO SEWER USE AND DRAINAGE (SUDP), PARKS, AND STREET OCCUPANCY.
2. THE CONTRACTOR SHALL SATISFY ALL REQUIREMENTS OF EACH PERMIT. THE CONTRACTOR SHALL INFORM HIMSELF OF ALL PERMIT REQUIREMENTS PRIOR TO BIDDING. COSTS FOR OBTAINING ALL PERMITS AND FOR ADHERING TO ALL PERMIT REQUIREMENTS SHALL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ALL NECESSARY PERMITS ARE IN PLACE PRIOR TO BEGINNING ANY WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING THE STREET CUT AND OCCUPANCY PERMITS (RIGHT-OF-WAY PERMITS FROM THE CITY AND COUNTY OF DENVER) FOR ALL THE WORK IN THE PUBLIC RIGHT-OF-WAY, AND OBTAINING A DEWATERING PERMIT IF WATER IS ENCOUNTERED WHILE DOING UNDERGROUND EXCAVATIONS. NO ADDITIONAL TIME SHALL BE ALLOTTED TO OBTAIN ANY PERMITS, AND NO ADDITIONAL COMPENSATION SHALL BE PAID FOR ANY FEES AND WORK, BUT SUCH COSTS SHALL BE INCLUDED IN THE WORK. STREET OCCUPANCY AND STREET CUT PERMITS ARE NO FEE. REQUEST FORM AND MHT'S MUST BE SUBMITTED BY EMAIL TO: PWPermits@denvergov.org AT LEAST 10 WORKING DAYS BEFORE NEEDED. COPY THE SUBMITTAL TO THE DENVER PROJECT MANAGER.
4. ALL WORK SHALL BE ACCOMPLISHED IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS THAT ARE APPLICABLE TO THE PROJECT.
5. WHERE APPLICABLE AND AS SHOWN ON THESE PLANS, COLORADO DEPARTMENT OF TRANSPORTATION STANDARD PLANS, M & S STANDARDS (LATEST EDITION), AND STANDARDS AND DETAILS FOR CITY AND COUNTY OF DENVER ENGINEERING ARE REFERENCED AS CONSTRUCTION DETAILS.
6. THE CONTRACTOR SHALL HAVE ONE (1) SIGNED COPY OF THE PROJECT PLANS AND SPECIFICATIONS AND A COPY OF THE NECESSARY PERMITS AT THE JOBSITE AT ALL TIMES.
7. SEE PROJECT SPECIAL PROVISION 107 FOR PERMITS WHICH THE OWNER HAS OBTAINED AND PERMITS THAT THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING AND ADHERING TO. THERE MAY BE ADDITIONAL PERMITS WHICH ARE REQUIRED BUT WHICH ARE NOT LISTED. ALL COSTS OF ANY NATURE REQUIRED TO OBTAIN AND ADHERE TO ANY PERMIT SHALL BE BORNE SOLELY BY THE CONTRACTOR, AT NO ADDITIONAL COST TO THE PROJECT.

UTILITIES

1. REFER TO PROJECT SUBSET UTILITY PLANS FOR ADDITIONAL INFORMATION.
2. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO LOCATE AND PROTECT ALL VAULTS, UNDERGROUND CONDUITS, AND OTHER APPURTENANCES DURING CONSTRUCTION.
3. UTILITY LINES AS SHOWN ON THE PLAN SHEETS ARE PLOTTED FROM THE BEST AVAILABLE INFORMATION. THE CONTRACTOR'S ATTENTION IS DIRECTED TO SUBSECTION 105.11 OF THE STANDARD SPECIFICATIONS CONCERNING UTILITIES.
4. THE CONTRACTOR SHALL DETERMINE THE TYPE AND LOCATION OF THE UNDERGROUND UTILITIES AS MAY BE NECESSARY TO AVOID DAMAGES.
5. THE CONTRACTOR SHALL COMPLY WITH ARTICLE 1.5 OF TITLE 9, CRS ("EXCAVATION REQUIREMENTS") WHEN EXCAVATING OR GRADING IS PLANNED IN THE ARE OF UNDERGROUND UTILITY FACILITIES. THE CONTRACTOR SHALL NOTIFY ALL AFFECTED UTILITIES AT LEAST TWO (2) BUSINESS DAYS, NOT INCLUDING THE ACTUAL DAY OF NOTICE, PRIOR TO COMMENCING SUCH OPERATIONS. THE CONTRACTOR SHALL CONTACT THE UTILITY NOTIFICATION CENTER OF COLORADO (UNCC) AT 811 OR 1-900-922-1987, TO HAVE LOCATIONS OF UNCC REGISTERED LINES MARKED BY MEMBER COMPANIES. ALL OTHER UNDERGROUND FACILITIES SHALL BE LOCATED BY CONTACTING THE RESPECTIVE OWNER. UTILITY SERVICE LATERALS SHALL ALSO BE LOCATED PRIOR TO BEGINNING EXCAVATION OR GRADING. THE CONTRACTOR SHALL LOCATE NON-MEMBER UTILITIES, SUCH AS STORM SEWER AND DITCH FACILITIES AS NECESSARY TO PREVENT DAMAGE THERETO.
6. IT IS SUGGESTED THAT THE CONTRACTOR CALL XCEL ENERGY AT 1-800-895-1999 FOR AN ELECTRIC EMERGENCY.
7. IT IS SUGGESTED THAT THE CONTRACTOR CALL XCEL ENERGY AT 1-800-895-2999 FOR A GAS EMERGENCY.
8. THE CONTRACTOR SHALL SUBMIT A XCEL ENERGY BUILDERS CALL LINE APPLICATION FOR EVERY XCEL ENERGY WORK ELEMENT THAT IS TO BE COORDINATED WITH THE PROJECT.
9. CONTRACTORS PERFORMING WORK ON ANY WASTEWATER FACILITY OR APPURTENANCE MUST BE PROPERLY LICENSED AND HAVE A LICENSED PLUMBER OR DRAIN LAYER ON SITE DURING THE WORK.
10. ALL OF THE CONTRACTOR'S COSTS OF ANY NATURE REQUIRED TO SATISFY ALL THE REQUIREMENTS CONTAINED IN THE UTILITY NOTES 1 THROUGH 9 SHALL BE INCLUDED IN THE WORK, AND NO ADDITIONAL PAYMENT WILL BE MADE.



RTD

1. REMOVAL OF BUS SHELTERS WILL BE DONE BY RTD. CONTACT PETE MUNIZ WITH RTD AT 303-299-6561 TO COORDINATE.
2. TWO WEEKS PRIOR TO REMOVAL OF TRANSIT AMENITIES SUCH AS BENCHES AT A BUS STOP, THE CONTRACTOR SHALL COORDINATE REMOVALS WITH DENVER PUBLIC WORKS RIGHT-OF-WAY SERVICES CONSTRUCTION ENGINEERING AT 303-446-3469.
3. TEMPORARY RELOCATION AND/OR COMBINING OF EXISTING TRANSIT STOPS ALONG FEDERAL BLVD. SHALL BE COORDINATED WITH THE CONTRACTOR'S PHASING OF THE WORK.
4. THE CONTRACTOR SHALL ACCOMMODATE PEDESTRIAN ACCESS TO ALL EXISTING, TEMPORARY AND PROPOSED TRANSIT STOPS ALONG THE PROJECT LIMITS THROUGHOUT THE DURATION OF THE PROJECT.
5. THE CONTRACTOR SHALL CONSTRUCT BENCHES, TRASH CANS, BIKE RACKS AND SHELTERS AT FINAL BUS STOP LOCATIONS AS SHOWN ON THE PLANS. THIS WORK IS EXPECTED TO BE COORDINATED DURING CONSTRUCTION. THE REQUIRED TIME SHALL BE DETERMINED BY THE CONTRACTOR AND RTD.

ENVIRONMENTAL NOTES

AIR QUALITY

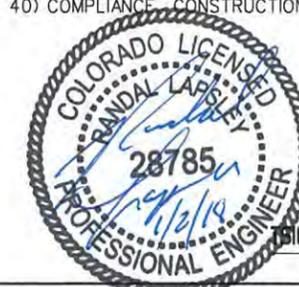
1. THE CONTRACTOR SHALL TAKE REASONABLE MEASURES TO PREVENT PARTICULATE MATTER FROM BECOMING AIRBORNE AND TO PREVENT THE VISIBLE DISCHARGE OF FUGITIVE PARTICULATE EMISSIONS BEYOND THE PROPERTY ON WHICH THE EMISSIONS ORIGINATE. THE MEASURES TAKEN MUST BE EFFECTIVE IN THE CONTROL OF FUGITIVE PARTICULATE EMISSIONS AT ALL TIMES ON THE SITE, INCLUDING PERIODS OF INACTIVITY SUCH AS EVENINGS, WEEKENDS, AND HOLIDAYS AS WELL AS ANY OTHER PERIOD OF INACTIVITY.
2. THE CONTRACTOR SHALL SYSTEMATICALLY CONTROL FUGITIVE DUST THROUGH DILIGENT IMPLEMENTATION OF CDOT'S STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, PARTICULARLY SECTIONS 107.24, 209 AND 250; AND COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT - AIR POLLUTION CONTROL DIVISION'S (APCD) AIR POLLUTANT EMISSION NOTIFICATION, CDPHE-APCD'S DEMOLITION PERMIT, AND FUGITIVE DUST CONTROL PLAN REQUIREMENTS.
3. THE CONTRACTOR SHALL MAINTAIN ENGINES AND EXHAUST SYSTEMS ON EQUIPMENT GOOD WORKING ORDER. EQUIPMENT SHALL BE MAINTAINED ON A REGULAR BASIS, AND WILL BE SUBJECT TO INSPECTION BY THE PROJECT ENGINEER TO ENSURE COMPLIANCE.
4. EXCESSIVE IDLING OF INACTIVE EQUIPMENT OF VEHICLES IS PROHIBITED, AND THE CONTRACTOR IS REQUIRED TO BE COMPLIANT WITH THE CITY AND COUNTY OF DENVER'S IDLING ORDINANCE (5 MINUTES' MAXIMUM IDLING PER ONE HOUR OF OPERATION).
5. CONSTRUCTION EQUIPMENT AND VEHICLES SHALL UTILIZE LOW-SULFUR FUEL TO REDUCE POLLUTANT EMISSIONS.

WATER QUALITY

6. A STORMWATER MANAGEMENT PLAN (SWMP) HAS BEEN DEVELOPED TO ADDRESS TEMPORARY CONSTRUCTION IMPACTS AS A RESULT OF CONSTRUCTION. A TRANSPORTATION EROSION-CONTROL SUPERVISOR SHALL INSPECT THE CONSTRUCTION SITE EVERY SEVEN DAYS, AND AFTER ANY PRECIPITATION OR SNOWMELT EVENT WITH THE POTENTIAL TO CAUSE SURFACE EROSION, DURING ACTIVE CONSTRUCTION, AND AS NECESSITATED BY PERMIT REQUIREMENTS. THE SUPERVISOR SHALL DOCUMENT EVIDENCE OF, OR THE POTENTIAL FOR, POLLUTANTS ENTERING THE LOCAL DRAINAGE SYSTEM. ANY BEST MANAGEMENT PRACTICES (BMPs) NOT OPERATING IN ACCORDANCE WITH THE SWMP SHALL BE ADDRESSED IMMEDIATELY IN ORDER TO MINIMIZE THE DISCHARGE OF POLLUTANTS. SEE THE STORMWATER MANAGEMENT PLANS AND NOTES FOR ADDITIONAL INFORMATION.
7. THE CONTRACTOR SHALL DEVELOP A SPILL PREVENTION, CONTROL, AND COUNTERMEASURE PLAN TO BE IMPLEMENTED FOR THE CONSTRUCTION SITE THAT SHALL ESTABLISH STANDARD OPERATING PROCEDURES AND REQUIRED EMPLOYEE TRAINING TO MINIMIZE THE ACCIDENTAL RELEASE OF POLLUTANTS WHICH COULD CONTAMINATE STORMWATER RUNOFF.

BIOLOGICAL RESOURCES

8. PROJECT SPECIAL PROVISION SPECIFICATION 240 SHALL BE FOLLOWED FOR MIGRATORY BIRD TREATY ACT (MBTA) COMPLIANCE. CONSTRUCTION ACTIVITIES SHALL ADHERE TO THESE SPECIFICATIONS.
9. CDOT SPECIFICATION 214 SHALL BE FOLLOWED FOR SENATE BILL 40 (SB 40) COMPLIANCE. CONSTRUCTION AND REVEGETATION ACTIVITIES SHALL ADHERE TO THESE SPECIFICATIONS.



BOUVARAS SIMMONS HOLDERNESSE
CONSULTING ENGINEERS

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Last Modification Date: _____ Init.: _____		<table border="1"> <thead> <tr> <th colspan="3">Sheet Revisions</th> </tr> <tr> <th>Date:</th> <th>Comments</th> <th>Init.</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table>		Sheet Revisions			Date:	Comments	Init.													<p>City and County of Denver Department of Public Works Engineering Division 201 W. Colfax, Dept. 505 Denver, CO. 80202</p>	<p>Colorado Department of Transportation 2000 South Holly Street Denver, CO 80222 Phone: 303-757-9511 FAX: 303-757-9907 Region 1 JV</p>	As Constructed No Revisions: Revised: Void:	FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE GENERAL NOTES Designer: RDL Detailer: SRF Sheet Subset: GENNOTE	Project No./Code NHP 2873-172 SA 19957 2011-PROJMSTR-0000364 Sheet Number 12
Sheet Revisions																										
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GENERAL NOTES (CONT.)

- 10. IN ORDER TO REDUCE THE SPREAD OF NOXIOUS-WEED SPECIES, AND TO REDUCE THE INTRODUCTION OF OTHER NOXIOUS WEED INTO THE AREA, STANDARD BMPS SHALL BE FOLLOWED. SOME GENERAL BMPS THAT WILL REDUCE THE SPREAD OF NOXIOUS WEEDS INCLUDE:
 - i. EQUIPMENT ENTERING AND LEAVING THE PROJECT AREA SHALL BE INSPECTED AS BEING FREE OF MUD AND VEGETATION MATERIAL CAPABLE OF MOVING WEED SEED. ANY VEHICLE FOUND TO BE TRANSPORTING MUD AND VEGETATION CAPABLE OF MOVING WEED SEED SHALL BE THOROUGHLY CLEANED BEFORE ENTERING OR LEAVING THE PROJECT AREA.
 - ii. SOIL DISTURBANCE SHALL BE MINIMIZED TO THE GREATEST EXTENT POSSIBLE.
 - iii. DISTURBED SOIL SHALL BE RE-SEEDED WITH A WEED-FREE SEED MIX AS SOON AS POSSIBLE AFTER COMPLETION OF WORK.
 - iv. TO REDUCE THE POTENTIAL FOR INTRODUCING AND SPREADING NUISANCE AQUATIC SPECIES, PROJECT EQUIPMENT THAT WAS PREVIOUSLY USED IN ANOTHER WATER BODY SHALL BE DISINFECTED AS DIRECTED IN THE SB40 REQUIREMENTS PRIOR TO ENTERING THE PROJECT AREA.

ARCHAEOLOGICAL RESOURCES

- 11. IF ANY SUBSURFACE ARCHAEOLOGICAL RESOURCES ARE FOUND, WORK SHALL BE IMMEDIATELY HALTED IN THE VICINITY OF THE FIND, AND THE ENGINEER AND THE CDOT SENIOR ARCHAEOLOGIST SHALL BE PROMPTLY NOTIFIED (DAN JEPSON, 303-757-9631). IF BONES OF POTENTIAL HUMAN ORIGIN ARE DISCOVERED DURING CONSTRUCTION, GROUND-DISTURBING WORK MUST BE STOPPED IN THE VICINITY OF THE DISCOVERY, AND THE DENVER COUNTY CORONER, THE DENVER COUNTY SHERIFF, THE COLORADO STATE HISTORIC PRESERVATION OFFICER (SHPO), THE COLORADO STATE ARCHAEOLOGIST, AND THE CDOT SENIOR ARCHAEOLOGIST SHALL BE PROMPTLY NOTIFIED. WORK CANNOT RESUME IN THE VICINITY OF THE FIND UNTIL CLEARANCE IS GRANTED. THE CONTRACTOR SHALL COMPLY WITH CDOT STANDARD SPECIFICATION 107.23 (ARCHAEOLOGICAL AND PALEONTOLOGICAL DISCOVERIES).

PALEONTOLOGICAL RESOURCES

- 12. IF ANY SUBSURFACE BONES OR OTHER POTENTIALLY SIGNIFICANT FOSSILS ARE FOUND, WORK SHALL BE IMMEDIATELY HALTED IN THE VICINITY OF THE FIND, AND THE ENGINEER AND THE CDOT STAFF PALEONTOLOGIST SHALL BE PROMPTLY NOTIFIED (NICOLE PEAVEY, 303-757-9632). IF THE DENVER FORMATION (I.E., BEDROCK) SHALL BE EXCAVATED, THE CDOT PALEONTOLOGIST SHALL BE NOTIFIED TO MONITOR THE CONSTRUCTION ACTIVITY, AND BE GIVEN ADEQUATE NOTICE TO SCHEDULE THE INSPECTION. THE CONTRACTOR SHALL COMPLY WITH CDOT STANDARD SPECIFICATION 107.23 (ARCHAEOLOGICAL AND PALEONTOLOGICAL DISCOVERIES).

NOISE CONTROL

- 13. EXHAUST SYSTEMS ON EQUIPMENT SHALL BE IN GOOD WORKING ORDER. EQUIPMENT SHALL BE MAINTAINED ON A REGULAR BASIS, AND SHALL BE SUBJECT TO INSPECTION BY THE PROJECT MANAGER TO ENSURE MAINTENANCE.
- 14. PROPERLY DESIGNED ENGINE ENCLOSURES AND INTAKE SILENCERS SHALL BE USED WHERE APPROPRIATE.
- 15. NEW EQUIPMENT SHALL BE SUBJECT TO NEW-PRODUCT NOISE-EMISSION STANDARDS.
- 16. STATIONARY EQUIPMENT SHALL BE LOCATED AS FAR FROM SENSITIVE RECEPTORS AS POSSIBLE.
- 17. MOST CONSTRUCTION ACTIVITIES IN NOISE-SENSITIVE AREAS SHALL BE CONDUCTED DURING HOURS THAT ARE LEAST DISTURBING TO THE GENERAL PUBLIC. IF NIGHT WORK IS ANTICIPATED, A TEMPORARY NOISE-VARIANCE PERMIT WITH THE CCD SHALL BE REQUIRED.
- 18. THE CONTRACTOR SHALL COMPLY WITH CCD NOISE REGULATIONS (MUNICIPAL CODE, CHAPTER 36). EXEMPTED HOURS FOR CONSTRUCTION IN THE CITY AND COUNTY OF DENVER ARE FROM 7 A.M. TO 9 P.M. MONDAY THROUGH FRIDAY AND 8 A.M. TO 5 P.M. ON SATURDAYS AND SUNDAYS PER SECTIONS 36-6.(B)(7) AND 36-7.(5)A., B. AND C. OF DENVER'S NOISE ORDINANCE, CHAPTER 36 NOISE CONTROL, DENVER REVISED MUNICIPAL CODE (DRMC). IF THERE IS AN ANTICIPATED NEED TO WORK OUTSIDE OF THE EXEMPTED HOURS FOR CONSTRUCTION: 1) THE CONTRACTOR SHALL NEED TO MAKE A REQUEST FOR A NIGHTTIME NOISE VARIANCE AS ALLOWED FOR IN SECTION 36-7.(5)C. OF THE DRMC AND 2) THE VARIANCE PROCESS NEEDS TO BE STARTED A MINIMUM OF THREE MONTHS PRIOR TO THE DESIRED START DATE OF ANY WORK NEEDING TO OCCUR OUTSIDE OF EXEMPTED HOURS. ANY NOISE VARIANCE QUESTIONS SHOULD BE DIRECTED TO PAUL RIESDESEL, DEPARTMENT OF ENVIRONMENTAL HEALTH, DENVER COMMUNITY NOISE PROGRAM, (PHONE 720-865-5410; FAX 720-865-5532) A MINIMUM OF THREE MONTHS PRIOR TO THE START OF THE WORK.

HAZARDOUS MATERIALS

- 19. THE PROJECT AREA IS CURRENTLY AND HAS HISTORICALLY BEEN OCCUPIED BY VARIOUS GASOLINE STATIONS, AUTOMOTIVE SERVICE FACILITIES, MANUFACTURING AND PROCESSING FACILITIES AND A BUS TERMINAL. GIVEN THE HISTORICAL AND CURRENT USES, A NUMBER OF RECOGNIZED ENVIRONMENTAL CONDITIONS HAVE BEEN IDENTIFIED. A MATERIALS MANAGEMENT PLAN (MMP) HAS BEEN PREPARED AND SHALL BE IMPLEMENTED DURING CONSTRUCTION ACTIVITIES. THE MMP INCLUDES SOIL AND GROUNDWATER LABORATORY RESULTS COLLECTED DURING A PHASE II ENVIRONMENTAL SITE ASSESSMENT AND WILL SERVE AS A GUIDANCE DOCUMENT TO MANAGE CONTAMINATED MATERIALS, IF ENCOUNTERED, DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR IS RESPONSIBLE FOR IMPLEMENTING THE MMP, FOLLOWING ALL APPROPRIATE REGULATIONS, OBTAINING THE PROPER PERMITS, AND INCORPORATING ENVIRONMENTAL INFORMATION FROM THE MMP INTO THEIR HEALTH AND SAFETY PLAN. THE CONTRACTOR IS ALSO RESPONSIBLE FOR PROVIDING THE MMP TO ITS STAFF AND SUBCONTRACTORS AND FOR COMPLIANCE WITH THE MMP. SEE PROJECT SPECIAL PROVISION 250 FOR ADDITIONAL INFORMATION.
- 20. DURING ANY SOIL DISTURBING ACTIVITIES, IF UNKNOWN/UNIDENTIFIED UNDERGROUND STORAGE TANKS, DRUMS, ODOROUS SOIL, STAINED SOIL, ASBESTOS-CEMENT PIPE (TRANSITE), BUILDING DEBRIS OR WASTE MATERIALS ARE ENCOUNTERED DURING THE PROJECT, CONTRACTOR SHALL IMMEDIATELY STOP WORK IN THE AREA OF THE DISCOVERY UNTIL DENVER ENVIRONMENTAL HEALTH (DEH) MAKES A DETERMINATION OF HOW TO PROCEED. CONTRACTOR SHALL IMMEDIATELY NOTIFY DEH OF THE DISCOVERY VIA THE PHONE NUMBER 720-460-1706.

- 21. ANY FILL MATERIAL OR SOILS TO BE MOVED TO AND PLACED ON CCD-OWNED PROPERTY OR PLACED ON REAL PROPERTY TO BE TRANSFERRED TO THE CCD MUST BE FREE OF KNOWN CONTAMINATION (OBSERVED AND DOCUMENTED OR PREVIOUSLY DOCUMENTED) AND BE ACCEPTABLE FOR UNRESTRICTED RESIDENTIAL USE. CONTACT DAVE ERICKSON, DENVER ENVIRONMENTAL HEALTH (720-865-5433) FOR CLARIFICATION, IF NEEDED, REGARDING THIS CCD REQUIREMENT.
- 22. THE CONTRACTOR SHALL DIRECT NON-RECYCLABLE, NON-HAZARDOUS WASTES FROM CCD-OWNED OR CONTROLLED PROPERTY OR FACILITIES TO THE DENVER ARAPAHOE DISPOSAL SITE (DADS) LANDFILL FOR DISPOSAL, FOLLOWING THE REQUIREMENT AND PROCEDURAL GUIDANCE OUTLINED IN CCD EXECUTIVE ORDER 115.
- 23. ANY EXISTING LIGHT STANDARDS OR SIGN POSTS THAT ARE COATED WITH PAINT WHICH ARE ASSUMED TO CONTAIN LEAD AND/OR OTHER HEAVY METALS SHALL BE REMOVED IN COMPLIANCE WITH THE CDOT 250 ENVIRONMENTAL HEALTH & SAFETY MANAGEMENT SPEC (INCLUDING, BUT NOT LIMITED TO SECTION 250.04) AND ALL APPLICABLE OSHA AND OTHER FEDERAL REGULATIONS. MINIMIZE PAINT FLAKING DURING THE REMOVAL PROCESS OR COLLECT ALL PAINT CHIPS AND CONTAINERIZE. A PAY ITEM 250 - ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT IS INCLUDED IN THE PROJECT TO PAY FOR THIS ITEM.
- 24. PER THE REVISION OF SECTION 250, ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT, FOUND IN THE PROJECT SPECIAL PROVISIONS, THE CONTRACTOR SHALL PREPARE A PROJECT SPECIFIC REGULATED ASBESTOS CONTAINING SOIL MANAGEMENT PLAN, AND THE CONTRACTOR WILL PROVIDE ASBESTOS AWARENESS TRAINING AND ONE OR MORE CABI'S DURING EXCAVATION ACTIVITIES. SEE SPECIAL PROVISIONS FOR FURTHER INFORMATION.

PAYMENT INFORMATION

ALL OF THE CONTRACTOR'S COSTS OF ANY NATURE REQUIRED TO COMPLY WITH ALL OF THE REQUIREMENTS CONTAINED IN THE ENVIRONMENTAL NOTES 1 THROUGH 24 SHALL BE INCLUDED IN THE WORK, AND NO ADDITIONAL PAYMENT WILL BE MADE TO THE CONTRACTOR TO ENSURE COMPLIANCE.

ABBREVIATIONS

@ = AT/AT EACH	EF = EACH FACE	MK = MARK	S = SURVEY LINE
ABC = AGGREGATE BASE COURSE	EL/ELEV = ELEVATION	NF = NEAR FACE	SCJ = SAW CUT JOINT
ABUT = ABUTMENT	EOP = EDGE OF PAVEMENT	NTS = NOT TO SCALE	SHT = SHEET
ALT = ALTERNATE	EOTW = EDGE OF TRAVELED WAY	OC = ON CENTER	SIM = SIMILAR
ARCH = ARCHITECTURAL	EST = ESTIMATED	OF = OUTSIDE FACE	SPA = SPACING/SPACES
BF = BACK FACE	EW = EACH WAY	OH = OVERHEAD	SPEC = SPECIFICATIONS
BM = BEAM	EQUIP = EQUIPMENT	OPNG = OPENING	SQ = SQUARE
BOF = BOTTOM OF FOOTING	EX, EXIST = EXISTING	OPP = OPPOSITE	STA = STATION
BOW = BOTTOM OF WALL	EXP = EXPANSION	P = PLATE	STD = STANDARD
BRG = BEARING	FF = FAR FACE	PC = POINT OF CURVATURE	SYM = SYMMETRICAL
BTM = BOTTOM	FTG = FOOTING	PEJF = PREFORMED EXPANSION JOINT FILLER	T & B = TOP & BOTTOM
CL = CENTERLINE	GAVL = GALVANIZED	PGL = PROFILE GRADE LINE	TAN = TANGENT
(CIP) = (COMPLETE IN PLACE)	GEOTECH = GEOTECHNICAL	PI = POINT OF INTERSECTION	TH = TEST HOLE
CJ = CONTROL JOINT	GRD BM = GRADE BEAM	PK = KNOWN POINT	TOC = TOP OF CONCRETE
CLR = CLEAR/CLEARANCE	HORIZ = HORIZONTAL	PP = POWER POLE / PIVOT POINT	TOF = TOP OF FOOTING
CONST JNT = CONSTRUCTION JOINT	HCL = HORIZONTAL CONTROL LINE	PROJ = PROJECTION	TOW = TOP OF WALL
COL = COLUMN	IF = INSIDE FACE	PROP = PROPOSED	TYP = TYPICAL
CONC = CONCRETE	INV EL = INVERT ELEVATION	PSS = POINT OF SLOPE SELECTION	UNO = UNLESS NOTED OTHERWISE
CONT = CONTINUOUS	LT = LEFT	PT = POINT OF TANGENCY	VAR = VARIABLE
CP = CONTROL POINT	LP = LIGHT POLE	QTY = QUANTITY	VERT = VERTICAL
Ø = DIAMETER	MAS = MASONRY	R/RAD = RADIUS	VC = VERTICAL CURVE
DET = DETAIL	MATL = MATERIAL	REINF = REINFORCING	VPC = VERTICAL POINT OF CURVATURE
DIAG = DIAGONAL	MAX = MAXIMUM	REF = REFERENCE	VPI = VERTICAL POINT OF INTERSECTION
DWG = DRAWING	MB = MAIL BOX	REQD = REQUIRED	VPT = VERTICAL POINT OF TANGENCY
DWLS = DOWELS	MFR = MANUFACTURER	ROW = RIGHT OF WAY	WL = WORKING LINE
E = EPOXY COATED	MIN = MINIMUM	RT = RIGHT	WP = WORKING POINT
			WWF = WELDED WIRE FABRIC

LEGEND

-  CROSS REFERENCE DRAWING NUMBER (IF BLANK, REFERENCE IS TO SAME SHEET)
-  SECTION OR DETAIL IDENTIFICATION
-  DENOTES KEY NOTE REFERENCE



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Drawing File Name: 1102188-005-General Notes.dgn		Date:	Comments	Init.			No Revisions:	GENERAL NOTES		NHPP 2873-172 SA 19957		2011-PROJMSTR-0000364
Horizontal Scale: 1:2 Vert. Scale: As Noted						Revised:	Designer: RDL	Structure Numbers			Sheet Number 13	
						Void:	Detailer: SRF	Subset Sheets: 4 of 4				

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INDEX	INDEX ITEM NO	CONTRACT ITEM	UNIT	CC 0881-025																PROJECT TOTALS		
				PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	
	201	CLEARING AND GRUBBING	LS	1																	1	
	202	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1																	1	
	202	REMOVAL OF TREE	EACH	21																	21	
	202	REMOVAL OF BOLLARD	EACH	20																	20	
	202	REMOVAL OF POWER OUTLET	EACH	10																	10	
	202	REMOVAL OF WHEEL STOP	EACH	14																	14	
	202	REMOVAL OF INLET	EACH	8																	8	
	202	REMOVAL OF MANHOLE	EACH	2																	2	
	202	REMOVAL OF GABION	CY	5																	5	
	202	REMOVAL OF PIPE	LF	626																	626	
	202	REMOVAL OF FIRE HYDRANT	EACH	3																	3	
	202	REMOVAL OF WATER SERVICE LINE	EACH	31																	31	
	202	REMOVAL OF WATER METER	EACH	28																	28	
	202	REMOVAL OF WALL	LF	12																	12	
	202	REMOVAL OF SIDEWALK	SY	5,336																	5,336	
	202	REMOVAL OF CURB AND GUTTER	LF	9,574																	9,574	
	202	REMOVAL OF CURB	LF	40																	40	
	202	REMOVAL OF CONCRETE PAVEMENT	SY	5,051																	5,051	
	202	REMOVAL OF ASPHALT MAT	SY	33,179																	33,179	
	202	REMOVAL OF PAVEMENT MARKING	SF	3,175																	3,175	
	202	REMOVAL OF LIGHT STANDARD	EACH	11																	11	
	202	REMOVAL OF LIGHT STANDARD FOUNDATION	EACH	17																	17	
	202	REMOVAL OF GROUND SIGN	EACH	24																	24	
	202	REMOVAL OF SIGN PANEL	EACH	15																	15	
	202	REMOVAL OF SIGN (SPECIAL)	EACH	5																	5	
	202	REMOVAL OF TRAFFIC SIGNAL EQUIPMENT	LS	1																	1	
	202	REMOVAL OF FENCE	LF	1,319																	1,319	

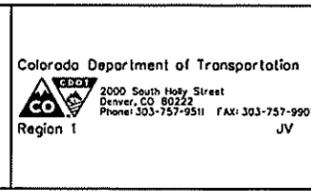
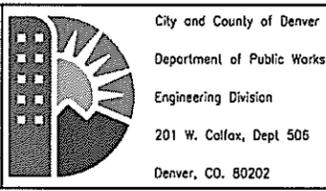
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
SUMMARY OF APPROXIMATE QUANTITIES

Designer:	SRF	Structure Numbers	
Detailer:	SRF	Subset Sheets:	1 of 13
Sheet Subset:	SAQ		

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SA 19957
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INDEX			INDEX ITEM NO	CONTRACT ITEM	UNIT	CC 0881-025															PROJECT TOTALS		
BOOK	PAGE	SHEET				PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST
			202	REMOVAL OF GUARDRAIL TYPE 3	LF	216																216	
			202	ABANDON WATER SERVICE	EACH	13																13	
			202	CLEAN VALVE BOX	EACH	34																34	
			202	PLUG PIPE	EACH	7																7	
			203	UNCLASSIFIED EXCAVATION (COMPLETE IN PLACE)	CY	11,970																11,970	
			203	MUCK EXCAVATION	CY	500																500	
			203	COMBINATION LOADER	HR	30																30	
			203	POTHOLING	HR	100																100	
			206	STRUCTURE EXCAVATION	CY	833																833	
			206	STRUCTURE BACKFILL (CLASS 1)	CY	790																790	
			206	STRUCTURE BACKFILL (CLASS 2)	CY	33																33	
			206	STRUCTURE BACKFILL (FLOW-FILL)	CY	100																100	
			206	SHORING	LS	1																1	
			206	SHORING (JACKING PIT)	LS	1																1	
			206	SHORING (RECEIVING PIT)	LS	1																1	
			207	TOPSOIL	CY	796																796	
			207	STOCKPILE TOPSOIL	CY	1,000																1,000	
			207	PLANTER SOIL MIX	CY	671																671	
			208	EROSION LOG TYPE 1 (12 INCH)	LF	54																54	
			208	SILT FENCE	LF	1,000																1,000	
			208	SILT FENCE (REINFORCED)	LF	336																336	
			208	AGGREGATE BAG	LF	1,825																1,825	
			208	CONCRETE WASHOUT STRUCTURE	LS	1																1	
			208	STORM DRAIN INLET PROTECTION (TYPE I)	LF	400																400	
			208	STORM DRAIN INLET PROTECTION (TYPE II)	LF	40																40	
			208	STORM DRAIN INLET PROTECTION (TYPE III)	EACH	3																3	
			208	VEHICLE TRACKING PAD	EACH	2																2	

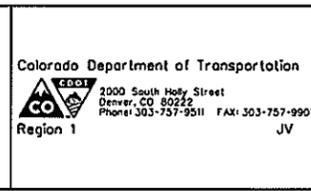
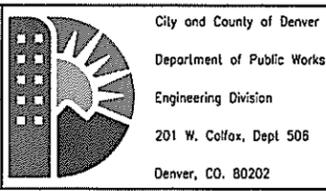
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
 SUMMARY OF APPROXIMATE QUANTITIES
 Designer: _____ SRF
 Detailer: _____ SRF
 Sheet Subset: _____ SAQ

Project No./Code
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 2011-PROJMSTR-0000364
 Sheet Number **15**

Structure Numbers
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BOOK	PAGE	SHEET																				
			208	REMOVAL AND DISPOSAL OF SEDIMENT (LABOR)	HR	40															40	
			208	REMOVAL AND DISPOSAL OF SEDIMENT (EQUIPMENT)	HR	30															30	
			208	SWEEPING (SEDIMENT REMOVAL)	HR	190															190	
			208	REMOVAL OF TRASH	HR	100															100	
			208	EROSION CONTROL MANAGEMENT (ECM)	DAY	380															380	
			210	RESET STRUCTURE (SIGN 2)	EACH	1															1	
			210	RESET STRUCTURE (SIGN 3)	EACH	1															1	
			210	RESET STRUCTURE (SIGN 4)	EACH	1															1	
			210	RESET STRUCTURE (SIGN 5)	EACH	1															1	
			210	RESET STRUCTURE (SIGN 6)	EACH	1															1	
			210	RESET WHEEL STOP	EACH	5															5	
			210	RESET FIRE HYDRANT	EACH	3															3	
			210	RESET LIGHT STANDARD	EACH	1															1	
			210	RESET GROUND SIGN	EACH	1															1	
			210	RESET SIGN PANEL	EACH	17															17	
			210	RESET VARIABLE MESSAGE SIGN	EACH	1															1	
			210	RESET TRAFFIC SIGNAL HEAD	EACH	1															1	
			210	RESET TRAFFIC SIGNAL POLE	EACH	1															1	
			210	RESET TRAFFIC SIGNAL CONTROLLER AND CABINET	EACH	1															1	
			210	RESET GATE	EACH	1															1	
			210	RESET CHAIN LINK FENCE	LF	121															121	
			210	RESET TREE GRATE	EACH	1															1	
			210	ADJUST MANHOLE	EACH	22															22	
			210	MODIFY MANHOLE	EACH	1															1	
			210	ADJUST VALVE BOX	EACH	34															34	
			211	WATER CONTROL	LS	1															1	
			212	SEEDING (NATIVE)	ACRE	0.82															0.82	

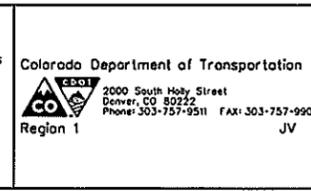
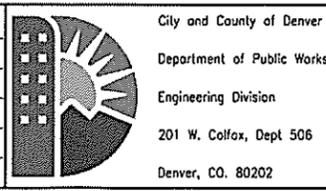
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE	
SUMMARY OF APPROXIMATE QUANTITIES	
Designer:	SRF
Detailer:	SRF
Sheet Subset:	SAQ

Project No./Code	NHPP 2873-172 SA 19957
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Subset Sheets:	3 of 13

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BOOK	PAGE	SHEET																			
			212	SOIL CONDITIONING	ACRE	0.98															0.98
			212	LANDSCAPE RESTORATION	LS	1															1
			213	METAL EDGER	LF	135															135
			213	MULCHING (WEED FREE HAY)	ACRE	0.55															0.55
			213	MULCHING (WOOD)	CF	488															488
			213	MULCHING (DECORATIVE)	CF	1,185															1,185
			213	TREE PLANTER (GRATES)	EACH	31															31
			213	LANDSCAPE BOULDER	EACH	8															8
			214	LANDSCAPE MAINTENANCE (24 MONTHS)	LS	1															1
			214	DECIDUOUS TREE (2 INCH CALIPER)	EACH	16															16
			214	DECIDUOUS TREE (3 INCH CALIPER)	EACH	38															38
			214	DECIDUOUS SHRUB (5 GALLON CONTAINER)	EACH	174															174
			214	EVERGREEN SHRUB (5 GALLON CONTAINER)	EACH	16															16
			214	PERENNIALS (1 GALLON CONTAINER)	EACH	666															666
			216	SOIL RETENTION BLANKET (STRAW/COCONUT) (PHOTODEGRADABLE CLASS 1)	SY	1,320															1,320
			240	WILDLIFE BIOLOGIST	HR	40															40
			240	REMOVAL OF NESTS	HR	40															40
			250	ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT	LS	1															1
			250	PROJECT SPECIFIC RACS MANAGEMENT PLAN	LS	1															1
			250	MATERIALS MANAGEMENT PLAN SUPERVISOR	HOUR	2,816															2,816
			250	HEALTH AND SAFETY OFFICER	HOUR	200															200
			250	CERTIFIED ASBESTOS BUILDING INSPECTOR	HOUR	1,408															1,408
			250	IMPORT MATERIAL SAMPLING EVENT	EACH	2															2
			250	MATERIAL HANDLING (STOCKPILE)	CY	2,556															2,556
			250	SOLID WASTE DISPOSAL	CY	2,556															2,556
			250	HAUL NON-HAZARDOUS WASTE	CY	2,000															2,000
			304	AGGREGATE BASE COURSE (CLASS 6)	CY	7,049															7,049

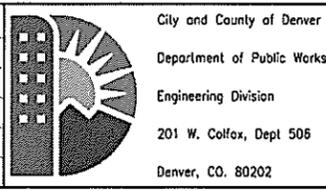
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Engineering Division
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Denver, CO. 80202

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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE			
SUMMARY OF APPROXIMATE QUANTITIES			
Designer:	SRF	Structure	
Detailer:	SRF	Numbers	
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Project No./Code
NHPP 2873-172
SA 19957
2011-PROJMSTR-0000364
Sheet Number 17

INDEX	INDEX ITEM NO	CONTRACT ITEM	UNIT	CC 0881-025																PROJECT TOTALS	
				PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST
BOOK	PAGE	SHEET																			
			403	HOT MIX ASPHALT (PATCHING) (ASPHALT)	TON	869															869
			403	HOT MIX ASPHALT (GRADING S) (100) (PG 64-22)	TON	668															668
			403	HOT MIX ASPHALT (GRADING SX) (100) (PG 76-28)	TON	397															397
			412	CONCRETE PAVEMENT (8 INCH)	SY	2,741															2,741
			412	CONCRETE PAVEMENT (10.5 INCH)	SY	26,561															26,561
			412	CONCRETE PAVEMENT (10.5 INCH) (FAST TRACK)	SY	405															405
			412	CONCRETE PAVEMENT (10.5 INCH) (SPECIAL)	SY	875															875
			412	CONCRETE PAVEMENT (11 INCH)	SY	599															599
			412	CONCRETE PAVEMENT (11 INCH) (FAST TRACK)	SY	619															619
			420	GEOTEXTILE (SEPARATOR) (CLASS I)	SY	29,209															29,209
			503	DRILLED CAISSON (30 INCH)	LF	1,112															1,112
			503	DRILLED CAISSON (36 INCH)	LF	93															93
			503	DRILLED CAISSON (48 INCH)	LF	51															51
			504	RETAINING WALL (BOULDER)	SF	72															72
			506	RIPRAP (6 INCH)	CY	4															4
			514	PEDESTRIAN RAILING (STEEL)	LF	93															93
			514	PEDESTRIAN RAILING (STEEL) (SPECIAL)	LF	50															50
			601	CONCRETE CLASS B	CY	5															5
			601	CONCRETE CLASS D (WALL)	CY	139															139
			601	STRUCTURAL CONCRETE COATING	SY	222															222
			602	REINFORCING STEEL	LB	14,764															14,764
			602	REINFORCING STEEL (EPOXY COATED)	LB	240															240
			603	15 INCH REINFORCED CONCRETE PIPE (COMPLETE IN PLACE)	LF	73															73
			603	18 INCH REINFORCED CONCRETE PIPE (COMPLETE IN PLACE)	LF	992															992
			603	24 INCH REINFORCED CONCRETE PIPE (COMPLETE IN PLACE)	LF	728															728
			603	30 INCH REINFORCED CONCRETE PIPE (COMPLETE IN PLACE)	LF	207															207
			603	36 INCH REINFORCED CONCRETE PIPE (COMPLETE IN PLACE)	LF	30															30

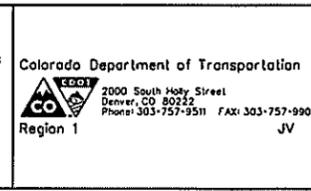
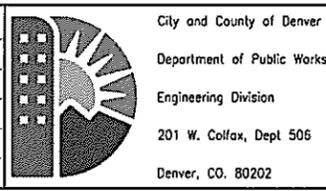
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
SUMMARY OF APPROXIMATE QUANTITIES

Designer: SRF
Detailer: SRF
Sheet Subset: SAQ

Structure Numbers
Subset Sheets: 5 of 13

Project No./Code
NHPP 2873-172
SA 19957

2011-PROJMSTR-0000364
Sheet Number 18

INDEX	INDEX ITEM NO	CONTRACT ITEM	UNIT	CC 0881-025																PROJECT TOTALS	
				PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST
BOOK	PAGE	SHEET																			
			603	42 INCH REINFORCED CONCRETE PIPE (COMPLETE IN PLACE)	LF	613															613
			603	54 INCH REINFORCED CONCRETE PIPE (COMPLETE IN PLACE)	LF	220															220
			603	30x19 INCH REINFORCED CONCRETE PIPE ELLIPTICAL (COMPLETE IN PLACE)	LF	67															67
			603	34x22 INCH REINFORCED CONCRETE PIPE ELLIPTICAL (COMPLETE IN PLACE)	LF	244															244
			603	45x29 INCH REINFORCED CONCRETE PIPE ELLIPTICAL (COMPLETE IN PLACE)	LF	48															48
			603	54 INCH REINFORCED CONCRETE PIPE (JACKED)	LF	75															75
			604	INLET NO 14 L 6 (5 FOOT)	EACH	4															4
			604	INLET NO 14 L 6 (10 FOOT)	EACH	2															2
			604	INLET NO 14 L 9 (5 FOOT)	EACH	4															4
			604	INLET NO 14 L 12 (5 FOOT)	EACH	6															6
			604	INLET NO 14 L 12 (10 FOOT)	EACH	1															1
			604	INLET NO 14 L 15 (5 FOOT)	EACH	3															3
			604	INLET NO 14 L 15 (10 FOOT)	EACH	2															2
			604	INLET NO 16 L 3'-4" VALLEY (5 FOOT)	EACH	1															1
			604	MANHOLE STANDARD (4' ID) (5 FOOT)	EACH	4															4
			604	MANHOLE STANDARD (4' ID) (10 FOOT)	EACH	3															3
			604	MANHOLE STANDARD (5' ID) (5 FOOT)	EACH	1															1
			604	MANHOLE STANDARD (5' ID) (10 FOOT)	EACH	3															3
			604	MANHOLE STANDARD (6' ID) (5 FOOT)	EACH	2															2
			604	MANHOLE STANDARD (6' ID) (15 FOOT)	EACH	1															1
			604	MANHOLE STANDARD TYPE B (15 FOOT)	EACH	3															3
			604	MANHOLE STANDARD TYPE B (SPECIAL) (10 FOOT)	EACH	1															1
			604	MANHOLE STANDARD TYPE B (SPECIAL) (15 FOOT)	EACH	2															2
			604	MANHOLE STANDARD TYPE P (20 FOOT)	EACH	2															2
			605	4 INCH NON-PERFORATED PIPE UNDERDRAIN	LF	558															558
			605	4 INCH PERFORATED PIPE UNDERDRAIN	LF	462															462
			606	GUARDRAIL TYPE 3 (6-3 POST SPACING) (31 IN. MGS)	LF	32															32

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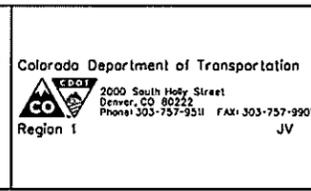
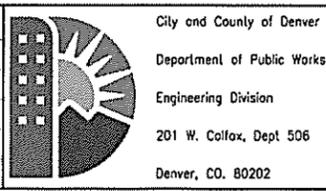
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE			
SUMMARY OF APPROXIMATE QUANTITIES			
Designer:	SRF	Structure	
Detailer:	SRF	Numbers	
Sheet Subset:	SAQ	Subset Sheets:	6 of 13

Project No./Code
NHPP 2873-172 SA 19957
2011-PROJMSTR-0000364
Sheet Number 19

INDEX			INDEX ITEM NO	CONTRACT ITEM	UNIT	CC 0881-025														PROJECT TOTALS		
BOOK	PAGE	SHEET				PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	
			606	TRANSITION TYPE 3G (31 IN. MGS)	EACH	1															1	
			606	TRANSITION TYPE 3J (31 IN. MGS)	EACH	1															1	
			606	END ANCHORAGE TYPE 3K (31 IN. MGS)	EACH	1															1	
			606	BRIDGE RAIL TYPE 10M (SPECIAL)	LF	93															93	
			607	FENCE (PLASTIC)	LF	500															500	
			607	FENCE (TEMPORARY)	LF	990															990	
			607	FENCE CHAIN LINK (72 INCH)	LF	324															324	
			607	24 FOOT GATE DOUBLE (CHAIN LINK) (ROLLING)	EACH	1															1	
			607	30 FOOT GATE DOUBLE (CHAIN LINK) (ROLLING)	EACH	2															2	
			607	36 FOOT GATE DOUBLE (CHAIN LINK) (ROLLING)	EACH	1															1	
			608	CONCRETE SIDEWALK	SY	4,773															4,773	
			608	CONCRETE SIDEWALK (SPECIAL)	SY	141															141	
			608	CONCRETE SIDEWALK (6 INCH PATTERNED CONCRETE)	SF	2,093															2,093	
			608	CONCRETE SIDEWALK (8 INCH) (SPECIAL)	SY	157															157	
			608	CONCRETE SIDEWALK (AMENITY ZONE)	SY	1,517															1,517	
			608	CONCRETE SIDEWALK (STAIRS)	SF	146															146	
			608	CONCRETE CURB RAMP	SY	502															502	
			608	SIDEWALK CHASE DRAIN	LF	68															68	
			609	CURB TYPE 2 (SECTION B)	LF	456															456	
			609	CURB AND GUTTER TYPE 2 (SECTION I-B)	LF	2,598															2,598	
			609	CURB AND GUTTER TYPE 2 (SECTION II-B)	LF	5,259															5,259	
			609	CURB AND GUTTER TYPE 2 (SECTION II-B) (SPECIAL)	LF	34															34	
			609	CURB AND GUTTER TYPE 2 (SECTION II-M)	LF	115															115	
			609	4 INCH MOUNTABLE CURB (OUTFALL)	LF	1,956															1,956	
			609	GUTTER TYPE 2 (8 FOOT)	LF	27															27	
			609	CURB TYPE 4 (SECTION B)	LF	525															525	
			609	CURB (BARRIER)	LF	710															710	

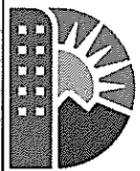
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 Engineering Division
 201 W. Colfax, Dept 505
 Denver, CO. 80202

Colorado Department of Transportation
 2000 South Holly Street
 Denver, CO 80222
 Phone: 303-757-9511 FAX: 303-757-9907
 Region 1 JV

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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE			
SUMMARY OF APPROXIMATE QUANTITIES			
Designer:	SRF	Structure	
Detailer:	SRF	Numbers	
Sheet Subset:	SAQ	Subset Sheets:	7 of 13

Project No./Code
 NHPP 2873-172
 SA 19957
 2011-PROJMSTR-0000364
 Sheet Number 20

INDEX	INDEX ITEM NO	CONTRACT ITEM	UNIT	CC 0881-025																PROJECT TOTALS		
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BOOK	PAGE	SHEET																				
			610	MEDIAN COVER MATERIAL (PATTERNED CONCRETE)	SF	12,091															12,091	
			610	MEDIAN COVER MATERIAL (COLORED CONCRETE)	SF	720															720	
			613	1/2 INCH ELECTRICAL CONDUIT (PLASTIC)	LF	20															20	
			613	3/4 INCH ELECTRICAL CONDUIT	LF	290															290	
			613	2 INCH ELECTRICAL CONDUIT (PLASTIC)	LF	5,755															5,755	
			613	2 INCH ELECTRICAL CONDUIT (BORED)	LF	800															800	
			613	3 INCH ELECTRICAL CONDUIT (PLASTIC)	LF	3,885															3,885	
			613	3 INCH ELECTRICAL CONDUIT (BORED)	LF	1,600															1,600	
			613	4 INCH ELECTRICAL CONDUIT (PLASTIC)	LF	1,640															1,640	
			613	PULL BOX (24"x36"x12") = TYPE B (TRAFFIC)	EACH	10															10	
			613	PULL BOX (SPECIAL)	EACH	8															8	
			613	WIRING	LS	1															1	
			613	LIGHT STANDARD METAL (35 FOOT)	EACH	31															31	
			613	CONCRETE FOUNDATION PAD	EACH	4															4	
			613	LIGHT STANDARD FOUNDATION	EACH	31															31	
			613	LIGHTING CONTROL CENTER	EACH	4															4	
			613	LUMINAIRE (LED) (14,000 LUMENS)	EACH	39															39	
			613	TEMPORARY LIGHTING	LS	1															1	
			614	SIGN PANEL (CLASS 1)	SF	522															522	
			614	STEEL SIGN POST (2x2 INCH TUBING)	LF	564															564	
			614	PEDESTRIAN SIGNAL FACE (16) (COUNTDOWN)	EACH	16															16	
			614	TRAFFIC SIGNAL FACE (12-12-12)	EACH	39															39	
			614	TRAFFIC SIGNAL FACE (12-12-12-12)	EACH	4															4	
			614	TRAFFIC SIGNAL CONTROLLER CABINET	EACH	2															2	
			614	PEDESTRIAN PUSH BUTTON	EACH	8															8	
			614	INTERSECTION DETECTION SYSTEM (CAMERA)	EACH	8															8	
			614	EMERGENCY VEHICLE TRAFFIC SIGNAL PRIORITY CONTROL SYSTEM	EACH	2															2	

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Sheet Revisions		
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INDEX	INDEX ITEM NO	CONTRACT ITEM	UNIT	CC 0881-025																PROJECT TOTALS	
				PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST
BOOK	PAGE	SHEET																			
			614	TRAFFIC SIGNAL-LIGHT POLE STEEL (1-30 FOOT MAST ARM)	EACH	1															1
			614	TRAFFIC SIGNAL-LIGHT POLE STEEL (1-40 FOOT MAST ARM)	EACH	1															1
			614	TRAFFIC SIGNAL-LIGHT POLE STEEL (1-50 FOOT MAST ARM)	EACH	2															2
			614	TRAFFIC SIGNAL-LIGHT POLE STEEL (1-55 FOOT MAST ARM)	EACH	1															1
			614	TRAFFIC SIGNAL-LIGHT POLE STEEL (1-60 FOOT MAST ARM)	EACH	3															3
			614	TRAFFIC SIGNAL PEDESTAL POLE STEEL	EACH	1															1
			614	TELEMETRY (FIELD)	EACH	3															3
			614	TRAFFIC SIGNAL CONTROLLER (SOLID STATE) (FULL-ACTUATED) (12 PHASE)	EACH	2															2
			614	TEST FIBER OPTIC CABLE	LS	1															1
			614	FIBER OPTIC CABLE (SPECIAL)	LF	3,050															3,050
			614	CLOSED CIRCUIT TELEVISION CAMERA	EACH	1															1
			614	ELECTRIC METER (PEDESTAL)	EACH	3															3
			619	WATER METER	EACH	39															39
			619	METER PIT (24 INCH)	EACH	37															37
			619	METER VAULT	EACH	2															2
			619	CURB STOP AND BOX	EACH	40															40
			619	3 INCH DUCTILE IRON PIPE	LF	31															31
			619	6 INCH DUCTILE IRON PIPE	LF	131															131
			619	8 INCH DUCTILE IRON PIPE	LF	138															138
			619	3/4 INCH COPPER PIPE	LF	809															809
			619	1 INCH COPPER PIPE	LF	291															291
			619	1-1/2 INCH COPPER PIPE	LF	38															38
			619	3/4 INCH COPPER PIPE CONNECTIONS	EACH	32															32
			619	1 INCH COPPER PIPE CONNECTIONS	EACH	6															6
			619	1-1/2 INCH COPPER PIPE CONNECTIONS	EACH	2															2
			619	6 INCH PLASTIC PIPE (C900)	LF	989															989
			619	8 INCH PLASTIC PIPE (C900)	LF	855															855

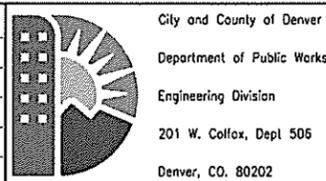
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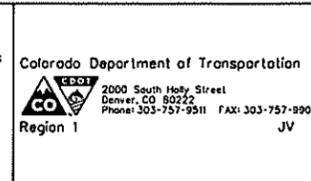


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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
 SUMMARY OF APPROXIMATE QUANTITIES
 Designer: SRF
 Detailer: SRF
 Sheet Subset: SAQ
 Structure Numbers
 Subset Sheets: 9 of 13

Project No./Code
 NHPP 2873-172
 SA 19957
 2011-PROJMSTR-0000364
 Sheet Number 22

INDEX	INDEX ITEM NO	CONTRACT ITEM	UNIT	CC 0881-025														PROJECT TOTALS		
				PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	
	619	3 INCH GATE VALVE & VALVE BOX	EACH	2															2	
	619	6 INCH GATE VALVE & VALVE BOX	EACH	7															7	
	619	8 INCH GATE VALVE & VALVE BOX	EACH	12															12	
	619	6 INCH TAPPING VALVE & VALVE BOX	EACH	3															3	
	619	8 INCH TAPPING VALVE & VALVE BOX	EACH	1															1	
	619	6 INCH SWIVEL TEE (ALL BRANCH SIZES)	EACH	2															2	
	619	8 INCH SWIVEL TEE (ALL BRANCH SIZES)	EACH	6															6	
	619	6 INCH TEE (ALL BRANCH SIZES)	EACH	3															3	
	619	8 INCH TEE (ALL BRANCH SIZES)	EACH	4															4	
	619	6 INCH HORIZONTAL BEND (ALL ANGLES)	EACH	4															4	
	619	8 INCH HORIZONTAL BEND (ALL ANGLES)	EACH	2															2	
	619	6 INCH VERTICAL BEND (ALL ANGLES)	EACH	10															10	
	619	8 INCH VERTICAL BEND (ALL ANGLES)	EACH	28															28	
	619	6 INCH TAPPING SLEEVE (ALL BRANCH SIZES)	EACH	2															2	
	619	8 INCH TAPPING SLEEVE (ALL BRANCH SIZES)	EACH	1															1	
	619	30 INCH TAPPING SLEEVE (ALL BRANCH SIZES)	EACH	1															1	
	619	FIRE HYDRANT ASSEMBLY	EACH	7															7	
	619	FIRE HYDRANT ASSEMBLY (EXTRA DEPTH)	EACH	3															3	
	620	FIELD OFFICE (CLASS 1)	EACH	1															1	
	620	SANITARY FACILITY	EACH	1															1	
	621	DETOUR PAVEMENT	SY	1,750															1,750	
	622	MEDIAN CONCRETE PLANTER WALL	LF	937															937	
	622	MASONRY WORK SANDSTONE CURB (MEDIAN WALL)	LF	254															254	
	622	MASONRY WORK SANDSTONE FACE (MEDIAN WALL)	LF	140															140	
	622	STONE END MARKERS	EACH	36															36	
	623	1 INCH BACKFLOW PREVENTER ASSEMBLY WITH CONCRETE PAD	EACH	2															2	
	623	BACKFLOW ENCLOSURE ASSEMBLY	EACH	2															2	

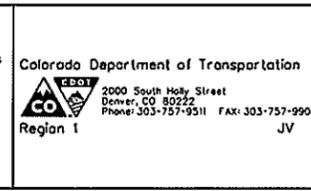
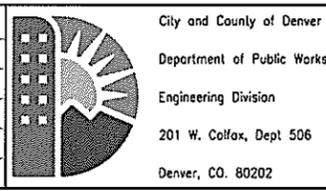
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
 SUMMARY OF APPROXIMATE QUANTITIES
 Designer: SRF
 Detailer: SRF
 Sheet Subset: SAQ
 Structure Numbers
 Subset Sheets: 10 of 13

Project No./Code
 NHPP 2873-172
 SA 19957
 2011-PROJMSTR-0000364
 Sheet Number 23

INDEX			INDEX ITEM NO	CONTRACT ITEM	UNIT	CC 0881-025														PROJECT TOTALS		
BOOK	PAGE	SHEET				PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	
			623	PLUMBER	EACH	2															2	
			623	1-1/2" HYDROMETER	EACH	2															2	
			623	RADIO REMOTE WITH TRANCEIVER (TURNOVER ITEM) - PARKS	EACH	2															2	
			623	ELECTRICIAN - CONTROLLER HOOKUP	EACH	2															2	
			623	120 VOLT ELECTRICAL CONDUCTOR	LF	100															100	
			623	12 STATION AUTOMATIC CENTRAL CONTROLLER ASSEMBLY - PARKS	EACH	2															2	
			623	RAIN SENSOR	EACH	2															2	
			623	2-WIRE COMMUNICATION CABLE	LF	4,580															4,580	
			623	1 INCH TYPE K COPPER PIPING	LF	20															20	
			623	1 INCH STOP & WASTE VALVE ASSEMBLY WITH VALVE BOX	EACH	2															2	
			623	1-1/2 INCH GATE VALVE	EACH	23															23	
			623	1 INCH QUICK COUPLER VALVE	EACH	12															12	
			623	3/4 INCH DRAIN VALVE	EACH	13															13	
			623	1-1/2 INCH CL200 PVC MAINLINE	LF	4,580															4,580	
			623	2 INCH CL160 PVC SLEEVES	LF	2,725															2,725	
			623	2 INCH HDPE SLEEVES	LF	1,675															1,675	
			623	4 INCH CL160 PVC SLEEVES	LF	1,945															1,945	
			623	4 INCH HDPE SLEEVES	LF	1,675															1,675	
			623	1 INCH 80# NSF POLY LATERAL	LF	2,280															2,280	
			623	1 INCH AUTOMATIC CONTROL VALVE	EACH	9															9	
			623	1 INCH DRIP VALVE KIT WITH BALL VALVE AND BASKET FILTER	EACH	4															4	
			623	0.5 GPM BUBBLER HEAD ASSEMBLY	EACH	68															68	
			623	12 INCH POP-UP SPRAY HEAD WITH NOZZLE	EACH	8															8	
			623	SUBSURFACE DRIPPERLINE	LF	2,425															2,425	
			623	DRIPLINE BLOWOUT WITH INDICATOR POPUP	EACH	8															8	
			625	CONSTRUCTION SURVEYING	LS	1															1	
			625	CONSTRUCTION SURVEYING (HOURLY)	HR	150															150	

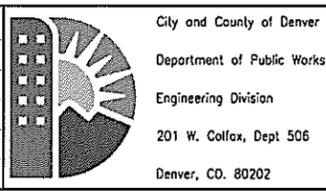
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 Denver, CO 80222
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 Region 1 JV

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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
 SUMMARY OF APPROXIMATE QUANTITIES
 Designer: SRF
 Detailer: SRF
 Sheet Subset: SAQ

Project No./Code
 NHPP 2873-172
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 2011-PROJMSTR-0000364
 Sheet Number 24

Structure Numbers
 Subset Sheets: 11 of 13

INDEX	INDEX ITEM NO	CONTRACT ITEM	UNIT	CC 0881-025														PROJECT TOTALS	
				PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST	PLAN	AS CONST
BOOK	PAGE	SHEET																	
			626	MOBILIZATION	LS	1													1
			626	PUBLIC INFORMATION SERVICES (TIER II)	LS	1													1
			627	PAVEMENT MARKING PAINT	GAL	150													150
			627	RAISED PAVEMENT MARKER	EACH	41													41
			627	PREFORMED THERMOPLASTIC PAVEMENT MARKING (60 MIL) (WORD-SYMBOL)	SF	258													258
			627	PREFORMED THERMOPLASTIC PAVEMENT MARKING (60 MIL) (XWALK-STOPLINE)	SF	2,611													2,611
			627	PREFORMED PLASTIC PAVEMENT MARKING (TYPE II)(INLAID)	SF	2,502													2,502
			627	THERMOPLASTIC PAVEMENT MARKING	SF	1,736													1,736
			629	SURVEY MONUMENT (TYPE 1)	EACH	72													72
			629	SURVEY MONUMENT (TYPE 3A)	EACH	12													12
			629	SURVEY MONUMENT (TYPE 6)	EACH	18													18
			630	FLAGGING	HR	3,600													3,600
			630	UNIFORMED TRAFFIC CONTROL	HR	80													80
			630	TRAFFIC CONTROL INSPECTION	DAY	171													171
			630	TRAFFIC CONTROL MANAGEMENT	DAY	429													429
			630	BARRICADE (TYPE 3 M-B) (TEMPORARY)	EACH	16													16
			630	CONSTRUCTION TRAFFIC SIGN (PANEL SIZE A)	EACH	33													33
			630	CONSTRUCTION TRAFFIC SIGN (PANEL SIZE B)	EACH	97													97
			630	PORTABLE MESSAGE SIGN PANEL	EACH	2													2
			630	ADVANCED WARNING FLASHING OR SEQUENCING ARROW PANEL (TYPE C)	EACH	2													2
			630	DRUM CHANNELIZING DEVICE	EACH	250													250
			630	CONCRETE BARRIER (TEMPORARY)	LF	1,000													1,000
			630	TRAFFIC CONE	EACH	100													100
			630	IMPACT ATTENUATOR (TEMPORARY)	EACH	2													2
			630	TRAFFIC SIGNAL (TEMPORARY)	EACH	2													2
			700	F/A PARTNERING	F/A	1													1

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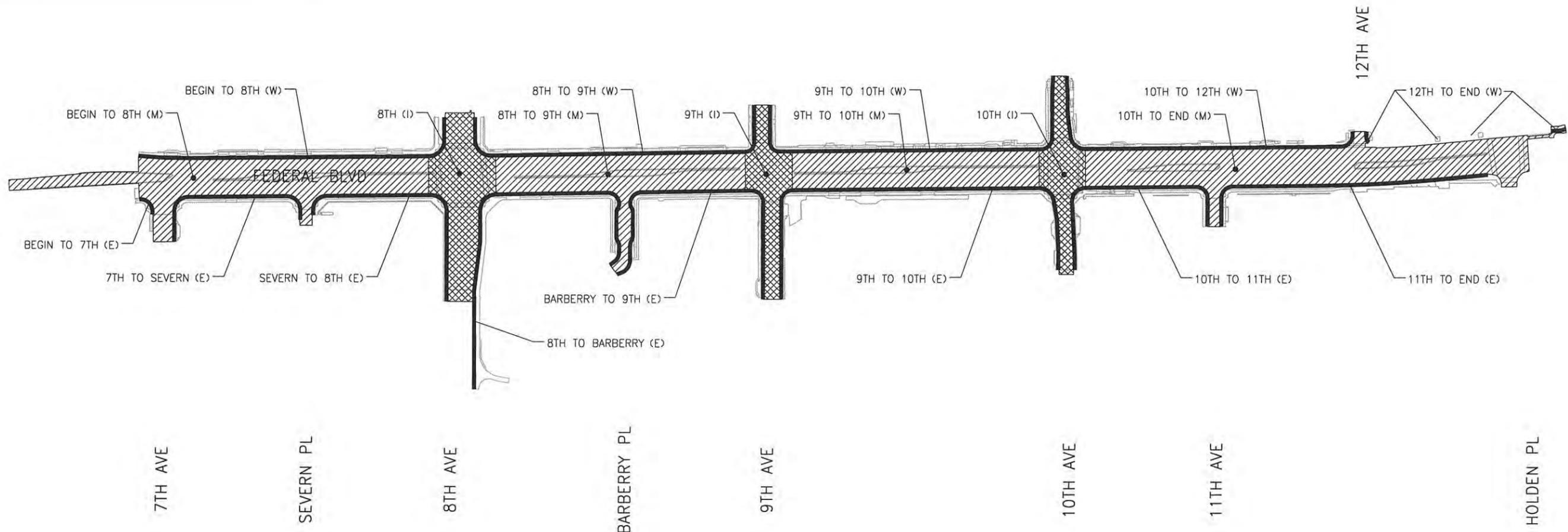
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 Engineering Division
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 SUMMARY OF APPROXIMATE QUANTITIES
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(M) & (I) KEY

LOCATION	STATION	
	FROM	TO
BEGIN TO 8TH (M)	BEGIN	21+63.98
8TH (I)	21+63.98	23+12.48
8TH (M) TO 9TH (M)	23+12.48	28+63.78
9TH (I)	28+63.78	29+67.87
9TH (M) TO 10TH (M)	29+67.87	35+14.48
10TH (I)	35+14.48	36+16.45
10TH (M) TO END	36+16.45	END

M = MIDDLE (INSIDE LIP OF CURB)
 W = WEST (INCLUDING CURB AND BEHIND)
 E = EAST (INCLUDING CURB AND BEHIND)
 I = INTERSECTION (INSIDE LIP OF CURB)

NOTES

- KEY MAP DOES NOT NECESSARILY APPLY TO ALL TABBED QUANTITIES, SEE PROJECT TABULATIONS FOR DETAILS.
- EXISTING ELEMENTS ARE FROM THE EXISTING LIP LOCATION.
- SEE SUBSETS FOR ADDITIONAL QUANTITIES.

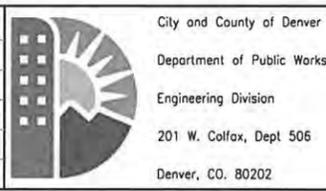


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 CONSULTING ENGINEERS

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 Engineering Division
 201 W. Colfax, Dept 505
 Denver, CO. 80202

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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE PROJECT TABULATIONS KEY MAP			
Designer:	SRF	Structure Numbers	
Detailer:	SRF	Structure Numbers	
Sheet Subset:	PROJTAB	Subset Sheets:	1 of 4

Project No./Code	NHPP 2873-172 SA 19957
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TABULATION OF REMOVALS

ITEM NO.	201					202											
	CLEARING AND GRUBBING	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	REMOVAL OF TREE	REMOVAL OF BOLLARD	REMOVAL OF POWER OUTLET	REMOVAL OF WHEEL STOP	REMOVAL OF INLET	REMOVAL OF MANHOLE	REMOVAL OF PIPE	REMOVAL OF SIDEWALK	REMOVAL OF CURB AND GUTTER	REMOVAL OF CURB	REMOVAL OF CONCRETE PAVEMENT	REMOVAL OF ASPHALT MAT	REMOVAL OF SIGN (SPECIAL)	REMOVAL OF FENCE	REMOVAL OF GUARDRAIL TYPE 3
LOCATION	LS	LS	EACH	EACH	EACH	EACH	EACH	EACH	LF	SY	LF	LF	SY	SY	EACH	LF	LF
PROJECT	1	1															
BEGIN TO 8TH (W)				1					393.2	743.3			189.8	273.6		172	
BEGIN TO 7TH (E)									65.5	115.9			15.8				
BEGIN TO 8TH (M)										26.8			487.3	4,522.8			
7TH TO SEVERN (E)								1	276.5	410.6			1,105.7	465.1	2	100	
SEVERN TO 8TH (E)			5		10				597.3	779.9			139.9		1	514	
8TH (I)											226		10.4	3,342.7			
8TH TO 9TH (W)				3					356.1	778.0			334.8	204.4			
8TH TO BARBERRY (E)									771.5	948.5			69.1	1,330.8	1	180	216
8TH TO 9TH (M)													422.5	3,906.7			
BARBERRY TO 9TH (E)				2		14			178.0	863.8			93.9	1,438.7			
9TH (I)											2	1	92				
9TH TO 10TH (W)				5					459.5	887.9			39.2	564.1		272.5	
9TH TO 10TH (E)			4	7					787.9	1,419.1				137.6	2,042.0		353
9TH TO 10TH (M)													392.8	3,013.8			
10TH (I)								1					46.8	1,993.1			
10TH TO 12TH (W)				2					395.1	807.8			208.6	133.9			
10TH TO 11TH (E)			1						310.5	790.3			316.8	117.5	1		
10TH TO END (M)													265.1	7,723.4			
11TH TO END (E)			11						672.0	942.1			176.2	285.7			
12TH TO END (W)									72.8	59.9			4.2				
TOTAL	1	1	21	20	10	14	8	2	318	5,336	9,574	40	5,051	33,179	5	1,319	216

NOTE: SEE SUBSETS FOR ADDITIONAL REMOVALS.

TABULATION OF RESETS & ADJUSTS

ITEM NO.	210										
	RESET STRUCTURE					RESET WHEEL STOP	RESET LIGHT STANDARD	RESET GATE	RESET CHAIN LINK FENCE	RESET TREE GRATE	ADJUST MANHOLE
LOCATION	(SIGN 2)	(SIGN 3)	(SIGN 4)	(SIGN 5)	(SIGN 6)	EACH	EACH	EACH	LF	EACH	EACH
BEGIN TO 8TH (M)											5
8TH (I)											1
8TH TO 9TH (M)											2
BARBERRY TO 9TH (E)								1	121		
9TH (I)											4
9TH TO 10TH (E)	1										
9TH TO 10TH (M)											1
10TH TO 12TH (W)				1			5				
10TH TO 11TH (E)		1						1			
11TH TO END (E)			1		1					1	
TOTAL	1	1	1	1	1	5	1	1	121	1	13

- NOTES:
 1. RESET STRUCTURE (SIGN 1) HAS BEEN OMITTED.
 2. SEE SUBSETS FOR ADDITIONAL RESETS & ADJUSTS.

TABULATION OF GUARDRAIL ITEMS

ITEM NO.	606			
	GUARDRAIL TYPE 3 (6-3 POST SPACING)	TRANSITION		END ANCHORAGE TYPE 3K
LOCATION	LF	TYPE 3G	TYPE 3J	EACH
8TH TO BARBERRY (E)	32	1	1	1
TOTAL	32	1	1	1

TABULATION OF FENCING ITEMS

ITEM NO.	607				
	FENCE (TEMPORARY)	FENCE CHAIN LINK (72 INCH)	24 FOOT GATE DOUBLE (CHAIN LINK) (ROLLING)	30 FOOT GATE DOUBLE (CHAIN LINK) (ROLLING)	36 FOOT GATE DOUBLE (CHAIN LINK) (ROLLING)
LOCATION	LF	LF	EACH	EACH	EACH
BEGIN TO 8TH (W)	191	103	1		1
SEVERN TO 8TH (E)	514				
9TH TO 10TH (E)	285	221		2	
TOTAL	990	324	1	2	1

REMOVAL NOTES

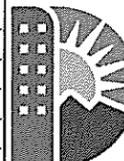
- REMOVAL OF BUS SHELTERS WILL BE DONE BY RTD. CONTACT PETE MUNIZ WITH RTD AT 303-299-6561 TO COORDINATE.
- TWO WEEKS PRIOR TO REMOVAL OF TRANSIT AMENITIES AT A BUS STOP, COORDINATE REMOVAL WITH PUBLIC WORKS RIGHT-OF-WAY SERVICES CONSTRUCTION ENGINEERING AT (303) 446-3469.

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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE	
PROJECT TABULATIONS	
TABULATIONS	
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 CONSULTING ENGINEERS



AD SUBMITTAL - JANUARY 2, 2018

TABULATION OF SURFACING ITEMS

ITEM NO.	304		403										412						420					
	AGREGATE BASE COURSE (CLASS 6)		HOT MIX ASPHALT										CONCRETE PAVEMENT						GEOTEXTILE (SEPARATOR) (CLASS 1)					
			(GRADING S) (100) (PG 64-22)					(GRADING SX) (100) (PG 76-28)		(PATCHING) (ASPHALT)			(8 INCH)	(10.5 INCH)	(10.5 INCH) (FAST TRACK)**	(10.5 INCH) (SPECIAL)	(11 INCH)	(11 INCH) (FAST TRACK)						
	AREA	UNIT	AREA	BOTTOM THICKNESS	UNIT	MIDDLE THICKNESS	UNIT	TOTAL	TOP LIFT THICKNESS	UNIT	AREA	THICKNESS	UNIT	THICKNESS	UNIT	UNIT	SY	SY	SY	SY	SY	SY	SY	
SY	CY	SY	INCH	TON	INCH	TON	TON	INCH	TON	SY	INCH	TON	INCH	TON	TON	SY	SY	SY	SY	SY	SY	SY	SY	
BEGIN TO 8TH (W)	605	94								132.6	4.0	29.2	3.0	21.9	51.1	471.9								
BEGIN TO 8TH (M)	6056	988	390.5	4.0	86.0		86.0	3.0	64.5								5665.3						5794.6	
7TH TO SEVERN (E)	121	21														120.8								
8TH (I)	3946	540								71.0	10.5	WEST	41.1	3.0	11.8	52.9								
8TH TO 9TH (W)	543	86								203.2	11.5	EAST	128.6	3.0	33.6	162.2								
8TH TO BARBERRY (E)	111	19								98.1	4.0		21.6	3.0	16.2	37.8								
8TH TO 9TH (M)	5133	829	479.3	4.0	105.5		105.5	3.0	79.1															
BARBERRY TO 9TH (E)	450	61								259.3	4.0	57.1	3.0	42.8	99.9	189.8								4832.5
9TH (I)	2340	327	1146.0	4.0	252.2		252.2	3.0	189.1															1193.2
9TH TO 10TH (W)	699	108								164.3	4.0	36.2	3.0	27.2	63.4	534.4								
9TH TO 10TH (E)	883	116								570.5	4.0	125.6	3.0	94.2	219.8	312.1								
9TH TO 10TH (M)	4509	752															4508.8							4628.7
10TH (I)	1257	134	126.2	4.0	27.8	6.5	45.2	73.0	3.0	20.9	35.6	10.5	20.6	3.0	5.9	26.5								1094.7
10TH TO 12TH (W)	330	53								48.0	4.0	10.6	3.0	8.0	18.6	281.1								
10TH TO 11TH (E)	200	34														199.9								
10TH TO END (M)	8712	1428	260.3	4.0	57.3	6.5	93.1	150.4	3.0	43.0	182.3	10.5	105.3	3.0	30.1	135.4								8433.4
11TH TO END (E)	76	13								3.1	4.0	0.7	3.0	0.6	1.3	72.5								
12TH TO END (W)	4	1														3.2								
TOTAL		*						668		397					869	2,741	26,561	405	875	599	619			29,209

* FOR INFORMATION ONLY, SEE TABULATION OF AGGREGATE BASE COURSE
 ** ITEM SHALL ONLY BE USED UPON APPROVAL BY THE CITY

TABULATION OF CONCRETE ITEMS

ITEM NO.	304		608					609									
	AGREGATE BASE COURSE (CLASS 6)		CONCRETE SIDEWALK		CONCRETE SIDEWALK	CONCRETE CURB RAMP	SIDEWALK CHASE DRAIN	CURB TYPE 2 (SECTION B)	CURB AND GUTTER TYPE 2			4 INCH MOUNTABLE CURB (OUTFALL)	GUTTER TYPE 2 (8 FOOT)	CURB TYPE 4 (SECTION B)	CURB (BARRIER)		
	AREA	UNIT	(SPECIAL)	(8 INCH) (SPECIAL)	(STAIRS)	SY	LF	LF	(SECTION I-B)	(SECTION II-B)	(SECTION II-B) (SPECIAL)	(SECTION II-M)	LF	LF	LF	LF	
LOCATION	SY	CY	SY	SY	SF	SY	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	
BEGIN TO 8TH (W)	637.7	79.0	465.5			25.8											
BEGIN TO 7TH (E)	105.3	13.4	58.3			15.6											
BEGIN TO 8TH (M)	314.4	52.4							642.6					489.4	460.6		
7TH TO SEVERN (E)	325.5	42.1	187.0			32.0											
SEVERN TO 8TH (E)	599.0	76.7	369.9		35.4	46.0										496.5	
8TH (I)																	
8TH TO 9TH (W)	550.9	67.8	362.9		29.2	40.7	11.0								17.9		
8TH TO BARBERRY (E)	1363.3	167.3	896.9	140.8		41.7											
8TH TO 9TH (M)	277.5	46.3							509.6					489.4			
BARBERRY TO 9TH (E)	545.5	70.8	330.8			31.7	6.0	214.7									
9TH (I)																	
9TH TO 10TH (W)	728.1	88.9	530.7			54.2		73.4									
9TH TO 10TH (E)	818.4	106.1	416.0		78.0	51.6		139.3								212.9	
9TH TO 10TH (M)	303.8	50.6							482.4					611.4			
10TH (I)																	
10TH TO 12TH (W)	629.7	80.8	373.7		109.9	60.4	44.7	28.3									
10TH TO 11TH (E)	529.2	68.8	223.2		49.1	77.2	5.5		105.2						46.2		
10TH TO END (M)	279.5	46.6							640.5					365.6			
11TH TO END (E)	790.0	103.7	488.4			15.6			217.3								
12TH TO END (W)	106.7	13.4	69.4			9.2				12.6	33.8				26.1		
TOTAL		*	4,773	141	157	146	502	68	456	2,598	5,259	34	115	1,956	27	525	710

* FOR INFORMATION ONLY, SEE TABULATION OF AGGREGATE BASE COURSE

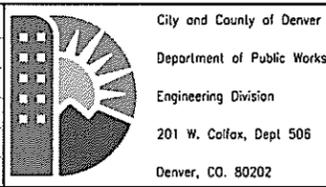
TABULATION OF AGGREGATE BASE COURSE (CLASS 6)

ITEM NO.	304
LOCATION	ARREGATE BASE COURSE (CLASS 6) CY
FROM TABULATION OF SURFACING ITEMS	5,604
SUBTOTAL	5,604
FROM TABULATION OF CONCRETE ITEMS	1,175
SUBTOTAL	1,175
FROM HARDSCAPE/LANDSCAPING NOTES SUBET	135
SUBTOTAL	135
TOTAL	6,914

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City and County of Denver
 Department of Public Works
 Engineering Division
 201 W. Colfax, Dept 506
 Denver, CO. 80202

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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
 PROJECT TABULATIONS
 TABULATIONS
 Designer: SRF
 Detailer: SRF
 Sheet Subset: PROJTAB

Project No./Code
 NHPP 2873-172
 SA 19957
 2011-PROJMSTR-0000364
 Sheet Number 29



AD SUBMITTAL - JANUARY 2, 2018

TABULATION OF EARTHWORK QUANTITIES

ITEM NO. INDEX			203	PROJECT TOTALS
BOOK	PAGE	SHEET	UNCLASSIFIED EXCAVATION (COMPLETE IN PLACE) FOR ROADWAY FROM COMPUTER SURFACE MODELS UNCLASSIFIED EXCAVATION	CU. YARDS
			FEDERAL BLVD. FEDERAL BLVD. (SUB-EXCAVATION) W. 7TH AVE. W. SEVERN PL. W. 8TH AVE. W. BARBERRY PL. W. 9TH AVE. W. 10TH AVE. W. 11TH AVE. W. HOLDEN PL.	7,442 4,371 179 132 116 160 89 331 144 11
			TOTAL	12,975
			REDUCTION FOR ITEM 250 - MATERIAL HANDLING FEDERAL - ROADWAY FEDERAL - SUB-EXCAVATION	-667 -338
			TOTAL FOR PAY QUANTITY	11,970
			MUCK EXCAVATION AS DIRECTED BY ENGINEER	CU. YARDS 500
			TOTAL FOR PAY QUANTITY	500
			FOR INFORMATION ONLY FOR ROADWAY FROM COMPUTER SURFACE MODELS EMBANKMENT (NET)	CU. YARDS
			FEDERAL BLVD. FEDERAL BLVD. (SUB-EXCAVATION) W. 7TH AVE. W. SEVERN PL. W. 8TH AVE. W. BARBERRY PL. W. 9TH AVE. W. 10TH AVE. W. 11TH AVE. W. HOLDEN PL.	682 4,371 3 2 454 37 350 98 5 1
			TOTAL	6,003
			UNCLASSIFIED EXCAVATION	TOTAL 11,970
			EMBANKMENT (NET)	TOTAL 6,003
			EMBANKMENT (NET) x FACTOR (1.15)	TOTAL 6,904
			EXCESS EXCAVATION	TOTAL 5,066
			EMBANKMENT FACTORED PLUS EXCESS EXCAVATION	TOTAL 11,970

NOTES:
1. QUANTITIES DO NOT REFLECT THE EXPORT OF TRENCH EXCAVATIONS.

TABULATION OF 250 ITEMS

ITEM NO.	ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT	MATERIALS MANAGEMENT PLAN SUPERVISOR	HEALTH AND SAFETY OFFICER	CERTIFIED ASBESTOS BUILDING INSPECTOR	IMPORT MATERIAL SAMPLING EVENT	250			SOLID WASTE DISPOSAL	HAUL NON-HAZARDOUS WASTE	PROJECT SPECIFIC RACS MANAGEMENT PLAN
						MATERIAL HANDLING (STOCKPILE)		UTILITIES			
						ROADWAY	SUB-EXCAVATION				
LOCATION	LS	HOUR	HOUR	HOUR	EA	CY	CY	CY	CY	CY	LS
PROJECT	1	2,816	200	1,408	2	667	338	1,551	2,556	2,000	1
TOTAL	1	2,816	200	1,408	2	2,556		2,556	2,000		1

TABULATION OF MISCELLANEOUS ITEMS

ITEM NO.	203	240	620	625	626				
	POTHOLING	WILDLIFE BIOLOGIST	REMOVAL OF NESTS	FIELD OFFICE (CLASS 1)	SANITARY FACILITY	CONSTRUCTION SURVEYING	CONSTRUCTION SURVEYING (HOURLY)	MOBILIZATION	PUBLIC INFORMATION SERVICES (TIER II)
LOCATION	HR	HR	HR	EACH	EACH	LS	HR	LS	LS
PROJECT	100	40	40	1	1	1	150	1	1
TOTAL	100	40	40	1	1	1	150	1	1

TABULATION OF FORCE ACCOUNT ITEMS

ITEM NO.	700				
	F/A PARTNERING	F/A ON-THE-JOB TRAINEE	F/A ADJUST UTILITIES	F/A REMOVALS	F/A ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT
LOCATION	F/A	F/A	F/A	F/A	F/A
PROJECT	1	1	1	1	1
TOTAL	1	1	1	1	1

*SEE SUMMARY OF TRAFFIC ENGINEERING AND STORMWATER MANAGEMENT SUBSETS FOR ADDITIONAL F/A ITEMS

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Last Modification Date: _____ Init.: _____		Sheet Revisions			City and County of Denver Department of Public Works Engineering Division 201 W. Colfax, Dept 506 Denver, CO. 80202	2000 South Holly Street Denver, CO 80222 Phone: 303-757-9511 FAX: 303-757-8907 Region 1 JV	As Constructed No Revisions: Revised: Void:	FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE PROJECT TABULATIONS TABULATIONS		Project No./Code NHPP 2873-172 SA 19957	
Drawing File Name: 1102188-007-Project Tabulations.dgn		Date:	Comments					Init.	Designer: _____ SRF Detailer: _____ SRF Sheet Subset: PROJTAB		Structure Numbers Subst Sheets: 4 of 4
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TO ESTABLISH GEOMETRIC CONTROL FOR THE CONSTRUCTION OF THIS PROJECT, THE DEPARTMENT HAS PROVIDED THE FOLLOWING INFORMATION:

Format *	
<input type="checkbox"/> 3D Design Modeling Electronic Files	Computer files
<input type="checkbox"/> Horizontal Control	Plan sheet
<input type="checkbox"/> Vertical Control	Plan sheet
<input type="checkbox"/> Roadway Alignment	Plan sheet, computer files
<input type="checkbox"/> Original Terrain Data	Computer files
<input type="checkbox"/> Other:	

* Specify the information format, i.e., plan sheet, computer disk, computer printout, or other. The information marked is either contained on the plans or is available from the Engineer.

TYPE OF PROJECT

- Landscaping
- Signalization
- Safety Improvement
- Asphalt Overlay
- Concrete Overlay
- Minor Widening
- Major Reconstruction
- New Roadway Construction
- Bridge Replacement
- Bridge Widening
- New Bridge
- Other: _____

SURVEY WORK TO BE PERFORMED BY OTHERS: _____

WORK PERFORMED BY THE CONTRACTOR'S SURVEYOR UNDER SECTION 625:

- Establish and Maintain Project Centerline or Engineer Approved Offset Line(s)
- Verification and Maintenance of Horizontal and Vertical Control
- Verify or Determine existing grades and alignments
- Verify or Determine existing topography
- Clearing and Grubbing Limits (Section 201)
- Removal Limits (Section 202)
- Reset Items (Section 210)
- Excavation and Embankment (Section 203)

- Excavation
 - Unclassified
 - Stripping
 - Muck
 - Rock
 - Borrow
 - Other: _____
 - Potholing

- Embankment
- Site Grading
- Erosion Control (Perm)
- Other: _____
- As Staked Earthwork Quantities (See General Notes)

- Landscaping
 - Top Soil (Section 207)
 - Seeding (Section 212)
 - Mulching (Section 213)
 - Planting (Section 214)
 - Herbicide (Section 217)
 - Other: _____

- Erosion Control (Section 208)
 - Seeding (Temp)
 - Silt Fence
 - Erosion Bales
 - Erosion Logs
 - Riprap (Temp)
 - Other: _____

- Roadway Bases
 - Untreated Subgrade
 - Treated Subgrade
 - Aggregate Base Course (Section 304)
 - Reconditioning
 - PMBB - Plant Mix Bituminous Base
 - Other: _____

	Slope Staking (Y/N)	Grid (Y/N)	Grade (Y/N)	Special Interval
Excavation	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-

	Slope Staking (Y/N)	Grid (Y/N)	Grade (Y/N)	Special Interval
Embankment	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-

	Grid (Y/N)	Grade (Y/N)	Special Interval	Special Offset
Roadway Bases	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-

- Pavements
 - HMA - Hot Mix Asphalt (Section 403)
 - Concrete (Section 412)
 - Heating & Scarifying Treatment
 - Prime Coat, Tack Coat & Rejuvenating Agent (Section 407)
 - Seal Coat or Chip Seal (Section 409)
 - Other: _____

	Grid (Y/N)	Special Interval	Special Offset
Pavements	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-

- Roadway Elements
 - Curb and Gutter (Section 609)
 - Drop inlets - alignment and grades (Section 604)
 - Retaining Walls
 - Guard Rail (Section 606)
 - Sidewalk (Section 608)
 - Overlay Stationing
 - Other: _____

	Tangent Interval	Curve Interval	Special Offset
Curb & Gutter	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-

- Riprap (Perm) (Section 506)
- Slope and Ditch Paving (Section 507)

	Left Interval	Center Interval	Right Interval
Stationing	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-

- Minor Structures
 - Structure Excavation limits (Section 206)
 - Culverts (Section 603)
 - Culverts w/ Headwalls and Wingwalls (Section 601)
 - Concrete Box Culverts w/ Headwalls and Wingwalls
 - Pipes (Section 603)
 - Sanitary Sewer
 - Storm Sewer
 - Water
 - Irrigation
 - Miscellaneous
 - Manholes (Section 604)
 - Inlets (Section 604)
 - Permanent Water Quality BMP (Section 208)
 - Other: _____

- Major Structures - Overhead Signs (Section 614), Concrete Box Culverts, Bridges - and all other structures assigned a structure number
 - Structure Excavation limits (Section 206)
 - Concrete Box Culverts (Section 603) w/ Headwalls and Wingwalls (Section 601)
 - Piling locations and cut off elevations (Section 502)
 - Caisson locations and elevations (Section 503)
 - Footing locations, alignment, and elevations
 - Abutment/Pier locations, alignment, and elevations
 - Wingwall skew angles/offsets
 - Structural concrete form locations
 - Substructure As-constructed survey required for Bridges (Subsection 601.12) and Overhead signs (S-614-50)
 - Bridge expansion joint(s) alignment and grade (longitudinal and transverse)
 - Deck grades at Girder 10th or "n" th point locations and elevations
 - Slope and Ditch Paving (Section 507)
 - Other: _____

- Fencing (Section 607)
 - Temporary
 - Permanent
 - Sound Barrier
 - Other: _____

- Delineators (Section 612)
 - Temporary
 - Permanent

- Lighting (Section 613) and Traffic Control Devices (Permanent) (Section 614)
 - Signal pole locations and elevations
 - Light pole locations and elevations
 - Sign locations
 - Field verify sign post locations, elevations, and lengths before fabrication.
 - Other: _____

- Pavement Marking (Section 627)
 - Striping (Temp)
 - Striping (Perm)
 - Symbols
 - Other: _____
- Temporary Lighting and Construction Traffic Control Devices (Section 630)
 - Signal pole locations and elevations (Temp)
 - Light pole locations and elevations (Temp)
 - Sign Locations (Temp)
 - Other: _____
- All Easements (Temp Staking by P.L.S. Only)
- Right of Way (Temp Staking by P.L.S. Only)

WORK PERFORMED BY THE CONTRACTOR'S SURVEYOR UNDER SECTION 629:

- Monumentation (Section 629)
 - Control
 - Right of Way
 - Land corners, Aliquot corners
 - Easements
 - Reference the specified existing monuments: ** _____
 - Replace the specified existing monuments: ** _____
 - Locate monuments. It is estimated _____ hours are required.

NOTE: All 629 items shall include adequate research, calculations, and evaluations of evidence for monuments to be set.

** A Tabulation of Survey Monuments may be provided on the plans.

GENERAL NOTES:

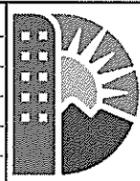
- Unless indicated otherwise on this Survey Tabulation Sheet, all survey work and staking intervals shall be done in accordance with the latest edition of the CDOT Survey Manual.
- Adequate information for establishing lines, grades, and locations for all work items have been specified on the plans. Any additional information required to stake the item or element shall be generated by the Contractor's surveyor.
- The Contractor's surveyor shall provide an estimate of the man-hours necessary to complete the work items indicated on this sheet. A copy of this sheet, with the estimated man-hours written on the blank line to the left of the specified items, shall be submitted with the Survey Schedule to the Engineer _____ days prior to the Presurvey Conference - Construction Survey.
- Stakes and Monuments which are damaged or destroyed by the progress of construction shall be replaced by the Contractor at no additional cost to the Department.
- The Contractor shall furnish an As Staked (or 3D Design Modeling Electronic Files) Earthwork Quantity report to the Engineer prior to completion of twenty percent (20%) of the planned earthwork in any phase as per the CDOT Survey Manual. A printed copy of the As Staked (or 3D Design Modeling Electronic Files) Earthwork data report and a computer disk with that information on it, in the specified format shall be submitted to the Engineer. The Contractor shall field verify original ground cross sections at a maximum 500 feet intervals.
- Prior to beginning work on any subsequent operation, such as placing base course or paving, the Contractor shall certify in writing to the Engineer that the final grade is within specified tolerance.
- The Contractor's surveyor shall perform all field surveying and calculations necessary to tie plan grades into field grades.
- The Contractor shall coordinate construction staking on the project with any utility work.
- Fieldbooks shall contain daily records of points set and or measurements observed. The information recorded shall contain: date, crew members' names, point no., description, staking information, and sketches. If the survey information is collected electronically, information recorded shall be provided to the Project Engineer in a hard copy format that is intuitive, clear and related to the supplemental information recorded in the field books. All linear surveys, such as slope stakes and blue tops, shall have the station and offset information related to the measured information. Non-linear surveys such as structures staking shall have sketches relating electronic information, such as point numbers, to the sketch.
- The Contractor's surveyor shall submit the following fieldbooks to the Engineer:
 - Horizontal Control (Primary & Secondary)
 - Vertical Control (i.e. Benchmarks)
 - Property Pin Ties
 - Horizontal Alignment
 - Grading
 - Slope Staking
 - Minor Structures
 - Major Structures
 - One fieldbook for each work category shown on this sheet
 - Other Fieldbook(s): _____

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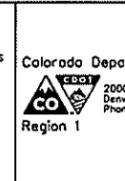
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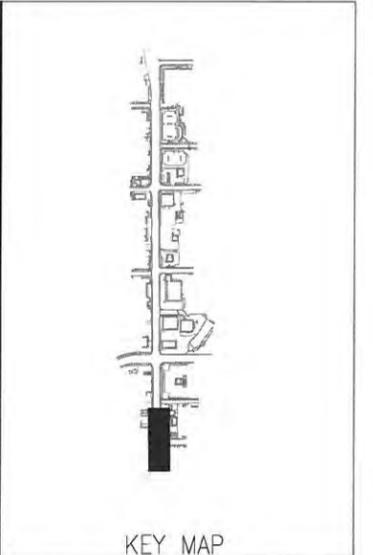
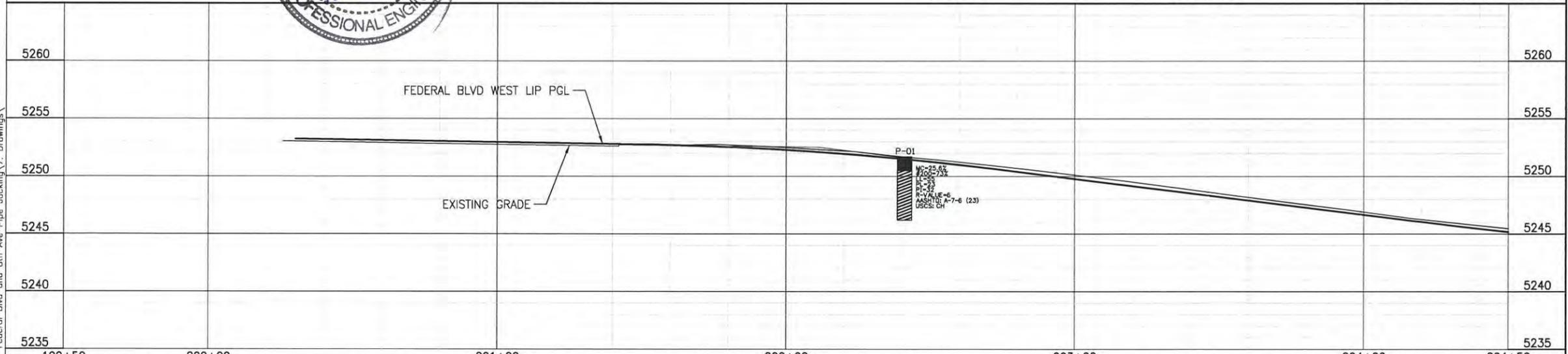
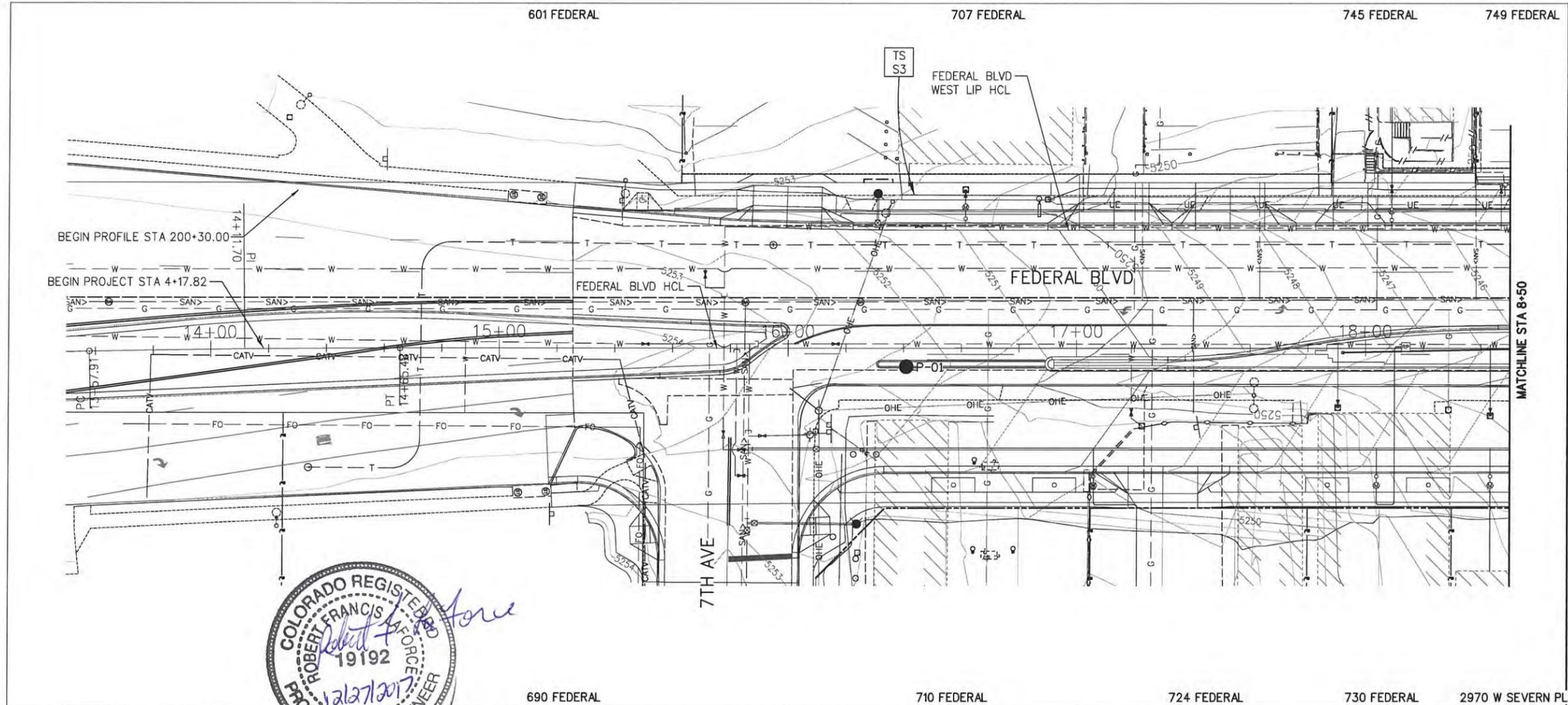
Colorado Department of Transportation
 2000 South Holly Street
 Denver, CO 80222
 Phone: 303-757-9511 FAX: 303-757-9907
 Region 1 JV

As Constructed	FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
No Revisions:	
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SURVEY TABULATION		
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Detailer:	SRF	
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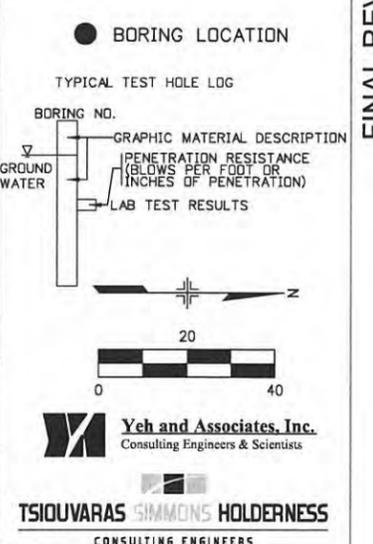
Project No./Code	NHPP 2873-172 SA 19957
2011-PROJMSTR-0000364	
Sheet Number	31

TSIUVARAS SIMMONS HOLDERNESS
 CONSULTING ENGINEERS



LEGEND

ASPHALT	USCS HIGH PLASTICITY CLAY
USCS CLAYEY SAND	USCS SILTY SAND
FILL WITH SAND AS MAJOR SOIL	FILL (MADE GROUND)
FILL WITH CLAY AS MAJOR SOIL	USCS LOW PLASTICITY CLAY
LOW PLASTICITY SANDY CLAY	FILL WITH GRAVEL AS MAJOR SOIL
USCS SANDY SILT	



COLORADO REGISTERED PROFESSIONAL ENGINEER
ROBERT FRANCIS LA FORCE
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2/22/2017

Mike Weitz
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199+50	200+00	201+00	202+00	203+00	204+00	204+50
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
ENGINEERING GEOLOGY
 FEDERAL BLVD - 3+50 TO 8+50

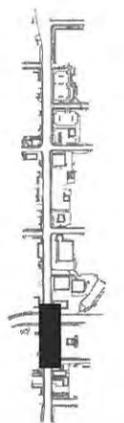
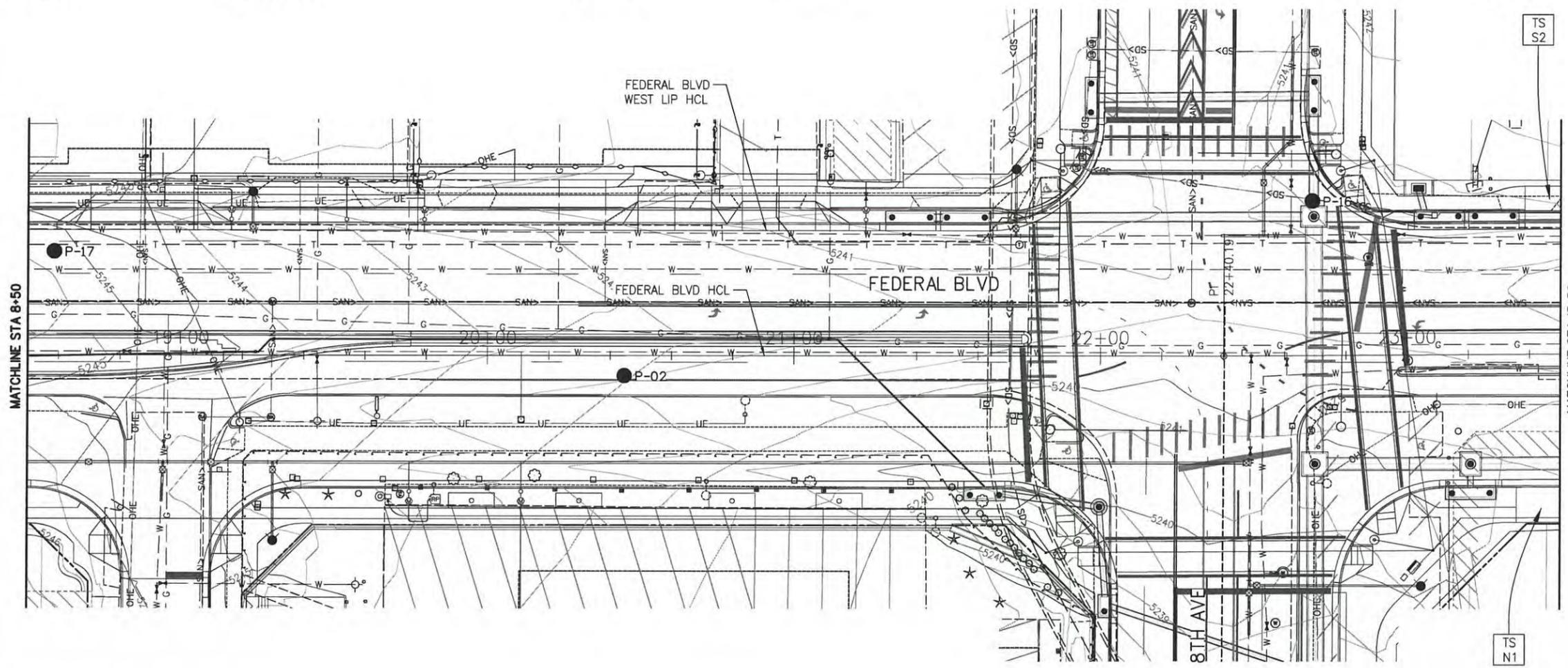
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 Detailer: MJW
 Sheet Subset: GEOLOGY

Structure Numbers
 Subset Sheets: 1 of 10

Project No./Code
 NHPP 2873-172
 SA 19957
 2011-PROJMSTR-0000364
 Sheet Number **32**

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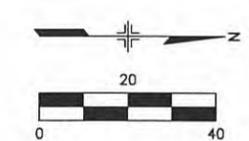
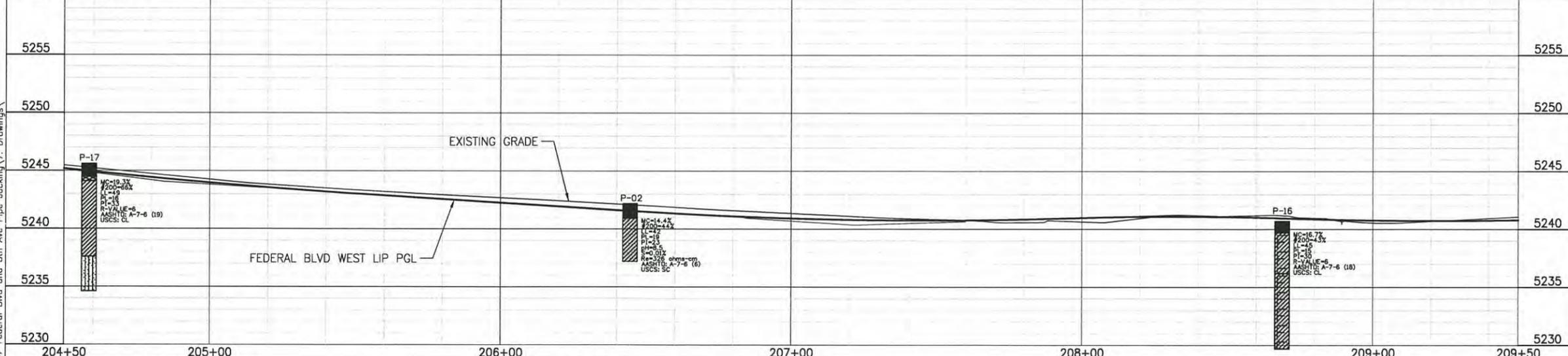
749 FEDERAL 753-759 FEDERAL 765 FEDERAL 775 FEDERAL 815 FEDERAL



KEY MAP



2970 W SEVERN PL 750 FEDERAL 816 FEDERAL



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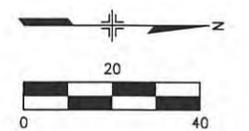
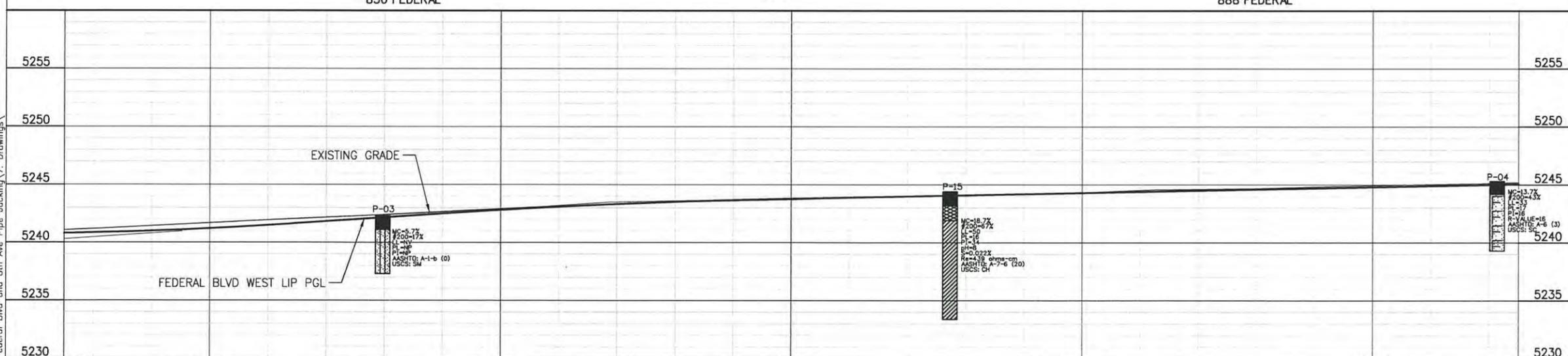
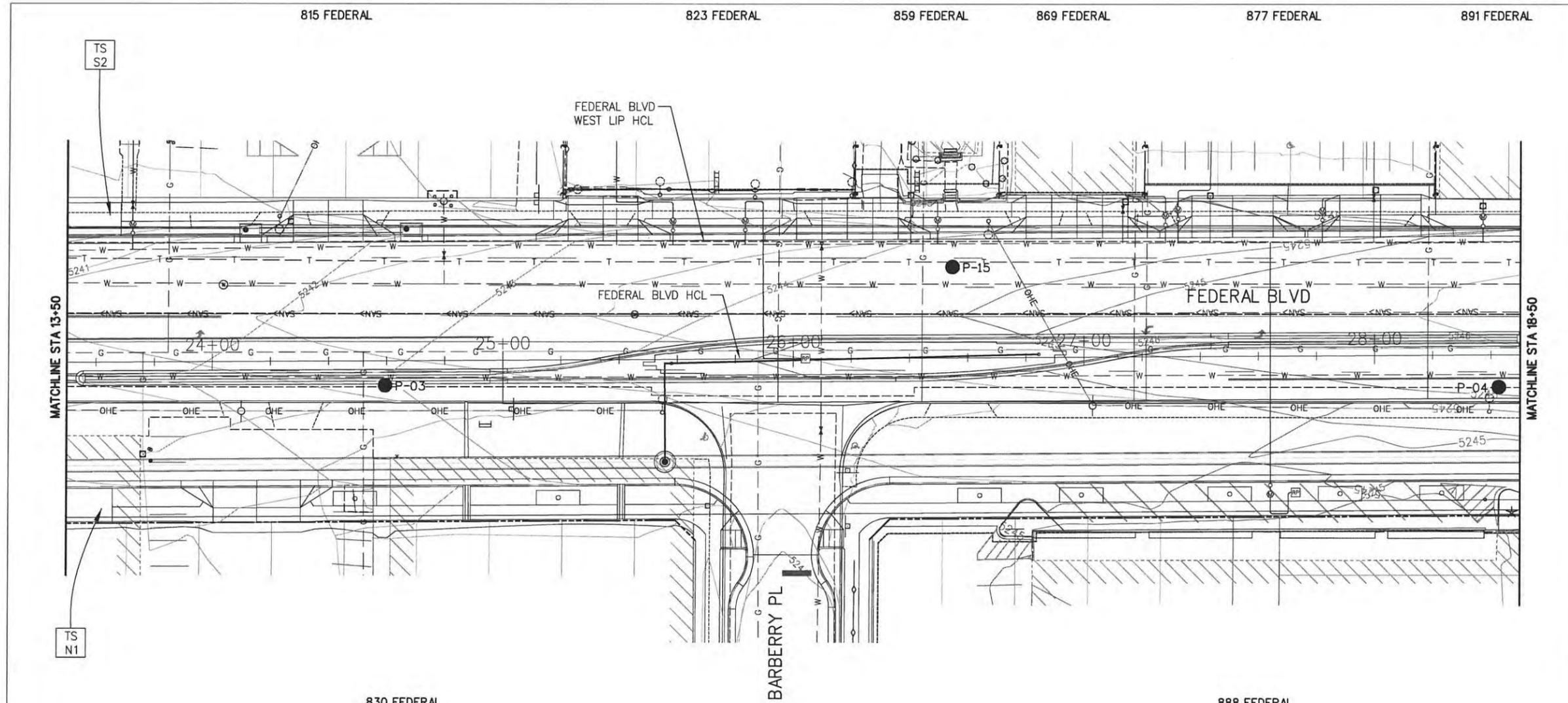
FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
ENGINEERING GEOLOGY
FEDERAL BLVD - 8+50 TO 13+50

Designer:	RLF	Structure Numbers
Detailer:	MJW	
Sheet Subset:	GEOLOGY	Subset Sheets: 2 of 10

Project No./Code
 NHPP 2873-172
 SA 19957
 2011-PROJMSTR-0000364
 Sheet Number **33**

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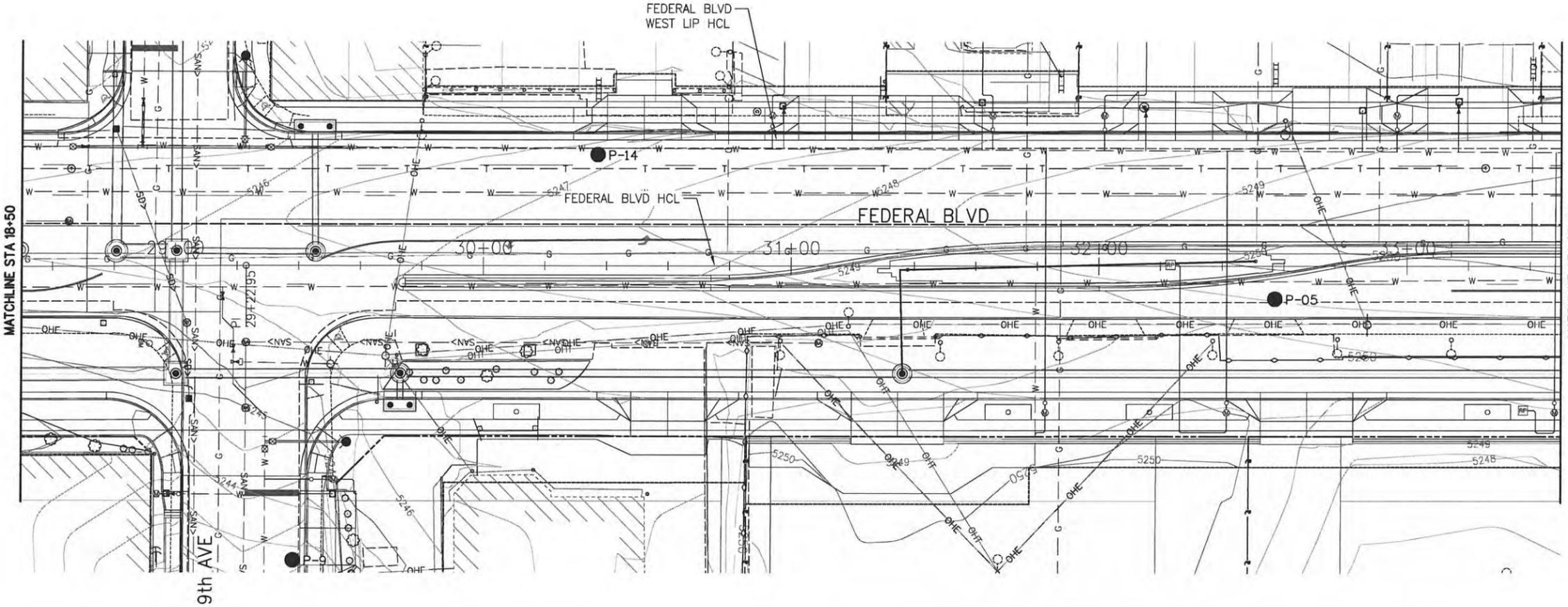
TSIOUVARAS SIMMONS HOLDENESS
CONSULTING ENGINEERS

Mike Weitz
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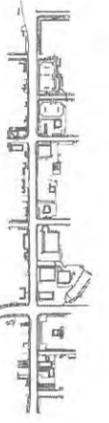
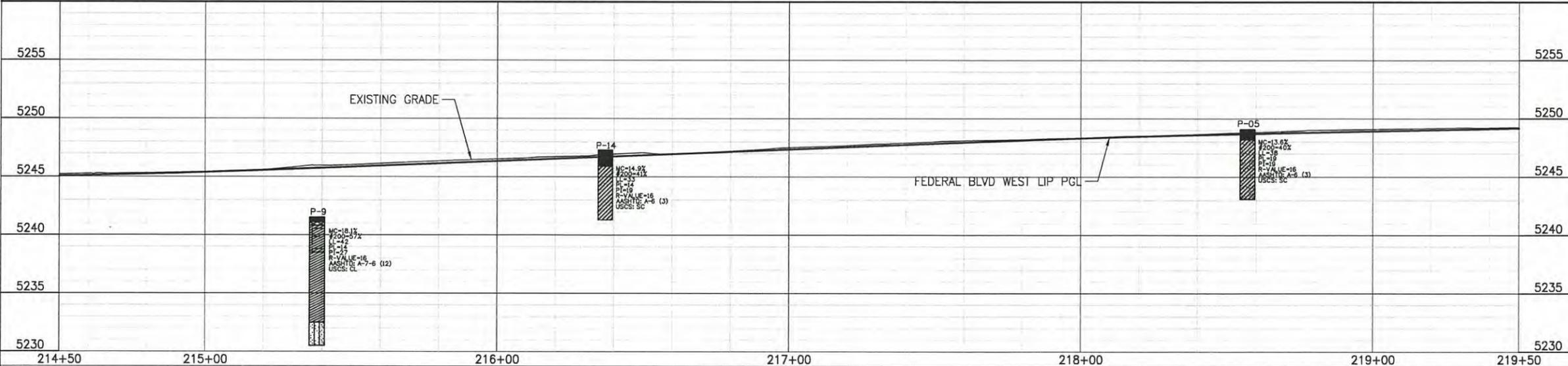
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Date	Comments	Init.																							

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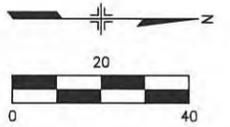
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888 FEDERAL 900 FEDERAL 950 FEDERAL 970 FEDERAL



KEY MAP



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Sheet Revisions			
Date:	Comments	Init.	

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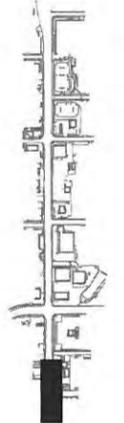
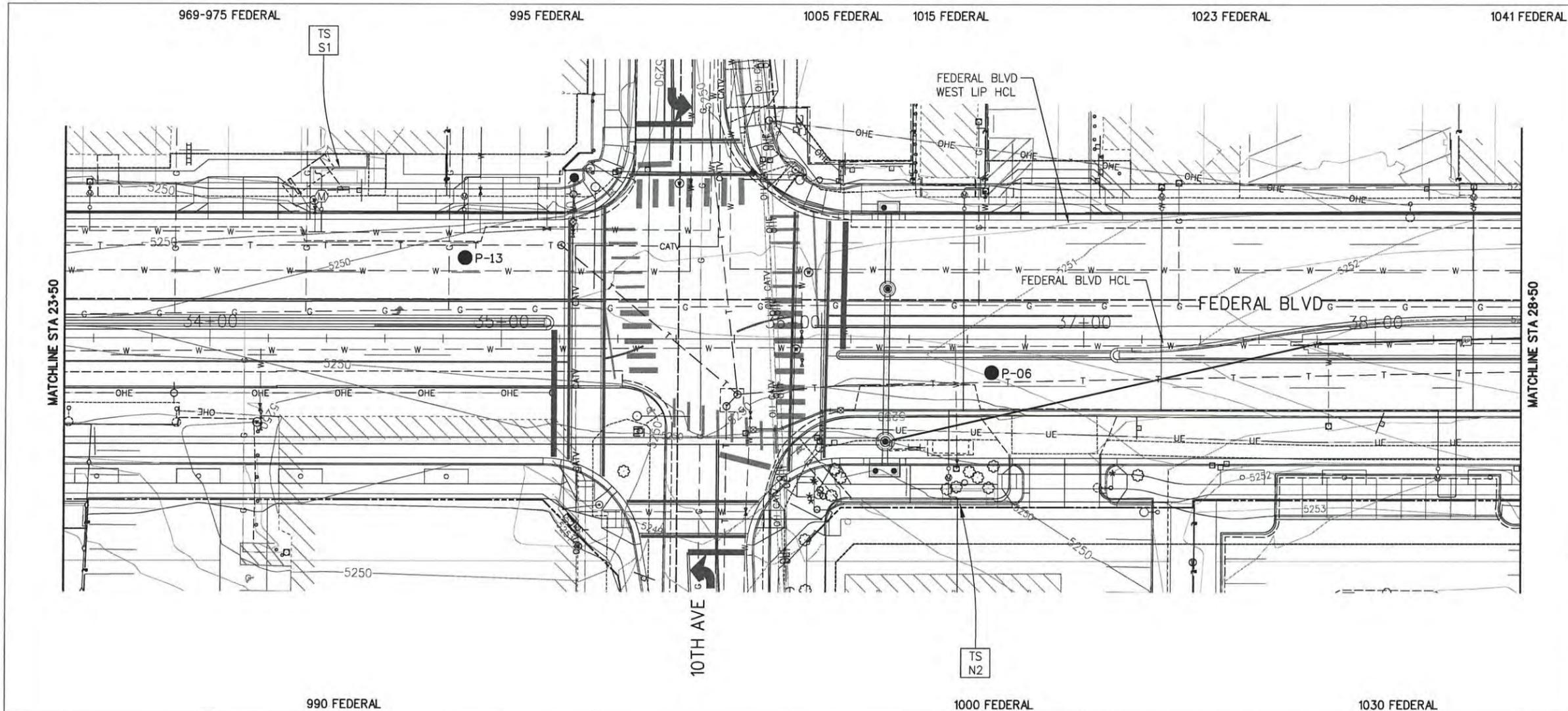
FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
ENGINEERING GEOLOGY
FEDERAL BLVD - 18+50 TO 23+50

Designer: RLF Structure Numbers
 Detailer: MJW
 Sheet Subset: GEOLOGY Subset Sheets: 4 of 10

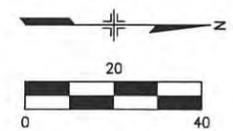
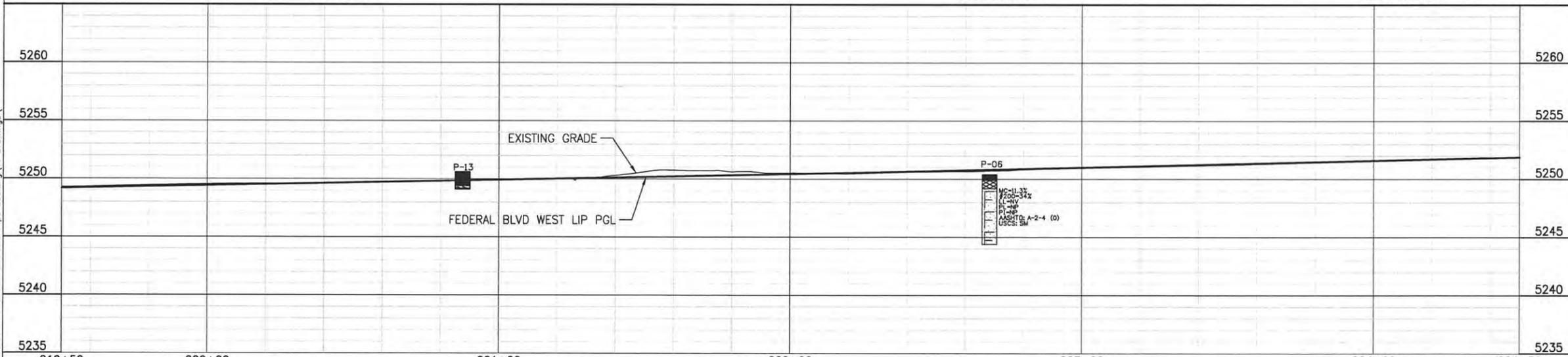
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 SA 19957
 2011-PROJMSTR-0000364
 Sheet Number **35**

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KEY MAP

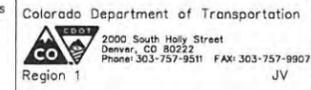


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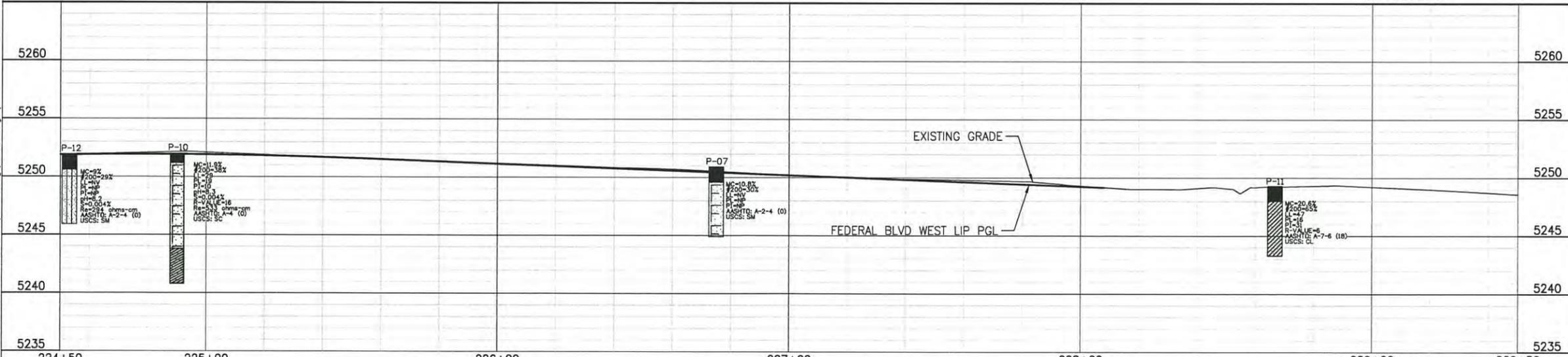
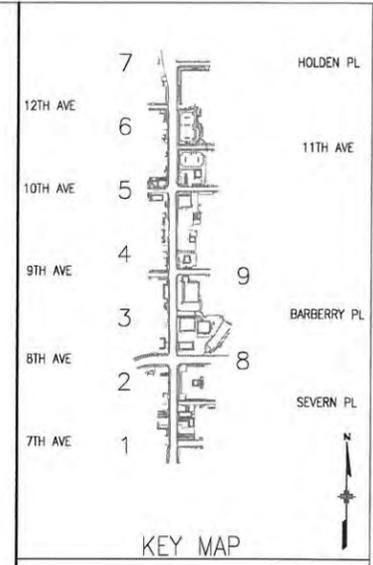
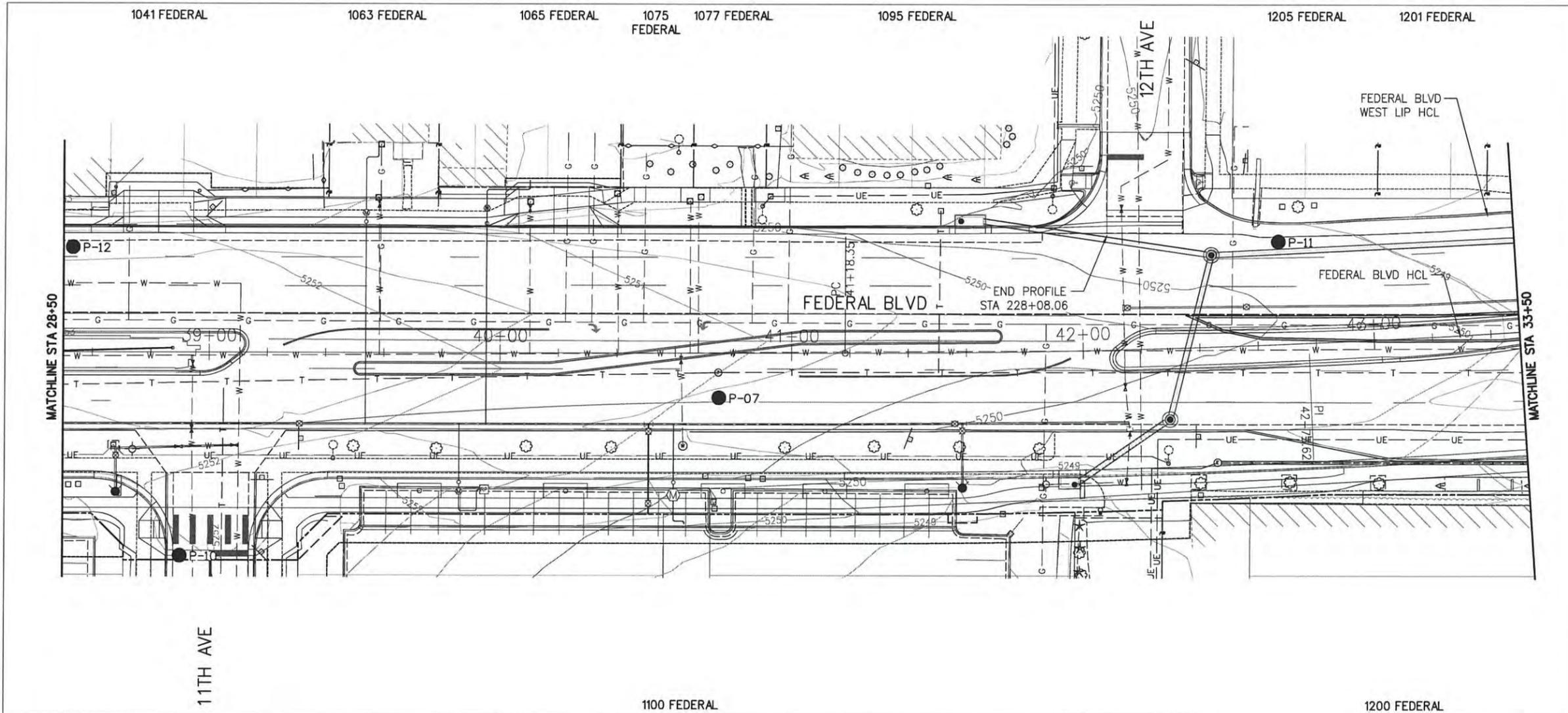
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
ENGINEERING GEOLOGY
FEDERAL BLVD - 23+50 TO 28+50
 Designer: RLF
 Detailer: MJW
 Sheet Subst: GEOLOGY

Project No./Code
 NHPP 2873-172
 SA 19957
 2011-PROJMSTR-0000364
 Sheet Number **36**

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North arrow pointing up.

Graphic scale: 0 to 40 feet.

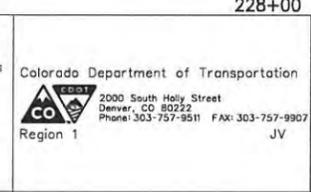
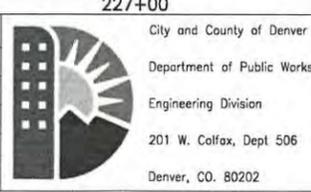
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Last Modification Date: 10/11/2011 Init.: MJW
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Date	Comments	Init.



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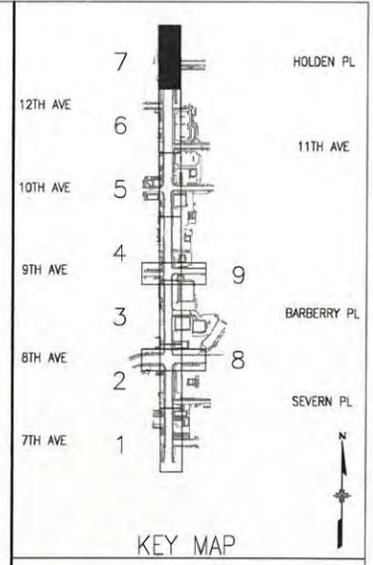
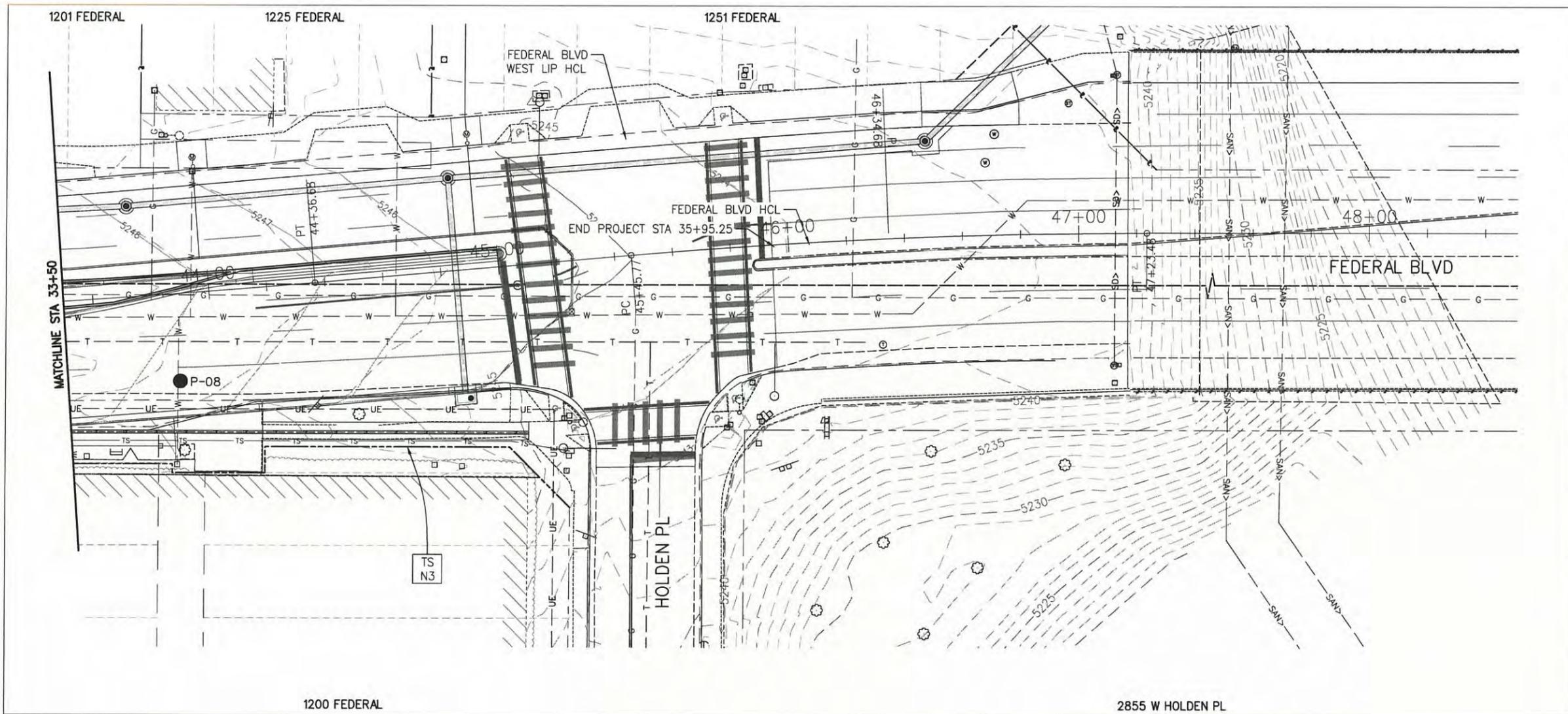
FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
ENGINEERING GEOLOGY
FEDERAL BLVD - 28+50 TO 33+50

Designer: RLF
Detailer: MJW
Sheet Subset: GEOLOGY

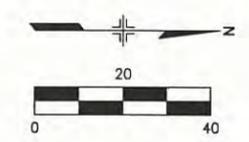
Structure Numbers
Subset Sheets: 6 of 10

Project No./Code
NHPP 2873-172
SA 19957
2011-PROJMSTR-0000364
Sheet Number **37**

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5265	
5260	
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 Drawing File Name: 1102188-02-Federal Plan - YA EngGeo.dgn
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 No Revisions:
 Revised:
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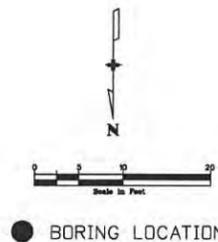
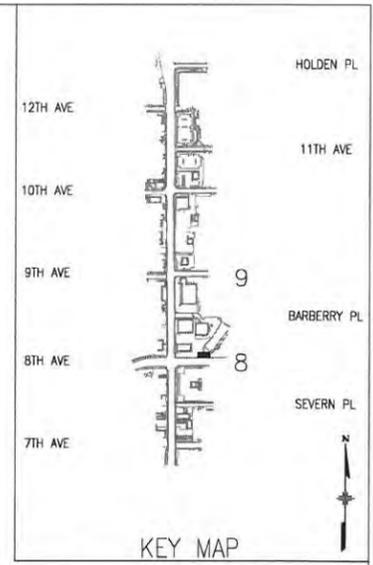
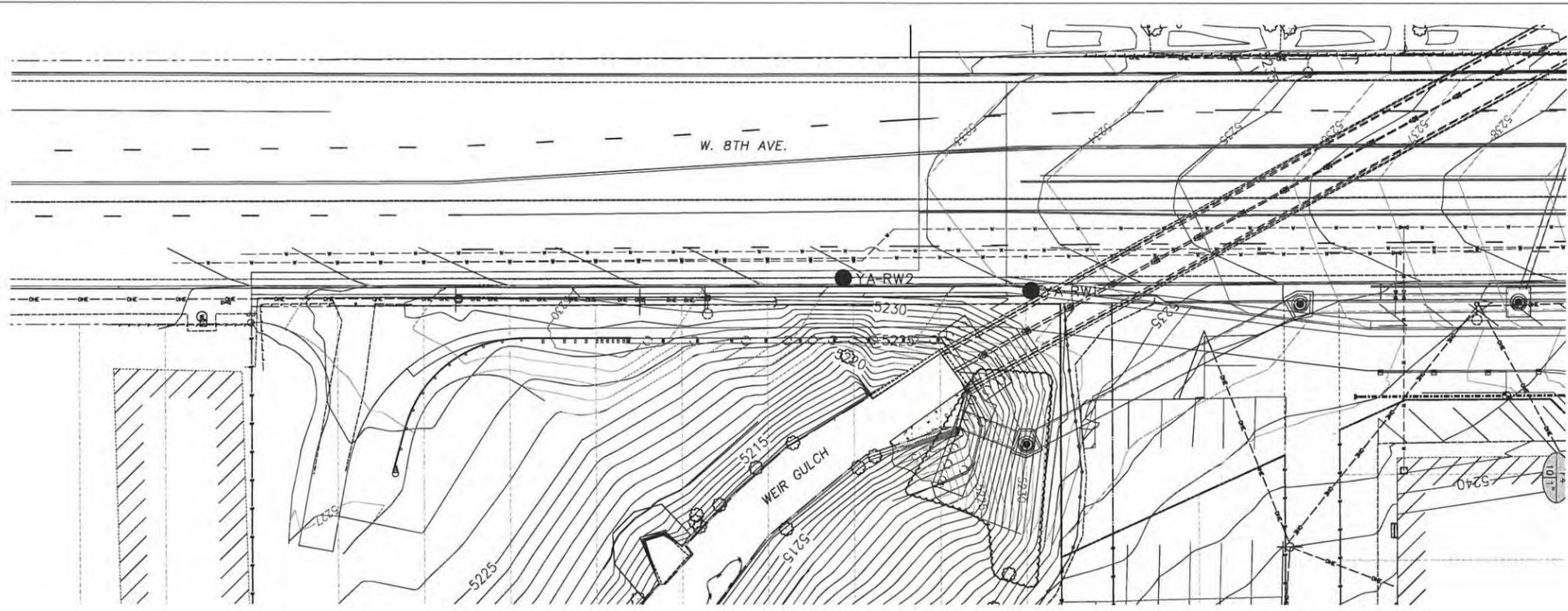
FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
ENGINEERING GEOLOGY
FEDERAL BLVD - 33+50 TO 38+50

Designer:	RLF	Structure Numbers	
Detailer:	MJW	Subset Sheets:	7 of 10
Sheet Subset:	GEOLOGY		

Project No./Code
 NHPP 2873-172
 SA 19957
 2011-PROJMSTR-0000364
 Sheet Number **38**

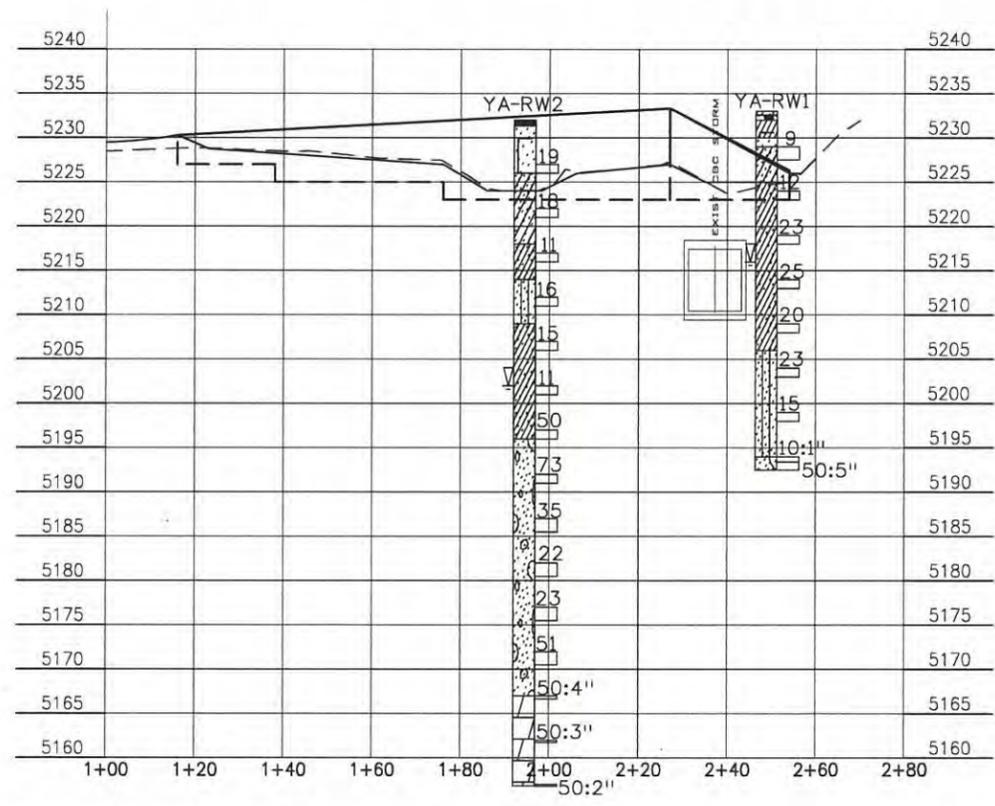
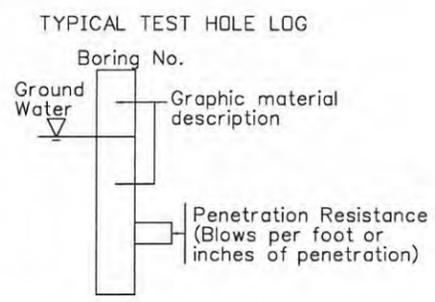
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FINAL REVIEW SUBMITTAL - MARCH 6, 2017



LEGEND

Concrete	USCS Well-graded Gravel
Fill with Clay as major soil	Fill with Sand as major soil
USCS Clayey Sand	USCS Low Plasticity Sandy Clay
USCS Silty Sand	USCS Poorly-graded Gravelly Sand
Asphalt	Claystone



NOTE:
BORINGS WERE NOT SURVEYED,
LOCATIONS ARE APPROXIMATE.
ELEVATIONS TAKEN FROM PROVIDED
TOPOGRAPHIC DGN.



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Sheet Revisions		
Date:	Comments	Init.

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Colorado Department of Transportation
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 Phone: 303-757-9511 FAX: 303-757-9907
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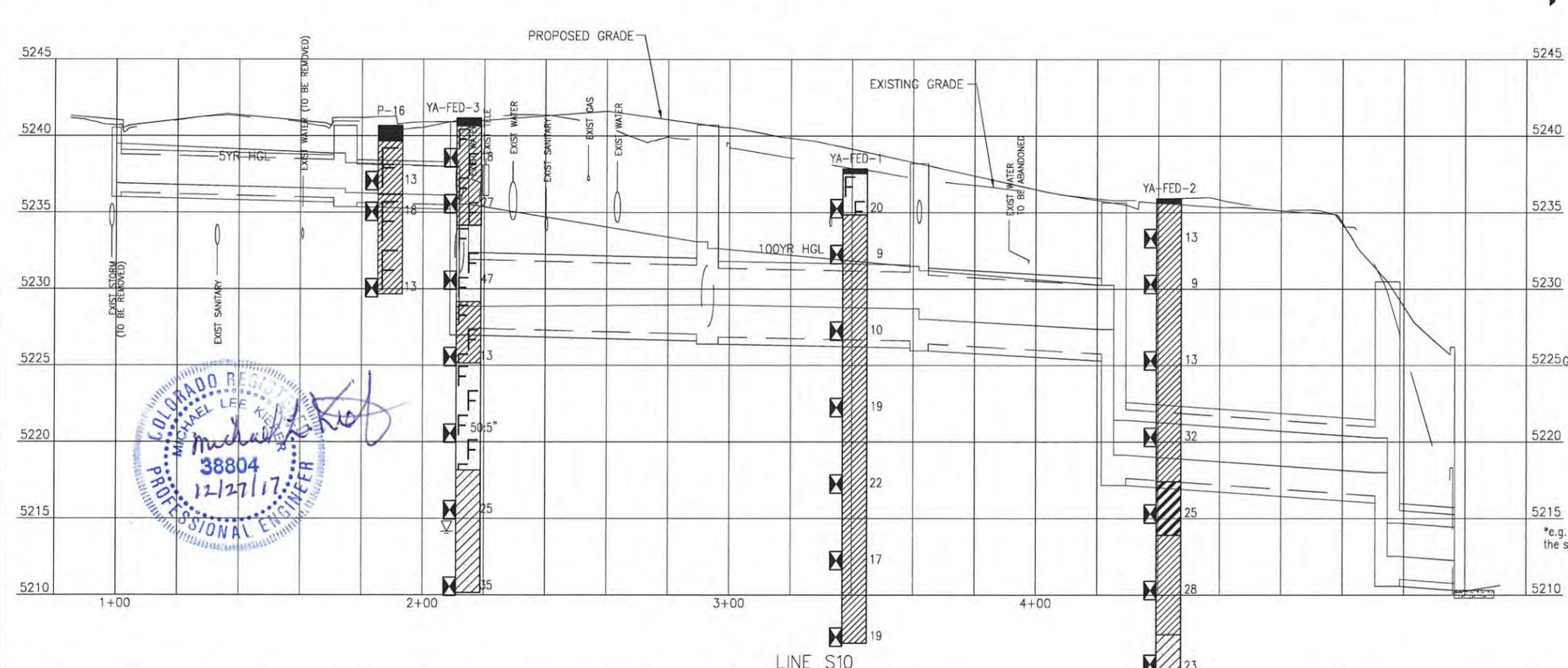
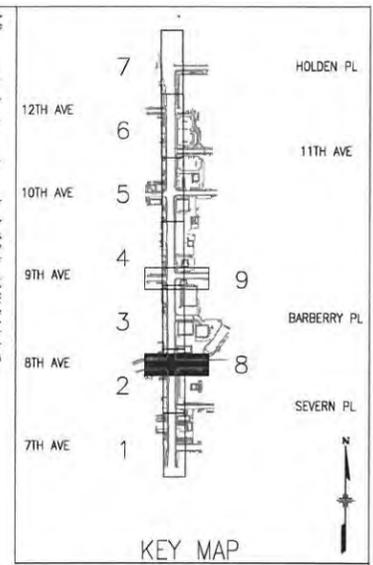
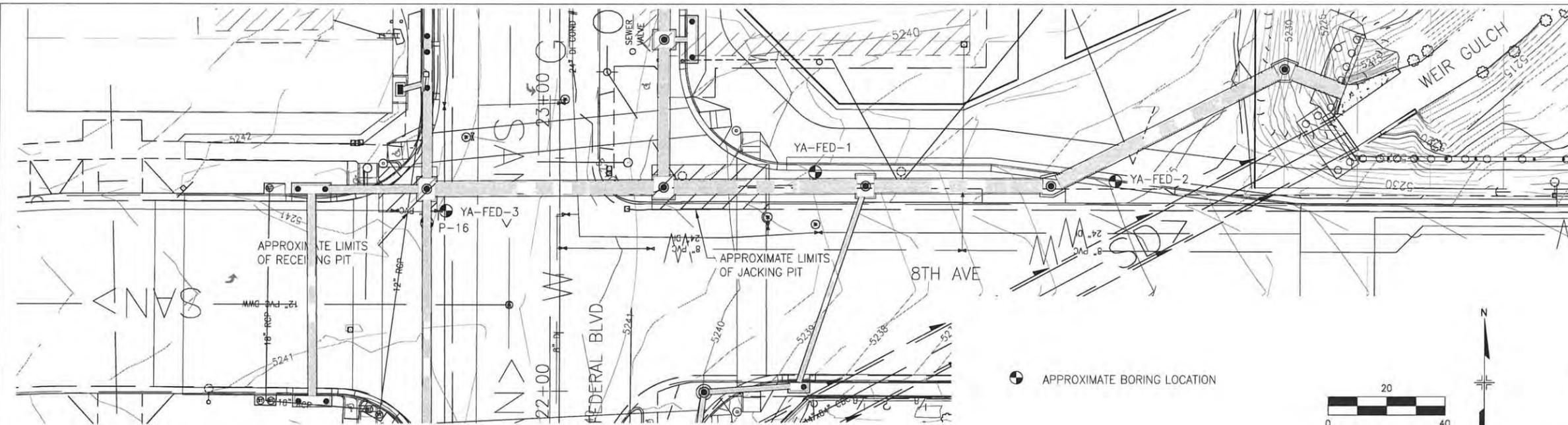
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
ENGINEERING GEOLOGY
8TH AVE RETAINING WALL AT WEIR GULCH

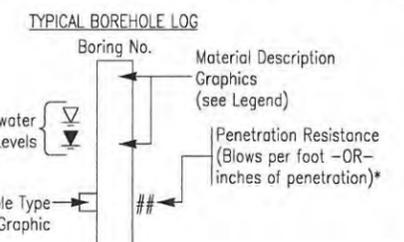
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Detailer:	M. Walz	
Sheet Subset:	Subset Sheets: 8 of 10	

Project No./Code
 NHPP 2873-172
 SA 19957
 2011-PROJMSTR-0000364
 Sheet Number **39**

FINAL REVIEW SUBMITTAL - MARCH 6, 2017



- USCS Low Plasticity Sandy Clay
- USCS High Plasticity Clay
- USCS Well-graded Gravel
- Concrete
- Asphalt
- CLAYSTONE
- Fill with Clay as major soil
- Fill with Sand as major soil
- USCS Silty Sand
- USCS Poorly-graded Gravelly Sand
- USCS Low Plasticity Clay
- USCS Clayey Sand



*e.g. A value of 50/3 or 50:3 indicates that 50 blows were applied to the sampler, with a penetration of 3 inches.

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CONSULTING ENGINEERS

COLORADO REGISTERED PROFESSIONAL ENGINEER
MICHAEL LEE KILGUS
38804
12/27/17

Last Modification Date: 10/26/2016 Init.: LAN
Drawing File Name: 1102188-07-Geotech_Phasing_PH1.dwg
Horizontal Scale: 1:40 Vert. Scale: As Noted

Sheet Revisions		
Date	Comments	Init.

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Region 1

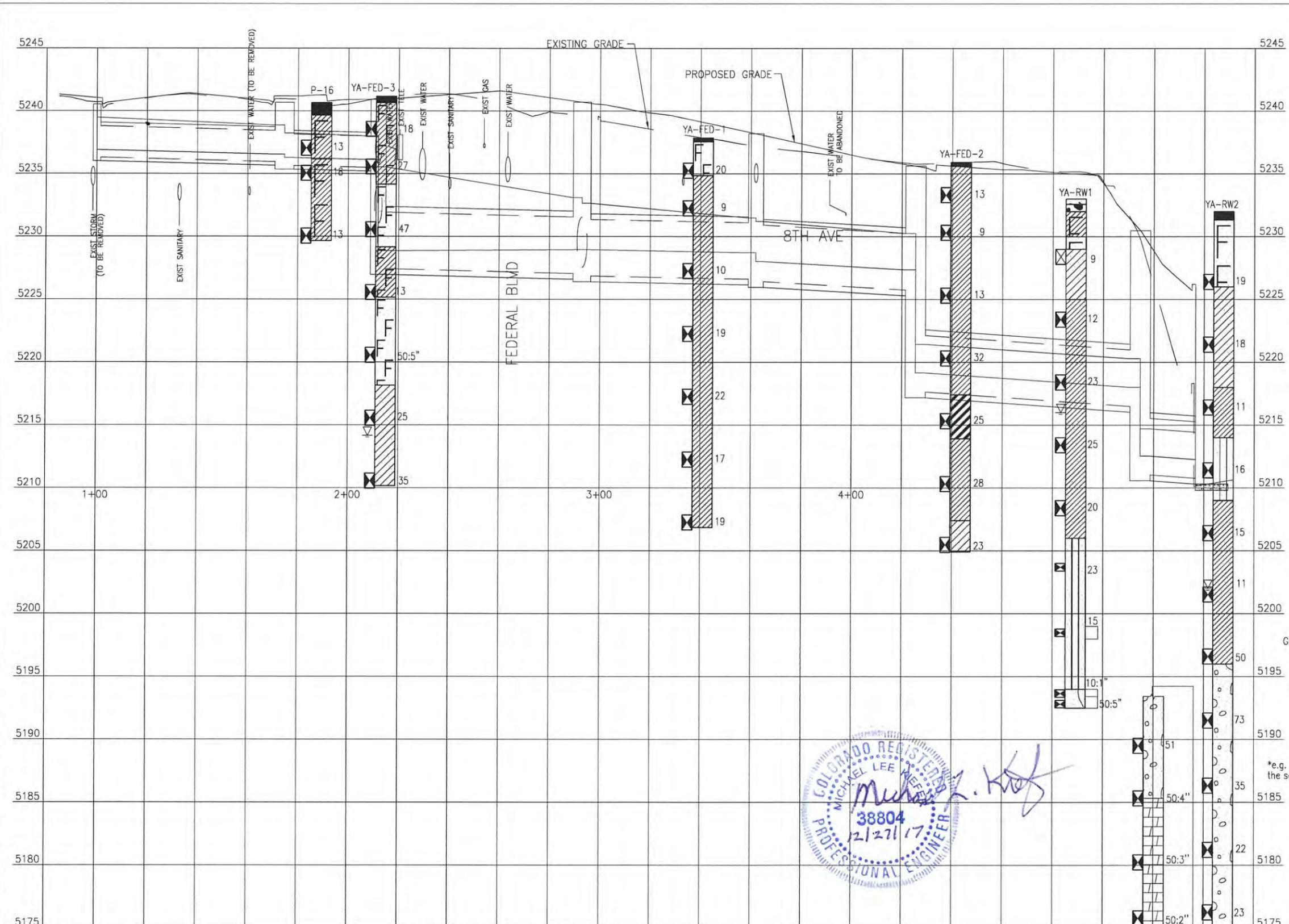
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
ENGINEERING GEOLOGY
STORM SEWER - PH 1 - LINE S10
Designer: HH Structure Numbers
Detailer: MJW
Sheet Subset: GEOTECH Subset Sheets: 9 of 10

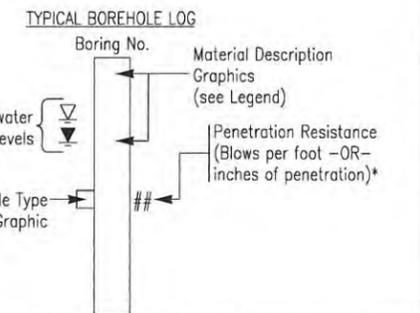
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SA 19957
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Sheet Number **40**

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FINAL REVIEW SUBMITTAL - MARCH 6, 2017



- USCS Low Plasticity Sandy Clay
- USCS High Plasticity Clay
- USCS Well-graded Gravel
- Concrete
- Asphalt
- CLAYSTONE
- Fill with Clay as major soil
- Fill with Sand as major soil
- USCS Silty Sand
- USCS Poorly-graded Gravelly Sand
- USCS Low Plasticity Clay
- USCS Clayey Sand



*e.g. A value of 50/3 or 50:3 indicates that 50 blows were applied to the sampler, with a penetration of 3 inches.

Michael Lee
 38804
 2/27/17
 PROFESSIONAL ENGINEER

Yeh and Associates, Inc.
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Sheet Revisions		
Date:	Comments	Init.

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 Void:

FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
 ENGINEERING GEOLOGY
 STORM SEWER - PH 1 - LINE S10

Designer: HH Structure Numbers
 Detailer: MJW
 Sheet Subset: GEOTECH Subset Sheets: 10 of 10

Project No./Code
 NHPP 2873-172
 SA 19957
 2011-PROJMSTR-0000364
 Sheet Number **41**

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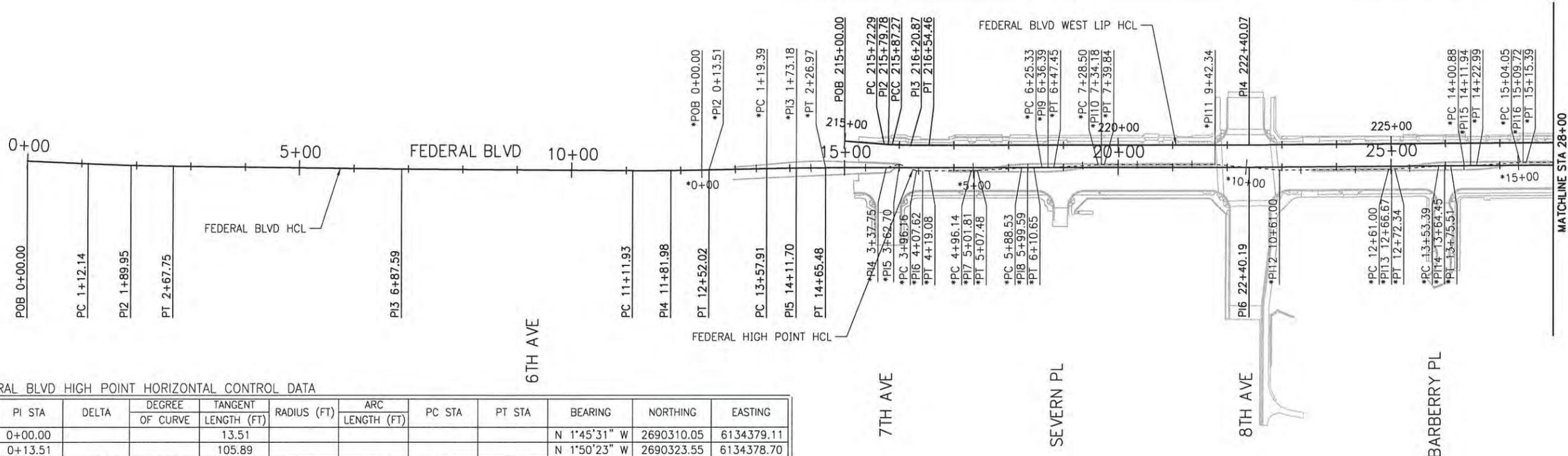
FINAL REVIEW SUBMITTAL - MARCH 6, 2017

FEDERAL BLVD CENTER HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	0+00.00									2689071.66	6134374.16
PI2	1+89.95	1'52'09"	1'12'04"	77.81	-4770.00	155.61	1+12.14	2+67.75	N 0°09'44" E	2689261.49	6134380.89
PI3	6+87.59									2689759.14	6134382.30
PI4	11+81.98	1'40'58"	1'12'04"	70.05	-4770.00	140.09	11+11.93	12+52.02	N 1°50'23" W	2690253.53	6134380.95
PI5	14+11.70	1'17'32"	1'12'04"	53.79	4770.00	107.57	13+57.91	14+65.48	N 0°32'51" W	2690483.14	6134373.57
PI6	22+40.19									2691311.60	6134365.66
PI7	29+22.95									2691994.28	6134355.13
PI8	42+77.62	5'03'59"	1'35'30"	159.27	-3600.00	318.33	41+18.35	44+36.68	N 5°36'50" W	2693348.89	6134342.19
PI9	46+34.68	5'01'51"	2'49'51"	88.91	2024.00	177.71	45+45.77	47+23.48	N 0°34'59" W	2693704.44	6134307.24
PI10	50+53.04	5'07'34"	5'43'46"	44.76	1000.00	89.47	50+08.27	50+97.74	N 4°32'35" E	2694122.89	6134302.98
POE	54+50.00									2694518.66	6134334.43

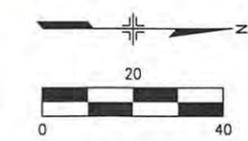
FEDERAL BLVD WEST LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	215+00.00			72.29					N 4°13'10" E	2690571.26	6134323.72
PI 2	215+79.78	2°50'30"	18°58'20"	7.49	-302.00	14.98	215+72.29	215+87.27	N 1°22'39" E	2690650.82	6134329.59
PI 3	216+20.87	1°55'30"	2°51'53"	33.60	-2000.00	67.20	215+87.27	216+54.46	N 0°32'51" W	2690691.91	6134330.58
PI 4	222+40.07			682.76					N 0°52'59" W	2691311.09	6134324.66
PI 5	229+22.83			1195.54					N 0°32'51" W	2691993.77	6134314.13
PI 6	241+34.00	0°32'34"	1°44'10"	15.63	-3300.00	31.26	241+18.37	241+49.63	N 1°05'25" W	2693204.88	6134302.56
PI 7	241+86.07			48.07					N 0°19'08" W	2693256.94	6134301.57
PI 8	242+34.14			20.12					N 0°01'51" E	2693305.01	6134301.30
PI 9	242+54.26			6.51					N 8°43'25" E	2693325.13	6134301.31
PI 10	242+60.77			21.37					N 1°57'35" W	2693331.56	6134302.30
PI 11	243+30.42	3°48'54"	3°57'05"	48.29	-1450.00	96.54	242+82.13	243+78.68	N 5°46'29" W	2693401.18	6134299.92
PI 12	244+72.52	0°24'49"	0°13'13"	93.85	26000.00	187.69	243+78.68	245+66.37	N 5°21'40" W	2693542.59	6134285.62
PI 13	245+87.68			36.32					N 4°36'37" W	2693657.25	6134274.86
PI 14	246+45.25	3°02'37"	7°09'43"	21.25	800.00	42.50	246+24.00	246+66.49	N 1°34'00" W	2693714.63	6134270.23
POE	247+00.00			33.51					N 1°34'00" W	2693769.37	6134268.73



*FEDERAL BLVD HIGH POINT HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	0+00.00			13.51					N 1°45'31" W	2690310.05	6134379.11
PI 2	0+13.51			105.89					N 1°50'23" W	2690323.55	6134378.70
PI 3	1+73.18	1°17'32"	1°12'04"	53.79	4770.00	107.57	1+19.39	2+26.97	N 0°32'51" W	2690483.14	6134373.57
PI 4	3+37.75			24.95					N 15°37'36" W	2690647.70	6134372.00
PI 5	3+62.70			33.46					N 20°41'24" E	2690671.73	6134365.28
PI 6	4+07.62	0°38'43"	2°48'53"	11.46	2035.50	22.92	3+96.16	4+19.08	N 0°32'51" W	2690714.49	6134376.86
PI 7	5+01.81	3°13'28"	28°26'05"	5.67	-201.50	11.34	4+96.14	5+07.48	N 3°46'18" W	2690808.68	6134375.96
PI 8	5+99.59	3°13'28"	14°34'45"	11.06	393.00	22.12	5+88.53	6+10.65	N 0°32'51" W	2690906.25	6134369.53
PI 9	6+36.39	3°13'28"	14°34'45"	11.06	-393.00	22.12	6+25.33	6+47.45	N 3°46'18" W	2690943.06	6134369.18
PI 10	7+34.18	3°13'28"	28°26'05"	5.67	201.50	11.34	7+28.50	7+39.84	N 0°32'51" W	2691040.63	6134362.74
PI 11	9+42.34			118.65					N 4°36'52" E	2691248.79	6134360.76
PI 12	10+61.00			200.00					N 0°52'59" W	2691367.06	6134370.30
PI 13	12+66.67	3°13'28"	28°26'05"	5.67	-201.50	11.34	12+61.00	12+72.34	N 4°06'27" W	2691572.71	6134367.13
PI 14	13+64.45	3°13'28"	14°34'45"	11.06	393.00	22.12	13+53.39	13+75.51	N 0°52'59" W	2691670.25	6134360.13
PI 15	14+11.94	3°13'28"	14°34'45"	11.06	-393.00	22.12	14+00.88	14+22.99	N 4°06'27" W	2691717.73	6134359.39
PI 16	15+09.72	3°13'28"	28°26'05"	5.67	201.50	11.34	15+04.05	15+15.39	N 0°52'59" W	2691815.27	6134352.39
PI 17	16+17.89			119.77					N 4°31'22" E	2691923.42	6134350.72
PI 18	17+37.66			102.50					N 0°32'51" W	2692042.82	6134360.17



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Sheet Revisions																					
Date:	Comments	Init.																			

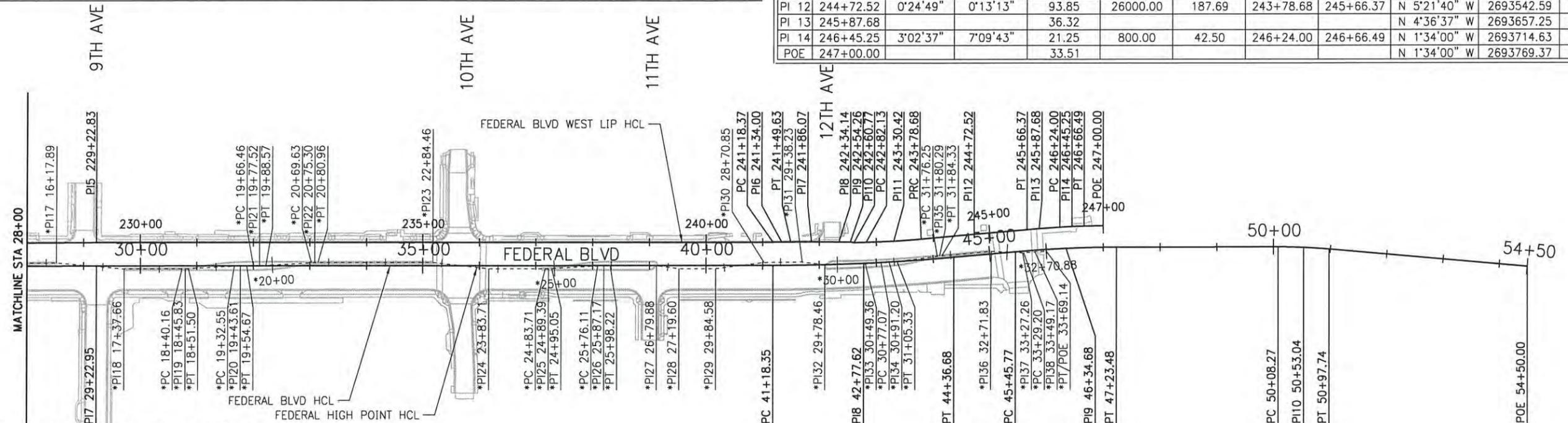
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FEDERAL BLVD CENTER HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	0+00.00									2689071.66	6134374.16
PI2	1+89.95	1'52'09"	1'12'04"	77.81	-4770.00	155.61	1+12.14	2+67.75	N 0°09'44" E	2689261.49	6134380.89
PI3	6+87.59									2689759.14	6134382.30
PI4	11+81.98	1'40'58"	1'12'04"	70.05	-4770.00	140.09	11+11.93	12+52.02	N 1°50'23" W	2690253.53	6134380.95
PI5	14+11.70	1'17'32"	1'12'04"	53.79	4770.00	107.57	13+57.91	14+65.48	N 0°32'51" W	2690483.14	6134373.57
PI6	22+40.19									2691311.60	6134365.66
PI7	29+22.95									2691994.28	6134355.13
PI8	42+77.62	5'03'59"	1'35'30"	159.27	-3600.00	318.33	41+18.35	44+36.68	N 5°36'50" W	2693348.89	6134342.19
PI9	46+34.68	5'01'51"	2'49'51"	88.91	2024.00	177.71	45+45.77	47+23.48	N 0°34'59" W	2693704.44	6134307.24
PI10	50+53.04	5'07'34"	5'43'46"	44.76	1000.00	89.47	50+08.27	50+97.74	N 4°32'35" E	2694122.89	6134302.98
POE	54+50.00									2694518.66	6134334.43

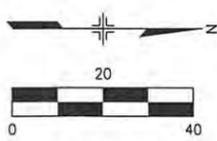
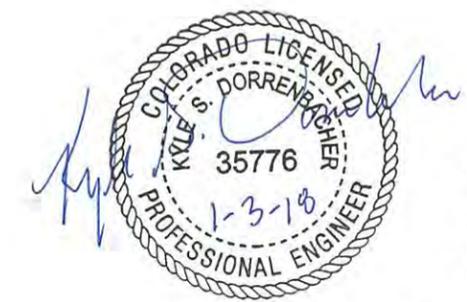
FEDERAL BLVD WEST LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING	
POB	215+00.00									N 4°13'10" E	2690571.26	6134323.72
PI 2	215+79.78	2'50'30"	18°58'20"	7.49	-302.00	14.98	215+72.29	215+87.27	N 1°22'39" E	2690650.82	6134329.59	
PI 3	216+20.87	1'55'30"	2°51'53"	33.60	-2000.00	67.20	215+87.27	216+54.46	N 0°32'51" W	2690691.91	6134330.58	
PI 4	222+40.07									N 0°52'59" W	2691311.09	6134324.66
PI 5	229+22.83									N 0°32'51" W	2691993.77	6134314.13
PI 6	241+34.00	0°32'34"	1°44'10"	15.63	-3300.00	31.26	241+18.37	241+49.63	N 1°05'25" W	2693204.88	6134302.56	
PI 7	241+86.07									N 0°19'08" W	2693256.94	6134301.57
PI 8	242+34.14									N 0°01'51" E	2693305.01	6134301.30
PI 9	242+54.26									N 8°43'25" E	2693325.13	6134301.31
PI 10	242+60.77									N 1°57'35" W	2693331.56	6134302.30
PI 11	243+30.42	3°48'54"	3°57'05"	48.29	-1450.00	96.54	242+82.13	243+78.68	N 5°46'29" W	2693401.18	6134299.92	
PI 12	244+72.52	0°24'49"	0°13'13"	93.85	26000.00	187.69	243+78.68	245+66.37	N 5°21'40" W	2693542.59	6134285.62	
PI 13	245+87.68									N 4°36'37" W	2693657.25	6134274.86
PI 14	246+45.25	3°02'37"	7°09'43"	21.25	800.00	42.50	246+24.00	246+66.49	N 1°34'00" W	2693714.63	6134270.23	
POE	247+00.00									N 1°34'00" W	2693769.37	6134268.73



*FEDERAL BLVD HIGH POINT HORIZONTAL CONTROL DATA (CONT.)

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
PI 19	18+45.83	3°13'28"	28°26'05"	5.67	-201.50	11.34	18+40.16	18+51.50	N 3°46'18" W	2692150.99	6134359.13
PI 20	19+43.61	3°13'28"	14°34'45"	11.06	393.00	22.12	19+32.55	19+54.67	N 0°32'51" W	2692248.56	6134352.70
PI 21	19+77.52	3°13'28"	14°34'45"	11.06	-393.00	22.12	19+66.46	19+88.57	N 3°46'18" W	2692282.47	6134352.38
PI 22	20+75.30	3°13'28"	28°26'05"	5.67	201.50	11.34	20+69.63	20+80.96	N 0°32'51" W	2692380.05	6134345.95
PI 23	22+84.46			99.25					N 5°48'57" E	2692589.21	6134343.95
PI 24	23+83.71			100.00					N 0°32'51" W	2692687.95	6134354.00
PI 25	24+89.39	3°13'28"	28°26'05"	5.67	-201.50	11.34	24+83.71	24+95.05	N 3°46'18" W	2692793.61	6134352.99
PI 26	25+87.17	3°13'28"	14°34'45"	11.06	393.00	22.12	25+76.11	25+98.22	N 0°32'51" W	2692891.19	6134346.56
PI 27	26+79.88			39.71					N 7°24'46" E	2692983.90	6134345.68
PI 28	27+19.60			64.98					N 0°32'51" W	2693023.29	6134350.80
PI 29	27+84.58			86.27					N 7°40'21" W	2693088.27	6134350.18
PI 30	28+70.85			67.38					N 1°05'25" W	2693173.76	6134338.66
PI 31	29+38.23			40.23					N 6°26'47" E	2693241.14	6134337.38
PI 32	29+78.46			70.90					N 1°50'11" W	2693281.11	6134341.89
PI 33	30+49.36			27.70					N 3°48'15" W	2693351.98	6134339.62
PI 34	30+91.20	4°06'24"	14°31'53"	14.14	-394.29	28.26	30+77.07	31+05.33	N 7°54'39" W	2693393.72	6134336.85
PI 35	31+80.29	2°17'49"	28°26'05"	4.04	201.50	8.08	31+76.25	31+84.33	N 5°36'50" W	2693481.97	6134324.58
PI 36	32+71.83			55.43					N 2°12'03" E	2693573.08	6134315.63
PI 37	33+27.26			1.94					N 5°12'39" W	2693628.46	6134317.76
PI 38	33+49.17	1°07'56"	2°50'06"	19.97	2021.00	39.94	33+29.20	33+69.14	N 4°04'43" W	2693650.28	6134315.77
POE	33+69.14	1°07'56"	2°50'06"	19.97	2021.00	39.94	33+29.20	33+69.14	N 4°04'43" W	2693650.28	6134315.77



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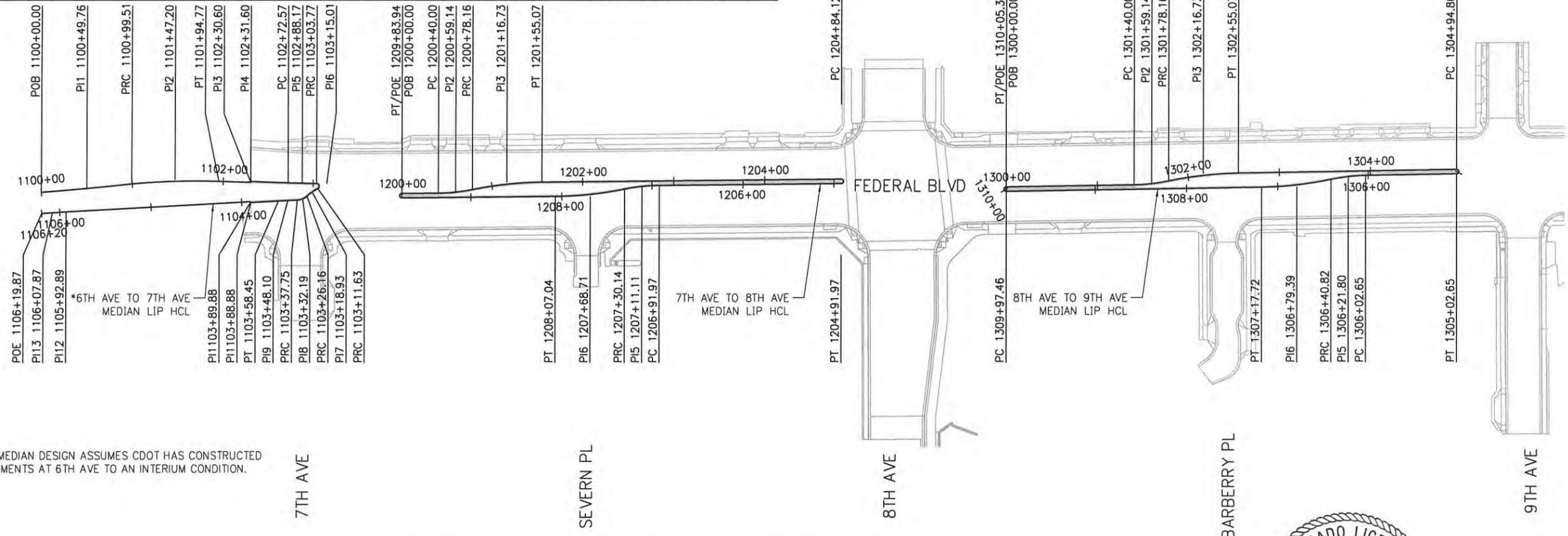
AD SUBMITTAL - JANUARY 2, 2018

6TH AVE TO 7TH AVE MEDIAN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	1100+00.00	1'46'07"	1'46'38"	49.76	-3223.73	99.51	1100+00.00	1100+99.51	N 6'08'24" W	2690416.32	6134368.74
PI 1	1100+49.76	1'46'07"	1'46'38"	49.76	-3223.73	99.51	1100+00.00	1100+99.51	N 6'08'24" W	2690416.32	6134368.74
PI 2	1101+47.20	7'16'41"	7'38'22"	47.70	750.00	95.27	1100+99.51	1101+94.77	N 1'56'12" E	2690513.28	6134358.98
PI 3	1102+30.60			1.00					S 89'05'44" W	2690596.75	6134361.80
PI 4	1102+31.60			40.98					N 1'56'12" E	2690596.74	6134360.80
PI 5	1102+88.17	0'52'45"	2'49'06"	15.60	-2033.00	31.19	1102+72.57	1103+03.77	N 1'03'27" E	2690653.28	6134362.71
PI 6	1103+15.01	150'07'11"	1909'51'34"	11.24	3.00	7.86	1103+03.77	1103+11.63	S 28'49'21" E	2690680.11	6134363.21
PI 7	1103+18.93	12'48'46"	88'08'50"	7.30	-65.00	14.54	1103+11.63	1103+26.16	S 41'38'08" E	2690663.87	6134372.15
PI 8	1103+32.19	39'03'36"	337'02'02"	6.03	17.00	11.59	1103+26.16	1103+37.75	S 2'34'32" E	2690653.91	6134381.00
PI 9	1103+48.10	0'34'59"	2'49'06"	10.35	-2033.00	20.69	1103+37.75	1103+58.45	S 3'09'31" E	2690637.55	6134381.74
PI 10	1103+88.88			1.00					S 86'50'29" W	2690596.83	6134383.98
PI 11	1103+89.88			203.00					S 3'09'31" E	2690596.77	6134382.99
PI 12	1105+92.89			14.99					S 3'31'42" E	2690394.08	6134394.17
PI 13	1106+07.87			12.00					S 4'12'37" E	2690379.12	6134395.09
POE	1106+19.87			12.00					S 4'12'37" E	2690367.15	6134395.97

8TH AVE TO 9TH AVE MEDIAN LIP HORIZONTAL CONTROL DATA

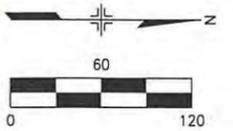
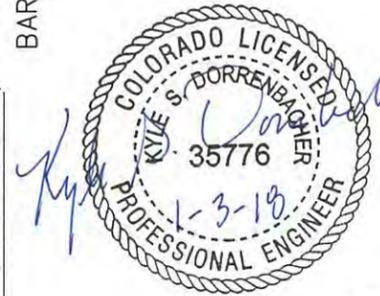
PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	1300+00.00									2691427.02	6134366.88
PI2	1301+59.14	10'59'17"	28'47'31"	19.14	-199.00	38.16	1301+40.00	1301+78.16	N 11'52'17" W	2691586.14	6134364.42
PI3	1302+16.73	10'59'17"	14'17'18"	38.57	401.00	76.90	1301+78.16	1302+55.07	N 0'52'59" W	2691642.62	6134352.55
PI4		180'00'00"	2291'49'52"	-1.00	2.50	7.85	1304+94.80	1305+02.65	S 0'52'59" E	NaN	NaN
PI5	1306+21.80	10'59'17"	28'47'31"	19.14	-199.00	38.16	1306+02.65	1306+40.82	S 11'52'17" E	2691801.84	6134355.10
PI6	1306+79.39	10'59'17"	14'17'18"	38.57	401.00	76.90	1306+40.82	1307+17.72	S 0'52'59" E	2691745.36	6134366.97
PI7		180'00'00"	2291'49'52"	-1.00	2.50	7.85	1309+97.46	1310+05.31	N 0'52'59" W	NaN	NaN
POE	1310+05.31									2691427.02	6134366.88



*NOTE: MEDIAN DESIGN ASSUMES CDOT HAS CONSTRUCTED IMPROVEMENTS AT 6TH AVE TO AN INTERIUM CONDITION.

7TH AVE TO 8TH AVE MEDIAN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	1200+00.00									2690762.98	6134373.90
PI2	1200+59.14	10'59'17"	28'47'31"	19.14	-199.00	38.16	1200+40.00	1200+78.16	N 11'32'08" W	2690822.12	6134373.33
PI3	1201+16.73	10'59'17"	14'17'18"	38.57	401.00	76.90	1200+78.16	1201+55.07	N 0'32'51" W	2690878.67	6134361.79
PI4		180'00'00"	2291'49'52"	-1.00	2.50	7.85	1204+84.12	1204+91.97	S 0'32'51" E	NaN	NaN
PI5	1207+11.11	10'59'17"	28'47'31"	19.14	-199.00	38.16	1206+91.97	1207+30.14	S 11'32'08" E	2691027.19	6134365.37
PI6	1207+68.71	10'59'17"	14'17'18"	38.57	401.00	76.90	1207+30.14	1208+07.04	S 0'32'51" E	2690970.64	6134376.91
PI7		180'00'00"	2291'49'52"	-1.00	2.50	7.85	1209+76.09	1209+83.94	N 0'32'51" W	NaN	NaN
POE	1209+83.94									2690762.98	6134373.90



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City and County of Denver
Department of Public Works
Engineering Division
201 W. Colfax, Dept 506
Denver, CO. 80202

Colorado Department of Transportation
Region 1
2000 South Holly Street
Denver, CO 80222
Phone: 303-757-9511 FAX: 303-757-9907
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE	
GEOMETRIC CONTROL	
6TH AVE TO 9TH AVE MEDIANS	
Designer:	KSD
Detailer:	SRF
Structure Numbers	
Sheet Subset:	GEOMCONT
Subset Sheets:	3 of 10

Project No./Code	NHPP 2873-172 SA 19957
2011-PROJMSTR-0000364	
Sheet Number	44

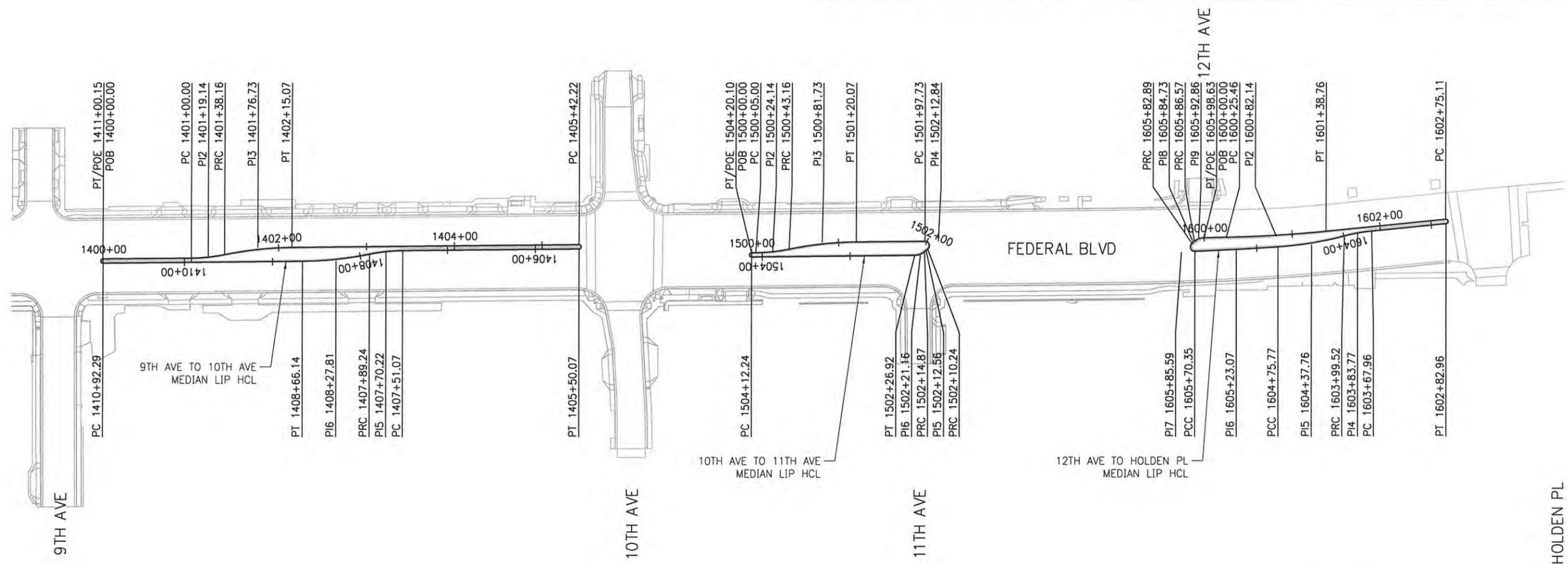
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9TH AVE TO 10TH AVE MEDIAN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	1400+00.00									2692045.30	6134357.64
PI2	1401+19.14	10°59'17"	28°47'31"	19.14	-199.00	38.16	1401+00.00	1401+38.16	N 11°32'08" W	2692164.43	6134356.51
PI3	1401+76.73	10°59'17"	14°17'18"	38.57	401.00	76.90	1401+38.16	1402+15.07	N 0°32'51" W	2692220.98	6134344.97
PI4		180°00'00"	2291°49'52"	-1.00	2.50	7.85	1405+42.22	1405+50.07	S 0°32'51" E	NaN	NaN
PI5	1407+70.22	10°59'17"	28°47'31"	19.14	-199.00	38.16	1407+51.07	1407+89.24	S 11°32'08" E	2692366.60	6134348.57
PI6	1408+27.81	10°59'17"	14°17'18"	38.57	401.00	76.90	1407+89.24	1408+66.14	S 0°32'51" E	2692310.06	6134360.11
PI7		180°00'00"	2291°49'52"	-1.00	2.50	7.85	1410+92.29	1411+00.15	N 0°32'51" W	NaN	NaN
POE	1411+00.15									2692045.30	6134357.64

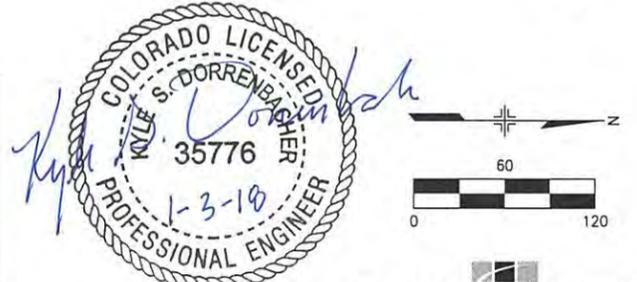
12TH AVE TO HOLDEN PL MEDIAN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	1600+00.00									2693296.12	6134333.83
PI2	1600+82.14	4°31'25"	3°59'34"	56.68	-1435.00	113.30	1600+25.46	1601+38.76	N 5°36'50" W	2693378.24	6134332.27
PI3		180°00'00"	2291°49'52"	-1.00	2.50	7.85	1602+75.11	1602+82.96	S 5°36'50" E	NaN	NaN
PI4	1603+83.77	9°05'08"	28°47'31"	15.81	-199.00	31.56	1603+67.96	1603+99.52	S 14°41'58" E	2693470.50	6134328.22
PI5	1604+37.76	10°53'44"	14°17'18"	38.24	401.00	76.25	1603+99.52	1604+75.77	S 3°48'15" E	2693418.22	6134341.94
PI6	1605+23.07	1°37'00"	1°42'33"	47.29	3352.00	94.58	1604+75.77	1605+70.35	S 2°11'15" E	2693332.87	6134347.61
PI7	1605+85.59	14°34'02"	114°54'56"	15.24	5.00	12.54	1605+70.35	1605+82.89	N 38°30'47" W	2693270.39	6134350.00
PI8	1605+84.73	3°11'53"	86°48'42"	1.84	-66.00	3.68	1605+82.89	1605+86.57	N 41°42'39" W	2693283.75	6134339.36
PI9	1605+92.86	40°37'15"	337°02'02"	6.29	17.00	12.05	1605+86.57	1605+98.63	N 1°05'25" W	2693289.82	6134333.95
POE	1605+98.63									2693296.12	6134333.83



10TH AVE TO 11TH AVE MEDIAN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	1500+00.00									2692782.92	6134350.60
PI2	1500+24.14	10°59'17"	28°47'31"	19.14	-199.00	38.16	1500+05.00	1500+43.16	N 11°32'08" W	2692807.06	6134350.37
PI3	1500+81.73	10°59'17"	14°17'18"	38.57	401.00	76.90	1500+43.16	1501+20.07	N 0°32'51" W	2692863.60	6134338.82
PI4	1502+12.84	14°32'24"	114°54'56"	15.12	5.00	12.51	1501+97.73	1502+10.24	S 37°08'51" E	2692994.94	6134337.57
PI5	1502+12.56	4°01'14"	86°48'42"	2.32	-66.00	4.63	1502+10.24	1502+14.87	S 41°10'05" E	2692981.05	6134348.10
PI6	1502+21.16	40°37'15"	337°02'02"	6.29	17.00	12.05	1502+14.87	1502+26.92	S 0°32'51" E	2692974.57	6134353.76
PI7		180°00'00"	2291°49'52"	-1.00	2.50	7.85	1504+12.24	1504+20.10	N 0°32'51" W	NaN	NaN
POE	1504+20.10									2692782.92	6134350.60



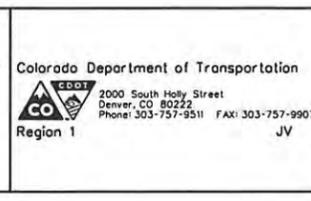
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE GEOMETRIC CONTROL 9TH AVE TO HOLDEN PL MEDIANS	
Designer:	KSD
Detailer:	SRF
Structure Numbers:	
Sheet Subset:	GEOMCONT
Subset Sheets:	4 of 10

Project No./Code	NHPP 2873-172 SA 19957
2011-PROJMSTR-0000364	
Sheet Number	45

AD SUBMITTAL - JANUARY 2, 2018

7TH AVE CENTER HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	69+60.00									2690651.19	6134331.96
POE	72+00.00									2690652.23	6134571.96

7TH AVE SE CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	180+00.00			19.11					N 3°09'31" W	2690580.01	6134417.96
PI 2	180+49.62	92°54'40"	197°34'18"	30.51	29	47.03	180+19.11	180+66.13	N 89°45'09" E	2690629.55	6134415.23
PI 3	180+73.80			6.00					N 89°26'36" E	2690629.72	6134453.41
PI 4	180+79.80			39.89					N 89°49'06" E	2690629.78	6134459.41
PI 5	181+19.70			40.31					N 89°54'29" E	2690629.9	6134499.3
POE	181+60.00			40.31					N 89°54'29" E	2690629.97	6134539.61

7TH AVE NE CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	185+00.00			90.30					S 89°45'09" W	2690674.07	6134534.94
PI 2	186+21.89	89°16'14"	179°02'58"	31.60	32	49.86	185+90.30	186+40.16	N 0°58'37" W	2690673.54	6134413.05
PI 3	186+47.65	0°25'46"	2°51'53"	7.50	2000	14.99	186+40.16	186+55.15	N 0°32'51" W	2690712.63	6134412.38
POE	186+80.00			24.85					N 0°32'51" W	2690744.98	6134412.07

SEVERN PL CENTER HORIZONTAL CONTROL DATA

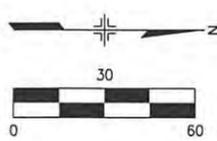
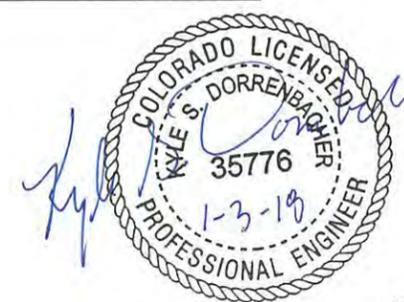
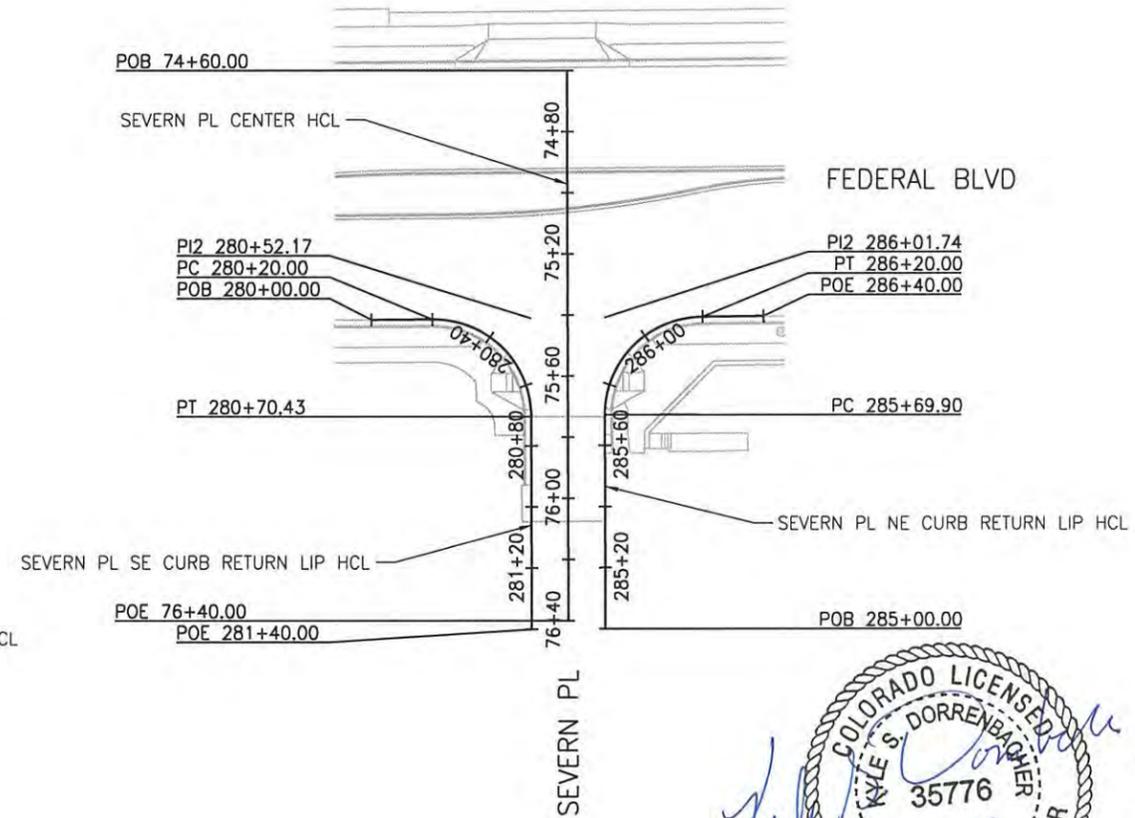
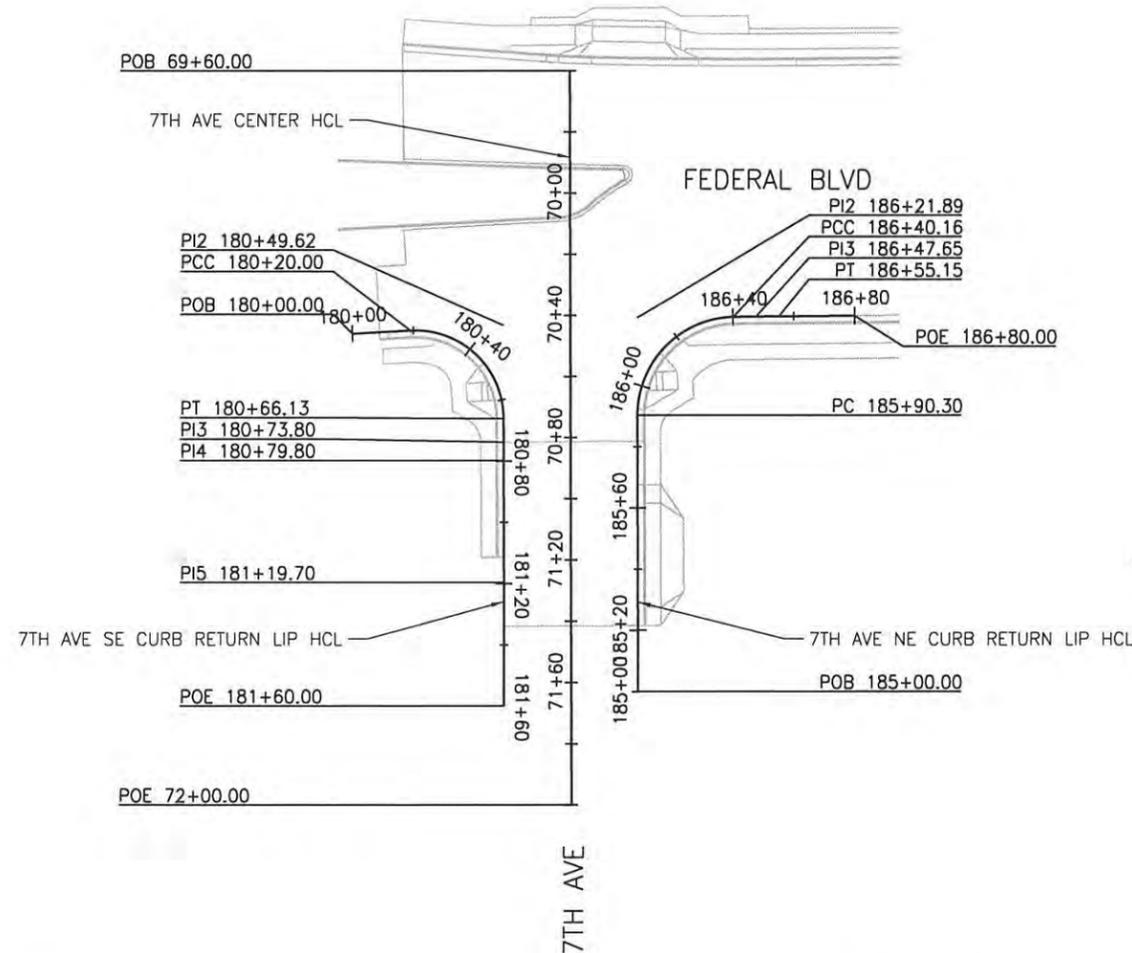
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POB	74+60.00									2690966.93	6134328.95
POE	76+40.00									2690967.71	6134508.95

SEVERN PL SE CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	280+00.00									2690903.11	6134410.56
PI2	280+52.17	90°18'00"	179°02'58"	32.17	32.00	50.43	280+20.00	280+70.43	N 89°45'09" E	2690955.28	6134410.06
POE	281+40.00									2690955.72	6134511.80

SEVERN PL NE CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	285+00.00									2690979.72	6134511.57
PI2	286+01.74	89°42'00"	179°02'58"	31.83	32.00	50.10	285+69.90	286+20.00	N 0°32'51" W	2690979.28	6134409.83
POE	286+40.00									2691031.11	6134409.34

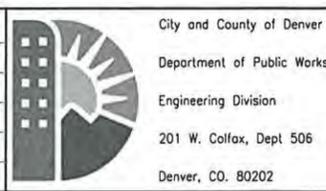


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Region 1
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
GEOMETRIC CONTROL
7TH AVE & SEVERN PL CENTER AND RETURNS

Designer:	KSD	Structure Numbers	
Detailer:	SRF		
Sheet Subset:	GEOMCONT	Subset Sheets:	5 of 10

Project No./Code
NHPP 2873-172
SA 19957
2011-PROJMSTR-0000364
Sheet Number **46**

AD SUBMITTAL - JANUARY 2, 2018

8TH AVE WEST CENTER HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	79+80.00									2691303.28	6134217.06
POE	81+60.00									2691304.20	6134397.06

8TH AVE SW CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	370+00.00									2691215.00	6134325.58
PI2	370+56.84	89°44'50"	154°51'12"	36.84	-37.00	57.96	370+20.00	370+77.96	S 89°42'19" W	2691271.83	6134325.03
POE	371+50.00									2691271.27	6134216.15

8TH AVE NW CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	375+00.00									2691335.27	6134215.40
PI2	376+08.88	90°35'18"	154°51'12"	37.38	-37.00	58.50	375+71.50	376+30.00	N 0°52'59" W	2691335.83	6134324.28
POE	376+50.00									2691393.20	6134323.39

8TH AVE EAST CENTER HORIZONTAL CONTROL DATA

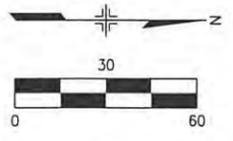
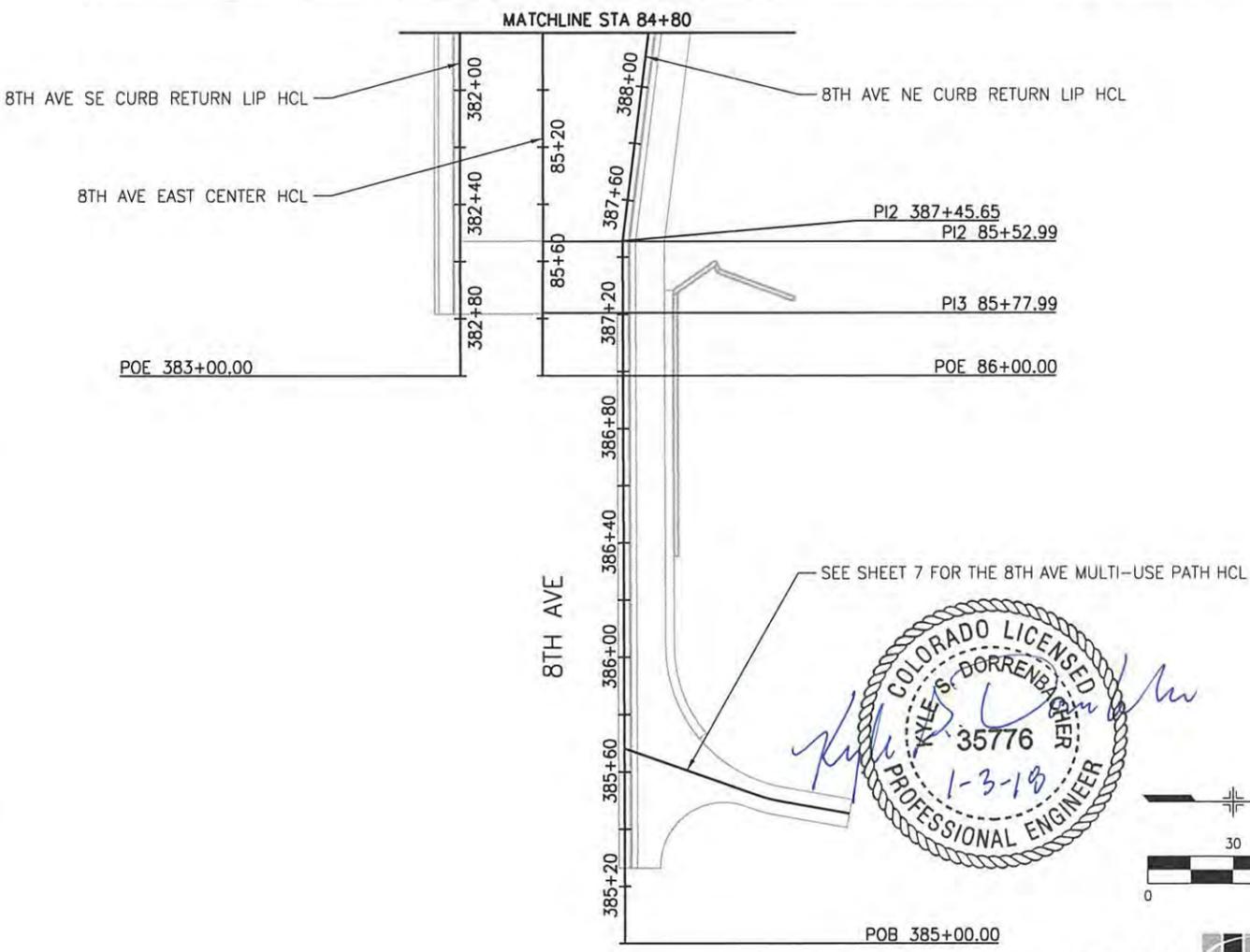
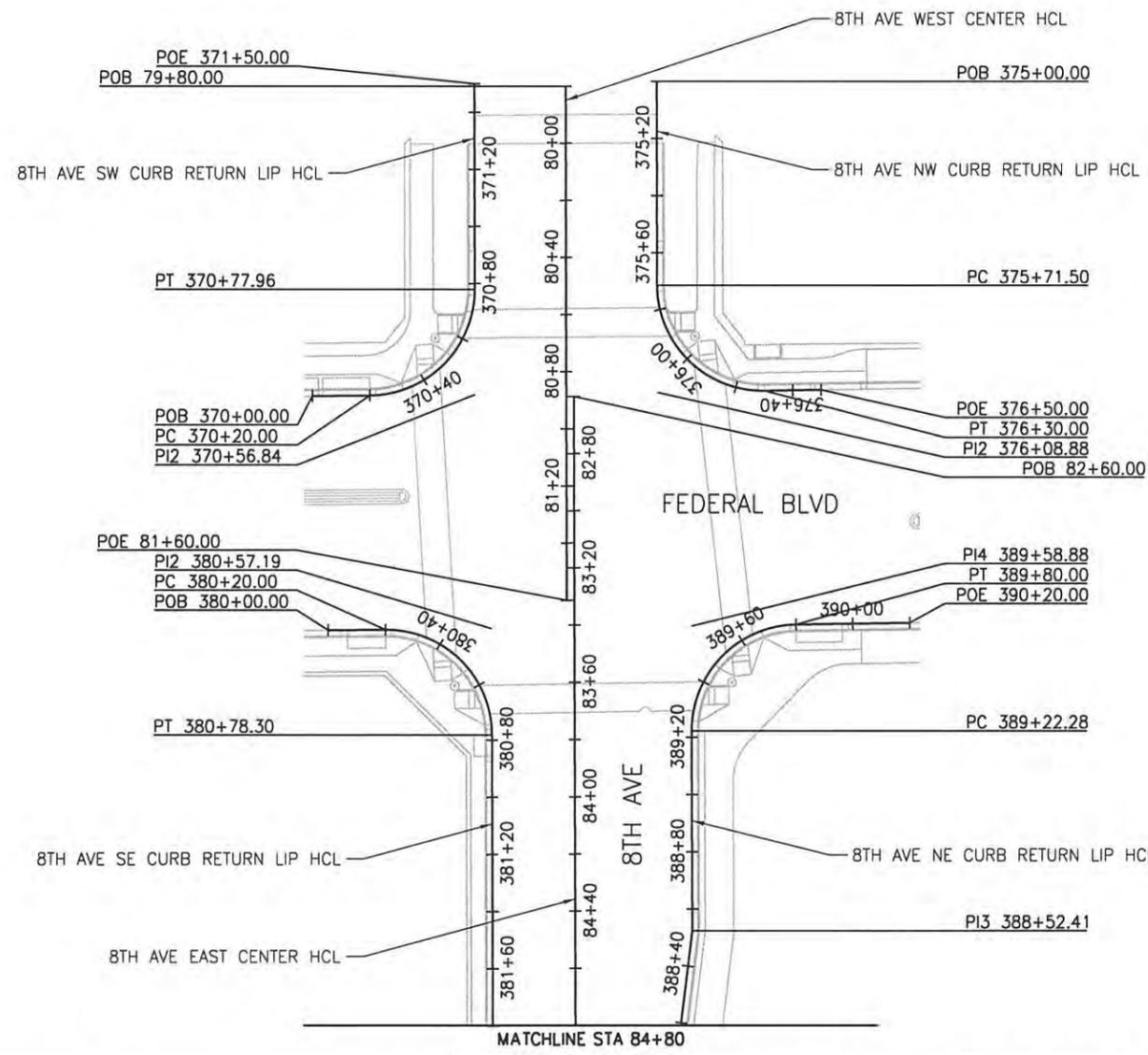
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POB	82+60.00									2691306.55	6134325.70
PI2	85+52.99									2691307.88	6134618.69
PI3	85+77.99									2691307.75	6134643.69
POE	86+00.00									2691307.85	6134665.70

8TH AVE SE CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	380+00.00									2691220.74	6134407.53
PI2	380+57.19	90°17'14"	154°51'12"	37.19	37.00	58.30	380+20.00	380+78.30	N 89°44'23" E	2691277.92	6134406.98
POE	383+00.00									2691279.10	6134665.86

8TH AVE NE CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	385+00.00									2691336.75	6134864.21
PI2	387+45.65									2691335.63	6134618.56
PI3	388+52.41									2691348.40	6134512.57
PI4	389+58.88	89°22'37"	154°51'12"	36.60	37.00	57.72	389+22.28	389+80.00	N 0°52'59" W	2691347.92	6134406.10
POE	390+20.00									2691424.51	6134404.92



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Department of Public Works
Engineering Division
201 W. Colfax, Dept 506
Denver, CO. 80202

Colorado Department of Transportation
2000 South Holly Street
Denver, CO 80222
Phone: 303-757-9511 FAX: 303-757-9907
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
GEOMETRIC CONTROL
8TH AVE CENTER AND RETURNS

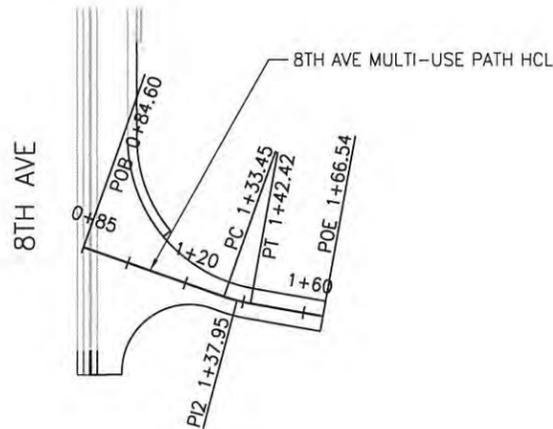
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Detailer:	SRF		
Sheet Subset:	GEOMCONT	Subset Sheets:	6 of 10

Project No./Code
NHPP 2873-172
SA 19957
2011-PROJMSTR-0000364
Sheet Number 47

AD SUBMITTAL - JANUARY 2 2018

8TH AVE MULTI-USE PATH HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	0+84.60									2691336.44	6134796.09
PI2	1+37.95	9°21'06"	104°10'27"	4.50	-55.00	8.98	1+33.45	1+42.42	N 10°02'33" E	2691386.76	6134813.81
POE	1+66.54									2691414.93	6134818.80



BARBERRY PL CENTER HORIZONTAL CONTROL DATA

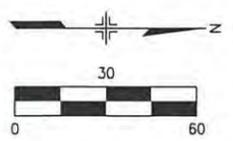
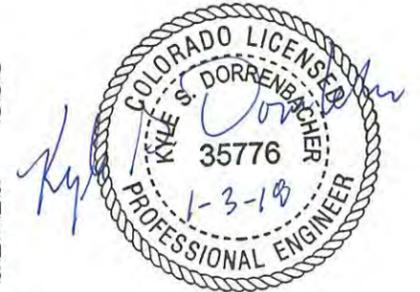
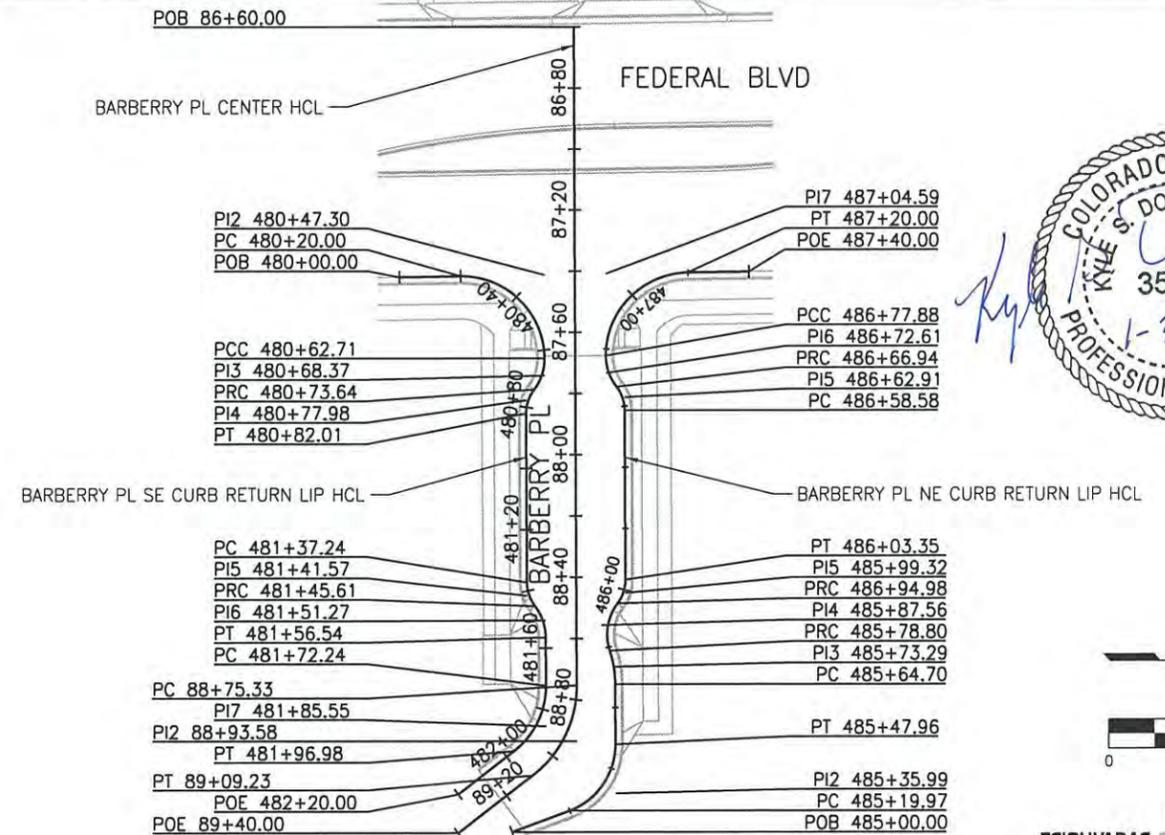
PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	86+60.00									2691668.03	6134320.16
PI 2	88+93.58	52°29'53"	154°51'12"	18.25	37.00	33.90	88+75.33	89+09.23	S 37°45'44" E	2691669.09	6134553.73
POE	89+40.00									2691630.34	6134583.75

BARBERRY PL SE CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	480+00.00									2691611.10	6134402.04
PI 2	480+47.30	90°37'23"	212°12'24"	27.3	27	42.71	480+20.00	480+62.71	N 89°44'23" E	2691658.39	6134401.31
PI 3	480+68.37	36°52'12"	337°02'02"	5.67	17	10.94	480+62.71	480+73.64	S 53°23'25" E	2691658.54	6134434.28
PI 4	480+77.98	36°52'12"	440°44'12"	4.33	-13	8.37	480+73.64	480+82.01	N 89°44'23" E	2691652.58	6134442.30
PI 5	481+41.57	36°52'12"	440°44'12"	4.33	-13	8.37	481+37.24	481+45.61	N 52°52'12" E	2691652.87	6134506.20
PI 6	481+51.27	36°52'12"	337°02'02"	5.67	17	10.94	481+45.61	481+56.54	N 89°44'23" E	2691658.91	6134514.17
PI 7	481+85.55	52°29'53"	212°12'24"	13.31	27	24.74	481+72.24	481+96.98	S 37°45'44" E	2691659.06	6134548.85
POE	482+20.00									2691630.34	6134571.10

BARBERRY PL NE CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	485+00.00								N 20°32'10" W	2691647.96	6134583.4
PI 2	485+35.99	69°43'27"	249°06'44"	16.02	-23.00	27.99	485+19.97	485+47.96	S 89°44'23" W	2691681.66	6134570.78
PI 3	485+73.29	17°40'05"	159°09'18"	5.60	-36.00	11.10	485+67.70	485+78.80	S 72°04'18" W	2691681.48	6134529.42
PI 4	485+87.56	54°32'17"	337°02'02"	8.76	17.00	16.18	485+78.80	485+94.98	N 53°23'25" W	2691677.06	6134515.76
PI 5	485+99.32	36°52'12"	440°44'12"	4.33	-13.00	8.37	485+94.98	486+03.35	S 89°44'23" W	2691684.87	6134505.25
PI 6	486+62.91	36°52'12"	440°44'12"	4.33	-13.00	8.37	486+58.58	486+66.94	S 52°52'12" W	2691684.58	6134441.35
PI 7	486+72.61	36°52'12"	337°02'02"	5.67	17.00	10.94	486+66.94	486+77.88	S 89°44'23" W	2691678.54	6134433.38
PI 8	487+04.59	89°22'37"	212°12'24"	26.71	27.00	42.12	486+77.88	487+20.00	N 0°52'59" W	2691678.39	6134401.01
POE	487+40.00								N 0°52'59" W	2691725.10	6134400.29



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Department of Public Works
Engineering Division
201 W. Colfax, Dept 506
Denver, CO. 80202

Colorado Department of Transportation
Region 1
2000 South Holly Street
Denver, CO 80222
Phone: 303-757-9511 FAX: 303-757-9907
JV

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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
GEOMETRIC CONTROL - 8TH AVE MUP,
BARBERRY PL CENTER AND RETURNS

Designer: KSD
Detailer: SRF
Sheet Subset: GEOMCONT

Structure Numbers
Subset Sheets: 7 of 10

Project No./Code
NHPP 2873-172
SA 19957
2011-PROJMSTR-0000364
Sheet Number **48**

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9TH AVE WEST CENTER HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	89+60.00									2691971.11	6134169.15
POE	91+86.33									2691972.07	6134395.48

9TH AVE SW CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	570+00.00									2691914.48	6134315.36
PI2	570+41.76	89°21'36"	260°26'07"	21.76	-22.00	34.31	570+20.00	570+54.31	S 89°45'25" W	2691956.23	6134314.71
POE	571+60.00									2691955.69	6134187.27

9TH AVE NW CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	575+00.00									2691986.69	6134186.76
PI2	576+27.44	90°18'16"	260°26'07"	22.12	-22.00	34.67	576+05.33	576+40.00	N 0°32'51" W	2691987.23	6134314.20
POE	576+60.00									2692029.34	6134313.79

9TH AVE EAST CENTER HORIZONTAL CONTROL DATA

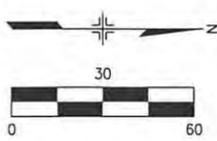
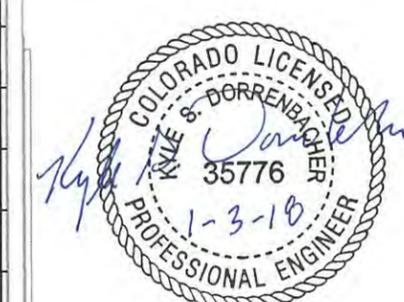
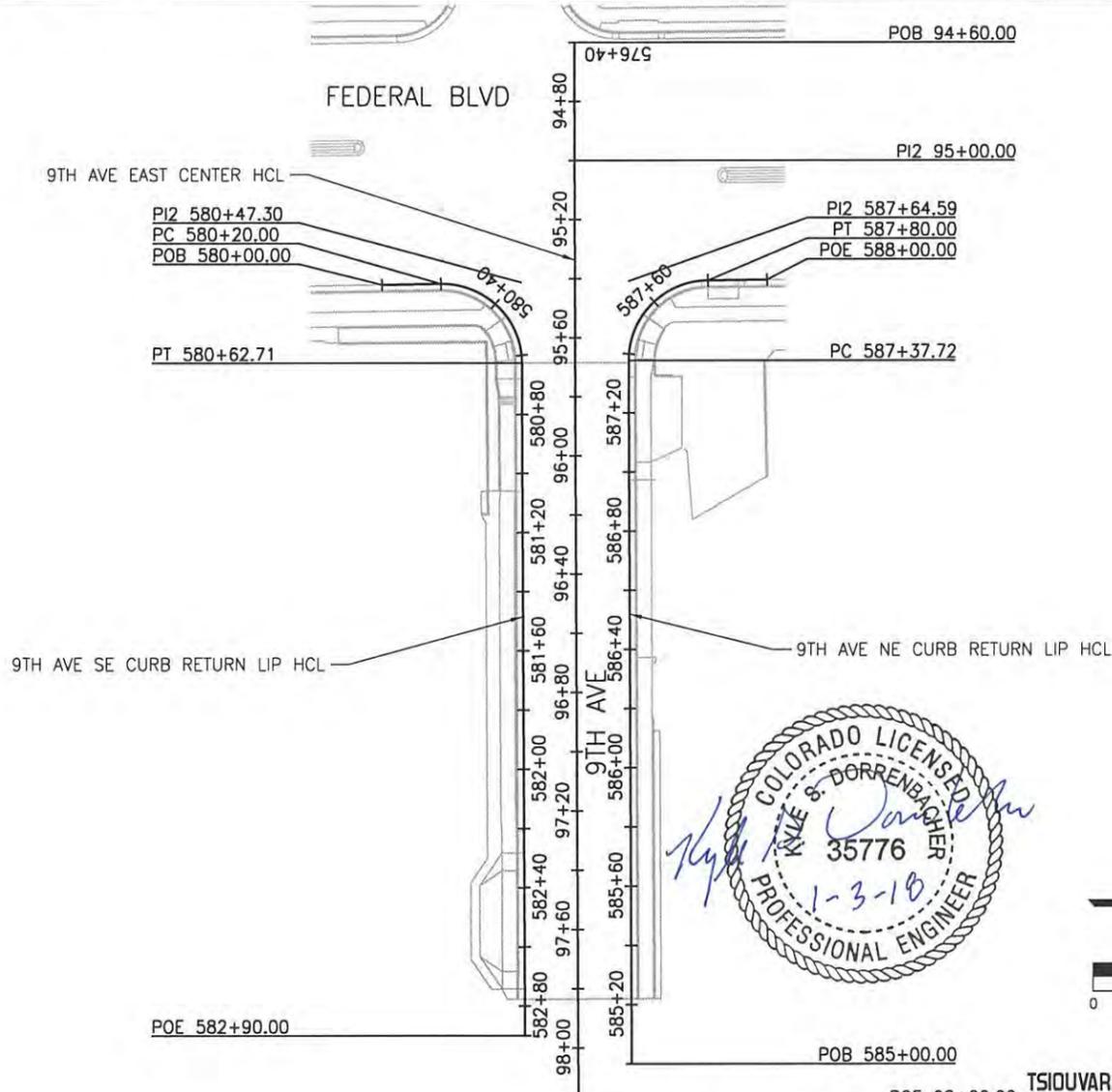
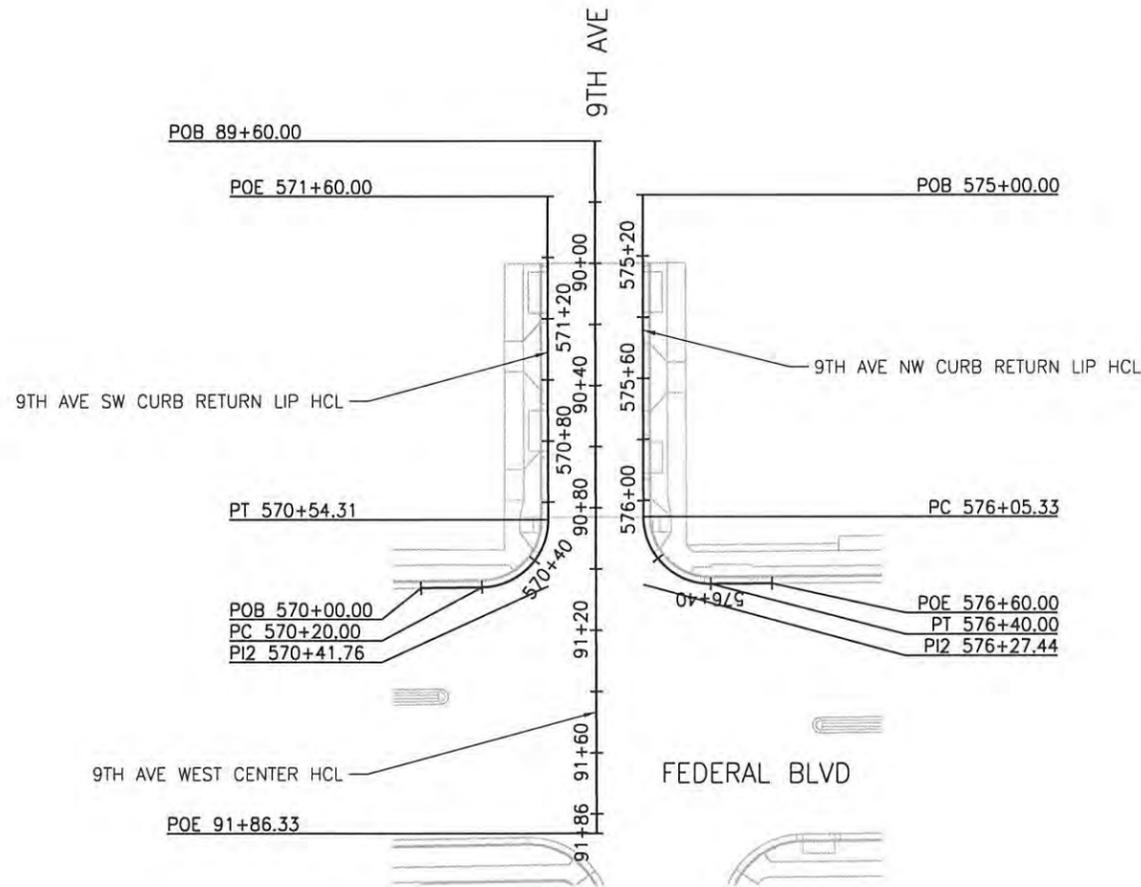
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POB	94+60.00									2691994.36	6134315.13
PI2	95+00.00									2691994.54	6134355.13
POE	98+20.00									2691995.99	6134675.13

9TH AVE SE CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	580+00.00									2691929.44	6134397.14
PI2	580+47.30	90°37'26"	212°12'24"	27.30	27.00	42.71	580+20.00	580+62.71	N 89°44'26" E	2691976.73	6134396.41
POE	582+90.00									2691977.88	6134650.99

9TH AVE NE CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	585+00.00									2692013.93	6134660.54
PI2	587+64.59	89°42'43"	212°12'24"	26.86	27.00	42.28	587+37.72	587+80.00	N 0°32'51" W	2692012.73	6134395.96
POE	588+00.00									2692059.59	6134395.51



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Sheet Revisions																					
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10TH AVE WEST CENTER HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	99+40.00									2692630.56	6134084.04
PI2	100+08.95									2692630.86	6134152.99
PI3	100+40.88									2692630.77	6134184.92
PI4	100+84.98									2692630.96	6134229.02
POE	102+05.12									2692637.45	6134348.99

10TH AVE SW CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	670+00.00									2692569.44	6134308.63
PI2	670+46.86	89°41'55"	212°12'24"	26.86	-27.00	42.27	670+20.00	670+62.27	S 89°45'14" W	2692616.30	6134308.19
PI3	671+58.62									2692615.77	6134184.98
PI4	671+98.75									2692617.82	6134144.90
POE	672+20.00									2692617.73	6134123.65

10TH AVE NW CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	675+00.00									2692643.75	6134127.71
PI2	675+25.23									2692643.86	6134152.94
PI3	675+57.20									2692645.77	6134184.85
PI4	676+00.37									2692645.96	6134228.02
PI5	676+80.82	83°10'35"	168°31'01"	30.17	-34.00	49.36	676+50.64	677+00.00	N 0°32'51" W	2692656.28	6134307.80
POE	677+20.00									2692706.45	6134307.32

10TH AVE EAST CENTER HORIZONTAL CONTROL DATA

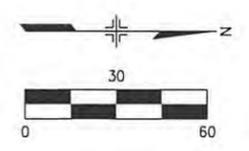
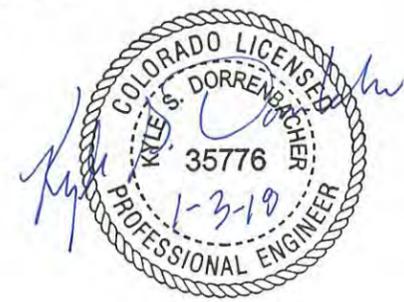
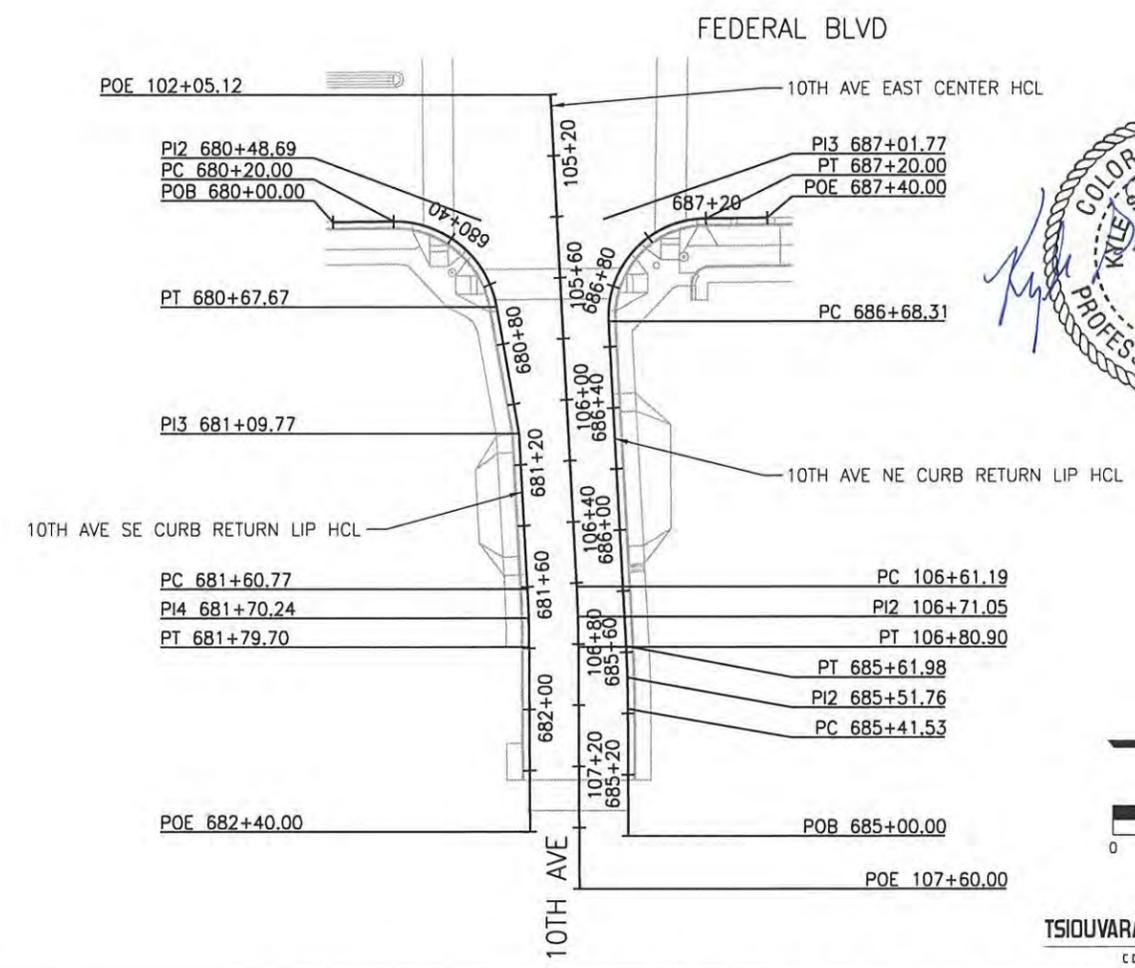
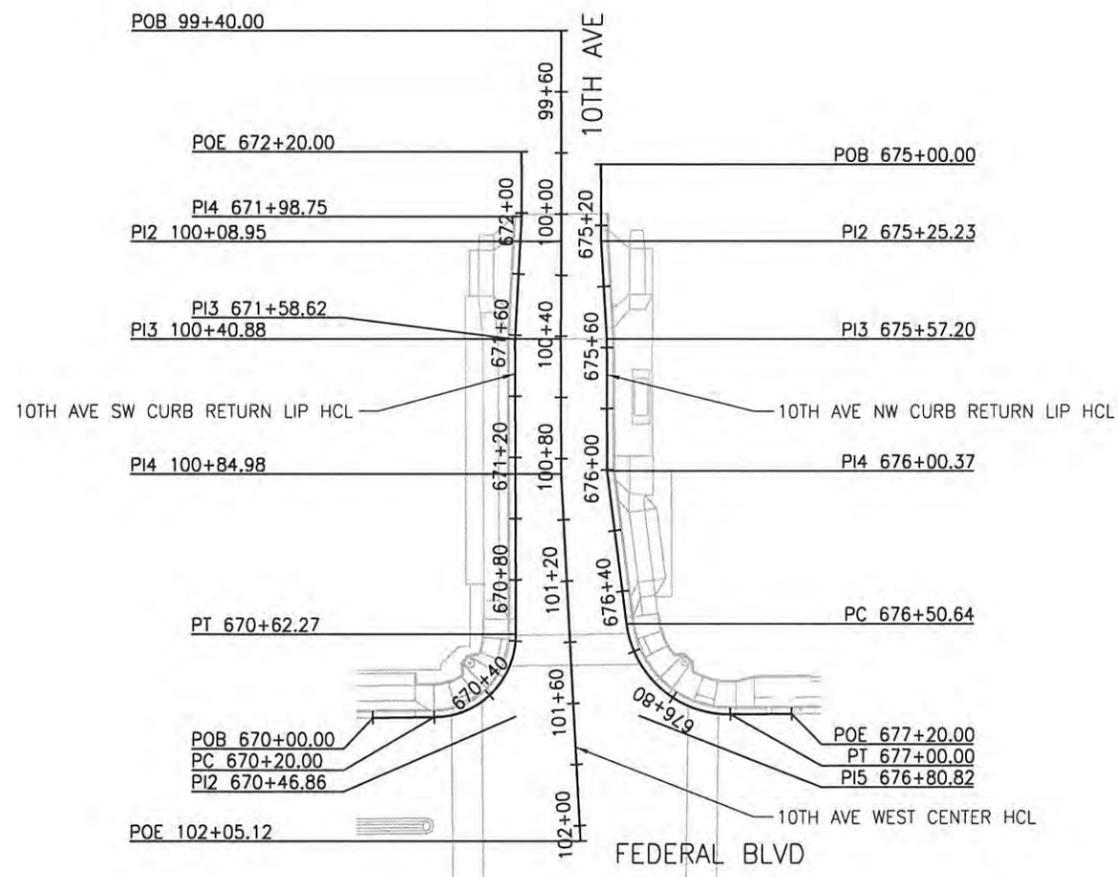
PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	105+00.00									2692637.45	6134348.99
PI2	106+71.05	2°49'24"	14°19'26"	9.86	400.00	19.71	106+61.19	106+80.90	N 89°43'39" E	2692646.69	6134519.79
POE	107+60.00									2692647.11	6134608.74

10TH AVE SE CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	680+00.00									2692566.17	6134390.67
PI2	680+48.69	80°19'35"	168°31'01"	28.69	34	47.67	680+20.00	680+67.67	N 79°46'44" E	2692614.86	6134390.20
PI3	681+09.77									2692627.42	6134459.87
PI4	681+70.24	2°49'24"	14°55'15"	9.46	384	18.92	681+60.77	681+79.70	N 89°43'39" E	2692630.69	6134520.26
POE	682+40.00									2692631.02	6134590.02

10TH AVE NE CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	685+00.00									2692663.03	6134591.37
PI2	685+51.76	2°49'24"	13°48'22"	10.23	-415.00	20.45	685+41.53	685+61.98	S 86°54'14" W	2692662.78	6134539.62
PI3	687+01.77	92°32'55"	179°02'58"	33.46	32.00	51.69	686+68.31	687+20.00	N 0°32'51" W	2692654.68	6134389.82
POE	687+40.00									2692708.13	6134389.31



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Sheet Revisions		
Date:	Comments	Init.

City and County of Denver
 Department of Public Works
 Engineering Division
 201 W. Colfax, Dept 506
 Denver, CO. 80202

Colorado Department of Transportation
 2000 South Holly Street
 Denver, CO 80222
 Phone: 303-757-9511 FAX: 303-757-9907
 Region 1 JV

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No Revisions:
Revised:
Void:

FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE			
GEOMETRIC CONTROL			
10TH AVE CENTER AND RETURNS			
Designer:	KSD	Structure	
Detailer:	SRF	Numbers	
Sheet Subset:	GEOMCONT	Subset Sheets:	9 of 10

Project No./Code	NHPP 2873-172 SA 19957
2011-PROJMSTR-0000364	
Sheet Number	50

AD SUBMITTAL - JANUARY 2, 2018

11TH AVE CENTER HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	109+60.00									2692972.32	6134305.78
POE	111+70.00									2692973.29	6134515.78

11TH AVE SE CURB RETURN LIP HORIZONTAL CONTROL DATA

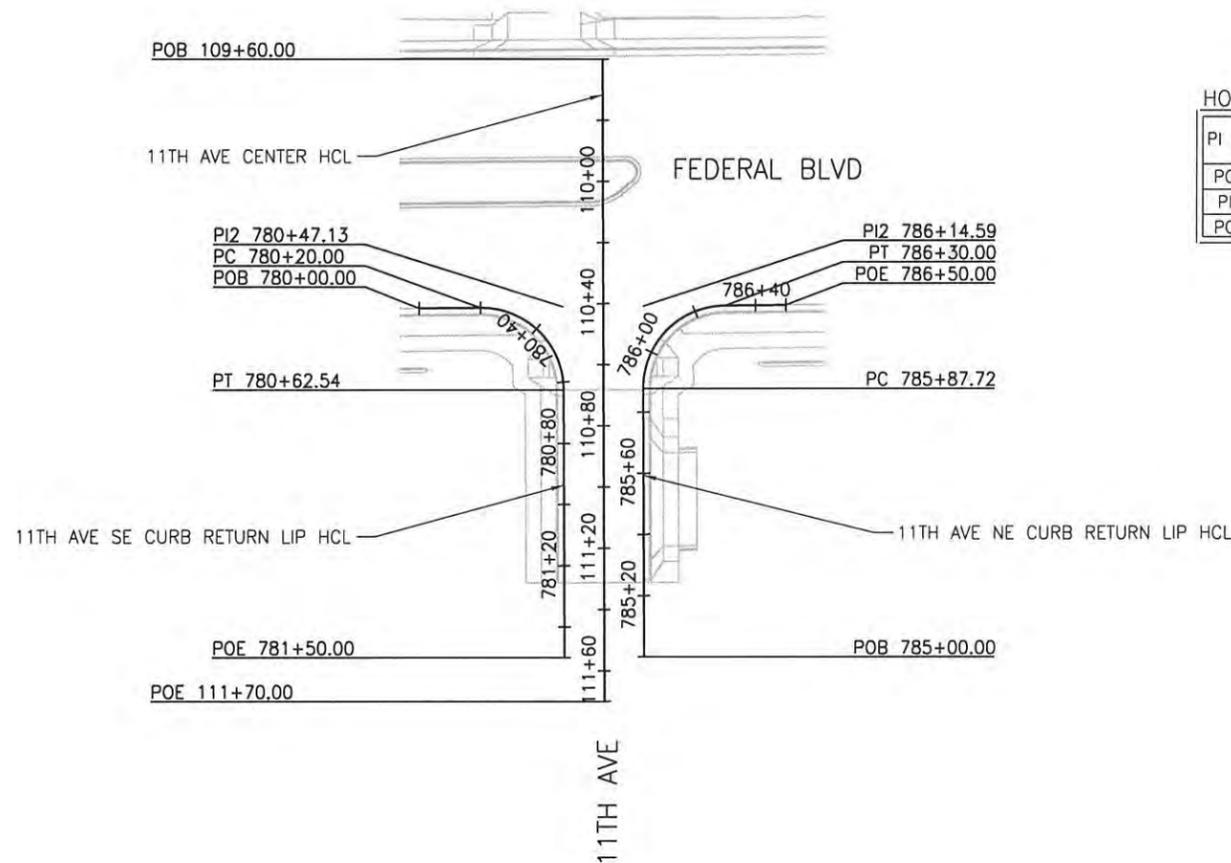
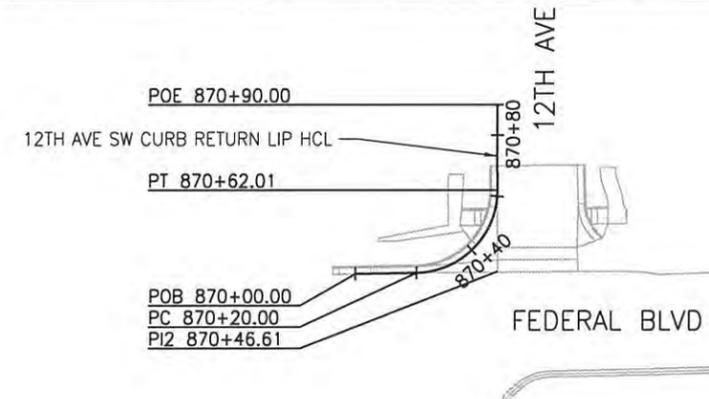
PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	780+00.00									2692912.56	6134387.36
PI2	780+47.13	90°16'56"	212°12'24"	27.13	27.00	42.54	780+20.00	780+62.54	N 89°44'05" E	2692959.69	6134386.91
POE	781+50.00									2692960.22	6134501.50

11TH AVE NE CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	785+00.00									2692986.22	6134501.25
PI2	786+14.59	89°43'04"	212°12'24"	26.87	27.00	42.28	785+87.72	786+30.00	N 0°32'51" W	2692985.69	6134386.66
POE	786+50.00									2693032.56	6134386.21

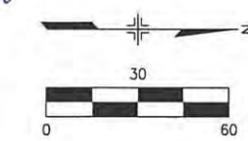
12TH AVE SW CURB RETURN LIP HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	870+00.00									2693232.17	6134302.04
PI2	870+46.61	89°09'21"	212°12'24"	26.61	-27.00	42.01	870+20.00	870+62.01	S 89°45'14" W	2693278.77	6134301.16
POE	870+90.00									2693278.53	6134246.56



HOLDEN PL CENTER HORIZONTAL CONTROL DATA

PI NO	PI STA	DELTA	DEGREE OF CURVE	TANGENT LENGTH (FT)	RADIUS (FT)	ARC LENGTH (FT)	PC STA	PT STA	BEARING	NORTHING	EASTING
POB	113+00.00			77.03					N 84°26'31"E	2693614.43	6134279.88
PI2	113+77.03			88.37					N 89°46'49"E	2693621.89	6134356.55
POE	114+65.40			88.37					N 89°46'49"E	2693622.23	6134444.92



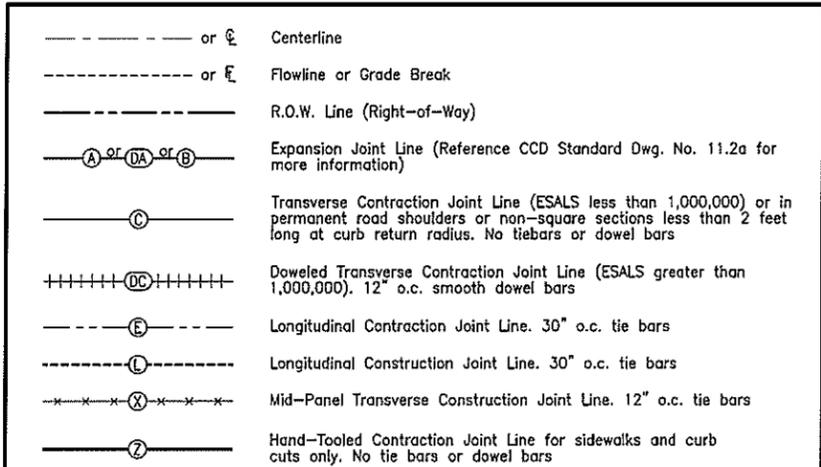
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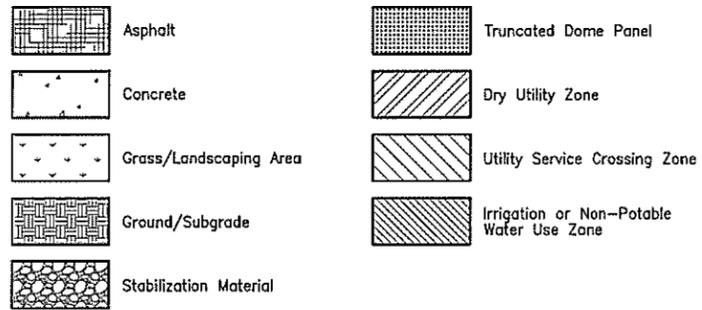
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Date:	Comments	Init.																					
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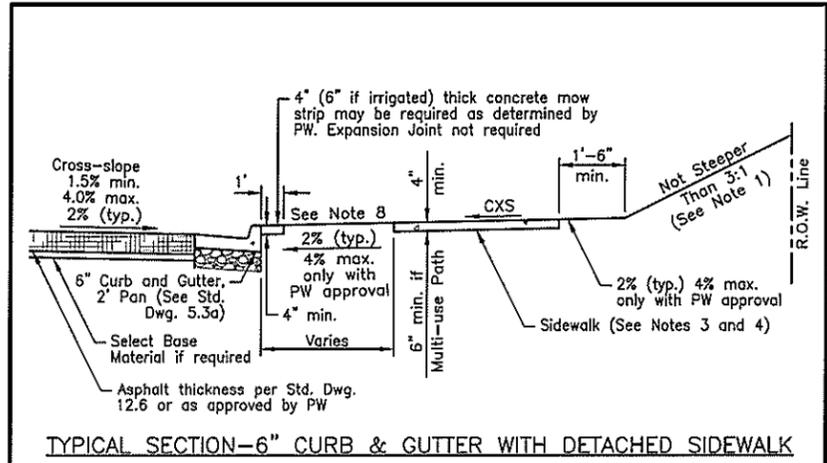
AD SURMITTAI - JANUARY 2 2018



FLR Accessible Flare Slope = 9.5% design max. (10% (10H:1V) max., 2.0% min. allowed)
 RMP Accessible Ramp Slope = 7.8% design max. (8.33% (12H:1V) max., 2.0% min. allowed)
 CXS Accessible Cross Slope = 1.8% design max. (2.0% (50H:1V) max., 1.5% min. allowed)
 RNG Accessible Running Slope = 4.5% design max. (5.0% (20H:1V) max. allowed)



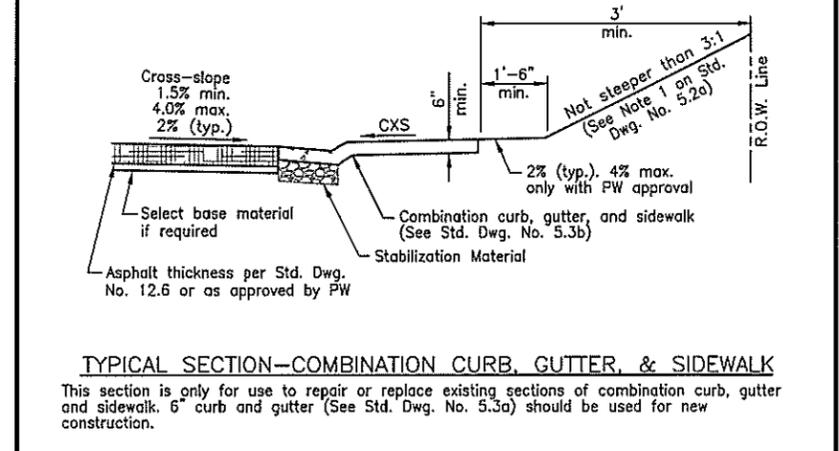
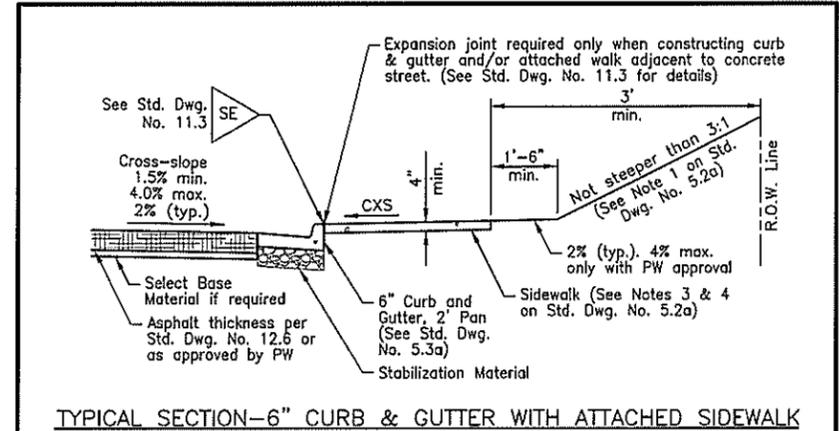
	City and County of Denver Department of Public Works	Date: 05/15
	Legend	Std. Dwg. No. 5.0



TYPICAL SECTION-6" CURB & GUTTER WITH DETACHED SIDEWALK

Notes:
 1. Side slope may exceed 3:1 only with the approval of Public Works. Some side slopes may require a hand railing to be installed.
 2. Proposed variations from minimum dimensions may require a variance request submittal.
 3. Standard minimum sidewalk widths for new construction: Local Street-5' detached or 5' attached; Collector Street-5' detached or 5' attached; Arterial Street-8' detached. Tree grates cannot be used as part of the sidewalk.
 4. Sidewalk Materials: The sidewalk material can be either concrete or sandstone for new sidewalk construction or full frontage sidewalk replacement. For limited sidewalk replacement work, like replacing several sidewalk panels for a utility trench, the sidewalk material should match the existing sidewalk material. Sandstone can only be used for the sidewalk material under the following conditions:
 a) No horizontal gaps or joints larger than 0.25" are allowed. Joints should be filled with sand.
 b) Sandstone must be at least 4" thick by 5' long (minimum) by 2' wide (minimum). Driving surfaces should be at least 6" thick. May use two layers to achieve this thickness.
 c) Sandstone must be set on a minimum 2" thick sand base under fitted with a rot resistant geotextile fabric. The Engineer may require a drainage system for some installations. Drainage systems, when required, must be able to support HS-20 loading.
 d) Sandstone should only be used on streets with a running slope less than or equal to 5%. Sandstone sidewalk on steeper slopes may not meet ADAAG slip resistance criteria.
 5. Refer to Std. Dwg. 12.0 for patching and saw cut details.
 6. Refer to Public Works Rules and Regulations for sidewalk and curb ramp construction.
 7. 3" schedule 40 PVC shall be placed behind the back of curb along the entire property frontage when warranted by the traffic operations Conduit Engineer (720.865.4000) for future street lights, signals, etc.
 8. All plantings within the tree lawn shall be per the Encroachment Rules & Regulations. No loose material shall be allowed. Decorative concrete or low growing plant material may be allowed only with the specific approval of Public Works. Trees shall be a minimum of 20' from property corners at intersections, 25' from street lights, 10' from the edge of driveways, 20' from curb ramps and 30' from stop signs.

	City and County of Denver Department of Public Works	Date: 05/15
	Curb & Gutter and Sidewalk	Std. Dwg. No. 5.2a



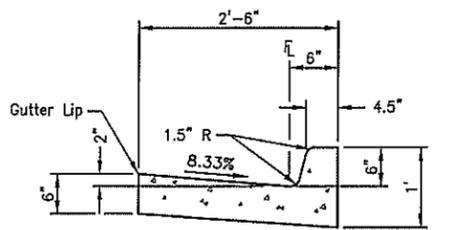
	City and County of Denver Department of Public Works	Date: 05/15
	Curb & Gutter and Sidewalk	Std. Dwg. No. 5.2b

NOTE: 2015 TRANSPORTATION STANDARDS AND DETAILS WERE USED FOR DESIGN ON THIS PROJECT. WHERE FEASIBLE, THE 2017 TRANSPORTATION STANDARDS AND DETAILS SHALL BE USED. IF A QUESTION ABOUT WHICH STANDARD OR DETAIL TO BE USED ARISES, THE CITY'S PROJECT MANAGER SHALL DETERMINE WHICH DETAIL TO USE.

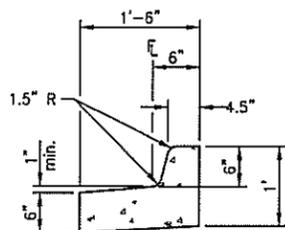


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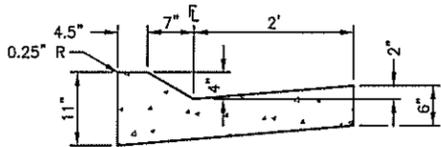
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Sheet Revisions																								
Date:	Comments	Inil.																						
Drawing File Name: 1102188-011-Typ Roadway Details.dgn Horizontal Scale: 1:2 Vert. Scale: As Noted			Denver, CO. 80202	Designer: KSD Structure Numbers Detailer: SRF Sheet Subset: TYPDET Subset Sheets: 1 of 15																				



6" CURB AND GUTTER-2' CATCH PAN



6" CURB AND GUTTER-1' SPILL PAN



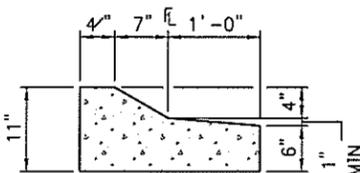
4" MOUNTABLE CURB
For existing conditions only

Note:

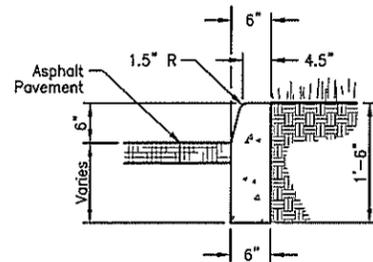
1. Curb and gutter section lengths shall be 10' long typical and adjusted in length so that concrete pavement panel joint lines will be continuous through the curb and gutter. Maximum length is 12' for a 6" thick gutter section.
2. Refer to Std. Dwg. No. 11.6 for additional information on concrete panel replacement.
3. Gutters must transition at all Pedestrian Ramps. See ramp details.

	City and County of Denver Department of Public Works	Date: 05/15
	Typical Curb & Gutter Sections	Std. Dwg. No. 5.3a

6" CURB AND GUTTER - 2' CATCH PAN TO BE PAID FOR AS ITEM 609- CURB AND GUTTER TYPE 2 (SECTION II-B)
 6" CURB AND GUTTER - 1' SPILL PAN TO BE PAID FOR AS ITEM 609 - CURB AND GUTTER TYPE 2 (SECTION I-B)
 4" MOUNTABLE CURB TO BE PAID FOR AS ITEM 609 - CURB AND GUTTER TYPE 2 (SECTION II-B)



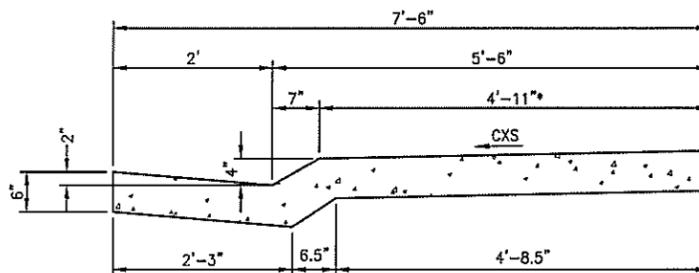
4" MOUNTABLE CURB (OUTFALL)
TO BE INCLUDED IN ITEM
608- 4 INCH MOUNTABLE CURB (OUTFALL)



6" CURB HEAD

Notes:

1. This section is only for use to repair or replace existing sections of 6" curb head. 6" curb & gutter (See Std. Dwg. No. 5.3a) should be used for new construction.
2. A 2' wide asphalt patch will also be required per Std. Dwg. No. 12.0.
3. Larger curb head sections may be required by Public Works. Public Works will review each project and make the final determination.

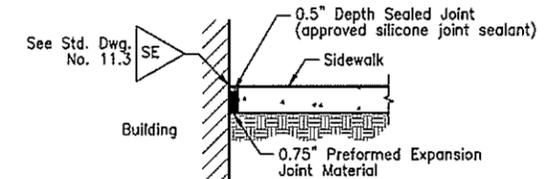


* Match existing width on repair projects only with 3' minimum width.

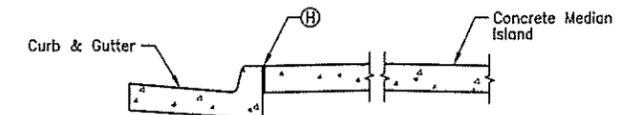
COMBINATION CURB, GUTTER AND SIDEWALK (5')

This section is only for use to repair or replace existing sections of combination curb, gutter and sidewalk. 6" curb and gutter (See Std. Dwg. No. 5.3a) should be used for new construction.

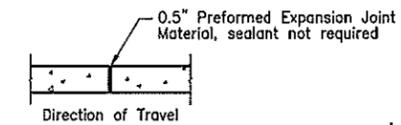
	City and County of Denver Department of Public Works	Date: 05/15
	Typical Curb & Gutter Sections	Std. Dwg. No. 5.3b



SIDEWALK EXPANSION JOINT AT BUILDINGS

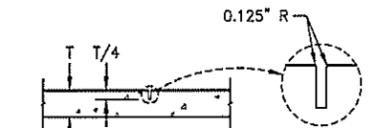


CURB & GUTTER/CONCRETE MEDIAN ISLAND EXPANSION JOINT



(H) SIDEWALK EXPANSION JOINT

All concrete panels with an adjacent (H) joint shall be generally square and shall not exceed 1.5L:1W shape. Triangular panels should not have any angles less than 30 degrees.



(Z) CURB & GUTTER/
SIDEWALK TOOLED JOINT

Notes:

1. Concrete curb & gutter and sidewalk tooled joint spacing:
 10' - Combination curb, gutter, and sidewalk
 10' - Curb & gutter, curb head, or mountable curb
 5' - Detached and attached sidewalks
2. For sidewalks, expansion joints shall be provided every 100' to 120' and shall extend the full depth of the concrete walk. May be lengthened for curve walks with approval of Public Works.
3. Expansion joint material shall be installed between new sidewalk and existing buildings (see detail above).
4. Expansion joint material shall be installed between new sidewalk and existing concrete slabs, inlets, fire hydrants, poles, and other fixed objects.
5. Expansion joint material between curb and sidewalk is required when sidewalk abuts back of curb on concrete streets.
6. These details and notes do not apply to bike paths - See Parks & Recreation Standards.
7. Minimum widening of sidewalks shall be 18" to accommodate (L) Joint (See Std. Dwg. No. 11.2b).

	City and County of Denver Department of Public Works	Date: 05/15
	Curb & Gutter and Sidewalk Joint Details	Std. Dwg. No. 5.4

NOTE: 2015 TRANSPORTATION STANDARDS AND DETAILS WERE USED FOR DESIGN ON THIS PROJECT. WHERE FEASIBLE, THE 2017 TRANSPORTATION STANDARDS AND DETAILS SHALL BE USED. IF A QUESTION ABOUT WHICH STANDARD OR DETAIL TO BE USED ARISES, THE CITY'S PROJECT MANAGER SHALL DETERMINE WHICH DETAIL TO USE.

CONSULTING ENGINEERS

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Sheet Revisions		
Date:	Comments	Init.

City and County of Denver
 Department of Public Works
 Engineering Division
 201 W. Colfax, Dept 505
 Denver, CO. 80202

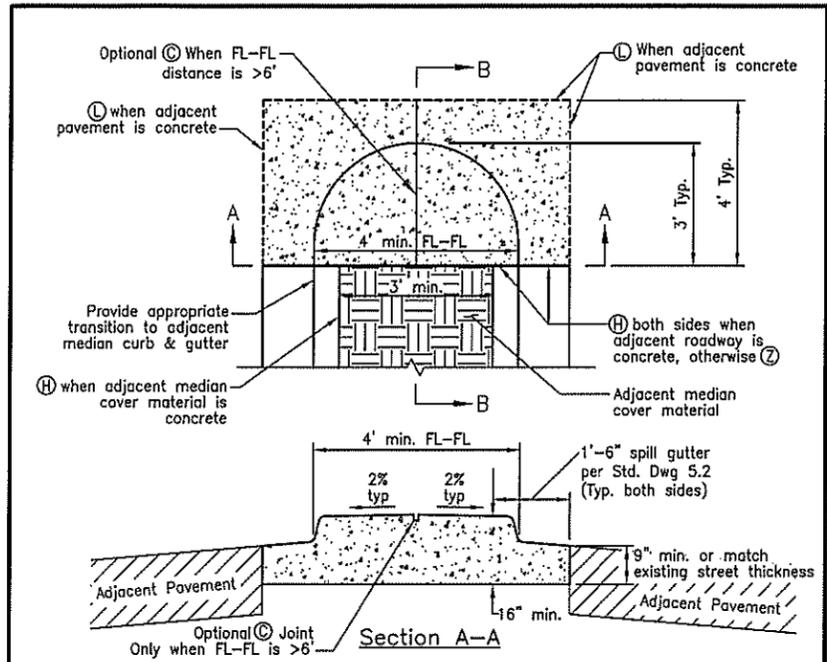
Colorado Department of Transportation
 2000 South Holly Street
 Denver, CO 80222
 Phone: 303-757-9511 FAX: 303-757-9907
 Region 1 JV

As Constructed
 No Revisions:
 Revised:
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
 TYPICAL ROADWAY DETAILS
 Designer: KSD
 Detailer: SRF
 Sheet Subset: TYPDET
 Structure Numbers:
 Subset Sheets: 2 of 15

Project No./Code
 NHPP 2873-172
 SA 19957
 2011-PROJMSTR-0000364
 Sheet Number 53

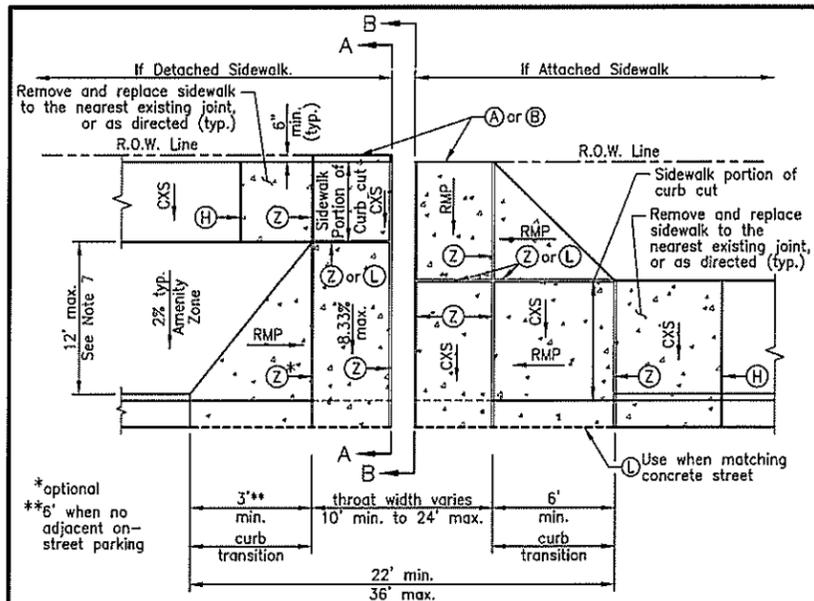
AD SUBMITTAL - JANUARY 2, 2018



- Notes:
1. Median nose shall be poured monolithically with curb and gutter transition.
 2. Curb height at median nose may be adjusted with approval by PW.

	City and County of Denver Transportation Standards & Details	Date: 04/17
	Monolithic Median Curb Nose	Std. Dwg. 5.6

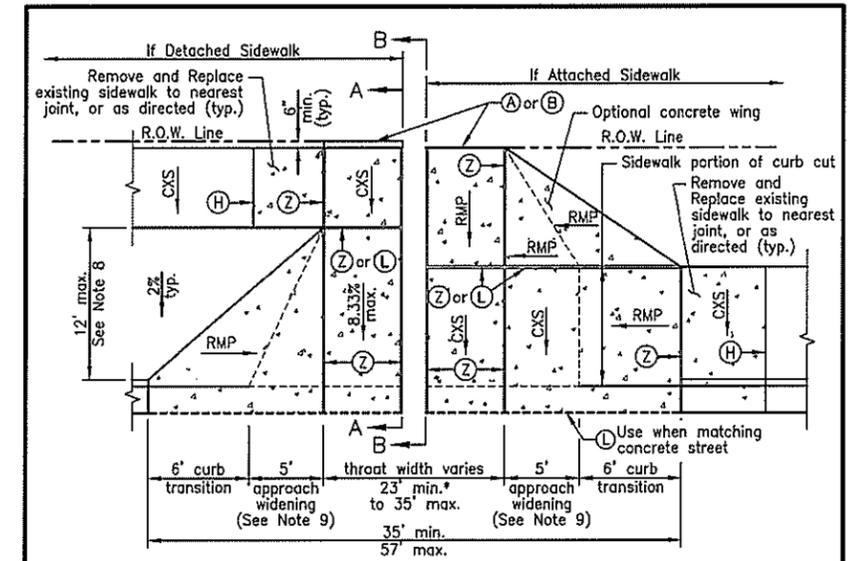
NOTE: MONOLITHIC MEDIAN CURB NOSE SHALL NOT BE PAID FOR SEPARATELY, BUT INCLUDED IN THE COST OF THE ASSOCIATED CURB & GUTTER, SEE PLANS FOR LOCATIONS.



STANDARD RESIDENTIAL CURB CUT

- Notes:
1. For construction in existing asphalt streets refer to asphalt patch requirements in Std. Dwg. No. 12.0.
 2. For (A) and (L) joints refer to Std. Dwg. No. 11.2a and 11.2b. For (Z) and (H) joints refer to Std. Dwg. No. 5.4.
 3. Tooled contraction joints are required to control the location of cracking, and to provide definition of sidewalk and driving surfaces. Tooled joints for driveway approaches shall be located as indicated above. Additional longitudinal tooled joints may be required when the driveway width exceeds 15'.
 4. On-site parking stalls that back into the driveway aisle shall be set back a minimum of 10' from the R.O.W. line, measured to the nearest point of the parking space.
 5. Any garage door or gate located within the driveway shall be located a minimum of 20' from the R.O.W. line and/or back of sidewalk, whichever is closer. A garage door or gate located at an exit only may be located at the R.O.W. line only by specific written permission of Public Works.
 6. The sidewalk portions of the curb cut shall match the width and alignment of the approaching sidewalk, with a minimum width of 5' and a cross-slope of CXS toward the flowline.
 7. If this distance is less than 6', additional detail grading must be developed to lower approaching sidewalks so that an 8.33% maximum driveway slope can be met.

	City and County of Denver Department of Public Works	Date: 05/15
	Standard Residential Curb Cut	Std. Dwg. No. 6.0



STANDARD COMMERCIAL & MULTI-FAMILY CURB CUT

- Notes:
1. For construction in existing asphalt streets refer to asphalt patch requirements in Std. Dwg. No. 12.0.
 2. For (A) and (L) joints refer to Std. Dwg. No. 11.2a and 11.2b. For (Z) and (H) joints refer to Std. Dwg. No. 5.4.
 3. Tooled contraction joints are required to control the location of cracking, and to provide definition of sidewalk and driving surfaces. Tooled joints for driveway approaches shall be located as indicated above. Additional longitudinal tooled joints may be required when the driveway width exceeds 15'.
 4. On-site parking stalls that back into the driveway aisle shall be set back a minimum of 10' from the R.O.W. line, measured to the nearest point of the parking space.
 5. Any garage door or gate located within the driveway shall be located a minimum of 20' from the R.O.W. line and/or back of sidewalk, whichever is closer. A garage door or gate located at an exit only may be located at the R.O.W. line only by specific written permission of Public Works.
 6. The sidewalk portions of the curb cut shall match the width and alignment of the approaching sidewalk, with a minimum width of 5' and a cross-slope of CXS toward the flowline.
 7. A wider curb cut than shown may be approved by Public Works.
 8. If this distance is less than 7', additional detail grading must be developed to lower approaching sidewalks so that a 8.33% maximum driveway slope can be met.
 9. Narrower approach widening widths due to site constraints must be approved by Public Works.

	City and County of Denver Department of Public Works	Date: 05/15
	Standard Commercial and Multi-Family Curb Cut	Std. Dwg. No. 6.1

NOTE: 2015 TRANSPORTATION STANDARDS AND DETAILS WERE USED FOR DESIGN ON THIS PROJECT. WHERE FEASIBLE, THE 2017 TRANSPORTATION STANDARDS AND DETAILS SHALL BE USED. IF A QUESTION ABOUT WHICH STANDARD OR DETAIL TO BE USED ARISES, THE CITY'S PROJECT MANAGER SHALL DETERMINE WHICH DETAIL TO USE.

CONSULTING ENGINEERS

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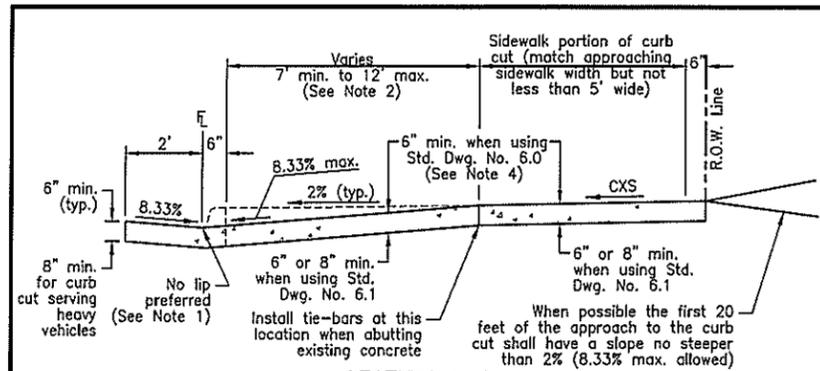
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City and County of Denver Department of Public Works Engineering Division 201 W. Colfax, Dept 505 Denver, CO. 80202	2000 South Holly Street Denver, CO 80222 Phone: 303-757-9511 FAX: 303-757-9907 Region 1 JV

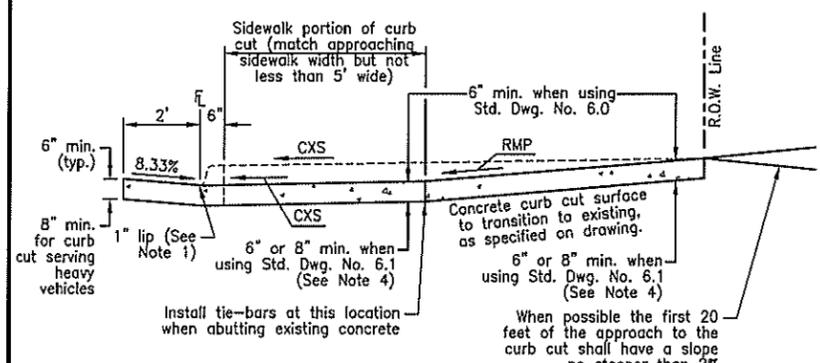
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Revised:	Designer: KSD Structure Numbers
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	Sheet Subset: TYPDET Subset Sheets: 3 of 15

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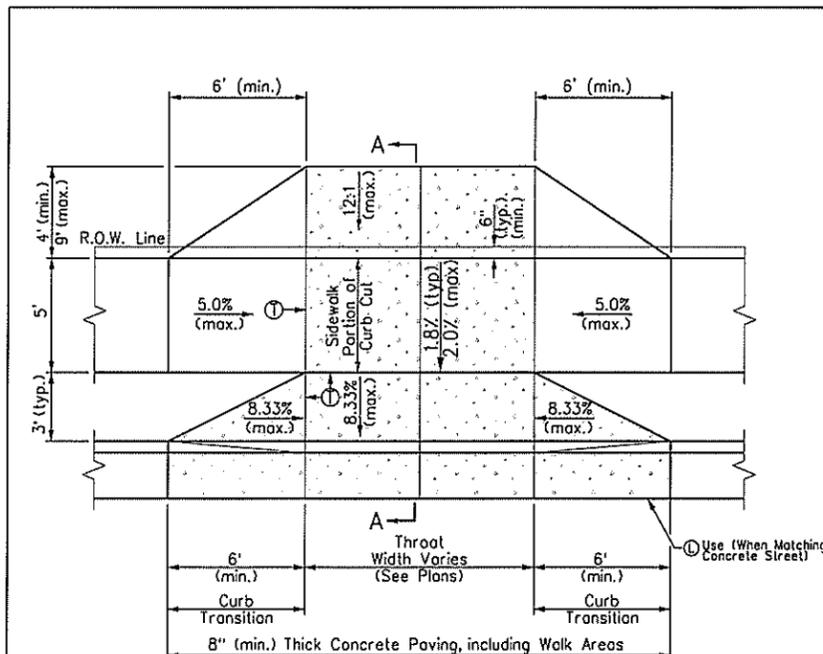
SECTION A-A



SECTION B-B

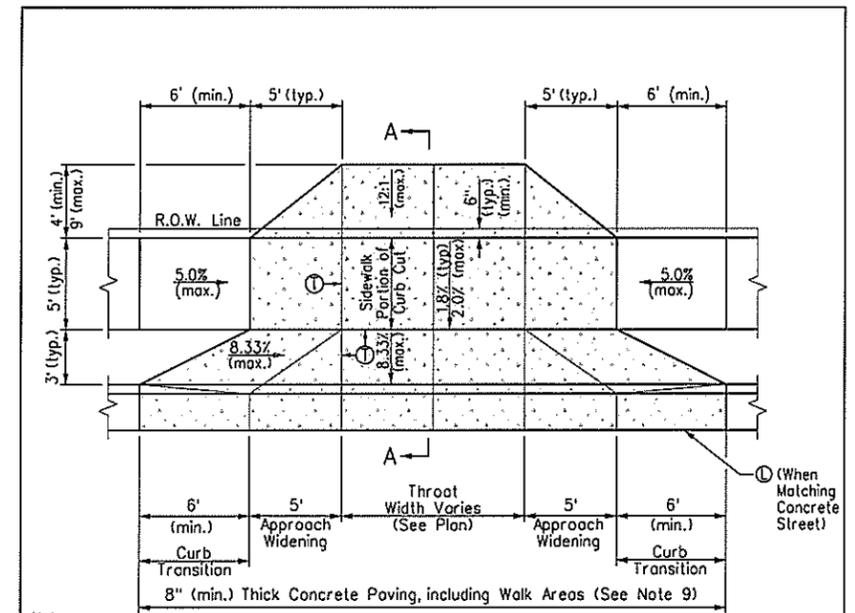
- Notes:
- In special circumstances when maintaining maximum 8.33% driveway grade is difficult or to prevent ponding, a 1" lip (1.5" maximum allowed, with 0.125" R) at flowline may be installed.
 - When this width is less than 7', a special detail must be developed to show how the sidewalk elevation transitions down to the approach to the curb cut.
 - Concrete curb cuts require fibermesh reinforcement at 1 to 1.5 pounds per cubic yard.
 - Driveways servicing heavy truck traffic shall provide 8" thick concrete at all places.

	City and County of Denver Department of Public Works	Date: 05/15
	Curb Cut Cross-Sections	Std. Dwg. No. 6.2



- Notes:
- For construction in existing asphalt streets, refer to Std. Dwg. No. 12.0 for asphalt patch requirements.
 - For (A), (L) and (T) Joints, refer to Std. Dwg. No. 11.0 through 11.5.
 - Tooled contraction joints are required to control the location of cracking and to provide definition of sidewalk and driving surfaces. Toolled joints for driveway approaches shall be located as indicated above. Additional longitudinal toolled joints may be required when the driveway width exceeds 15'.
 - Tree grates cannot be used as part of the sidewalk.
 - On site parking stalls that back into the driveway aisle shall be set back a minimum of 10' from the R.O.W. line, measured to the nearest point of the parking space.
 - Any garage door or gate located within the driveway shall be located a minimum of 20' from the R.O.W. line and/or back of sidewalk, whichever is closer. A garage door or gate located at an exit only may be located at the R.O.W. line only by specific written permission of PW.
 - The sidewalk portions of the curb cut shall match the width and alignment of the approaching sidewalk, with a minimum width of 5' and a cross-slope of 2% towards the flowline.
 - Lip of curb thickness shall match adjoining concrete pavement thickness. All curb cut and walk areas shall be paid for as Item 412 - Concrete Pavement (8 Inch).

Typical Residential Curb Cut



- Notes:
- For construction in existing asphalt streets, refer to Std. Dwg. No. 12.0 for asphalt patch requirements.
 - For (A), (L) and (T) Joints, refer to Std. Dwg. No. 11.0 through 11.5.
 - Tooled contraction joints are required to control the location of cracking and to provide definition of sidewalk and driving surfaces. Toolled joints for driveway approaches shall be located as indicated above. Additional longitudinal toolled joints may be required when the driveway width exceeds 15'.
 - Tree grates cannot be used as part of the sidewalk.
 - On site parking stalls that back into the driveway aisle shall be set back a minimum of 10' from the R.O.W. line, measured to the nearest point of the parking space.
 - Any garage door or gate located within the driveway shall be located a minimum of 20' from the R.O.W. line and/or back of sidewalk, whichever is closer. A garage door or gate located at an exit only may be located at the R.O.W. line only by specific written permission by PW.
 - All commercial & multi-family curb cuts shall install approach widening unless otherwise approved by PW.
 - Wider curb cut than shown may be approved by PW.
 - Lip of curb thickness shall match adjoining concrete pavement thickness. All curb cut and walk areas shall be paid for as Item 412 - Concrete Pavement (8 Inch).
 - The sidewalk portions of the curb cut shall match the width and alignment of the approaching sidewalk, with a minimum width of 5' and a cross-slope of 2% towards the flowline.

Typical Commercial & Multi-Family Curb Cut

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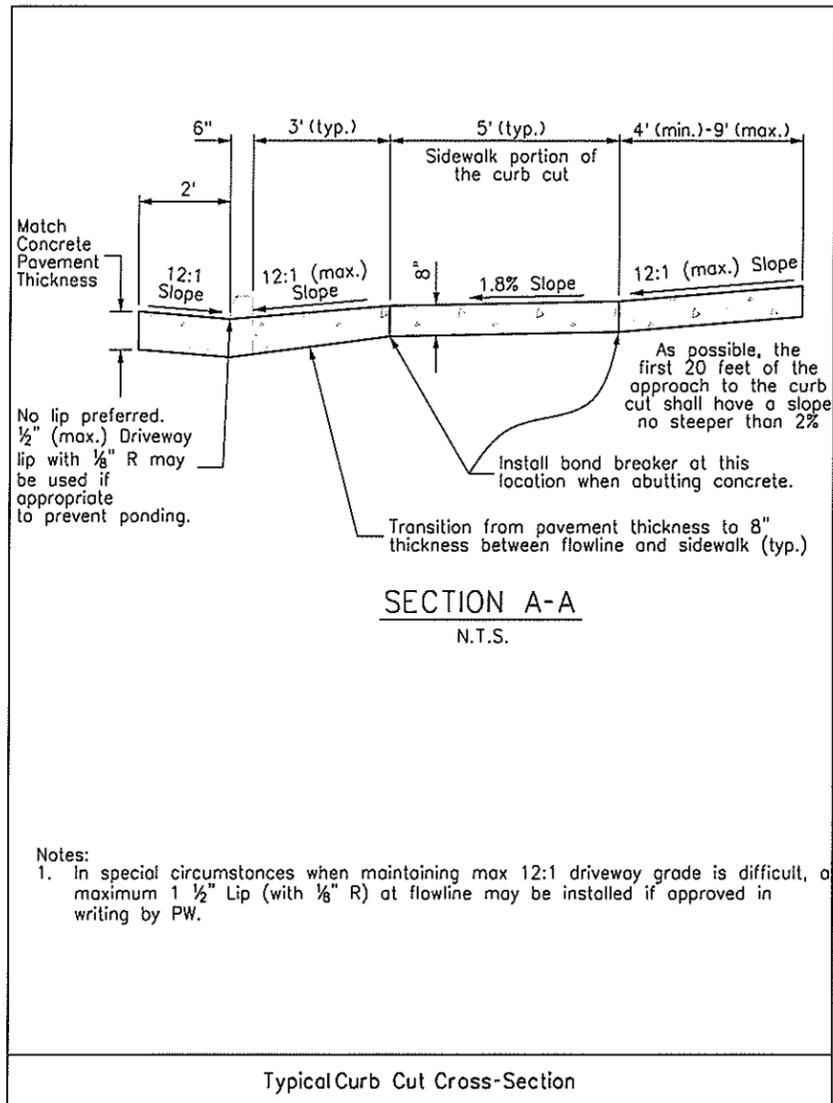
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TYPICAL ROADWAY DETAILS	
Designer: KSD	Structure Numbers
Detailer: SRP	
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GENERAL NOTES FOR CURB RAMPS

- The following Curb Ramp types are general representations and many require modifications to fit actual field conditions. Most applications within the City are retrofit situations where one or more constraints such as limited R.O.W., significant grade differences, and drainage concerns must be taken into account in locating the Curb Ramp. Design resources are available within the City to assist with the proper selection and application of ramp types to maintain applicable Standards.
 - Type 1 Ramps are for use in areas where the sidewalk is set back from the street, and pedestrian access from the side of the ramp is not likely to occur because the approach area is covered by lawn or gravel, or an obstacle is present.
 - Type 2 Ramps are for use where pedestrian access can occur from both sides of the ramp.
 - Type 3 Ramps are for use where sidewalk is attached on one side, detached on the other, and pedestrian access can occur from only one side.
 - Type 4 Ramps are for use when there are existing obstructions or there is not sufficient room in the R.O.W. to construct a Type 1, 2, or 3 Ramp, including the landing at the top of the ramp and an ADA route around the top of the ramp.
 - Downtown Signalized Corner Blended Transitions are for use in the Downtown area or other areas where the entire radius is depressed to eliminate use of teardrop islands between ramps.
- Consult with the City Project Manager or Public Works for procedures and standards to follow for ramps located in Denver Landmark Districts, abutting Denver Landmark Districts, or for districts and structures listed in the National Register of Historic Places.
- Refer to the most current version of the City and County of Denver "Sidewalk and Curb Ramp Construction Rules and Regulations" and "Curb Ramp Installation and Replacement Policy and Procedures" for additional design parameters.
- Curb Ramps shall be positioned as directionally as possible to align with opposing curb ramps.
- Placement of diagonal or mid-block Curb Ramps must be approved in writing by Public Works.
- For each Curb Ramp installation, additional removal and replacement of existing sidewalks may be required to facilitate proper transitions to ramp. When "chasing grade," ramp and sidewalk transition length need not exceed 15', but slope must be uniform.
- Curb Ramps shall match approaching clear sidewalk width, or 5' minimum, whichever is greater. Curb Ramp throat width shall not exceed 8' unless serving a shared use path, for which the throat width shall not exceed 10'.
- The distance between the flowline (FL) and the back of the Curb Ramp is variable depending on site conditions.
- The maximum cross-slope of the Curb Ramp surface shall be 2%. Where ramps are being constructed on existing streets, the cross-slope of the ramp can increase beyond 2% to match the longitudinal street flowline grades at the bottom of the ramp. For construction of multiple Curb Ramps at corners, the longitudinal grade of the curb and gutter between the ramps shall not exceed an amount that causes either ramp to fall outside slopes as defined in Note 7.
- The maximum 'slope' of the gutter in front of a ramp shall be 5%. For a standard 2' gutter pan, this results in a maximum gutter depth of no more than 1.25". To transition from the standard 2' gutter depth to the 1.25" depth in front of the ramp, warp the gutter lip in a 2'-6" curb & gutter section adjacent to the ramp, as noted on each drawing.
- A level (2% slope maximum in any direction) landing area, 5' deep typical by the width of the ramp throat, shall be required at the top of each Curb Ramp. Slopes shall be designed to CXS in all directions. The depth of the level landing area is typically set at 5' to match the width of approaching sidewalks, but in no cases shall be less than 4'.

Continued on 7.0b...

	City and County of Denver Department of Public Works	Date: 05/15
	Curb Ramp Notes and Typical Section	Std. Dwg. No. 7.0a

GENERAL NOTES FOR CURB RAMPS

...continued from 7.0a

- If possible, drainage structures shall not be placed in line with ramps. Location of the ramp shall take precedence over location of the drainage structure, except where existing structures are being preserved in proposed construction areas.
- All Curb Ramps shall be constructed with tactile warnings (truncated dome panels). Truncated dome panels shall be installed across the full width of the ramp, and set so that the closest point or points are 6" from the face of curb/flowline. See Std. Dwg. No. 7.6a and 7.6b.
- Truncated dome panels shall be brick red, tile red, black when noted, or other equivalent color as approved by Public Works to provide color contrast with the adjoining ramp or blended transition surface. When adjoining sidewalk is flagstone, or retrofitting truncated dome panels within red concrete, the truncated dome panels shall be light gray in color to provide required contrast. See Std. Dwg. No. 7.5 for dome panel colors in Blended Transition ramp application. Concrete for curb ramp construction shall never be stained or have color added.
- A sample of the truncated domes shall be submitted to, and approved by Public Works prior to construction. Truncated dome size shall meet ANSI requirements and have non-slip tops. Panels are to be wet set into concrete. Integral anchors may be used if resetting is needed. Truncated dome sections set in a sand or other non-cementitious bed will not be allowed unless approved by Public Works. Truncated domes may not be stamped into wet concrete. Surface applied truncated domes are only allowed on pre-existing curb ramps that are otherwise in conformance with ADA standards, and are not allowed on newly constructed ramps unless specifically approved by Public Works. Brick shall not be used for truncated dome panels unless specifically approved in writing by Public Works.
- Truncated domes fabricated from non-cementitious material (fiberglass composite, plastic, etc.) with hollow undersides may not be cut unless approved by Public Works and the manufacturer. Any proposed cuts must be at and along a rib-line, so whole sections to ribs are set into wet concrete ramp. Any section without ribs shall be cut off and discarded. If solid cementitious or other non-hollow truncated dome panels are cut, the location of the cuts should be positioned to minimize cutting through domes. If domes are cut, the remaining partial domes must be ground off completely. Placement of small cut triangles of truncated dome panels to fill gaps, corners, etc. is not allowed.
- Curb ramps require fiberglass reinforcement at 1 to 1.5 pounds per cubic yard.
- Any required transition between vertical and mountable curb adjacent to ramps should occur in a maximum of 10'.
- Refer to Std. Dwg. No. 12.0 for patching and saw cut on asphalt streets. Refer to Std. Dwg. No. 11.1a and 11.1b for saw cut on concrete pavements and pavement joints.
- Pay limits of all ramps are comprised of all area shown with concrete hatching on the applicable details, unless otherwise noted.

	City and County of Denver Department of Public Works	Date: 05/15
	Curb Ramp Notes and Typical Section	Std. Dwg. No. 7.0b

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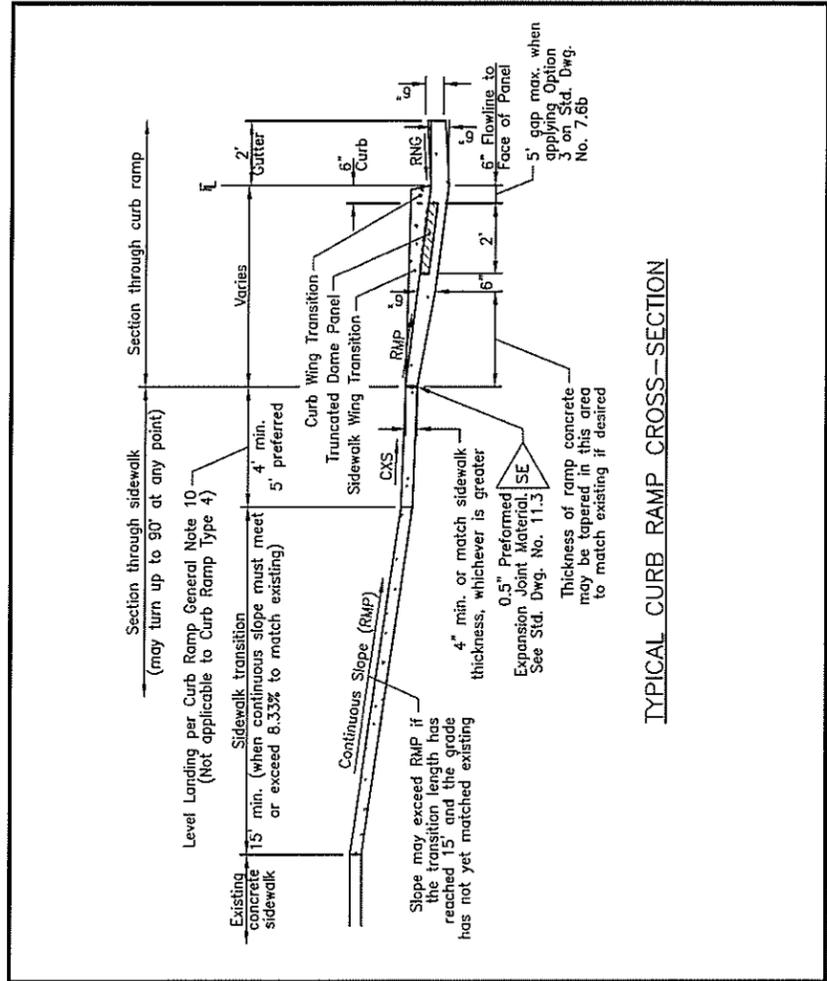
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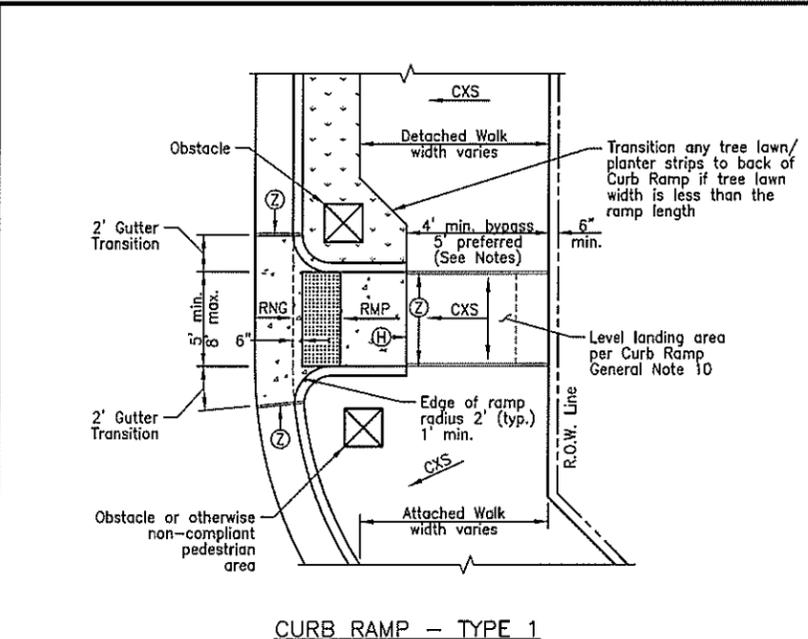
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TYPICAL CURB RAMP CROSS-SECTION

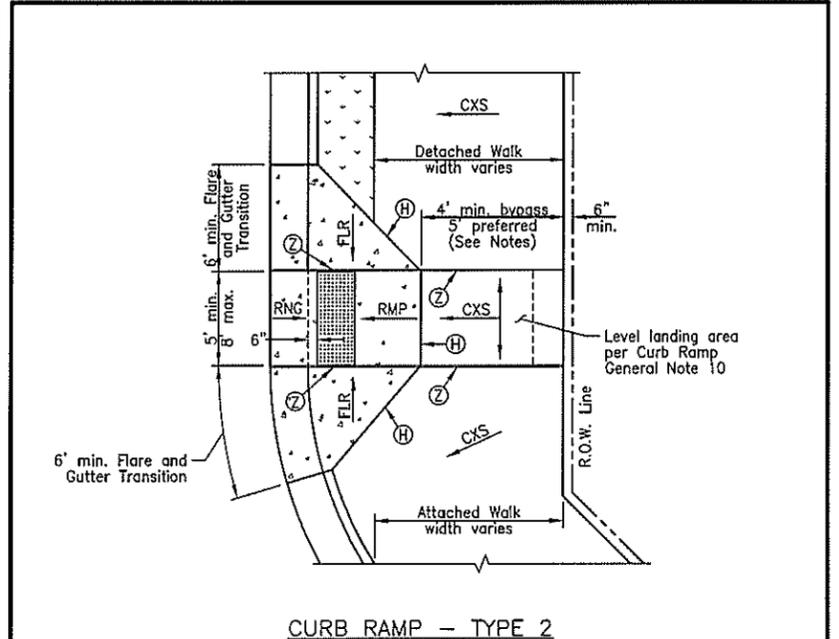
DENVER PUBLIC WORKS	City and County of Denver Department of Public Works	Date: 05/15
	Curb Ramp Notes and Typical Section	Std. Dwg. No. 7.0c



CURB RAMP - TYPE 1

- Notes:
- Type 1 Ramps shall be used where there is insufficient room for compliant flares (as shown on Std. Dwg. No. 7.2) on both sides of the ramp.
 - Typical Type 1 Curb Ramp installations shall consist of two ramps at each corner, each positioned to cross its leg of the intersection to a receiving ramp. A single ramp placed diagonally should not be used in new construction.
 - Adjacent landscaping/planted strips should transition to the back of Type 1 Curb Ramps. Alternatively, the ramp may be shortened such that its back matches the width of the landscaping, but not so much that a 12:1 maximum slope is exceeded.
 - Additional R.O.W. may be required to ensure that the Curb Ramp, including top landing and flares, are entirely within the public R.O.W.
 - See Std. Dwg. No. 7.0a - 7.0c Curb Ramp Notes and Typical Section.
 - 5' bypass required for arterial streets.

DENVER PUBLIC WORKS	City and County of Denver Department of Public Works	Date: 05/15
	Curb Ramp Type 1	Std. Dwg. No. 7.1



CURB RAMP - TYPE 2

- Notes:
- A Type 2 Curb Ramp shall be used where there is sufficient room for flares as depicted on this Std. Dwg., on both sides of the ramp.
 - Typical Type 2 Curb Ramp installations shall consist of two ramps at each corner, each positioned to cross its leg of the intersection to a receiving ramp. A single ramp placed diagonally should not be used in new construction.
 - Additional R.O.W. may be required to ensure that the Curb Ramp, including top landing and flares, are entirely within the public R.O.W.
 - See Std. Dwg. No. 7.0a - 7.0c Curb Ramp Notes and Typical Section.
 - 5' required bypass for arterial streets.

DENVER PUBLIC WORKS	City and County of Denver Department of Public Works	Date: 05/15
	Curb Ramp Type 2	Std. Dwg. No. 7.2

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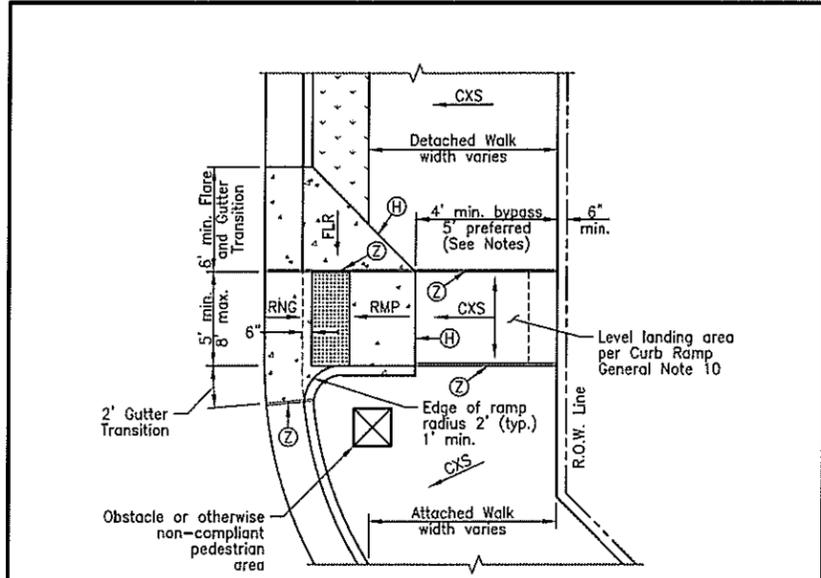
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As Constructed	FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
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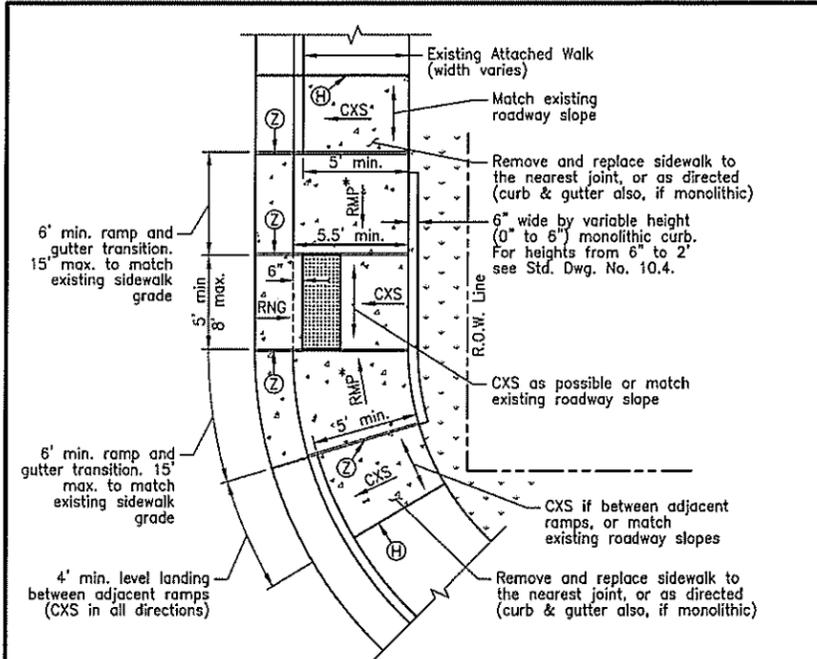
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CURB RAMP - TYPE 3

- Notes:
1. A Type 3 Curb Ramp shall be used where there is insufficient room for a compliant flare (as shown on Std Dwg. No. 7.2) on one side of the ramp.
 2. Typical Type 3 Curb Ramp installations shall consist of two ramps at each corner, each positioned to cross its leg of the intersection to a receiving ramp. A single ramp placed diagonally should not be used in new construction.
 3. Additional R.O.W. may be required to ensure that the Curb Ramp, including top landing and flares, are entirely within the public R.O.W.
 4. See Std. Dwg. No. 7.0a - 7.0c Curb Ramp Notes and Typical Section.
 5. 5' bypass required for arterial streets.

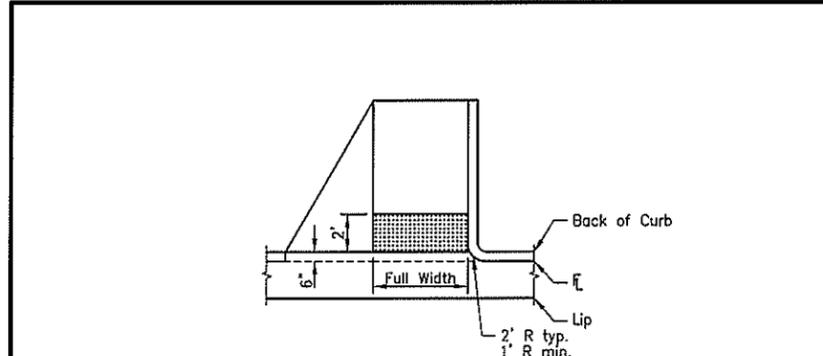
DENVER PUBLIC WORKS	City and County of Denver Department of Public Works	Date: 05/15
	Curb Ramp Type 3	Std. Dwg. No. 7.3



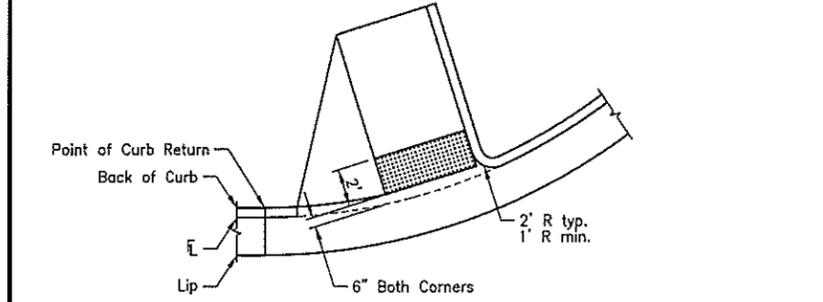
*Slope may exceed RMP if transition length has reached 15' and the ramp has not yet matched existing matching grade

- Notes:
1. A Type 4 Curb Ramp may be used in retrofit situations wherever there are existing obstructions or inadequate R.O.W. width at the intersection of existing residential streets to provide a Type 1, 2, or 3 Curb Ramp.
 2. Typical Type 4 Curb Ramp installations shall consist of two ramps at each corner, each positioned to cross its leg of the intersection to a receiving ramp. Any proposed single ramp placed diagonally will only be considered if in retrofit situations at the intersection of existing residential streets, and must be specifically approved in writing by Public Works.
 3. Additional R.O.W. may be required to ensure that the Curb Ramp, including top landings and flares, are entirely within the public R.O.W.
 4. See Std. Dwg. No. 7.0a - 7.0c Curb Ramp Notes and Typical Section.

DENVER PUBLIC WORKS	City and County of Denver Department of Public Works	Date: 05/15
	Curb Ramp Type 4	Std. Dwg. No. 7.4a



OPTION 1
Apply when edge of ramp closest to intersection is located either at or outside of corner Point of Curb Return



OPTION 2
Apply when inside edge of ramp closest to intersection is located either at or inside of corner Point of Curb Return

DENVER PUBLIC WORKS	City and County of Denver Department of Public Works	Date: 05/15
	Curb Ramp Truncated Dome Placement Options	Std. Dwg. No. 7.6a

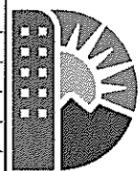
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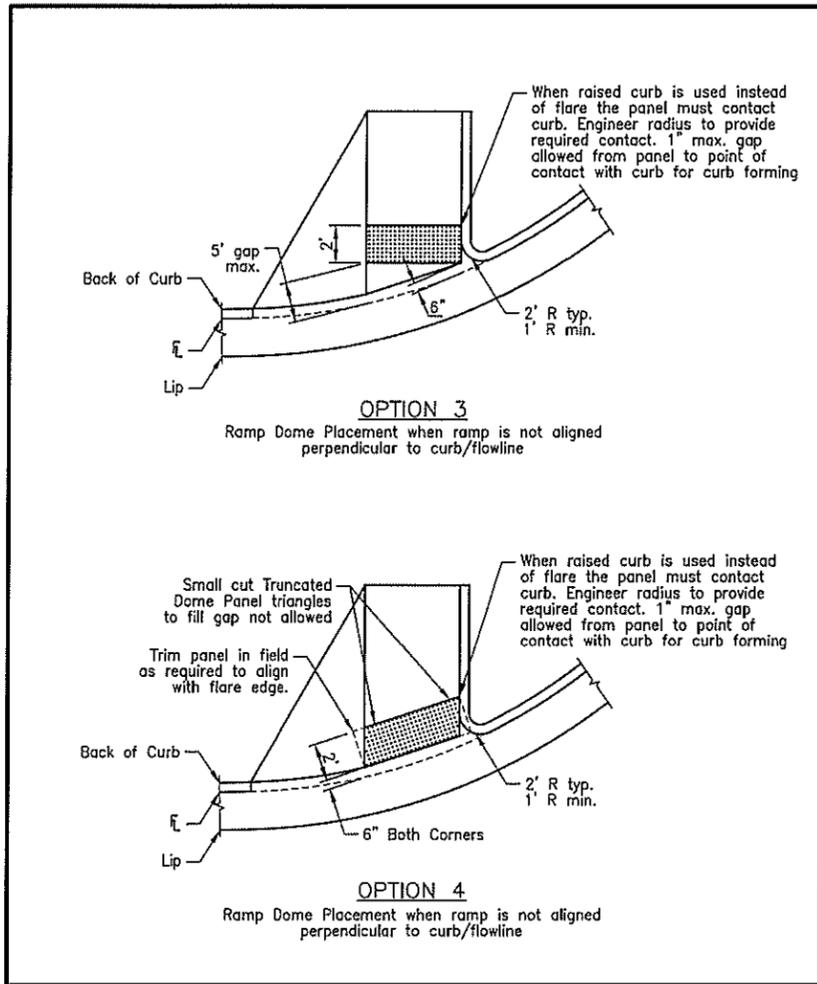
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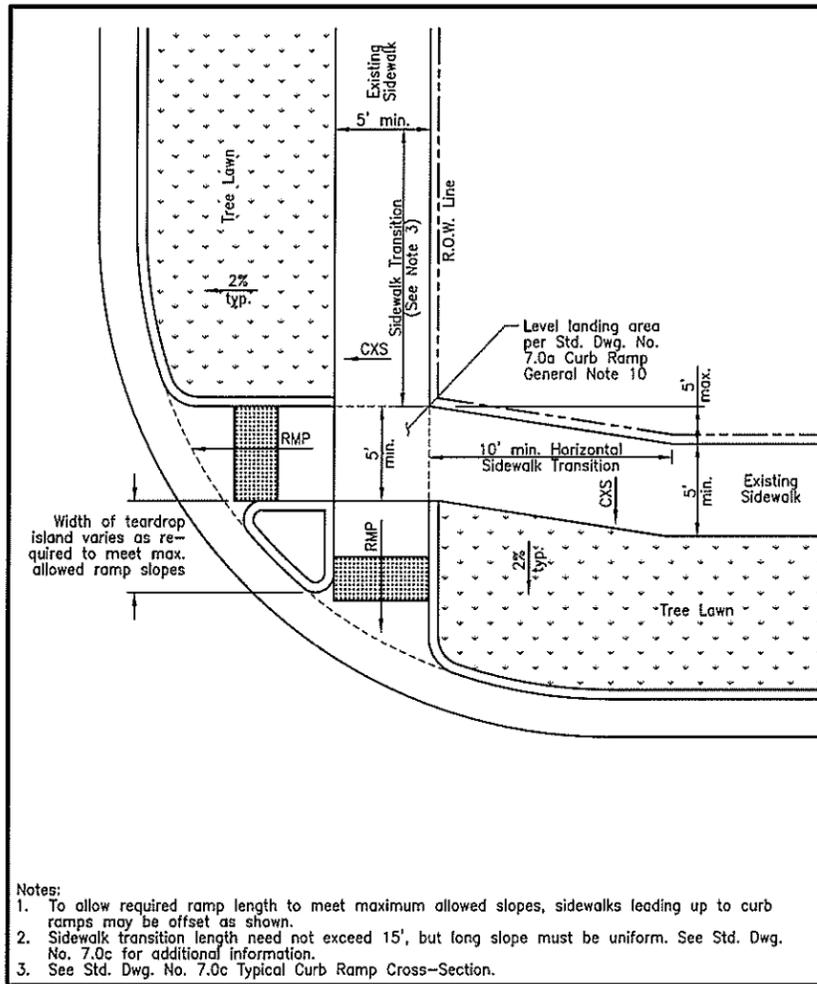
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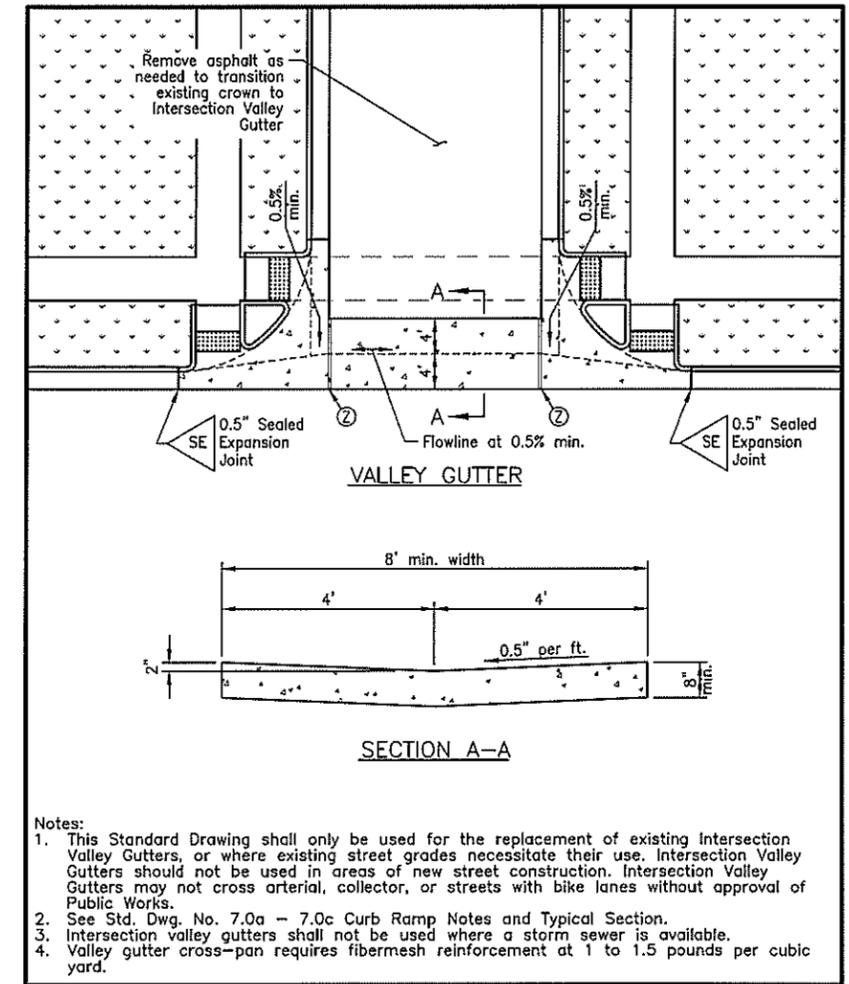
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	Curb Ramp Truncated Dome Placement Options	Std. Dwg. No. 7.6b



	City and County of Denver Department of Public Works	Date: 05/15
	Typical Sidewalk Transitions to Curb Ramp Landing	Std. Dwg. No. 7.7



	City and County of Denver Department of Public Works	Date: 05/15
	Intersection Valley Gutter	Std. Dwg. No. 8.0

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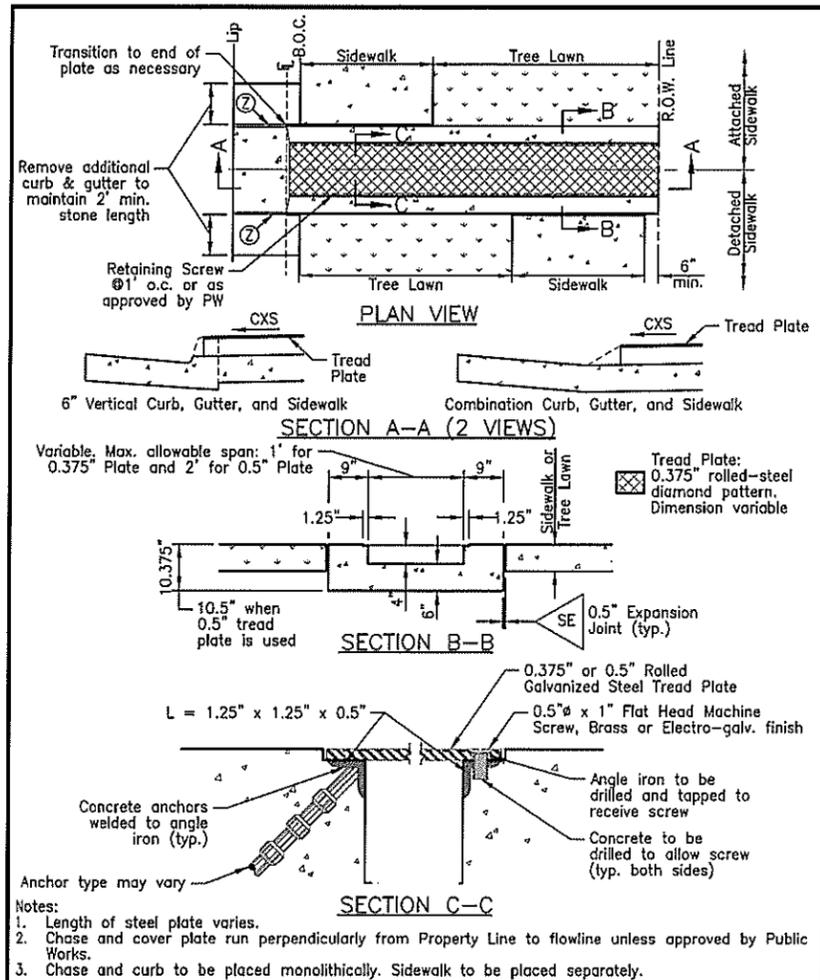
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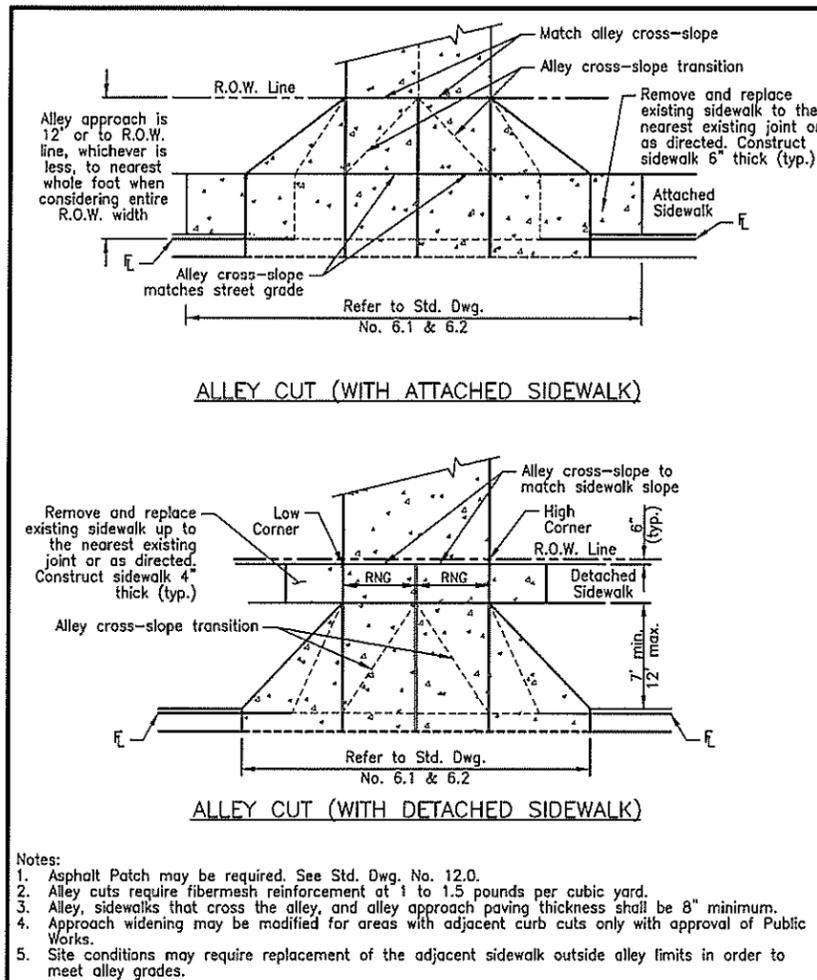
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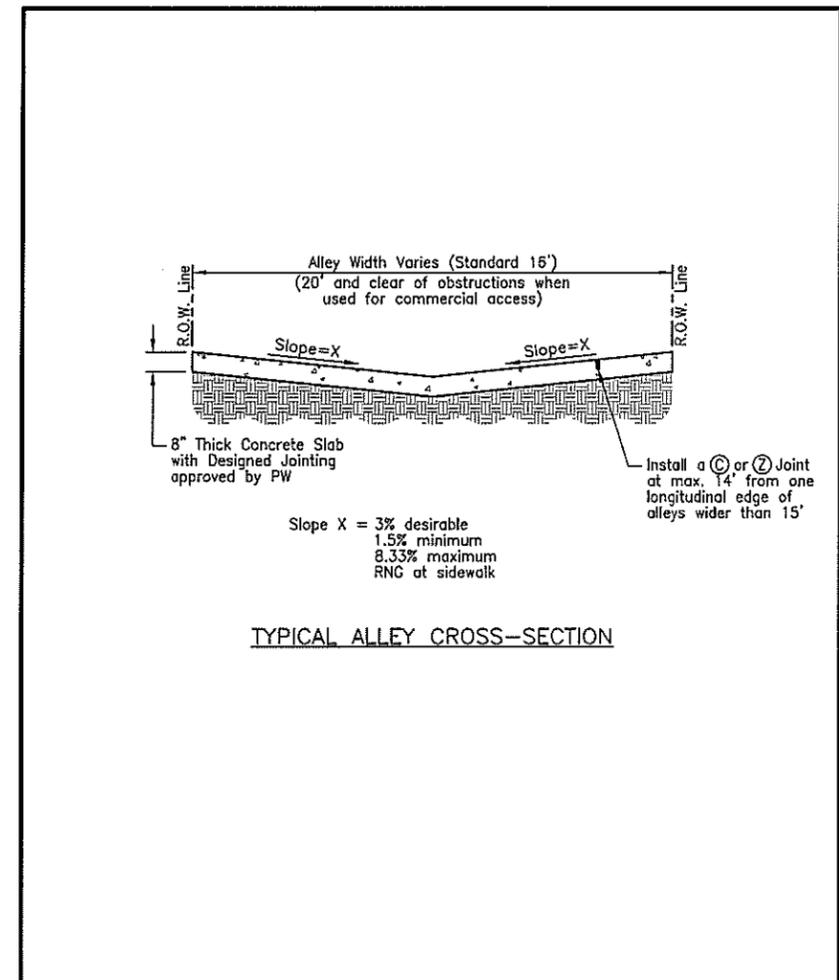
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	City and County of Denver Department of Public Works	Date: 05/15
	Sidewalk Chase Drain and Tread Plate	Std. Dwg. No. 9.0



	City and County of Denver Department of Public Works	Date: 05/15
	Alley Cut	Std. Dwg. No. 10.1



	City and County of Denver Department of Public Works	Date: 05/15
	Typical Alley Cross-Section	Std. Dwg. No. 10.3

NOTE: 2015 TRANSPORTATION STANDARDS AND DETAILS WERE USED FOR DESIGN ON THIS PROJECT. WHERE FEASIBLE, THE 2017 TRANSPORTATION STANDARDS AND DETAILS SHALL BE USED. IF A QUESTION ABOUT WHICH STANDARD OR DETAIL TO BE USED ARISES, THE CITY'S PROJECT MANAGER SHALL DETERMINE WHICH DETAIL TO USE.



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Department of Public Works
Engineering Division
201 W. Colfax, Dept 505
Denver, CO. 80202

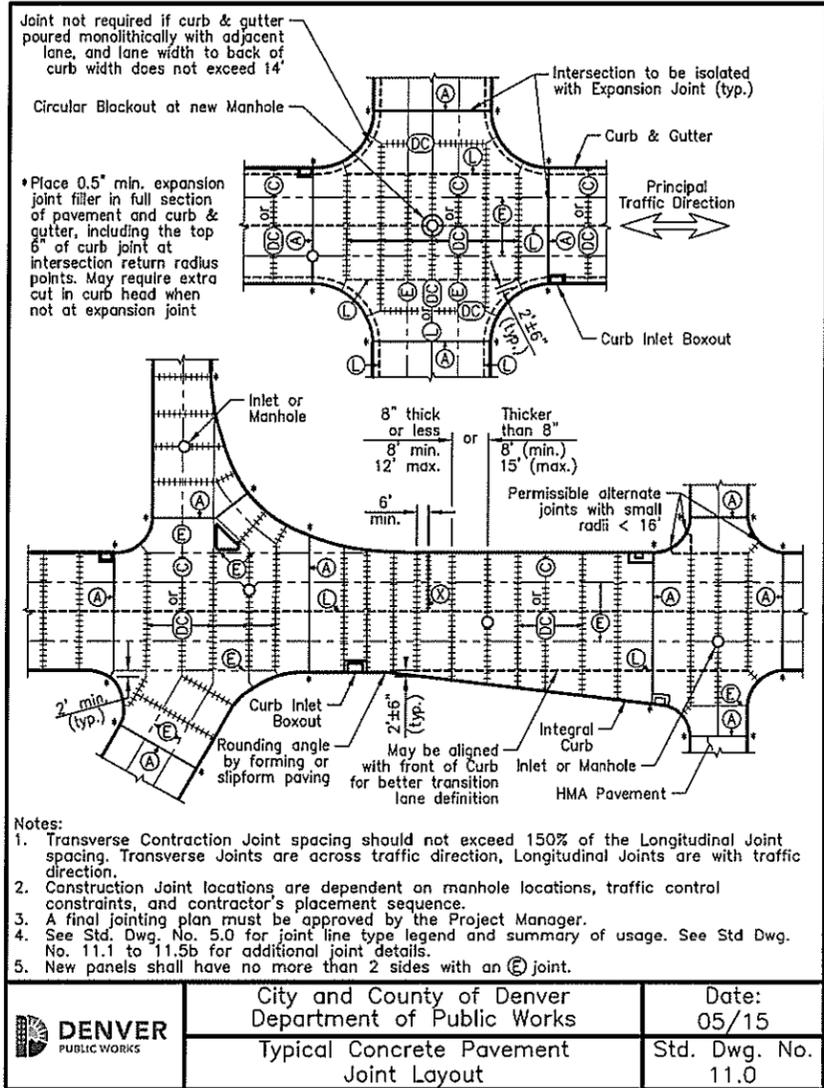
Colorado Department of Transportation
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE	
TYPICAL ROADWAY DETAILS	
Designer:	KSD
Detailer:	SRF
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AD SUBMITTAL - JANUARY 2, 2018



GENERAL NOTES FOR CONCRETE PAVEMENT AND PAVEMENT JOINTS

- For new construction, all transverse joints (A), (B), (C), (DA), and (DC) shall be continuous across the pavement and curb and gutter. Construct transverse joints perpendicular to the centerline of pavement and extend the sawed joint through the curb and gutter. Gutter sections do not require dowels. Curb and gutter section should be designed to match the intended panel joint layout.
- If the contractor proposes variations from this standard or the project has unusual or irregular conditions not discovered herein, a pavement joint layout shall be prepared for approval by Public Works.
- Longitudinal joints shall coincide with edge of lane markings, if possible, and have a maximum spacing of 13' or 14' to back of curb if monolithic without extra joint. All longitudinal joints shall be tied. Lane widths over 13' require special design.
- Immediately after sawing, joints shall be cleaned by pressurized water jet or other approved method. Joints shall also be cleaned and dried with sandblasting and compressed air just ahead (100' or less) of placing backer rod material and joint sealant. Joint cleaning methods shall be contained or vacuumed to prevent fugitive dust and runoff. Public Works may require other methods of joint cleaning if necessary.
- The contractor shall use a circular blockout at new manholes and other roadway appurtenances of similar or larger sizes. Small appurtenances, such as valves, monument boxes, and existing manholes do not require a blockout, but do require a bond breaker and flexible expansion joint material. Unless otherwise directed, the blockout may be eliminated at new manholes if Removable CLSM is used for backfill of the manhole from manhole base to paving subgrade where soil compaction equipment cannot reach.
- Tie bars shall conform to AASHTO M284 grade 40, epoxy coated, and deformed. Dowel bars shall conform to AASHTO M255 grade 60 for core material, and AASHTO M254 for epoxy coating the smooth bars. Dowel bars shall be wiped with form oil, but not dripping, just prior to concrete placement to prevent concrete bonding.
- Tie and dowel bars shall be normally started half the required spacing from a panel edge. Tie bars shall be kept at least 6" clear of any dowel bar. Tie bars may be slightly bent to follow this rule. Dowel bars shall be spaced the full width across intersections and merged traffic lanes. Straight traffic lane sections shall have a minimum of 4 dowels in each wheel path, and 5 in the wheel path adjacent to any shoulder or gutter.

REINFORCING SIZE TABLE

Pavement Thickness T (in)	Tie Bar Size Grade 40 (deformed)	Dowel Bar Dia (in) Grade 60 (smooth)
T < 8	No. 4	1.00
8 ≤ T ≤ 10	No. 5	1.25
10 < T ≤ 15	No. 6	1.50

TIE BAR AND DOWEL BAR SPACING

Joint Type	Tie Bars deformed, 30" long		Dowel Bars smooth, 18" long	
	on center	from edge	on center	from edge
DA	N/A	N/A	12"	12"
DC	N/A	N/A	12"	12"
E	30"	15"	N/A	N/A
L	30"	15"	N/A	N/A
X	12"	12"	N/A	N/A

Continued on 11.1b...

City and County of Denver
Department of Public Works
Date: 05/15

DENVER PUBLIC WORKS
General Notes for Concrete Pavement and Pavement Joints
Std. Dwg. No. 11.1a

GENERAL NOTES FOR CONCRETE PAVEMENT AND PAVEMENT JOINTS

...continued from 11.1a

- Any concrete road that carries heavy traffic loads (1,000,000 ESALS or greater) shall have Doweled Transverse Contraction Joints per Std. Dwg. No. 11.2a.
- Full panel replacement may be required at new curb cuts to concrete streets if the (Z) joints of the driveway surfaces do not line up with the (C) or (DC) joints of street pavement. Refer to Std. Dwg. No. 6.0 & 5.1. Selected (C) joint tie bars may be eliminated between drive pan and pavement. Use (C) joints on longitudinal tie-ins along street direction.
- When within 100' of Railroad Track Centerline, concrete pavement for the entire roadway width shall be required for a minimum of 100' on either side of the Railroad Track centerline or 2' beyond Separator Medians, if any. Panels adjacent to tracks, bearing on ballast and/or aggregate base with separator geotextile, shall be reinforced with minimum 3 each full length rebar (use tie bar size and spacing in table above) longitudinally, with one transverse bar at each end and middle, 2" clear, placed at depth T/2. Also use dowels per (DC) joints to adjacent panels.
- Minimum width of concrete lane widening is 18" using (L) joint. Special jointing and reinforcing plans are required when transverse to longitudinal spacing is >1.5 or <0.70. Full panel length rebar is required when these panel size ratios are exceeded. Use minimum 2 each epoxy coated rebar, spaced and sized per above table for tie bars, 2" clear at ends, placed at depth T/2.
- All sawn joints shall be to a minimum depth of T/4 when no reinforcing steel is used, and not less than T/3 when tie bars or dowel bars are used.
- Dowel placement tolerances to be inspected and adjusted before concrete placement (refer to CDOT M-412-1 for graphical definition of terms and CDOT Specification 412.13(b)2) shall be:
 - Vertical Translation <1.0", Horizontal Translation <2.0" when spacing bars from edge of panels.
 - Longitudinal (End) Shift (equal bar length in each panel) <2.1"
 - Horizontal and Vertical Rotational Alignment (ends not parallel with pavement surface) <0.5"
- All concrete pavement and associated curb & gutter shall be placed on CDOT Class 6 aggregate base course, unless the existing subgrade materials are similar. Base shall be moisture conditioned, compacted, proof-rolled, final shaped, and re-compacted to allow the required thicknesses to be placed.
- If a sawed appearance joint is desired inside regular panels, it shall be no more than 0.5" deep. This appearance joint is designated (SA). See Std. Dwg. No. 11.2a.
- Notes for Panel Replacements or rework for Trench Patches when ideal situations do not apply:
 - Full panel replacement to normal joint lines is required.
 - For establishing transverse joints, maintain the existing joint gap on existing adjoining panels at the time of panel replacement. Remove any gap filling material in the new joint before new joints are sealed. Use expansion caps the same as the gap width on the poured end of dowels to allow future movement of the entire length of joint across all lanes.
 - Longitudinal joints should line up with existing adjacent joints. Transverse joints shall be made continuous across the street.
 - Consult Construction Engineering for advice on special situations. Use of bond breakers, eliminating selected tie bars for offset joints or narrow panels, use of predicted crack mitigation techniques, added panel replacements, or special reinforcing for narrow or skinny panels may be advised or required.
 - The Contractor's warranty obligation shall not be waived if CCD conveys any advice or directive for non-standard situations.
- Concrete street paving shall require fibermesh reinforcement at 1 to 1.5 pounds per cubic yard.
- Take reasonable measures during saw cutting and joint cleaning to prevent particulate matter from becoming airborne and to prevent the discharge of particulate matter beyond the property from which the emissions originate. The measures must be effective in the control of fugitive particulate emissions at all times on the project site, including periods of inactivity.

City and County of Denver
Department of Public Works
Date: 05/15

DENVER PUBLIC WORKS
General Notes for Concrete Pavement and Pavement Joints
Std. Dwg. No. 11.1b

NOTE: 2015 TRANSPORTATION STANDARDS AND DETAILS WERE USED FOR DESIGN ON THIS PROJECT. WHERE FEASIBLE, THE 2017 TRANSPORTATION STANDARDS AND DETAILS SHALL BE USED. IF A QUESTION ABOUT WHICH STANDARD OR DETAIL TO BE USED ARISES, THE CITY'S PROJECT MANAGER SHALL DETERMINE WHICH DETAIL TO USE.



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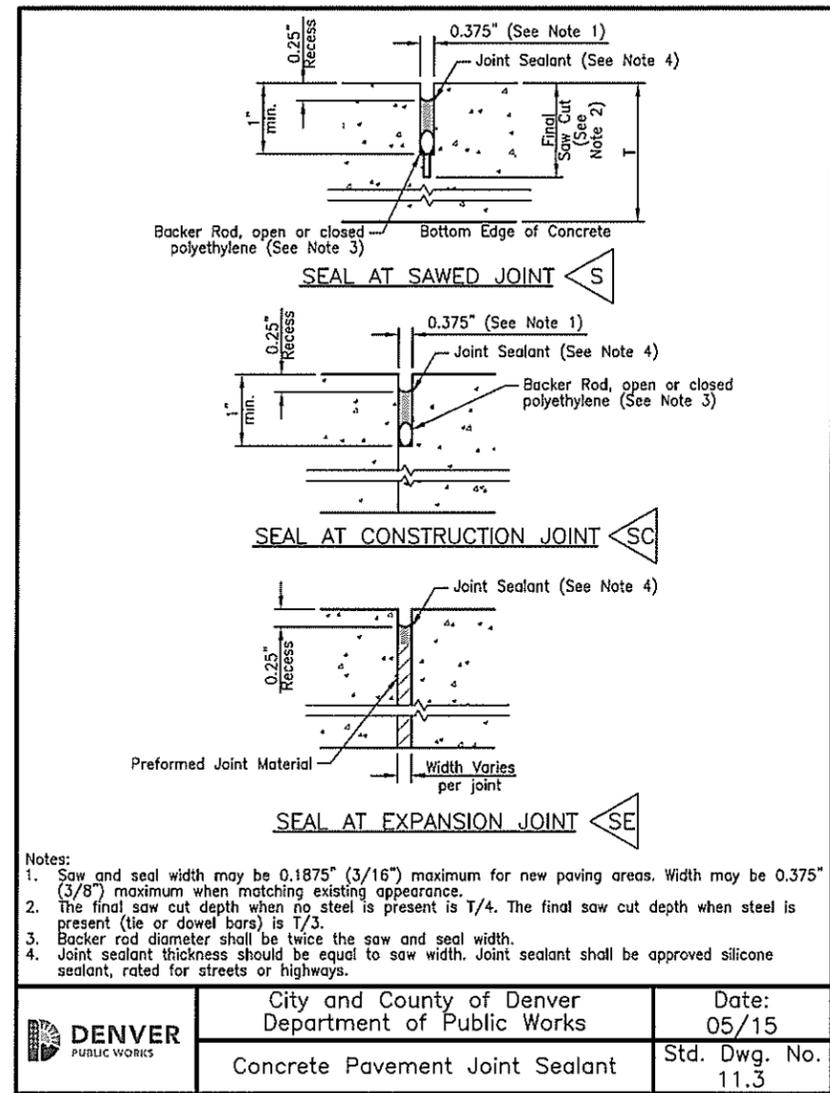
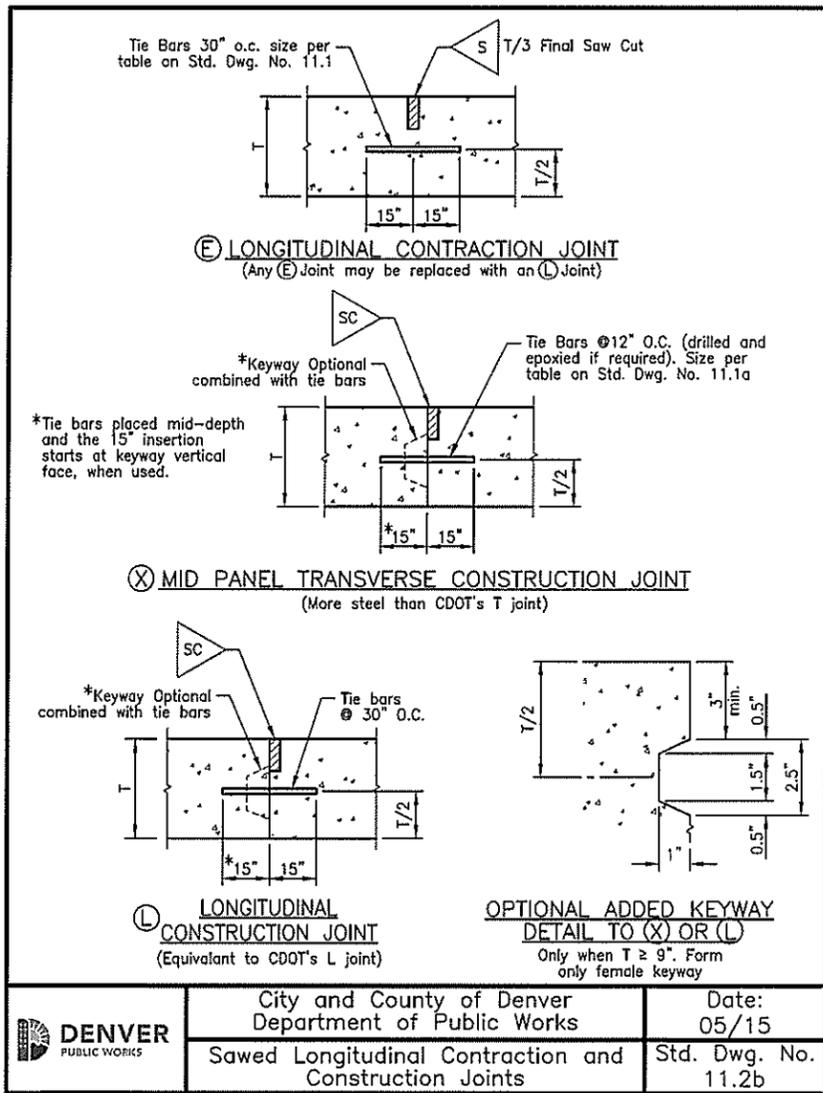
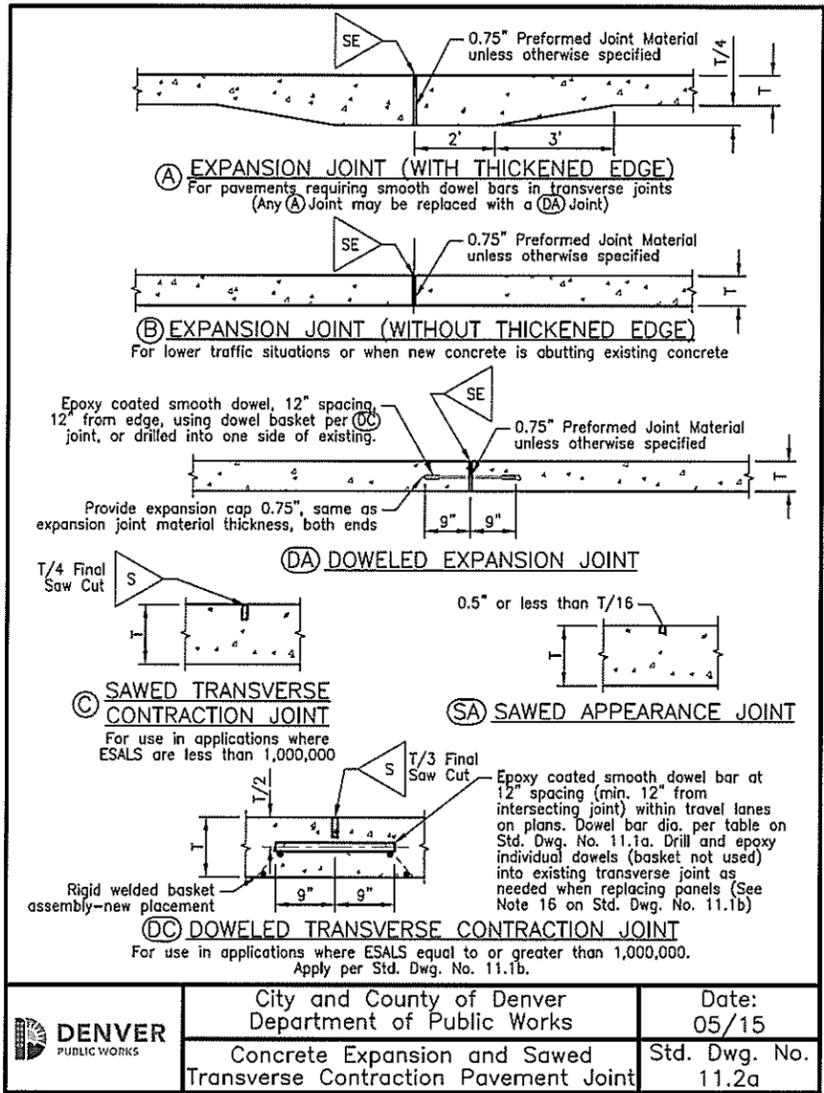
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As Constructed	FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
No Revisions:	TYPICAL ROADWAY DETAILS
Revised:	Designer: KSD Structure Numbers
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- Notes:
- Saw and seal width may be 0.1875" (3/16") maximum for new paving areas. Width may be 0.375" (3/8") maximum when matching existing appearance.
 - The final saw cut depth when no steel is present is T/4. The final saw cut depth when steel is present (tie or dowel bars) is T/3.
 - Backer rod diameter shall be twice the saw and seal width.
 - Joint sealant thickness should be equal to saw width. Joint sealant shall be approved silicone sealant, rated for streets or highways.

	City and County of Denver Department of Public Works	Date: 05/15
	Concrete Expansion and Sawed Transverse Contraction Pavement Joint	Std. Dwg. No. 11.2a

	City and County of Denver Department of Public Works	Date: 05/15
	Sawed Longitudinal Contraction and Construction Joints	Std. Dwg. No. 11.2b

	City and County of Denver Department of Public Works	Date: 05/15
	Concrete Pavement Joint Sealant	Std. Dwg. No. 11.3

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As Constructed	FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE	Project No./Code
No Revisions:	TYPICAL ROADWAY DETAILS	NHPP 2873-172 SA 19957
Revised:	Designer: KSD Detailer: SRF	2011-PROJMSTR-0000364
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TE MATCH EXISTING CURB AND GUTTER
(No tie-bars required for short sections. Extra precautions are needed to obtain suitable compaction due to hand work)

L (at C&G) CONCRETE PAVEMENT CURB AND GUTTER

C-A CONCRETE PAVEMENT TO ASPHALT PAVEMENT TRANSITION

	City and County of Denver Department of Public Works	Date: 05/15
	Concrete Pavement Miscellaneous Details	Std. Dwg. No. 11.4

CIRCULAR BLOCKOUT AT NEW MANHOLE*

BOXOUT AT INLET

* Unless otherwise directed, the boxout may be eliminated if Removable CLSM is used for the entire backfill of the manhole.
** Joints must line up with other joints and not dead-end or tee at panel sides. Transverse joint spacing shall be adjusted to align at the diameter, or pass at least 4' from the blockout. Use skewed longitudinal joints when the joints are within 2' of the blockout.

Circular rebar rings may be required around large manholes with min. 2' wide boxout frame

SECTION A-A BLOCKOUT/BOXOUT

Note:
1. Reference Std. Dwg. No. 11.5b for additional details.

	City and County of Denver Department of Public Works	Date: 05/15
	Concrete Pavement Jointing at New Manholes and All Inlets	Std. Dwg. No. 11.5a

EXISTING MANHOLE
When distance to nearest longitudinal joint is greater than or equal to 2'

EXISTING MANHOLE
When distance to nearest longitudinal joint is less than 2'

Note: Adjust C or DC to hit on diameter of manhole or pass at least 4' from the blockout.

SECTION B-B

Notes:
1. Bond Breaker shall be composed of plastic sheet, building paper, or other approved material to prevent bonding.
2. All expansion joint material shall be in preformed sheets, shall meet AASHTO M213 or ASTM 1751, asphalt saturated fiber. Material shall be full depth, width, and length in joints, and punched to snugly admit smooth dowel bars.
3. The sides of all valve boxes, pipes, and objects penetrating a placement shall be wrapped full depth with sealant backer material (Type 2 compressible foam sheets) meeting ASTM D 5249.

	City and County of Denver Department of Public Works	Date: 05/15
	Concrete Pavement Jointing at Existing Manholes	Std. Dwg. No. 11.5b

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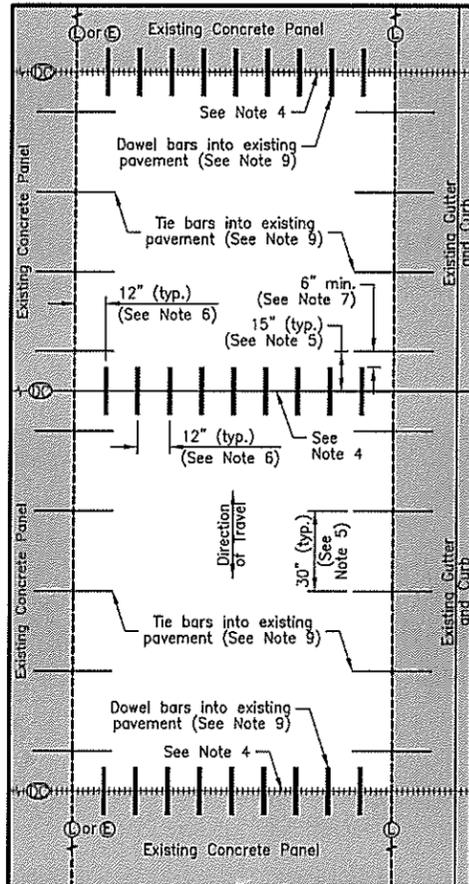
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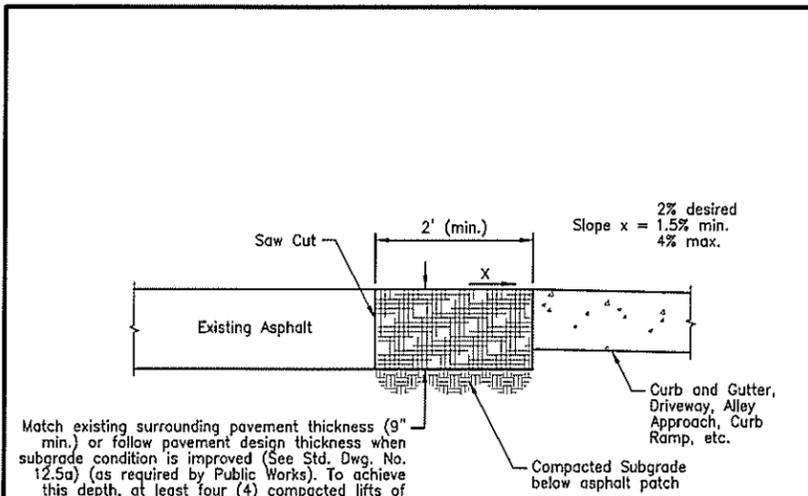
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TYPICAL ROADWAY DETAILS		
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- Notes:
- See Std. Dwg. No. 11.0 to 11.5b for joint and sealant details.
 - All saw cuts shall be straight and follow existing panel joint lines. Contractor should use full slot cut to relieve pressure and minimize damage to surrounding panels during panel removals. Contractor shall replace any panels damaged during their activities. Consult City Inspector for alternate instruction when existing joints do not line up.
 - Subgrade preparation shall be completed to meet compaction and proofroll specifications. The surface shall be smooth and flat including areas under tie and dowel bars. Add 4" Class 6 Aggregate Base Course meeting moisture and compaction specifications if subgrade is not sand or gravel.
 - Re-establish any existing expansion joints (A or DA) in transverse joints with full-depth expansion joint material. Match existing saw cut width of surrounding panels.
 - All steel is placed at mid-depth of thickness (1/2). See Std. Dwg. No. 11.1a and 11.1b for sizing, spacing, and alignment.
 - Use CC joints even if dowels did not previously exist in transverse joints.
 - Minimum clearance between tie bars and dowel bars is 6". Tie bars may be bent horizontally to achieve clearance.
 - Tie bar spacing may be adjusted to keep 15" clear from any non-ideal panel lines and gutter pan lines. Do not drill in tie bars if panel is <30" long or near any existing cracks.
 - Drill larger than dowel or tie bar and epoxy bars into existing concrete per supplier instructions. Eliminate tie bars in the shortest section of adjoining panels when joint lines do not align.
 - Exposed end of dowel bars shall be lightly oiled or greased. Tie bars used and exposed shall be clean, rust free, and not oiled or greased.
 - Repeat layout on the left for multiple lane replacement.

	City and County of Denver Department of Public Works	Date: 05/15
	Concrete Panel Replacement at Trench or Street	Std. Dwg. No. 11.6

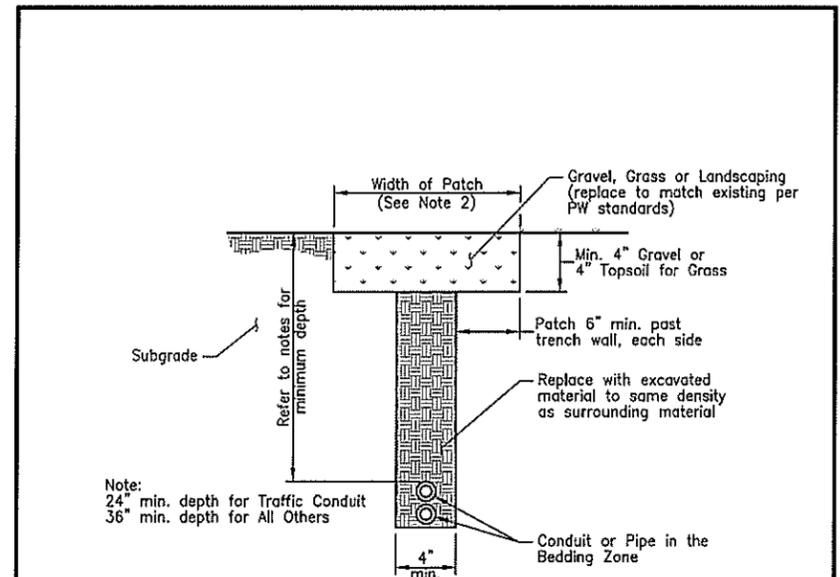


Match existing surrounding pavement thickness (9" min.) or follow pavement design thickness when subgrade condition is improved (See Std. Dwg. No. 12.5a) (as required by Public Works). To achieve this depth, at least four (4) compacted lifts of asphalt are required. Refer to Std. Dwg. No. 12.5b

ASPHALT PATCH

- Notes:
- Larger patch section may be required on new streets or streets that have undergone recent pavement work.
 - Curb to Curb replacement is required on a Moratorium Street, (those paved or resurfaced within the past 3 years).
 - Patches more than 10' wide, or more than one lane wide, may trigger reconstruction of more of the existing street. When required, street reconstruction shall be per Std. Dwg. No. 12.5a.
 - Refer to Std. Dwg. No. 12.5a, 12.5b, and 12.6 for lift thickness and material usage.
 - Avoid saw cuts in the existing or future planned wheel paths.
 - Lane edges (joints between paving passes) shall follow the traffic striped lanes as much as practicable. Lane edge joints shall not be in a wheel path. They should stagger previous edge by a minimum of 6" to avoid stacked edges.
 - Where existing cross-slope is steeper than 4%, patch cross-slope may be allowed to match, with approval of Public Works.

	City and County of Denver Department of Public Works	Date: 05/15
	Asphalt Patch	Std. Dwg. No. 12.0



Note:
24" min. depth for Traffic Conduit
36" min. depth for All Others

TRENCH PATCH (GRAVEL OR LANDSCAPING)

- Notes:
- Wherever possible, conduit or cable shall be installed by boring, driving, or any other acceptable means under concrete units. Open cutting shall be used only under special circumstances and only with approval of Public Works.
 - Minimum width and type of restoration to be determined by PW Inspector, based on contractor's pre-activity photos, to match pre-existing conditions.
 - Sod replacement shall be a minimum of 18" in width.
 - Any hardscape (concrete or pavers) should be replaced in full panels or pavers of the same type, color, and size as before.
 - Restoration in Denver Parks shall be per the Parks Operations Supervisor. Contact Denver Parks at 720-865-0368 for details and any permits required.

	City and County of Denver Department of Public Works	Date: 05/15
	Trench Patch (Gravel or Landscape Materials)	Std. Dwg. No. 12.1

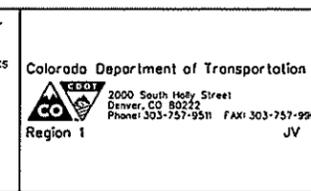
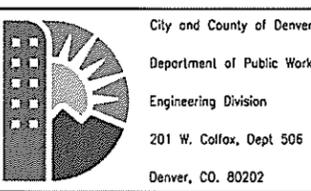
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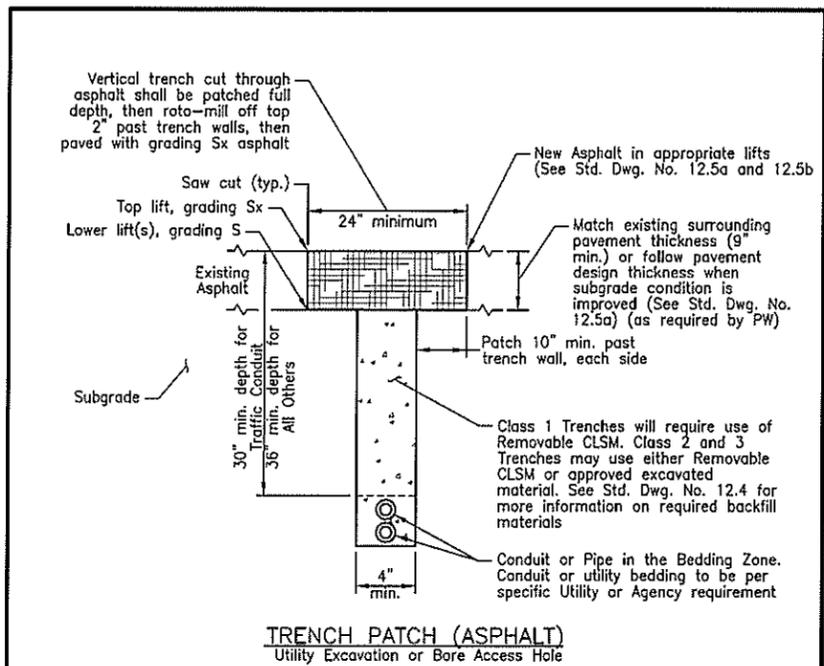


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AD SUBMITTAL - JANUARY 2, 2018



TRENCH PATCH (ASPHALT)
Utility Excavation or Bore Access Hole

Vertical trench cut through asphalt shall be patched full depth, then roto-mill off top 2" past trench walls, then paved with grading Sx asphalt.

New Asphalt in appropriate lifts (See Std. Dwg. No. 12.5a and 12.5b)

Saw cut (typ.)

Top lift, grading Sx

Lower lift(s), grading S

Existing Asphalt

Subgrade

24" minimum

Match existing surrounding pavement thickness (9" min.) or follow pavement design thickness when subgrade condition is improved (See Std. Dwg. No. 12.5a) (as required by PW)

Patch 10" min. past trench wall, each side

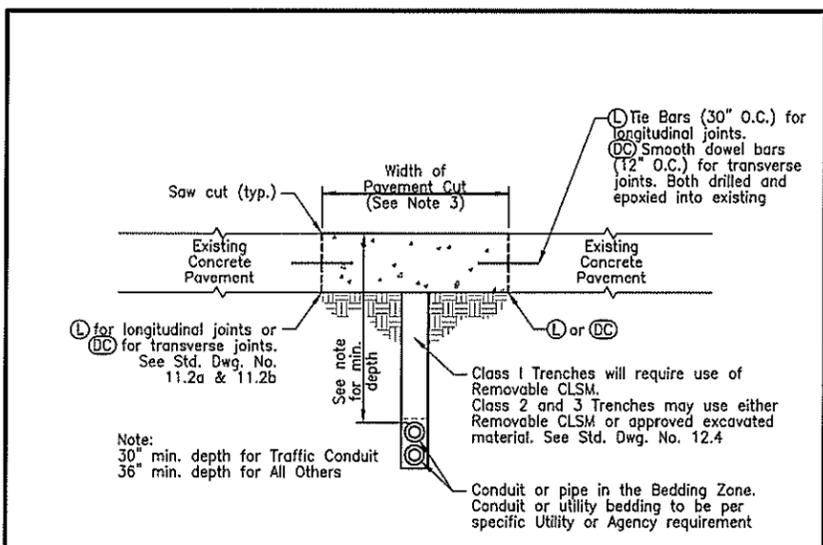
Class 1 Trenches will require use of Removable CLSM. Class 2 and 3 Trenches may use either Removable CLSM or approved excavated material. See Std. Dwg. No. 12.4 for more information on required backfill materials

Conduit or Pipe in the Bedding Zone. Conduit or utility bedding to be per specific Utility or Agency requirement

30" min. depth for Traffic Conduit
36" min. depth for All Others

4" min.

	City and County of Denver Department of Public Works	Date: 05/15
	Trench ("T") Patch (Asphalt) Moratorium/Residential	Std. Dwg. No. 12.2



TRENCH PATCH (CONCRETE)

Width of Pavement Cut (See Note 3)

Saw cut (typ.)

Existing Concrete Pavement

Existing Concrete Pavement

Class 1 Trenches will require use of Removable CLSM. Class 2 and 3 Trenches may use either Removable CLSM or approved excavated material. See Std. Dwg. No. 12.4

Conduit or pipe in the Bedding Zone. Conduit or utility bedding to be per specific Utility or Agency requirement

See note for min. depth

Ⓛ Tie Bars (30" O.C.) for longitudinal joints.
Ⓞ Smooth dowel bars (12" O.C.) for transverse joints. Both drilled and epoxied into existing

Ⓛ for longitudinal joints or Ⓞ for transverse joints. See Std. Dwg. No. 11.2a & 11.2b

Note:
30" min. depth for Traffic Conduit
36" min. depth for All Others

Notes:

- Wherever possible conduit or cable shall be installed by boring, driving, or any other acceptable means under concrete units. Open cutting shall be used only under special circumstances and only with approval of Public Works.
- This Standard Drawing applies to all concrete streets, alleys, sidewalks, curb, gutters, and driveways.
- Full panel replacement is required for concrete pavement including potholes for utilities and investigations.
- A construction joint (Ⓛ) shall be used to tie the concrete patch to both existing concrete longitudinal joints. A doweled contraction joint (Ⓞ) shall be used at the connection into existing transverse joints. Continue existing transverse joint lines across pavement, duplicate transverse joints as Ⓞ joints. See Std. Dwg. No. 11.2a and 11.2b for details.
- The limits of concrete patching shall be perpendicular or parallel to the centerline of the street. Skewed panel replacement over trenches is not permitted.
- Removable CLSM layer thickness not to exceed 3' at a time, and bleed water shall be pushed off surface before another layer can be added.
- See Std. Dwg. No. 12.4 for Trench Material Requirements.

	City and County of Denver Department of Public Works	Date: 05/15
	Trench ("T") Patch (Concrete)	Std. Dwg. No. 12.3

Backfill Materials Required per Trench Class
(Apply to Standard Drawings 12.2, 12.3a, and 12.3b)

Reference the Public Works Rules and Regulations Governing Street Cuts and Roadway Excavation specifications, August 1, 1998.

Trench Class	Trench Size or Structure	Backfill Materials and Method Before Test
1	Less than 150 square feet of surface cut	Method A=> use Removable CLSM
1	4 inch wide to 24 inch wide. No minimum length	Method A=> use Removable CLSM
1	Within 4 feet of structure, manhole or vault	Method A=> use Removable CLSM
2 & 3	Greater than 150 square feet of surface cut, AND Greater than 24 inches wide	Method A=> use Removable CLSM OR Method B=> approved excavated soil or import moisture adjusted and compacted**

**Before test refer to the specific Utility or Agency Specifications or Standards for pipe bedding and backfill material and construction requirements for lift thickness, moisture, and compaction.

Requirements for Removable CLSM
(Apply to Standard Drawings 12.2, 12.3a, and 12.3b)

	Air Entrainment	28 day compressive strength	Flowability by Slump or Spread	Construction Criteria
Flow-Fill (normal Removable CLSM)	6.0% min. to 25.0% (test by pressure method or unit weight method)	50 psi minimum to 150 psi maximum	Slump (C143) 7" to 10"	Limit 3 feet thick. Between placements, push water OFF surface before adding more.
Flash-Fill (fast Removable CLSM)	15.0% min. (test by unit weight method)	50 psi minimum to 300 psi maximum	Slump (C143, one lift, no rodding) 7" to 10", or Spread (D6103) 8" min.	Limit 3 feet thick. Between placements, protect from bonding to conduits, pipes.

Notes:

- CLSM (Controlled Low Strength Material) that shall be easily removable and air entrained is required for Class 1 trenches, and optional for Class 2 trenches. CLSM shall consist of an approved mix design using either flow-fill (cement and aggregate based) or flash-fill (flyash based). Both types are required to meet Removability Modulus of less than 1.5, and require different ranges of air entrainment, per MGPEC Item 19 Specifications. Refer to www.mgpec.org.
- Requirements for Reuse of Excavated Materials in Trench Backfill: materials shall be free of organics, trash, hazardous materials, rock or bedrock more than 3" diameter, high clay content (Plasticity Index (PI) shall be no more than 20), and soft or wet materials.

	City and County of Denver Department of Public Works	Date: 05/15
	Trench Material Requirements	Std. Dwg. No. 12.4

NOTE: 2015 TRANSPORTATION STANDARDS AND DETAILS WERE USED FOR DESIGN ON THIS PROJECT. WHERE FEASIBLE, THE 2017 TRANSPORTATION STANDARDS AND DETAILS SHALL BE USED. IF A QUESTION ABOUT WHICH STANDARD OR DETAIL TO BE USED ARISES, THE CITY'S PROJECT MANAGER SHALL DETERMINE WHICH DETAIL TO USE.



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Sheet Revisions		
Date:	Comments	Init.

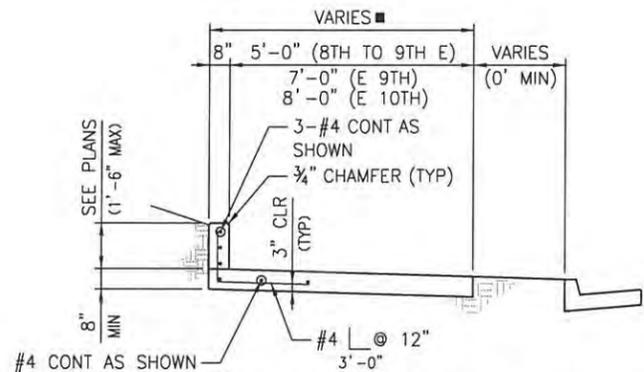
City and County of Denver
Department of Public Works
Engineering Division
201 W. Colfax, Dept 506
Denver, CO. 80202

Colorado Department of Transportation
3000 South Holly Street
Denver, CO 80222
Phone: 303-757-9511 FAX: 303-757-9907
Region 1
JV

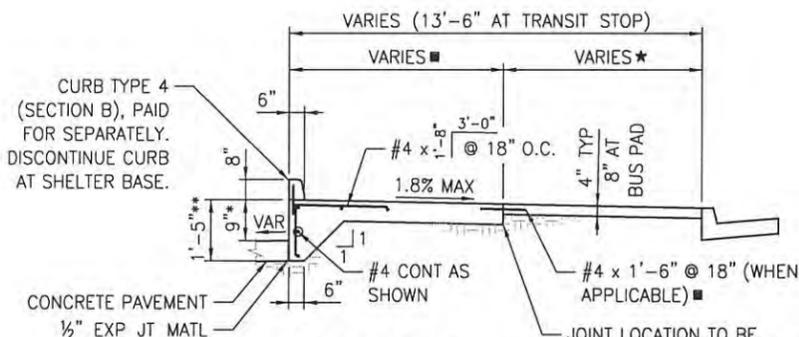
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Revised:
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TYPICAL ROADWAY DETAILS	
Designer:	KSD
Detailer:	SRF
Structure Numbers	
Sheet Subset:	TYPDET
Subset Sheets:	14 of 15

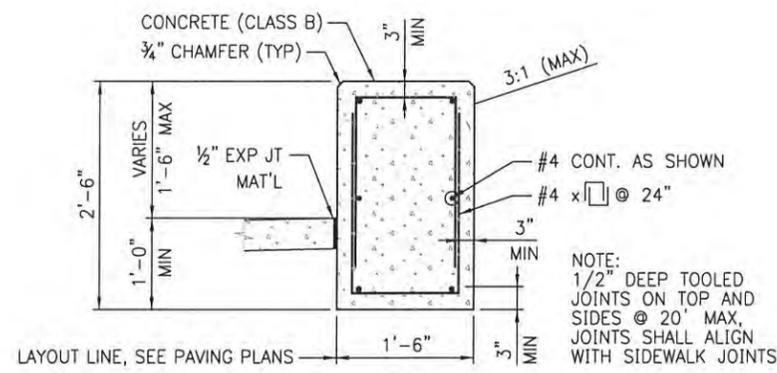
Project No./Code	NHPP 2873-172 SA 19957
2011-PROJMSTR-0000364	
Sheet Number	65



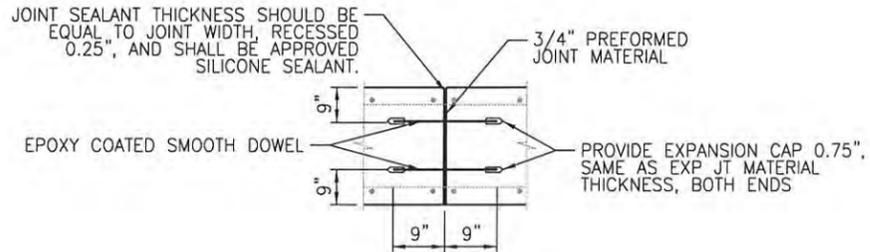
■ INCLUDED IN ITEM 608 - CONCRETE SIDEWALK (8 INCH) (SPECIAL). WHERE USED AT DRIVEWAY, REBAR AND CURBED PORTION SHALL BE INCLUDED IN THE DRIVEWAY PAY ITEM.
8TH TO 9TH (WEST SIDE), E 9TH (NORTH SIDE), & E 10TH (SOUTH SIDE)



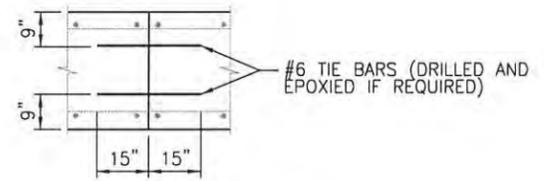
* 1'-4" MAX DESIGN HEIGHT
 ** 2'-0" MAX DESIGN HEIGHT
 ■ INCLUDED IN ITEM 608 - CONCRETE SIDEWALK (8 INCH) (SPECIAL)
 ★ SEE PLANS FOR PAY ITEM
 NOTE: SEE HARDSCAPE PLANS FOR SCORING, SURFACE TREATMENTS, AND ADDITIONAL INFORMATION.
NE CORNER OF 10TH



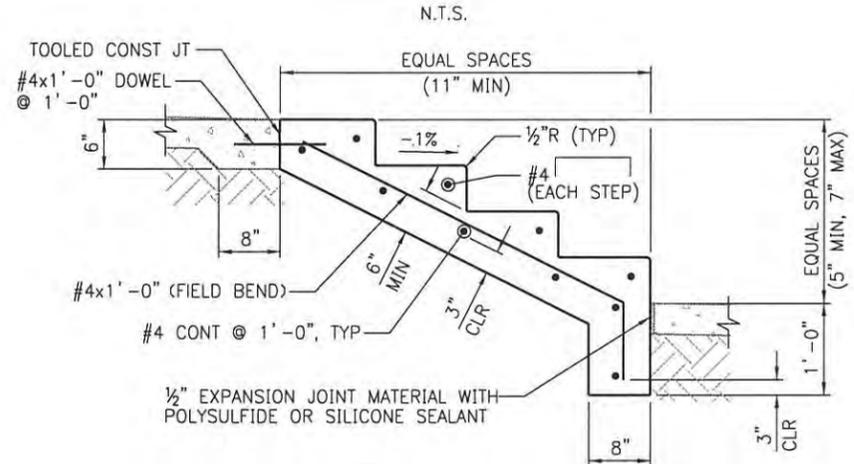
NOTE:
 1/2" DEEP TOOLED JOINTS ON TOP AND SIDES @ 20' MAX, JOINTS SHALL ALIGN WITH SIDEWALK JOINTS.



EXPANSION JOINTS SHALL BE PLACED EVERY 80' TO 100'
EXPANSION JOINT ELEVATION

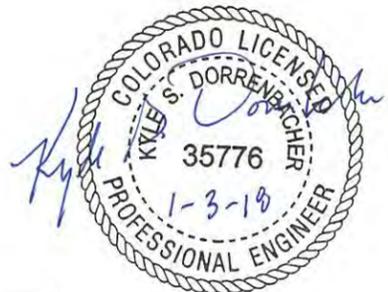


CONSTRUCTION JOINT ELEVATION
CURB (BARRIER) DETAIL



CONCRETE SIDEWALK (STAIRS)
CONCRETE SIDEWALK (8 INCH) (SPECIAL) DETAILS
 N.T.S.

NOTE: 2015 TRANSPORTATION STANDARDS AND DETAILS WERE USED FOR DESIGN ON THIS PROJECT. WHERE FEASIBLE, THE 2017 TRANSPORTATION STANDARDS AND DETAILS SHALL BE USED. IF A QUESTION ABOUT WHICH STANDARD OR DETAIL TO BE USED ARISES, THE CITY'S PROJECT MANAGER SHALL DETERMINE WHICH DETAIL TO USE.



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 CONSULTING ENGINEERS

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Drawing File Name: 1102188-011-Typ Roadway Details.dgn	
Horizontal Scale: 1:2	Vert. Scale: As Noted

Sheet Revisions		
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City and County of Denver
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 Engineering Division
 201 W. Colfax, Dept 506
 Denver, CO. 80202

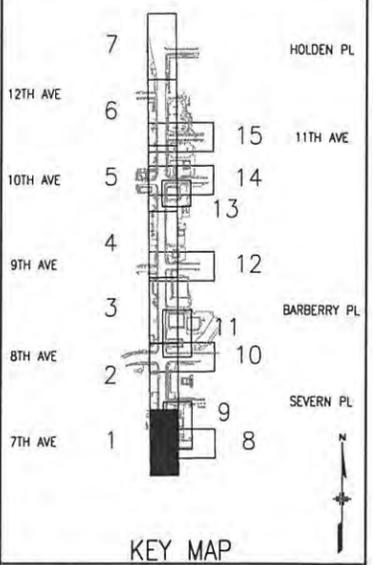
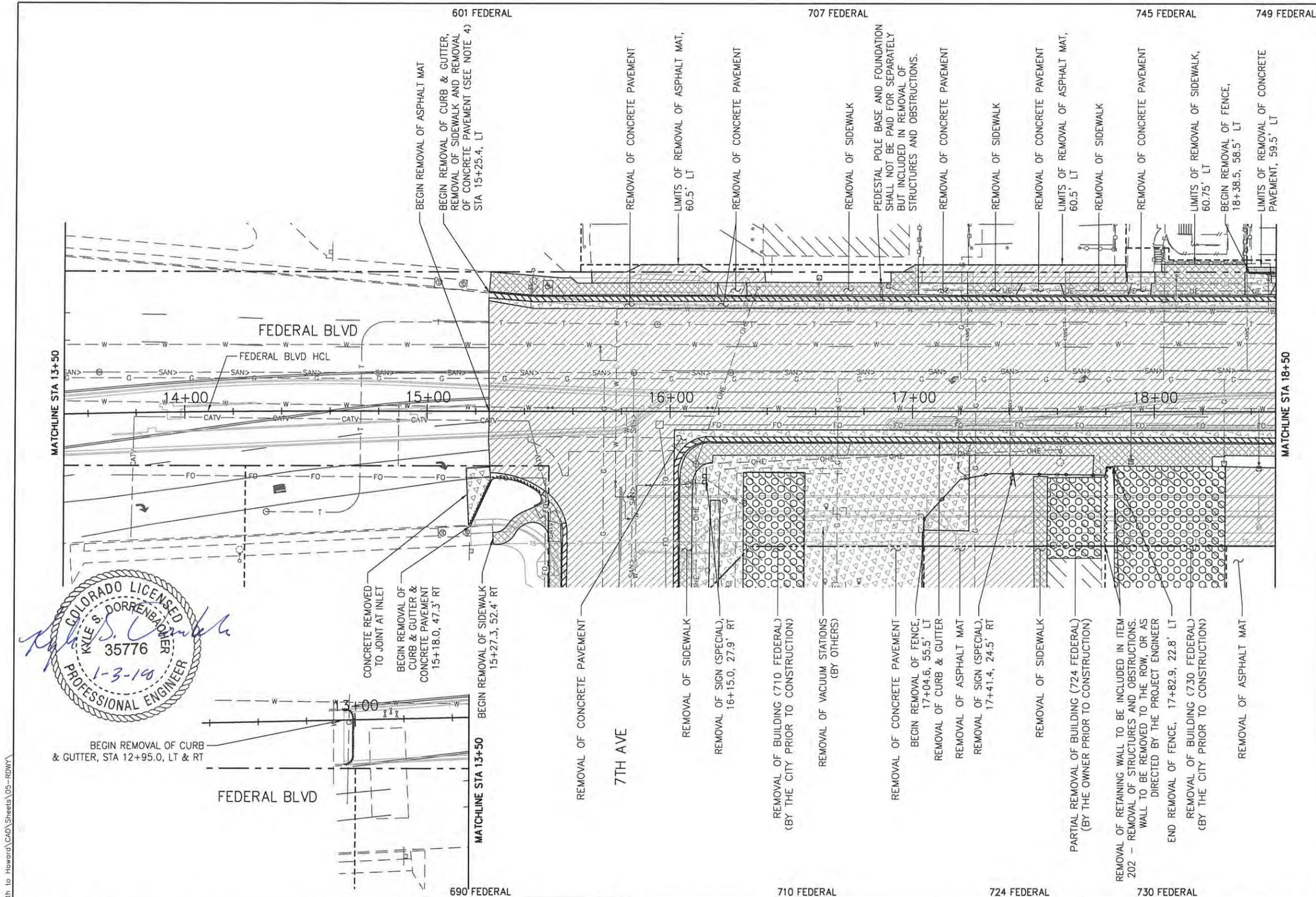
Colorado Department of Transportation
 2000 South Holly Street
 Denver, CO 80222
 Phone: 303-757-9511 FAX: 303-757-9907
 Region 1 JV

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No Revisions:
Revised:
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE	
TYPICAL ROADWAY DETAILS	
Designer:	KSD
Detailer:	SRF
Structure Numbers	
Sheet Subset:	TYPDET
Subset Sheets:	15 of 15

Project No./Code	NHPP 2873-172 SA 19957
	2011-PROJMSTR-0000364
Sheet Number	66

AD SUBMITTAL - JANUARY 2, 2018



- NOTES**
- UNLESS NOTED OTHERWISE REMOVAL EXTENTS SHALL NOT EXTEND PAST THE RIGHT-OF-WAY LINE.
 - SEE UTILITY, SIGNING & STRIPING PLANS AND WATER LINE SUBSET FOR ADDITIONAL REMOVALS
 - ALL PRIVATE UTILITIES THAT ARE REQUIRED TO BE REMOVED, MODIFIED OR ADJUSTED SHALL BE PERFORMED BY THE UTILITY OWNER.

- LEGEND**
- REMOVAL OF SIDEWALK
 - REMOVAL OF CURB AND GUTTER
 - REMOVAL OF CONCRETE PAVEMENT
 - REMOVAL OF ASPHALT MAT
 - REMOVAL OF BUILDING (BY OTHERS)

0 20 40

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Date:	Comments	Init.

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Denver, CO. 80202

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2300 South Holly Street
Denver, CO 80222
Phone: 303-757-9511 FAX: 303-757-9907
Region 1 JV

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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE REMOVAL AND RESET PLAN FEDERAL BLVD - 13+50 TO 18+50	
Designer:	KSD
Detailer:	SRF
Sheet Subset:	REMRES
Structure Numbers	
Subset Sheets:	1 of 15

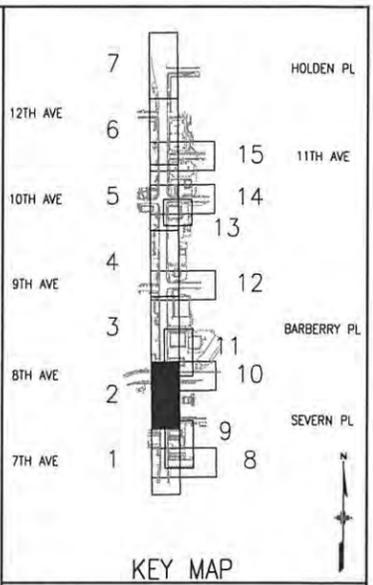
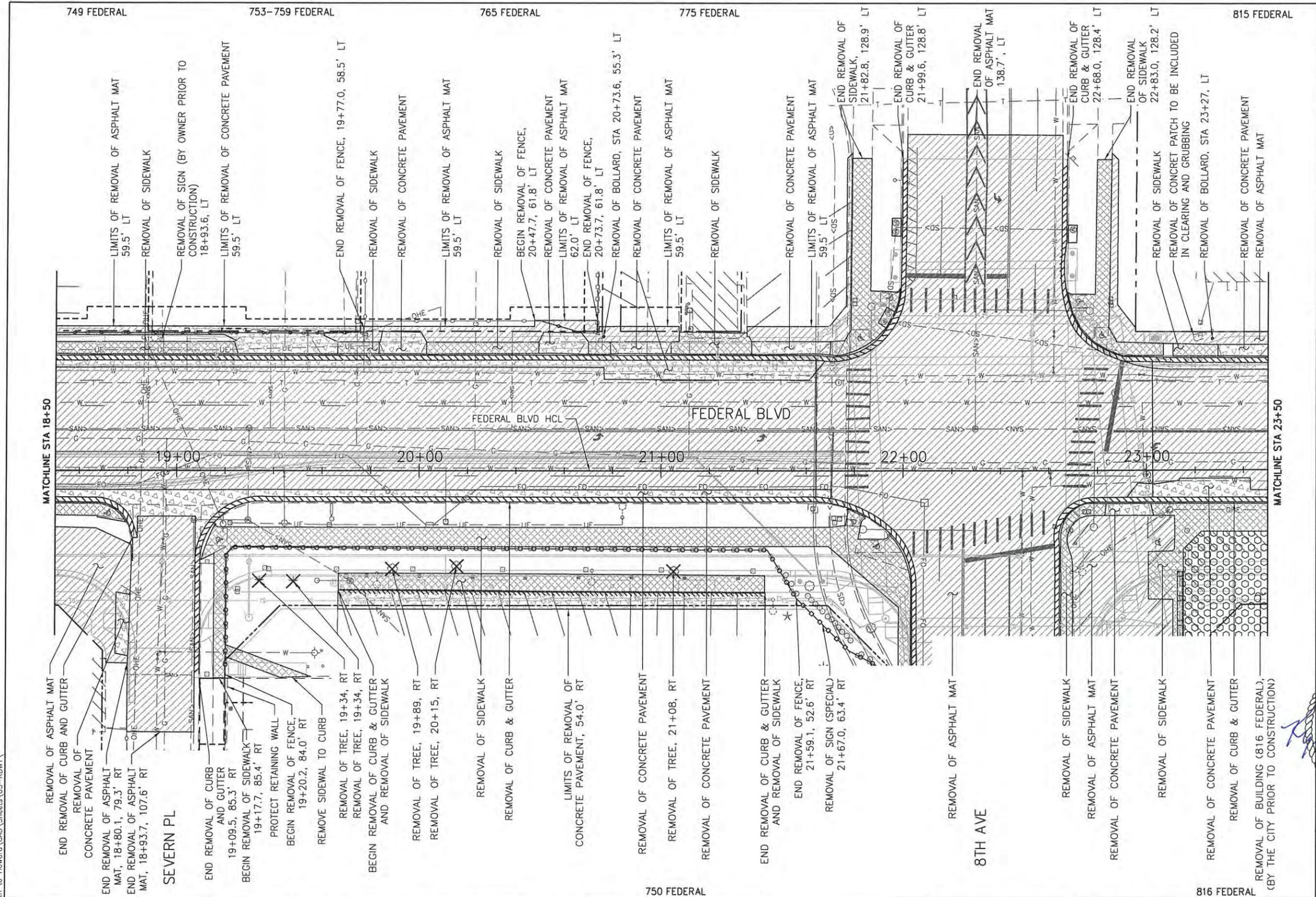
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Sheet Number	67

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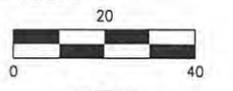
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LEGEND

- REMOVAL OF SIDEWALK
- REMOVAL OF CURB AND GUTTER
- REMOVAL OF CONCRETE PAVEMENT
- REMOVAL OF ASPHALT MAT
- REMOVAL OF BUILDING (BY OTHERS)

COLORADO LICENSED
KYLE S. DORRENBACHER
35776
1-3-10
PROFESSIONAL ENGINEER



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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
REMOVAL AND RESET PLAN
FEDERAL BLVD - 18+50 TO 23+50

Designer: KSD
Detailer: SRF
Sheet Subset: REMRES

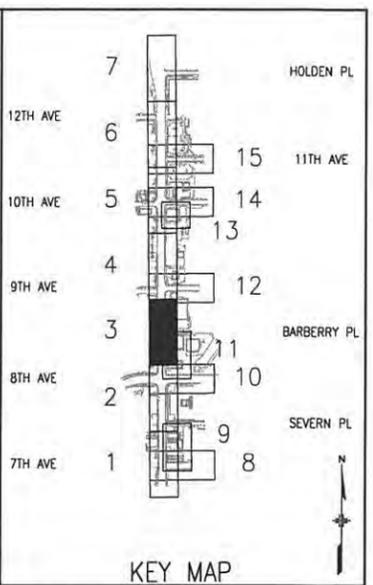
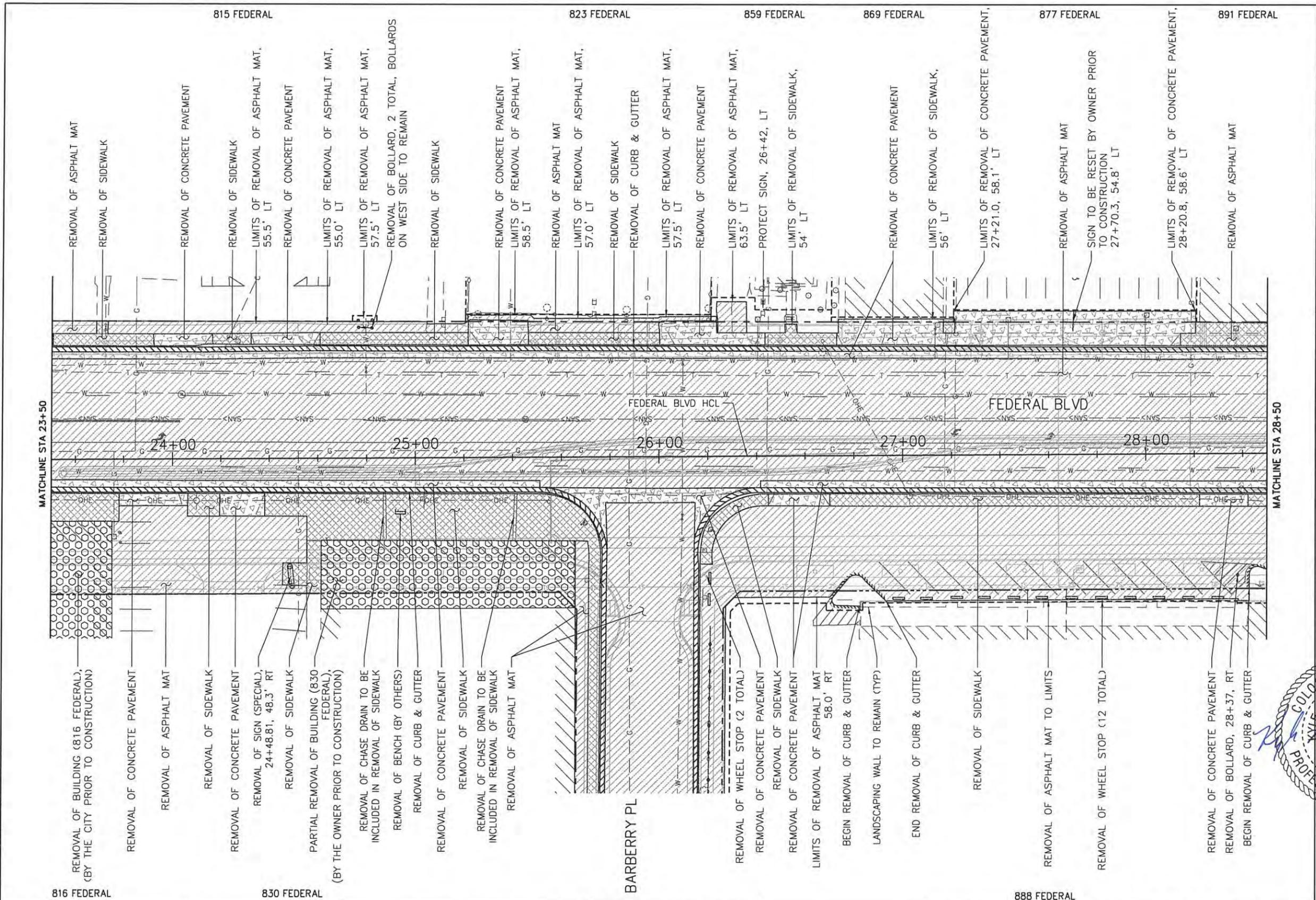
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Subset Sheets: 2 of 15

Project No./Code
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SA 19957
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Sheet Number 68

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NOTES

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LEGEND

- REMOVAL OF SIDEWALK
- REMOVAL OF CURB AND GUTTER
- REMOVAL OF CONCRETE PAVEMENT
- REMOVAL OF ASPHALT MAT
- REMOVAL OF BUILDING (BY OTHERS)



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City and County of Denver
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Engineering Division
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Denver, CO. 80202

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Denver, CO 80222
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Region 1 JV

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No Revisions:
Revised:
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
REMOVAL AND RESET PLAN
FEDERAL BLVD - 23+50 TO 28+50

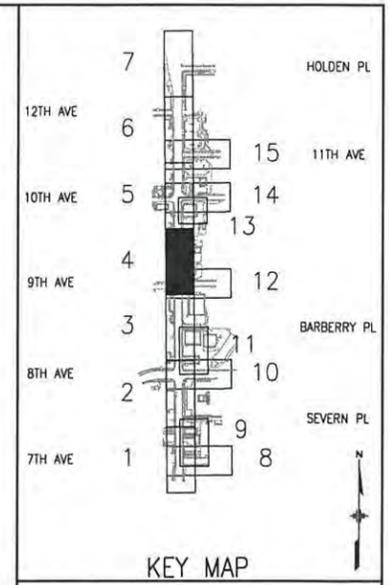
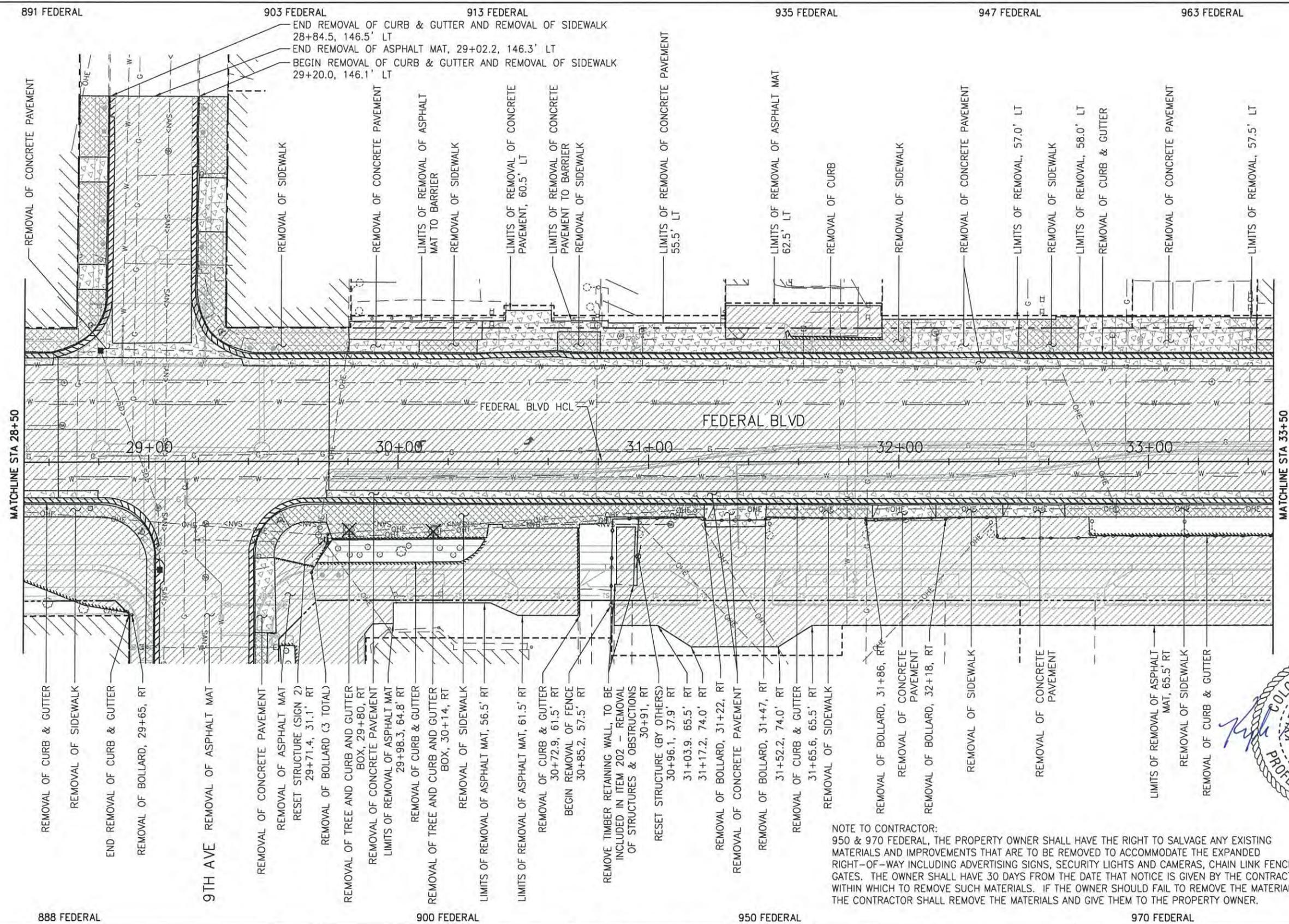
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Subset Sheets: 3 of 15

Project No./Code
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SA 19957
2011-PROJMSTR-0000364
Sheet Number 69

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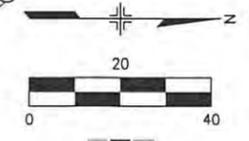
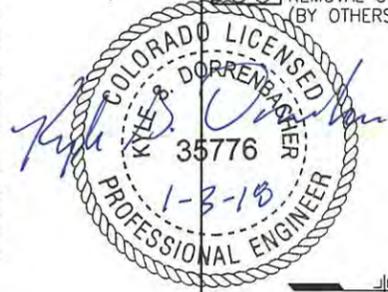
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- NOTES**
- UNLESS NOTED OTHERWISE REMOVAL EXTENTS SHALL NOT EXTEND PAST THE RIGHT-OF-WAY LINE.
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- LEGEND**
- REMOVAL OF SIDEWALK
 - REMOVAL OF CURB AND GUTTER
 - REMOVAL OF CONCRETE PAVEMENT
 - REMOVAL OF ASPHALT MAT
 - REMOVAL OF BUILDING (BY OTHERS)



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CONSULTING ENGINEERS

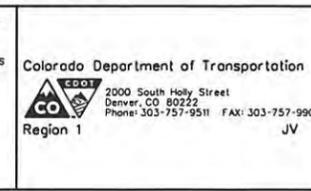
NOTE TO CONTRACTOR:
950 & 970 FEDERAL, THE PROPERTY OWNER SHALL HAVE THE RIGHT TO SALVAGE ANY EXISTING MATERIALS AND IMPROVEMENTS THAT ARE TO BE REMOVED TO ACCOMMODATE THE EXPANDED RIGHT-OF-WAY INCLUDING ADVERTISING SIGNS, SECURITY LIGHTS AND CAMERAS, CHAIN LINK FENCE AND GATES. THE OWNER SHALL HAVE 30 DAYS FROM THE DATE THAT NOTICE IS GIVEN BY THE CONTRACTOR WITHIN WHICH TO REMOVE SUCH MATERIALS. IF THE OWNER SHOULD FAIL TO REMOVE THE MATERIALS, THE CONTRACTOR SHALL REMOVE THE MATERIALS AND GIVE THEM TO THE PROPERTY OWNER.

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Drawing File Name: 1102188-01-Removal & Reset.dgn	
Horizontal Scale: 1:40	Vert. Scale: As Noted

Sheet Revisions		
Date:	Comments	Init.



City and County of Denver
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Engineering Division
201 W. Colfax, Dept 506
Denver, CO. 80202



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Revised:
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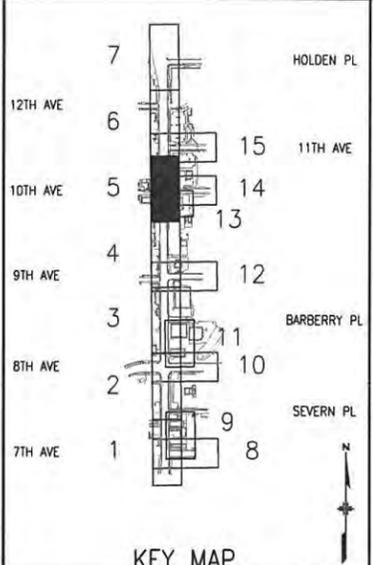
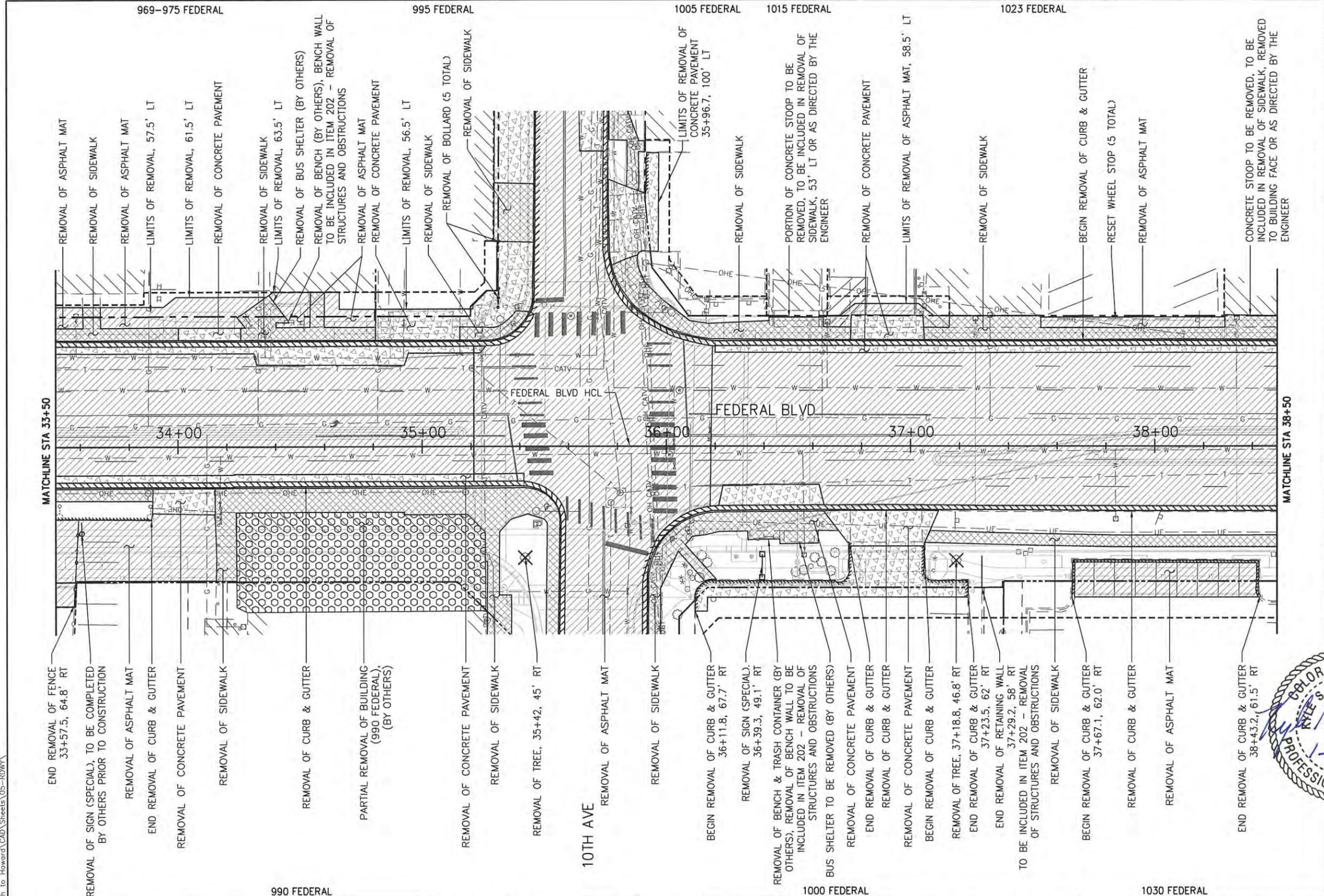
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Detailer:	SRF	Subset Sheets:	4 of 15
Sheet Subset:	REMRES		

Project No./Code	NHPP 2873-172 SA 19957
Sheet Number	2011-PROJMSTR-0000364 70

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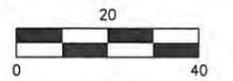
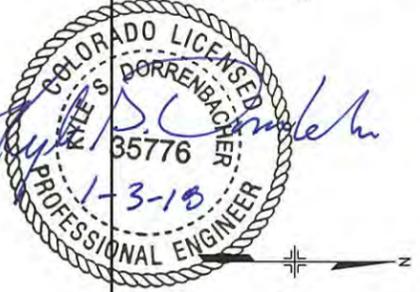
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- NOTES**
- UNLESS NOTED OTHERWISE REMOVAL EXTENTS SHALL NOT EXTEND PAST THE RIGHT-OF-WAY LINE.
 - SEE UTILITY, SIGNING & STRIPING PLANS AND WATER LINE SUBSET FOR ADDITIONAL REMOVALS
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- LEGEND**
- REMOVAL OF SIDEWALK
 - REMOVAL OF CURB AND GUTTER
 - REMOVAL OF CONCRETE PAVEMENT
 - REMOVAL OF ASPHALT MAT
 - REMOVAL OF BUILDING (BY OTHERS)



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Last Modification Date:	Init.:
Drawing File Name: 1102188-01-Removal & Resel.dgn	
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Sheet Revisions		
Date:	Comments	Init.

City and County of Denver
Department of Public Works
Engineering Division
201 W. Colfax, Dept 506
Denver, CO. 80202

Colorado Department of Transportation
2000 South Holy Street
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Region 1 JV

As Constructed

No Revisions:

Revised:

Void:

**FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
REMOVAL AND RESET PLAN
FEDERAL BLVD - 33+50 TO 38+50**

Designer: KSD
Detailer: SRF
Sheet Subset: REMRES

Structure Numbers
Subset Sheets: 5 of 15

Project No./Code

NHPP 2873-172
SA 19957

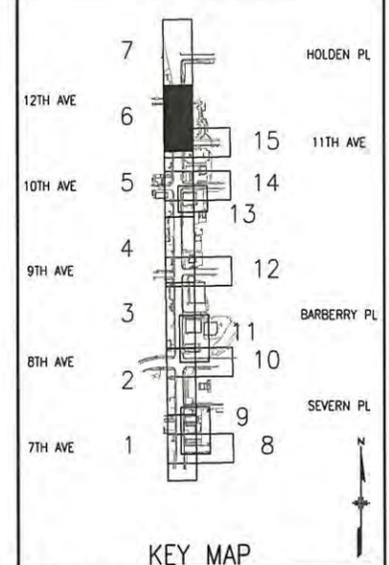
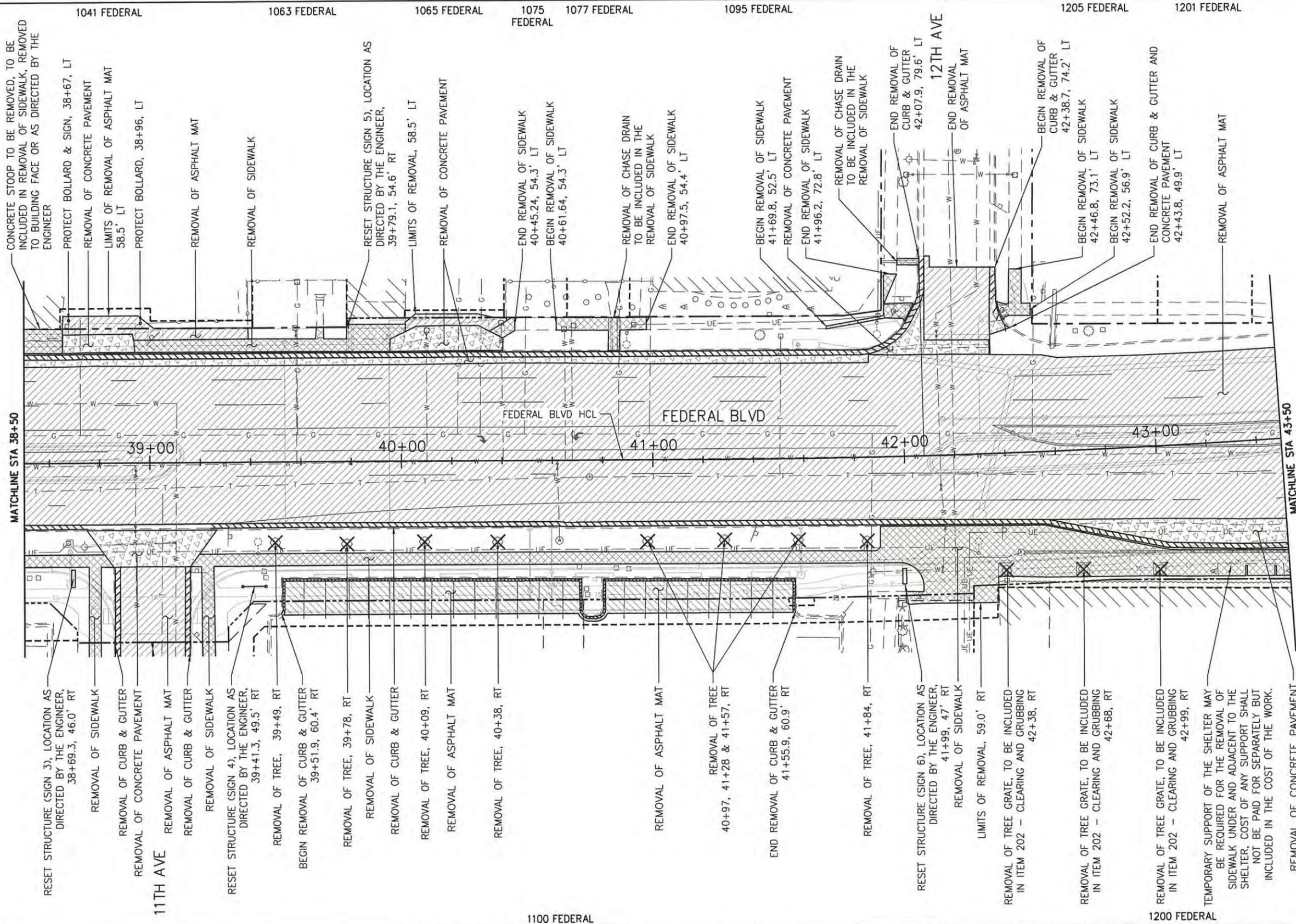
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- NOTES**
- UNLESS NOTED OTHERWISE REMOVAL EXTENTS SHALL NOT EXTEND PAST THE RIGHT-OF-WAY LINE.
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 - REMOVAL OF CURB AND GUTTER
 - REMOVAL OF CONCRETE PAVEMENT
 - REMOVAL OF ASPHALT MAT
 - REMOVAL OF BUILDING (BY OTHERS)

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Date:	Comments	Init.

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 Denver, CO. 80202

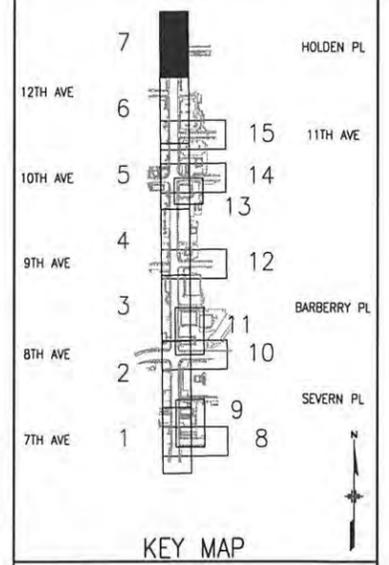
Colorado Department of Transportation
 2000 South Holly Street
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 Region 1 JV

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No Revisions:
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE REMOVAL AND RESET PLAN FEDERAL BLVD - 38+50 TO 43+50	
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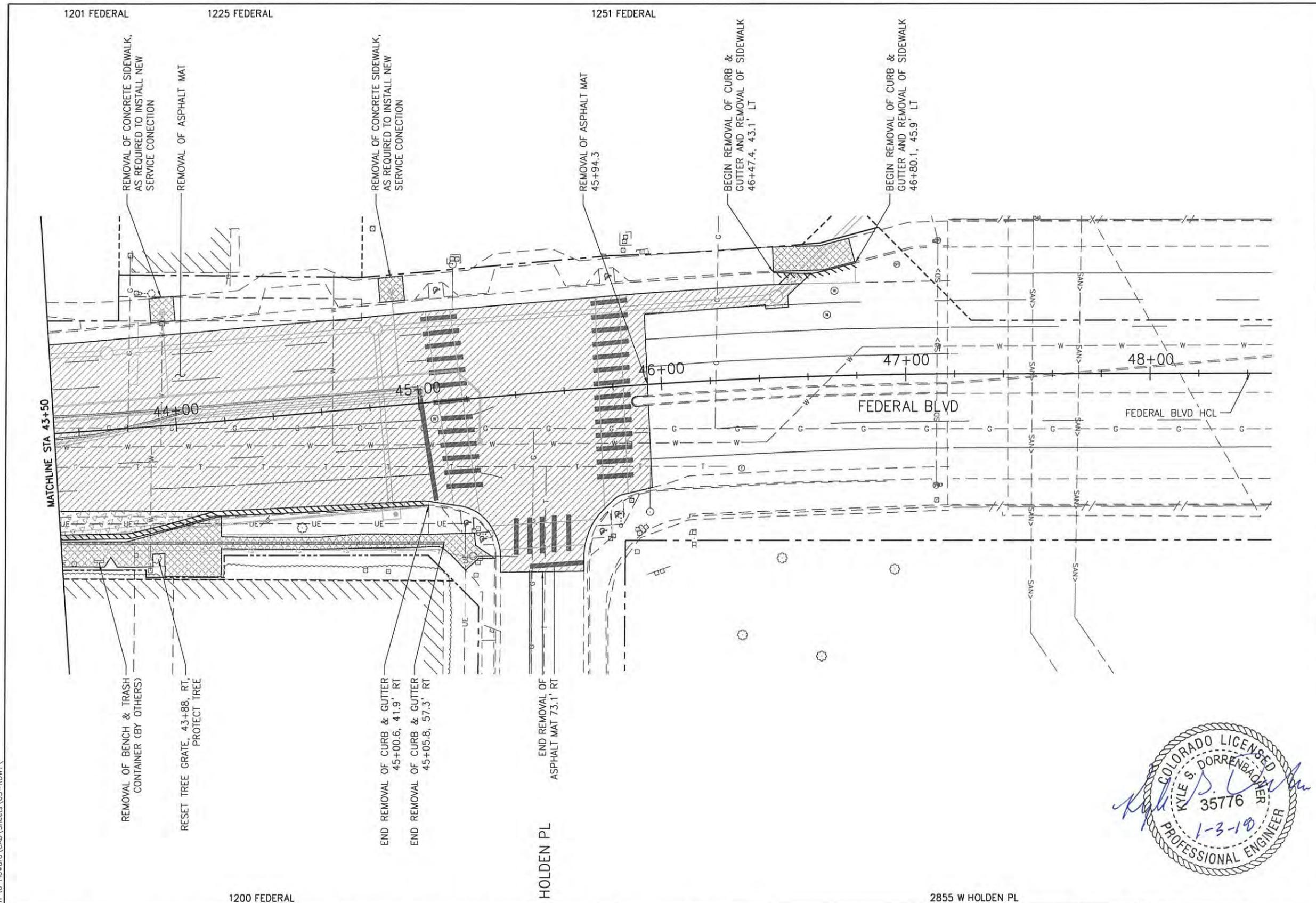
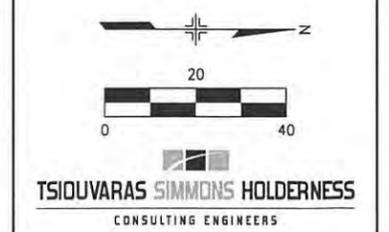
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NHPP 2873-172 SA 19957
2011-PROJMSTR-0000364
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- NOTES**
- UNLESS NOTED OTHERWISE REMOVAL EXTENTS SHALL NOT EXTEND PAST THE RIGHT-OF-WAY LINE.
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- LEGEND**
- REMOVAL OF SIDEWALK
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 - REMOVAL OF CONCRETE PAVEMENT
 - REMOVAL OF ASPHALT MAT
 - REMOVAL OF BUILDING (BY OTHERS)



Last Modification Date:	Init.:
Drawing File Name: 1102188-01-Removal & Reset.dgn	
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Sheet Revisions		
Date:	Comments	Init.

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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
REMOVAL AND RESET PLAN
FEDERAL BLVD - 43+50 TO 48+50

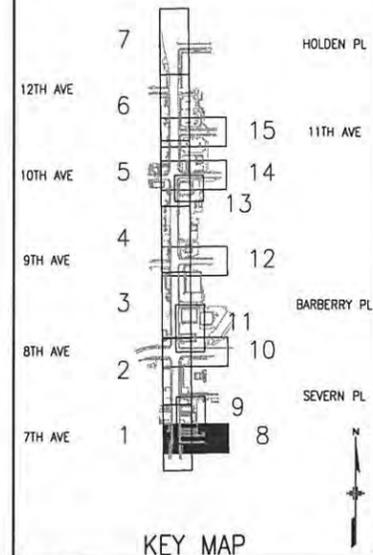
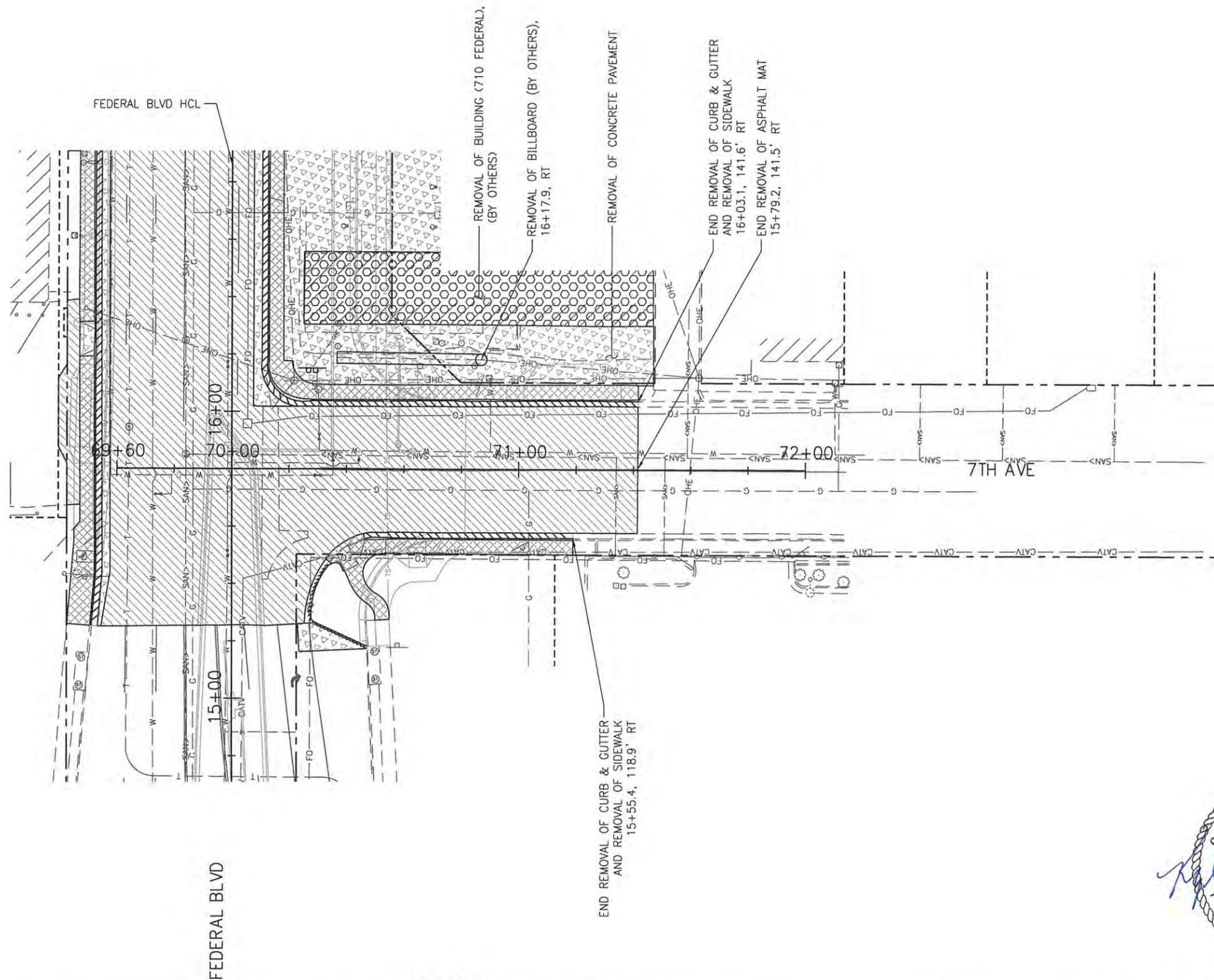
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Project No./Code
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SA 19957
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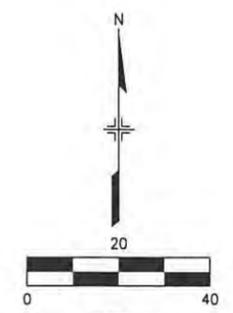
AD SUBMITTAL - JANUARY 2, 2018

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- NOTES**
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- LEGEND**
- REMOVAL OF SIDEWALK
 - REMOVAL OF CURB AND GUTTER
 - REMOVAL OF CONCRETE PAVEMENT
 - REMOVAL OF ASPHALT MAT
 - REMOVAL OF BUILDING (BY OTHERS)



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Colorado Department of Transportation
2000 South Holly Street
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Region 1 JV

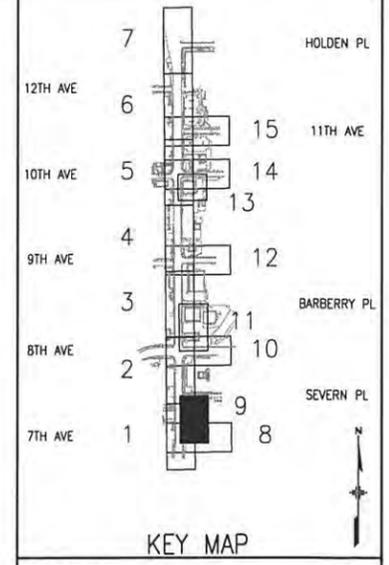
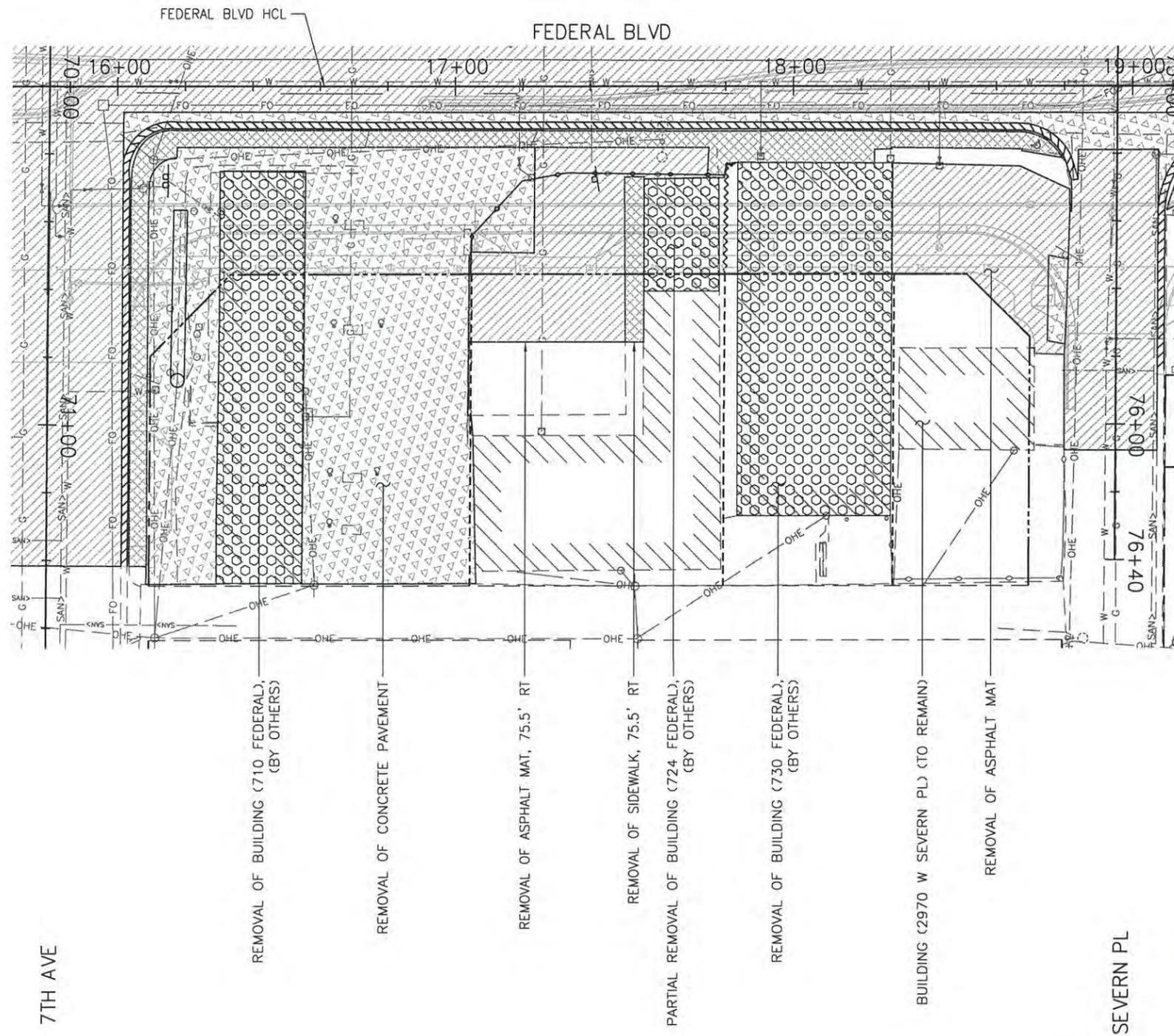
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Detailer:	SRF	Subset Sheets:	8 of 15
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Project No./Code
NHPP 2873-172 SA 19957
2011-PROJMSTR-0000364
Sheet Number 74

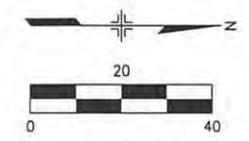
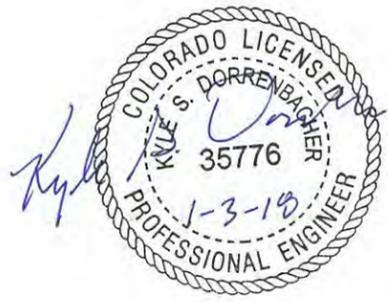
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- NOTES**
- UNLESS NOTED OTHERWISE REMOVAL EXTENTS SHALL NOT EXTEND PAST THE RIGHT-OF-WAY LINE.
 - SEE UTILITY, SIGNING & STRIPING PLANS AND WATER LINE SUBSET FOR ADDITIONAL REMOVALS
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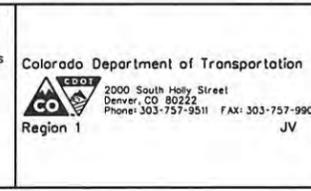
- LEGEND**
- REMOVAL OF SIDEWALK
 - REMOVAL OF CURB AND GUTTER
 - REMOVAL OF CONCRETE PAVEMENT
 - REMOVAL OF ASPHALT MAT
 - REMOVAL OF BUILDING (BY OTHERS)



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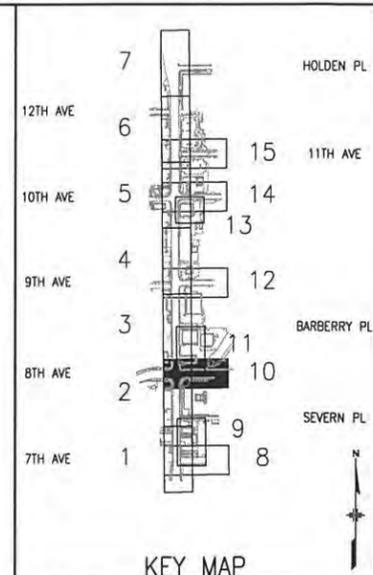
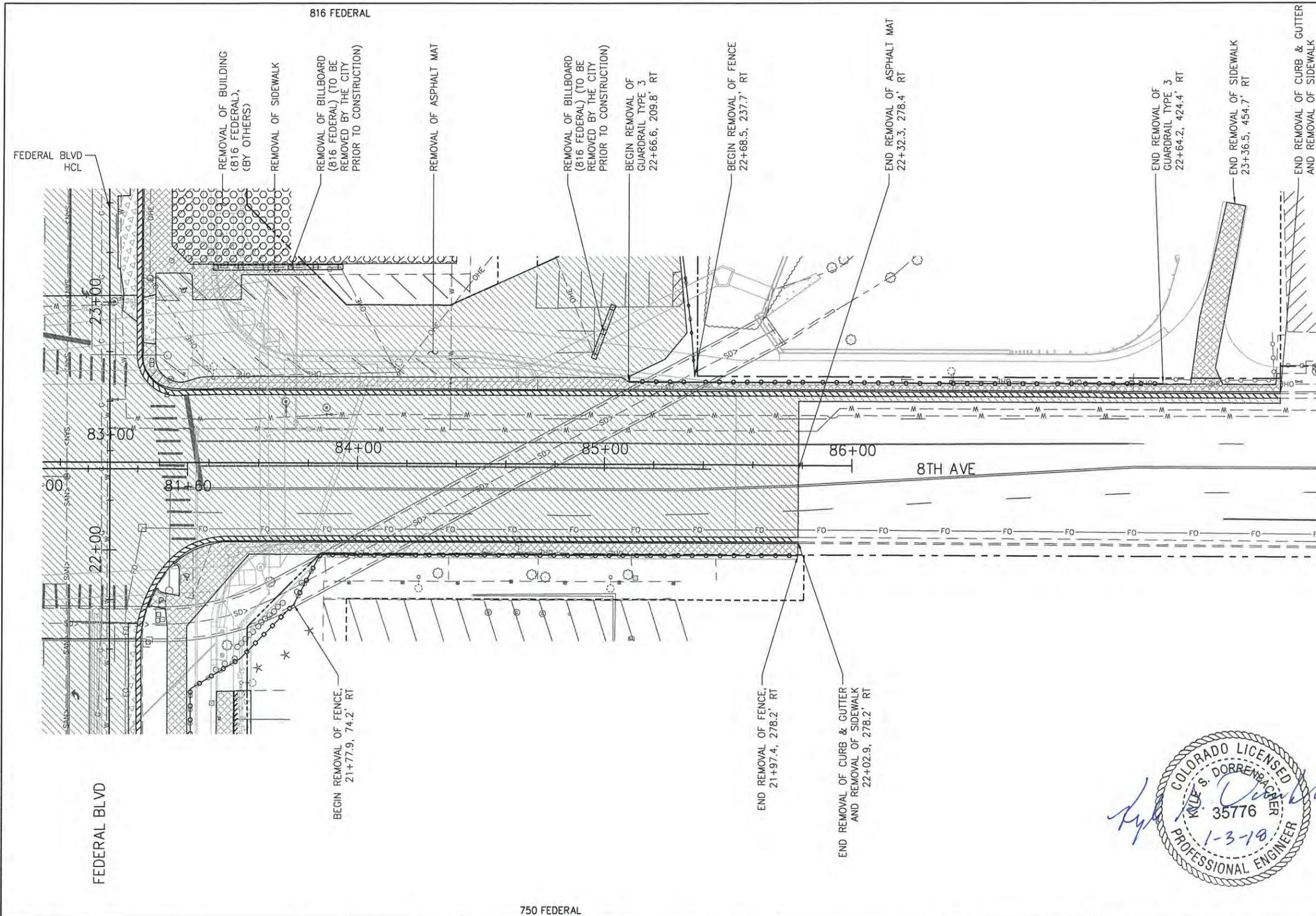
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Detailer: SRF	
Sheet Subset: REMRES	Subset Sheets: 9 of 15

Project No./Code
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2011-PROJMSTR-0000364
Sheet Number 75

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- NOTES**
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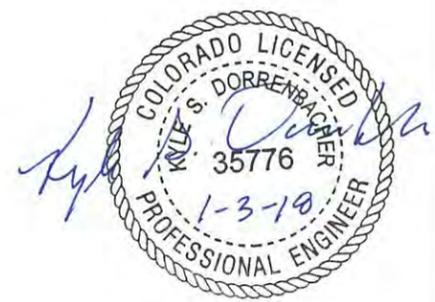
- LEGEND**
- REMOVAL OF SIDEWALK
 - REMOVAL OF CURB AND GUTTER
 - REMOVAL OF CONCRETE PAVEMENT
 - REMOVAL OF ASPHALT MAT
 - REMOVAL OF BUILDING (BY OTHERS)

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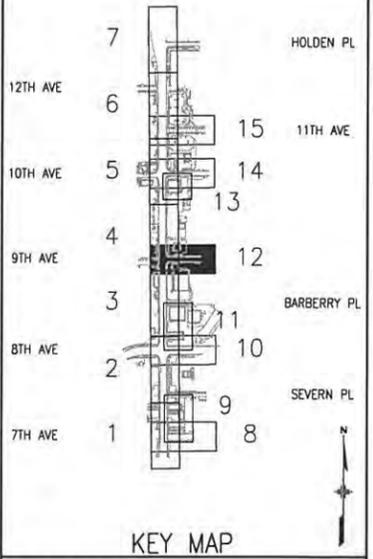
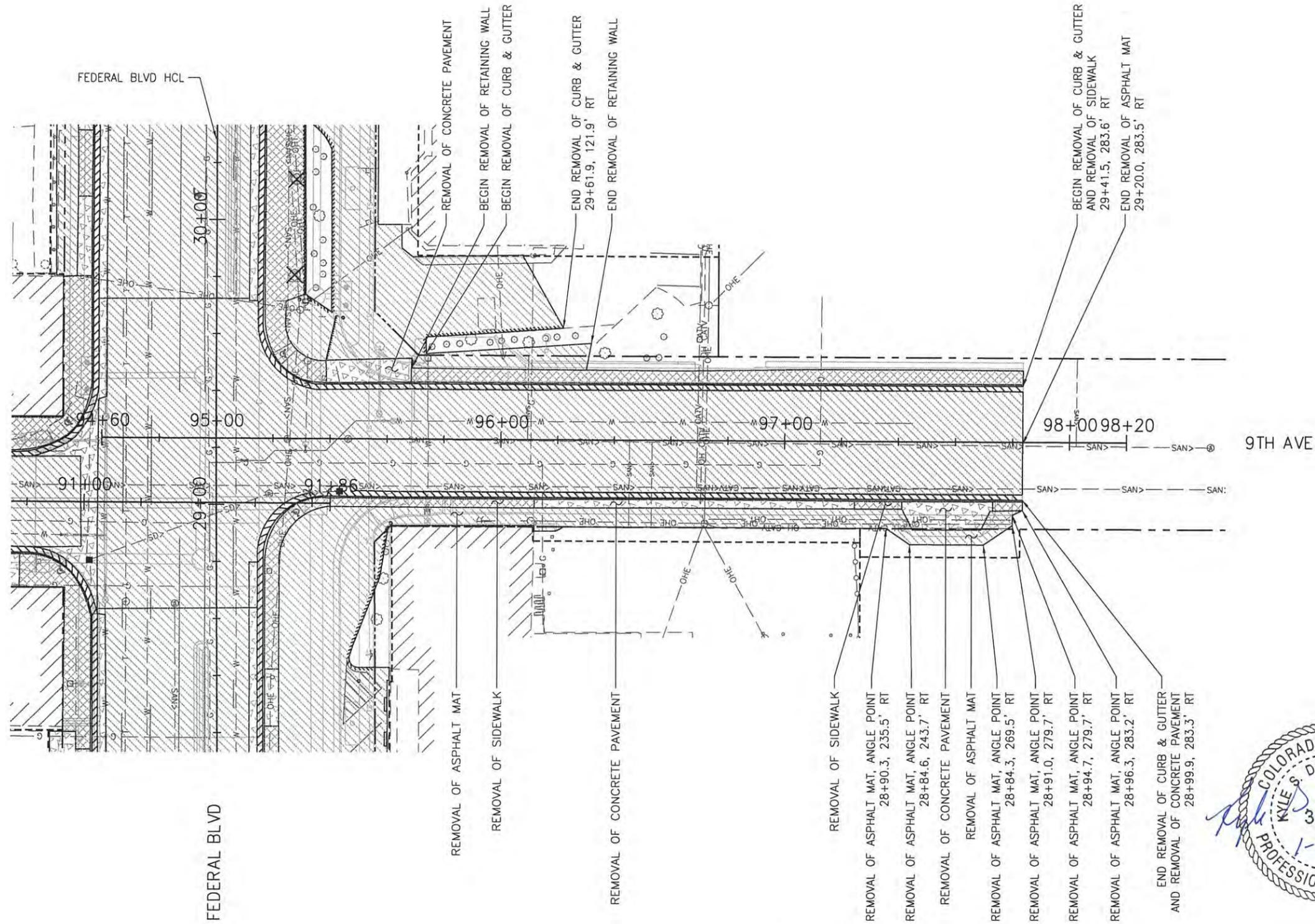
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Structure Numbers	
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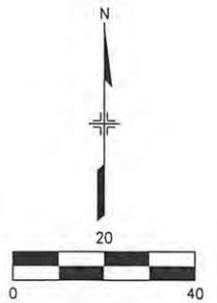
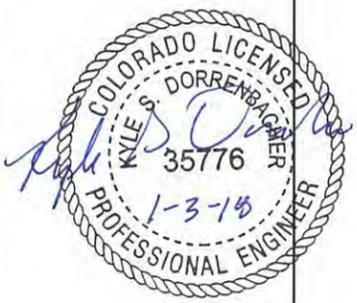
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- NOTES**
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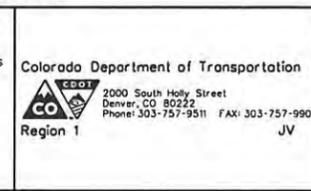
- LEGEND**
- REMOVAL OF SIDEWALK
 - REMOVAL OF CURB AND GUTTER
 - REMOVAL OF CONCRETE PAVEMENT
 - REMOVAL OF ASPHALT MAT
 - REMOVAL OF BUILDING (BY OTHERS)



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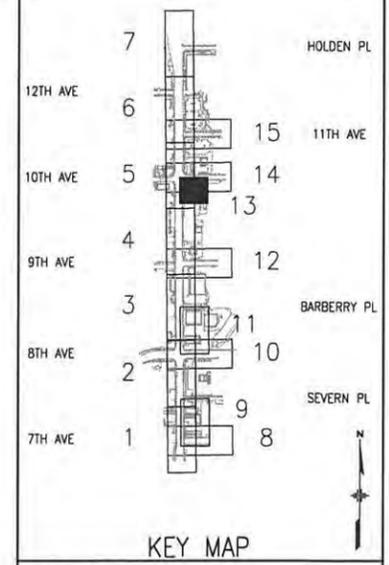
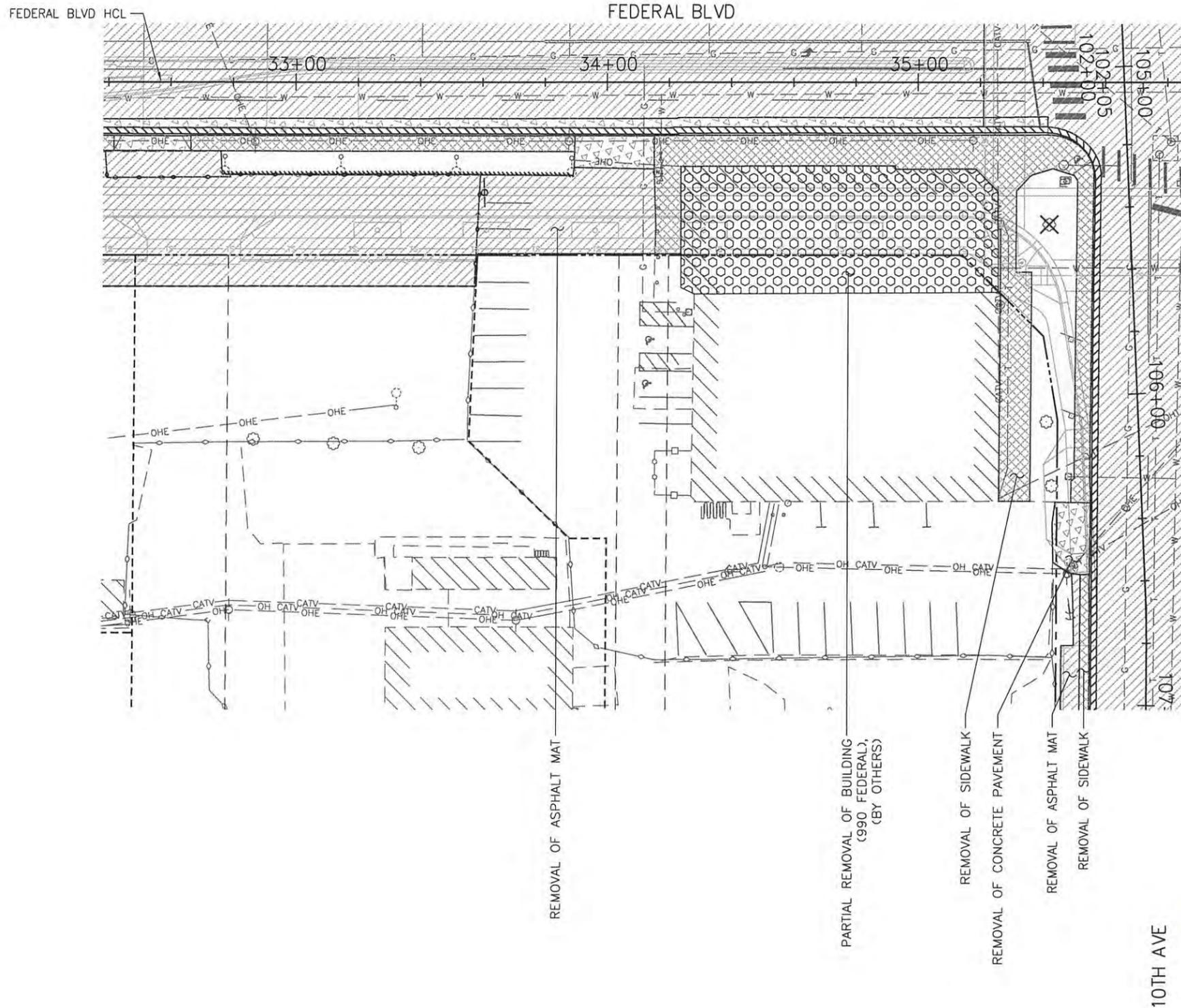
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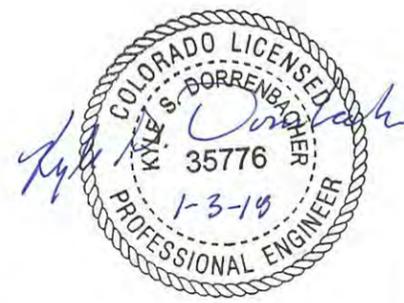
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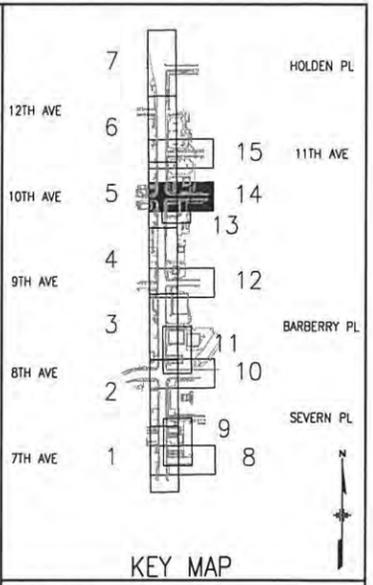
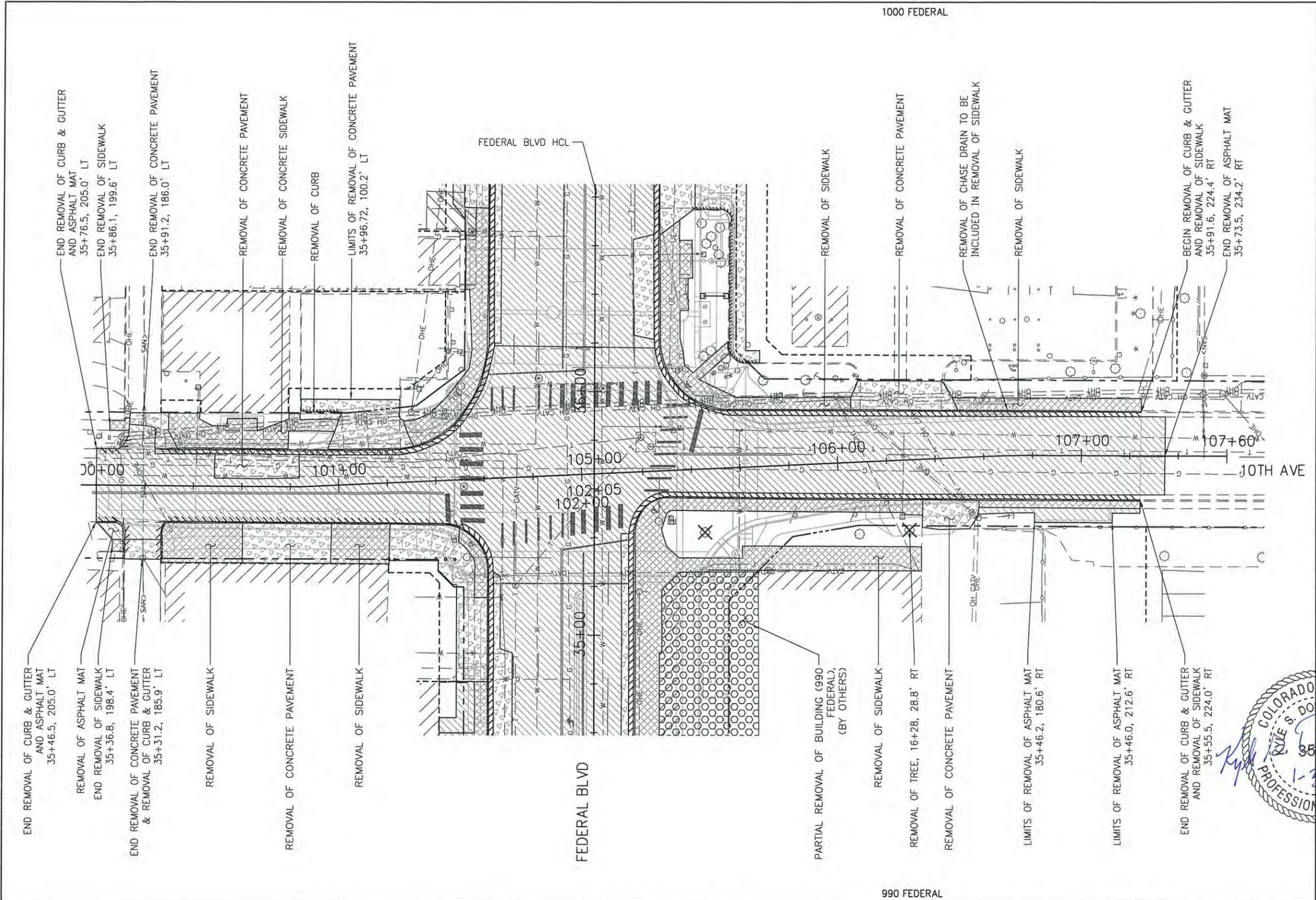
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- NOTES**
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 - REMOVAL OF CONCRETE PAVEMENT
 - REMOVAL OF ASPHALT MAT
 - REMOVAL OF BUILDING (BY OTHERS)

PROFESSIONAL ENGINEER
 KYIE S. DORRENBACHER
 35776
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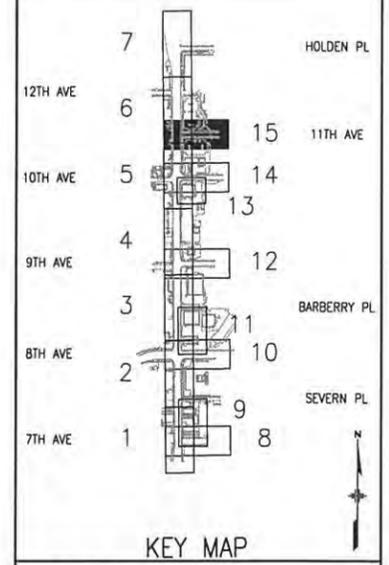
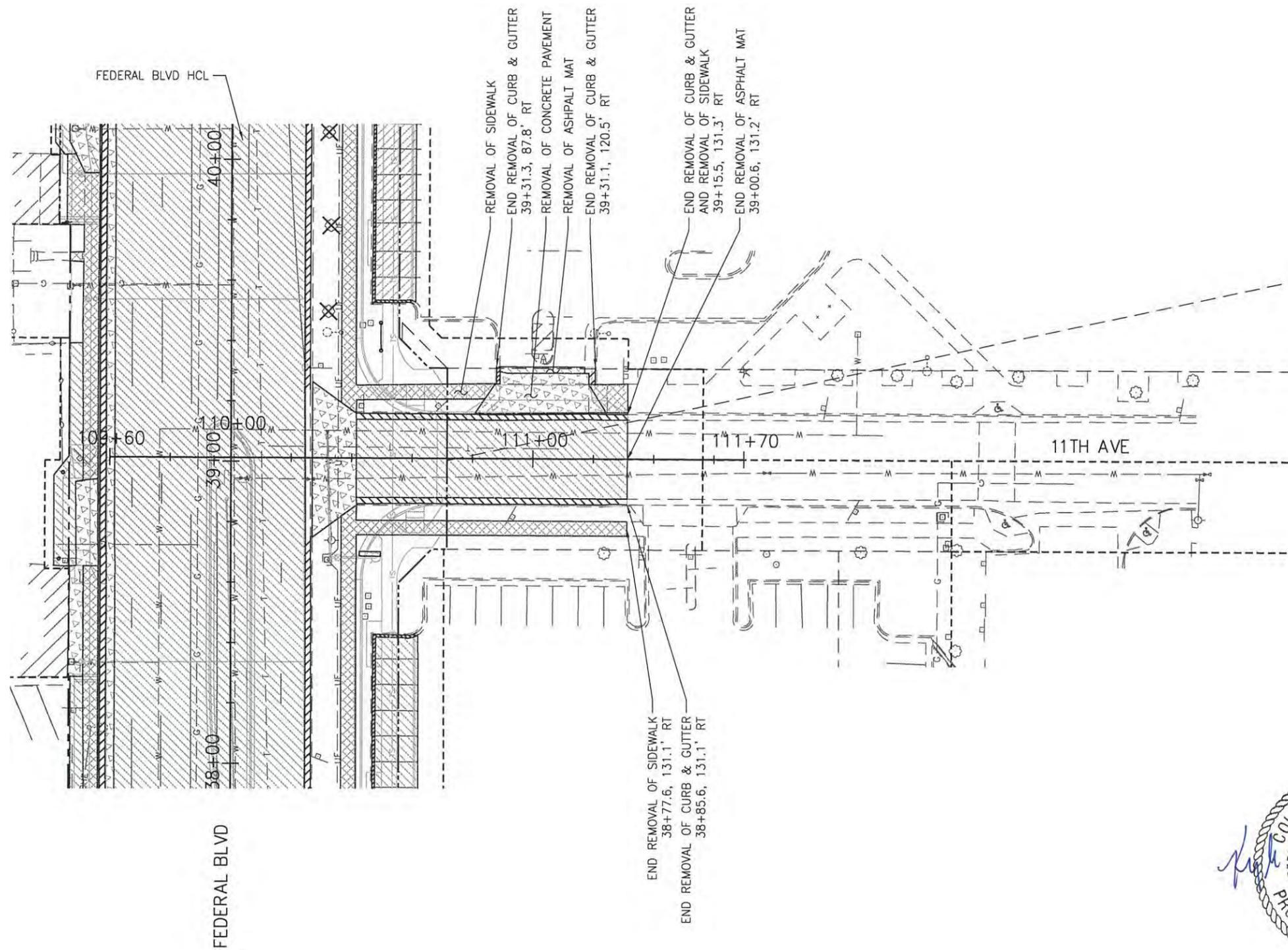
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Detailer:	SRF
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Project No./Code	NHPP 2873-172 SA 19957
2011-PROJMSTR-0000364	
Sheet Number	80

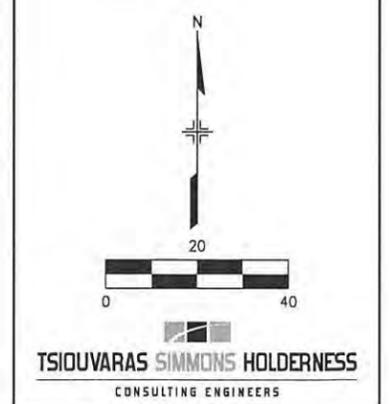
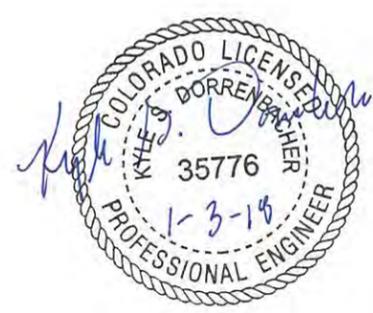
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1100 FEDERAL



- NOTES**
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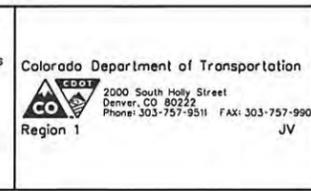
- LEGEND**
- REMOVAL OF SIDEWALK
 - REMOVAL OF CURB AND GUTTER
 - REMOVAL OF CONCRETE PAVEMENT
 - REMOVAL OF ASPHALT MAT
 - REMOVAL OF BUILDING (BY OTHERS)



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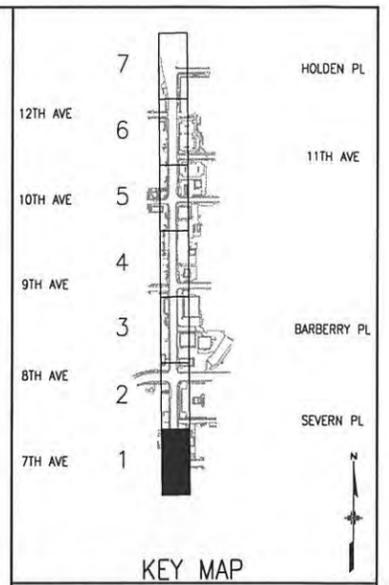
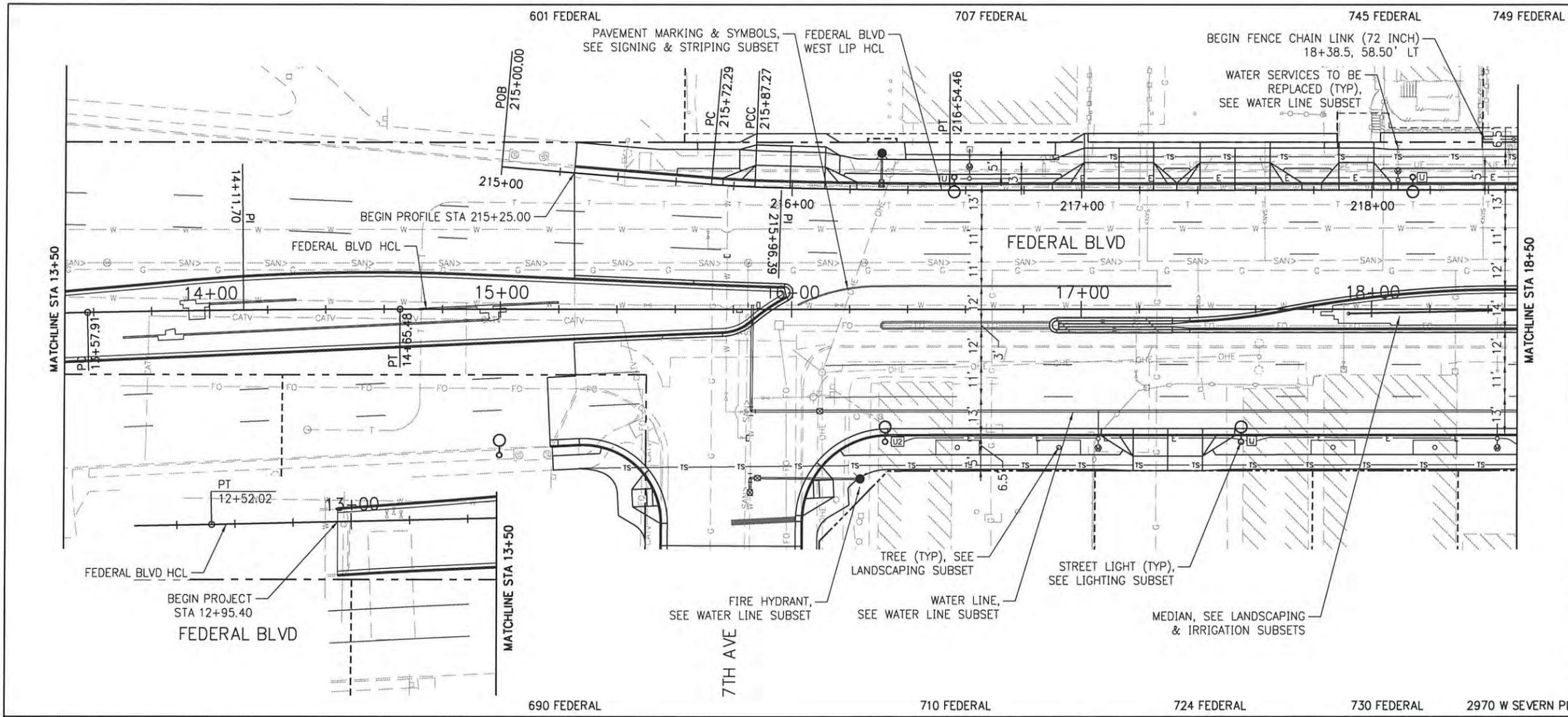


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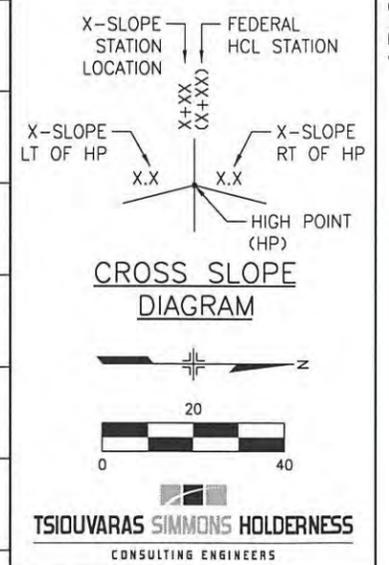
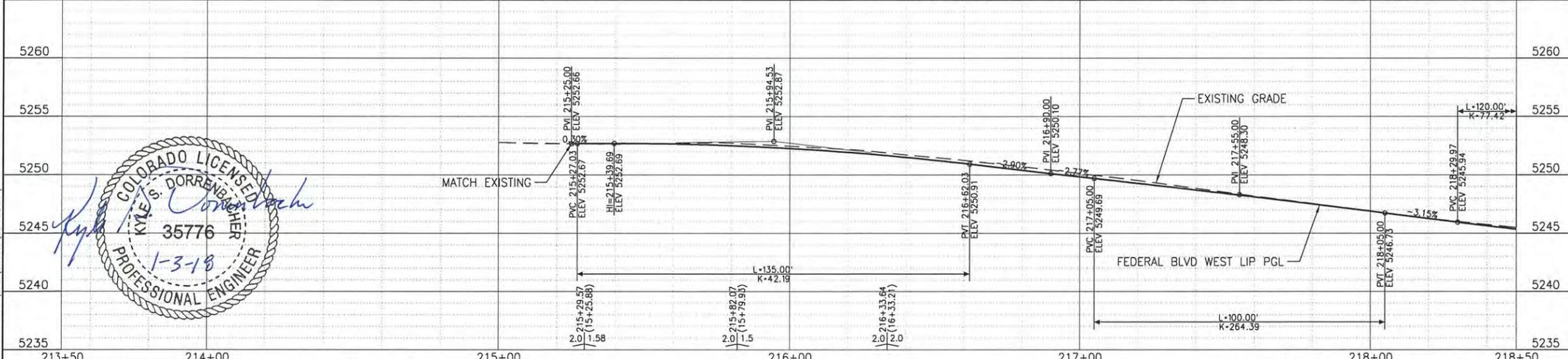
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Structure Numbers	
Subset Sheets:	15 of 15

Project No./Code
NHPP 2873-172 SA 19957
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Sheet Number
81

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- LEGEND**
- TS TRANSIT STOP
- NOTES**
- HCL'S, PGL'S, HIGH POINT LOCATIONS, AND VARIABLE CROSS SLOPES SHOWN ON PROFILES CONTROL FEDERAL CONSTRUCTION.
 - HIGH POINT VERTICAL ELEVATIONS ALONG FEDERAL ARE BASED ON THE FEDERAL WEST LIP PGL AND THE CROSS SLOPE LT DATA.
 - HIGH POINT LOCATION VARIES, SEE GEOMETRIC CONTROL SHEETS FOR HIGH POINT HORIZONTAL CONTROL DATA.
 - CROSS SLOPE VALUES SHOWN ARE BASED ON STATION LOCATION LOOKING UP STATION.
 - SEE PAVING PLANS FOR FENCE (TEMPORARY) LOCATIONS



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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
 ROADWAY PLAN & PROFILE
 FEDERAL BLVD - 13+50 TO 18+50

Designer: KSD
 Detailer: SRF
 Sheet Subset: ROADPLAN

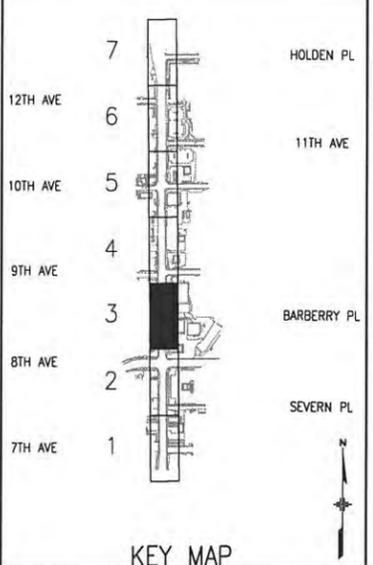
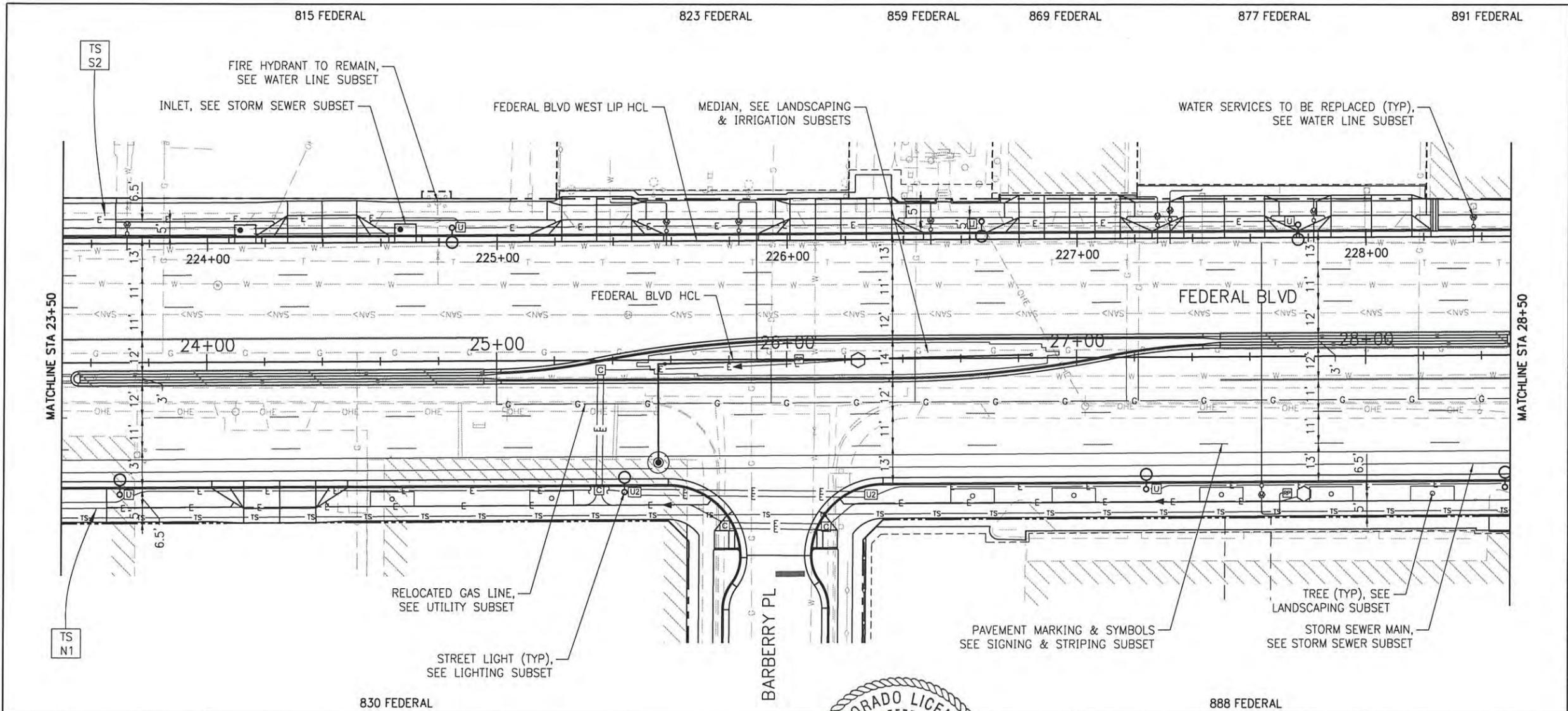
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Project No./Code
 NHPP 2873-172
 SA 19957
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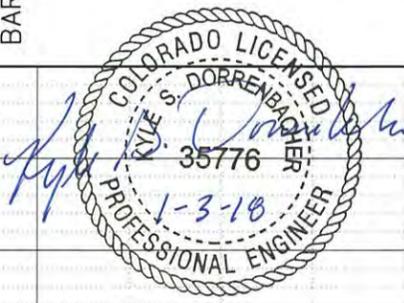
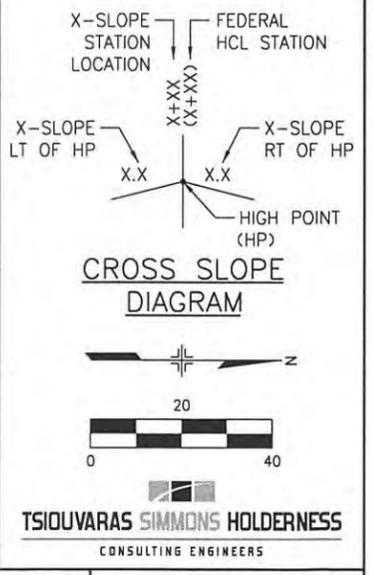
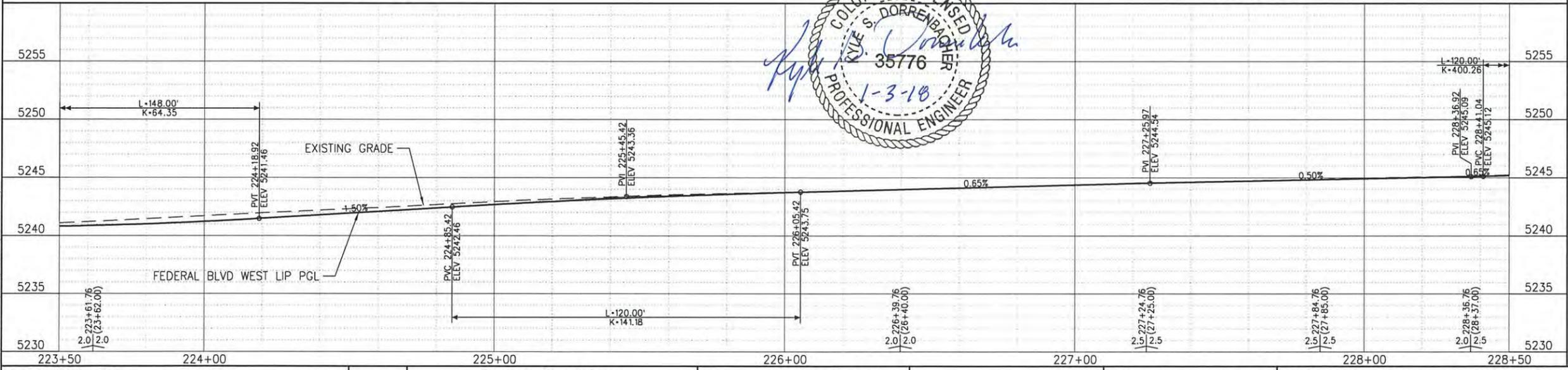
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- LEGEND**
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
 ROADWAY PLAN & PROFILE
 FEDERAL BLVD - 23+50 TO 28+50

Designer: KSD
 Detailer: SRF
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 Structure Numbers:
 Subset Sheets: 3 of 7

Project No./Code
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 SA 19957
 2011-PROJMSTR-0000364
 Sheet Number **84**

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