



SCHEDULE E



COLORADO SPRINGS AIRPORT
COLORADO SPRINGS, COLORADO

SPECIAL CONDITIONS & TECHNICAL SPECIFICATIONS

RAC LOOP ROAD REHABILITATION

SCHEDULE I (BASE BID):

Rehabilitate Rental Car Loop Road and Interior Service Roads

DEDUCT ALTERNATE 1:

Rehabilitate Long Term Parking Entrance Lane

DEDUCT ALTERNATE 2:

Rehabilitate Portion of East-West Interior Service Road & West Cul-De-Sac

ADD ALTERNATE 1:

Rehabilitate Toll Plaza Pavement

Solicitation Number: B16-094 IP
RS&H Project No.: 224-0124-004



BID DOCUMENTS

Client:
CITY OF COLORADO SPRINGS
7770 Milton E. Proby Pkwy, Suite 50
Colorado Springs, CO 80916

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July 8, 2016

VOLUME 2 OF 2

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**COLORADO SPRINGS AIRPORT
COLORADO SPRINGS, COLORADO
RAC LOOP ROAD REHABILITATION**

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SPECIAL CONDITIONS

SECTION 1

PRE-CONSTRUCTION ENVIRONMENTAL PLANNING GUIDE

1-01. The Contractor is required to prepare, obtain and pay for all documentation, fees, services, permits and approvals from any and all local, state and federal regulatory agencies as it pertains to required environmental protection for this project.

A Pre-Construction Environmental Planning Guide has been provided in this section to assist the Contractor with pre-planning operations to determine and meet environmental requirements associated with this project. This guide is intended only as an aid and does not in any way waive the Contractor's obligation to meet environmental regulatory requirements or obtain required permits. It remains the Contractor's responsibility to ensure all local, state and federal environmental regulations are being met.

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This document is produced for the benefit and reliance on by the City of Colorado Springs Airport. Use by any other party is at their own risk.

Project Name:	
Proposed Construction Start Date:	Sq. Ft./Acreage Disturbed:
Project Manager:	phone/e-mail:

This Pre-Construction Environmental Planning guide is designed to assist project managers and contractors with pre-planning to determine and meet environmental requirements for construction activities. *This is only a general guide and is not all inclusive of all permit and regulatory requirements. This guide does not include guidelines and requirements for FAA funded projects that must go through the National Environmental Policy Act (NEPA) process. Any projects requiring NEPA documentation must be coordinated through the Airport. It is the contractor's responsibility to comply with all local, state and federal environmental regulations.*

Please note that it may take 30 to 90 days or longer for permits to be processed or issued. A copy of all environmental permits and/or environmental documentation (i.e., Stormwater Management Plan) for your project should be sent to the Airport Environmental Health & Project Specialist at Kandrews@springsgov.com or contact 719-550-1915 for any questions.

State and Local Contacts for Permits and Questions:

Colorado Department of Public Health & Environment (CDPHE): www.cdphe.state.co.us

Colorado Springs Fire Department (Office of the Fire Marshall): www.springsgov.com

Colorado Department of Labor and Employment, Oil & Public Safety (CDLE-OPS):
<http://oil.cdle.state.co.us/>

El Paso County Public Health Department, Environmental Health Division:
www.elpasocountyhealth.org

AIR EMISSIONS REQUIREMENTS

1. Will the project disturb at least one acre, but less than 25 acres and last less than six months? Yes No

If Yes, an El Paso County Public Health Air Quality Construction Activity Permit is required.

2. Will the project disturb more than 25 acres and/or be more than six months in duration? Yes No

If Yes, a Land Development Air Pollution Emission Notice (APEN) is required from the CDPHE. **The Airport also has a Land Development permit for all Airport construction and all construction projects must meet the requirements outlined in the permit. Please contact kandrews@springsgov.com for a copy of the permit.**

3. Will the project involve demolition? Yes No

If Yes, a Demolition Permit may be required from the CDPHE (*not necessary for taxiway and runway demolition*). A wrecking permit from the Regional Building may be required and a Utility Disconnect Permit from Utilities, depending on the situation. An inspection will need to be performed for asbestos by a certified inspector prior to submitting the demolition permit application. If asbestos is identified, materials that are friable or would be rendered friable during demolition must be removed by a State licensed/certified asbestos abatement contractor. All asbestos containing waste must be disposed at an approved facility.

4. Will the project require operation or installation of a new or modified air emission source such as a batch plant? Yes No

If Yes, an APEN may be required from CDPHE.

5. Will the project include sandblasting operations? Yes No

If Yes, and if more than 2 tons will be generated per year, the State must be notified. Identify what will be done with the sandblasting debris. _____

WATER DISCHARGE REQUIREMENTS

1. Will the project disturb at least 1 acre or more of land? Yes No

If Yes, a Construction Stormwater permit will need to be obtained from the CDPHE. A Stormwater Management Plan (SWMP) will also need to be prepared prior to the start of the project. Construction activities must comply with the SWMP and permit throughout the project. The SWMP will need to be continually updated to reflect any changes in planning documents or construction activities.

2. Will the project require removing water from a trench or excavation and discharging it? Yes No

If Yes, what is the plan for discharging or disposing of the water?

Construction dewatering discharges may need to be permitted by CDPHE. Per CDPHE, Construction dewatering water may be discharged to the ground under a construction stormwater permit if all of the following conditions are met:

- 1) The discharge and the BMPs are included in the SWMP;
- 2) Adequate BMPs are included to control stormwater pollution;
- 3) The discharge does not leave the site as surface runoff or to surface waters/storm sewer systems; and
- 4) The groundwater being pumped is not contaminated so as to exceed State groundwater standards.

If the project involves **water discharges**, what are the plans to obtain permits or meet the environmental requirements for water quality? _____

3. **Will the project require discharging water that may have contaminants such as detergents/soap or chemicals?** Yes No

If Yes, arrangements must be made to have water disposed to a sanitary sewer or collected and properly disposed off-site.

Will the project have a concrete washout that will be discharged to the ground?

Yes No

If Yes, concrete washout water from washing of tools and concrete mixer chutes may be discharged to the ground if all of the following conditions are met:

- 1) The source is identified in the SWMP;
- 2) Adequate BMPs are included in the SWMP to prevent pollution of groundwater; and
- 3) These discharges do not leave the site as surface runoff or to surface waters/storm sewer systems.

4. **Will the project disturb more than 1 acre of land, move more than 500 cubic yards of soil, grade on property with over an 8% slope, OR grade on a Hillside Overlay Area?** Yes No

If Yes, a grading and erosion control plan may need to be submitted and approved by the City of Colorado Springs Engineering Development Review.

5. **Will the project involve saw cutting?** Yes No

If Yes, saw cutting residual water and material cannot be discharged to the storm sewer. Best Management Practices (BMPs) must be in place to contain and remove the residual water and material to be properly disposed off-site. Please list BMPs that will be used and how the wastewater will be contained and removed:

6. **Does the project involve land platting?** Yes No

If Yes, a Drainage Report and Plan will need to be submitted to the City of Colorado Springs Engineering Development Review (contact 719-385-5918).

7. **Will project impact a waterway or disturb any wetlands?** Yes No

If Yes, U.S. Army Corps of Engineers (USACE) coordination and jurisdictional determination is required. An individual permit can take 90 to 120 days and a regional/nationwide can take 10 to 15 working days to acquire. Note: the USACE requires an approved 100-year Floodplain permit prior to permit approval.

8. **Is the project going to be within a floodplain?** Yes No

If Yes, all construction (e.g. any structures, fill, excavation, utilities and bank stabilization) in federally designated floodplain areas must obtain a floodplain development permit. A flood plain permit is not required for construction in a 500-year flood plain. This permit can be obtained from Colorado Springs Regional Building.

9. **Does the project involve installation or closing a well monitoring portal and/or observation hole?** Yes No

If Yes, the State Engineer's office must be notified prior to installation or closing.

10. **Does the project involve installing infrastructure for (wells, distribution piping) or utilizing non-potable water (raw water or reclaimed wastewater) for landscape irrigation or any other commercial or industrial use?** Yes No

If Yes, review the provisions of Colorado Springs Utilities' Non-potable Water Line Extension and Service Standards and/or the Colorado Reclaimed Domestic Wastewater Control Regulation (Regulation No. 84). Authorization from the CDPHE for the use of reclaimed wastewater is required after plans are approved by Colorado Springs Utilities.

WASTE GENERATION/DISPOSAL REQUIREMENTS

1. **Will the project involve removal of any construction debris such as liquid wastes, pipe, soil, rock, asphalt, or concrete?** Yes No

Type(s) of debris to be removed. _____

Where will the debris be disposed? _____

2. **Will the project involve digging a trench or excavating in an area that may have petroleum or other contamination (e.g. service stations, spills or old landfills)?**
 Yes No

If contamination exists, where will material be disposed of? _____

Note: Contaminated material cannot be used for backfill; it must be properly disposed at an approved site.

3. **Will any special wastes be generated such as asbestos, sandblasting debris, soils, solvents, flammable liquids, chemical wastes, paint wastes, fluorescent light tubes or ballasts, or wastes that may contain metals such as lead, chromium, or mercury (e.g. lead paint)?** Yes No

List type(s) of waste that will be generated. _____

Where will the special wastes be disposed? (Note: Wastes must be sampled to determine the appropriate disposal method) _____

FUEL/OIL STORAGE & EQUIPMENT MAINTENANCE

1. Will equipment be refueled at the construction site? Yes No

If equipment is going to be refueled with tankers, how and where will that be done? (*See Guidelines below for on-site fuel transfers*)

2. Will fuel be stored on-site? Yes No

If Yes, a permit for temporary storage (including fuel truck kept on site) may be required from the Colorado Springs Fire Department. The fuel storage area must have spill containment controls (i.e. berms).

3. If fuel is being stored, how much fuel or oil is going to be stored (gallons)? _____ . Depending on the quantity (660 gallons or more) and type, it may be necessary to register the tanks with the Colorado Department of Labor and Employment, Division of Oil and Public Safety. If registered, the tanks will need to be inspected monthly. In addition, if there is a total 1320 gallons or greater stored on site aboveground, a Spill Prevention Control and Countermeasure (SPCC) Plan will be required.

Will the storage tank be installed aboveground or underground? Please explain type of storage tank: _____

4. Will an LPG tank(s) be installed for temporary heat at construction site?

Yes No

If Yes, will it be at least 125-gallon water capacity? If so, a temporary LPG heating-fuel permit is required from the Fire Department.

5. Will equipment be repaired or maintained at the construction site? Yes No

If Yes, what kind of solvents will be used for parts washing? _____

How will waste solvent and/or used oil be managed or disposed? _____

What provisions are being made to ensure that oil or other chemicals will not be released to the ground? _____

If project involves **fuel/oil storage or equipment maintenance**, please explain project plans to meet the environmental requirements for bulk fuel storage & fueling and for release protection.

WILDLIFE

1. Will the project be within 300 feet of the 100-year floodplain (or within 300 feet of the edge of the riparian vegetation along a waterway if floodplain isn't mapped)?

Yes No

If Yes, a Preble's Meadow Jumping Mouse habitat assessment may be required prior to beginning work to identify if the mouse or its habitat will be impacted. A survey can only be conducted between June 1 and September 15. The US Fish & Wildlife Service has the approval authority on this and it may take 30-60 days for approval once the survey is submitted. This approval will be required before a USACE permit can be authorized.

Airport property has previously been included in the Block Clearance Zone for Colorado Springs that excludes the requirement for a habitat assessment or US Fish & Wildlife Service approval. Please confirm that the Block Clearance is still active.

2. Does the project have the potential to disrupt bird nesting areas (e.g. bare ground, grasslands, shrubs, trees, stream banks, and buildings)? Yes No

If Yes, a bird survey must be conducted and any appropriate permits must be obtained. **The Airport coordinates these surveys with the on-site USDA Wildlife Biologist.**

ASBESTOS REQUIREMENTS

1. Will the project involve remodeling or disturbing any material that may contain asbestos, such as pipe insulation, roofing material, wallboard, underground electrical conduit, asbestos-cement pipe (transits), stucco, flooring, or ceiling tiles?

Yes No

If Yes, please list materials:

Note: An inspection of these materials must be performed by a certified inspector.

2. What is the approximate quantity of asbestos that will be disturbed in square feet or linear feet? _____ If more than 160 square feet or more than 260 linear feet or the equivalent of one 55-gallon drum will be disturbed; a permit will be required from the CDPHE. Special work practices must be followed to disturb any asbestos and removal must be conducted by certified abatement workers.

3. Where will the asbestos waste be disposed? _____

Note: Specific disposal sites have been approved for City disposal of asbestos.

If the project involves **asbestos**, what are plans to obtain permits or meet the environmental requirements for asbestos? _____

COLORADO/COLORADO SPRINGS LANDFILLS FOR WASTE DISPOSAL

Landfill	Address	Phone	Type of Operation	Materials Accepted	Materials Prohibited
Fountain Landfill – US Waste	10000 Squirrel Creek Road, Fountain, CO 80817	(719) 382-9661	Commercial Subtitle D Facility	Non-hazardous commercial and industrial waste - petroleum contaminated soils, sludges*, and non-friable asbestos*	Hazardous wastes, wastes containing free liquids, and friable asbestos
Colorado Springs Landfill – Waste Management	13320 East Highway 94, Colorado Springs, CO 80929	(719) 683-2600	Commercial Subtitle D Facility	CERCLA waste, industrial/special waste - petroleum contaminated soils* and friable and non-friable asbestos*	Hazardous wastes, wastes containing free liquids
Midway Landfill	8925 El Centro Boulevard, Fountain, CO 80817	(719) 382-8383	Commercial Subtitle D Facility	Industrial and special waste - petroleum contaminated soils*, CERCLA waste, non-friable asbestos	Hazardous wastes, wastes containing free liquids, and friable asbestos
Denver Arapahoe Disposal Site (DADS)	3500 South Gun Club Road, Aurora, CO 80018	(800) 963-4776	Commercial Subtitle D Facility	Friable* and non-friable asbestos*, CERCLA Waste, construction & demolition debris	Hazardous wastes, bulk liquids for direct disposal, liquid materials, CESQG Waste

* - Requires approval prior to shipping.

Guidelines for On-Site Fuel Transfers

This procedure should be readily available to facility personnel involved in product transfer operations or on display in the transfer area. In order to minimize the potential for a spill during fuel transfers and to be prepared in the event of a spill, the following measures are to be followed. This includes minimum Department of Transportation (DOT) regulations that shall be followed during loading/unloading of fuel:

1. Keep fire away while loading/unloading. Persons in the vicinity are forbidden to smoke, light matches, or carry any flame or lighted cigar, pipe, or cigarettes 49 CFR 177.834 (c)(d).
2. Fuel shall not be loaded/unloaded from any motor vehicle while the engine is running. The exception is when the engine of the vehicle is to be used in the operation of the pump 49 CFR 177.837(a).
3. The supply truck driver shall notify a facility representative when arriving on site.
4. The supply truck driver and an Airport representative shall observe the transfer during the entire operation 49 CFR 177.834(l)(2).
5. Sufficient secondary containment surrounding the truck shall be available; or enough containment boom to surround the truck shall be available in the immediate area.
6. Once the truck is in position, its handbrake will be applied and reasonable precautions will be taken to prevent motion of the truck during unloading 49 CFR 177.834(e). (Example – utilize wheel chocks when parked on an incline).
7. Signs must be posted that remind drivers NOT to pull away before detaching hoses 40 CFR 112.7(h)(2).
8. Containers and cargo tanks shall be grounded prior to and during transfer 49 CFR 177.837(b)(c).
9. All outlets to the vehicle and tank and the transfer line shall be checked for leakage. Any problems shall be fixed prior to hooking up any lines.
10. A drip pan shall be placed under the outlet of the fuel truck transfer line.
11. The transfer line must be properly engaged at each end before opening any valves.
12. Checks for leaks must be conducted after starting the transfer. Any leaks must be corrected before continuing the transfer.
13. All valving must be properly shut off prior to disengaging the transfer line.
14. The transfer line must be properly disengaged and the valves and piping of both the tank and truck must be checked for leaks before allowing the truck to leave the site 40 CFR 112.7(h)(2).

END OF SPECIAL CONDITIONS - SECTION 1

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SPECIAL CONDITIONS

SECTION 2

Utility Adjustment Procedures

2-01. The Contractor is required to obtain and pay for all, fees, services, permits and approvals from the City of Colorado Springs and Colorado Springs Utilities as it pertains to required manhole and watervalve adjustments for this project.

The following guidance is provided for the adjustment of structures. It remains the Contractor's responsibility to ensure all regulations are being met.

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SANITARY SEWER MANHOLE ADJUSTMENTS

10749 Version 04

Approval Date 01/04/2012

1.0 PURPOSE

The purpose of this document is to describe the process used to raise or lower sanitary sewer manholes after yearly street resurfacing programs by the City of Colorado Springs Street Division and other activities that affect the surface grade around manholes.

2.0 SCOPE

This process applies to adjustments within the wastewater collection system.

3.0 TERMS AND ABBREVIATIONS

CFM	Cubic Feet per Minute
DOT	Department of Transportation
GVW	Gross Vehicle Weight
OSHA	Occupational Safety and Health Administration
QBD	Quality by Design

4.0 SAFETY REQUIREMENTS

All Colorado Springs Utilities safety and health policy and procedure requirements shall be integrated into any referenced operational procedures in this document. All safety related policies and procedures contained in this document must comply with the Safety and Health Program Manual.

5.0 RESPONSIBILITIES

This section outlines the responsibilities of the person or group that must implement or control the process being described.

5.1. The Operations Supervisor is responsible for:

- Developing a work schedule.
- Assigning work at the beginning of each week.
- Providing training to employees when work requirements change.

5.2. The Distribution/Collection Specialist is responsible for:

- Raising and lowering sanitary sewer manholes.
- Maintaining appropriate records.

SANITARY SEWER MANHOLE ADJUSTMENTS

10749 Version 04

Approval Date 01/04/2012

6.0 PROCESS

- 6.1. Overview. The purpose of this program is to adjust wastewater manholes to surface grade. This program assures access to wastewater manholes after the Street Division has resurfaced the street and covered the manholes and valves with new asphalt. All manholes adjusted shall have the rim elevation set at final asphalt. In non-traffic areas the rims should be set at least 6 inches above the existing ground. At no time shall the total of grade adjustment rings exceed 12 inches.
- 6.2. Safety Considerations
 - 6.2.1. Maintain required inventory of safety equipment: combustible, toxic gas and oxygen level meter; tripod and harness for Confined Space Entry Permitting requirements, ventilation equipment, fire extinguishers, traffic control devices, compressed fresh air escape packs, explosion proof lighting, and first aid kit.
 - 6.2.2. Maintain inventory of personal protective equipment: OSHA approved safety shoes or boots; safety gloves; OSHA approved hard hats; OSHA approved safety glasses, goggles, or face shield; DOT approved safety vests; bio-hazard suits; hearing protection; back support.
 - 6.2.3. Attire oneself using proper safety equipment and clothing.
 - 6.2.4. Analyze safety risks at job site: foot traffic, auto traffic, children, electric wires, noise levels and visual obstructions.
 - 6.2.5. Set up traffic control devices as needed, (i.e., barricades, cones, blockades, etc.)
 - 6.2.6. Always test manhole for atmospheric conditions before use.
 - 6.2.7. Always pull the manhole lid using proper lifting techniques.
 - 6.2.8. Truck shall always be driven on City of Colorado Springs and DOT approved truck routes.
- 6.3. Operation Preparation and Set-Up
 - 6.3.1. Determine if manhole should be adjusted using reference document C01-10795, Manhole Location and Raising Decision Tree.

SANITARY SEWER MANHOLE ADJUSTMENTS

10749 Version 04

Approval Date 01/04/2012

6.3.2. Schedule barricades if work is to be done on any major arterial. Pre-trip asphalt truck and associated compressor. Pre-trip and stock flat bed truck with manhole rings and covers, water, plastic adjustment rings, and plastic shims. Pre-trip asphalt truck and associated portable vibrating/compaction asphalt roller. Perform required maintenance on vehicles and equipment.

6.4. Manhole Raising

6.4.1. Locate asphalt-covered manholes with a magnetic locating wand using QBD document COD-10795. Mark hidden manhole locations with green spray paint. If manhole is in a paved area, set up truck in optimal position for jack hammering out asphalt or cement around the manhole ring for the purpose of exposing ring and cover. Jackhammer out hidden manhole ring until it is exposed. Use manhole outline to mark area of street to be jack hammered. Jackhammer and remove asphalt to expose manhole ring and cover. Place spoils into dump truck and sweep street of excess debris. Place cone on top of cover to barricade.

6.4.2. Set up flat bed truck in optimal position to raise manhole cover to existing street grade. Remove manhole cover. Place leveling bar across cutout area of street. Measure space between leveling bar and top of manhole ring in equal quadrants. Pull manhole ring out of cutout area in street and use plastic grade rings and shims to adjust ring and cover to street grade. Place manhole ring onto grade rings. Place leveling bar across cut out in street to make sure the manhole ring is adjusted to the grade of the street. If manhole ring is not level with grade, adjust grade rings and shims until level. Stand on manhole ring to make sure it is properly seated and has no movement. Place manhole lid back onto manhole ring. Sweep small debris back into area between manhole ring and lid and the edge of the street to be covered by the new asphalt, if applicable. Replace cone on manhole cover to barricade.

6.4.3. If the manhole is located in a paved area, drive asphalt truck with hot asphalt and portable vibrating compaction roller into place and remove roller. Remove cone from top of manhole cover. Remove the portable vibrating compaction roller from the tailgate of the asphalt truck. Wet top of ring and cover with asphalt release agent so that hot asphalt will not adhere to them. Dump asphalt into hole approximately six inches higher than street grade. Move asphalt truck forward 15'. Shovel the hot asphalt in a way that it stays in the area between the ring and cover and the edge of the street. Start

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engine, vibrator, and drum wetting device on the portable vibrating compaction roller. Roll and compact the hot asphalt using the portable vibrating compaction roller. Replace shovels, portable vibrating compaction roller.

6.5. Manhole Lowering

6.5.1. Jackhammer and remove asphalt to expose manhole ring and cover. Area to be removed will be apparent due to the manhole being raised in the past. Place spoils onto dump truck and sweep street of excess debris. Place cone on manhole lid to barricade.

6.5.2. Set up flat bed truck in optimal position to lower manhole ring and cover 4" below the surface of the street. Remove the barricade cone. Remove and load the manhole ring and cover onto the truck using proper lifting techniques. Place a 32" metal plate over the exposed hole. Sweep any debris back into the cut out area of the street. Replace barricade cone.

6.5.3. If manhole is located in a paved area, drive asphalt truck with hot asphalt and portable vibrating compaction roller into place and remove roller. Remove barricade cone. Remove the portable vibrating compaction roller from the tailgate of the asphalt truck. Wet top of ring and cover with asphalt release agent so that hot asphalt will not adhere to them. Dump asphalt into hole approximately six inches higher than street grade. Move dump truck forward 15'. Shovel the hot asphalt in a way that it stays in the area between the ring and cover and the edge of the street. Start engine, vibrator, and drum wetting device on the portable vibrating compaction roller. Roll and compact the hot asphalt using the portable vibrating compaction roller. Replace shovels, portable vibrating compaction roller.

6.6. Clean-Up

6.6.1. Identify and mark the manhole distance and location on curb using stencil and spray paint. Pick up traffic control devices as needed, (i.e., barricades, cones, blockades, etc.).

6.7. Documentation

6.7.1. Record the manhole LID completion on the computerized area basin map and document the completed manhole.

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Approval Date 01/04/2012

6.7.2. At the end of each day, fill out a Daily Production Report to be turned in to the section team leaders. If completing all work on the work order, then fill out the PF7 section or (COMPLETION REMARKS) portion of the work order, and return to the Customer Operations Supervisor to be placed into the work management system.

6.7.3. Once per week each field crew should fill out a Safety Equipment & Field Crew Checklist to be turned in to the section team leaders.

7.0 PROCESS METRIC/SERVICE LEVELS

Metric	Not Applicable
Definition of Metric	
Source of Metric	
Calculation of Metric	

8.0 EQUIPMENT AND TOOLS

The equipment necessary to complete the task of wastewater manhole adjustments consists of three trucks and associated equipment:

- One 35,000gw single axel hammer with 185cfm compressor and 60 pound jack hammers. Each truck contains two flat shovels, one line shovel, one street broom, magnetic locating wand, and green spray paint.
- Two 35,000 gw flat bed trucks Each truck contains one flat shovel, one round point shovel, street room, leveling bar, tape measure, (4) 24" manhole rings & covers, sledge hammer, manhole lid pulling debris grabbers, (10 ea.) 1", 2", 2.5", plastic adjustment rings, (3 ea.) 2", 4", 6" concrete grade rings, magnetic locating wand, curb paint stencil, green spray paint.
- One single axle asphalt truck and its associated portable vibrating/compaction asphalt roller, two flat shovels, and hot asphalt mix.

9.0 RECORDS MANAGEMENT

<u>Record Number</u>	<u>Record Title</u>	<u>Record Owner</u>	<u>Record Location</u>	<u>Type of Record</u>	<u>Retention Time</u>
Map	Area Basin	Operations	[TBD]	Electronic	Indefinite

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10749 Version 04

Approval Date 01/04/2012

<u>Record Number</u>	<u>Record Title</u>	<u>Record Owner</u>	<u>Record Location</u>	<u>Type of Record</u>	<u>Retention Time</u>
	Map	Supervisor			
Report	Daily Production Report	Operations Supervisor	[TBD]	Paper	[TBD]
Checklist	Safety Equipment & Field Crew Checklist	Operations Supervisor	[TBD]	Paper	[TBD]
Form	Manhole ID and Condition Form	Infrastructure Records Management	[TBD]	Paper	[TBD]

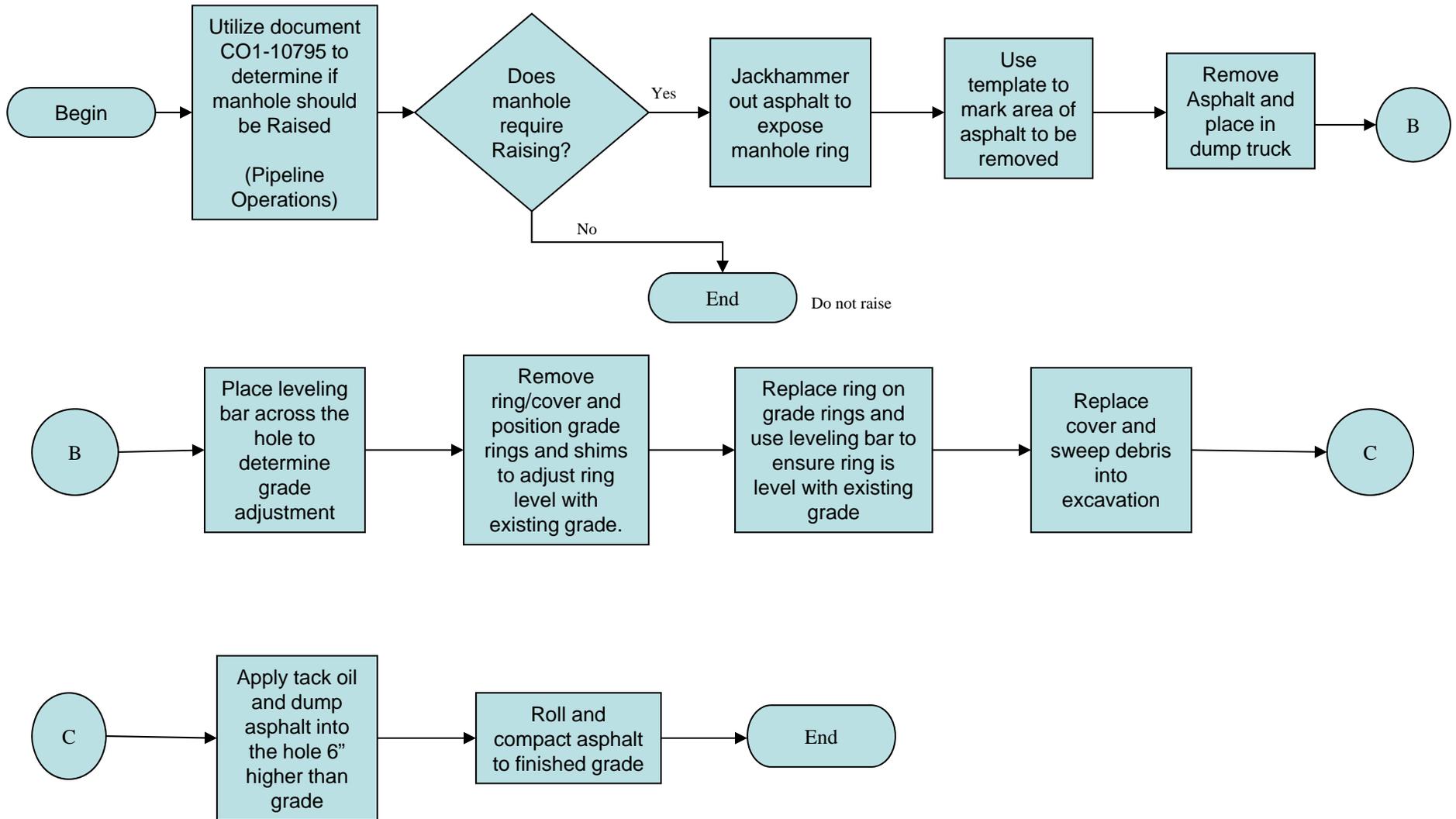
10.0 REFERENCE DOCUMENTS

Source/Standard	Document #	Title/Description	QBD Status
Colorado Springs Utilities	Not Applicable	Wastewater Line Extension and Service Standards	N/A
QBD	C01-10795	Manhole Location and Raising Decision Tree	A

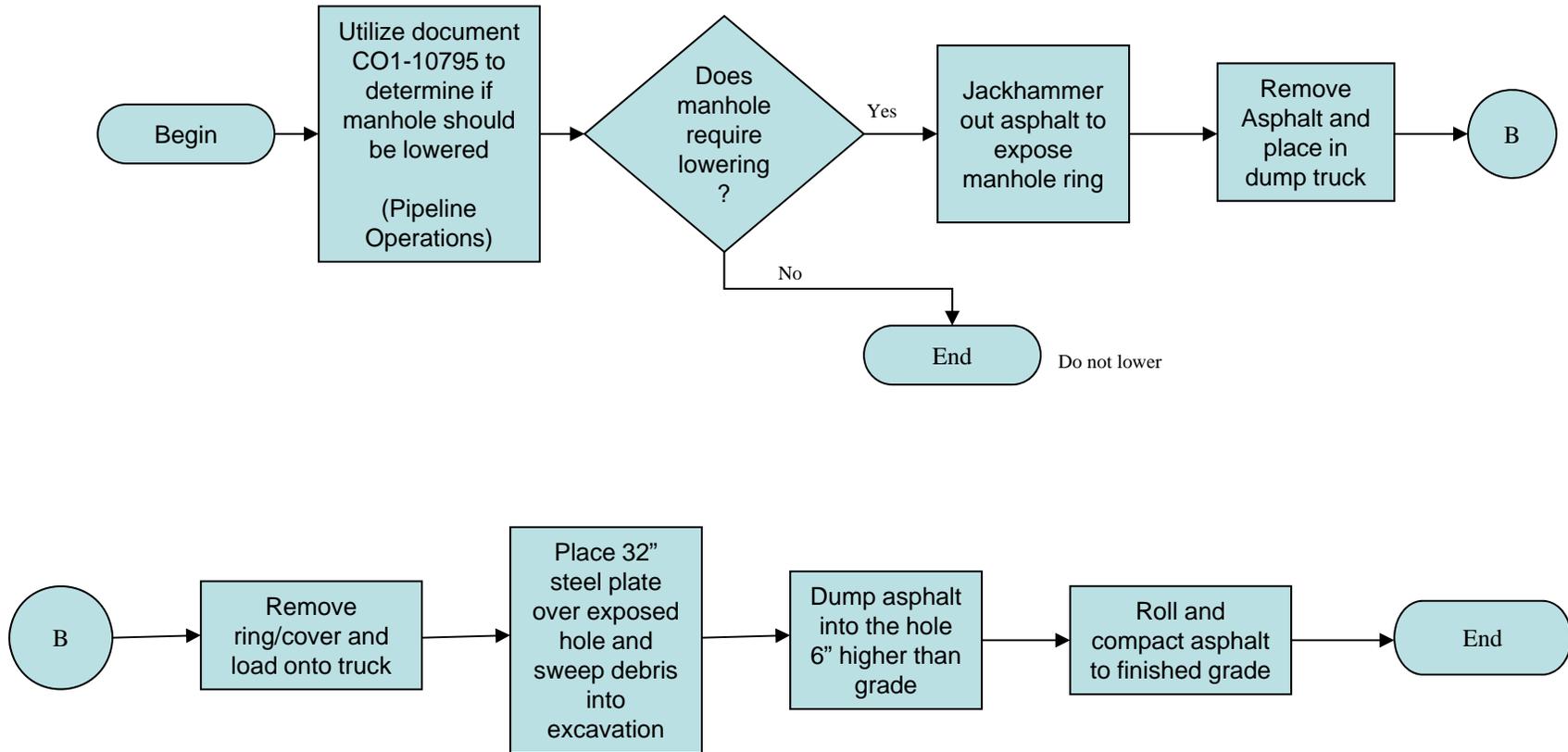
11.0 ATTACHMENTS

Attachment Number	Title
CO1-10749	Manhole Raising
CO2-10749	Manhole Lowering

Sanitary Sewer Manhole Raising



Sanitary Sewer Manhole Lowering



WATER, GAS AND NON-POT VALVE ADJUSTMENTS

12119 Version 02

Approval Date 01/04/2012

1.0 PURPOSE

The purpose of this Standard Operating Procedures (SOP) is set fourth the procedures to be used in Valve Box Raising and Lowering, after yearly street resurfacing programs by the City of Colorado Springs Street Division and RTA activities that affect the surface grades around water, gas and non-pot valves.

2.0 SCOPE

This process applies to adjustments within the water, gas and non-pot distribution systems.

3.0 TERMS AND ABBREVIATIONS

This section contains an alphabetized list of acronyms or infrequently used terms that may confuse the user or distort the meaning of the document.

PPE Personal Protective Equipment

SOP Standard Operating Procedures

4.0 SAFETY REQUIREMENTS

All Colorado Springs Utilities safety and health policy and procedure requirements shall be integrated into any referenced operational procedures in this document. All safety related policies and procedures contained in this document must comply with the Safety and Health Program Manual.

5.0 RESPONSIBILITIES

This section outlines the responsibilities of the person(s) or group(s) that must implement or control the process being described:

5.1. The Customer Operations Supervisor is responsible for:

- Developing a work schedule.
- Assigning work at the beginning of each week.
- Provide training, coaching and mentoring when work requirements change.

5.2. The Distribution/Collection Specialist is responsible for:

- Raising and lowering of water, gas, and non-pot valves.
- Maintaining appropriate records.

6.0 PROCESS

6.1. Overview. The purpose of this program is to vac and adjusts water, gas and non-pot valves to surface grade. This program insures access to these valves after Street Division and RTA has resurfaced the street and covered the valves with new asphalt.

WATER, GAS AND NON-POT VALVE ADJUSTMENTS

12119 Version 02

Approval Date 01/04/2012

6.2. Safety Considerations

- 6.2.1. Maintain required inventory of safety equipment: Vehicle strobe lights, safety cones, safety lanyards for air compressor hose, safety pins for crows feet connectors, advanced warning signs, fist aid kit and fire extinguisher.
- 6.2.2. Maintain inventory of personal protective equipment : OSHA approved safety shoes or boots; safety gloves; OSHA approved hard hats; OSHA approved safety glasses, goggles or face shield; DOT approved safety vest; hearing protection and proper lifting techniques.
- 6.2.3. Attire one self using proper safety equipment and clothing. Use of PPE identified for this activity, Hardhat, vest, protective footwear, eye protection, hearing protection, Gloves
- 6.2.4. Analyze safety risks at job site: foot traffic, auto traffic, over head power lines, under ground lines (gas, fiber optics, electric etc.), noise levels, weather and children.
- 6.2.5. Set up traffic control devices as needed: (i.e., barricades, cones, advanced warning signs, blockades, etc.)
- 6.2.6. Trucks shall always be driven on City of Colorado Springs and DOT truck routes. If job site is on a no truck route, the nearest truck route shall be used to get to the job site.
- 6.2.7. Always check equipment each day before use (air compressors, jack hammer, hoses and hose reels and always check that all safety devices are in place. Follow DOT Pre-trip and Post trip inspection procedures.

6.3. Operational Preparation and Set-up

- 6.3.1. Determine if valves should be adjusted.
- 6.3.2. Schedule barricades if work is to be done on any major arterial. Pre-trip valve dump truck and associated compressors. Pre-trip and stock valve truck with water, gas and non-pot lids, riser rings, 2 1/4" and 3" risers. Pre-trip vac trailer and stock necessary tools (flat head screw drivers, gasoline powered demo saw, three pound hammer, three gallon gasoline tank filled with gas, blue, purple and yellow marking paint). Checks associated engines for fluid loss and refill them with necessary fluids. Check water tank for wear and tear, check water levels, and fill if necessary. Pre-trip the asphalt truck and associated vibrating rollers. Check for tarp operation, Check to see if lights are visual and in good operating condition. Pre-trip vibrating roller, check fluids and fill with necessary fluids, check safety shut-off switch for vibrating roller. Grease roller drum once a week, check that forward and reverse is operating in a safe manner. Checks and fills water tank on roller.

6.4. Valve Raising

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- 6.4.1 Locate asphalt covered valves with a magnetic wand and Fims map book
With all advanced warning signs out, mark hidden valve location with blue, yellow or purple paint depending on the type of valve you are raising. Use a spotter to set up truck in optimal position and barricade the truck and job site with cones for jack hammering out asphalt or concrete around the valve for the purpose of uncovering the valve box top. Use valve box circle to outline the area around the valve box that needs to be cut out. Jack hammer out asphalt about five inches from the outer edge of the valve box in a complete circle (30" circle) and dispose of the debris. Take off valve box lid and look inside to determine if valve box is straight and what size riser you will need to raise the valve box. Retrieve the necessary equipment to raise the valve box flush with the surface of the road. After valve (s) have been raised, put cone (s) on the valve box (s) and move safely to the next job site.
- 6.4.2. Set up vac truck in optimal safe position to clean outthe valve box (s). Remove cone (s) and valve box lid (s) and barricade the truck and the job site. Turn on the vac and put the vac tube into the valve box to remove any loose debris, if needed, use the pressure washer to remove hard packed debris. If needed, the pressure washer can be used to dig out dirt around the outside of the valve box; this method would be used to replace a valve box top, valve box bottom or to straighten a valve box. Once the valve box (s) are clean of debris, take a flash light and look down into the valve box and make sure the valve is exposed and accessible for a valve key to fit on the valve. Once valve is cleaned out, install a debris cap and put tools back on truck, put necessary lid back on valve and put cone back on the valve, then proceed safely to next job site.
- 6.4.3. Drive asphalt truck with hot asphalt and portable vibrating compaction roller into place and remove the roller. Remove the cone from the valve and proceed to barricade the asphalt truck and the job site with cones. Guide driver into optimal position to put hot asphalt into the cut out hole of the valve (s). Then proceed to open the tailgate using the hydraulic lever and dump the hot asphalt into the cut out area around the valve box (s). Pour enough asphalt as needed giving room for compaction from the vibrating roller (mound asphalt up 6" all the way around the valve box). Move the asphalt truck up 15', begin using the vibrating compaction roller and start rolling and vibrating the asphalt, while using water. Add or take some asphalt out as needed. Compact asphalt until asphalt is flush with existing surface. Once asphalt is compacted to existing surface, sweep the street and dispose of the extra soils back into the dump truck. Put compaction roller back on tail gate replace all shovels and then mark the curb with a stencil and paint (use the color of paint that pertains to the valve you are raising) then paint the valve lid. Put all safety cones back on the truck and drive safely to next job site.

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6.5. Valve lowering

- 6.5.1. Set out all advanced warning signs, locate valve (s) and put the truck in a safe optimal position of the valve(s) using a spotter. Place cones out to barricade the truck and the job site. After job site is secure proceed to jack hammer out the asphalt around the exposed valve (s) (dispose of the asphalt into the asphalt bin on the truck). Once the asphalt is all cut out around the valve (s), then proceed to break the dirt up around the valve (s), once the dirt is broken up, pull the lid off the valve to see if the valve box is able to adjust (you would be looking to see if there is enough clearance from the inside nipples of the box top to the insert riser), if there is enough clearance, put the valve box lid back into the valve box top and jack hammer on top of the valve lid to push the valve box down to 4" (valves should be lowered 4" or more, unless specified prior to work in that basin). If the valve box cannot be lowered to the 4" required, then you will need to lower them as much as you can and paint the exact depth of that individual valve (all valves need to be painted the exact depth weather it is 4" or greater or 4" or lesser using the color of paint that pertains to valve you are lowering). Sweep and dispose of debris, then mark the curb with the valve location using a stencil. Barricade the valves that were cut out and drive safely to the next job site.
- 6.5.2. Drive up to the cut out valves and get in a safe optimal position using a spotter. Barricade truck and job site with cones, then measure the depth of the cut out valve (s) and paint the measurement on the asphalt using the color paint that pertains to the valve that is lowered. Raise dump truck bed up, using a spotter and watching for any overhead obstructions. Unload vibrating compaction roller and back the driver up to the cut out valve (s). Lift the tail gate with the manual lever and begin to fill the lowered valves with asphalt (making sure the valve box lid is in the valve box properly), fill hole with asphalt to 6" high above the existing grade. Move the asphalt truck up 15', start the vibrating compaction roller and begin to compact the asphalt using the vibrator and water. Add or take away asphalt as needed, completing this task with a mound to accommodate settlement. Sweep the street and dispose of any access soils into the dump truck, put compaction roller on the tail gate of the asphalt truck replace all shovels pick all cones up and drive safely to the next job site.

6.6 Clean-up

- 6.6.1. Every truck is responsible for their clean-up, but the asphalt truck is usually the last truck to see the valve, they should pick up any cones that are not in use, look to see if curbs and measurements are marked in right locations and all of the debris are shoveled up and disposed of properly.

6.7. Documentation

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- 6.7.1. Record the valve LID completion on the computerized area basin map and document the completed production after completing work on a valve.
- 6.7.2. At the end of each day, fill out a Daily Production Report to be turned in to the supervisor to be placed into an Excel Spreadsheet for up to twelve months. If completing all work on the work order, then fill out PF7 section or (COMPLETION REMARKS) portion of the work order, and return the info to the Operation Supervisor to be placed into the work management system.
- 6.7.3. Daily each field crew should fill out a Safety Equipment & Field Crew Check list to be turned in to the Operation Supervisor to be placed into an Excel Spreadsheet for up to twelve months.

7.0 PROCESS METRIC/SERVICE LEVELS

Metric	
Definition of Metric	
Source of Metric	
Calculation of Metric	

8.0 EQUIPMENT AND TOOLS

The equipment necessary to complete the task of water, gas and non-pot valve Adjustment consists of three trucks and associated equipment.

- “The Hammer Truck “- 35,000 GVW single axle dump trucks. Which contains the necessary equipment in one full working day. Such as a 60 or 90 pound jack hammer, an attached air compressor (185 cfm), post hole diggers, 2 spud bars, 2 flat shovels, 1 street broom, 2 round point shovels, 1 blow tube, 1 lolli-pop, 1 ratchet chain cutter, 1 demo saw, 1 three gallon can of gasoline, 4 valve box bottoms, 8 insert risers, 8 valve box tops, fifty 3” risers, fifty 2 ¼” risers, 80 valve box lids, 20 gas lids, 3 closed lids 3 non-pot lids, 2 lid pullers, 1 cold cut three pound hammer, 1 sledge hammer, 1 dye cutter and one tool box with crescent wrenches, small hammer, screw drivers, wrench set, socket set, and replacement gaskets for the air compressor.
- “The Vac Truck” equipped with a tool box stalked with screw drivers, 2 lid pullers, wrenches, socket set, 2 cycle engine oil, 2 pipe wrenches, 2 four inch flash lights.

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- “The Heated Patch Truck”, one 35,000 GVW single axle truck with an attached heated bed and a mini portable compaction roller, 2 flat shovels house broom, spoils bin, 1 propane tank and 1 tact oil tank.

9.0 RECORDS MANAGEMENT

<u>Record Number</u>	<u>Record Title</u>	<u>Record Owner</u>	<u>Record Location</u>	<u>Type of Record</u>	<u>Retention Time</u>
N/A	Daily Production Report (Daily)	Operations Supervisor	Paper entered in Group drive Excel	Paper then electronic	12 months
N/A	Safety Equipment & Field Crew Check list (weekly)	Operations Supervisor	Paper entered in Group drive Excel	Paper then electronic	12 months

10.0 REFERENCE DOCUMENTS

<u>Source/Standard</u>	<u>Document #</u>	<u>Title/Description</u>	<u>QBD Status</u>

11.0 ATTACHMENTS

<u>Attachment Number</u>	<u>Title</u>
I01-00032	Valve raising
I02-00032	Valve Lowering

END OF SPECIAL CONDITIONS - SECTION 2

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SECTION 202 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

DESCRIPTION

202.01 This work consists of the removal and disposal of trees, slope and ditch protection, abandoned utility services, curb, gutter, pipes, sidewalk, structures, bridges or parts of bridges, railroad appurtenances, traffic control devices, impact attenuators, guardrail, fences, foundations, detours, pavements, pavement markings, and all other obstructions that are not designated or permitted to remain. It shall also include salvaging, stockpiling and loading salvable materials, sandblasting, plugging structures, cleaning culverts, and sawing and cutting to facilitate controlled breaking and removal of concrete and asphalt to a neat line. Except in areas to be excavated, the resulting trenches, holes, and pits shall be backfilled.

Materials removed and not designated in the Contract to be salvaged or incorporated into the work shall become the property of the Contractor.

CONSTRUCTION REQUIREMENTS

202.02 General. The Contractor shall raze, remove, and dispose of all structures and obstructions which are identified on the project, except utilities, structures and obstructions removed under other contractual agreements, and salvable material designated to remain the property of the Department.

Where portions of structures are to be removed, the portions designated to remain shall be prepared to fit the new construction, and shall be protected from damage. All damage to structures designated to remain in place shall be repaired at the Contractor's expense. Method of repair shall be approved by the Engineer.

Sawing of concrete shall be done to a true line, with a vertical face, unless otherwise specified. The minimum depth of a saw cut in concrete shall be 2 inches or to the depth of the reinforcing steel, whichever occurs first.

202.07 Pavements, Sidewalks, Curbs. All concrete pavement, sidewalks, structures, curbs, gutters, etc., designated for removal, shall be disposed of in accordance with subsection 201.02.

202.09 Removal of Asphalt Mat (Planing). The Contractor shall not commence planing operations until the hot mix asphalt (HMA) Mix Design has been approved.

Prior to beginning planing operations, the Contractor shall submit a planing plan for approval by the Engineer. This plan shall include as a minimum:

- (1) The number and types of planers to be used.
- (2) The width and location of each planing pass.
- (3) The number and types of brooms to be used, and their locations with respect to the planers. The Contractor shall have at least one back-up broom on the project at all times in case one of the operating brooms breaks down.

Each planer shall conform to the following:

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

Operation with broken or missing teeth will not be allowed. Worn teeth shall be replaced if the planer does

not produce a uniform surface.

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

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

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

At the completion of each days work, vertical edges caused by planing that are greater than 1 inch in height shall be: Longitudinal - tapered to not less than a 3:1 slope, Transverse - tapered to not less than a 50:1 slope.

The roadway shall be left in a safe and usable condition at the end of each work day. All required pavement markings, removed by the planing, shall be restored before the roadway is opened to traffic. All pavement markings shall adhere to the requirements of Section 620.

All planing shall be completed parallel to the travel lanes unless otherwise directed by the Engineer.

All Removed asphalt material shall be placed in the existing airport millings stockpile as shown in the project plans.

METHOD OF MEASUREMENT

202.11 When the Contract provides payment for removal of obstructions on a lump sum basis, this payment will include all stipulated structures and obstructions encountered within the right of way in accordance with this section. When the Contract provides payment for the removal of specific items on a unit basis, measurement will be by the unit.

Removal of temporary pavement markings will not be measured and paid for separately but shall be included in the work.

Removal of asphalt mat (planing) will be measured by the area in square yards, completed to the required depth, and accepted.

Removal of concrete curb and gutter will not be measured and paid for separately but shall be included in the work under item 609.07-1.

BASIS OF PAYMENT

202.12 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 shall be full compensation for sawing, removing, disposal, excavation and subsequent backfill, and salvage of materials removed, their custody, preservation, storage, and disposal as provided herein.

Payment will be made under:

Pay Item	Pay Unit
202.12-1 Removal of Asphalt Mat (Planing) – 2" Nominal Depth	Square Yard
202.12-2 Removal of Asphalt Mat (Planing) – 3" Nominal Depth	Square Yard

SECTION 210 RESET STRUCTURES

DESCRIPTION

210.01 This work consists of removing, relaying, resetting, or adjusting structures and related materials. All designated items shall be carefully removed, and stored, reinstalled, or adjusted, in a manner that will avoid loss or damage.

CONSTRUCTION REQUIREMENTS

210.02 General. Materials in good condition from removed structures may be re-used. Salvable material, as designated in the Contract, that is not re-used shall remain the property of the Owner, and the Contractor shall be held responsible for safekeeping of all materials until receipted by the Owner. Materials damaged, stolen, or lost prior to receipt by the Owner shall be repaired or replaced, as determined by the Engineer, at no cost to the Owner.

Unserviceable material, as determined by the Engineer, shall be replaced with new material of similar dimensions, and the material costs will be paid for in accordance with subsection 109.04(b), except as otherwise provided in this section. All new materials and replacement parts shall conform to the requirements of the Contract for the appropriate items.

210.10 Adjust Structure. Adjusting structures shall apply, but not be limited to, manhole rings and covers, inlet gratings and frames, water valve boxes, water meters, gate posts, and other structures and facilities. Construction operations shall consist of raising, lowering, moving, or removing masonry or concrete; adding brick-work, masonry, or concrete; and resetting grates, frames, or rings and covers to fit the new construction. Structures in the traveled roadway shall be adjusted to a tolerance of ¼ to ½ inch below the surface of the roadway. Work on water services shall be subject to inspection and testing by the owners. Damage to any fire hydrant or any part of the water system by the Contractor shall be repaired at the Contractor's expense.

METHOD OF MEASUREMENT

210.12 The quantity to be measured where items are reset or adjusted on an "each" basis shall be the actual number of those items restored for service at new location, completed and accepted.

BASIS OF PAYMENT

210.13 The accepted quantities, measured as provided above, will be paid for at the contract price for each of the pay items listed below that appear in the bid schedule.

Payment will be made under:

Pay Item	Pay Unit
210.13-1 Adjust Manhole Cover to Grade	Each
210.13-2 Adjust Water Valve Box to Grade	Each

Except as otherwise provided in the Contract, collars and connecting devices will not be measured and paid for separately but shall be included in the work.

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SECTION 306 RECONDITIONING

DESCRIPTION

306.01 This work consists of blading, shaping, wetting, and compacting the existing subgrade with moisture and density control.

CONSTRUCTION REQUIREMENTS

306.02 The top 6 inches of the existing subgrade shall be reconditioned by blading and rolling. Sufficient water shall be added to meet the density requirements as specified in the Contract. The reconditioned surface shall not vary above or below the lines and grades as staked by more than 0.08 foot. The surface shall be tested for smoothness and density prior to the application of any base course material. Where asphalt surfacing materials are to be placed directly on the subgrade, the subgrade plane shall not vary more than 0.04 foot. All irregularities exceeding the specified tolerance shall be corrected to the satisfaction of the Engineer at no additional cost to the Owner. The surface shall be satisfactorily maintained until base course or asphalt surfacing materials have been placed.

METHOD OF MEASUREMENT

306.03 Reconditioning will be measured by the square yard of subgrade, including auxiliary lanes, and shall include blading, shaping, scarifying, compacting the subgrade, finishing, and maintenance of the finished surface.

BASIS OF PAYMENT

306.04 The accepted quantities of reconditioning will be paid for at the contract unit price for reconditioning.

Payment will be made under:

Pay Item	Pay Unit
306.04-1 Reconditioning of Subgrade	Square Yard

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

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Pikes Peak Region Asphalt Paving Specifications

1.001 General Description. These specifications cover the requirements for the construction of Superpave Hot Mix Asphalt pavements. They include the general requirements for the construction of one or more lifts of Hot Mix Asphalt pavement on a prepared surface. The work shall consist of the preparation of the Hot Mix Asphalt (HMA) meeting the requirements herein, and the placement of the HMA to the lines, grades, thickness and typical cross sections shown on the plans or established by the Owing Agency Engineer. When more than one lift is required, each lift shall be compacted to the required density prior the placement of the next lift.

In these specifications the following terminology listed in Table 1.001.1 defines the traffic and volume levels for the different designations.

TABLE 1.001.1 - TRAFFIC AND VOLUME DESIGNATION

Designation	Volume and Loading Level
Low	≤ 300,000 ESALs *

* Equivalent Single-Axle Loads

1.002 Materials. The HMA shall be composed of a mixture of aggregate, approved filler or additives, asphalt binder and reclaimed asphalt pavement (RAP), when permitted. The materials used in the manufacture of HMA shall meet the following requirements.

- A. Aggregates.** Aggregates shall be of uniform quality, clean, hard, durable particles of crushed stone, crushed gravel, natural gravel or crushed slag free from clay balls, vegetable matter or other deleterious materials meeting the requirements in Table 1.002.1.

The coarse and fine aggregates for the HMA mixture shall be graded and combined in such proportions that the resulting composite blend meets the grading requirements of the Job Mix Formula (JMF). The following Table 1.002.2 is for identification of material for bidding purposes only.

Aggregates meeting the requirements in Table 1.002.1 shall be used to develop the Job Mix Formula (JMF) for the HMA mixture. The aggregate should be composed of angular, coarse textured, and cube shaped particles. Excess of fine material shall be wasted before crushing. Natural sand may be used to obtain gradation of the blended aggregate mixture but should not exceed 25%. If the percent of aggregate passing the #4 sieve is greater than 10% by weight of the individual aggregate sample, plasticity will be determined in accordance with AASHTO T 90. The gradation of the aggregates used in the mixture shall meet the criteria shown in the Aggregate Master Range Table 1.002.2, and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be well graded from coarse to fine. The nominal size aggregate used in the HMA mixture shall not be more than one-third the thickness of the uncompacted HMA lift being constructed.

TABLE 1.002.1 - AGGREGATE PROPERTIES

Property	Test Procedure	Coarse Retained on #4 Sieve	Fine Passing the #4 Sieve
Fine Aggregate Angularity ³			
Traffic Level Low, Moderate, Trails and Pathways	AASHTO T304 Method A		40% Minimum
Traffic Level 3 to 5 Moderate, High, Parking Lots			45% Minimum
Fractured Faces (minimum of 2)	CP-45	70% Minimum	
LA Abrasion Micro- Deval	AASHTO ² T 96 CP-L 4211	45% Maximum 18% Maximum	
Flat and Elongated Pieces 5:1	ASTM D4791	10% Maximum	
Sodium Sulfate Soundness	AASHTO T 104	12% Maximum Combined Coarse and Fine	
Sand Equivalent ³	AASHTO T 176		45% Minimum

¹CP designates the most recent Colorado Department of Transportation material Testing Procedures.

²AASHTO designates American Association of State Highway and Transportation Officials Testing procedures.

³Tests are for the combined or blended samples.

TABLE 1.002.2 - AGGREGATE MASTER RANGE FOR HOT MIX ASPHALT MIXTURES

Sieve Size	Percent by Weight Passing Square Mesh Sieves	
	Grading S	Grading ST
1"	100	
3/4"	90 - 100	*
1/2"	*	100
3/8"	*	90 - 100
#4	*	*
#8	23 - 49	28 - 58
#30	*	*
#200 ¹	2-8	2 - 10

*These additional screens will be established for the Contractor's Quality Control Testing using values from the Mix Design gradation.

- B. Mineral Filler.** If mineral filler is required to meet the JMF, it shall conform to the requirements of AASHTO M 17. It shall consist of rock dust, slag dust, hydrated lime, hydraulic cement, fly ash or other suitable mineral matter. Mineral filler shall have a plasticity index not greater than four (4) excluding hydrated lime and hydraulic cement. Mineral filler shall meet the grading limits shown in Table 1.002.3. The maximum amount of allowable hydrated lime or hydraulic cement shall not exceed 3% by weight of mix.

TABLE 1.002.3 - MINERAL FILLER GRADING LIMITS

Sieve Size	Mass Percent Passing
#30 (600 μm)	100
#50 (300 μm)	95 - 100
#200 (75 μm)	70 - 100

- C. Additives.** Additives to the mineral aggregate shall be added if the asphalt binder will not coat or stick to the aggregates. Additives shall be either Hydrated Lime, or other Anti-stripping Agents as approved by owner / agency engineers.

- Hydrated Lime.** Hydrated lime shall conform to ASTM C 207, Type N. The residue retained on a #200 (75μm) sieve shall not exceed 30% when determined in accordance with ASTM C 110. Refer to table 1.002.3

2. Anti-stripping Agent. Liquid Anti-strip Agent shall be submitted for review and approval by owner.

D. Reclaimed Asphalt Pavement. Reclaimed Asphalt Pavement (RAP) shall be allowed in the HMA mixture. It shall be of uniform quality and gradation with a maximum size particle no greater than the maximum size allowed in the HMA mixture. HMA mixtures containing RAP shall meet the same gradation requirements as a virgin HMA mix. HMA pavements shall not contain more than 20% reclaimed asphalt pavement. The reclaimed asphalt pavement shall meet all the requirements for HMA pavement, as contained herein.

Reclaimed Asphalt Pavement (RAP) Material: The Engineer may require the contractor to maintain separate stockpiles for each type of RAP material. All processed material shall be free of foreign materials and segregation shall be minimized. Any RAP material that cannot be readily broken down in the mixing process, and/or affects the paving operation, shall be processed prior to mixing with the virgin material.

E. Asphalt Binder. Recommended Performance Graded asphalt binders are listed in Table 1.002.4, Binder Grades for HMA mixtures, and shall meet the requirements listed in Table 1.002.5, Properties for Performance Graded (PG) Binders. Any asphalt binder supplied must be from an approved source. An approved source for asphalt binders has to be certified by the Colorado Department of Transportation.

TABLE 1.002.4 - BINDER GRADES FOR HMA MIXTURES

Traffic Levels ¹	Binder Grades
Low (< 300,000 ESALs)	PG 58-28

¹ For 20-Year Designs.

TABLE 1.002.5 - PROPERTIES OF PERFORMANCE GRADED BINDERS

Property	PG Graded Binder Requirements	AASHTO Test No.
	58-28	
Original Binder Properties		
Flash Point Temperature, °C, minimum	230	T 48
Viscosity at 135 °C, Pa·s, maximum	3	TP 48
Dynamic Shear, Temperature °C, where $G^*/\sin @ 10 \text{ rad/sec} \geq 1.00 \text{ kPa}$	58	TP 5
Ductility, 4°C (5cm/min) cm, minimum		T 51
Toughness, joules, minimum		CP L-2210 ²
Tenacity, joules, minimum		CP L-2210 ²
RTOF Residue Properties AASHTO T 240		
Mass Loss, percent maximum	1	T 240
Dynamic Shear, Temperature °C where $G^*/\sin @ 10 \text{ rads} \geq 2.20 \text{ kPa}$	58	TP 5
Elastic Recovery, 25 °C, percent minimum		CP L-2211 ² Method A
Ductility, 4 °C (5 cm/min) cm, minimum		T 51
Pressure Aging Vessel Residue Properties, Aging Temperature 100 °C PP 1		
Dynamic Shear, Temperature °C where $G^*/\sin @ 10 \text{ rads} \leq 5000 \text{ kPa}$	19	TP 5
Creep Stiffness, @ 60 s, test Temp. in °C	-18	
S, maximum, MPa	300	TP 1
m-value, minimum	0.3	TP 1
Direct Tension, Temp. in °C, @ 1mm/min. where failure strain $\geq 1.0\%$	-18	TP 3

¹ Special grades used for unique loading or climate conditions.

² CDOT Test Method.

The Contractor shall provide to the Owner acceptable "Certification of Compliance" of each applicable asphalt binder grade that will be used on the project. Binder grades other than those shown above shall not be used unless the proposed binder and the mix design are approved by the Engineer.

1. **Mixture Binder Selection.** The binder to be used in the HMA mixture will depend on the local traffic level and traffic conditions. Binder grade selection for the HMA mixture for different traffic levels is shown in Table 1.002.4 Binder Grades for HMA Mixtures.
2. **Tack Coat Material Requirements.** Tack coat material shall be an Emulsified Asphalt conforming to AASHTO M 140 or M 208 for the designated grades.

F. Material Acceptance. Prior to the delivery of materials to the job site, the Contractor shall submit certification tests to the Engineer, for his approval, showing all materials to be used on the project meet the appropriate specification. The certification shall show the appropriate test(s) for each material, the test results and a statement that the materials meet the appropriate specification. If the Engineer requests samples of the materials for verification testing prior to and/or during the production of the HMA mixture, the Contractor shall deliver the requested materials to the owner's designated representative.

1.003 Hot Mix Asphalt Mixture Composition. The HMA mix shall be composed of well-graded aggregate, mineral filler, anti-stripping agent (if required and approved) and asphalt binder.

A. Mix Design. The Contractor shall submit the mix design Job Mix Formula (JMF) to the Owning Agency Engineer for approval fourteen (14) days prior to the beginning of paving operations. The mix design(s) of each mixture(s) to be used on the project shall be approved by the Owning Agency Engineer prior to the start of any paving operation. The mix design(s) shall be developed using the CDOT Superpave mix design procedures and shall be stamped (sealed) by an engineer licensed in the State of Colorado practicing in this field.

The Contractor shall submit as part of the mixture design the following items:

1. Source(s) of materials.
2. Aggregate gradation, specific gravity, source and description of individual aggregates and the final mixture blend.
3. Aggregate physical properties.
4. Source and grade of Performance Graded binder along with certification of binder.
5. Proposed JMF: aggregate and additive blending, final gradation shown on a 0.45 power graph, optimum binder content.
6. Mixing and compaction temperatures.
7. N_{ini} and N_{des} (N = number of gyrations).
8. Mixture properties determined at the minimum of four binder contents and interpolated at optimum and graphs showing mixture properties versus binder content.
9. Anti-stripping agent - product name and manufacturer.
10. Percent of RAP if used in the mixture.

The mix design(s) shall meet the requirements of Table 1.002.2 - Aggregate Master Range for Hot Mix Asphalt Mixtures, Table 1.002.4 - Binder Grades for HMA Mixtures, Table 1.003.1 - Superpave Mixture Properties, and Table 1.003.2 - Voids in Mineral Aggregate. Mixes shall be designed at 3.5% Air Voids unless approved by the Engineer. The HMA mixture(s) will be designed for the traffic level, nominal aggregate size and binder grade designated or as specified in the Special Provisions.

TABLE 1.003.1 - SUPERPAVE MIXTURE PROPERTIES

Test Property	Traffic Levels
	Low
Initial Gyration, N _{ini} (information only)	7
Air Voids @ N _{ini}	> 9.5
Design Gyration, N _{des}	75 ¹
Hveem Stability, CP-L 5106	28 min.
Voids Filled w/Asphalt, VFA, MS-2	65 - 80
Lottman, Tensile Strength Ratio, % Retained CP-L 5109 (Optimum AC)	80 min. ²
Lottman, Dry Tensile Strength, PSI, CP-L 5109	30 min.
Dust to Asphalt Ratio (CP-50)	0.6-1.2

¹ Unless otherwise specified by the Engineer

² Lottman requirement is 80 min. for mix design and 70 min. for field acceptance

TABLE 1.003.2 - VOIDS IN MINERAL AGGREGATE

Nominal Maximum Particle Size *	Minimum VMA - %		
	Design Air Voids - %		
	3	3.5	4.0
3/8"	15.5	15.6	15.7
1/2"	14.5	14.6	14.7
3/4"	13.5	13.6	13.7
1"	12.5	12.6	12.7

* The nominal maximum particle size is one sieve size larger than the first sieve to retain more than 10%.

If the Contractor proposes to use RAP in the HMA mixture(s), the resulting mixture(s) must meet the same requirements as a mixture(s) that does (do) not contain RAP. The RAP shall be of uniform quality. The maximum size of the RAP shall be 1½" prior to the introduction into the mixer. The maximum aggregate size contained in the combination of RAP and new aggregate shall not exceed the maximum specified in Table 1.002.2.

- B. Plant Mix Production Verification.** Mixture(s) being produced by the plant shall be verified during initial production or prior to the start of the placement of the mixture(s). Verification shall be performed by a **LabCAT Level C** certified technician(s) to verify the volumetric properties of the mixture(s). Verification shall consist of three (3) consecutive tests, each test representing a separate production run, that have met all the requirements of Table 1.003.3. If the mixture(s) has been produced for another project within the last 90 days, verification results from that project can be submitted for this verification. Superpave mix design volumetric tolerances for the approved HMA mixture(s) shall be within the limits shown in Table 1.003.3.

TABLE 1.003.3 - HMA MIXTURE DESIGN VERIFICATION TOLERANCES

Property	Tolerance
Air Voids	± 1.2%
VMA	± 1.2%
Asphalt Binder Content	± 0.4%
Stability	Applicable minimum

1.004 Hot Mix Asphalt Pavement Construction.

- A. Pre-paving Meeting.** Prior to the start of the paving season, project or operation, all key parties involved in the supply, haul, placement, compaction, inspection and quality control and quality assurance (QC/QA) of the HMA pavement shall attend a pre-paving meeting to go over procedures and acceptance of the HMA pavement. The layout and QC for joints shall also be discussed. The meeting may be scheduled by the Engineer or Owner. Areas of responsibility and contact names and phone numbers will be shared. Refer to the Guideline for Pre-Paving Meetings, Appendix A.
- B. Paving Schedule.** The Contractor shall arrange the work in such a manner as to cause a minimum of inconvenience to the traveling public and the abutting property owners. The Contractor shall submit to the Engineer a plan of this operation. In general, the Contractor shall be allowed to proceed as he proposes. However, the Engineer retains the authority to order the Contractor to schedule the proposed operation in another manner if such a change in schedule is to the benefit of the owner and beneficial to the interests of a good project. The Contractor shall arrange to have the haul vehicles operate over roads that will not be damaged by such vehicles. The Contractor shall provide all necessary Traffic Control in conformity with the current MUTCD and the MUTCD supplement for the City of Colorado Springs requirements. Traffic Control shall be paid for as specified in the contract documents.
- C. Weather Restrictions.** The HMA mixture shall be placed only on properly constructed surfaces that are unfrozen surfaces which are free of standing or puddled water, snow and/or ice. During light rain events or other less than ideal conditions, the contractor shall perform extra Quality Control density testing, in accordance with Industry Best Practices, to assure that the pavement meets project specifications. Pavement that does not meet specified density shall be removed and replaced at the Contractor's expense. The HMA shall be placed in accordance with the temperature limits shown in Table 1.004.1 and only when weather conditions permit the pavement to be properly placed and compacted as determined by the Engineer. Placement and compaction of the HMA may be accomplished at temperatures less than that that shown in Table 1.004.1 when meeting the compaction requirements stated herein and obtaining approval from the Engineer.

TABLE 1.004.1 - HMA PAVEMENT PLACEMENT TEMPERATURE LIMITATIONS

Paving Course	Thickness	Unmodified Asphalt Binder Minimum Surface and Air Temperature °F	Modified Asphalt Binder Minimum Surface and Air Temperature °F
Surface	1 ½ - < 3"	50	60
Surface	≥ 3"	45	50
Subsurface	1 ½ - < 3"	40	40
Subsurface	≥ 3"	35	35

Air temperature is to be taken in the shade. Surface is defined as the existing base on which the new pavement is to be placed.

CDOT Table 401-3 for Placement Temperature Limitations in °F shall be observed for thicknesses < 1 ½”.

D. HMA Production Facilities. The HMA plant used to produce the asphalt aggregate mixture shall meet the requirements of AASHTO M 156 and shall have adequate capacity and be maintained in good mechanical condition. The plant shall control dust, smoke, or other contaminants such that it meets the Colorado Air Quality Control Act, Title 25, Article 7, Colorado Revised Statutes (CRS) and all regulations promulgated there under.

1. **Scales.** The HMA mixture shall be weighed on approved scales furnished by the Contractor or on public scales at the Contractor's expense. Such scales shall be inspected and sealed as often as the Engineer deems necessary to assure their accuracy.
2. **Inspection of Plant.** The Engineer or authorized representative shall have access, at all times, to all areas of the plant for checking the adequacy of the equipment; inspecting the operation of the plant; verifying weights, proportions and material properties and checking the temperatures maintained in the preparation of the mixtures.
3. **Storage Bins and Surge Bins.** HMA mix may be stored provided that any and all characteristics of the mixture are not altered by such storage.

If the Engineer determines that there is an excessive amount of heat loss, segregation or oxidation of the mixture or other adverse effects on the quality of the finished product due to the temporary storage, corrective action shall be taken. Unsuitable mixture shall be disposed of at the Contractor's expense. In no case shall HMA mix be stored more than 60 hours.

E. Hauling Equipment. Trucks used for hauling HMA mixtures shall have tight, clean and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution or other approved release agent material. Petroleum distillates such as kerosene or fuel oil will not be permitted. Each truck shall have a

cover of canvas or suitable cover to protect the mixture from adverse weather and to maintain temperature of the mixture. When necessary, to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened.

- F. Placement Equipment.** Pavers shall be self-propelled, with activated screed assemblies, heated as necessary, to spread and finish the HMA mixture to the specified width, thickness, smoothness and grade shown. The pavers shall have sufficient power to propel themselves and the hauling equipment without adversely affecting the finished pavement surface.

The receiving hopper of the paver shall have sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving or gouging the mixture.

The paver shall be capable of operating at consistent speeds to apply the mixture in an even, continuous layer avoiding stop and go operations. If an automatic grade and slope control device is used, the paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from a reference line or through a system of mechanical sensors or sensor-directed mechanisms, which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within $\pm 0.1\%$.

If the contractor fails to obtain and maintain the specified surface tolerances, the paving operations shall be suspended until satisfactory corrections, repairs, or equipment replacements are made.

- G. Compaction Equipment.** All compaction equipment used on the project for obtaining the required density of the HMA pavement shall be self propelled vibratory, steel wheel or pneumatic tire type capable of obtaining 94% ($\pm 2\%$) of the maximum theoretical density without crushing the aggregate. They shall be in good condition and capable of operating at slow speeds to avoid displacement and tearing of the HMA mixture. Vibratory rollers shall be equipped with separate energy and propulsion controls. The number, type and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. The use of equipment, which causes excessive crushing of the aggregate, will not be permitted.

- H. Hot Mix Asphalt Mixture Production.** The HMA mixture shall be produced in a plant meeting the requirements of Section 1.004 D. The dried aggregates and asphalt binder shall be combined in the plant in the quantities required to meet the Job Mix Formula (JMF).

- 1. Preparation of the Asphalt Binder.** The asphalt binder shall be heated in a manner that will avoid local overheating and provide a continuous supply of the binder material to the plant at a uniform temperature. The temperature of the asphalt binder delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles but shall not exceed the maximum temperature prescribed by the asphalt refiner.
- 2. Preparation of the Aggregate.** The aggregate for the mixture shall be dried, and the temperature and rate of heating shall be such that no damage occurs to the aggregates. The temperature of the aggregate and mineral filler shall not exceed 350 °F when the asphalt is added. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to

obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability. When hydrated lime is required to achieve complete and uniform coating of the aggregate by the asphalt binder, it shall be added to the aggregate in either a slurry or a dry form and then thoroughly mixed in an approved pug mill. The slurry shall contain a minimum of 70% water by weight. If dry hydrated lime is used, it shall be added to the wet aggregate at a minimum of 2% above saturated surface dry and then mixed thoroughly in an approved pug mill. Care should be taken to not add more moisture to the aggregate than required to insure proper coating.

- 3. **Preparation of the Hot Mix Asphalt Mixture.** The heated and dried aggregates and the asphalt binder shall be combined by weight in the mixer in the amount specified by the Job Mix Formula. The materials shall be mixed until the aggregate is completely and uniformly coated, and the asphalt cement is uniformly distributed throughout the aggregate. Baghouse fines shall be fed back to the mixing plant in a uniform and continuous manner to maintain uniformity in the mixture. The baghouse, fines feeder, auger, and related equipment shall be in good working condition and operated in accordance with manufacturer's recommendation. If the Engineer determines that nonuniform operation of the equipment is detrimental to the mixture paving operations may be suspended until the Contractor takes appropriate action.

The temperature of the HMA mixture, for different asphalt binder grades, when discharged from the plant, shall be within the maximum and minimum limits shown in Table 1.004.2. The HMA mixture shall be produced at the lowest temperature within the specified temperature range that produces a workable mix and provides for uniform coating of aggregates (95% minimum in accordance with AASHTO T 195), and allows the required compaction to be achieved.

TABLE 1.004.2 - HMA TEMPERATURE LIMITS³

Asphalt Grade	Minimum Mix Discharge Temperature, °F ¹	Minimum Delivered Mix Temperature, °F ²
PG 58 - 28	275	235
All temperatures shall be determined using a calibrated thermometer.		
Reference the supplier's recommendation for temperatures; varies from producer to producer and asphalt supplier; need to follow the viscosity charts provided by the asphalt supplier.		

¹ The maximum mix discharge temperature shall not exceed the minimum discharge temperature by more than 30 °F.

² Delivered mix temperature shall be measured from the paver hopper.

³ These temperature limits do not apply to warm mix asphalt (WMA). WMA shall be produced at temperatures in accordance with the WMA technology and to meet production and compaction specifications as accepted by the Agency.

- I. **Preparation of the Underlying Surface.** The HMA mixture shall be placed on a prepared surface. Prior to the placing of the mixture, irregularities in the underlying surface shall be brought to uniform grade and cross section. The surface shall be cleaned of all dust and debris. A tack coat shall be applied as required by the contract or approved plans.

- J. **Tack Coat.** This work consists of preparing and treating the surface that will be receiving the HMA mixture in accordance with these specifications and in conformity with the lines shown on

the plans or established by the Engineer. Existing asphalt surfaces receiving an asphalt overlay, existing vertical concrete surfaces such as curb and gutter, crosspans and manholes, or the underlying courses of multi-course asphaltic pavement structure, shall receive a tack coat as required to ensure bonding of the new mat.

The asphaltic material for all tack coats shall meet the requirements of Section 1.002.E.2. The emulsified asphalt shall be diluted to not more than 1:1 with water and applied at a rate of 0.08-0.2 gallons per square yard of diluted material. The Engineer may direct other application rates to match the age and/or condition of the surface.

Before applying the tack coat, surfaces shall be thoroughly cleaned of all dirt and other debris to insure adequate bond between tack surface and asphaltic mat. Tack coats shall not be applied when the surface to receive the tack coat is wet or when weather conditions would prevent the proper construction of the tack coat. The surface shall be allowed to cure in order to permit drying and setting of the tack coat prior to the paving operation.

The Contractor shall provide equipment for heating and uniformly applying the tack coat material. The distributor or equipment for applying the tack coat shall be capable of uniformly spraying the material at even temperature and uniform pressure on variable widths of surface up to 15 feet in width at readily determined and controlled rates as required.

The tack coat shall be applied in a uniform and continuous spread. When traffic is maintained, sufficient width shall be left to adequately handle traffic. Care shall be taken so the application of the tack coat materials at the junctions of spreads is not in excess of the specified quantity. Excess material shall be removed or distributed as directed. Tack coat shall not be placed on any surface where traffic will travel on the freshly applied material.

- K. Patching.** Remove the backfill material to the depth and extent required by the owner/agency engineer. Prepare the subgrade and/or base course as specified by the owner/agency engineer. Depths and/or thickness of base course and/or asphalt pavement shall be as indicated on the drawings. The asphalt pavement shall be a minimum of four (4) inches or equal to the existing pavement thickness, whichever is greater. The subgrade and/or base course material shall be thoroughly compacted to the densities as specified by the owner with a roller for large areas and smaller hand operated compactor for small patches. Thoroughly compacted, where found in these specifications, is intended to mean compaction by the contractor using their best effort or until further consolidation is unlikely using mechanical or hand tampers where a roller cannot be used. These areas are still subject to testing if requested by the owner.

Existing pavement may be rough cut initially in conjunction with trenching; however, a square even vertical cut shall be made in the existing HMA pavement after placement of backfill and prior to pavement replacement. The square vertical cut shall be made at a minimum of six (6) inches back from the trench line into good pavement. Before placement of the new pavement, the cut edges shall be thoroughly cleaned and a tack coat shall be uniformly and evenly applied to vertical faces. The patch shall be made with placement of a hot asphalt cement and aggregate mixture.

In large patches or whenever possible, a self-propelled paving machine shall be used to place the mixture. The material shall be placed to the grade and thickness required to allow for compaction by rolling. The HMA shall be compacted using the number, weight and type of rollers required to provide 94% (+/- 2%) of the maximum density of the approved Job Mix Formula. Rolling shall continue until roller marks are eliminated.

In small patches, where the use of rollers is not practicable, the material shall be hand placed or placed with a spreader box without separation of the material and thoroughly compacted by best effort and no further consolidation is possible in the pavement.

L. Hauling of HMA Mixture. Transporting the HMA mixture from the plant to the job site shall be done in vehicles meeting the requirements of Section 1.004.E. The Contractor shall have an adequate number of vehicles so delivery of the HMA mixture can be continuous with a minimum of interruptions of material to the paving equipment in order for a continued non-stop paving operation and before the temperature of the HMA material falls below 235 °F for nonmodified material or not less than 280 °F for polymerized modified material. WMA shall be delivered at temperatures to meet production and compaction specifications. Deliveries shall be planned so the placing and compaction of all the mixture prepared for one day's operation can be completed during daylight, unless adequate artificial lighting is provided by the Contractor and approved by the Engineer. When the atmospheric temperature is less than 50 °Fahrenheit, all loads shall be delivered continuously in covered vehicles meeting the requirements in Section 1.004.E. Hauling over newly placed mixture shall not be permitted until the mixture has been compacted as specified and allowed to cool sufficiently so vehicular traffic does not damage or deform the final lift.

M. Placing of HMA Mixture. The HMA mixture shall be placed using equipment meeting the requirements in Section 1.004.F to the established grade and required thickness over the entire width or partial width as practicable.

The mixture shall be laid upon an approved surface, spread and struck off to obtain the required grade and elevation after compaction. The thickness of the mixture being placed should be such that after compaction is achieved, the finished mat will be even with the existing adjacent mat. Raking is discouraged and should not be allowed if it is causing segregation in the mat. Casting or raking that causes any segregation will not be permitted.

On areas where the use of mechanical spreading and finishing equipment is impracticable, the mixture shall be carefully dumped, spread, raked, screeded, and luted by hand tools to the required compacted thickness plus the amount necessary to achieve the required compacted thickness. Carefully move or minimally work the HMA mix with the use of rakes, lutes, or shovels to avoid segregation. Mixtures made with modified asphalt cement require more rapid completion of handwork areas than for normal mixtures. Hauling and placement sequences shall be coordinated so that the paver is in constant motion. Excessive starting and stopping should be avoided. If stopping and starting of the paving operation cannot be avoided, it should be done as rapidly as possible within reason. A construction joint shall be placed any time the paver stops, and the screed drops enough to cause a surface dip in violation of Table 1.004.7 for smoothness, or the mat temperature falls enough that the compaction cannot be obtained as specified.

When echelon paving is permitted and approved by the Engineer, production of the mixture shall be maintained so pavers can be used in echelon to place the wearing course in adjacent lanes.

When material is shoveled, it shall be deposited by turning the shovel over above the desired area. No "slinging" of the shovel will be permitted. The hand placed material shall be smoothed and left higher than the machine laid material by about 1/4 inch per inch of depth prior to rolling. If the machine laid mixture has been rolled, then the hand laid mixture shall be smoothed and left higher than the rolled pavement by about 1/4 inch per inch depth. The majority of the raker's work shall be done with a lute rather than a tined rake.

1. Segregation. The HMA mixture shall be transported and placed on the roadway without segregation. If at any time, the Engineer observes segregated areas of pavement, he/she will notify the Contractor immediately. Further laydown operations will then be at the Contractor's risk. Any segregated areas behind the paver shall be removed upon verification. The segregated material shall be replaced with specification material.

After rolling, segregated areas will be delineated by the Engineer and evaluated as follows:

- a. The Engineer will delineate the segregated areas to be evaluated and inform the Contractor of the location and extent of these areas within two calendar days, excluding weekends and holidays, of placement.
- b. In each segregated area or group of areas to be evaluated, the Contractor shall take five 10 inch cores at random locations designated by the Engineer. In accordance with CP 75, the Contractor shall also take five 10 inch cores at random locations designated by the Engineer in non-segregated pavement adjacent to the segregated area. These cores shall be within 30 feet of the boundary of the segregated area and in the newly placed pavement. The coring shall be in the presence of the Engineer and the Engineer will take immediate possession of the cores. The Contractor may take additional cores at the Contractor's expense.
- c. Gradation of the aggregate of the cores will be determined in accordance with CP 46.
- d. The core aggregate gradations from the segregated area will be compared to the core aggregate gradations of the corresponding non-segregated area.
- e. Two key sieves of the core gradations from the segregated area will be compared to the core gradations from the corresponding non-segregated area to determine the difference. If differences for both key sieves exceed the allowable difference specified in Table 1.004.3, the area is segregated.

TABLE 1.004.3 - SEGREGATION DETERMINATION

Mix Grading	Key Sieves	Allowable Difference, %
ST, S	2.36 mm (#8) 4.75 mm (#4)	9

- f. Segregated areas in the top lift shall be removed and replaced, full lane width, at the Contractor's expense. The Engineer may approve a method equivalent to remove and replace that results in a non-segregated top lift. Segregated areas in lifts below the top lift, that are smaller than 50 square feet per 100 linear feet of lane width, will be corrected by the Contractor at the Contractor's expense in a manner acceptable to the Engineer. Segregated areas larger than 50 square feet per 100 linear feet of lane width in any lift shall be removed and replaced, full lane width, by the Contractor at the Contractor's expense.
- 2. Lift Thickness.** Each lift of compacted asphalt pavement shall be of uniform thickness. The minimum uncompacted lift thickness shall be three times the nominal aggregate size of the mixture. The maximum compacted lift thickness shall not exceed six (6) times the nominal maximum aggregate size unless the Contractor can demonstrate the ability to achieve required compaction of thicker lifts without damaging the surface or fracturing the aggregate. Placement of lifts thicker than 4" compacted asphalt shall be approved by the Owning Agency Engineer prior to placement.

The final lift, when placed adjacent to guttering, shall extend ¼ to ½ inch above the lip of the gutter when compacted for a catch curb and gutter and shall be even with a spill curb and gutter at the time of construction.

The average compacted total pavement thickness shall be greater than or equal to the design specified on the construction drawings, with no single core thickness less than 90% of the specified thickness or over 110% of the specified thickness.

- 3. Joint Construction.** The formation of all joints shall be made in such a manner as to ensure a continuous bond between the courses and to obtain the required density. All joints shall have the same texture and smoothness as other sections of the mat and shall meet the requirements for smoothness and grade.

The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course.

The free edge of the paved pass shall be laid as straight as possible and to the satisfaction of the Engineer. This joint shall be spray tack coated prior to placement of adjacent paving.

The new compacted mat shall overlap the adjacent previous placed mat no more than 1.5 inches. Excess overlap or thickness shall not be raked or cast onto the new mat, but shall be wasted by pulling back and removing. The hot edge shall be blocked or bumped in a smooth line consistent with the previous longitudinal edge. Minor raking will only be allowed to correct major grade problems or provide mix around manholes and meter covers.

- a. **Longitudinal Joints.** The longitudinal joint in both a new pavement and an overlay pavement layer shall offset the joint in the layer immediately below by a minimum of 6 inches. In multiple lift (3 lifts or more) construction the joint in any succeeding lift shall not be placed in line of any of the previous lifts. The joints in any pavement layer shall not fall in a wheel path. The Contractor shall submit a longitudinal joint and pavement marking plan three days prior to the Pre-Paving Conference. The plan shall show the location and configuration of the proposed longitudinal joints and pavement markings, and shall detail the methods to be used in the field to establish a control line. The Contractor shall use a continuous string line to delineate every longitudinal joint during paving operations. All exposed string line shall be picked up and disposed of at the end of each day's paving. Paving shall not commence until the plan has been approved in writing by the Engineer.

The joints in the top layer of pavement shall be located as follows unless otherwise approved in writing by the Engineer:

- 1) For two lane roadways, offset 6 to 12 inches from the center of pavement and from the outside edge of the travel lanes.
- 2) For roadways of more than 2 lanes, offset 6 to 12 inches from lane lines and outside edge of travel lanes.

Longitudinal joints shall not cross the centerline, lane lines or edge line unless approved by the Engineer.

Where paving operations are on the present traveled roadway, the Contractor shall arrange paving operations so there will be no exposed longitudinal joints between adjacent travel lanes longer than 25 feet at the end of a day's run. With the approval of the Engineer, the Contractor may be permitted to:

- 1) Leave a vertical exposed longitudinal joint when the thickness of the pavement course being placed is 1.5 inches or less.
- 2) Leave an exposed longitudinal joint when the thickness of the pavement course being placed is greater than 2 inches provided that the top 1 inches of the longitudinal joint shall be vertical. The remainder of the joint, below 1-inch vertical portion, shall be tapered. The minimum width of the taper shall be two times the remaining thickness of the pavement course.

In the methods listed in paragraphs (1) and (2) above, all contact surfaces shall be given a tack coat of bituminous material before placing any fresh HMA mixture against the edge.

- b. **Transverse Joints.** Along with the longitudinal joint plan, the Contractor shall submit a transverse joint plan showing the locations and the methods to be used to construct transverse joints. The Engineer must approve such plans prior to paving. Placing of the HMA mixture shall be continuous with a minimum of transverse joints.

Rollers shall not pass over the unprotected end of a freshly laid mixture. Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the course. Tack coat material shall be applied to contact surfaces of all joints just before additional mixture is placed against the previously compacted material.

The end of transverse joints shall be located so they will be constructed with a full head of mix in front of the screed. When butt joints are constructed, runoff boards shall be used to support the roller on the downstream side of the joint. All tapered sections, rounded edges and segregated areas shall be removed to achieve a vertical face at the butt joint before paving is restarted.

When a tapered joint is required for traffic access, the ramp shall be removed back to a full depth before paving is restarted.

When restarting paving operations, the paver screed shall be placed on starter blocks on the completed side of the transverse joint. The starter blocks should be approximately 25% of the thickness of the existing completed mat, so that adequate grade and compaction can be achieved on starting the paving operation.

4. **Compaction.** The HMA shall be compacted by rolling. 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 binder (PG 58-28), and the surface temperature falls below 185 °F, further compaction effort shall not be applied unless the contractor can demonstrate no damage to the surface of the asphalt pavement.

Roller marks shall be removed with the finish rolling. Use of vibratory rollers with the vibrator on will not be permitted during surface course final rolling.

Pavement shall be compacted to a density of 94% ($\pm 2\%$) of the maximum theoretical density, of the approved Job Mix Formula. Field density determinations will be made in accordance with CP 44 or 81 (see Table 1.004.7). Core samples and compaction testing locations shall include a representative sampling (20% - 30%) of tests taken at 12 inches from visible joint lines for one lift paving and 18 inches from visible joint lines for multiple

lift paving, for both longitudinal and transverse joints, in order to verify correlation between mat density and joint density. The joint density requirement shall be a minimum of 90% of the maximum theoretical density. If nuclear density measurements indicate results outside the tolerance limits, cores shall be used to verify results. Cores must be taken to establish correlation to nuclear gage results.

Along forms, curbs, headers, walls, and all other places not accessible to the rollers, the mixture shall be thoroughly compacted with mechanical tampers. Locations too narrow for mechanical tampers shall be compacted with a hand tamper to achieve the best density.

Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective, shall be immediately removed and replaced with fresh hot mixture, and compacted to conform to the surrounding area.

N. Testing and Inspection.

- 1. Quality Control (QC).** For the purposes of this Specification, QC is defined as the program employed by the Contractor for controlling the production and installation of HMA pavements in compliance with this Specification and industry standards. QC of the work will be based on the implementation of the Contractor's Quality Control Plan, on the results of QC testing, and on the following characteristics of the HMA mixture and the completed pavement:

- Binder Grade Certification
- Asphalt Binder Content
- Aggregate Gradation
- Air Voids
- Voids in the Mineral Aggregate (VMA)
- Mat Density
- Mat Thickness
- Mat Smoothness
- Lottman Tensile Strength

Quality Control (QC) testing shall be performed by the Contractor. QC testing shall include both the plant-produced materials as specified in Tables 1.004.5 and 1.004.6, and the field-placed material as specified in Table 1.004.7. Test results from each day's production shall be completed and submitted as soon as possible to the Owner/Agency representative. Failing QC test results shall be reported to the Engineer within one business day.

Testing facilities shall conform to AASHTO requirements, including R-18. Personnel performing sampling and testing of HMA mixtures, in the lab and in the field, shall possess the appropriate and current LabCAT certification or combination of certifications, issued by the Rocky Mountain Asphalt Education Center for all sampling and testing performed.

- 2. Quality Assurance (QA).** For the purposes of this Specification, QA is defined as the program employed by contractor, in addition to QC for assuring compliance with this Specification and industry standards, for assuring that the Contractor's QC program is functioning properly, and for accepting the finished HMA pavement product.

The Owner/Agency reserves the right to conduct additional Quality Assurance (QA) testing on any and all features of the HMA production and paving operations. Failing tests and required retests and corrective actions will be paid for by the Contractor, provided that sampling and

testing are performed in accordance with proper procedures. The cure for failed testing is at the discretion of the Owner/Agency Engineer, and may include removal and replacement, deductive change order, or extended warranty with financial assurance.

QA of the work will be primarily based on the following characteristics of the HMA mixture and the completed pavement:

- Asphalt Binder Content
- Aggregate Gradation
- Mat Density (Including Joints)
- Mat Thickness
- Mat Smoothness

VMA/volumetric QA testing will normally be reserved for larger jobs, and utilized at the discretion of the Owner/Agency by special provision and include a check test program in accordance with CP-13.

QA tests will be performed by either the Contractor or an Independent Testing Lab. Testing facilities shall conform to AASHTO requirements, including R-18. Personnel performing testing, in the lab and in the field, shall possess the appropriate and current LabCAT certification or combination of certifications issued by the Rocky Mountain Asphalt Educations Center (RMAEC) for all testing performed. Failing QA test results shall be provided to the Engineer within one business day.

3. Testing Responsibilities.

a. **Capital Projects and Overlays.** For capital projects, overlays and similar projects that are managed directly by contracts between the owning agency and general contractors, paving contractors and/or HMA suppliers, the testing responsibilities will be specified by the contract.

1. **QC.** In general, QC for overlays and capital projects will be managed by the HMA Supplier or Paving Contractor, primarily using the HMA Supplier's lab.
2. **QA.** The Contractor will augment the Contractor's QC program by providing for the required testing frequencies as specified in Table 1.004.7 – "Field Acceptance Testing", or as specified in the contract. Additional QA tests on both plant-produced materials and field-placed materials may be ordered by the Owner's representative at any time as deemed necessary by the Owner's project manager.

b. **Summary.** Table 1.004.4 – "Testing Responsibilities" (page 20) summarizes these requirements.

TABLE 1.004.4 – TESTING RESPONSIBILITIES

<u>SAMPLING LOCATION</u>	<u>TESTS</u>	<u>QC</u>	<u>QA</u>
		Capital Projects & Overlays	Capital Projects & Overlays
PLANT - PRODUCED MATERIALS	Asphalt Binder Grade Certification	Contractor	N/A
	Asphalt Binder Content	Contractor	N/A
	Aggregate Gradation	Contractor	N/A
	Air Voids	Contractor	N/A
	Voids in Mineral Aggregate (VMA)	Contractor	N/A
	Lottman Tensile Strength	Contractor	N/A
FIELD - PLACED MATERIALS	Asphalt Binder Content	Contractor	Contractor or Ind. Lab
	Aggregate Gradation	Contractor	Contractor or Ind. Lab
	Mat Density (% Compaction)	Contractor	Contractor or Ind. Lab
	Mat Thickness	Contractor	Contractor or Ind. Lab
	Mat Smoothness	Contractor	Contractor

4. Testing Frequencies and Tolerances.

- a. Plant-Produced Material.** Sampling shall be at the plant. Sufficient material for preparation of test specimens shall be obtained by the Contractor in accordance with CP 41 and AASHTO T168, most recent. When the Contractor chooses to conduct QA testing through an Independent Testing Lab, samples shall be split with the supplier's materials laboratory. One set of laboratory compacted specimens will be prepared for QA and QC at the number of gyrations required in Table 1.003.1. Each set of laboratory compacted specimens will consist of three test portions prepared from the same sample increment. The material shall be compacted in accordance with CP L-5115 at the temperature as specified in the Job Mix Formula.

The testing of plant-produced material shall be in accordance with Table 1.004.5 and 1.004.6. Two consecutive gradation tests falling outside the Action Limits, or one gradation test falling outside the Suspension Limits, will warrant corrective action and shall be subject to engineering review and possible removal and replacement of the represented day's production.

The asphalt binder in the plant-produced material shall meet the specification in Table 1.002.5 – Properties of Performance Graded Binders, for the binder grade specified.

TABLE 1.004.5 – PLANT QC TESTING FREQUENCIES AND TOLERANCES ¹

Test	Current Procedure	Specification Tolerance Limits	Frequency
Asphalt Binder Content	CP-L 5120	± 0.4%	1 per 1000 tons ² or 1 per day min.
Aggregate Gradation	CP 31	Table 1.004.6	1 per 1000 tons ² or 1 per day min.
Air Voids	CP 44	+/-1.2%	1 per 1000 tons ^{2,3} or 1 per day min.
Void in Mineral Aggregate	CP 48	+/-1.2%	1 per 1000 tons ^{2,3} or 1 per day min.
Lottman Tensile Strength	CP-L 5109	70 min.	1 per mix design in first month of production

¹ Subject to owning agency engineer's direction on a job by job basis.

² The frequency of testing shall be based on *cumulative tonnage* of all projects using the approved Job Mix Formula. Representative tests for each mix design may be used for multiple jobs.

³ Upon verification in accordance with Section 1.003, air voids and VMA testing frequency may be 1 per 10,000 tons or 1 per week minimum.

TABLE 1.004.6 - CONTROL LIMITS FOR AGGREGATE GRADATION MEASUREMENTS

Sieve	Action Limit	Suspension Limit
1 in.	0 %	0 %
¾ in.	± 6 %	± 8 %
½ in.	± 6 %	± 8 %
⅜ in.	± 6 %	± 8 %
No. 4	± 5 %	± 7 %
No. 8	± 5 %	± 7 %
No. 30	± 4 %	± 6 %

No. 200	± 2%	± 3 %
---------	------	-------

- b. Field-Placed Material.** Sampling for Asphalt Binder Content and Aggregate Gradation shall be taken by the QC representative, preferably at the plant in accordance with CP41 or AASHTO T168, or at the job site in accordance with CP41, and witnessed by an authorized representative of the Owner/Agency. HMA pavement shall be tested in-place for acceptance in accordance with Table 1.004.7. Densities shall be determined by core sampling in most cases.

Acceptance will be based on QC tests provided by the Contractor, and verified by QA testing by the Contractor or Independent Testing Laboratories as required by this Specification and the Owner/Agency representative.

TABLE 1.004.7 – FIELD ACCEPTANCE TESTING

Test	Current Procedure	Specification Tolerance Limits	Frequency
Asphalt Binder Content	CP-L 5120	± 0.4 %	1 per 1,000 tons, or 1 per day minimum ²
Aggregate Gradation	CP 31	See Table 1.004.6	1 per 1,000 tons, or 1 per day minimum ²
Mat Density (% Compaction by the approved JMF Rice)	CP 44 or CP 81	94% ± 2%	1 per 500 tons, or portion thereof ¹
Mat Thickness	Core Measurement	Design minus 10% on a single test. Job average must be ≥ design thickness.	1 per lane every 1,000 feet, or portion thereof
Longitudinal Mat Smoothness (with no grade changes present)	10-ft Straightedge	≤ 3/16-inch	at Owner/Agency Inspector's discretion

¹ Longitudinal joints shall be tested at 20% - 30% of the total number of compaction tests taken, with a minimum of at least one per job.

² The frequency of testing shall be based on cumulative tonnage of all projects using the approved Job Mix Formula. Representative tests for each mix design may be used for multiple jobs.

Core samples shall be neatly cut with a core drill or other approved equipment. The minimum diameter of the sample shall be four inches. Samples that are clearly defective, as a result of sampling, shall be discarded and another sample taken. Cores shall not be taken closer than one foot from a transverse or longitudinal joint. The Contractor installing the pavement shall furnish all tools, labor and materials for cutting samples and filling the cored pavement. The Contractor shall be responsible for supplying the Owner's materials

laboratory with the core samples. Cored holes shall be filled in a manner acceptable to the owner and within one day after sampling.

Test results of the percent of relative compaction (density) shall be determined by dividing the density reading of the nuclear density gauge or core by the maximum density of the product as determined by the approved Job Mix Formula (JMF). Testing frequency for Percent Relative Compaction shall be in accordance with Table 1.004.7.

The required compacted HMA mat thickness shall be as specified on the construction plans and/or specified in the Special Conditions. Final mat thickness shall be determined from the same cores as are used to test for density. No single core thickness shall be less than ninety percent (<90%) of the specified thickness on the construction plans and/or Special Conditions. In addition, the average thickness for the job must be greater than or equal to the design thickness. When a single core thickness is less than ninety percent (<90%) of that specified, or when the job average is less than the specified design thickness, the Contractor shall correct the situation at his expense. Core thicknesses shall not exceed 110% of the specified thickness.

Surface Smoothness of the final riding surface of all pavements is subject to testing by the 10-foot straightedge method. The Contractor shall furnish an approved 10-foot straightedge and depth gauge and provide an operator to aid the Engineer in testing the finished pavement surface. Areas to be tested shall be determined by the Engineer or the Owner Agency Inspector. The variation between any two contacts with the surface shall not exceed 3/16-inch in 10 feet. Areas showing deviation of more than 3/16-inch shall be marked and corrected at the Contractor's expense.

5. **Contractors' Quality Control Program.** The Asphalt Producers and the Installing Contractors shall develop Quality Control (QC) Programs. The QC programs shall address all elements which affect the quality of the pavement including, but not limited to:

- Mix Design
- Aggregate Grading
- Quality of Materials
- Stockpile Management
- Proportioning
- Mixing and Transportation
- Placing and Finishing
- Asphalt Binder
- Air Voids
- Voids in Mineral Aggregate (VMA)
- Compaction
- Surface Smoothness

- a. **Testing Laboratory.** The Contractor shall provide a fully equipped asphalt laboratory or shall hire an independent testing laboratory for quality control testing. Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition. The Owner's designated representative shall be permitted unrestricted access to inspect the Contractor's laboratory facility and witness quality control activities. The Owner's representative will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, testing personnel and testing procedures. When the deficiencies are serious enough to be adversely affecting test results, the incorporation of the materials into

the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

- b. Quality Control Testing.** The Contractor shall develop a quality control testing plan and perform all quality control tests necessary to control the production and construction processes applicable to these specifications. Quality control test results shall be submitted to the Engineer within 24 hours of sampling. Personnel performing sampling and testing of aggregates or HMA mixtures in the lab and in the field shall possess the appropriate LabCAT certification or combination of certifications issued by the Rocky Mountain Asphalt Education Center for all sampling and testing performed.

Test procedures for QC testing are shown in Tables 1.004.5 and 1.004.7.

The quality control testing plan shall include, but not necessarily be limited to, the following tests:

1. **Asphalt Binder.** Asphalt content tests shall be performed for determination of binder content and shall be sampled at the same time as the VMA and air voids samples are obtained.
2. **Air Voids and VMA.** Air Voids and VMA shall be tested in accordance with CP 44 and CP 48, respectively, at a frequency in accordance with Table 1.004.5.
3. **Gradation.** Aggregate gradations shall be determined from mechanical analysis of extracted aggregate. When binder content is determined by a nuclear method, aggregate gradation shall be determined from the cold feed on drum mix or continuous mix plants or from hot bin samples on batch plants. The samples shall use actual batch weights to determine the combined aggregate gradation of the mixture.
4. **Lottman Tensile Strength.** One sample per mix design during the first month of production, and as necessary for control thereafter.
5. **Moisture Content of Aggregate.** The moisture content of the aggregate used for the production shall be determined in accordance with AASHTO T 255.
6. **Moisture Content of Mixture.** The moisture content of the mixture shall be determined in accordance with CP 43 Method B.
7. **Temperatures.** Temperatures shall be checked, at least twice per day, at necessary locations to determine the temperatures of the dryer, the binder in the storage tank, the mixture at the plant and the mixture at the job site.
8. **In-Place Density Monitoring.** The Contractor shall conduct testing to ensure that the specified density is being achieved during the construction of the HMA pavement.
9. **Additional Testing.** Any additional testing that the Contractor deems necessary to control the process may be performed at the Contractor's option.
10. **Monitoring.** The Engineer and/or the owner reserve the right to monitor any of the quality control tests listed above and to perform verification sampling and testing of all materials.
11. **Sampling.** When directed by the Engineer, the Contractor shall sample and test any material that appears inconsistent with similar material being sampled, unless such

material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

12. Control Charts. The Contractor shall maintain linear control charts both for individual measurements and ranges (i.e., difference between highest and lowest measurements) for aggregate gradation and asphalt content.

O. Method of Measurement. The accepted quantities of HMA pavement will be measured by the ton for the compacted thickness of pavement specified in each pay item. Batch mass (weights) will not be permitted as a method of measurement. The tonnage shall be the mass (weight) used in the accepted pavement.

If there is no pay item for HMA pavement of the type specified, it will not be measured and paid for separately, but shall be included in the pay item most closely associated with the work.

HMA used Major Crack Repair (Greater than 1-Inch) will not be measured and paid for separately but shall be included in the work under item 408.05-2.

HMA used in Full Depth Pavement Repair will not be measured and paid for separately but shall be included in the work under item 408.05-3.

Tack coat will be measured by the diluted gallon.

P. Basis of Payment. The accepted quantities of HMA pavement will be paid for at the contract unit price for each pavement type and/or thickness listed in the bid schedule. The price will be full compensation for furnishing all materials, for preparation, mixing, placing and compaction of these materials and for all labor, equipment, tools and incidentals necessary to complete the work.

Payment for tack coat shall be a separate bid item and shall include all materials, tools, equipment and labor necessary to complete the work in accordance with the plans and specifications and as directed by the Engineer. Tack coat shall be paid for based on diluted gallons.

Payment will be made under:

Pay Item	Pay Unit
400.01-1 HMA (Grading S, PG 58-28)	Ton
400.01-2 Tack Coat	Gallon

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Appendix A

HOT MIX ASPHALT PREPAVING CONFERENCE AGENDA

The items in the following agenda are minimum requirements that should be covered during the conference. The agenda may be used as is or as a base to develop a customized agenda.

Project Number:		Owner's Rep:	
Project Code (SA):		Project Engineer:	
Location:		Contractor:	
Date:		Superintendent:	
Time:		Foreman:	

I. Attendance Roster

Name:		Office Number:	
Representing:		Fax Number:	
Responsibilities:		Cell Number:	
City, State, Zip:		Email Address:	

Name:		Office Number:	
Representing:		Fax Number:	
Street Address:		Cell Number:	
City, State, Zip:		Email Address:	

Name:		Office Number:	
Representing:		Fax Number:	
Street Address:		Cell Number:	
City, State, Zip:		Email Address:	

II. Project Organization and Status

A. OWNER/AGENCY Personnel:

1. Personnel in Charge at Paving Site:

Name/Title:		Fax Number:	
Office Number:		Home Number:	

Mobile Number:		Email Address:	
2. Alternate Contact (when personnel identified in A.1 is not present):			
Name/Title:		Fax Number:	
Office Number:		Home Number:	
Mobile Number:		Email Address:	
3. Quality Assurance Supervisor:			
Name/Title:		Fax Number:	
Office Number:		Home Number:	
Mobile Number:		Email Address:	
4. Inspector/Duties:			
Name/Title:		Fax Number:	
Office Number:		Home Number:	
Mobile Number:		Email Address:	
5. Inspector/Duties:			
Name/Title:		Fax Number:	
Office Number:		Home Number:	
Mobile Number:		Email Address:	
Comments			

HOT MIX ASPHALT PREPAVING CONFERENCE AGENDA (continued)

B. CONTRACTOR / DEVELOPER Personnel:

1. Quality Control Supervisor:			
Name/Title:		Fax Number:	
Office Number:		Home Number:	
Mobile Number:		Email Address:	
2. Personnel to Notify at Paving Site			
Name/Title:		Fax Number:	
Office Number:		Home Number:	
Mobile Number:		Email Address:	
3. Other:			
Name/Title:		Fax Number:	

Office Number:		Home Number:	
Mobile Number:		Email Address:	
Comments			
C. Testing Information: (Compaction Test Results, acceptance tests to be performed, frequency)			
1. Test locations determined by?			
2. Frequency of tests to be performed?			
2. Are Quality Assurance tests to be performed in addition to Quality Control tests? ➤ If Yes how often, and who will be responsible to schedule the QA tests?			
3. Turnaround time of test results? ➤ Preliminary? ➤ Final?			
4. Is the mix design(s) approved by the Owner/Agency?			
D. Submittal and Notification of Test Results			
1. What projects and affected owners/agencies will this JMF be provided to?			
2. What process will be provided for submittal of test results?			
3. Who should copies of the JMF be provided to?			
4. Who will be responsible for QA testing?			
III. Scheduling			
A. Materials:			
Materials will be available for sampling on:			
B. Asphalt Plant:			
The asphalt plant will be ready to be checked on:			
C. Paving Equipment:			
The paving equipment will be set up and ready to be checked on:			

HOT MIX ASPHALT PREPAVING CONFERENCE AGENDA (continued)

D. Paving Sequence:

1. The Contractor will commence paving on:
2. Hot Bituminous Pavement will be delivered at:
3. The Contractor proposes to work the following hours:
4. How many days per week does the Contractor intend to work?
5. What paving sequence will the Contractor follow?
6. Where will paving start?

E. A quality control plan shall provide information to control the quality of the following:

1. Segregation:
2. Longitudinal Joint Construction:
3. Transverse Joint Construction:
4. Smoothness:
5. Other:

F. Scales and Certified Weigher:

1. Scales shall be checked and sealed. Comments:
2. Weigh tickets shall contain information required by the owner. Comments:
3. Are truck weigh ticket required to be delivered on site? How will the weight tickets be collected? Comments:

IV. Preparation

A. Method of Approval SubSurface Materials?

Comments:

B. Has the Subsurface Been Approved for Paving?

Approved By Whom?

C. Tack Coat:

1. Material type, Application Rate?

V. Production and Placement

A. Compaction Test Section:

The following procedures should be observed and documented:

1. The Contractor must establish a roller pattern and carefully record the following information:
 - a. Type, size, amplitude, frequency, and speed of roller:

HOT MIX ASPHALT PREPAVING CONFERENCE AGENDA (continued)

V. Production and Placement (continued)

b. Tire pressure for rubber tire rollers and if the pass for vibratory rollers is vibratory or static:

c. Surface temperature of mixture behind the laydown machine and subsequent temperatures and densities after each roller pass:

d. Sequence and distance from laydown machine for each roller and total number of passes of each roller to obtain specified density:

2. When the Compaction Test Section has been completed, the Contractor shall furnish a complete copy of this data to the person in charge (II.A.1) before continuing to pave. Comments:

3. When a successful Compaction Test Section has been completed, the Contractor is required to maintain the roller pattern established during the Compaction Test Section for the balance of the Hot Bituminous Pavement construction (i.e., the Contractor must use the same number and type of rollers and operate them at the same speed, frequency, and amplitude and in the same position, relative to the laydown machine, as was performed during the Compaction Test Section). If the Contractor wants to change the roller pattern that was established during the Compaction Test Section, the Contractor must construct a new Compaction Test Section and demonstrate that the density can be obtained with the new roller pattern before proceeding with the paving operation. Comments:

4. The Contractor is responsible for compaction testing of the Compaction Test Section. Comments:

HOT MIX ASPHALT PREPAVING CONFERENCE AGENDA (continued)

V. Production and Placement (continued)

5. Cores are required to calibrate the nuclear density gauge. The Contractor can continue to pave under the following conditions:

- The period that the Contractor continues to pave without test results from cores shall not exceed one working day.
- Construction proceeds at the Contractor's risk.

Comments:

6. A new Compaction Test Section will be required whenever there is a change in the compaction process.

Comments:

7. Striping plan: Sub Contractor or contractor to do striping?

When will striping occur? When will striping occur?

Have Materials Data Sheets been submitted? Approved? If Not when?

B. Laydown Equipment:

1. Does the paving equipment meet the requirement detailed in the specifications? Comments:

VI. Traffic Control

A. Method of Handling Traffic:

Has the Method of Handling Traffic been submitted for the Mix Asphalt Pavement placement operation? If not, when will it be submitted?

Is the traffic control plan approved?

VII. Follow Up Items

Items discussed during the meeting needing follow up.

Item for follow up	Who will follow up	Date of completion or response
1.		
2.		

PIKES PEAK REGION ASPHALT PAVING SPECIFICATIONS
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3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Appendix B

**Mixture Design Requirements for
Hot Mix Asphalt (HMA) Pavements**

Agency: _____

Project Number: _____

Date: _____

Project Name: _____

Project Special Provision Sheet for Hot Mix Asphalt (HMA) Pavements

This form is a **mandatory part of the bid documents**, and shall be filled out by the AGENCY for each mix specified. The Contractor shall include a copy of this form with each Mix Design submittal after the contract is awarded.

Street Classification: _____

(examples: Residential, Collector, Arterial, Industrial, Parking Lot).

Construction Application: Top Lift Intermediate Lift(s) Bottom Lift(s)

Patching Other _____

Aggregate Gradation: Grading ST Grading SX Grading S Other _____
_____ < 2" thick lifts _____ 2" to 3" thick lifts

RAP Quantity, Maximum: 0% 20% 25%* Other _____

Mix Design Method & Compaction Level: (Chose one Method & one Traffic Level ⇒ Compaction Level).

Superpave Gyratory, N_{design} : (See Table 1.003.1)

N=75 N=100

Asphalt Binder:

PG 58-28 PG 64-22 PG 64-28 Other _____

A completed Asphalt Mix Design Form shall supplement the Construction Specifications defining the contract specific requirements. Refer to the Specifications for details.

*RAP above 20% must be approved by the governing agency prior to placement.

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SECTION 408 JOINT AND CRACK SEALANT

DESCRIPTION

408.01 This work consists of furnishing and placing an approved hot poured joint and crack sealant in properly prepared cracks in asphalt pavements. Cracks with a width greater than 1/8 inch and less than 1 inch are to be filled with this material.

MATERIALS

408.02 Materials for hot poured joint and crack sealant shall meet the following requirements:

A. Hot Poured Joint Sealant (Minor Crack Repair)

- a. Hot poured material for filling joints and cracks shall conform to the requirements of ASTM D 6690, Type II. The concrete blocks used in the Bond Test shall be prepared in accordance with CP-L 4101.
- b. 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.
- c. 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.
- d. The sealant shall be listed in CDOT's Approved Products List prior to use.

Using a mixture of different manufacturers' brands or different types of sealant is prohibited.

B. HMA (Major Crack Repair & Full Depth Pavement Repair)

- a. All HMA material used in Major Crack Repair or Full Depth Pavement Repair shall adhere to the requirements of Pikes Peak Region Asphalt Paving Specifications.

C. Stress Absorbing Membrane (Minor and Major Crack Repair)

- a. The pavement stress membrane used in Minor and Major Crack Repair shall be Paveprep as manufactured by Crafcoc, Inc. or approved equal.

CONSTRUCTION REQUIREMENTS

408.03 Immediately before applying hot poured joint and crack sealant, the cracks shall be cleaned of loose and foreign matter to a depth approximately twice the crack width. Cleaning shall be performed using a hot compressed air lance. This lance shall be used to dry and warm the adjacent asphalt immediately prior to sealing. Direct flame dryers shall not be used.

These Cracks shall be filled with hot poured joint and crack sealant flush with the pavement surface. Immediately following the filling of the crack, excess sealant shall be leveled off at the wearing surface by squeegee, a shoe attached to the applicator wand, or other suitable means approved by the Engineer. The

squeegeed material shall be centered on the cracks and shall not exceed 3 inches in width or 1/16 inch in depth.

The sealant material shall be heated and applied according to the manufacturer's recommendations. The equipment for heating the material shall be an indirect heating type double boiler using oil or other heat transfer medium and shall be capable of constant agitation. The heating equipment shall be capable of controlling the sealant material temperature within the manufacturer's recommended temperature range and shall be equipped with a calibrated thermometer capable of ±5 °F accuracy from 200 to 600 °F. This thermometer shall be located so the Engineer can safely check the temperature of the sealant material. Overheating of the sealant material will not be permitted.

The face of the crack shall be surface dry and the air and pavement temperatures shall both be at least 40 °F and rising at the time of sealant application.

Sealant material picked up or pulled out after being placed shall be replaced at the Contractor's expense. The Contractor shall have blotter material available on the project in the event it is required to prevent tracking or pulling. If required, blotter material shall be approved by the Engineer and placed at the Contractor's expense.

METHOD OF MEASUREMENT

408.04 The quantity for Minor Crack Repair (¼ -Inch to 1½ -Inch) shall be measured by the actual number of linear feet of crack repair completed and accepted by the Engineer.

The quantity for Major Crack Repair (Greater than 1½ -Inch) shall be measured by the actual number of linear feet of crack repair completed and accepted by the Engineer.

The quantity for Full Depth Pavement Repair shall be measured by the square yard of repair completed and accepted by the Engineer.

BASIS OF PAYMENT

408.05 The accepted quantities for Minor Crack Repair (¼-Inch to 1½-Inch) will be paid for at the contract unit price per liner foot. This price shall be full compensation for furnishing all materials, labor, equipment, tools and any other work necessary to complete the item.

The accepted quantities for Major Crack Repair (Greater than 1½-Inch) will be paid for at the contract unit price per liner foot. This price shall be full compensation for furnishing all materials, labor, equipment, tools and any other work necessary to complete the item.

The accepted quantities for Full Depth Pavement Repair will be paid for at the contract unit price per square yard. This price shall be full compensation for furnishing any materials, labor, equipment, tools including but not limited to removal of existing pavement (below the required planed depth as shown on the plans), new HMA (to the depth of the surrounding planed surface), , and any other work necessary to complete the item.

Payment will be made under:

Pay Item	Pay Unit
408.05-1 Minor Crack Repair (¼ -Inch to 1½ -Inch)	Linear Foot
408.05-2 Major Crack Repair (Greater than 1½ -Inch)	Linear Foot
408.05-3 Full Depth Pavement Repair	Square Yard

All materials, equipment, and costs incidental to the preparation of the surface prior to application of the hot poured joint and crack sealant will not be paid for separately, but shall be included in the work.

SECTION 609 CURB AND GUTTER

DESCRIPTION

609.01 This work consists of the construction of curb, gutter or combination curb and gutter in accordance with these specifications and in conformity with the lines and grades shown on the plans or established.

The type of curb is Type 2 Cast-in-Place Concrete Curb. The section will be as shown on the plans.

MATERIALS

609.02 Except as provided below the materials used shall meet the following requirements:

A. Bed Course Material.

- (a) Bed course material for sidewalks, curbing, and bikeways shall consist of cinders, sand, slag, gravel, crushed stone, or other approved material of such gradation that all particles shall pass through a sieve having 19.0 mm (¾ inch) square openings.
- (b) Bed course material for slope protection, or riprap filter blanket shall be a porous, free draining material consisting of sand, gravel, cinders, slag, crushed stone, or other approved free draining material. This material shall meet the following gradation requirements:

Sieve Size	Mass Percent Passing Square Mesh Sieves
75 mm (3 inch)	100
4.75 mm (No. 4)	20-65
75 µm (No. 200)	0-10

B. Joint Filler.

- (a) Joint Sealant with Backer Rod. The joint sealant material shall be a silicone that is on the Department's Approved Products List. The silicone materials shall be stored and applied in accordance with manufacturer's recommendations, but they shall not be exposed to ambient temperatures in excess of 125 °F or stored in direct sunlight. The backer rod placed prior to joint sealant shall be constructed of closed cell polyethylene strand as approved.
- (b) Preformed Joint Fillers. Preformed fillers for joints shall conform to the requirements of AASHTO M 213 and shall be punched to admit the dowels where called for on the plans. The filler for each joint shall be furnished in a single piece for the full depth and thickness required for the joint unless otherwise authorized by the Engineer. When the use of more than one piece is authorized for a joint, the abutting ends shall be fastened securely, and held accurately to shape, by stapling or other positive fastening satisfactory to the Engineer.

C. Reinforcing Steel. Reinforcing steel shall conform to the requirements of the following specifications:

Deformed and Plain Billet-Steel Bars for Concrete Reinforcement	ASTM A 615
Axle-steel Deformed and Plain Bars for Concrete Reinforcement	ASTM A 996
Low-Alloy Steel Deformed Bars for Concrete Reinforcement [to be Welded]	ASTM A 706
Fabricated Deformed Steel Bar Mats for Concrete Reinforcement	ASTM A 184
Steel Welded Wire Fabric, Plain for Concrete Reinforcement	AASHTO M 55
Steel Welded Wire Fabric, Deformed for Concrete Reinforcement	AASHTO M 221
Epoxy Coated Reinforcing Bars	AASHTO M 284

Unless otherwise designated, bars conforming to ASTM A 615 & ASTM A 996 shall be furnished in

Grade 60 for # 5 bars and larger and Grade 40 or 60 for bars smaller than # 5.

Concrete for curb shall be Class B, and meet the requirements of Section 601.

Bituminous curb shall be constructed of the same gradation of aggregate and the same grade of bituminous material as the top layer or top course of bituminous pavement used on the project.

Concrete and bituminous mixes will be subject to inspection and tests at the plants for compliance with quality requirements.

CONSTRUCTION REQUIREMENTS

609.03 Cast-in-Place Concrete Curb. All required hand finishing shall be performed in conformance with subsection 601.12(a).

- (a) *Excavation.* Excavation and bedding shall conform to the following requirements:

Excavation shall be made to the required depth and to a width that will permit the installation and bracing of the *forms*. The foundation shall be shaped and compacted to a firm even surface conforming to the section shown on the plans or as staked. When the Engineer determines that material is uncompactable the material shall be removed and replaced in accordance with subsection 206.03.

- (b) *Forms.* Forms shall be of wood or metal, straight, free from warp and of such construction that there will be no interference to the inspection of grade or alignment. All forms shall extend for the entire depth of the curb and shall be braced and secured sufficiently so that no deflection from alignment or grade will occur during the placing of the concrete.
- (c) *Mixing and Placing.* Concrete shall be proportioned, mixed and placed in accordance with the requirements for the class of concrete specified. Compaction of concrete curb, gutters or combination curb and gutter, placed in forms shall have thorough consolidation which shall be achieved by tamping and spading, vibrating or other acceptable methods. Forms shall be left in place until the concrete has set sufficiently so that they can be removed without injury to the curb. Upon removal of the forms, the exposed curb face shall be immediately finished to a uniform surface. For the purpose of matching adjacent concrete finishes or for other reasons, the Engineer shall approve methods of finishing. Plastering will not be permitted.
- (d) *Sections.* Curb shall be constructed in sections having a uniform length of 10 feet, unless otherwise ordered. Sections shall be separated by open joints 1/8 inch wide except at expansion joints.
- (e) *Expansion Joints.* Expansion joints shall be formed at the intervals shown on the plans using a 1/2 inch preformed expansion joint filler. When the curb is constructed adjacent to or on concrete pavement, expansion joints shall be located opposite the expansion joints in the pavement.

Expansion joints shall be installed between concrete curb and any fixed structure or bridge. Expansion joint material shall extend the full depth of contact surface.

- (f) *Curing.* Immediately upon completion of the finishing, the curb shall be moistened and kept moist for three days, or the curb shall be cured by the use of membrane forming curing compound. The method and details of curing shall be subject to the approval of the Engineer.
- (g) *Backfilling.* After the concrete has set sufficiently, the spaces in back of the curb shall be backfilled to the required elevation with suitable material which shall be thoroughly tamped.
- (h) *Curb Machine.* With the approval of the Engineer, the curb may be constructed by the use of a curb

forming machine.

- (i) *Surface Tolerance.* The Engineer may determine that the exposed surfaces of the concrete curb, gutters, or combination curb and gutter shall be tested with a 10 foot straightedge laid along the exposed surface in a longitudinal direction. The Contractor shall furnish an approved 10 foot straightedge and provide an operator to aid the Engineer in testing the exposed surfaces. All surfaces shall be measured in a longitudinal direction. Deviation of any exposed surface in excess of that specified shall be corrected at the Contractor's expense.

Longitudinal surface tolerances for the top and face are:

- (1) On tangent roadway alignments and curves with radius greater than 1000 feet: 0.25 inch from the edge of the straightedge.
- (2) On sharp vertical curves and horizontal curves with radius of 1000 feet or less: 0.25 inch from the edge of the straight edge with allowance made for curve deflection.

METHOD OF MEASUREMENT

609.06 Curb will be measured by linear foot along the front face of the section at the finished grade elevation. Gutter will be measured along centerline of the gutter. Curb and gutter will be measured along the face of the curb. Deduction in length will be made for drainage structures, such as catch basins, drop inlets, etc., installed in the curb, gutter, or curb and gutter.

BASIS OF PAYMENT

609.07 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, including dowels, expansion joint material, and the removal of the existing concrete curb and gutter. This price shall be full compensation for furnishing all materials, labor, equipment, tools and any other work necessary to complete the item.

Payment will be made under:

Pay Item	Pay Unit
609.07-1 Curb and Gutter, Type 2 (Section IB & IIB)	Linear Foot

Bed course material will not be measured and paid for separately but shall be included in the work.

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SECTION 625 CONSTRUCTION SURVEYING

DESCRIPTION

625.01 This work consists of the construction surveying, calculating, and staking necessary for the construction of all elements of the project. The work shall be done under the supervision of a Professional Land Surveyor (PLS) or Professional Engineer (PE) who is experienced and competent in road and bridge construction surveying and licensed in the State of Colorado.

Locating, preserving, referencing, installing and restoring land monuments such as Primary Control monuments from which the Right of way or any land boundary will be calculated, described or monumented, Public Land Survey System (PLSS) monuments, General Land Office (GLO) monuments, Bureau of Land Management (BLM) monuments, Mineral Survey (MS) monuments, Right of way (ROW) monuments, property boundary monuments, easement monuments, and other monuments that are required by law or regulation to be established by a PLS, and the determination of any land boundary, shall be done in accordance with Section 629, under the supervision of a Professional Land Surveyor (PLS) who is experienced and competent in Right of way and boundary surveying and licensed in the State of Colorado. The PLS or PE shall be available to review work, resolve problems, and make decisions in a timely manner. Unless specified otherwise in the Contract, all survey procedures shall be in conformance with the CDOT Survey Manual.

MATERIALS AND EQUIPMENT

625.02 The Contractor shall furnish all personnel, survey equipment, safety equipment, materials, and traffic control necessary to perform the required construction surveying and staking. All surveying equipment, including Electronic Distance Meters (EDM), total stations, theodolites, levels, rods, tapes, tripods, tribrachs, and Global Positioning System (GPS) receivers and equipment, shall be checked and calibrated in accordance with the CDOT Survey Manual, Chapter 6, Section 6.1.10, and documented in the survey records prior to the start of work and every six months thereafter.

EDM and total stations shall be checked and calibrated on a National Oceanic and Atmospheric Administration/National Geodetic Survey (NOAA/NGS) calibrated baseline in accordance with the CDOT Survey Manual, Chapter 2, Section 2.1 and 2.2, and documented in the survey records prior to the start of work and every six months thereafter.

GPS receivers and equipment shall be checked and calibrated on a NOAA/NGS calibrated baseline in accordance with the CDOT Survey Manual Chapter 3, Section 3.3, and documented in the survey records prior to the start of work and every six months thereafter.

Levels shall be checked and calibrated in accordance with the CDOT Survey Manual, Chapter 6, Section 6.4.5, and Chapter 5, Section 5.9.12, and documented in the survey records prior to the start of any level circuit.

If any survey equipment is found to be functioning outside the manufacturer's specified tolerance, certification from an approved repair facility showing that the instruments have been repaired, properly adjusted, or both if necessary shall be included in the survey records and submitted to the Engineer before being used.

Traffic control shall be in accordance with Section 630.

CONSTRUCTION REQUIREMENTS

625.03 General. The Department will establish Primary horizontal and vertical control for the project. All

available information defining the extent of that control is provided on the plans in accordance with the CDOT Survey Manual Chapter 6, Section 6.1.11 and 6.1.16, or is available from the Engineer.

A Presurvey Conference – Construction Survey shall be held in accordance with the CDOT Survey Manual Chapter 6, Section 6.1.6, prior to performing any surveying work under this section. The Engineer, Region Survey Coordinator (or designee), Contractor's Superintendent, Contractor's Surveyor (PLS or PE) and Party Chief shall attend. A Presurvey Conference – Construction Survey Form shall be included in accordance with the CDOT Survey Manual Chapter 6, Appendix 6.A.4. A surveying work schedule shall be submitted to the Engineer for review prior to the conference.

625.04 Contractor Surveying. The Contractor shall perform all construction surveying and staking necessary for construction of the project. Construction surveying and staking shall be based on the Primary Horizontal and Vertical Control established by the Department. Bid items which require stakes to be set by the Contractor's Surveyor are shown on the Surveyor Tabulation Sheet of the plans and shall be in accordance with the CDOT Survey Manual Chapter 6.

The Contractor shall check all Airport established Primary horizontal and vertical control points in accordance with the CDOT Survey manual Chapter 6, Section 6.1.13, and verify and document in the survey records their horizontal accuracy tolerance in accordance with the CDOT Survey Manual Chapter 5, Section 5.5, and their vertical accuracy tolerance in accordance with the CDOT Survey Manual Chapter 6, Section 6.4.3 and Chapter 5, Section 5.8.6, for a CDOT Class A - Primary Survey prior to using them for construction surveying control.

625.05 Staking. Acceptable staking placement intervals for the various construction survey items are described in the CDOT Survey Manual Chapter 6. Staking placement intervals specified on the Survey Tabulation Sheet have precedence over those in the CDOT Survey Manual. Stationing shall be established in the field on centerline or an approved offset.

625.06 Accuracy and Tolerances. Horizontal and vertical accuracy tolerances for Secondary Control surveys and monuments, and for each construction item being staked shall be as specified in the Contract or in the CDOT Survey Manual Chapter 6. If a discrepancy should occur, the higher degree of accuracy or the more restrictive tolerance shall apply.

Horizontal accuracy tolerances for Primary Control surveys and monuments shall be as specified in the CDOT Survey Manual Chapter 5, Section 5.5. Vertical accuracy tolerances for Primary Control surveys and monuments shall be as specified in the CDOT Survey Manual Chapter 6, Section 6.4, and Chapter 5, Section 5.8.6.

Horizontal accuracy tolerances for Secondary Control surveys and monuments shall be as specified in the CDOT Survey Manual Chapter 6, Section 6.2.4. Vertical accuracy tolerances for Secondary control surveys, monuments, and/or Secondary benchmarks shall be as specified in the CDOT Survey Manual Chapter 6, Section 6.2.7.

625.07 Responsibility and Inspection. Supervision and coordination of construction surveying and staking is the Contractor's responsibility. The Engineer may inspect the Contractor's surveying; however such inspection will not relieve the Contractor of any responsibility for accuracy or completeness of work. The Contractor shall check the work to verify the accuracy and include documentation of this check in the Survey Records. All Contractor surveying inaccuracies, errors, or omissions shall be corrected at the Contractor's expense. Engineer's inspection or the Contractor's corrections shall not entitle the Contractor to additional payment or contract time extension.

625.08 Reset Monuments and Stakes. Primary and Secondary Control monuments, benchmarks, and other significant stakes that are damaged, destroyed, or made inaccessible by the progress of construction shall be replaced, transferred or re-established at the Contractor's expense in accordance with the CDOT

Survey Manual Chapter 6, Section 6.2.

A supplemental or amended Project Control Diagram shall be submitted to the Engineer and the Region Survey Coordinator for any replaced, transferred or reestablished Primary Control monuments in accordance with the CDOT Survey Manual Chapter 6, Section 6.2.3.

Locating, preserving, referencing, installing and restoring land monuments such as Primary Control monuments from which the Right of way or any land boundary will be calculated, described or monumented, PLSS monuments, GLO monuments, BLM monuments, MS monuments, ROW monuments, property boundary monuments, easement monuments, and other monuments that are required by law or regulation to be established by a PLS, shall be done in accordance with Section 629, under the supervision of a PLS who is experienced and competent in Right of way and boundary surveying and licensed in the State of Colorado.

625.09 Changes. All changes in lines and grades required by field conditions and all discrepancies in grades, alignment, location or dimensions detected by the Contractor shall be immediately submitted to the Engineer in writing. No changes in given data or plans will be allowed unless approved by the Engineer in writing. All changes shall be documented in the survey records.

625.10 Pay Quantities Measurements. The Engineer will perform all interim and final measurements deemed necessary by the Department to determine contract pay quantities. The Contractor shall establish and maintain Primary and Secondary Control points and stationing as required for these measurements.

625.11 Survey Records. Survey records shall be completed as the work is done. Field survey notes for construction surveying and checking by the Contractor shall be recorded in survey records in conformance with the format given in the CDOT Survey Manual Chapter 6, Section 6.1.15. Survey fieldbooks shall be indexed in accordance with the Survey Manual Chapter 2, Section 2.4.14.

All survey records generated shall be the property of the Department and shall be available to the Engineer for inspection or reproduction at all times. All survey records shall be transmitted to the Engineer for inclusion into the project records before final project acceptance. All survey records shall be stamped with the seal of, and signed by, the responsible PLS or PE identified in subsection 625.01.

If an electronic format is used it shall contain the same information and format as required in the Survey Manual Chapter 6, Section 6.1.15, for written documentation, a printout shall be signed and sealed by the PLS or PE in responsible charge identified in subsection 625.01, and shall be submitted to the Engineer on a CD ROM compact disc, or other acceptable medium which contains the stakeout data and the raw data from the actual placement of stakes.

Initial staking for major structures (overhead signs, concrete box culverts, bridges, and all other structures assigned a structure number) shall be done in accordance with the CDOT Survey Manual Chapter 6, Section 6.9, from two independent setups. An independent check shall be made by the Contractor and shown in the survey records for all bridge structures.

METHOD OF MEASUREMENT

625.12 Construction surveying will not be measured but will be paid for on a lump sum basis.

BASIS OF PAYMENT

625.13 Payment for construction surveying will be the contract lump sum bid and will be full compensation for all surveying work necessary to complete the project as shown on the plans, to include all resetting of stakes, marks, monuments Secondary and Primary Control points, and preparing supplemental or amended Project Control Diagrams.

Construction surveying required by plan force account or by additional work beyond the scope of the original Contract will be paid for at a negotiated rate not to exceed the rate established in Section 105. That rate shall also apply to reductions in construction surveying as impacted by reductions or deletions to the original contract work. Any survey work not performed to the contract requirements shall be subject to price reduction or rejection.

Partial payment for construction surveying, as determined by the Engineer, will be made as the work progresses. The Contractor shall submit a schedule of estimated contractor construction surveying time as required on the Survey Tabulation Sheet before the first partial payment is made. Copies of the Survey Records for all completed survey work shall be submitted to the Engineer prior to payment of the monthly estimate.

Before final payment is made, the following two items shall be completed, bear the seal and signature of the responsible PLS or PE identified in subsection 625.01, and have copies submitted to the Engineer for review:

- (1) All survey records
- (2) Supplemental or amended Project Control Diagram (a copy of which shall be submitted to the Region Survey Coordinator) Payment will be made under:

Pay Item	Pay Unit
625.13-1 Construction Surveying	Lump Sum

Traffic control for construction surveying will not be measured and paid for separately, but shall be included in the work under item 650.05-1.

SECTION 626 MOBILIZATION

DESCRIPTION

This work consists of the mobilization of personnel, equipment and supplies at the project site in preparation for work on the project. This item shall also include the establishment of the Contractor's offices, buildings and other necessary facilities, and all other costs incurred or labor and operations which must be performed prior to beginning the other items under the Contract.

BASIS OF PAYMENT

Partial payments for mobilization will be made once each month as the work progresses. These partial payments will be made as follows:

When 5 percent of the original contract amount is earned, 25 percent of the amount bid for mobilization, or 2½ percent of the original contract amount, whichever is less, will be paid.

When 10 percent of the original contract amount is earned, 50 percent of the amount bid for mobilization, or 5 percent of the original contract amount, whichever is less, will be paid.

When 25 percent of the original contract amount is earned, 60 percent of the amount bid for mobilization, or 6 percent of the original contract amount, whichever is less, will be paid.

When 50 percent of the original contract amount is earned, 100 percent of the amount bid for mobilization, or 10 percent of the original contract amount, whichever is less, will be paid.

Upon completion of all work on the project, payment on any amount bid for mobilization in excess of 10 percent of the original contract amount, will be paid.

The total sum of all payments shall not exceed the original contract amount bid for the item, regardless of the fact that the Contractor may have, for any reason, shut down the work on the project or moved equipment away from the project and then back again.

For the purpose of this Section the term "original contract amount" as used above shall mean the amount bid for the construction items in the Contract not including the amount bid for mobilization. Payments for materials on hand, as described in subsection 109.07, will not be included as a percent of original contract amount earned until said materials on hand have been incorporated into the work and accepted and paid for as contract items.

These payments shall be independent of partial payments as defined in subsection 109.06. Payment will be full compensation for all work necessary to complete the item.

Payment will be made under:

Pay Item	Pay Unit
626.01-1 Mobilization	Lump Sum

Nothing herein shall be construed to limit or preclude partial payments for other items as provided for by the Contract.

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SECTION 627 PAVEMENT MARKING

DESCRIPTION

627.01 This work consists of furnishing and applying pavement marking, and furnishing, installing, and removing temporary pavement marking in accordance with these specifications, the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), the Colorado supplement thereto, and in conformity to the lines, dimensions, patterns, locations and details shown on the plans or established.

MATERIALS

627.02 Materials shall conform to the requirements of the following subsections:

A. Paint

Pavement Marking Materials. Pavement marking materials shall be selected from the Department's Approved Products List (APL). Prior to start of work, a Certified Test Report (CTR) for all pavement marking materials shall be submitted in accordance with subsection 106.13.

For white paint, 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. For yellow paint, the Federal Standard 595B shall be used to designate colors and the ASTM E308 shall be used to quantitatively define colors. After drying, the yellow paint shall visually match Federal Standard 595B color chip number 33538, and shall be within 6 percent of central color, PR-1 Chart, where $x = 0.5007$ and $y = 0.4555$ (The four pairs of chromaticity coordinates determine the acceptable color in terms of the CIE 1931 Standard Colorimetric System measured with Standard Illuminant D65.) The Contractor shall submit the exact formulation of the paint for approval by the Engineer. The paint shall not be used until written approval has been received from the Engineer.

- (a) Acrylic Waterborne Paint. Acrylic waterborne paint shall be a lead-free, 100 percent Acrylic resin polymer waterborne product. The finished product shall maintain its consistency during application at temperatures compatible with conventional equipment.

Waterborne paint shall meet all of the following requirements:

Performance Requirements: The paint shall be water resistant and shall show no softening, blistering or loss in gloss.

**Table 708-1
ACRYLIC WATERBORNE PAINT**

Property	Minimum	Maximum	Test Method
Composition Requirements			
Nonvolatile portion of vehicle (white and yellow),	43.0		FTMS 141C - Method 4031 or Method
Pigment Composition			
(white and yellow), % by weight ◆	58.0	62.0	ASTM D 4451 ASTM D 3723
White Paint			
Titanium Dioxide	80		ASTM D 476, Type III
Total Carbonate,%	94		ASTM D 1199, Type GC
Yellow Paint			
Titanium Dioxide	80		ASTM D 476, Type III
Total Carbonate,%	94		ASTM D 1199, Type GC
Organic Yellow Pigments,%	5.0		
Yellow Iron Oxide, %	83		ASTM D 768
Properties of the Finished			
Total Non-volatiles, (solids) % by weight			
White Paint, %	77.0		FTMS 141C - Method
Yellow Paint, %	76.0		ASTM D 2369, or ASTM D 4758
Density, lbs/gal ■			
White Paint	14.0		ASTM D 1475 using U.S. Standard weight per gallon cup as defined in U.S. Military Standard 4566A
Yellow Paint	13.7		
Consistency (Viscosity) White and Yellow, Krebs-	85	95	ASTM D 562
Freeze Thaw Stability	Shall complete 5 or more test cycles		ASTM D 2243
Fineness of Grind, Cleanliness Rating B	3		ASTM D 1210
Hydrogen ion content: pH	9.6		ASTM E 70
Directional Reflectance: [15 mil Wet Film]			
	85		ASTM E 1347
Yellow, dried	50		
Dry Opacity (Contrast Ratio): [15 mil Wet Film]			
White Paint	0.95		ASTM D 2805
Yellow Paint	0.88		
◆ Percent by weight shall include percent of organic yellow pigment.			
■ Density shall not vary more than 0.3 lbs/gal between batches.			

B. Glass Beads.

Glass Beads for Traffic Markings. Glass beads for Traffic Paint shall conform to AASHTO M 247, Type I, nonflotation grade.

Glass beads shall be furnished in fully identified containers and shall be free of extraneous material or clumps.

Glass beads used for any type of pavement marking shall not contain more than 75 parts per million (ppm) Arsenic, 75 ppm Antimony and 100 ppm Lead.

CONSTRUCTION REQUIREMENTS

627.03 General. All pavement markings shall be placed in accordance with the following requirements. When the term "full compliance" is used, it means the pavement markings shall meet the requirements of Standard Plan S-627-1.

- (a) **Pavement Marking Plan.** When pavement marking location details are not provided in the Contract, the Contractor shall submit a layout of existing conditions to the Engineer for approval or modification. This layout is to be used as the final pavement marking plan.
- (b) **Roadways Closed to Traffic During Construction.** Full-compliance final markings shall be in place prior to opening the roadway to traffic.

Pavement markings on detour routes shall be full-compliance markings.

- (c) **Roadways Constructed Under Traffic.** Full compliance final pavement markings shall be placed within four weeks after prime coat markings are placed on the final surfacing. Full compliance pavement markings shall also be placed on any roadways opened to traffic when the project pavement work is discontinued for more than two weeks.
- (d) **Temporary Pavement Markings.** Temporary pavement markings and control points for the installation of those pavement markings for roadways that are being constructed under traffic shall be installed as follows:

- 1. When one roadway of a normally physically divided highway is closed, and a crossover is constructed, full-compliance pavement markings shall be placed along the tapers and through the median crossovers to the two-way traffic section. Pavement markings through the two-way traffic section shall be as shown on the plans.

All temporary paved roadways shall have full-compliance center line, lane line, and edge line markings before they are open for traffic.

Upon removal, markings applied to a final surface shall not leave a scar that conflicts with permanent markings.

- 2. The following criteria apply to all construction on roadways open to traffic other than (d)1. above:

Full-compliance center line, lane line, and edge line temporary markings shall be in place at the end of each work day.

No-passing zone restrictions shall be identified by full-compliance no-passing zone markings. No-passing zone markings shall be in place daily.

Temporary pavement stencils (SCHOOL, RR xing, etc) are not required unless specified in the plans.

Temporary pavement markings shall be installed according to the manufacturer's recommendations in such a way that the markings adequately follow the desired alignment.

3. Control Points consisting of 4 inch by 1 foot marks at 40-foot intervals may be placed as guide markers for the installation of temporary or final pavement markings. Raised flexible pavement markers may be substituted for these marks. Control points shall not be used as a substitute for any required marking.
4. Prime Coat Markings: Prime coat markings shall be installed prior to full-compliance final pavement markings.

627.04 Pavement Marking with Waterborne Paint. Striping shall be applied when the air and pavement temperatures are no less than 45 °F for waterborne paint on asphalt or portland cement concrete pavements. The pavement surface shall be dry and clean. Surface cleaning shall be required when there is deicing material on the road. Weather conditions shall be conducive to satisfactory results.

The Contractor shall utilize equipment that meets the following requirements, as approved:

- (1) Equipment shall permit traffic to pass safely within the limits of the roadway surface and shoulder while operating.
- (2) Equipment shall be designed for placement of both solid and broken line stripes with a reasonably clean-edged stripe of the width and location as shown on the contract and no overspray on the road surface.
- (3) Equipment shall have a glass bead dispenser directly behind, synchronized with the paint applicator. Each applicator shall have individual control and automatic skip control that will paint a strip with a gap as shown in the contract.
- (4) The equipment may be equipped with a heat exchanger to heat the paint to reduce drying time.
- (5) The operation shall include a trailing vehicle equipped with a flashing arrow board.

The Contractor shall prevent traffic from crossing a wet stripe. Stripes which have been marred or picked up by traffic before they have dried shall be repaired at the Contractor's expense. Removal of paint from vehicles that crossed wet paint shall be at the Contractor's expense.

The water-based paint and stripes shall fall within the following minimum and maximum ranges:

	Description	Minimum	Maximum
Alignment	Lateral Deviation	N/A	2.0 inch per 200 ft
Paint	Coverage rate per gallon of paint	100 sq. ft	110 sq. ft
	Thickness	15 mil	N/A
	Width of painted lines	4 inch	N/A
	Width Variance	N/A	1/4 inch
Water-Based Paint	Dry time to no tracking conditions	N/A	90 seconds
Beads	Application rate per gallon of paint	5 lbs 3 oz	6 lbs 3 oz

Prime coat pavement marking shall be installed at half the application rate of the full rate listed in the table above. Glass beads shall not be applied to prime coat markings.

Equipment shall have a bead dispenser directly behind, synchronized with the paint applicator and shall be capable of painting a clean-edged stripe of the designated width $\pm \frac{1}{4}$ inch with no overspray on the road surface. For centerlines and lane lines, an automatic skip control shall be used. Machines having multiple applicators shall be used for centerlines with "no passing zones." In areas where machines are not practical, suitable hand-operated equipment shall be used as directed by the Engineer. Stripes shall be protected until dry.

METHOD OF MEASUREMENT

627.12 The types of pavement marking described herein will be measured by the following units, complete in place and accepted.

Pavement marking paint will be measured by the square foot including glass beads. Material used in excess of coverage limit prescribed will not be measured.

Prime coat pavement marking paint will be measured by the square foot. Material used in excess of coverage limit prescribed will not be measured.

Temporary pavement markings will not be measured and paid for separately but shall be included in the work under item 650.05-1.

BASIS OF PAYMENT

627.13 The accepted quantities will be paid for at the contract price per square foot. This price shall include all materials, labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Pay Item	Pay Unit
627.13-1 Pavement Marking Prime Coat	Square Foot
627.13-2 Pavement Marking Paint (Waterborne)	Square Foot

Control points and Contractor pavement marking plans will not be measured and paid for separately, but shall be included in the work.

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650 TEMPORARY CONSTRUCTION ITEMS

DESCRIPTION

650.01 This item consists of furnishing all labor, materials and equipment for temporary construction items necessary for the safe and proper execution of work and not otherwise included in other contract bid items. The Contractor will be expected to supply and utilize the items listed below and other items contained in the plans and specifications. Temporary construction items to be provided include, but are not limited to the following: all necessary traffic control and erosion control measures.

MATERIALS

650.01 TRAFFIC CONTROL. Traffic control materials shall be in accordance with CDOT Specification Section 713 *TRAFFIC CONTROL MATERIALS*.

650.02 EROSION CONTROL. Erosion control materials shall consist of curb inlet protection and shall be in accordance with the project plans.

CONSTRUCTION METHODS

650.03 TRAFFIC CONTROL. All traffic control measures shall meet the requirements of the Manual on Uniform Traffic Control Devices (MUTCD, 2009) and the MUTCD supplement for the City of Colorado Springs. A traffic control plan must be submitted to COS for approval prior to beginning any work.

650.034 EROSION CONTROL. Curb inlet protection shall be placed around each curb inlet near or adjacent to the project work area in accordance with the erosion control plan and shall remain in place until completion of work. Curb inlet protection shall be maintained throughout the duration of the contract.

METHOD OF MEASUREMENT

650.04.1 No direct measurement will be made for this item. Payment will be made on a lump sum basis.

BASIS OF PAYMENT

650.05.1 Payment will be made at the lump sum bid price for "Temporary Construction Items." This payment shall be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary for temporary items required for construction of this work.

Payment for these items will be made in installments. The first payment of 10 percent of the lump sum price will be included in the first progress estimate following the initiation of construction work. The remaining 90 percent of the lump sum price will be included as installments in subsequent progress estimates. Each such installment will be determined based on the ratio of the total work completed to date of the total contract amount.

Payment will be made under:

Pay Item	Pay Unit
650.05-1 Temporary Construction Items	Lump Sum.

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