

STANDARD SPECIFICATIONS

All work required for the project shall be in accordance with the latest edition of the COLORADO DEPARTMENT OF TRANSPORTATION (CDOT) Standard Specifications for Road and Bridge Construction, the CDOT M&S Standards, the Town of Castle Rock Public Works Regulations, and the Town of Castle Rock Details Plans List.

STANDARD SPECIAL PROVISIONS

All changes to the CDOT Standard Specifications for Road and Bridge Construction, to include revisions, additions, deletions, terms and definitions, are contained in the Special Provisions. All bids and all construction shall be in accordance with the Special Provisions.

**DIVISION 100
GENERAL PROVISIONS**

**SECTION 101
DEFINITIONS AND TERMS**

101.36 **Holidays.** Replace Subsection 101.36 with the following:

Holidays recognized by the Town of Castle Rock are:

New Year's Day

Martin Luther King Jr. Day

Presidents' Day

Memorial Day

Independence Day

Labor Day

Veterans Day

Thanksgiving Day

Christmas Day

When New Year's Day, Independence Day, or Christmas Day falls on a Sunday, the following Monday shall be considered a holiday. When one of these days falls on a Saturday, the preceding Friday shall be considered a holiday.

**SECTION 104
SCOPE OF WORK**

104.04 **Maintaining Traffic.** Replace paragraph three in Subsection 104.04 with the following:

Portions of the roadway that are not included in the contract work will be maintained by the Town of Castle Rock. Snow removal within the contract work limits will be the responsibility of the Contractor. The Contractor shall be responsible for maintaining all work that is included in the Contract, and maintaining approaches, crossings, intersections, and other features as may be necessary to accommodate traffic without direct compensation, except as provided in the Contract or described in (a) and (b) below.

104.04 **Maintaining Traffic.** Add the following to Subsection 104.04:

The Contractor shall be responsible for maintaining access to all residences and businesses along the Project areas during construction. Lane widths during construction shall not be less than 10 feet, and a minimum clearance of two (2) feet shall be maintained between traffic and the construction work zone.

The Contractor will not be permitted to have construction equipment or materials in the lane(s) open to traffic at any time unless permitted by the Director.

The Contractor is cautioned that all personal vehicle and construction equipment parking will be prohibited where it conflicts with safety, access, or the flow of traffic.

**SECTION 105
CONTROL OF WORK**

- 105.02 Plans, Shop Drawings, Working Drawings, Other submittals, and Construction Drawings.** Replace Subsection 105.02(b)4. with the following:
- Unless otherwise specified, three (3) sets of shop drawings, and other submittals shall be submitted to the Engineer. One additional set of shop drawings shall be submitted for each railroad company.
- 105.03 Conformity to the Contract.** Change the first sentence of the seventh paragraph of Subsection 105.03 as follows:
- Materials may be sampled and tested at the discretion of the Town in accordance with the CDOT Field Materials Manual.
- 105.90 Coordination of Plans, Specifications, Supplemental Specifications, and Special Provisions.** Add the following to Subsection 105.09:
- (e) General Conditions
- 105.10 Cooperation by Contractor.** Replace the first paragraph of Subsection 105.10 with the following:
- The Contractor will be supplied with three sets of contract documents and electronic files in portable document format (pdf).
- 105.10 Cooperation by Contractor.** Add the following to Subsection 105.10:
- Not furnishing a FULL-TIME competent superintendence will be grounds for suspension of the Project until such superintendence is furnished by the Contractor. **CONTRACT TIME WILL CONTINUE IN THE EVENT OF A WORK SUSPENSION CAUSED BY LACK OF FURNISHING FULL-TIME PROJECT SUPERINTENDENCE SATISFACTORY TO THE TOWN.**
- 105.11 Cooperation with Utilities.** Add the following to Subsection 105.11:
- The locations of all utilities shown on the Project plans should be considered approximate. It is therefore the responsibility of the Contractor to notify the appropriate utility and/or utility locating service to obtain more precise locations. No compensation will be made to the Contractor for any damage, delay or additional cost incurred as a result of failure to obtain utility locations.
- Utilities which are adjusted, removed, or reset for the construction convenience of the Contractor and which would not conflict with the line or grade of the proposed Project works shall be done at the Contractor's expense. This shall include, but not be limited to, sewer service lines, water service lines, telephone, gas and electrical lines.
- 105.125 Protection of Survey Markers.** (Added Subsection)
- (a) *Permanent Survey Markers.* The Contractor shall notify the Director not less than seven (7) days prior to starting work in the vicinity of permanent survey monuments in order that the Director may take necessary measures to insure their preservation. The Contractor shall bear the expense of replacing any that may be disturbed without permission. Replacement shall be done by a registered land surveyor at no expense to the Owner.
- When a change is made in the finished elevation of the pavement of any roadway in which a permanent survey monument is located, the monument cover or box shall be adjusted to the new grade.
- (b) *Lot Stakes.* Unless otherwise directed by the Director or shown in the plans, the Contractor shall preserve existing survey stakes that mark property lines and corners. Any stakes that become lost or disturbed by its operations shall be replaced, at the Contractor's expense, by a registered land surveyor, in accordance with Section 629. Any lot corners marked on sidewalks that are

designated for removal by the Contract Documents or the Director are not the responsibility of the Contractor for replacement.

105.16 Inspection and Testing of Work. Add the following to Subsection 105.16:

The Public Works Department will provide all inspections during construction. The Inspector will oversee the materials testing. The Contractor shall keep the Inspector informed of future construction operations to facilitate scheduling of required inspection. The Contractor shall notify the Inspector 24 hours in advance of starting any construction operation that will require inspection. Failure of the Contractor to provide such notice shall relieve the Owner from any responsibility for extra costs or delays caused by such failure.

Inspection of the work or materials by the Owner shall not relieve the Contractor of the obligation to fulfill the requirements of the Contract. Work and materials not meeting such requirements shall be made good, and unsuitable work or materials may be rejected, notwithstanding that such work or materials have been previously inspected by the Owner or that payment thereof has been included in a progress estimate.

Inspection and acceptance of work pertaining to utilities not owned by the Town shall be made by a representative of the specific utility owner. The Contractor shall notify the owning utility prior to commencing any work so that a representative may be made available to approve the work to be performed.

105.21 Acceptance. Add the following to Subsection 105.21(a):

The one-year guarantee period for the portion or unit of the Project partially accepted will not begin until Final Acceptance of the entire Project unless otherwise agreed to by the Director.

105.22 Dispute Resolution. Change Subsection 105.22 as follows:

All references to CDOT in Subsection 105.22 shall mean the Town of Castle Rock.

All references to Project Engineer in Subsection 105.22 shall mean the Project Manager.

All references to Resident Engineer in Subsection 105.22 shall mean the Engineering Manager.

105.22 Dispute Resolution. Replace the third paragraph in Subsection 105.22(d) with the following:

If these meetings do not result in a resolution or the participants mutually agree that they have reached an impasse, the Contractor may further pursue resolution of the dispute by providing written notice to the Director of the Public Works within seven days, according to Subsection 105.22(e).

105.22 Dispute Resolution. Add the following to Subsection 105.22:

(e) *Director of Public Works Review.* Within seven days after receipt of the Contractor's written notice to the Director of Public Works of unsatisfactory resolution of the dispute, the Project Manager, Engineering Manager, and Director of Public Works will meet with the Contractor to discuss the dispute. Meetings shall continue weekly for a period of up to 21 days and shall include a Contractor's representative with decision authority above the project level.

If these meetings result in resolution of the dispute, the resolution will be implemented in accordance with Subsections 108.08, 109.04, 109.05, or 109.10 and the dispute is resolved.

If these meeting do not result in a resolution or the participants mutually agree that they have reached an impasse, the Contractor may pursue resolution of the dispute by providing written notice to the Town Manager within seven days, according to Subsection 105.22(f).

105.22 Dispute Resolution. Add the following to Subsection 105.22:

(f) *Town Manager Review.* Within seven days after receipt of the Contractor's written notice to the Town Manager of unsatisfactory resolution of the dispute, the Director of Public Works and Town Manager will meet with the Contractor to discuss the dispute. Meetings shall continue weekly for a period up to 14 days and shall include a Contractor's representative with decision authority above the project level.

The Town Manager Review is the last administrative level of appeal.

If these meetings result in resolution of the dispute, the resolution will be implemented in accordance with Subsections 108.08, 109.04, 109.05, or 109.10 and the dispute is resolved.

If these meeting do not result in a resolution or the participants mutually agree that they have reached an impasse, the Contractor may file a claim in accordance with Subsection 105.24.

105.23 **Dispute Review Board.** Delete Subsection 105.23.

105.24 **Claims for Unresolved Disputes.** Change Subsection 105.24 as follows:

All references to CDOT in Subsection 105.24 shall mean the Town of Castle Rock.

All references to Project Engineer in Subsection 105.24 shall mean the Project Manager.

All references to Resident Engineer in Subsection 105.24 shall mean the Engineering Manager.

All references to Regional Transportation Director in Subsection 105.24 shall mean the Director of Public Works.

All references to Chief Engineer in Subsection 105.24 shall mean the Town Manager.

105.24 **Claims for Unresolved Disputes.** Replace the fifth paragraph of Subsection 105.24 with the following:

The venue for all unresolved disputes with an aggregate value \$15,000 or less shall be the County Court for the County of Douglas.

105.24 **Claims for Unresolved Disputes.** Replace the first sentence of Subsection 105.24(a) with the following:

Within 30 days after rejection of the Town Manager's recommendation issued in accordance with Subsection 105.22(f), the Contractor shall provide the director of Public Works with a written notice of intent to file a claim.

105.24 **Claims for Unresolved Disputes.** Delete Subsection 105.24(c).

105.24 **Claims for Unresolved Disputes.** Replace the third paragraph of Subsection 105.24(f) with the following:

If the Contractor selected litigation, then de novo litigation shall proceed in accordance with the Colorado Rules of Civil Procedure and the proper venue is the Colorado State District Court in and for the County of Douglas, unless both parties agree to the use of arbitration.

**SECTION 106
CONTROL OF MATERIAL**

106.03 **Samples, Tests, Cited Specifications.** Replace Subsection 106.03 as follows:

Materials sampling and testing shall be performed at the expense of the Contractor. The Contractor shall employ an independent materials testing company to sample and test the materials or the finished product in accordance with Section 720, Materials Sampling and Testing, of the Special Provisions. All materials sampling, testing and inspection shall be performed by certified field technicians who work under the supervision of a registered professional engineer in the State of Colorado. Acceptance will be based on the applicable requirements of Subsection 105. Any work in which untested and uninspected materials are used shall be performed at the Contractor's risk and may be considered as unacceptable and unauthorized work.

Field technicians shall furnish copies of failed test results to the Director promptly as the results become available. On a weekly basis, the Contractor shall furnish the Director with copies of all test results taken that week and a cover letter, signed by the supervising registered professional engineer, which summarizes the results and discusses any failed tests or inconsistencies.

Unless otherwise designated, all specifications, standards or policies referenced in Section 720 shall be the latest edition as revised or updated by approved supplements published and issued prior to the date of the advertisement for bids.

106.08 **Storage of Materials.** Add the following to Subsection 106.08:

The Contractor will not receive compensation for storage of topsoil or other materials generated onsite that are stored either onsite or offsite for later disposal or inclusion into the Work.

106.14 **Trade Names, Approved Equals, or Substitutes.** (Added Section)

In order to establish a basis of quality, certain processes, types of machinery and equipment, or kinds of materials may be specified either by description or process or by designating a manufacturer by name and referring to that brand or product designation or by specifying a kind of material. It is not the intent of the specifications to exclude other processes, equipment or materials of equal value, utility or merit.

Whenever a process is designated, or a manufacturer's name, brand or item designation is given, or whenever a process or material covered by patent is designated or described, it shall be understood that the words "or approved equal" follow such name, designation, or description, whether in fact they do so or not.

If it is desirable to furnish items of equipment by manufacturers other than those specified as a substitute after the Contract is executed, the Contractor shall secure approval prior to placing a purchase order or furnishing the same.

If the proposal includes a list of equipment, materials, or articles for which the Contractor must name the manufacturer at the time of submission of the bid, no substitutions therefore will be permitted after a proposal has been accepted without the express consent of the Owner.

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

107 **General.** Change section 107 as follows:

All references to Engineer in section 107 shall mean the Project Manager.

All references to Department in section 107 shall mean the Town of Castle Rock.

All references to CDOT in section 107 shall mean the Town of Castle Rock.

107.02 **Permits, Licenses and Taxes.** Replace Subsection 107.02 with the following:

The Contractor will obtain all licenses and permits required to do the Work. This refers to all permits required by the Town as well as those required by County, State and Federal Agencies. Permit fees are waived for Town permits.

Pursuant to 39-26-114, C.R.S. as amended, the Town of Castle Rock is exempt from paying sales or use taxes. Materials and equipment purchased solely for Town projects that will become a permanent part of the final Project are tax-exempt. Contractors must obtain their own tax-exempt number from the Colorado State Department of Revenue for each project. The Town will furnish its tax-exempt numbers for the Contractor to reference when applying for its own tax-exempt number.

107.12 **Protection and Restoration of Property and Landscape.** Add the following to Subsection 107.12:

Property pins, right-of-way markers and any other survey markers shall remain undisturbed until a method of preserving or perpetuating such markers is approved by Owner. Should any such markers be obliterated without obtaining said approval, the Contractor shall be assessed for any costs incurred in resurveying and resetting said markers.

107.15 **Responsibility for Damage Claims.** Add the following to Subsection 107.15:

Certificates of Insurance shall be attached to the executed Contract Documents and shall become a part of the Contract. These certificates shall include a provision that thirty (30) days prior to insurance cancellation, written notice shall be given to the Town.

Indemnification of Owner. Contractor hereby indemnifies and agrees to hold the Owner harmless for and on account of any act or omission in the completion and execution of the Project specified herein, which indemnification shall extend to and include any damage of whatever sort or description suffered by any person or entity and shall include compensatory, punitive or special damages. Contractor agrees to defend Owner hereunder, at Contractor's sole expense, and if he fails to do so, to thereafter indemnify Owner in addition to the above indemnification for all court costs and attorney's fees incurred in any defense required to be undertaken by the Owner.

107.18 **Contractor's Responsibility During Warranty.** (Added Subsection)

The Contractor shall, at his sole expense and cost, remedy any defects in the Work and pay for any damage to other work resulting there from which shall appear within a period of one (1) year from the date of final acceptance of work unless a longer period is specified. The Owner will give notice of defects with reasonable promptness upon their discovery. The Standard Specifications and Special Provisions of the original Contract shall apply to all warranty work.

**SECTION 108
PROSECUTION AND PROGRESS**

108 **General.** Change section 108 as follows:

All references to Engineer in section 108 shall mean the Project Manager.

108.02 **Notice to Proceed.** Replace the last sentence of Subsection 108.02 as follows:

The Contractor shall commence work within ten (10) calendar days of the date of the Notice to Proceed. Saturday work will be permitted with a minimum 48-hour notice and approval of the Project Manager.

108.05 **Limitation of Operations.** Add the following to Subsection 108.05:

Working hours under this Contract shall be between 7:00 a.m. and 5:00 p.m. The Contractor shall not operate or move equipment before 7:00 a.m. and shall schedule all Work operations to be completed before 5:00 p.m. Work after 5:00 p.m. will not be allowed except when required for circumstances beyond the Contractor's control and when approved by the Director. Work between 5:00 p.m. and 6:00 p.m. on more than two consecutive working days will be charged as one-half working day. Work after 6:00 p.m. on any day will be charged as one-half working day.

Contractor operations in lanes open to traffic are not allowed between the hours of 6:30 a.m. to 8:30 a.m. and 3:30 p.m. to 6:30 p.m. unless otherwise approved by the Director. These restrictions apply to temporary delays including ingress and egress of materials, etc.

108.08 **Determination and Extension of Contract Time.** Add the following to Subsection 108.08:

Written requests for extension of Contract time must be submitted prior to the Contract completion date as stated on the weekly statement. Written requests shall include but not be limited to daily time reports for labor, materials and equipment, interruption of a controlling or "critical path" bid item or process. The decision by the Owner of the term of any extension or denial thereof shall be final.

An extension of time for completion of the Work shall be the Contractor's sole remedy for delays in performing this Contract if such delay is caused, in whole or in part, by acts or omissions of the Town or its agents unless the Department accepts responsibility.

An extension of time for completion of the Work shall be the Contractor's remedy for delays in performing this Contract caused by the failure of a utility company or special district to relocate its facilities in a timely manner. Relief from failure of utility companies to fulfill their responsibilities is discussed in Section 105.06 of these Standard Specifications, and Special Provisions.

108.09 **Failure to Complete Work on Time.** Replace Subsection 108.09 as follows:

A daily charge will be made against the Contractor for each working day that any Work shall remain uncompleted after elapse of Contract Time. Completion date shall be defined as the date on the Notice of Construction Completion. This daily charge, determined by the original Contract amount for the Project from the Table below, will be deducted from any money due the Contractor. This deduction will not be considered a penalty but as liquidated damages.

The schedule of liquidated damages set forth below is an amount agreed to for purposes of this Contract by the Contractor and the Town as reasonably representing the additional costs incurred by the Town for its time, labor and expenses and for those damages and inconveniences suffered by the residents of the Town as a result of delay in completion of the Project.

Schedule of Liquidated Damages

Original Amount of Contract		Per Diem Amount Liquidated Damages
For More Than	Up to & Incl.	
\$ 0	\$ 100,000	\$ 500
100,000	500,000	750
500,000	1,000,000	1,000
1,000,000	2,000,000	1,750
2,000,000		2,400

Due account shall be taken of any adjustments of the Contract Time for completion of the Work granted under the provisions of Section 108.08.

Permitting the Contractor to continue and finish the Work or any part thereof after the Contract Time has elapsed shall not be construed as a waiver on the part of the Town of any of its rights under the Contract.

Any deduction assessed as liquidated damages under this Section shall not relieve the Contractor from liability for any damages or costs resulting from delays to other Contractors on the Project or other Projects caused by a failure of the assessed Contractor to complete the Work according to Contract Time.

**SECTION 109
MEASUREMENT AND PAYMENT**

- 109.04(c) Compensation for Changes and Force Account Work.** Change Subsection 109.04(c) as follows:
- Delete the formulas for Hourly Rate and Standby Rate (RR and SR respectively). Payment will be made on a flat rate for hourly and standby rental rates plus EOC. Hourly rate compensation will only be made for the actual hours the equipment is actually working on the Project.
- 109.04(f) Compensation for Changes and Force Account Work.** Add the following to Subsection 109.04(f):
- The Contractor and Director will compare records on a daily basis and mutually agree on the equipment and manpower hours and material incorporated into the extra and force account work.
- 109.04(h) Compensation for Changes and Force Account Work.** Add the following to Subsection 109.04(h):
- Time extension for force account work shall be allowed only if a controlling operation or critical path item of the Project is interrupted. Time extension requests shall meet the requirements of Sec. 108.08. Force account items shall be completed in a workmanlike manner so as not to cause undue delays.
- 109.06 Partial Payments.** Add the following to Subsection 109.06:
- At the time of the Preconstruction meeting, the Contractor shall submit to the Town a schedule of partial progress payments. This schedule will show the percentage of Work completed and the date and dollar amount of each anticipated progress payment.
- The Town will pay any monies due the Contractor as a result of a Request for Partial Payment within thirty (30) calendar days of receipt and approval of same.
- 109.06(a) Partial Payments.** Replace Subsection 109.06(a) as follows:
- Standard Amount Retained.* The Town will make a deduction from the progress estimate in the amount considered necessary to protect the interests of the Town, pursuant to Section 24-91-103, CRS. The amount to be retained will be 5 percent of the valued of the completed work. The withheld percentage of the contract price may be retained until the contract is completed satisfactorily and finally accepted by the Town of Castle Rock.
- At no time may the amount retained exceed 5 percent of the total Contract Price.
- 109.06(b) Partial Payments.** Replace Subsection 109.06(b) as follows:
- Securities in Lieu of Standard Amount Retained.* Securities are not acceptable to the Town in lieu of standard amount retained.
- 109.11 Final Guarantee.** (Added Subsection)
- All Work shall be and is guaranteed by the Contractor for a specified period of one (1) year from and after the date of **written** Final Acceptance as the Notice of Construction Completion of all Work by the Owner. All other current applicable state statutes shall apply.
- If within the guarantee period, repairs, changes, or replacements are required in connection with guaranteed work which, as determined by the Owner, is rendered necessary as the result of the use of materials, equipment or workmanship which are inferior, defective or not in accordance with the terms of the Contract, the Contractor shall, promptly upon receipt of notice from the Owner, and without expense to the Owner:
- (a) Place in satisfactory condition, in every particular, all of such guaranteed work, correct all defects therein, or proceed with replacement of defective or unsatisfactory work where deemed necessary by the Director; and
 - (b) Make good all damage to the building or site, or equipment or contents thereof which, in the opinion

of the Director, is the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the Contract; and

- (c) Make good any work or material disturbed, or the equipment and contents of any building or structure on the site, in fulfilling any such guarantee.

**SECTION 201
CLEARING AND GRUBBING**

201.02 Construction Requirements. Delete the first two paragraphs and the first sentence of the third paragraph of Subsection 201.02.

201.02 Construction Requirements. Add the following to Subsection 201.02:

All surface objects, stumps, roots and vegetation to include designated trees and shrubs shall be cleared and grubbed under the pay item for clearing and grubbing.

Any trees or shrubs included under a separate pay item for removal of trees or shrubs under Section 202, Removal of Structures and Obstructions, shall not be included under the pay item for clearing and grubbing.

**SECTION 202
REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

202.02 **General.** Add the following to Subsection 202.02:

Areas designated as removal of asphalt mat shall be sawcut to the full depth of the asphalt or cut by a method approved by the Director, which leaves a vertical face on the existing pavement and no deformation of the surface at the cut. Limits of cutting, for patching shall be as directed by the Director

202.025 **Trees and Shrubs.** (Added Subsection)

Trees with a specified trunk diameter measured three (3) feet above the adjacent ground surface and shrubs that are designated for removal under this Section shall be removed in accordance with the requirements of Section 201, Clearing and Grubbing. Removal of remaining vegetation as required by the Project will be paid under the Section 201, Clearing and Grubbing pay item.

202.03 **Salvable Material.** Add the following to Subsection 202.03:

All inlet castings, manhole rings and covers and other metal items relating to structures to be removed shall remain the property of the Town or the owning utility company. This material shall be reused on the Project where possible or as directed by the Director. Material not reused on the Project shall be delivered to the owning utility company unless arrangements have been made for it to be picked up by the owning utility company.

202.07 **Pavements, Sidewalks, Curbs.** Add the following to Subsection 202.07:

Concrete from curbs, gutters, sidewalks and pavements may not be used in fills unless crushed to meet the general gradation requirements for Class 4 Aggregate Base Course.

202.09 **Removal of Asphalt Mat (Planing).** Delete the following from the first paragraph of Subsection 202.09:

Reference to CDOT Form 43.

202.09 **Removal of Asphalt Mat (Planing).** Add the following to Subsection 202.09:

Removal of Asphalt Mat (Planing) will be called Asphalt Planing and shall be removal of asphalt pavement to a specified depth at the edges of a planer pass.

Asphalt Edge Planing shall be a bid item with a specified width for tapered asphalt planing from the lip of the curb. Asphalt Edge Planing shall be removal of a tapered section of asphalt that is one (1) inch in depth at the lip of the gutter unless specified otherwise on the plans, tapering to the existing asphalt grade at a width from the lip as specified in the bid item.

Asphalt Planing shall be a bid item with a specified depth of asphalt removal over the entire width of the pass.

All planing shall be done parallel to the flow of traffic unless otherwise approved by the Director. Planers shall operate moving against traffic in areas being planed in order to ensure that trucks used in hauling removed materials will be able to arrive and depart with the flow of traffic.

Planing shall result in a surface acceptable to the Director. Acceptability shall be based upon the following criteria:

1. Free of surface ridges in excess of one-quarter inch
2. Planed surface parallel to lane lines
3. Surface area free of excess surface fines

4. All planed surfaces, especially wheel ruts, show scoring by planer teeth
5. Specified cut depth attained at edges of roadway appurtenances and curb lips

Vertical cuts adjacent to traffic lanes from planing over one (1) inch depth shall be delineated at 50-foot intervals immediately after removal operations.

Asphalt planing shall be accomplished by the use of an approved planing machine or grinder. Planers for lip milling shall be capable of planing the specified distance in one pass. Planers shall be capable of planing a minimum depth of six (6) inches in one pass.

All asphalt millings shall become the property of the Town of Castle Rock. The contractor shall deliver and stockpile the millings to a location determined by the Project Manager. Delivering and stockpiling within the Town limits will not be measured and paid for separately but shall be included in the work.

The Contractor shall use caution when planing around manholes, water valve boxes and other roadway appurtenances. Manholes, water valve boxes and other similar structures shall either be adjusted to below the bottom of the cut prior to commencing planing operations or cut around using planing equipment. The maximum deviation between the top of the milled pavement and top of the manhole or water valve box shall be no more than three-quarter-inch in areas open to traffic. This condition may be achieved by placing a temporary wedge taper of HBP around the structure. This temporary taper shall be removed prior to placement of paving fabric and new HBP.

202.095

Concrete Pavement Grinding (Planing). (Added Subsection)

This subsection covers diamond grinding of Portland cement concrete pavement to eliminate joint faulting, and restore proper drainage and ride quality. This work shall be accomplished in accordance with these specifications, the details shown on the plans, and as directed by the engineer.

The grinding equipment shall use diamond tipped saw blades mounted on a power driven, self-propelled machine that is specifically designed to smooth and texture PCC pavement. The equipment shall grind the pavement to the specified texture and smoothness tolerances. The equipment shall not damage the underlying surface of the pavement, cause excessive ravels, aggregate fractures, spalls, or otherwise disturb the transverse or longitudinal joint

The plans/specifications will designate areas of pavement surfaces to be ground. Grinding of roadway shoulders and bridge decks will not be required unless indicated on the plans, or is directed by the engineer. Grinding shall be performed in a longitudinal direction and shall begin and end at lines normal to the pavement centerline in any ground section. However, this is not required at the end of each work shift.

The grinding shall produce a uniform finished surface, eliminate joint or crack faults, and provide positive lateral surface drainage. Auxiliary or ramp lane grinding shall transition as required from the mainline edge to maintain or provide positive lateral drainage and an acceptable riding surface.

Grinding will provide a positive lateral drainage by maintaining a constant cross slope across each lane. The entire area designated on the plans shall be textured and surfaces on both sides of the transverse joints or cracks shall be in essentially the same plan, in accordance with smoothness specifications. A 1 by 30-meter (3-foot x 100-foot) test area shall require 95% coverage. However, extra depth grinding to eliminate minor depressions is not required.

The slurry or residue resulting from the grinding operations shall be continuously removed from the pavement. The slurry shall not be allowed to flow across lanes occupied by traffic or to flow into gutters or other drainage facilities. However, in rural areas it may be deposited directly onto adjacent slopes.

The ground pavement surface shall be uniform in appearance with longitudinal corduroy type texture. The grooves shall be between 2 and 4 mm (0.10 and 0.15 inches) wide. The land area between the grooves shall be between 1.5 and 3.5 mm (0.065 and 0.125 inches). The peak of the ridges shall be approximately 1.5 mm (1/16 inch) higher than the bottom of the grooves. Adjusting the blade spacing may be necessary to achieve the specified texture.

The ground pavement shall meet a surface tolerance at least as stringent as the specifying agency's surface tolerance for new pavement. The pavement surface shall be measured for riding quality using a multiple wheel profilograph or a profiler. If a profilograph is used, the pavement is to be evaluated in 1.6 km (0.1 mile) sections. When using a profilograph, the profile index shall not exceed 40 inches per mile for a 100 mm blanking band. A unit price adjustment may be used for a profile index of 40 to 50 inches per mile in lieu of re-grinding to meet the 40 inches per mile criterion. No payment will be made for a profile index in excess of 50 inches per mile. The profiler tolerance will be the same as the agency's surface tolerance for new pavement.

A straight-edge requirement may be used to control bumps and/or rides in the pavement surface. Grinding along the inside edge of existing pavement shall conform to the highway agency's straight-edge requirement. Straight-edge requirements do not apply across longitudinal joints or outside the ground areas. The transverse slope of the pavement shall be uniform to a degree that there shall be no depressions or misalignment of slope greater than 1/8 inch between passes of the cutting head when tested by string line or straight-edge placed perpendicular to the centerline. Transverse joints and random cracks shall be visually inspected to insure that adjacent surfaces are in the same plane. Misalignment of the planes of these surfaces shall not exceed 1.5 mm per meter (1/16 inch in 3 feet)

202.11 Method of Measurement. Add the following to Subsection 202.11:

The accepted quantities of trees removed with specified diameters measured three (3) feet above the ground surface adjacent to the tree and shrubs removed will be paid for at the Contract unit price for each tree and shrub removed. Multiple tree trunks from one root structure with one trunk being the specified diameter measured three (3) feet above the ground surface adjacent to the tree will be considered one tree for the purpose of the tree removal pay item. When the Bid Schedule does not include removal of trees and shrubs as separate pay items, removal of trees and shrubs shall be included in the bid item for clearing and grubbing.

Asphalt Edge Planing will be measured by the linear foot, completed from the gutter lip to the required distance from the gutter, and accepted. Existing asphalt pavement that may be above the lip of the gutter will not be considered as additional depth at the lip but shall be included in the pay item for Asphalt Edge Planing.

Removal of existing asphalt mat will be measured by the square yard of surface area removed. Sawcutting for patch areas will not be measured but shall be included in the Work.

Temporary HBP wedge tapers will not be measured but shall be included in the Work.

202.12 Basis of Payment. Add the following to Subsection 202.12:

Pay Item	Pay Unit
Removal of Tree (4" or greater)	Each
Removal of Tree (< or > ___")	Each
Removal of Shrub	Each
Asphalt Planing (____')	Square Yard
Asphalt Edge Planing (____')	Linear Feet
Removal of Asphalt Mat (Patching)	Square Yard
Concrete Pavement Grinding (Planing)	Square Yard

Payment for concrete pavement grinding (planing) will be full compensation for furnishing all labor, materials, supplies, tools, equipment, any incidental work, and for doing all work involved in grinding and texturing the pavement and shoulders and cleaning the pavement.

**SECTION 203
EXCAVATION AND EMBANKMENT**

203.01 **General.** Add the following to Subsection 203.01:

This Work shall also consist of "roadway excavation and embankment" classification of work.

203.02 **Excavation.** Add the following to Subsection 203.02:

- (g) *Roadway Excavation and Embankment.* Roadway excavation and embankment shall consist of the excavation of all existing materials from the surface of the existing roadway to the depth of the new pavement subgrade as specified in the Bid Schedule and to the lines and grades within the grading limits of the Project. Work also includes filling with suitable excavated materials from the Project and import materials if necessary, within the limits of grading for the Project and compaction of the materials.

203.05 **Excavation.** Replace the second paragraph of Subsection 203.05(g) *Potholing*, with the following:

Potholing consists of locating utilities by removal of pavements, excavation of materials of whatever character required to expose the utilities, replacement and compaction of the excavated material and patching the pavement. The Contractor will coordinate survey activities to document utility locations.

203.05 **Excavation.** Add the following to Subsection 203.05:

- (h) *Roadway Excavation and Embankment.* All materials from the surface of the existing roadway to the depth of the new pavement subgrade shall be removed under this item. Removed materials shall become the property of the Contractor. Suitable material may be re-used on the Project as directed by the Engineer. Unsuitable materials shall be removed from the Project and disposed of by the Contractor. The soil below the designated depth shall conform with subsection 203.07.

203.06 **Embankment.** Add the following to Subsection 203.06:

The Contractor shall use material excavated from the Project for embankment to the greatest extent possible. The Director shall approve excavated material for placement as embankment on the Project. Compaction shall be in accordance with AASHTO T99.

Excavated material necessary for Project embankment but rejected by the Director as unsuitable material shall be considered unclassified excavation and replaced with stabilization material.

Embankment material imported to the site for inclusion in a pavement structure shall have a resistance value of at least 8 at 300 psi exudation pressure, as measured by the Hveem Methodology. The Contractor shall submit test results to the Engineer for approval prior to importing embankment material. Earthen material imported to the site for other fill outside the roadway shall be easily compacted, stable material with zero-to-low swell/shrinkage potential.

203.07 **Construction of Embankment and Treatment of Cut Areas with Moisture and Density Control.** Replace the first paragraph of Subsection 203.07 with the following:

Soil embankments shall be constructed with moisture and density control, and the soil upon which the embankments are to be constructed shall be scarified to a depth of 12 inches and compacted with moisture and density control. The moisture content of the soil at the time of compaction shall be as specified or directed.

203.07 **Construction of Embankment and Treatment of Cut Areas with Moisture and Density Control.** Replace the second paragraph of Subsection 203.07 with the following:

The material shall be removed from the full width of roadbed in all cut sections to the designated depth. The soil below the designated depth shall be thoroughly scarified to a depth of 12 inches and the moisture content increased or reduced, as necessary, to obtain the moisture content specified. This scarified layer shall then be compacted to the relative compaction specified.

203.07 Construction of Embankment and Treatment of Cut Areas with Moisture and Density Control. Add the following to Subsection 203.07:

Equipment used for moisture and density control shall be a bo-mag tiller or an approved equal.

203.13 Method of Measurement. Add the following to Subsection 203.13(b) *Embankment*:

When the pay unit is a lump sum, embankment will not be measured but shall be paid by the percentage of all embankment work for the Project, as indicated by the plans and cross sections. Embankment material imported to the site will not be measured but shall be included in the Embankment bid item when the pay unit is a lump sum.

203.13 Method of Measurement. Add the following to Subsection 203.13:

(g) *Roadway Excavation and Embankment.* Roadway Excavation and Embankment shall be measured by the square yard for excavation to a depth of the new pavement subgrade. Pavement saw cutting, disposal of excess materials, grading within the limits of the Work, and moisture and density control will not be measured and paid for separately but shall be included in the Work.

(h) *Unclassified Excavation (6").* Unclassified Excavation (6") shall be measured by the square yard for excavation to a 6-inch depth below subgrade of the new pavement section. Additional depth of unclassified excavation, in 6-inch increments, will be measured by the square yard area and paid at the same unit bid price.

203.14 Basis of Payment. Delete the paragraph of Subsection 203.14 which begins with "Excavated material which...".

203.14 Basis of Payment. Add the following to Subsection 203.14:

Add "Roadway Excavation and Embankment (CIP)" to the fourth from the last paragraph, which begins with "Payment for..." Complete in Place is identified as (CIP) in the Bid Schedule.

Pay Item	Pay Unit
Roadway Excavation and Embankment (CIP)(___")	Square Yard
Unclassified Excavation (CIP)(6")	Square Yard
Embankment (CIP)	Lump Sum

Bid items may be identified on the Bid Schedule as a "contingency" item for subgrade stabilization work that may be required by the Engineer if poor soil conditions are encountered in localized areas.

Scarifying will not be measured but shall be included in the Work.

**SECTION 206
EXCAVATION AND BACKFILL FOR STRUCTURES**

206.02 **General.** Add the following to Subsection 206.02:

(d) *Squeegee.* Bedding material known commonly as “Squeegee” shall meet the following gradation:

Sieve Designation	Percent by Weight Passing
3/8-inch	100
No. 4	60-90
No. 8	0-45
No. 16	0-25
No. 50	0-6
No. 200	0-2

206.03 **Structure Excavation and Structure Backfill.** Replace the first sentence of the first paragraph of Subsection 206.03 with the following:

Unsuitable foundation material shall be removed and wasted in a manner suitable to the Engineer, and the removed material will be paid for as Muck Excavation.

206.03 **Structure Excavation and Structure Backfill.** Add the following to Subsection 206.03:

Squeegee material shall only be used as bedding for reinforced concrete pipe. Compactive effort shall be used on squeegee material to consolidate the material around the pipe haunches.

Compaction of Structure Backfill (Flowfill) will not be required except as necessary to ensure complete filling of any voids around structures and pipe.

Bracing, shoring, sheeting, etc., shall be in accordance with all applicable State and Federal Occupational Safety and Health Requirements. Shoring shall be removed as the Work and backfilling operations progress unless ordered by the Engineer to be left in place. The Contractor will be paid for shoring so ordered to be left in place on the basis of invoiced material only. Shoring shall be considered as incidental to construction and all costs incurred, except materials ordered to be left in place will be considered to be included in the unit price bid for the construction of each section of sewer or associated structure.

The decision to brace, shore or sheet the excavation shall be entirely the Contractor's responsibility. However, if the Director is of the opinion that at any point the trench walls are not properly supported, he may order the placement of additional supports by and at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibilities for the safety of the Work.

206.06 **Method of Measurement.** Add the following to Subsection 206.06:

Structure Backfill (Flowfill) used at the direction of the Director will be measured in accordance with the lesser of that quantity calculated as shown in detail M-206-1 or the actual quantity used. Structure Backfill (Flowfill) not required by the Contract Documents may be used at the Contractor's discretion but will not be measured and paid for.

206.06 **Method of Measurement.** Replace paragraph (b) of Subsection 206.06 as follows:

Excavation, bedding, backfill, compaction, disposal of surplus material, haul, water and all other required work for construction of pipe and structures will not be measured and paid for separately but shall be considered incidental to construction of the pipe and/or structure. Pipe and structures will not be considered for payment until all backfill is completed.

206.07

Basis of Payment. Add the following to Subsection 206.07:

Structure Backfill (Class 1, 2 or Flowfill) will be paid according to the unit prices on the Bid Schedule only when the excavated material is unacceptable for backfill as determined by the Director.

Structure Excavation will be paid according to the unit price on the Bid Schedule only when over-excavation is required for removal of unsuitable material and replacement by Structure Backfill (Class 1, 2 or Flowfill).

**SECTION 207
TOPSOIL**

207.03 Construction Requirements. Add the following to Subsection 207.03

The topsoil or subgrade placed in areas to be seeded or sodded shall be leveled and compacted prior to placement of sod or seed to prevent settlement of landscaped areas.

207.04 Method of Measurement. Replace the last paragraph of Subsection 207.04 with the following

Topsoil secured from the Contractor's source will be paid for by the ton of material placed as shown on the plans or directed by the Director. Spot checks on soil depth may be taken to verify depth of material placed.

207.05 Basis of Payment. Delete the following from Subsection 207.05

Pay Item	Pay Unit
Topsoil	Cubic Yard

207.05 Basis of Payment. Add the following to Subsection 207.05

Topsoil imported to the project will be paid for at the contract unit price per ton of material placed in areas as shown on the plans or as directed by the Director.

Pay Item	Pay Unit
Topsoil	Ton

**SECTION 210
RESET STRUCTURES****210.02 General.** Add the following to Subsection 210.02:

Any work performed by the Contractor on a utility facility is subject to inspection and approval by the owning utility company. The Contractor is responsible for coordinating inspection with the owning utility.

The Contractor must give written notice to all customers affected by water service outages at least 24 hours before the water is turned off for this Work. The Contractor shall give a minimum of 24-hour's notice to the owning utility company before any work that will affect their facilities. The Contractor shall not operate any water valves without permission of the owning utility company.

210.021 Fire Hydrant. (Added Subsection)

Fire hydrants shall be reset to the location shown on the plans or indicated in the field and raised or lowered to match the finished grade. The new hydrant lead is to be constructed of new pipe and hardware. Prior to commencing work on this item, the Contractor shall contact the owning utility for inspection of the hydrant. Hydrants that are unsatisfactory to the owning utility due to type and/or material may be replaced by the owning entity at its own expense and by its own forces.

"Adjust fire hydrant" shall involve raising or lowering the hydrant, at its existing location, to match the finished grade. All hardware required for this Work shall be new unless otherwise approved by the owning utility.

210.022 Sewer Service. (Added Subsection)

Sewer services shall be reset to new locations and/or elevations as shown on the plans or indicated in the field. Work may entail replacement of the service line from the utility main line or may be a lesser portion. All pipe and fittings shall be new and approved by the owning utility for use in the Work.

210.023 Water Service. (Added Subsection)

Water services shall be reset to new locations and/or elevations as shown on the plans or indicated in the field. Work may entail replacement of the service line from the utility main or may be a lesser portion. All pipe and fittings shall be new and approved by the owning utility for use in the Work.

210.024 Water Meter. (Added Subsection)

Water meters and their associated meter pits and curb stops shall be reset to the location shown on the plans or indicated in the field and raised or lowered to match the finished grade. Service lines shall be modified accordingly. All pipe and fittings shall be new and approved by the owning utility for use in the Work.

"Adjust water meter" shall involve raising or lowering the meter, meter pit, and associated curb stop, at their existing location, to match the finished grade. All materials required for this item shall be new unless otherwise approved by the owning utility.

210.025 Water Meter Pit. (Added Subsection)

"Replace water meter pit" shall include removal of the existing meter pit and installation of a new meter pit at the location and elevation shown on the plans or indicated in the field. This item shall also include replacement of the curb stop riser assembly if required. All materials required for this item shall be new unless otherwise approved. The re-use of any existing materials shall be approved by the owning utility.

"Adjust water meter pit" shall involve raising or lowering the meter pit and the frame and cover, at its existing location, to match the finished grade. This item shall also include adjustment of the associated curb stop. Materials used for the adjustment shall be approved by the owning utility for use in the Work.

210.026 Water Meter Pit Frame and Cover. (Added Subsection)

"Replace meter pit frame and cover" shall involve removal of the existing frame and cover and installation of a heavy-duty frame and cover, and raising or lowering the new frame and cover to match the finished grade. Any work required on the associated curb stop shall also be included in this item. Unless otherwise specified, all required materials shall be supplied by the Contractor. All materials used for this item shall be approved by the owning utility for use.

210.027 Sprinkler. (Added Subsection)

Sprinklers shall be reset to the locations shown on the plans or as indicated in the field and adjusted to match finished grade. Sprinkler heads, feed lines, wiring and conduit, control valves and all other items associated with the system needing to be reset as a result of construction shall be included in this item.

210.028 Valve Box. (Added Subsection)

"Replace valve box" shall involve removal of the existing valve box riser assembly, or a portion thereof, and installation of a new valve box assembly, and raising or lowering the new assembly to match the finished grade. Unless otherwise specified, all required materials shall be supplied by the Contractor. All materials used for this item shall be approved by the owning utility for use.

"Adjust valve box" shall involve raising or lowering the valve box to match the finished grade. Materials used for the adjustment shall be approved by the owning utility for use in the Work.

210.029 Type R Inlet. (Added Subsection)

Replace inlet top shall involve sawcutting and removal of the existing inlet top and installation of new rebar and concrete to construct a new top. The existing frame and lid may be re-used. All materials used for this item shall be approved by the owning utility for use.

Replace inlet pan shall involve sawcutting and removal of the existing inlet gutter pan and installation of new rebar and concrete to construct a new gutter pan.

210.03 Light Standard. Replace "Department's Standard Plans" with "CDOT Standard Plans" in Subsection 210.03.

210.05 Guard Rail. Replace "Department's Standard Plans" with "CDOT Standard Plans" in Subsection 210.05.

210.06 Mailbox. Replace "Department's Standard Plans" with "CDOT Standard Plans" in Subsection 210.06.

210.10 Adjust Structure. Add the following to Subsection 210.10:

Structures within the roadway surface shall be adjusted prior to placement of the final lift of asphalt. Manhole ring and cover assemblies shall be adjusted to finish grade on reconstructs. Manholes located within overlays will require grade adjustment rings that can be mechanically secured to the existing manhole ring. "Drop in" adjusting rings will not be allowed. All materials shall be approved by the owning utility.

When adjusting valve boxes, the box shall be cleaned of all foreign debris such that the operating nut of the valve is fully accessible to operate. The Work shall be subject to inspection by and approval of the owning utility and is incidental to the pay item for adjusting water valves.

210.12 Method of Measurement. Replace "Department's Standard Plans" with "CDOT Standard Plans" in Subsection 210.12.

210.12 Method of Measurement. Add the following to Subsection 210.12:

When an item is to be **reset**, the adjustment to match finished grade will not be paid for separately but shall be included in the Work. Materials required to accomplish the Work will not be measured and paid for separately but shall be included in the Work.

Adjustment of items shall include everything necessary to complete the Work. Materials required to

210.13 accomplish the Work will not be measured and paid for separately but shall be included in the Work.
Basis of Payment. Add the following to Subsection 210.13:

Pay items shall include, unless otherwise specified, all new hardware and installation materials.

Pay Item	Pay Unit
Replace Water Meter Pit	Each
Replace Water Meter Pit Frame and Cover	Each
Replace Inlet Top	Linear Feet
Replace Inlet Pan	Linear Feet

**SECTION 211
LANDSCAPING (Added Section)**

DESCRIPTION

211.01 This Work consists of constructing, installing, maintaining and restoring landscaped areas along, within, and/or adjacent to the roadway.

MATERIALS

211.02 Landscape Rock.

(a) *Landscape Rock.* Rock for landscaping shall be of the size and type as shown in the Contract documents. Each variety shall be clean and free from foreign matter. The Contractor shall submit three (3) copies of the supplier(s) to be used for each product source. The Engineer may elect to visit the supplier(s)' yard to inspect the material prior to approval, or at his discretion, require the Contractor to provide a sample of the rock to be used. Sample size shall be such that it will cover a 3-square-foot area to a depth of 1½ times that of the rock size.

CONSTRUCTION REQUIREMENTS

211.03 Landscape Restoration.

This item of Work shall include all necessary work and materials to restore existing landscaping within eighteen (18) inches of the proposed sidewalk or pavement impacted by construction of the Project. Work shall include but is not limited to salvaging and reusing existing materials to restore gravel walkways, landscape rock and landscape mulch and resetting landscape timbers, lawn edging, patio stones and brick pavers. Landscape Restoration work within eighteen (18) inches of the proposed sidewalk or pavement also includes placing sod unless seeding is specified on the plans, and adjusting and resetting existing sprinkler systems, unless a separate pay item is provided. All backfill placed behind concrete work and along sprinkler lines shall be compacted to prevent settlement.

211.04 Landscape Rock.

Landscape rock of the size and type as shown on the plans or as directed by the Engineer shall be installed in all areas designated on the plans. Landscape rock shall be to a depth as shown on the plans or indicated by the bid item. Landscape weed barrier conforming to Section 420 shall be placed in areas designated to receive landscape rock prior to placement of rock.

METHOD OF MEASUREMENT

211.06 Landscape restoration will not be measured.

Excavation, embankment and grading will be paid for in accordance with Section 203.

Landscape weed barrier will not be measured and paid for separately but shall be included in the cost of the Landscape Rock item.

BASIS OF PAYMENT

211.07 Partial payments for Landscape Restoration will be made each month based on the amount of the total work completed.

The accepted quantities of landscape rock will be paid for at the Contract unit price for each of the pay items listed below that appear in the Bid Schedule.

Pay Item	Pay Unit
Landscape Restoration	Lump Sum
Landscape Rock (size and type)	Square Yard

**SECTION 212
SEEDING, FERTILIZER, SOIL CONDITIONER AND SODDING**

212.02 **Seed, Soil Conditioners, Fertilizer, and Sod.** Add the following to Subsection 212.02:

Lawn seed types and sod species shall match existing grass when restoration or replacement is required by the Contract.

Upland seed mix shall be in accordance with the Town of Castle Rock Grading, Erosion, and Sediment Control Manual.

Wetland seed mix shall be in accordance with the Town of Castle Rock Habitat Conservation Plan.

Fertilizing and soil conditioning shall not be required for sodding.

212.05 **Sodding.** Delete item (c) from Subsection 212.05.

212.05 **Sodding.** Add the following to Subsection 212.05:

The limits of existing lawn that is removed due to construction requirements shall be cut in a straight line and vertical edge with a sod cutter or tool designed for sod removal.

212.07 **Method of Measurement.** Replace the first sentence of the first paragraph of Subsection 212.07 as follows:

Seeding quantity shall be measured by slope distances in square yards or acres.

212.08 **Basis of Payment.** Replace Seeding (Lawn) and Seeding (Native) pay units as follows:

Pay Item	Pay Unit
Seeding (Lawn)	Hectare (acre) or Square Yard
Seeding (Upland)	Hectare (acre) or Square Yard
Seeding (Wetland)	Hectare (acre) or Square Yard

**SECTION 213
MULCHING**

213.02 **Materials.** Delete the second last paragraph of Subsection 213.02.

213.02 **Materials.** Add the following to Subsection 213.02:

Wood chip mulch shall be of the type as specified in the Contract documents. The Contractor shall submit three (3) copies of the supplier(s) to be used for each product source. The Engineer may request a visit to the supplier(s) yard to inspect the material prior to approval, or at his discretion may require the Contractor to provide a sample for inspection and approval. The sample size shall be one (1) cubic foot.

Metal landscape border shall be standard, 4" x 3/16", ASTM A569, rolled edge, fabricated in sections with loops stamped or welded to the face 30 inches apart to receive stakes. Provide factory painted steel with tempered steel stakes.

213.03(d) **Wood Chip Mulch.** Add the following to Subsection 213.03(d):

Landscape weed barrier conforming to Section 420 shall be placed in all areas designated to receive wood chip mulch prior to the placement of mulch.

213.03(e) **Metal Landscape Border.** Replace Subsection 213.03(e) with the following:

Metal landscape border shall be installed along the lines and grades shown on the plans by an approved method that will not damage the border. Ends of metal landscape border shall overlap the next adjacent section a minimum of six (6) inches. Metal landscape border shall be anchored with tempered steel stakes. Metal landscape border shall be inserted into the ground by driving against the tempered steel stakes; ground may be moistened to ease entrance into the ground. Driving on edge of metal landscape border will not be permitted except when the edge is properly shielded so as to avoid damage. Metal landscape border may be bent for sharp angles, and overlapped at closure of perimeter.

213.04 **Method of Measurement.** Add the following to Subsection 213.04:

Landscape weed barrier will not be measured and paid for separately but shall be included in the cost of the Wood Chip Mulch item.

**SECTION 214
PLANTING**

214.02 General. Add the following to Subsection 214.02

Submit four (4) copies of a list of all materials to be used in the planting operations, together with the source of those materials.

Plants: Plants types be as shown on the plans and shall be true to species and of size(s) specified as follows:

- Deciduous Trees - 2" Ball and Burlap
- Evergreen Trees - 6' Ball and Burlap
- Shrubs - Number 5 container
- Perennials - Number 1 container
- Ornamental Grasses - Number 1 container

Provide trees and shrubs grown in one of the following areas:

- (1) Colorado Grown: Trees and shrubs grown in Colorado nursery fields for a major portion of plant life.
- (2) Out of State Container Grown: Plants from USDA Hardiness Zones other than 1 through 5 which have been acclimatized to site conditions at time of planting.
- (3) Northern Grown: Trees and shrubs grown in nurseries for at least one year in USDA Hardiness Zones 1-5.

All plants shall:

- (1) Be selected by the Inspector at the place of growth or nursery before delivery and inspected at the site before planting.
- (2) Be clearly tagged identifying species.
- (3) Have well formed buds with size normal for the species. Growth increments of shoots for the previous year shall be of a length that consistent with normal growth for that season.
- (4) Be free of harmful insects, mites, diseases and mechanical injuries to trunks and major scaffold branches.

Plants specified in containers shall be "container-grown" as defined by the Colorado Nursery Act. Plants specified as balled and burlapped (B&B) shall conform to or exceed the minimum sizes specified in the Colorado Nursery Act. No balled and burlapped plant shall be accepted if the ball is broken or the trunk loose in the ball or viable roots exposed.

214.03 General. Add the following to Subsection 214.03

Contractor Qualifications: The work in this section shall be performed by an experienced landscape contractor having not less than five (5) years successful experience in landscape projects of similar size and scope. The Director may require documentation to demonstrate this requirement.

Site Supervision: Contractor shall maintain an experienced full-time supervisor on the Project site during times landscaping work is in progress, and is able to speak in languages of landscape workers with skill. A Certified Landscape Technician is preferred.

Ground Cover: Space ground cover, as indicated on the drawings, and protect it from hot sun and wind for several days. Remove protection when plants show evidence of recovery from transplanting shock. Provide two (2) inch thickness of mulch in areas between ground cover plants; see Special Provisions Subsection

211 for mulch specifications.

Mulching: Dish top of backfill around plants to allow for mulching. Place landscaping fabric and provide two (2) inch thickness of mulch over planting pit area and finish level with adjacent grades; see Special Provisions Subsection 211 for mulch and fabric specifications.

Pruning: Any injured, dead or broken roots or branches shall be pruned in accordance with current recommended practices published by the International Society of Arboriculture. Unless otherwise specified, no pruning shall be done by the contractor to limb up, thin or shape a plant after planting. Such pruning shall be the sole responsibility of the Town. Remove and replace excessively pruned or malformed stock resulting from improper pruning.

214.06

Basis of Payment. Add the following to Subsection 214.06

Unless a separate Mulch bid item is provided, mulch for ground cover areas shall not be measured but will be incidental to the work.

SECTION 304
AGGREGATE BASE COURSE

304.01 Description. Add the following to Subsection 304.01:

This Work also includes furnishing and placing recycled (reclaimed) asphalt and concrete, Stabilization Material and Trench Foundation Material.

Also included in this Section is hauling and placing materials supplied by the Owner.

304.02 Aggregate. Add the following to Subsection 304.02:

The source of aggregate for Aggregate Base Course is not designated. Approval of the aggregate as a source for the Class(es) of aggregate specified will be contingent on material meeting the appropriate gradation requirements and having a resistance value of at least fifty (50) when tested the Hveem Stabilometer Method. Aggregate for aggregate base course shall have a specific gravity greater than 2.4 (at the source).

304.025 Stabilization Material. (Added Subsection)

Stabilization Material may be crushed stone, crushed slag, crushed gravel, crusher waste, recycled asphalt pavement or recycled Portland cement concrete that closely meets the specified Aggregate Base Course Classification from Table 703-3. When the Stabilization Material bid item does not specify an Aggregate Base Course Class, Class 4, 5 or 6 is acceptable. The Contractor shall provide gradation specifications from the supplier for materials to be used as Stabilization Material. The Director shall determine if the material is within acceptable tolerances of Class 4, 5 or 6 specifications for the purpose of the material.

Stabilization Material shall be compactable with minimal effort and shall be clean and free from contaminating materials such as clay or clay lumps and organic matter. The material shall not be cross-mixed with other types of materials such as milled asphalt, nonspecific gravel materials, rock, etc. Presence of contaminating materials, clay or clay lumps or organic matter will be grounds for rejection by the Inspector.

Recycled Asphalt shall be made from bituminous pavement and Recycled Concrete shall be made from Portland cement concrete. Recycled Asphalt and Recycled Concrete shall closely meet the specifications of Aggregate Base Course, Class 6.

304.026 Trench Foundation Material. (Added Subsection)

Trench Foundation Material shall be used when unsuitable or unstable native trench material is encountered during pipe construction. The material shall consist of 1½- to 2-inch crushed stone, crushed slag, crushed gravel, natural gravel, crusher waste, pit run gravel, recycled asphalt pavement or recycled Portland cement concrete that generally meets the specifications of Aggregate Base Course Classes 4 or 5.

Trench Foundation Material shall be compactable with minimal effort and shall be clean and free from contaminating materials such as clay or clay lumps and organic matter. The material shall not be cross-mixed with other types of materials such as milled asphalt, nonspecific gravel materials, rock, etc. Presence of contaminating materials, clay or clay lumps or organic matter will be grounds for rejection by the Inspector.

304.04 Placing. Add the following to Subsection 304.04:

When stabilization material is placed on a geogrid material the Contractor shall minimize the amount of rubber tired equipment allowed on the stabilization material and shall preferentially use a small tracked dozer or loader to spread the material. After placement and rough shaping of the material, the surface may be shaped to final cross-section with a motor grader. Water for compaction shall be sparingly applied as required. The use of vibratory equipment may be used unless the subgrade shows evidence of failure by deflection of the aggregate surface.

304.07

Method of Measurement. Add the following to Subsection 304.07:

Stabilization Material (Class 6) (6") will be measured by the square yard of 6-inch layer placed and compacted in place as directed by the Director for stabilization in areas of pavement patching. When directed by the Director, a second layer will be placed for additional subgrade stabilization and paid at the bid price of the first layer.

Stabilization Material will be measured by the ton of material compacted in place.

Recycled asphalt and concrete will be measured by the ton of material compacted in place as directed by the Director.

Trench Foundation Material will be measured by the ton of material compacted in place.

304.08

Basis of Payment. Add the following to Subsection 304.08:

The accepted quantities of Stabilization Material will be paid for at the Contract bid price per square yard of 6-inch depth or ton of material, as shown in the Bid Schedule.

The accepted quantities of Trench Foundation Material, recycled asphalt and recycled concrete will be paid for at the Contract bid prices per ton of material.

Bid items in the Bid Schedule may be identified as "contingency" items for subgrade stabilization work that may be required by the Director if poor soil conditions are encountered in localized areas.

Bid items in the Bid Schedule may be identified as "haul and place" items for materials to be supplied by the Owner.

Pay Item	Pay Unit
Stabilization Material (Class 6)(6 ")	Square Yard
Stabilization Material	Ton
Recycled Asphalt (Class 6)	Ton
Recycled Concrete (Class 6)	Ton
Trench Foundation Material	Ton

304.08

Basis of Payment. Delete the last paragraph in Subsection 304.08.

**SECTION 307
LIME TREATED SUBGRADE**

CONSTRUCTION REQUIREMENTS

307.05 **Preparation of Subgrade.** Replace subsection 307.05 with the following:

The subgrade shall be processed in accordance with subsection 203.07. The subgrade shall also be proof rolled in accordance with subsection 307.07.

307.06 **Test Section.** Delete the last paragraph of subsection 307.06.

307.08 **Processing Materials.** Replace the first sentence in subsection 307.08 with the following:

After the subgrade has been finished and approved as specified, the subgrade shall then be cut and pulverized by a cutting and pulverizing machine to the depth and width shown on the plans or identified in the field.

SECTION 308
CEMENT TREATED SUBGRADE (Added Section)

DESCRIPTION

308.01 This Work consists of treating the earth subgrade by combining cement and water with the pulverized soil subgrade material to the depth and compaction requirements as shown on the plans.

MATERIALS

308.02 **Cement.** Portland cement for cement treated subgrade shall be Type I/II and shall meet the requirements of ASTM C-150.

308.03 **Water.** Water used for mixing or curing shall be in accordance with subsection 712.01, with the additional requirement that the sulfate content shall be less than 500 ppm.

CONSTRUCTION REQUIREMENTS

308.04 **General.** The Contractor shall construct one or more compacted courses of treated material, to the depth specified on the Contract. The treated material shall be a uniform blend of soil, cement, and water, free from loose or segregated areas. It shall have a uniform density and moisture content and be void of all vegetation and other organic or man-made material. The subgrade shall be well bound for its full depth and width with a smooth surface suitable for placing subsequent courses. The Contractor shall regulate the sequence of the work to accurately apply and uniformly blend the cement at the designed rate and rework the courses as necessary to meet the above requirements.

The Contractor shall submit a mix design to the Engineer for approval, prior to constructing the test section.

Cement treatment operation shall not begin unless the air temperature is at least 35°F and rising.

308.05 **Preparation of Subgrade.** The subgrade shall be processed in accordance with subsection 203.07. The subgrade shall also be proof rolled in accordance with subsection 308.07.

308.06 **Test Section.** Prior to full-scale production, the Contractor shall construct a test section to demonstrate, to the satisfaction of the Engineer, subgrade stabilization using materials, equipment, and methods to be used in full-scale production. The test section shall be at least 100 feet long, two spreading and mixing lanes wide, and the same depth as the course represented in the plans. The test section shall be constructed at a location approved by the Engineer.

The test section shall be tested in accordance with the same test requirements for the cement and soil design mix, and as determined by the Contractor.

If the test section is unsatisfactory, the Contractor shall adjust the materials, equipment, and methods or combinations thereof as necessary to conform to the specifications. Additional test sections shall be constructed as required to produce a satisfactory test section prior to full-scale production. Unsatisfactory test sections shall be removed and replaced at the Contractor's expense. Full production shall not begin until a satisfactory test section is completed and approved by the Engineer.

308.07 **Proof Rolling.** Both prior to and after the cement treatment, the Contractor shall perform proof rolling in accordance with subsection 203.09, except the final proof rolling will take place a minimum of three days after cement treatment, unless otherwise approved by the Engineer.

308.08 **Processing Materials.** After the subgrade has been finished and approved as specified, the subgrade shall then be cut and pulverized by a cutting and pulverizing machine to the depth and width shown on the plans or identified in the field. Precautions shall be taken to avoid forming furrows of loosened material below the depth specified for the cement stabilized soil mixture. The machine shall uniformly cut and pulverize the loosened material to a depth not greater than 10 percent over the thickness of the cement treated layer as specified in the Contract and shall have cutters that plane the base of the cut and pulverized zone to a smooth surface over the entire width of the cut. The machine must give visible indication at all times that it is

cutting to the proper depth.

Dry cement shall be applied uniformly on that area where the mixing, compacting, and finishing operations can be completed during the same day, and at the specified percentage of portland cement. The cement and soil shall be thoroughly mixed and blended by a self propelled rotary type mixing machine, until a uniform mixture throughout the required depth and width is obtained. Immediately after mixing the soil and cement, add water as necessary and remix the soil-cement mixture until a uniform mixture of soil, cement, and water has been obtained.

308.09 **Compaction.** Compaction of the soil-cement mixture shall begin immediately after completing mixing. The material shall be sprinkled as necessary to maintain the mixture within the specified moisture content limits during and following compaction. The field density for the compacted mixture shall be at least 95 percent of the maximum density supplied by the Engineer. The moisture content of the mixture at the start of compaction shall be at 2 ± 1 percent above the optimum moisture content supplied by the Engineer.

The finished surface shall be smooth and uniform conforming to the typical sections specified. All irregularities, depressions, or weak spots, which develop, shall be corrected immediately by scarifying the areas affected, adding or removing materials as required, and reshaping and re-compacting by sprinkling and rolling. The surface of the course shall be maintained in a smooth condition, free from undulations and ruts, until other work is placed thereon or the work is accepted.

In addition to the requirements specified for density, the full depth of the materials shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section is completed, the Engineer will conduct tests. If the material fails to meet the density and strength requirements in accordance with the cement and soil design mix, it shall be reworked to meet these requirements at the Contractor's expense. Throughout this entire operation, the shape of the course shall be maintained by blading, and the surface upon completion shall be smooth and shall conform with the typical section shown on the plans and to the established lines and grades. Variation from the subgrade plan elevations specified shall not exceed 0.04 foot. Should the material, due to any reason or cause, lose the required stability, density, or finish, before the next course is placed or the work is accepted, it shall be recompacted and refinished at the Contractor's expense.

308.10 **Finishing and Curing.** When the initial compaction of the top layer of the soil-cement soil mixture is nearing completion, the surface shall be shaped to the required lines, grades, and cross section, and compaction continued until uniform and adequate compaction is obtained. The treated material shall be maintained at a moisture content satisfactory for proper curing by one of the following:

- (1) Sprinkling for a period of three days.
- (2) Sprinkling for a period less than three days until emulsified asphalt prime coat (diluted 1 to 1) is applied in accordance with subsection 308.10, item (3) below.
- (3) Applying a protective film of emulsified asphalt coat (diluted 1 to 1 with water) immediately after the soil-cement subgrade has been finished. One application shall be made consisting of 0.20 gallon diluted mixture per square yard.

The completed section shall be cured for a minimum of three days before further courses are added or any traffic is permitted, unless otherwise directed by the engineer. Acceptable compression strength test results shall be in a range from a minimum of 160 pounds per square inch to 500 pounds per square inch.

308.11 **Construction Joints.** Construction joints are not required after each day's work unless there is a time lapse of three days or more between the processing of adjacent sections. If construction joints are required, they shall be formed by cutting back into the completed work to form a vertical face. Damage to completed work shall be avoided.

308.12 **Thickness Acceptance.** Cement treated subgrade will be accepted for minimum thickness on a lot basis. A lot will consist of 1,500 square yards. One core shall be taken at random by the Contractor's Quality Control Inspector in each lot. When the measurement of the core from a lot is not deficient by more than 0.5 inch from the minimum plan thickness, full payment will be made. When such measurement is deficient by more than 0.5 inch and not more than 1.0 inch from the plan thickness, two additional cores shall be taken at

random and used in determining the average thickness for that lot. The thickness of the core shall be determined by average caliper measurement of cores tested in accordance with ASTM C 174. When the average measurement of the three cores is not deficient by more than 0.5 inch from the plan thickness, full payment will be made. If the average measurement of the three cores is deficient by more than 0.5 inch but less than 1.0 inch from the plan thickness, the entire lot may be left in place and a 10 percent price reduction to the contract unit price will be made. If the average measurement of the three cores is deficient more than 1.0 inch but less than 2.0 inches from the plan thickness, the entire lot may be left in place and a 50 percent reduction to the contract unit price will be made. When the average thickness is deficient by more than 2.0 inches, the entire lot shall be replaced at the Contractor's expense.

METHOD OF MEASUREMENT

308.13 Portland cement will be measured by the ton.

Processing cement treatment subgrade will be measured by the square yard for the area completed and accepted. Overlap mixing will not be measured and paid for separately but shall be included in the work.

BASIS OF PAYMENT

308.14 The accepted quantity 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 include all processing materials, cement application and mixing, compaction, and materials used in curing.

Payment will be made under:

Pay Item	Pay Unit
Portland Cement	Ton
Processing Cement Treated Subgrade (____Inch)	Square yard

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

All proof rolling will be measured and paid for in accordance with Section 203.

**SECTION 401
PLANT MIX PAVEMENTS-GENERAL**

Replace Section 401 with the following:

HOT MIX ASPHALT PAVEMENTS

DESCRIPTION

401.01

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, thicknesses and typical cross-sections shown on the plans or established by the Engineer. When more than one lift is required, each lift shall be compacted to the required density and approved prior to the placement of the succeeding lift.

Warm mix asphalt (WMA) is allowed as an alternate to hot mix asphalt provided that all material requirements and specification standards are met and as approved by the Agency.

The volume and loading levels for the various designations are listed in Table 401-1 and shall be used for these specifications.

Table 401-1

Designation	Volume and Loading Level
Low	≤ 300,000 ESALs
Moderate	> 300,000 and ≤ 10,000,000 ESALs
High	> 10,000,000 ESALs
Trails and Pathways	< 100,000 ESALs – able to accommodate a 4000 lb vehicle for safety and maintenance purposes
Parking Lots	25% of volume used for entrance roadways

MATERIALS

401.02

General. The HMA shall be composed of a mixture of aggregates, approved filler or additives, asphalt binder, and reclaimed asphalt pavement (RAP), when permitted.

401.03

Aggregates. Aggregates shall be of uniform quality, clean, hard, durable particles of crushed stone, crushed gravel or crushed slag free from clay balls, vegetable matter or other deleterious materials meeting the requirements of Table 401-2.

**Table 401-2
Aggregate Properties**

Property	Test Procedure	Coarse Retained on #4 Sieve	Fine Passing the #4 Sieve
Fine Aggregate Angularity Traffic Level Low, Moderate, Trails and Pathways	CP-L5113 Method A		40% Minimum
Traffic Level 3 to 5 Moderate, High, Parking Lots			45% Minimum
Fractured Faces (Minimum of 2)	CP-45	80% Minimum	
LA Abrasion	AASHTO T96	45% Minimum	
Flat and Elongated Pieces	AASHTO M283	10% Maximum	
Sodium Sulfate Soundness	AASHTO T104	12% Maximum Combined Coarse and Fine	
Adherent Coating (Dry Sieve)	ASTM D5711	0.5%	45% Minimum

Sand Equivalent	AASHTO T176	45% Minimum
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Aggregates meeting the requirements of Table 401-2 shall be used to develop the Job Mix Formula (JMF) for the HMA mixture. The aggregate should be composed of angular, coarse textured, cube-shaped particles. Excess of fine material shall be wasted before crushing. Sand may be used to obtain gradation of the blended aggregate mixture but should not exceed more than 15%. 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 T90. The gradation of the aggregates used in the mixture shall meet the criteria shown in Table 703-4 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 HMA lift being constructed.

- 401.04 Mineral Filler.** If mineral filler is required to meet the JMF it shall conform to the requirements of Section 703.06.
- 401.05 Additives.** Additives to the mineral aggregate shall be used if the asphalt binder will not coat or stick to the aggregates. Additives shall be in the form of hydrated lime and shall conform to ASTM C207, Type N. The residue retained on a #200 sieve shall not exceed 10% when determined in accordance with ASTM C110. Hydrated lime shall be added at the rate of 1% by dry weight of the aggregate.
- 401.06 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 no greater the nominal size of the HMA mixture. HMA mixtures containing RAP shall meet the same gradation requirements as a virgin HMA mix.
- 401.07 Asphalt Binder.** Performance Grade asphalt binders shall meet the requirements of Table 702-2. 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. The Contractor shall provide to the Owner acceptable "Certification of Compliance" for each applicable asphalt binder grade that will be used on the Project. Binder grades other than those shown in Table 702-2 will not be allowed unless the proposed binder and mix design are approved by the Engineer.
- (a) *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 401-3.

**Table 401-3
Binder Grades for HMA Mixtures**

Traffic Levels		Binder Grades
Low	(<300,000 ESALs)	PG 58-28
Moderate	(300,000 to ≤10,000,000 ESALs)	PG 64-22
High	(>10,000,000 ESALs)	PG 76-28
Trails and Pathways	(100,000 ESALs)	PG 58-28
Parking Lots	(25% of entrance roadway)	PG 64-22

- (b) *Prime Coat Material.* Prime coat material shall either be an emulsified asphalt prime coat conforming to the requirements of Table 702-4 or a penetrating priming stabilizer conforming to the requirements of Table 702-5.
- (c) *Tack Coat Material.* Tack coat material shall be an emulsified asphalt conforming to AASHTO M140 or M208 for the designated grades. When grade CSS-1h or SS-1h emulsified asphalt is used, residue penetration test values shall be between 40 and 120.
- 401.08 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. The certification shall show 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 within two (2) days of the initial request.

CONSTRUCTION REQUIREMENTS

401.09

General. The Contractor shall submit his JMF to the Engineer for approval fourteen (14) calendar days prior to the beginning of paving operations. The JMF for each mixture to be used on the Project shall be approved prior to the start of any paving operation. The mix design(s) shall be developed using the Superpave Mix Design Procedures and shall be prepared under the direct supervision of an engineer licensed in the State of Colorado practicing in this field.

The Contractor shall submit the following as part of each mix design:

1. Source(s) of materials.
2. Aggregate gradation, specific gravity, source and description of individual aggregates in 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} , N_{des} , and N_{max} .
8. Mixture properties determined at the minimum of four binder contents and interpolated at optimum and graphs showing mixture properties versus binder content.
9. Percent of RAP if used in the mixture.

The mix design(s) shall meet the requirements of Table 703-4, Table 401-3, Table 401-4, and Table 401-5. The HMA mixture(s) will be designed for each item listed in Section 403.05 as shown in the Bid Schedule.

**Table 401-4
Superpave Mixture Properties**

Test Property	Traffic Levels		
	Trails and Pathways	Low, Moderate, Parking Lots	High
Traffic Level – Design period ESALs		< 3 million	> 3 million
Initial gyrations, N_{ini}	6	7	8
Air voids @ N_{ini}	> 8.5	> 9.5	> 11.0
Design gyrations, N_{des}	50	75	100
Hveem stability, CP-L 5106	NA	28 min.	30 min.
Voids filled with asphalt, VFA, MS-2	70 – 80	65 – 78	65 – 75
Lottman, Tensile strength ration, % retained CP-L 5109	80 min.	80 min.	80 min.
Lottman, Dry tensile strength, psi, CP-L 5109	30 min.	30 min.	30 min.

**Table 401-5
Voids in Mineral Aggregate**

Nominal Maximum Particle Size ¹	Minimum VMA - %		
	Design Air Voids - %		
	3.0	4.0	5.0
½"	13	14	15
¾"	12	13	14
1"	11	12	13

¹The nominal maximum particle size is one sieve 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 the mixture(s) that do not contain RAP. The RAP shall meet the requirements of Subsection 401.06. Maximum of 20% RAP in the mixtures(s).

Mixture(s) shall be verified prior to the start of placement. Verification of the volumetric properties of the mixture(s) shall be performed by a **LabCAT Level C** certified technician(s). If the mixture(s) has (have) been produced for another Project within the last 90 days, verification results from that Project may be submitted for this verification. Superpave mix design volumetric tolerances for the approved HMA mixture(s) shall be

within the limits shown in Table 401-6.

**Table 401-6
HMA Mixture Design Verification Tolerances**

Property	Tolerance
Air Voids	± 1.2%
VMA	± 1.2%
Binder Content	± 0.3%
Stability	Applicable minimum

401.10 Pre-paving Meeting. Prior to the start of the paving operation, all key parties involved in the supply, haul, placement, compaction, inspection and quality control and quality acceptance (QC/QA) of the HMA pavement shall attend a pre-paving meeting to go over procedures and acceptance of the HMA placement. The meeting will be scheduled by the Engineer. Areas of responsibility and contact names and phone numbers will be shared.

401.11 Weather Restrictions. The HMA mixture shall be placed only on properly constructed surfaces that are dry and unfrozen, and only when weather conditions allow for the proper handling and compaction of the mixture. The HAM shall be placed in accordance with the temperature limitations shown in Table 401-7 and only when weather conditions permit the pavement to be properly placed and compacted as determined by the Engineer.

**Table 401-7
HMA Placement Temperature Limitations**

Paving Course	Thickness	Air Temperature ¹	Surface Temperature ¹
Surface	All	50 °F	55 °F
Subsurface	≤ 3"	40 °F	44 °F
Subsurface	> 3"	32 °F	36 °F

¹Temperatures shall be taken in the shade. Temperatures shall be stable or rising in order for work to progress.

401.12 HMA Production Facilities. The HMA plant used to produce the asphalt aggregate mixture shall meet the requirements of AASHTO M156 and shall have adequate capacity and be maintained in good mechanical condition. The plant shall control dust, smoke, and/or other contaminants such that it meets the *Colorado Air Quality Control Act*, Title 25, Article 7, CRS and all regulations promulgated thereunder. The Engineer or his 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.

- (a) *Truck 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 accuracy.
- (b) *Storage and Surge Bins.* Use of surge bins or storage bins for temporary storage of HMA mixtures will be permitted as follows:
 1. The HMA mixture may be stored in surge bins for a period of time not to exceed three (3) hours.
 2. The HMA mixture may be stored in insulated storage bins for a period of time not to exceed nine (9) hours, unless otherwise approved.
 3. The mix drawn from the bins shall meet the same requirements as the mix loaded directly into trucks. If the Engineer determines that there is 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 material shall be disposed of at the Contractor's expense.

401.13 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 material. Each truck shall have a 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.

401.14

Placement Equipment. Pavers shall be self-propelled, with activated screed assemblies and 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 of 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.

401.15

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 92-to-96 percent 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 have 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.

401.16

HMA Mixture Production. The HMA mixture shall be produced in a plant meeting the requirements of Subsection 401.12. The dried aggregates and asphalt binder shall be combined in the plant in the quantities required to meet the JMF.

- (a) *Asphalt Binder.* The asphalt binder shall be heated in a manner that will avoid local overheating and provide a continuous supply of the HMA 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.
- (b) *Aggregate.* The aggregate for the mixture shall be dried and heated prior to induction into the mixer. The maximum 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 should 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 the form of a slurry 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 3% above saturated surface dry and then mixed thoroughly in an approved pug mill.

- (c) *HMA Mixture.* The heated and dried aggregates and the asphalt binder shall be combined by weight in the mixer in the amount specified by the JMF. 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 the manufacturer's recommendation. If the Engineer determines that nonuniform operation of the equipment is detrimental to the mixture, he may suspend all paving operations 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 limits shown in Table 401-8. The HMA mixture shall be produced at the lowest temperature within the specified range that produces a workable mix and provides for uniform coating of aggregates (95% minimum in accordance with AASHTO T195), and allows the required compaction to be achieved.

**Table 401-8
HMA Mixing Temperature Limits**

Asphalt Binder Grade	Minimum Discharge Temperature	Maximum Discharge Temperature
PG 58-28	275°F	305°F
PG 64-22	290°F	320°F
PG 76-28	320°F	350°F

HMA mix may be stored provided that any and all characteristics of the mixture are not altered by such storage. If storing or holding of the mixture causes segregation, excessive heat loss, or adversely affects the quality of the finished product, corrective action shall be taken. Unsuitable mixture shall be disposed of at the Contractor's expense.

- (d) *Underlying Surface.* The HMA mixture shall be placed on a prepared surface. Prior to placement of the mixture, irregularities in the underlying surface shall be brought to uniform grade and cross-section. The surface shall be cleaned of dust and debris. A prime or tack coat shall be applied if required.

Surfaces of curbing, gutters, manholes, valve boxes and other structures coming into contact with the HMA mixture shall be coated with a uniform coating of asphaltic material prior to the placement of the HMA mixture against them.

1. *Prime Coat.* Prime coat materials shall meet the requirements of Subsection 401.07(b).

Prime coats shall not be applied when the surface to receive the prime coat is wet or when weather conditions would prevent the proper construction of the prime coat.

The Contractor shall provide equipment for heating and uniformly applying the prime coat material. The distributor shall be capable of uniformly spraying the material at even temperature and uniform pressure on variable widths of surface up to fifteen (15) feet in width at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard at an allowable variation from any specified rate of ± 0.02 gallons per square yard.

The prime coat shall be applied in a uniform and continuous spread. Excess material shall be removed or distributed as directed. Prime coat material shall not be placed on any surface where traffic will be allowed to travel on the freshly applied material.

The rate of application, temperatures, and areas to be treated shall be as stated in the Contract documents or as directed by the Engineer and shall be approved prior to the application of the prime coat.

2. *Tack Coat.* Tack coat materials shall meet the requirements of Subsection 401-07(c). The emulsified asphalt shall be diluted 1:1 with water and applied at 0.10 \pm 0.01 gallons per square yard of diluted material.

Tack coats shall not be applied when the surface to receive the prime coat is wet or when weather conditions would prevent the proper construction of the prime coat.

The Contractor shall provide equipment for heating and uniformly applying the tack coat material. The distributor shall be capable of uniformly spraying the material at even temperature and uniform pressure on variable widths of surface up to fifteen (15) feet in width at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard.

The tack coat shall be applied in a uniform and continuous spread. Excess material shall be removed or distributed as directed. Tack coat material shall not be placed on any surface where traffic will be allowed to travel on the freshly applied material.

The rate of application, temperatures, and areas to be treated shall be as stated in the Contract documents or as directed by the Engineer and shall be approved prior to the application of the tack coat.

401.17 Hauling of HMA Mixture. Transporting the HMA mixture from the plant to the job site shall be done in vehicles meeting the requirements of Subsection 401.13. The Contractor shall have an adequate number of vehicles so delivery of the HMA mixture can be continuous with a minimum of interruptions of materials to the paving equipment in order for a continued nonstop paving operation and before the temperature of the HMA material falls below 250°F or satisfactory compaction temperature. Deliveries shall be planned so the placing and compaction of all of 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. Hauling over newly placed mixture shall not be permitted until the mixture has been compacted as specified and allowed to cool to atmospheric temperature.

401.18 Placing of HMA Mixture. The HMA mixture shall be placed, using equipment meeting the requirements of Subsection 401.14, to the established grade and required thickness over the entire width or partial width as is practicable.

The mixture shall be placed on an approved surface, spread and struck off to obtain the required grade and elevation after compaction. The mixture placed directly behind the paver shall be 25% thicker than desired to account for compaction. Raking is discouraged and will not be allowed except to correct major problems of grade and elevation, 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 25%. Carefully move or minimally work the HMA mixture with rakes, lutes, or shovels to avoid segregation. Mixtures made with modified asphalt binders require more rapid completion of the handwork.

Hauling and placement sequences shall be coordinated so that the paver is in constant motion. Excessive starting and stopping will not be allowed. A construction joint shall be placed any time the paver stops and the screed drops enough to cause a surface dip in violation of Subsection 401.19 or the mat temperature falls below that which is allowed in Subsection 401.18(d).

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

(a) *Segregation.* The bituminous material shall be transported and placed on the roadway without segregation. All segregated areas behind the paver shall be removed immediately upon discovery. The segregated material shall be replaced with specification material before the initial rolling has taken place. If more than 50 square feet of segregated pavement is ordered removed and replaced in any continuous 500 linear feet of paver width, laydown, operations shall be discontinued until the source of segregation has been found and corrected. The Engineer will determine the extent of the segregated areas. Segregated areas shall be corrected at the Contractor's expense.

(b) *Lift Thickness.* Each lift of compacted bituminous pavement shall be of uniform thickness. The minimum compacted lift thickness shall be three times the nominal aggregate size of the HMA mixture. The maximum lift thickness shall be three (3) inches unless the Contractor can demonstrate his ability to achieve the required compaction of thicker lifts.

The final lift, when placed adjacent to guttering, shall extend ¼" to ½" above the lip of the gutter

when compacted.

- (c) *Joint Construction.* The formation of all joints shall be made in such a manner as to ensure a continuous bond between the courses and obtain the required density. All joints shall have the same texture, density and smoothness as other sections of the mat, and 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 a transverse joint is necessary, 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, if cold, shall be tack coated prior to placement of the adjoining mat.

The new compacted mat shall overlap the adjacent previously 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 valve boxes.

1. *Longitudinal Joints.* The longitudinal joint in both a new pavement structure and an overlay pavement layer shall offset the joint in the layer immediately below by six (6) inches. 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 (3) days prior to the Pre-Paving meeting. The plan shall show the location and configuration of the proposed longitudinal joints and pavement marking materials 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 by the Engineer:

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

Longitudinal joints shall not cross the centerline, lane lines, or edge lines 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 twenty-five (25) feet at the end of a day's run. With the approval of the Engineer, the Contractor may be permitted to:

- A. Leave a vertical exposed longitudinal joint when the thickness of the pavement course being placed is 1.5 inches or less.
- B. Leave an exposed longitudinal joint when the thickness of the pavement course being placed is greater than 1.5 inches provided that the top 1.5 inches of the joint is vertical and the remainder of the joint is tapered. The minimum width of the taper shall be three times the thickness of the remaining pavement course.

The tapered portion of the joint shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing the adjacent mat. In both methods, all contact surfaces shall be given a tack coat of bituminous material before placing any

fresh mixture against the joint.

2. *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 prior to placement of fresh mixture against the joint.

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 taper 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. Raking of this joint shall not be allowed except to correct major grade problems.

- (d) *Compaction.* The plant mix bituminous pavement shall be compacted by rolling. Both steel wheel and pneumatic tire rollers will be required. The number, weight, and type of rollers required shall be sufficient to obtain the required density while the mixture is in a workable condition.

The Contractor shall construct a control strip with production materials and equipment and shall determine the roll pattern necessary to meet the specified density. This roll pattern shall be used throughout the paving operation unless conditions change.

Compaction shall begin immediately after the mixture is placed and shall be continuous until the required density is obtained. When the temperature of the mixture's surface falls below 185°F, no further compaction effort will be permitted unless approved by the Engineer.

The Contractor shall prevent the HMA material from adhering to the rollers by using a very small quantity of detergent or other approved material.

The longitudinal joint shall be rolled from the hot side and overlap the joint by approximately 6 inches on the cold side.

The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result or reversing the direction of the roller or from any other causes shall be corrected immediately.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with hand tampers or small mechanical hand compactors.

Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way is defective shall be removed and replaced with fresh material and immediately compacted to conform to the surrounding area at the Contractor's expense. Skin patching will not be allowed.

While the surface is being compacted and finished, the Contractor shall carefully trim the outside edges of the pavement to the proper alignment. Edges so formed shall be beveled while still hot and thoroughly compacted by tampers or by other satisfactory methods.

All roller marks shall be removed with the finish rolling. The use of vibratory rollers with the vibrator on will not be permitted during the final rolling of any pavement course.

The pavement shall be compacted to a density of 92-to-96 percent of the maximum theoretical density, determined according to AASHTO T209.

401.19 **Testing, Inspection, and Acceptance.** Testing of the HMA mixture shall be performed in accordance with the requirements of Section 720. Failing results on two (2) consecutive tests shall be cause for suspension of the paving operation until corrective measures have been implemented.

Surface smoothness testing 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 assist the Engineer in testing the finished pavement surface. Areas to be tested shall be determined by the Engineer. 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.

Inspection shall be provided by the Town. The Contractor shall notify the Town a minimum of 48 hours in advance of his intent to commence paving operations so that adequate inspection can be scheduled. Failure on the part of the Contractor to provide proper notification shall be grounds for suspending the paving operation. Any pavement surface placed without proper inspection or authorization shall be subject to immediate rejection and shall be removed at the Contractor's expense.

Acceptance of the pavement(s) shall be based on: conformity with the lines, grades, cross-sections, and thicknesses shown in the Contract; surface smoothness in accordance with this specification; passing test results in accordance with Section 720; and a visual appearance that is consistent for the HMA mixture used.

Nonconformity shall be determined in accordance with the *MGPEC Pavement Design Standards & Construction Specifications Manual*, latest edition thereof.

METHOD OF MEASUREMENT

401.20 The accepted quantities of hot mix asphalt pavements will be measured by the square yard for the compacted thickness of pavement specified for each pay item in the Bid Schedule. Batch weights will not be permitted as a method of measurement.

BASIS OF PAYMENT

401.21 All work performed and measured as described above will be paid for as provided in the respective Sections for each type specified.

Water used in the mixing plant for lime slurry will not be measured and paid for separately but shall be included in the Work.

Prime coat and/or tack coat will not be measured and paid for separately but shall be included in the Work.

**SECTION 403
HOT MIX ASPHALT (HMA)**

403.01 **Description.** Add the following to Subsection 403.01

Placement of HMA shall commence within 72 hours after milling operations have been completed or as approved by the project manager.

403.02 **Materials.** Replace Subsection 403.02 with the following:

The materials shall conform to the requirements of Subsections 401.02 through 401.08.

403.03 **Construction Requirements.** Replace the first sentence of Subsection 403.03 with the following:

The construction requirements shall be as prescribed in Subsections 401.09 through 401.19.

403.04 **Method of measurement.** Replace Section 403.04 with the following:

Hot Mix Asphalt will be measured as prescribed in Subsection 401.20.

403.05 **Basis of Payment.** Replace Subsection 403.05 with the following:

The accepted quantities of Hot Mix Asphalt will be paid for at the unit bid price per square yard for each pavement type and thickness listed in the Bid Schedule.

The price shall be full compensation for furnishing all materials; for preparation, mixing, placing, and compacting these materials; and for all labor, equipment, tools, and incidentals necessary to complete the Work.

Payment will be made under:

Pay Item

Hot Mix Asphalt (Grading) (Asphalt) (___")
Hot Mix Asphalt (Patching) (Grading) (Asphalt) (___")

Pay Unit

Square Yard
Square Yard

**SECTION 405
HEATING AND SCARIFYING
TREATMENT**

405.01 **Description.** Add the following to Subsection 405.01:

This Work shall also consist of adding additional HMA filler material to the patch area.

405.02 **Materials.** Add the following to Subsection 405.02:

HMA used for filler material shall be 3/8-inch minus. The Contractor shall submit a mix design for approval fourteen (14) days prior to the commencement of Work. Filler material shall be kept at a working temperature of 270° - 300°F.

405.03 **Construction Requirements.** Add the following to the second paragraph of Subsection 405.03:

(4) Capable of producing a true infrared ray with a minimum of convection heat.

405.03 **Construction Requirements.** Replace the third paragraph of Subsection 405.03 with the following:

The infrared heater will be positioned over a patch area so as to ensure heating a minimum of 12 inches beyond the edge or joint of the area to be restored. The heating time will be approximately seven minutes, depending on ambient temperature and pavement condition. An experienced operator can tell when optimum heating penetration has occurred. Under NO circumstances will the pavement be allowed to overheat to the point of damaging the asphalt binder.

405.03 **Construction Requirements.** Replace the fourth paragraph of Subsection 405.03 with the following:

The area to be patched will be neatly outlined ("picture framed") with the back of an asphalt rake; this will be approximately six inches within the heated area. This area will then be deeply and thoroughly scarified using a long tong asphalt rake. Application of an asphalt-rejuvenating agent shall be applied as specified. HMA filler material will be added as necessary to bring the patch area to final grade allowing for compaction; completed patch area shall not be greater than 1/8-inch higher than the surrounding area, and in no case, lower.

405.03 **Construction Requirements.** Replace the fifth paragraph of Subsection 405.03 with the following:

The patch area shall be compacted immediately after it has been distributed and leveled and while it is still workable. Compaction will be accomplished by use of a vibratory roller with a capacity equal to a three-to five-ton static roller. Proper technique will be employed to assure bonding and compaction, which produces a smooth finished restoration. Traffic will not be allowed on the patch area for 24 hours or until it has properly cooled, whichever is longer, unless otherwise directed by the Engineer.

405.05 **Basis of Payment.** Replace the last paragraph of Subsection 405.05 with the following:

Asphalt rejuvenating agent will not be measured and paid for separately but shall be included in the Work.

405.05 **Basis of Payment.** Add the following to Subsection 405.05:

HMA filler material will not be measured and paid for separately but shall be included in the Work.

**SECTION 408
JOINT AND CRACK SEALANT**

408.02 **Materials.** Add the following to Subsection 408.02

Hot Pour Rubberized Asphalt Crack Filler. Crack Filler material shall be hot pour polymer rubberized asphalt crack filler and **shall not contain vulcanized or reclaimed rubber.** Contractor shall submit a certificate of compliance with the specifications of the proposed crack filler to the Director prior to any placement. Crack filler material shall meet or exceed the following requirements.

Cone Penetration 77° F, 150 g, 5 sec.
ASTM D-3407 60% Min. 80% Max

Resilience 77° F 20 sec
ASTM D-3407 60% Min

Flow 140° F, 5 hr, 75° Angle
ASTM D-3407 1 mm Max

Softening Point ASTM 2398 190° F Min.

Tensile Adhesion ASTM D-3406 500% Min.

Forced Ductility @ 4° C, 4 lbs. Max @ 39.2°F

Ductility @ 1cm/min. @ 39.2°F
ASTM D-113 30cm Min

Flexibility: Specimen 6" x 1" x 1/8"
Conditioned to -15°F, shall Bend 90° over 1.125" Mandrel in 2 sec., no cracks

Recommended Pouring Temp. 350°-380° F

Safe Heating Temp. 400° F

408.03 **Construction Requirements.** Add the following to Subsection 408.03

Equipment. The following equipment shall be required:

- A. The heating equipment shall consist of a double-jacketed melting kettle with the inner jacket containing a high temperature transfer oil to ensure even melt down and uniformity of flow. Internal specifications of the kettle shall include an agitation system to ensure an even melt down of the material.

The equipment used to apply the sealant shall be capable of heating the sealant to 300° F minimum and 420° F maximum and shall have a positive means to keep the sealant agitated and thoroughly mixed during sealing activities. The equipment shall also have a minimum melting capacity of 100 gallons per hour and shall be in conformance to the material supplier's recommendation.

The heating unit shall have available at all times a direct reading temperature measurement device capable of reading within ± 5° F from 200° F to 600° F. A log of product tank temperatures shall be recorded at one hour, ± 10 minute intervals by the contractor, and kept available for inspection. Any material that has been overheated in excess of 30° above the manufacturer's recommended maximum temperature shall be wasted at the contractor's expense.

- B. Heat lance equipment will consist of an air compressor capable of delivering a steady flow of air at a minimum of 175 psi and a heating apparatus capable of sustaining air temperatures at a minimum of 750° F.

- C. Sweeping will be with a self-propelled pickup sweeper with the proper brushes to successfully clean the

curb and gutter and street after each days' work.

Sweeping will include use of any blowers or compressors to remove any dirt or debris deposited onto sidewalks and/or driveways during the crack sealing operation and shall be removed at the end of each day by the Contractor.

Preparation and Placement. The following procedures shall be required:

- A. All cracks greater than 1/4 inch and less than one inch in width shall be cleaned with compressed air (minimum 175 psi) and the surface area shall be dried with the use of a heat lance ahead of placing the hot sealant. The cracks will be cleaned prior to placement of sealant to assure all surface moisture is vaporized. Cracks shall be free of dust, dirt, moisture, vegetation or other materials that might prevent bonding of the hot sealant. The asphalt/concrete joint along the edge of the street with the curb and gutter shall be prepared and sealed.

Any crack sealing work which is determined to have been done under this contract without the required crack preparation will not be eligible for payment under this contract.

- B. The Contractor's procedures for loading materials into the product tank shall not depress the sealant temperature at the wand tip below the manufacturer's recommended temperature.
- C. Placement of the crack sealing material shall be accomplished only when weather conditions are dry and meet the material manufacturer's recommendation for placement.

An approved squeegee method shall be used to smooth the material tightly against the surface so that when the sealant is cured its surface is from 1/8 to 1/4 inch below the adjacent pavement surface.

The sealant shall be held in the mixing tank at application temperature until very little separation of the asphalt and rubber occurs when a bead of sealant material is placed on the pavement. The contractor's procedures for loading material into the product tank shall not depress the sealant temperature below the manufacturer's recommended application temperature at the tip of the wand or pour pots.

Traffic shall be kept off the freshly-sealed cracks until the sealant has cured or has been treated with an approved blotter material to prevent tracking. Blotting will not be paid for separately but considered incidental to the project.

Contractor shall sweep entire street to include sidewalks, driveways and gutters, after completion of crack sealing work.

Notification of Sealing. The Contractor will be responsible for notifying all residents by distributing a handout to the occupants of each property adjoining the work areas a minimum of 48 hours and a maximum of seven (7) days prior to beginning work. The original copy of the notice will be given to the Town by the Contractor for approval. In addition, the Contractor shall erect "No Parking" signs along the proposed work area on the day prior to commencing work in that area. If there is a delay of one week or more due to weather, equipment, or other causes, the Contractor will be required to re-notify the residents.

Parked Cars. The Contractor is responsible for clearing parked cars from streets when these cars will interfere with the work. The Contractor will not be required to tow abandoned or immobilized vehicles parked in the street. Every effort shall be made to contact vehicle owner. If unsuccessful the Inspector will have the vehicle towed after a reasonable amount of time.

Location of Work. The crack sealing work will be performed on streets as described in the Project Document. The Town reserves the right to add, delete, or substitute other streets and intersections in this project.

In some areas within the project, off-street parking is not available to residents. In these areas, the Contractor will be required to perform crack sealing work on streets oriented north/south on different days than the streets oriented east/west so that motorists will be able to park within one block of their destination.

Stockpile of Material. It shall be the contractor's responsibility to find a suitable location to store materials.

Storage of materials must meet the requirements of the Town Code. It is the contractor's responsibility to keep the immediate area of storage clean during the progress of the project and to clean the immediate area upon completion of the project.

Testing. The Contractor must submit certificates of compliance with each shipment of material to be used prior to placement. In addition, the Contractor must submit test results from an independent laboratory that confirms that the material provided contains no vulcanized or reclaimed rubber. The Town may also have the material tested to assure compliance with material specifications. Assurance testing costs will be paid by the Town of Castle Rock, but costs of retests due to failure of material to meet the specifications will be the responsibility of the Contractor.

408.04 **Method of Measurement.** Replace Subsection 208.04 with the following:

Sweeping will not be paid separately but shall be included in the work.

Hot poured joint and crack sealant (material) will be measured by the pound of material delivered. Weight shall be based on invoiced weight, tare weight, or the average weight of individual blocks of material as approved by the Town's inspector.

408.05 **Basis of Payment.** Replace Subsection 208.05 with the following:

The accepted quantities of crack sealing for material supplied and placed will be paid for at the contract unit price per pound. Reinstallation of material that does not meet the specifications will not be paid for and the contractor will be responsible for removing and replacing defective material.

Payment will be made under:

Pay Item	Pay Unit
Hot Poured Joint & Crack Sealant	LB

**SECTION 409
SEAL COAT**

409.02 Bituminous Material. Add the following to Subsection 409.02:

Emulsified asphalt shall be polymerized rapid set emulsified asphalt conforming to the requirements of subsection 702.03 for CRS-2P.

409.03 Cover Coat Material. Add the following to Subsection 409.03:

Aggregate shall have a retained bituminous film above 95% when tested in accordance with AASHTO T-182-70; aggregates not meeting this requirement may be used only when a satisfactory chemical additive or wetting agent is used to provide a water resistant film.

Aggregate shall show a loss of not more than 25% when tested by the standard method of test for abrasion, AASHTO Method T96-70.

Aggregate shall be moist at the time of application but the moisture content shall not exceed 2% of the weight of dry aggregate.

Aggregate shall be black or gray in color to provide a visually pleasing appearance. NO tan, brown or other color aggregate will be allowed.

409.04 Weather Limitations. Replace Subsection 409.04 with the following:

Bituminous material shall not be applied on a wet surface or when the pavement temperature is below 60°F unless otherwise specified, or when weather conditions would prevent the proper construction of the seal coat.

409.05 Equipment. Replace the following in Subsection 409.05:

- (2) A pick-up-type sweeper. (The use of power brooms must be approved by the Engineer).
- (3) A minimum of two pneumatic rollers. The pneumatic tired rollers shall be self-propelled, and the gross load adjustable to apply 200-to-350 pounds-per-inch of rolling width as directed. Tire pressures or contact pressures may be specified for the pneumatic tired rollers. Tire pressures on each roller shall not vary more than ± 2.0 p.s.i.

409.06 Preparation of Surface. Add the following to Subsection 409.06:

All streets will be reasonably clean and free of debris; however, the Contractor shall be responsible for removing all loose and objectionable material, mud, and silt immediately prior to the application of the seal coat. Areas of weed growth shall be removed by the Contractor's forces. Because all streets will be crack-sealed and patched prior to the seal coat, large areas of weed growth are not anticipated. Minor street surface cleaning and weed removal will be considered incidental to the Work.

All manholes and valve boxes shall be covered during the application of the seal coat and shall be clean when the Work is completed. The covering shall be removed immediately after the seal coat is applied. It is the responsibility of the Contractor to locate all manholes and valve boxes prior to seal coat operations.

409.07 Applying Bituminous Material. Add the following to Subsection 409.07:

Bituminous material shall be applied at a rate between 0.35 and 0.38 net gallon per square yard. The application rate will be set by the Engineer.

409.08 Application of Cover Coat Material. Add the following to Subsection 409.08:

Cover coat material shall be applied at a rate between 22 and 25 lbs. per square yard. The application rate will be set by the Engineer.

Rolling shall proceed in the following manner: first, rolling via rubber tire roller; second, rolling with rubber tire wheel roller; and third, rolling with a rubber tire roller. Each rolling shall be comprised of three (3) complete coverages.

A coverage shall be the number of passes required to cover the entire surface from side to side. Each pass shall overlap the previous pass by approximately one-half (1/2) the width of the front wheel or roll.

The first rolling of the aggregate shall be completed before the emulsion "breaks".

The second rolling shall be performed as soon as possible after the first rolling.

The third rolling shall pay special attention to areas that are not in the main travel areas (shoulders, parking areas, etc.). Additional rolling may be required in these areas as directed by the Engineer and will be considered incidental to the Work.

All rolling shall be done at low speed (not to exceed 5 mph).

Fog seal shall be placed over the entire seal coated street surface in a uniform manner. Fog seal shall be placed after the street has been sufficiently swept by the Contractor, normally within two (2) working days of the seal coat application. Streets to be fog sealed are identified in the Appendix. Streets shall be swept after (5) working days of the fog seal application via a pick-up-type sweeper.

409.09

Method of Measurement. Add the following to Subsection 409.09:

Surface preparation to include removal of objectionable material, sweeping, and weed growth removal will not be measured but shall be included in the Work.

Water used to moisten the cover coat material will not be measured but shall be included in the Work.

SECTION 410
SLURRY SEAL (Added Section)

DESCRIPTION

- 410.01** This Work shall consist of mixing properly proportioned mineral aggregate, asphalt emulsion, and water in a self-propelled mixer and spreading the mixture on an existing surface in accordance with these Specifications and in conformity with the lines shown on the plans or established. The slurry mixture, when cured, shall have a homogeneous appearance, fill all cracks, adhere firmly to the underlying pavement surface and have skid resistance texture with a high friction number.

MATERIALS

- 410.02** **Asphalt Emulsion.** The emulsified asphalt shall be CQS-1hL (Cationic Quick Setting Emulsified Asphalt with 3% Latex Polymer). CQS-1hL shall be an emulsified blend of asphalt, water, styrene-butadiene rubber (SBR) latex and emulsifiers. The emulsion shall be pumpable and suitable for use in slurry seal mixing and spreading equipment and suitable for application through a distributor truck. The emulsion shall contain a minimum of 3% by weight of styrene-butadiene rubber (SBR) polymer solids based on the weight of residual asphalt. The polymer shall be added as SBR latex by high shear mixing by co-milling or post-milling. The emulsified asphalt shall conform to the following requirements:

Property	Requirement		Test Method
	Min.	Max.	
Viscosity, Saybolt Furol, 77°F, s	20	50	ASTM D88
Storage stability test, 24-h, % ^A		1	ASTM D244 (§ 82 to 88)
Particle charge test		Positive	ASTM D244 (§ 28 to 33)
Sieve test, % ^A	0.1		ASTM D244 (§ 58 to 63)
Distillation ^B : Residue, %	60		ASTM D244 (§ 11 to 15)
Tests on residue from oven evaporation test (ASTM D244 § 21 to 27)^B			
Penetration, 77°F, 100g, 5s	40	90	ASTM D5
Ductility, 77°F, 5 cm/min, cm	40		ASTM D113
Solubility in trichloroethylene, %	97.5		ASTM D2042
Elastic recovery, 77°F, 10cm, 1h, %	40		ASTM D6084

^A This test requirement on representative samples is waived if successful application of the material has been achieved in the field.

^B Distillation to 500°F (D244 §11 to 15) shall be the reference method for percent distillate and percent residue. Residue by evaporation at 325°F (D244 §21 to 27) shall be the reference method to obtain material for tests on residue. Residue from distillation shall not be used for tests on residue due to polymer degradation at 500°F.

- 410.03** **Aggregates:** The aggregate shall consist of manufactured granite crusher fines. The smooth textured crusher fines shall have less than 1.25% water absorption. The aggregate shall be gray in color. The aggregate shall be clean and free from organic matter, other deleterious substances, and clay balls. Oversized granular material and/or presence of clay balls will require the project to be stopped and shall meet the following requirements:

The storage/stockpile site for aggregate will be the responsibility of the Contractor.

The aggregate shall be clean and free from organic matter, other deleterious substances, and clay balls. The total aggregate, including mineral filler, shall be tested and conform to the following requirements:

Sampling Aggregate will be sampled per ASTM D75

Unit Weight of Aggregate from 0 to 5% moisture by (ASTM C29) Rodding Procedure

Job aggregate will be within the specifications and within the stockpile tolerance of the aggregate used in the mix design.

Gradation (ASTM C136 and ASTM C117)

Sieve Size	Percent Passing	Stockpile Tolerance
3/8"	100	0%
No. 4	90-100	±5%
No. 8	65-90	±5%
No. 16	45-70	±5%
No. 30	30-50	±5%
No. 50	18-30	±4%
No. 100	10-21	±3%
No. 200*	5-15	±2%

*Materials finer than No. 200 sieve will be determined by washing.

Oversized granular material and/or the presence of clay balls will be cause to halt the slurry seal operation. If oversized material is present, screening through a ¼-inch screen will be required prior to delivery of the material to the slurry machine. If clay balls are present, the aggregate will be rejected.

Resistance to Degradation (ASTM C131) 30% maximum loss

Soundness of Aggregate (ASTM C88) 15% maximum loss

Sand Equivalent Value (ASTM D2419^A) 65 minimum

^AThe reference method for preparation of the sample shall be as follows: The aggregate shall be oven-dried at 140°F to a constant weight and allowed to cool to room temperature. 2% of water based on weight of the aggregate shall be mixed with the aggregate and the aggregate/water mixture shall be sealed in a moisture proof and waterproof container for a minimum of 24 hours. Complete using ASTM D2419 Procedure B.

Determination of height of the largest aggregate particle retained on the No. 4 sieve.

Mineral fillers such as Portland cement, limestone dust, lime, and fly ash shall be considered as part of the blended aggregate, and shall be used in the amount required. They shall meet the gradation requirements of AASHTO M 17. Mineral fillers shall be used for one or more of the following reasons only: to improve the gradation of the aggregate; to control the time of break of the emulsion; to provide improved stability and workability of the slurry; or to increase the durability of the cured slurry. (Use only materials as specified in the mix design.)

Acceptance of the aggregate will be determined at the job location stockpile. All stockpile testing shall be performed and submitted to the engineer prior to start of construction for acceptance. The aggregate shall be available for Quality Assurance testing three full working days prior to use. The aggregate shall be tested according to the schedule in the Field Materials Manual for Item 409 and acceptance will be determined in accordance with Section 105. If tests show the aggregate does not conform to the gradation requirements, the material shall not be used.

410.04

Water. Water used in making the slurry shall be potable and free of dissolved materials that may affect the mix characteristics or finished characteristics of the product. The effect of moisture content on the specific weight of the aggregate, and the moisture content of the aggregate being used, shall be taken into account in calibrating the machine to deliver asphalt in the correct proportion.

CONSTRUCTION REQUIREMENTS

410.05

Equipment. All equipment, tools and machines to be used in the performance of this Work shall be

maintained in satisfactory working order at all times. Any equipment found to be defective and potentially affecting the quality of the Work shall be replaced.

1. **Slurry Mixing Equipment:**

The slurry machine shall be a double-shafted continuous flow-mixing unit capable of delivering accurate predetermined proportions of aggregate, water, and asphalt emulsion to a revolving spiraled multi-blade mixer tank and of discharging the thoroughly mixed product on a continuous basis. The machine shall be capable of mixing materials in preset proportions regardless of the speed of the machine engine and without changing machine settings.

The aggregate shall be prewetted immediately prior to mixing with the emulsion. The mixing unit shall be capable of thoroughly blending all ingredients together without violent action. The mixing machine shall be equipped with suitable means of accurately metering each individual material being fed into the mixer. The units shall be equipped with approved devices so that the machine can be accurately calibrated and the quantities of materials used during any one period estimated.

The mixing machine shall be equipped with a water pressure system and fog-type spray bar adequate for completely fogging the surface with up to 0.10 gallons per square yard immediately ahead of the spreading equipment. (Application rate will be dependent upon conditions or as directed by the Engineer.)

2. **Slurry Spreading Equipment:**

The spreader box shall be equipped to prevent loss of slurry seal from all sides and shall have a flexible rear strikeoff screed. It shall be capable of producing a uniform surface over its full width. The ability to regulate width of placement of new material is a desirable feature. It shall have suitable means for side tracking to compensate for deviations in pavement geometry. The spreader box shall be furnished with a full-width burlap drag. Drags shall be kept in a completely flexible condition at all times. The box shall be kept clean and build-up of asphalt and aggregate shall not be permitted.

3. **Cleaning Equipment:**

Sweepers, power blowers, air compressors, water flushing equipment and hand brooms shall be suitable for cleaning the base pavement surface and cracks therein. Power brooms will only be allowed with the prior approval of the Engineer.

4. **Sweeping**

Streets shall be swept after five (5) working days of the slurry seal application via a pick-up-type sweeper.

410.06

Preparation of Surface. All streets will be reasonably clean and free of debris; however, the Contractor shall be responsible for removing all loose and objectionable material, mud, and silt immediately prior to the application of the slurry seal. Areas of weed growth shall be removed by the Contractor's forces. Because all streets will be crack-sealed and patched prior to the slurry seal, large areas of weed growth are not anticipated. Minor street surface cleaning and weed removal will be considered incidental to the Work.

All manholes and valve boxes shall be covered during the application of the slurry seal and shall be clean when the Work is completed. The covering shall be removed as soon as is possible. It is the responsibility of the Contractor to locate all manholes and valve boxes prior to seal coat operations.

410.07

Mix Design. The Contractor shall submit a certified mix design covering the specific materials to be used on the Project. The design shall be prepared by an independent laboratory qualified in slurry seal mix design and testing. Once the materials are selected, no substitution will be permitted unless first tested and approved by the laboratory preparing the mix design. This mix design shall be prepared at the Contractor's expense and be submitted two (2) weeks prior to the start of any work.

The qualified laboratory shall develop the job mix design and present certified test results to the Engineer.

Compatibility of the aggregate and emulsion shall be verified by the mix design. All component materials used in the mix design shall be representative of the material proposed by the Contractor for use on the Project.

The Engineer shall review the mix design and all materials and methods prior to use. The component materials shall be within the following limits:

Residual Asphalt	7.5% to 13.5% by dry weight of aggregate
Mineral Filler	0% to 3% by dry weight of aggregate
Additive	As required, to provide the specified properties
Water	As required, to produce proper mix consistency

Sources of all materials shall be selected and identified by the Contractor. All materials shall be pre-tested for the Contractor, at his expense, by a qualified laboratory as to their suitability for use in slurry and conformance with Project specifications.

The laboratory report will show the results of the tests performed on the individual materials, comparing their values to those required by this specification. The report will provide the following information:

Wet Track Abrasion Test – 6-day soak 1-hour soak test not allowed as a substitute	ISSA T100	75 g/ft ² max
Sand Adhesion by Loaded Wheel Tester	ISSA T109	50 g/ft ² max
Asphalt Content (based on dry aggregate)	ISSA A105	7.5% to 13.5%

Determination of Emulsion Content by Graphical Method ISSA T111

Trial Mix Characteristics:

A sufficient number of variations will be shown to provide the applicator with an indication of the effects of changing filler rate, additive rate, etc.

Mix Characteristics	ISSA T113/3.5	No excess free liquids in mix No excess dry or stiff mix
Mix Time at 77°F	ISSA T113/3.6	180 seconds minimum
Mix Time at 100°F	ISSA T113/3.6	120 seconds minimum
Set Time at 77°F displacement	ISSA T113/3.7	30 minutes maximum
clear blot	ISSA T113/3.8	30 minutes maximum

Cured Trial Mix Evaluation (24-hr, 77°F cured mix from ISSA T113/16 – 30-second mix):

A sufficient number of variations will be shown to provide the applicator with an indication of the effects of changing filler rate, additive rate, etc.

Surface Examination	ISSA T113/4.1	No tackiness No shininess
Fines Flotation	ISSA T113/4.2	No fines flotation
Internal Adhesion	ISSA T113/4.3	95% minimum coating, all size particles securely held in mix, no asphalt/aggregate segregation

Wet Stripping Test – modified to a 10-minute boiling period (ISSA T114)

(24-hr, 77°F cured mix from ISSA T113/3.6 – 30-second mix):

A sufficient number of variations will be shown to provide the applicator with an indication of the effects of changing filler rate, additive rate, etc.

Coated aggregate Integrity	ISSA T114	95% minimum coating report: solid, broken, crumbly, etc.	
Cohesion Values at 77°F	ISSA T139	30-min 60-min 2-hr 4-hr 24-hr	12 minimum report report report solid spin (26-in-lb)

Job Mix Recommendations and Comments.

Calculation of minimum slurry application rate for large stone embedment based on measured maximum aggregate size retained on the No. 4 sieve and bulk dry density by rodding procedure.

The laboratory shall report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effect). The laboratory report must clearly show the proportions of aggregate, mineral filler (min. and max.), water (min. and max.), additive(s) (usage), and asphalt based on the dry aggregate weight.

A complete laboratory analysis and test report accompanied by abraded and unabraded slurry test samples shall be submitted by the Contractor a minimum of two (2) weeks prior to use. The Engineer shall be allowed to observe all testing.

The Engineer will perform testing on materials and mix design proposed for the Project. This testing will be at the Town's expense. The Contractor shall supply material samples as needed at no expense to the Town. In addition to the test shown above, the Town shall use Schulze-Breuer-Ruck compatibility, methylene blue, cohesion, loaded wheel, and other tests it deems necessary to verify the quality of the slurry and its components.

410.08 Weather Limitations. No slurry shall be applied:

1. When there is any danger the finished product will freeze before it cures completely.
2. When the pavement and/or air temperature is 60°F or below.
3. In the period following a rain while puddles of water remain on the surface.

Slurries that cure by evaporation should not be placed during periods of abnormally high humidity or when rain may fall within four (4) hours of placement.

Slurry seal areas damaged by water (storm related events) shall be re-slurried as directed by the Engineer. Costs associated with repairing water damaged areas and removal of asphalt emulsions from curbs, gutters, ditches, and lawns will be borne by the Contractor. The Contractor will be allowed to suspend work to minimize the potential for water damage to the slurry seal and surrounding facilities with an appropriate adjustment to Contract time.

410.09 Application. The surface shall be fogged with water directly preceding the spreader, if required. The slurry mixture shall be of the desired consistency as it leaves the mixer and no additional elements shall be added. A sufficient amount of slurry shall be carried in all parts of the spreader at all times so that complete coverage is obtained. No lumping, balling, or unmixed aggregates shall be permitted. No segregation of the emulsion and aggregate fines from the coarse aggregate will be permitted. If the coarse aggregate settles to the bottom of the mix, the slurry will be removed from the pavement. No excessive breaking of the emulsion will be allowed in the spreader box. No streaks, as caused by oversized aggregate, will be left in the finished pavement. Rippling of the finished pavement is undesirable and shall be minimized.

No excessive build-up or unsightly appearance shall be permitted on longitudinal or transverse joints. Joints

shall be straight and have a neat appearance. Drags shall be kept relatively clean and free of excessive build-up. Drags shall be replaced daily or more often as directed by the Engineer.

Squeegees shall be used to spread the slurry in areas not accessible to the spreader box. Every effort shall be made to minimize segregation during handwork. Material shall be placed as close to final position as practicable to reduce the amount of handwork. Care shall be exercised so as to leave a pleasing appearance.

The mixture shall possess sufficient stability so that premature breaking of the material in the spreader box does not occur. The mixture shall be homogenous during and following mixing and spreading; it shall be free of excess water or emulsion and free of segregation of the emulsion and aggregate fines from the coarse aggregate.

Care shall be taken to ensure straight lines along curbs, shoulders, and joints. No runoff in these areas will be permitted. Lines at intersections will be kept straight to provide a good appearance.

Slurry surfacing shall be completed within a time frame to allow opening of the roadway, parking lot, or other resurfaced area within normal working hours, while providing sufficient cure time.

In order to minimize rippling, slurry machines will NOT be permitted to travel at speeds in excess of 220 ft./min. The Engineer may further reduce machine speed if excessive rippling of the surface occurs.

Care should be taken not to overlap slurry onto the concrete adjacent to the slurry area. The seam shall be sufficient to seal the joint between the pavement and the concrete. Any overlapping slurry shall be removed as directed by the Engineer and costs associated with such removal shall be borne by the Contractor.

APPLICATION RATE. Proportions of the material components to be used will be set by the Project Manager, as well as the spread rate. These will be identified in the Project mix design. For purposes of estimating quantities for the Project, the following proportions and spread rates were assumed:

Dry Aggregate Spread Rate = 18 lb/sq yd
 % Mineral Filter* = 1.00%
 % Asphalt Content* = 8.0%

*By dry weight of aggregate

Application rates will be set to match the approved mix design. The range of acceptable application rates will be set to within plus or minus 10% of the application rates set by the Project Manager. At the conclusion of the Project, emulsion mineral filler and aggregate tickets will be compared with the area of slurry seal placed to determine the average coverage rate for the Project. Any material delivery tickets in excess of the maximum application rates will be subject to nonpayment. If material delivery tickets indicate that the average application rates were below the minimum application rates, the final payment will be reduced as shown below:

Amount Below Minimum Application Rate Aggregate, Emulsion or Mineral Filler	To be negotiated No pay
1-3%	
3-5%	
5-7%	
7-10%	
10%+	
Percent Reduction in Final Payment for Aggregate, Emulsion or Mineral Filler	
10%	
15%	
20%	

The Town of Castle Rock will continually be checking quantities using run sheets. The Contractor shall provide the Project Manager with run sheets each day. The Contractor is encouraged to also check quantities with run sheets to avoid the penalties described above. Responsibility for ensuring proper spread rates and material proportions is solely the Contractor's.

METHOD OF MEASUREMENT

410.10 Slurry seal will be measured by the square yard of surface area covered, complete in place. Asphalt emulsion, aggregates, fillers, and water required to complete the Project will not be measured and paid for separately but shall be included in the Work.

BASIS OF PAYMENT

410.11 The accepted quantity will be paid for at the unit bid price for the slurry seal item.

Payment will be made under:

Pay Item	Pay Unit
Slurry Seal	Square Yard

**SECTION 412
PORTLAND CEMENT CONCRETE PAVEMENT**

412.03 **Classification.** Add the following to Subsection 412.03:

Concrete for crosspan and fillet pavement shall be Class B or D.

High Early Concrete shall reach a compressive strength of 3000 psi in twenty-four (24) hours to allow the new concrete pavement to be opened to traffic. Admixtures to decrease curing time shall be nonreactive to steel reinforcement and shall not include calcium chloride unless approved by the Director. All other requirements for the class of concrete specified shall be met.

When not specified or required at the direction of the Director, High Early Concrete may be used at the option and expense of the Contractor.

412.12 **Finishing.** Delete Subsection 412.12(d).

412.14 **Curing.** Replace the first sentence of the first paragraph of Subsection 412.14 as follows:

Immediately after the finishing operations have been completed, the entire surface, including exposed sides of the newly placed concrete, shall be sprayed uniformly with an impervious membrane-curing compound.

412.17 **Surface Smoothness Test.** Replace Subsection 412.17 as follows:

Surface testing will be performed with a ten-foot straight edge as described in the Ten-Foot Straight Edge Method.

412.18 **Sealing Joints.** Add the following to Subsection 412.18:

Mastic joint sealer is **not** considered suitable for joint material in concrete pavement. Joint material will be silicone based and shall be recommended for this usage by the manufacturer.

412.23 **Method of Measurement.** Delete the first paragraph in Subsection 412.23.

412.23 **Method of Measurement.** Add the following as the first paragraph in Subsection 412.23:

The quantities of Concrete Pavement and Concrete Pavement (High Early) to be paid will be the number of square yards completed and accepted. Concrete Pavement (High Early) will be paid at the same price as Concrete Pavement unless it is required by the Contract Documents or its' use is directed by the Director.

412.24 **Basis of Payment.** Add the following to Subsection 412.24:

Joint sealing on new concrete pavement construction will not be measured and paid separately but shall be included in the work.

Pay Item	Pay Unit
Concrete Pavement (10")(Crosspan)	Square Yard
Concrete Pavement Joint Sealing	Linear Foot

**SECTION 413
HOT CHIP SEAL (Added Section)**

413.01 Description.

The Contractor shall furnish all labor, equipment, material, supplies, raised markers, signage traffic control, and other incidentals necessary to provide a **hot chip seal** satisfactory to the Project Manager at the locations specified. The work shall consist of placing a standard chip seal followed by an application of an additional cover coat material (hot chip seal).

413.02 Emulsified Polymerized Asphalt Material (Chip Seal): Polymerized cationic rapid set emulsified asphalt (CRS-2P) shall be an emulsified blend of polymerized asphalt, water, emulsifiers, and polymer. The asphalt cement shall be polymer modified prior to emulsification and shall contain a minimum of 3% styrene-butadiene-styrene (SBS) block copolymer by weight of asphalt cement. The emulsion, standing undisturbed for a minimum of 24 hours, shall show no milky white separation, but shall be smooth and homogeneous throughout. The emulsion shall be pump able and suitable for application through a distributor truck. The CRS-2P shall conform to the following specifications:

Test on Emulsion	Minimum	Maximum	Test Method
Viscosity, Say bolt Furol, 122° F,s	80	400	ASTM D88
Storage Stability Test, 24-h,%(a)		1	ASTM D244
Demulsibility, 36 ML, 0.8% dioctyl sodium Sulfoucciaante, %	40		ASTM D244
Particle Charge Test	Positive		ASTM D244
Sieve Test, %(a)		0.1	ASTM D244
Distillation: (b)			ASTM D244
Oil Distillate, by Volume of Emulsion, %		3	ASTM D244
Residue, %	73		ASTM D244
Test on Residue			
Penetration, 77° F, 100g, 5s	70	150	ASTM D5
Ductility, 77° F, 5 cm/min,cm	75		ASTM D113
Ductility, 39.2° F, 5 cm/min,cm	25		ASTM D113
Solubility in Trichloroethylene, %	97.5		ASTM D2042
Toughness, in-lb	90		ASTM D5801
Tenacity, in-lb	60		ASTM D5801
Elastic Recover, 77° F, 10cm,1h,%	80		ASTM D5976

- a) This test requirement on representative samples is waived if successful application of the material has been achieved in the field.
- b) Residue by evaporation at 325° F shall be the reference method to obtain material for tests on residue. Residue from distillation shall not be used for tests on residue due to polymer degradations at 500° F.

A one-quart sample of the final emulsion shall be submitted upon request. The source of the base asphalt, polymer, additive, and supplier shall be stated on the sample and shall not change during the course of construction.

413.03 Cover Coat Material (Chip Seal):

The chip or cover coat aggregate shall be washed, hard, durable, clean rock and free from coatings or deleterious material. All of the aggregate shall be crushed gray granite with 100% fractured faces. The aggregate shall be crushed gray granite with 100% fractured faces. The aggregate shall have minimum loss of 20% when tested with the LA Abrasion procedure as defined by AASHTO T96. Only one type of aggregate shall be used and shall conform to the following gradations:

Gradation Table – Cover Coat Aggregation (percent passing)

Sieve Size	1/2" Chip	3/8" Chip	1/4" Chip
3/4"	100	100	100
5/8"	90-100	100	100
1/2"	80-100	100	100
3/8"	0-80	90-100	100
1/4"	0-20	0-60	90-100

No. 8	0-3	0-3	0-3
No. 200	0-2.5	0-2.5	0-2.5

413.04 Cover Coat Material (Hot Chip Seal):

The hot chip or cover coat aggregate shall be washed, hard, durable, clean rock and free from coatings or deleterious material. All of the aggregate shall be crushed gray granite with 100% fractured faces. The aggregate shall have minimum loss of 20% when tested with the LA Abrasion procedure as defined by AASHTO T96. Only one type of aggregate shall be used and shall conform to the following gradations based on percent passing:

Sieve Size	1/2" Cover Coat material	3/8" Cover Coat material
3/4"	100%	100%
1/2"	90-100%	100%
3/8"	60-90%	100%
1/4"	N/A	25-60%
No. 4	25-35%	25-35%
No. 8	15-25%	15.25%
No. 200	3-8%	3-8%
Asphalt Content (AC 20)	5.0 % to 5.5 %	5.5% to 6.0%

An approved mix design shall be provided and approved

413.05 Aggregate Acceptance:

Acceptance of the aggregate will be determined at the job location stockpile. All stockpile testing shall be performed and submitted to the engineer prior to start of construction for acceptance. The aggregate shall be available for Quality Assurance testing three full working days prior to use. The aggregate shall be tested according to the schedule in the Field Materials Manual for Item 409 and acceptance will be determined in accordance with Section 105. If tests show the aggregate does not conform to the gradation requirements, the material shall not be used.

413.06 Mix Design:

A minimum of two weeks before work commences, the Contractor shall submit a complete mix design using the materials (aggregates, emulsion, and mineral fillers) to be supplied on the project to the Engineer. Construction shall not commence until a job mix formula (Form 43) is issued. This mix design shall be performed by a qualified laboratory acceptable to the Engineer. The mix design shall be made with the same aggregate and gradation that the Contractor will provide on the project. Once materials are approved, no substitutions will be permitted unless first tested by the laboratory preparing the mix design and approved by the Engineer. The target emulsion rate should be 0.30 gallons per square yard or more to secure one layer of chips to the street.

413.07 Equipment:

The size and condition of the equipment shall be approved prior to construction. Should equipment be unsatisfactory for whatever cause, the Contractor shall remove and replace the equipment without delay or cost. The equipment shall conform to the following minimum requirements.

413.08 Bituminous Distributor:

A minimum of two like distributors shall be used on the project. The distributors shall be self-powered and capable of providing a uniform application rate of emulsion varying from .05-1.00 gallons per square yard over a variable width up to twenty feet in a single pass. The uniformity of the distributors shall not vary by more than two-hundredths gallons per square yard. The distributors shall be equipped with a variable power unit for the pump and full circulation spray bars, which are adjustable laterally and vertically. The nozzle angle and bar height shall be set to provide one hundred percent of double coverage in a single pass. Where multiple passes will be required to complete the full width, the four inches adjacent to the second pass may be left with fifty percent coverage so that the next pass will complete the full application rate specified. Distributors shall be self-powered and include a computerized application controls, a tachometer, pressure gages, accurate volume devices, calibrated tank, and a thermometer for measuring temperatures

of the emulsion in the tank.

413.09 Aggregate Spreader:

The aggregate spreader shall be self-propelled and supported by at least four tires on two axles capable of providing a uniform application rate of aggregate from five to fifty pounds per square yard over a variable width up to twenty feet in a single pass. The uniformity of this machine shall not vary by more than one pound per square yard. The aggregate spreader shall be equipped with the means of applying the cover coat material to the surface with computerized application controls so that the required amount of material will be deposited uniformly over the full width of the bituminous material. A computer rate controlled aggregate spreader shall be required.

413.10 Asphalt Paver:

The hot chip seal shall be placed by a type of paver used for the placement of hot asphalt material. The paver shall be self-contained, power propelled units provided with an adjustable activated screed, heated and capable of spreading and finishing course material on variable widths of surface up to 18 feet.

413.11 Rollers:

A minimum of two self-propelled pneumatic tired rollers for the chip seal application and two steel wheel rollers will be used to seat the hot chip seal. The rubber tired rollers shall have a gross load adjustable to apply 200-250 pounds per inch of rolling width. Tire pressure shall be specified for the pneumatic tire rollers and shall not vary more than plus or minus 5.0 psi. The steel drum rollers shall be double drum rollers with a loaded rate of five tons. At no time shall the rollers travel more than ten miles per hour.

413.12 Sweepers:

A minimum of two vacuum designed sweepers having only negative air pressure at the road surface capable of removing excess aggregate and debris material shall be used on this project. The body hoppers of the vacuum sweepers shall be a minimum capacity of ten cubic yards, and the negative air pressure at the intake shall re-rated at forty six inches of negative water pressure. Sweepers shall meet applicable U.S. Environmental Protection Agency Standards. No mechanical pick-up brooms will be allowed on the project.

MATERIAL APPLICATION RATES

Material	1/2" Chip Seal	3/8" Chip Seal	1/4" Chip Seal
CRS-2P Chip seal	.36-.40 Gal/SY	.34-.38 Gal/SY	.28-.32 Gal/SY
Hot Chip seal	85 lbs Minimum	75 lbs Minimum	60 lbs Minimum N/A
Cover Coat Aggregate	25 lbs/SY Minimum	23 lbs/SY Minimum	20 lbs/SY Minimum

The specific emulsion and cover aggregate application rate shall be determined using factors such as surface temperature, traffic volume, existing road condition, and time of year. The Contractor may alter the application rate at any time during the course of the construction upon approval by the project manager.

413.13 Surface Preparation:

The Contractor shall be responsible for all measures required providing a thoroughly clean and dry pavement surface including vegetation removal, and sweeping prior to the chip seal application. The Contractor shall observe the condition of the pavement prior to bidding to determine the work necessary to provide a clean, dry pavement for construction and shall include the work necessary in the bid.

413.14 Application of Bituminous Materials:

The application of the emulsion shall be performed by means of a pressure distributor in a manner to achieve a uniform and continuous spread over the asphalt surface. The temperature of the emulsion shall be a minimum of 160 F. The quantity of the emulsion per square yard shall be as specified herein and agreed upon with the Project Manager. The distributor shall be moving forward at proper application speed at the time the spray bar is opened. If at any time a nozzle becomes clogged or not spraying a proper pattern, the operation shall be immediately halted until repairs are made. Repairs shall be made immediately after deficiencies are noted and prior to the aggregate spreader at all times

during construction. The additional passes are required the emulsion shall be four inches beyond the aggregate spread at fifty percent application rate. At no time shall the emulsion be allowed to break, chill, setup, harden, or otherwise impair the aggregate retention before aggregate has been properly applied and rolled.

413.15 Application of Cover Coat Aggregate (Chip Seal):

The aggregate shall be applied immediately following the emulsion application by the approved aggregate spreader. The quantity of cover coat aggregate per square yard shall be specified herein and agreed upon with the Project Manager. The Contractor, prior to start of work, shall calibrate the aggregate spreader to achieve the design application rate of the cover coat aggregate. Spreading shall be accomplished in such a manner that the tires of the trucks and aggregate spreader never contact the newly applied bituminous material. The width of the aggregate spreader shall be equal to the width of the emulsion spread, except where additional passes are required. Areas, which are deficient in aggregate, shall be covered immediately with additional material.

413.16 Rolling (Chip Seal):

Initial rolling shall begin immediately after the application of cover coat aggregate. Rollers shall work in tandem and complete a minimum of three passes with a sufficient overlap. Should the rolling operation be delayed, the aggregate and emulsion spreading shall be halted until the operation regains proper sequencing and timing. The maximum speed of the rolling operations shall be ten miles per hour.

413.17 Sweeping:

Within 24 hours of chip seal application, excess aggregate shall be swept and removed from the roadway and adjacent areas with specified herein sweepers.

413.18 Application of Cover Coat Material (Hot Chip Seal):

The hot chip seal shall be applied within two weeks of the chip seal application and after the loose material has been swept up. The Hot chip seal material shall have a minimum temperature of 275° F. The hot chip seal shall be applied of the entire chip seal surface and struck off to the established grade and proper elevation.

413.19 Rolling (Hot Chip Seal):

A minimum of two steel wheel rollers making two or more passes shall follow immediately to seat and cool the material. The surface shall be available to traffic within 15 minutes after the rolling has been completed.

413.20 Utility Protection:

Manholes, valve boxes, and thermo markings shall be covered with an approved material during the operation and shall be removed immediately after the street has been chip sealed. The Contractor is responsible for locating all exposed manholes, valve boxes and thermo markings prior to placing cover coat materials.

413.21 Weather limitations:

No construction shall take place when either the air or pavement surface temperature fall below fifty degrees (50°) or when the pavement is moist, or when the weather is or may be detrimental. Detrimental weather is defined as rain showers, cool temperatures, moist pavements, threat of rain showers, or other factors which could affect the performance of the construction.

413.22 Method of Measurement:

Chip seal will be paid for by the square yard of street surface properly seal coated and accepted by the Town. The area for payment will normally be the measured width of the street from lip to lip of gutters multiplied by the length of chip seal coating applied. The contractor shall supply the Project Manager with weight tickets for cover aggregate and asphalt used on the job. Such tickets will serve as a check on the application rate. The contract unit price per square yard shall be full compensation for all labor, materials and equipment necessary to complete this project in its entirety.

413.23 Basis of Payment.

Pay Item
Hot Chip Seal

Pay Unit
SY

**SECTION 420
GEOSYNTHETICS**

420.01 Description. Add the following to Subsection 420.01:

This Work also consists of furnishing and installing a geogrid material for subgrade stabilization. Geogrid shall be installed in accordance with these Specifications and the manufacturer's recommendations.

420.02 Materials. Add the following to Subsection 420.02:

Geogrid material shall meet the requirements of Tensar Geogrid material. Material grade shall be Tensar SS-1 or equivalent.

420.035 Subgrade Stabilization. (Added Subsection)

Areas to receive geogrid material shall be excavated to grade and be reasonably smooth, free of windrows, depressions and mounds, which would affect the placement of the material. The material shall be placed in accordance with manufacturer's recommendations and secured to the subgrade to prevent movement of the material and separation of joints during placement of granular stabilization material.

After placement of the geogrid material, the granular roadway stabilization material shall be placed in accordance with Section 304. Contractor shall minimize traffic and the use of rubber-tired equipment on the stabilization material. The use of vibratory equipment is allowed as long as the subgrade does not deflect excessively.

420.04 Paving. Replace the second sentence of the first paragraph of Subsection 420.04 as follows:

The pavement surface shall be swept immediately prior to beginning paving geotextile treatment using a pick-up-type street sweeper.

420.04 Paving. Add the following to Subsection 420.04:

Longitudinal joints between adjacent runs of paving geotextile shall be overlapped a minimum of six (6) inches. Transverse joints shall be overlapped in the direction of travel of the paving train. Joints shall be treated with sufficient asphalt binder to promote total saturation of the paving geotextile after the hot bituminous pavement material is placed.

Paving geotextile shall be placed a maximum of six (6) inches from concrete gutters and structures.

Paving geotextile shall be applied by mechanical means. Placement by hand methods will be approved only in areas inaccessible to mechanical equipment. Material placed in curves shall be placed along the chord of the curve, in wedge-shaped sections or by other methods as approved by the Inspector that will minimize or eliminate folds in the material. Material shall not be placed along curves by a continuous lay-down method unless the procedure is approved by the Inspector.

The presence of folds or wrinkles with a fold length or height in excess of one (1) inch will be justification for the Director to stop placement of the geotextile until the Contractor takes appropriate measures to place the material to the satisfaction of the Inspector. All wrinkles or folds exceeding one (1) inch in fold length or height shall be cut and rolled or repaired to the Director's satisfaction.

420.09 Method of Measurement. Add the following to Subsection 420.09:

Geogrid will be measured in place by the square yard of surface area covered and accepted. Material used in joint overlaps will not be added to the in-place measurement.

The quantity of paving geotextile will be measured by the square yards of Hot Bituminous Pavement (Overlay) placed on the roadway after the paving geotextile is placed. Material used in joint overlaps will not be added to the measured amount, and deductions will be made for the 6-inch bare strip along concrete gutters or for cutouts for manholes, water valve boxes and other street fixtures.

The quantity of geotextile for rip-rap lining shall not be measured but shall be included in the pay item for rip rap.

420.10

Basis of Payment. Add the following to Subsection 420.10:

Pay Item
Geogrid

Pay Unit
Square Yard

**SECTION 508
TIMBER STRUCTURES**

508.01 **Description.** Add the following to Subsection 508.01:

This work shall consist of the construction of timber retaining walls in accordance with these specifications and in reasonably close conformance with the lines and grades as shown on the plans or as established.

508.03 **Treated Timber.** Add the following to Subsection 508.03:

The preservative used in treatment of timber used in timber structures shall be pentachlorophenol. The solvent may be either volatile petroleum solvent or light hydrocarbon solvent for oil borne preservatives. The treatment type shall be for soil contact.

508.10 **Method of Measurement.** Replace Subsection 508.10 with the following:

Timber Retaining Wall will be measured by the facing surface area of timber wall constructed. The pay item shall include anchor beams and all hardware unless otherwise designated.

508.11 **Basis of Payment.** Replace Subsection 508.11 with the following:

The accepted quantity of timber retaining wall will be paid for at the contract unit price per surface square foot of timber wall constructed and accepted. Payment will be made under:

Pay Item	Pay Unit
Timber Retaining Wall	Square Foot

**SECTION 509
STEEL STRUCTURES**

Replace Section 509 with the following:

DESCRIPTION

- 509.01** The work of this section consists of furnishing and installing an engineered clear span steel pedestrian bridge. This section shall be regarded as minimum standards for design and construction.
- 509.02** Workmanship, fabrication and shop connections shall be in accordance with the American Association of State Highway and Transportation Officials (AASHTO) specifications. All welding shall be performed by welders qualified in accordance with AWS D1.5-88 bridge welding code. The bridge manufacturer shall provide assurance test reports to the owner, upon request, to insure that the structure meets the requirements of AWS D1.1.
- 509.03** Submit three copies of bridge shop drawings and structural design calculations. All drawings and calculations shall be signed and sealed by a professional engineer registered in the State of Colorado.

MATERIALS

- 509.04** Bridge shall be fabricated from ASTM A572 steel. Bridge shall be sand blasted and painted with one coat of primer and a finish coat of rust inhibitive enamel.
- 509.05** Decking and handrails shall be west coast-region Douglas fir or southern yellow pine planks and shall be treated to AWWPA standards. Wood shall be treated with either ammoniacal copper arsenate or chromated copper arsenate. Wood shall be treated to a total absorption of 0.40 pounds per cubic foot of wood or to refusal.

DESIGN

- 509.06** Pedestrian bridge design shall be in accordance with the Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings by the American Institute of Steel Construction (AISC) - latest edition. Welded tubular structure design shall be in accordance with the Structural Welding Code, Chapter 10, Tubular Structures (ANSI/AWS D1.1-90).

The pedestrian bridge shall:

- 1) Be mounted on plates and teflon slip pads.
- 2) Accommodate abutment elevation differences as indicated on the plans.
- 3) Have no field splices (one piece shipping).
- 4) Be designed to prevent an accumulation of water at any point on the steel structure.
- 5) Be designed for a uniform live load of 85 PSF and vehicle load of 6,000 pounds.
- 6) Have a span and clear width as shown on the plans and stated in the bid schedule pay item..
- 7) Have a bridge deck with no camber (flat).
- 8) Use the Pratt Truss (one diagonal per panel).
- 9) Have 3" x 12" deck planks installed perpendicular to the length of bridge
- 10) Have continuous steel safety rails with maximum clear openings of six (6) inches and top rail height of 54 inches above the deck.
- 11) Have 2" x 6" handrails placed 42 inches above the deck.
- 12) Have a warranty of 10 years.

CONSTRUCTION

- 509.07** The pedestrian bridge shall be installed in accordance with the manufacturers written procedures and instructions.

METHOD OF MEASUREMENT

- 509.8** The pedestrian bridge shall be measured as complete-in-place to included design, fabrication and installation.

BASIS OF PAYMENT

509.10

The pedestrian bridge shall be paid on a lump sum basis for all design, labor, equipment, materials and incidental items required to complete the work. Payment will be made under:

Pay Item

Steel Pedestrian Bridge (____' x ____')

Pay Unit

Lump Sum

**SECTION 514
PEDESTRIAN AND BIKEWAY RAILING**

514.01 **Description.** Add the following to Subsection 514.01

Construction of Pedestrian Railing (Steel) as shown on plans and details in the Contract Documents shall be included as work in Section 514.

514.03 **Steel Tube Railing.** Add the following to Subsection 514.03

Pipe sections may be either field or shop cut to size with mechanical means only. Pipe splices shall only be made at fittings shown on the plans. Welds made to attach the pipe to steel plates placed in concrete retaining walls or sidewalks, etc., shall receive 3 coats of zinc rich paint after welding and chipping is completed.

514.04 **Timber Railing.** Add the following to Subsection 514.04

Pedestrian Railing (Steel) with Timber Railing will be measured by the linear foot constructed. Measurement will be made from end to end of the railing.

514.05 **Combination Railing.** Add the following to Subsection 514.05

The accepted quantities of Pedestrian Railing (Steel) will be paid for at the contract unit price per linear foot of railing constructed and accepted. The pay unit shall include all materials, including mounting plates to set the railing, as required to complete the item. Payment will be made under:

Pay Item	Pay Unit
Pedestrian Railing (Steel)	Linear Foot
Pedestrian Railing (Steel) with Timber Railing	Linear Foot

**SECTION 601
STRUCTURAL CONCRETE**

601.01 **Description.** Add the following to Subsection 601.01:

Work under this Section also includes construction of backside footers as shown on the plans.

601.19 **Method of Measurement.** Add the following to Subsection 601.19:

Backside footers will be measured by the square foot of footer face constructed in accordance with the plans or as directed by the Director.

601.20 **Basis of Payment.** Add the following to Subsection 601.20:

Payment for backside footers will be made under:

Pay Item	Pay Unit
Backside Footer	Square Foot

**SECTION 602
REINFORCING STEEL**

602.07 **Method of Measurement.** Delete Subsection 602.07.

602.08 **Basis of Payment.** Replace Subsection 602.08 with the following:

Payment for reinforcement will be included in the contract unit price bid for individual structures and no separate payment will be made for reinforcement.

**SECTION 603
CULVERTS AND SEWERS**

603.02 **Materials.** Delete the last paragraph of Subsection 603.02.

603.02 **Materials.** Add the following to Subsection 603.02:

Unless otherwise noted on the plans, storm sewer pipe materials from those specified on the construction plans will be allowed for the Project. Pipe sizes shown on the plans have been designed based on the pipe materials shown on the plans. If an alternate pipe material size chart is shown on the plans, sizes for alternate pipe materials shall be made in accordance with this chart. In the absence of a pipe material size chart on the plans, the following rules shall apply in bidding alternate pipe materials:

No decrease in pipe diameter from the pipe material specified on the plans and bid proposal shall be made by the Contractor to allow for changes in "N" value of the alternative pipe material.

Smooth interior pipe shall have a published "N" value of .015 or less.

Pipe materials for this Project shall be limited to the following materials for construction of storm sewer.

DESCRIPTION	SPECIFICATION
Concrete Pipe	CDOT Section 706 and M&S Standard M-603-2
Polyvinyl Chloride Pipe Smooth Interior, Ribbed or Smooth Exterior	ASTM F 795, PS 46 ASTM F 679, PS 46 AASHTO Sec. 18
Polyethylene Pipe Smooth Interior, Ribbed or Corrugated Exterior	AASHTO M 294, Type S or ASTM F 894 RSC 63 for depth <=15 feet RSC 120 for depth >15 feet depth

Concrete conduit shall be Class III minimum.

The Town gives the option to the Contractor to use non-reinforced concrete pipe as allowed by CDOT Standard Plan No. M-603-2 provided the conditions of the general notes are met.

The flow line of an alternate pipe material shall be the same as that shown in the plans. Additional payment will not be made for changes in the pipe size or type for any increased or decreased quantities including excavation, backfill, enlarged manholes and inlets, etc., resulting from the use of alternative pipe material by the Contractor. Cost for additional relocation of utilities or additional structural design due to optional pipe material selection shall be borne by the Contractor. The Contractor will be responsible for additional engineering services required to verify flow velocities and other structural design efforts related to use of the alternate pipe material.

Polyethylene pipe shall conform to the requirements of AASHTO Bridge Book, Section 18.

Rubber O-ring gaskets conforming to Subsection 705.03 shall be used for all concrete storm sewer pipe joints.

All pipe joints shall be "premium joints" such as bell and spigot joints, etc., which minimize or eliminate leakage into or out of the storm sewer pipe.

603.03 **General.** Add the following to Subsection 603.03:

Allowable trenches and fill heights for pipe will be as shown on the appropriate CDOT M-Standard for the sizes, types and classes of pipe material used.

Storm sewer pipes shall be a maximum of five feet deep and no less than eighteen inches deep from finished grade.

All sanitary sewer line materials and construction shall be in conformance with the standards and specifications of the owning utility company. Contractor shall notify the utility company at least forty-eight (48) hours in advance of commencing construction on the utility company's system. All Work shall be inspected and approved by the owning utility company.

The Contractor shall notify all sanitary sewer utility customers affected by scheduled construction a minimum of twenty-four (24) hours in advance of any service disruption.

603.04 Excavation. Add the following to Subsection 603.04:

The Contractor shall provide and maintain ample means and devices with which to promptly remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the laying of the pipe, and until the backfill at the pipe zone has been completed. The Contractor shall dispose of the water in a suitable manner without damage to adjacent property. No ground water is to be discharged into a "State Body of Water" unless permitted by the State to do so. Ground water shall not be discharged into sanitary sewers. Dewatering systems shall be designed and operated so as to prevent removal of the natural soils and so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property.

Dewatering of the trench shall be considered as incidental to, and all costs included in, the various Contract pay items in the proposal.

Burial depth shall be a maximum of 5' and no less than 18" from finished grade.

603.095 Testing. (Added Subsection)

ALL PIPE JOINTS AND PIPE MATERIALS ARE TO BE WATERTIGHT. JOINTS, JOINT MATERIAL AND PIPE MATERIAL SHALL PROVIDE FOR THIS. Tests for water tightness, when directed by the Director for acceptance, shall be conducted by the Contractor at his own expense in the presence of and under the direction of the Director on all new sewer lines. The Contractor shall supply all materials and water required to perform the test. The maximum allowable infiltration or exfiltration of all storm sewer pipe and pipe joints shall not exceed 500 gallons per day per inch diameter per mile of pipe. Should any section of the pipe fail to meet this requirement, it shall be corrected at the Contractor's expense.

The test shall be made so as not to exceed the manufacturer's recommended maximum head (minimum of 15 feet) for the type of joint used. Test section length shall be representative for the size and type of pipe constructed. Generally, pipe lengths will be between manholes, stubouts, pipe laterals or other features, which would affect pipe integrity. A minimum of one (1) hour will be allowed to allow for adsorption in concrete pipes. The actual test shall extend for a minimum of one (1) hour beyond the time allowed for adsorption. The length of pipe tested and the time of the test shall be prorated to reflect the conditions relating to the maximum leakage rate.

Should the rate of infiltration or exfiltration be found to exceed the prescribed amount, the Contractor shall cease further pipe laying activities, locate the leak(s), make appropriate repairs and then continue to test the conduit until the leakage is within the allowable limits. Before Final Acceptance, the Town reserves the right to require the Contractor to perform one infiltration/exfiltration test two (2) weeks after the line is completed and a second, two weeks after the first test. If both tests are the same, or the last test shows a decrease in infiltration or exfiltration and the infiltration or exfiltration is below the maximum acceptable amounts, the line shall be accepted. If the second test shows an increase over the first, the Contractor shall correct the leakage problems and retest to acceptable infiltration/exfiltration limits before the line will be accepted. Unless otherwise specified, infiltration or exfiltration will be measured by the Director using measuring devices furnished by the Contractor at his own expense.

When stubouts are required, the bell end of the stubout shall face upstream and be plugged with an approved prefabricated plug of the same material as the stubout with a joint conforming to the same detail as the pipe supplied. The use of concrete or brick as a means of plugging will only be authorized on pipes to be abandoned.

603.11 Method of Measurement. Replace the first paragraph of Subsection 603.11 as follows:

Measurement for culverts, storm sewers or irrigation pipe will be made on a linear foot basis for the various classes, types and sizes of pipe installed as shown. Measurement will be the pipe length along the centerline from end to end of each pipe, including any manholes installed. Measurement through pipe bends will not be made if there is a separate

pay item for the bend.

603.12 **Basis of Payment.** Delete the second-to-last paragraph of Subsection 603.12.

603.12 **Basis of Payment.** Add the following to Subsection 603.12:

Payment for each pipe size and type included on the Bid Schedule shall include surface removal, trench excavation, dewatering, disposal of excess excavated material, pipe bedding, pipe zone material, trench backfill and compaction. Surface restoration, which involves pavement, sod, or seeding shall be paid on the basis of Contract unit prices for those items. Unless separate bid items are included on the Bid Schedule, all joints, elbows, concrete collars, connecting bands and other connecting devices will not be paid for separately but shall be included in the Work.

**SECTION 604
MANHOLES, INLETS AND METER VAULTS**

604.02 **Materials.** Add the following to Subsection 604.02:

Manholes and base sections shall be cast-in-place or pre-cast concrete units. Joints and bases shall be watertight.

Mortar. Mortar shall conform to the requirements of ASTM C378, or be proportioned one (1) part Portland Cement to two (2) parts clean, well-graded sand which will pass a 1/8-inch screen. Admixtures may be used not exceeding the following percentages of weight of cement: hydrated lime: 10% diatomaceous earth, or other inert materials, 5%. Consistency of mortar shall be such that it will readily adhere to the pre-cast concrete if using the standard tongue and groove-type joint. If the keylock-type joint is used, the consistency shall be such that the excess mortar will be forced out of the groove, and support is not provided for the next manhole section to be placed. Mortar mixed for longer than 30 minutes shall not be used.

Preformed plastic gaskets. When approved, preformed plastic gaskets may be used in lieu of mortar-type joints and shall meet all the requirements of Federal Specification SS-S-00210.

604.04 **Manholes, Inlets, and Meter Vaults.** Replace the second paragraph in Subsection 604.04(b) as follows:

When a manhole is located in the pavement area, the ring and lid casting shall be adjusted to 1/4" below finished grade prior to or during placement of the final lift of asphalt. The intent of this specification is to compact the freshly placed pavement material during rolling of the remainder of the roadway. Rim elevations shown on the plan are approximate. Final elevations will be determined in the field.

604.06 **Method of Measurement.** Replace Subsection 604.06 with the following:

Manholes and inlets will be measured by each unit complete in place, including ring, cover, grating, frame, and all connecting devices.

Meter vaults will be measured by the complete unit, including ring and cover.

Structure excavation and backfill for manholes, inlets and meter vaults will not be measured and paid for separately but shall be included in the Work.

604.07 **Basis of Payment.** Replace Subsection 604.07 with the following:

The accepted quantities will be paid for at the Contract unit bid price for each of the items below that appear in the Bid Schedule. Except as otherwise indicated on the plans or in the special provisions, all connecting devices will not be measured and paid for separately but shall be included in the Work.

Payment will be made under:

Pay Item	Pay Unit
Manhole, Type	Each
Inlet, Type (depth)	Each
Meter Vault	Each

**SECTION 605
SUBSURFACE DRAINS**

605.02 **Materials.** Add the following to Subsection 605.02

Edge drain shall consist of an 18" wide polyethylene core prewrapped in geotextile fabric placed with backfill as shown in the project drawings.

Edge drain shall be "ADS Advanedge" as marketed by Advanced Drainage Systems, Inc., "Strip Drain 100" as marketed by Contech Products, Inc., or approved equal.

605.07 **Method of Measurement.** Replace the last sentence of Subsection 605.07 with the following:

Subsurface drain outlet will not be measured but shall be included in the unit price for Geocomposite Edge Drain. Unit price for Geocomposite Edge Drain shall include excavation and specified backfill material. Unit Price for Geocomposite Underdrain shall include excavation, filter fabric and specified filter material.

**SECTION 607
FENCES**

607.02 **Materials.** Add the following to Subsection 607.02

All wood used in stockade fence construction shall be commercial grade cedar material. 4x4 wood columns shall be pressure treated structural pine.

Fasteners, hinges, nails, screws, etc. are to be galvanized steel or other rust resistant material approved by the Director.

607.05 **Basis of Payment.** Add the following to Subsection 607.05

The pay item for gates and fence shall include all lumber, fasteners, concrete and other materials and labor to completely install the item. Payment shall be made under:

Pay Item	Pay Unit
Fence (type) (____')	Linear Feet
Gate (type) (____')	Each

**SECTION 608
SIDEWALKS AND BIKEWAYS**

608.01 Description. Add the following to Subsection 608.01:

This Work shall include the construction of sidewalk chases in accordance with the Contract Documents.

608.02 Materials. Add the following to Subsection 608.02:

Frame for sidewalk chase shall meet the requirements of ASTM A36 for Carbon Steel, or ASTM B209, B211, B221, or B241 for Aluminum Alloy 6061-T6 or 6063-T6. Top shall be hot-dipped galvanized steel.

608.03 Concrete Sidewalks and Bikeways. Replace Subsection 608.03(a) with the following:

Excavation. Excavation shall be made to the required depth and to a width that will permit the installation and bracing of the forms. The Contractor will be responsible for the top six (6) inches of the subgrade, including removal and replacement with suitable material. Any additional excavation beyond the first six (6) inches shall be paid under sections 203 and 304.

608.03 Concrete Sidewalks and Bikeways. Add the following to Subsection 608.03(b):

All sidewalk faces shall be formed. The terminal ends of all Work shall be formed to maintain a true vertical edge.

608.03 Concrete Sidewalks and Bikeways. Add the following to Subsection 608.03(e):

The depth of open joints shall be 1/3 the depth of the concrete except at the expansion joints. All upper edges of each section shall be tooled. Sidewalk joints shall line up with curb and gutter joints when contiguous. Expansion joint material, when required, shall be placed for the full depth of the concrete.

608.03 Concrete Sidewalks and Bikeways. Add Subsection 608.03(g):

Structures. Meter pits and manholes shall be installed or adjusted such that the frame and cover rest flush with the sidewalk. Cover shall not move within the frame and shall be reinforced as necessary to prevent deflection under light vehicle wheel loads (pick-up truck).

608.05 Method of Measurement. Replace Subsection 608.05 with the following:

Concrete sidewalks, bikeways, and curb ramps will be measured by the square yard of finished surface. Bituminous sidewalks, bikeways, and curb ramps will be measured by the square yard of bituminous mixture placed. Sidewalk chase will be measured by each chase installed.

608.06 Basis of Payment. Add the following to Subsection 608.06:

Pay Item	Pay Unit
Concrete Sidewalk (___ Inch)	Square Yard
Concrete Curb Ramp (Type)	Square Yard
Sidewalk Chase (Curb Type)	Each
Bituminous Sidewalk (___ Inch)	Square Yard
Bituminous Curb Ramp (Type)	Square Yard

**SECTION 609
CURB AND GUTTER**

609.03 Cast-in-Place Concrete Curb. Add the following to Subsection 609.03(b):

All curb and gutter faces shall be formed. The terminal ends of all Work shall be formed to maintain a true vertical edge. Forms shall be straight, true and in good condition. The Director reserves the right to order forms, which he deems unsatisfactory, removed from use in the Work.

In the event curbs, gutters, and sidewalks are to be contiguous but not monolithic, and the sidewalk slopes to the curb head, the top of the curb head shall be finished to slope to the street side of the curb.

609.03 Cast-in-Place Concrete Curb. Add the following to Subsection 609.03(d):

The depth of the open joints shall be 1/3 the depth of the concrete except at expansion joints. All upper edges of each section shall be tooled. Sidewalk joints shall line up with curb and gutter joints when contiguous. Tooled contraction joints shall be placed where form joint templates are placed. In the event the tooled joint and the form joint template do not coincide and a random crack appears outside the tooled joint, the Contractor will be required to remove the improperly cracked joint. Removal limits will be 1/3 the distance to the next joint on either side of the unsatisfactory joint. In the event contiguous joints are unsatisfactory, the entire section between the joints will be removed to the outside of the unsatisfactory joint. Concrete sawing will be required to provide a clean joint.

609.03 Cast-in-Place Concrete Curb. Add the following to Subsection 609.03(e):

Expansion material or approved bond breaker material shall be installed between curb and gutter Type 2 and abutting sidewalk for the full depth and length if the placement is not monolithic.

**SECTION 610
MEDIAN COVER MATERIAL**

610.01 **General.** Add the following to Subsection 610.01:

This Work shall include construction of Bomacron Textured Splash Pans / Crosswalk, or approved equal, and patterned concrete in accordance with these specifications and in conformity with the lines and grades shown on the drawings or established.

610.02 **Materials.** Add the following to Subsection 610.02

The concrete shall have a minimum compressive strength of 4,000 psi. Portland cement shall conform to ASTM C150, Type I, II, or V depending on soil conditions. Aggregates shall conform to ASTM C33. Mixing water shall be fresh, clean and potable. An air-entraining agent complying with ASTM C260 shall be used to achieve an entrained air content for the particular concrete mix used in accordance with the published recommendations of the Portland Cement Association and the American Concrete Institute (for freeze thaw climate). A normal set or retarded set water reducing admixture complying with ASTM C494 may be used. Nothing containing calcium chloride is permitted in the mix.

Bomanite Color Hardener: The base color of concrete shall be Steadman Buff. The grade of the hardeners shall be heavy duty. The release agent color shall be Walnut. It shall be applied to all concrete surfaces to be imprinted and textured. The pattern shall be Ashlar Slate. All imprinting tools used in the execution of this Project shall be manufactured by Bomanite Corporation, or approved equal.

Control and expansion joints will be located as needed by the Contractor or as shown in the plans to minimize cracking. Expansion joints with sealant shall be placed between all splash pans and curbs.

Supplementary Reinforcement. 3/4-inch fiber mesh synthetic reinforcing fibers. This material will be used whether the Bomacron paving is used or not. Engineered synthetic reinforcing fibers shall be 100% polypropylene collated, fibrillated fibers. Fiber length and amount per manufacturer's recommendations shall correspond with the concrete mixture. The fiber manufacturer or approved distributor shall provide the services of a qualified technician for a pre-job meeting and initial job start up.

Physical properties of the fibers shall be as follows:

- Specific gravity: 0.91
- Modulus of elasticity: 0.5 x 10 to 0.7 to 10 psi
- Tensile strength: 70 to 110 ksi
- Length: 3/4 inches

The fiber manufacturer shall certify that all polypropylene fibers meet the physical properties and are specifically manufactured for use in concrete from virgin polypropylene, containing no reprocessed olefin materials. If the fiber manufacturer is other than the brand name listed on the literature and packaging, the certification must be from the original manufacturer of the fibers. The fiber manufacturer will supply an evaluation from the Council of American Building Officials that states that this fiber will control shrinkage and thermal cracking, and is a suitable alternative to welded wire fabric.

Execution. All fibers shall be added at the concrete batch plant to assure uniform and complete dispersion of the collated fibrillated fiber bundles into single monofilaments within the concrete. The synthetic reinforcing fiber will be provided by:

Fiber Mesh Company
5390 Parmalee Gulch Road
Indian Hills, Colorado 80454
303-697-1950

610.03 **Construction Requirements.** Add Subsection 610.03(d):

Bomacron Paving. The Bomacron Paving will be as provided by a licensed, trained Bomanite Contractor, using Bomacron tools and processes. The Contractor will be required to provide a foreman or supervisor who has done at least three installations of demonstrated high quality. Preparation work such as subgrade preparation shall be as designated by the General Contractor. Finish grade setting of forms and screeds and reinforcing shall be done by the concrete Contractor.

Work provided by the Bomacron Contractor shall include:

1. Materials: Concrete, Bomanite Color Hardener, and Bomacron Release agent.
2. Bomacron texturing tools
3. Final surface treatment:
 - a. Washing
 - b. One application of Acroseal sealant following manufacturer's recommendations.

610.04 **Method of Measurement.** Add the following to Subsection 610.04:

Median/Crosswalk cover material will be measured by the square foot; splash pan will be measured by the linear foot.

610.05 **Basic of Payment.** Add the following to Subsection 610.05:

Pay Item	Pay Unit
Median / Crosswalk Cover Material (Patterned Concrete)	Square Foot
14" Concrete Splash Pan (Bomacron)	Linear Foot

**SECTION 614
TRAFFIC CONTROL DEVICES**

614.08 Traffic Signal Materials. Replace applicable portions of Subsection 614.08 as follows

(a) Traffic Signal Units All signal units shall be of the individual section, adjustable type, black polycarbonate. Signal units shall be supplied by Eagle, IDC or Econolite. Programmable heads shall be cast aluminum frame units supplied by 3M.

Visors shall be detachable, of the eight (8) or twelve (12) inch tunnel type, open at the bottom; be black in color on the outside and flat black on the inside.

Reflector shall be silvered glass or Alzak type units.

Lenses shall be in accordance with Institute of Traffic Engineers Specifications.

Sockets shall be fixed focus.

Doors on the signal heads for the installation of lamps and lens replacement or other maintenance shall not require use of any tool to be opened. Doors and lenses shall be equipped with neoprene weather proof gaskets to insure against infiltration of moisture, road film and dust. Each three-color signal unit shall have the socket leads from all signal sections connected to a terminal board stamped identifiable with terminals. There shall be a terminal for color indication plus a common terminal where one lead from each socket shall terminate. The terminal board shall be mounted in the middle section and be properly insulated. All openings, top and bottom, shall be for 1-1/2 inch pipe or pipe mounting brackets. Gaskets shall be supplied for top and bottoms openings.

(b) Pedestrian Signal Units Eighteen (18) inch one-way ICC pedestrian signal head. The specifications are the same as paragraph Traffic Signal Units with the following exceptions:

Walk/Don't Walk Indications shall be symbolized and side by side.

Visors shall be egg crate type and heads shall be black.

(c) Back Plates Where shown on the plans, black back plates shall be furnished and installed on signal faces. No background light shall show between the back plates and the signal face or between sections. All back plates are to be of aluminum. Back plates shall provide a minimum 8" border for all 8" and 12" signal heads. When combinations of 8" and 12" signal indications are used in the same head, the minimum border shall be 6". Back plate attachments to signal faces will be by rivets or 10-32 pan head screws.

(d) Traffic Signal Lamps Size of lamps to be used in traffic signal units shall be as follows:

67 or 69 watt; 125 volt lamps for all 8" traffic signals indications.

150 watt, 120 volt lamps for all 12" traffic signals indications.

For 3M programmable signal head use 150 watt, 115 volt (150 PAR46/TS/3M) 12" signals indications

Lamps shall be supplied by Phillips and shall have 8,000/hour minimum rating. If the manufacturer recommends a lower rating, the Town must be advised of this recommendation and will have the option to decide which rating will be used.

(e) Electrical Cable

(1) Signal Cable - 14 AWG multi-conductor stranded copper wire manufactured to meet

IMSA 19-1 specifications or approved equivalent. Each conductor in the cable will be individually insulated and rated at 600 volts. There shall be a minimum of 4 and a maximum of 9 strands per conductor. As a minimum, one spare conductor shall be provided for each cable run.

(2) Interconnect Cable - The telephone interconnect wire shall be #19 AWG, 6 twisted pairs, shielded cable, with petrolatum-polyethylene gel filling compound. The cable shall meet R.E.A. Specification PE-39 (Clifford of Vermont Catalog #6P19-B1-BJFC or approved equal).

No splicing of the interconnect cable will be allowed. The cable shall be installed between two adjacent controller cabinets in continuous runs.

All telephone interconnect cable pairs will be connected to either active or spare terminal points provided in the controller cabinet. The Contractor shall identify and label all terminal points.

All interconnect wires shall be checked after installation to determine their resistance and residence to ground. Each pair shall be shorted together at one end and a resistance check will be made at the other end. Resistance will be checked between each conductor and ground. All resistance readings shall be recorded showing value, color and location of wire. Data is to be supplied to the Town's Traffic Department within 30 days of completion of the project.

At the terminal points the jackets shall be stripped and the ends taped. Gel filling compound shall be removed using filled cable cleaner.

(3) Service Cable - Two (2) #THHN-8, seven (7) strands tinned soft drawn copper wire, 1/16 inch neoprene insulation, black and white in color. Conductors shall be twisted.

(4) Loop Detector Wire - Single conductor #14, stranded THHN as supplied by Detect-A-Duct.

(5) Loop Detector Wire (Preformed) Wire shall be High Temperature Preformed Loops, Model 1700 Series, as supplied by Detector Systems, Inc., 11650 Seaboard Circle, Stanton, CA 90680, 1-800-828-7775, or approved equal. Loops will be equivalent to quadripole type with 2-4-2 turns.

(6) Pedestrian Push-button Cable - One (3) conductor #14 seven strands tinned soft drawn copper wire, 1/16 inch neoprene insulation, conductors to be twisted. Color coded, 1 white, 1 red and 1 black.

(7) Loop Lead-In Cable - Two (2) conductor, Canoga CC3003.

(8) Ground - Single conductor, AWG #6, soft drawn bare solid copper wire.

(f) Solid State Loop Vehicle Detectors This specification defines the minimum design, operational and performance requirements for multiple channel, digital self-timing inductive loop detectors. Detector units shall be card rack mounted plug-in type 3M Canoga 400 4 channel units. Micro Detector shall be as supplied by 3M Micro Probes. Opticom shall be as supplied by 3M.

(g) Pedestrian Push Buttons Pedestrian push buttons shall be of the direct push button contact type. They shall operate on a voltage not to exceed 18 volts AC. They shall be of tamper-proof design and equipped with a push button instruction sign. The assembly shall be weatherproof.

The housing shall be shaped to fit the curvature of the pole to which it is attached to provide a

rigid installation. Saddles shall be provided to make a neat fit when required. The push-button assembly shall include a sign mounting bracket with a pedestrian instruction sign which shows the ICC walk symbol and walk directions arrow. Symbols shall be white on a black background.

(h) Traffic Signal Poles, Pedestals and Mastarms Traffic signal poles, pedestals, and mastarms shall be of the general configuration shown on Standard Drawings. All traffic signal poles and mastarms shall be designed to meet the requirements outlined in the 1985 edition of "Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals", published by AASHTO, for a wind velocity of 90 mph with a 1.3 gust factor. Signal poles shall be supplied with a 16.5 inch bolt pattern for mastarms 35 feet and less or with a 20 inch bolt pattern for mastarms in excess of 35 feet. Handholes are to be supplied at the base and across from the mast arm fitting.

(i) Controller Cabinet Shell The cabinet shell shall meet or exceed the requirements of NEMA 3R rating with the following additions:

The cabinet shell shall be 0.125 inch thick aluminum Type 5052-H32. External welds shall be made using heliarc welding method, whereas internal welds shall be made by the wire or heliarc method. All welds shall be neatly formed and free of cracks, blow holes and other irregularities. All inside and outside edges of the cabinet shall be free of burrs. The exterior surface shall be polished graffiti free aluminum.

The cabinet shall be designed with a sloped top to prevent the accumulation of water on its top surface.

The door opening shall be double flanged on all four sides. A door restraint shall be provided to prevent door movement in windy conditions. The cabinet door shall be a minimum of 80% of the front surface of the cabinet and hinged on the right side when facing the cabinet. The hinges shall be continuous and bolted to the cabinet door using 1/4-20 stainless steel carriage bolts and ny-lock nuts. The hinges shall have a 0.120 inch diameter stainless steel hinge pin capped top and bottom to render it tamper proof. The door latching mechanism shall be a 3- point draw roller type with push rods of 0.250 inch by 0.750 inch steel, minimum. Rollers shall have a minimum diameter of .875 inch and be made of nylon with a 0.140 inch steel center. An outside door opening handle will be furnished and shall be stainless steel with a 3/4 inch diameter shank. The latching handle shall have a provision for locking in the closed position. The cabinet shall be provided with louvered vents on the main door. The inside of the main door shall have a washable metal mesh air filter held firmly in place by bottom and top brackets and a spring loaded upper clamp.

The inside of the main door shall be provided with a brace at least 15 inches long, 6 inches high and 1/2 inch deep. A print envelope of at least 15 inches by 12 inches and 10 mil thickness shall be mounted to this brace, with washers to prevent ripping.

A switch (police door) compartment with removable back panel shall be supplied on the outside of the cabinet main door.

The switch compartment and main door shall be furnished with a gasket that satisfies the physical properties as found in UL508 Table 21.1 and will form a weather tight seal between cabinet and door.

The switch compartment door lock shall be Corben R357SGS series or equal and have a key hole cover. The main door shall have a Corben #1548-1 or equal lock with cover. Two keys of each type shall be supplied with each cabinet.

Exhaust air will be vented out between the top of the cabinet and door. The exhaust area shall be screened with material having a maximum hole diameter of 0.125 inch. A removable fan plate shall be furnished with a 100 CFM ball bearing fan controlled by an adjustable thermostat. An incandescent light shall also be mounted to this plate.

Eight (8) phase cabinets shall be "P" type and supplied with 2 shelves.

A "P" type shell will be approximately 56 inches high, 38 inches wide and 26 inches deep excluding the door.

(j) Controller Cabinet Wiring All conductors used shall be 19 strand #22 AWG or larger Type B nylon jacketed polyvinyl chloride or irradiated cross linked polyethylene. Conductors that are # 14 AWG or larger as an option shall be UL type THHN. The cabinet ground conductor feeding the ground point within the cabinet shall have the same amperage as the main breaker. A single #14 AWG conductor shall supply no more than 3 load switches. If each load switch is wired separately, then # 16 AWG or larger conductor shall be used.

The signal common ground buss (AC-) shall not be grounded to the cabinet and shall provide at least 10 terminals. An earth ground buss shall be provided and have at least 6 terminals. Wiring within the cabinet shall be neatly arranged and laced or enclosed in a protective sleeve. All crimp style connectors shall be applied with a proper tool which prevents opening of the handles until the crimp is completed.

(k) Controller Cabinet Components A controller shall consist of a complete electrical mechanism for controlling the operation of traffic control signals, including the timing mechanism and all necessary auxiliary equipment.

Each cabinet shall be supplied with a surge arrestor comprised of at least a metal oxide transient suppressor and a dual gas tube suppressor.

The metal oxide suppressor shall have:

Recurrent Peak Voltage	150 VDC
Energy Rating, Maximum	20 Joules
Power Dissipation, Average	0.85 Watts
Peak Current for Less than 7 Microseconds	1250 Amperes

The dual gas tube shall have:

Breakdown	300-500 VDC
Impulse Breakdown	Less than 1000V in less than 1.1 Microseconds at 10KV/USEC
Operating Delay	less than 0.1 US when measured by applying 1500 VDC in less than 0.1 US.
Energy Application	Withstands 20 AMP AC for 1 second applied 10 times at 3 minute intervals on either side
Current Rating	40,000AMP (8/20 impulse)
Capacitance	6 Picofarads, line to GND

A radio interference suppressor (RIS) shall be supplied and be hermetically sealed in a substantial metal case filled with a suitable insulating compound. Four phase cabinets shall have RIS rated for 30 AMP minimum, 8 phase cabinets shall have RIS rated at 60 AMP minimum.

Three circuit breakers shall be provided which are UL approved and of the magnetic type. Breakers shall be quick-break type on either manual or automatic operation. The operating mechanism shall be enclosed and shall be trip-free from the operating handle on overload and be trip-indicating. The main breaker on a 4 phase cabinet shall be 30 AMP and on an 8 phase cabinet shall be 50 AMP. A 15 AMP breaker shall be used to power the controller, conflict monitor, and detectors. A 15 AMP breaker shall be wired from incoming AC power and supply the fan, cabinet light, and ground fault interrupter outlet.

The fan located on the vent panel shall be fused at 125% of its motor amperage. A mercury contractor shall be used to switch AC power to the load switches and its amperage shall match or

exceed the main breaker amperage.

The switch compartment located on the outside of the main door shall have an auto/flash and signal lights on/off switch. The police panel auto/flash switch shall restart the controller when switched from the flash to the auto position. This switch shall also stop time the controller in the flash position if the stop time switch is in the flash stop timing position.

A panel located on the inside of the main door shall have a fuse holder and fuse for the vent panel's fan, controller on/off switch, auto/flash switch, stop time /on/off/flash stop timing switch, and a ground fault interrupter outlet. As an option, the ground fault interrupter outlet may be supplied on the load switch panel. The conflict monitor shall stop time the controller regardless of the switch positions.

Detector test switches shall be provided on the inside door panel and shall be momentary type push button switches used to place manual calls into the controller during actuated operation. These switches shall be in parallel with detector amplifier relay closure circuits. One switch will be provided for each vehicle phase and pedestrian phase.

Door switches of the push button type shall be provided to turn off the cabinet light and controller display when the door is closed.

The load bay panel shall be designed to allow access to the back plane for servicing. Wing nuts or other threaded fastening devices which are hand loosened or hand tightened shall be provided. The panel shall be designed to separate from the cabinet without the need to remove any internal cabling. Unsoldering wires to remove this panel is unacceptable. Connections to all load bay components can be crimped or push-on connectors.

A system interface panel, with necessary cables, shall be installed on the left side wall of the cabinet. This interface panel shall have all termination points to effect all inputs and outputs of the latest version of the Econolite Zone Monitor Closed Loop Signal System. At a minimum, all monitoring functions are to be installed. System detectors will be installed as called for on the plans.

(l) Controller Cabinet Detection/Pre-emption Eight phase cabinets shall be supplied with a permanently fixed 7 slot card rack. A power supply plug-in module capable of supplying +24 VDC power to each slot shall be provided with the card rack.

(m) Controller Cabinet Flasher The cabinet shall be equipped for alternating flashing operation of signal lights with a 2 circuit solid state flasher in accordance with latest NEMA specifications (15 AMP per circuit).

(n) Controller Cabinet Load Switches The load switches shall be in accordance with the latest NEMA specifications and shall have 3 input and 3 output L.E.D. indications on the front panel. The load switches shall contain 3 separate cube type solid state relays and shall have triacs rated for 25 AMPS but de-rated to 10 AMP when used in the load switch assembly. Cabinets shall be supplied with the correct number of load switches necessary to accomplish the phasing as shown on the plans.

(o) Controller Cabinet Flash Transfer Relay Flash transfer relays shall be as manufactured by Midtex Model #136-62T3A1, 120 VAC, DPDT, 30 AMP with Jones plug base and dust cover or approved equal. One flash transfer relay shall be provided for every two vehicular traffic phases (including overlaps).

(p) Controller Cabinet Conflict Monitors The conflict/voltage monitor shall comply to Part 6 of NEMA Standard TS-1, latest edition. Bidders will be required to supply documentation with their bid from an independent laboratory that the conflict monitors they propose to furnish have passed all NEMA certification and environmental tests. Eight (8) phase cabinets shall be supplied with a 12 channel conflict monitor. In addition, the unit must also be capable of detecting the following

error conditions:

- (1) Simultaneous sensing of active yellow and green inputs on a channel.
- (2) Simultaneous sensing of active red and green or yellow inputs on a channel. If either of these conditions exist for less than 200MS, the unit shall not trigger. If either of these conditions exist for more than 500MS, the unit shall trigger.
- (3) Absence of a 2.8 second period of an active yellow input on a channel during red to green to yellow to red sequence. Functions #1 and/or #2 and #3 shall be enabled on a per channel basis via front panel accessible programming devices. One or both of the above dual combinations (#1 & #2) shall be selectable via front panel accessible programming devices.
- (4) Absence of a logic input transition from the cabinet controller watchdog circuitry for 1500MS (+/- 100MS) shall cause the unit to trigger. This function shall be enabled via a front panel accessible programming device.
- (5) Absence of or and improperly seated programming card shall cause the unit to trigger. Should one of these conditions exist which triggers the unit, it shall cause the output relay contacts to transfer. These contacts shall remain in this state until the unit is reset by activation of front panel control of the external reset input. AC+ power interruption shall not reset the unit once it has been triggered. Upon restoration of AC+ power to the unit, all display indications shall return to their original state before the interruption.
- (6) A voltage monitor latch function shall be provided which will sense an improper voltage level at the controller voltage monitor input or either of the +24 V monitor inputs and cause the unit to trigger. If this function is enabled via a front panel accessible programming device, restoration of proper voltage levels will not reset the unit. Only a manual reset or external reset will reset the unit.
- (7) When the AC+ line voltage is below the drop-out level of 92VRMS for 475MS (+/-25MS) the unit will suspend all fault monitoring functions, de-energize the output relay, and de-energize the start relay. The power indicator on the front panel will blink at a rate of 2HZ to indicate the brown-out status.

When the AC+ line voltage returns above the restore level of 100 VRMS for 100 MS (+/-16 MS), the monitor will resume normal operation and the power indicator on the front panel will remain illuminated. After a 2.5 second (+/-1 second) delay, the start relay will be energized. After a programmable delay determined by front panel accessible programming device, the output relay will be energized. The delay shall be programmable from 4 seconds to 15 seconds in 1 second increments. A 0.5 second delay shall be provided for test purposes.

- (8) An internal watchdog shall be provided to assure continuous operation of internal microprocessor device. Failure of this circuitry to detect a logic input transition from the microprocessor device for 100 MS or a DC supply voltage sufficient to assure proper operation shall cause the unit to trigger.
- (9) If a reset command is received from either the front panel control or the external reset input for a continuous duration of more than 120 seconds, the unit will ignore the reset command and begin normal monitoring functions.
- (10) A real time clock shall be provided to mark the date and time when the unit is triggered by an error condition. Backup power to the real time clock shall allow it to maintain timing accuracy during interruptions of AC+ power to the unit. Automatic adjustments should be made to the time of day and date to

accommodate leap years and daylight savings time.

- (11) In addition to displaying the fault status and field output status for an error condition which may have the monitor unit currently triggered, the unit shall maintain a complete record of at least the last 9 faults which caused the monitor to trigger. These events should be able to be reviewed at any time via activation of a front panel control. This fault record shall not be lost due to AC+ power interruptions.
- (12) All critical timing functions shall be accomplished by digital methods and shall utilize either the power line frequency or a quartz crystal based timer. All monitoring functions except conflict monitoring shall have a dedicated timer unique to each channel being monitored.
- (13) A field input monitoring function (BND) shall be provided to sense improper input wave forms on the field signal inputs. Improper inputs may result from irregularly rapidly blinking (flickering) inputs, constant extraneous noise, or dimming operations other than half-waved suppressed.
- (14) The monitor unit shall be capable of verifying the program card information by displaying the channels programmed as permissive in a sequential fashion for each channel monitored via front panel control.
- (15) The monitor unit shall be capable of displaying the fault timing values being used to trigger the monitor for conflicts, red failures, controller voltage monitor (CVM) and 24V monitor (24 V-I & 24 V-II) conditions, dual indications, clearance failures and controller watchdog failures (if enabled) via front panel control. If any fault monitoring functions are disabled by control inputs, red enable or +24V monitor inhibit, this shall be indicated. Channels which are selected for dual indication and clearance monitoring via the front panel accessible programming devices shall also be displayed.
- (16) An infrared LED output shall be provided to transfer to a hand held printer all internal settings and previous faults. The printer is not required at this time.
- (17) The power, fault, and monitor fail indicator shall be LED type. All other displays and indications shall be LCD type.

The minimum display indicators are required as follows:

- a. Triggering of the conflict monitoring portion of the unit.
- b. Triggering of the red monitoring portion of the unit.
- c. Triggering of the sequence monitoring portion of the unit.
- d. Triggering of the dual monitoring portion of the unit.
- e. Triggering of the controller voltage monitoring or controller watchdog monitoring portion of the unit.
- f. Triggering of the +24V monitor #1 portion of the unit.
- g. Triggering of the +24V monitor #2 portion of the unit.
- h. Triggering of the program card monitoring portion of the unit.
- i. Triggering of the internal watchdog portion of the unit.

- j. Time of day and date display.
- k. Four indications per channel which display an active red, yellow, or green input for each channel monitored.
- l. AC+ power indicator which is flashing when AC+ power is below 92 VRMS and illuminated when AC+ line voltage returns above 100 VRMS.
- m. One indicator per channel which identifies a channel as being involved in an error condition which has triggered the unit.
- n. Triggering of the field input monitoring (BND) portion of the unit.

(g) Controller Cabinet Documentation Two paper copies of the cabinet prints shall be accurate and complete and shipped with each cabinet. An additional copy shall be supplied in digital format (DXF) on 3.5 inch high density diskette. If additions or deletions are necessary to the cabinet as supplied, a new print will be supplied. Corrections to an existing print will not be accepted.

A quality assurance sheet shall be supplied stating the following:

- (1) The date of the test.
- (2) The duration of the test.
- (3) The method of testing.
- (4) If the testing involved components, the manufacture and model number of the devices used.
- (5) The technician's signature (not initials).
- (6) Quality control supervisor's signature (not initials).
- (7) The serial number or other unique identifier of the cabinet.

(r) Traffic Signal Controller The traffic signal controller shall be an Econolite ASC 2 or ASC 2M master controller with most recent software version. **No equal or equivalent will be considered.**

(s) On Street Master Controller - Cabinet Assembly - The master controller shall be wired into a cabinet assembly which also includes a local intersection equipment configuration. The cabinet shall be wired complete with master connecting cables in accordance with applicable portions of the local controller cabinet specifications. The incoming power service and interconnect terminals shall be adequately equipped with surge arresters to protect against high energy transients.

(t) Miscellaneous Hardware

- (1) Aluminum pedestal mounts (Type ITT) shall be either of two types as called for in the plans specifications:
 - a. Center mount with two side ports plain
 - b. Offset mount separated with one side port
- (2) Covers for water valve pull boxes shall have the word "Traffic" cast into them to avoid confusion with water valve boxes.

(u) Instructions and Wiring Diagrams All equipment shall be provided with complete installation instructions, including a complete chart of field connections, as well as manuals for the controller containing service instructions including wiring diagrams,

troubleshooting procedures, etc. Each and every component used shall be clearly referenced in the service manual and its value, ratings and manufacturer's part number shall be given.

(v) Foundation Concrete Foundation concrete shall be Portland cement concrete, class A or B, conforming to the requirements of Section 601.

(w) Mastarm Brackets Mastarm brackets shall be Astro Brackets or the equivalent.

614.10 Traffic Signal Systems – Construction. Replace applicable portions of Subsection 614.10 as follows:

(a) General The work specified in this section describes the installation of necessary material and equipment to complete traffic signals and/or other electrical systems as specified on the drawings, in the special contract provisions, or herein.

When existing traffic signal installations are modified or completely rebuilt, the Contractor shall work around existing traffic signal equipment until the new or modified traffic signal system has been installed and put into operation. If the existing traffic signal equipment must be removed to accommodate the new construction, the contractor shall, if directed by the Director, install temporary overhead traffic signal equipment. The contractor shall at all times maintain a minimum of two (2) 12 inch, three-section (red, yellow, green) traffic signal heads for each roadway approach. If, during construction, a traffic signal must be turned off so that there are no indications in one or more directions, the contractor shall, if so directed by the Director, provide a uniformed traffic officer to direct traffic. Provision of temporary signal equipment or uniformed traffic control will be paid for at contract unit prices or paid for as extra work

Signal heads shall not be installed on standards or poles at new signal locations until all circuits and controllers are in place and ready for operation. During construction, if traffic signal heads have been installed, but are not ready for actual electrical connection, such heads will be totally covered. If the covering material should come loose, the contractor must replace or repair covering within six (6) hours of notification.

Testing The Town may, at its option and cost, retain the services of an independent testing lab to perform all testing consultation and to assist in the review of the work and equipment.

Barricades and Cleanup The contractor shall be responsible for insuring that all work sites are properly cleaned and barricaded prior to the completion of the day's activities. Failure on the part of the contractor to do so shall result in the Town doing so at the contractor's expense. All such expense shall be deducted from the final contract price. The determination of the cleanliness of the work site and/or proper barricading will be within the judgment and scope of the Director.

Notifications The contractor shall notify the Director two (2) weeks prior to the signal turn-on so that orders may be issued to IREA for power connection to the intersection on the specified turn-on date.

Salvage All traffic signal equipment which is removed shall remain the property of the Town of Castle Rock. Such property shall be removed from the work site and returned by the Contractor to _____. Work relating to the salvage and delivery of salvage material _____ will be incidental to the Project.

Surveying All loops, poles, control cabinets, pull box locations and pole foundations shall be field located by the Town.

Permits The contractor shall obtain any and all permits as necessary from the Colorado State Highway Department, Region 1. The Town will sign the completed permit when all of Region 1's requirements are met.

Work Hours The contractor shall work only on week days between the hours of 8:00 a.m. to 5:00 p.m. Work hours for work which affects the flow of traffic on the roadway is limited to between 8:30 am to 3:30 pm. The Contractor must receive written approval from the Director to work at any other time.

(b) Regulations and Code All electrical equipment and material shall conform to these specifications, the standards of the National Electrical Manufacturers Association (NEMA), IREA, or the Colorado Department of Transportation "M" and "S" Standards, whichever is applicable. In addition to requirements of these specifications, the plans, and the special contract provisions, all material and work shall conform to the requirements of the National Electrical Code, hereinafter referred to as the "Code"; the Rules for Overhead Electrical Line Construction of the Public Utilities Commission; the Standards of the American Society for Testing Materials (ASTM); the American Standards Association (ASA), and any local ordinance which may apply.

Wherever reference is made in these specifications or in the special contract provisions to the Code, Rules, or the Standards mentioned above, the reference shall be construed to mean the Code, Rule, or Standard that is in effect at the date of bidding.

(c) Equipment List and Drawings The contractor shall submit with his Bid a list of equipment and material which he proposes to furnish, including all equipment and material as identified on the plans or in the specifications by the manufacturer's name which is necessary or customary in the trade to identify such equipment and material. The list shall be complete as to name of manufacturer, size and catalog number of unit, and shall be supplemented by such other data as may be required.

Inspection or sampling of any material other than those already approved according to the material specifications will be made by the Engineer or his designee prior to installation. the Contractor proposes a substitution of equipment called for in the plans or specifications, he shall provide additional information to prove the substitution item is of equal or superior quality. Any material and/or equipment installed by the Contractor that is not in conformance with the Town of Castle Rock's specifications will be removed or changed at the contractor's expense.

Upon completion of the work, the contractor shall submit "as-built drawings" or corrected plan showing in detail all construction changes, including, but not limited to, wiring, cable, and location and depth of conduit. This information is in addition to wiring diagrams and other required information.

(d) Excavation and Backfill All work shall be in conformance with Special Provisions Subsection 206. Trench excavations for conduit in existing pavement shall be two (2) inches wider than the outside diameter of the conduit. Backfilling of conduit trenches in existing pavement shall be accomplished by placing Structure Backfill (flowfill) up to the bottom surface of the roadway pavement material. Pavement shall be patched in accordance with Special Provisions Section 403 or 412. Care shall be taken during placement of multiple conduit runs in one trench to insure Structure Backfill (flowfill) completely surrounds the conduit.

(e) Traffic Maintenance and Control Traffic shall be maintained and controlled in accordance with Special Provisions Subsection 104.04 and Section 630. When excavations must remain open overnight, they shall be properly marked to warn motorists and/or pedestrians according to the most recent revision of Part VI in the "Manual on Uniform Traffic Control Devices for Streets and Highways".

(f) Removing and Replacing Improvements The contractor shall replace or reconstruct sidewalks, curbs, gutters, rigid or flexible pavement, and any other improvements removed, broken or damaged by him with materials and in a manner which conforms to these Standards and Specifications. Damaged concrete shall be removed from joint to joint or as directed by the Director. Whenever a part of a square or slab of existing concrete sidewalk, driveway or pavement surface is broken or damaged, the entire square slab or stone shall be

removed and the concrete reconstructed as above specified.

(g) Foundations The bottom of concrete foundations shall rest on firm ground. Cast-in-place foundations shall be poured monolithically where practical. Both forms and ground which will be in contact with the concrete shall be thoroughly moistened before placing concrete. Forms shall not be removed until the concrete has thoroughly set. The exposed portions shall be formed with "Sonotube" to present a neat appearance. Sonotube forms shall not extend below finished grade no more than 1 foot. A concrete vibrator shall be used on all concrete foundation pours. Forms shall be true to line and grade. Tops of foundations, except as noted on plans, shall be finished to curb or sidewalk grade or as ordered by the Director. Forms shall be rigid and securely braced in place, and inspected prior to the pouring of concrete. Conduit ends and anchor bolts shall be placed in proper position and in a template for a minimum of 24 hours after placement of the concrete material.

Precast signal footings shall not be used with poles with mast arms. Precast traffic signal pole footings shall be installed in drilled holes, with tamped sand backfill material.

Anchor bolts shall conform to the specifications of the manufacturer of the poles and mast arms and each individual bolt shall have two (2) flat washers, one (1) lock washer and two (2) nuts. Shims or other similar devices for plumbing or raking will not be permitted. Threaded portions of the anchor bolts shall be protected from contamination with concrete or other damage.

Any abandoned foundation shall be removed to 18 inches below finish subgrade and disposed of by the contractor. Any conduit runs associated with an abandoned foundation shall be extended or abandoned as called for on the plans. When a foundation is removed, the hole shall be backfilled in accordance with paragraph Special Provisions Section 206.

(h) Conduit All cables and conductors not shown on the plans as aerial cable shall be installed in conduit unless installed in poles, pedestals or mastarms. All metal conduit referred to in the specifications and shown on the plans shall be rigid and adequately galvanized, or approved equal. All PVC conduit will be of schedule 80 or heavier. Galvanized rigid conduit shall be used only for installations above grade.

(1) All signal cable conduit shall be not less than three (3) inches inside diameter. Conduit for low voltage conductor (pedestrian and vehicle detector) shall not be less than two (2) inches inside diameter. Conduit between power pole and controller cabinet used for IREA feed and interconnect cable (where not supplied by IREA) shall be two (2) inches inside diameter.

(2) The contractor, at his sole expense, may use larger conduit if desired. Where larger conduit is used, it shall be for the entire length of the run from outlet. No reducing couplings will be permitted underground.

(3) The ends of all metal conduit, existing or new, shall be well reamed to remove burrs and rough edges. Ends shall be capped or otherwise closed off until cable is pulled. Field cuts of existing or new conduit shall be made square and true, and the ends shall butt together for the full circumference thereof. Slip joints of running thread will not be permitted for coupling metal conduit. When a standard coupling cannot be used, an approved threaded union coupling shall be used. All couplings shall be screwed up until the ends of the metal conduits are brought together. Joints for PVC pipe shall be cut square and true and the ends shall butt together for the full circumference. All Joints shall be solvent welded unless otherwise approved. Slip joints may be used to joint two separate runs of conduit.

(4) Where a "stub-out" is called for on the plans, a sweeping "ell" shall be installed in the direction indicated and properly capped. The ends of all conduits in structures or terminating at curbs shall be marked by a "Y" at least three (3) inches high, cut into the face of the curb, gutter or wall directly above the conduit.

(5) Conduit bends, except factory bends, shall have a radius of not less than six (6) times the inside diameter of the conduit. Where factory bends are not used, conduit shall be bent without crimping or flattening, using the longest radius practical.

(6) Conduit shall be laid at a depth of not less than twenty four (24) inches below the curb gutter grade in the sidewalk areas and to a depth of not less than twenty four (24) inches below the finished subgrade in all other areas. Conduit under railroad tracks shall be not less than forty-eight (48) inches below the bottom of the tie or as directed by the owning railroad company.

(7) Trench excavations for conduit in existing pavement shall be two (2) inches wider than the outside diameter of the conduit. Backfilling of conduit trenches in existing pavement shall be accomplished by placing Structure Backfill (flowfill) up to the bottom surface of the roadway pavement material. Pavement shall be patched in accordance with Special Provisions Section 403 or 412. Care shall be taken during placement of multiple conduit runs in one trench to insure Structure Backfill (flowfill) completely surrounds the conduit.

(8) Conduit shall always enter a pedestal base, pull box, or any other type structure from the direction of the run only.

(9) Conduit terminating in a standard or pedestal shall extend approximately two (2) inches above foundation vertically. The conduit shall be installed in such a way that it will slope toward the hand hole opening.

(10) All conduit runs that exceed ten (10) feet in length shall have a continuous 1/4 inch diameter nylon line pulled into the conduit along with the specified electrical cables. The line shall be firmly secured at each end of the conduit run with a minimum slack of three (3) feet. The purpose of this line is to be able to pull future electrical cable through the existing conduit runs.

(11) Existing underground conduit to be incorporated into a new system shall be cleaned with a mandrel or blown out with compressed air.

(12) New conduit runs shown on the plans are for bidding purposes only and may be changed with approval of or as directed by the Director.

(13) All conduit connections at pull boxes shall be tightly secured and water proofed. Conduit entering controller cabinets shall be sealed by the use of paraffin or other approved sealing compound or as directed by the Director.

(i) Pull Box A pull box shall always be installed in combination with a steel strain pole and at all other locations shown on the plans and at such additional points as ordered by the Director. The contractor may install, at his own expense, any additional pull box he may desire in order to facilitate the work and as approved by the engineer. Special pull boxes and extensions which are required shall be fabricated and installed in general conformance with the size and details shown on standard drawings. Pull boxes shall be installed so that the covers are level with curb or sidewalk grade or level with the surrounding ground when no grade is established. The bottoms of all pull boxes shall be bedded in crushed rock.

When a new conduit run enters an existing pull box, the Contractor shall remove the pull box or tunnel under the side at no less than eighteen (18) inches and enter from the direction of the run. No new conduit will be allowed to enter a new or existing pull box in any other manner than that shown on the standard drawings.

Water valve pull boxes installed in the street shall be placed according to the plans or as directed by the Director. The lids shall have the word "Traffic" cast into them.

(j) Conductor and Cable Wiring shall conform to appropriate articles of the National Electrical Code. Wiring within cabinets, junction boxes, etc., shall be neatly arranged. Powdered soapstone, talc, or other approved non petroleum lubricant shall be used in placing conductors in conduit. A common neutral conductor, separate from the signal light circuit neutral, shall be used for all low voltage circuits, including the detectors and pedestrian push-button circuit. Inboard and outboard heads, mounted on mastarms are to be wired separately from head to base of pole.

Splicing of cable will not be permitted in conduit or outside of pull boxes, standards, or pedestals at the hand-hold circuits unless permitted by the Director or called out on the plans. All splices in pull box shall be water tight. The cable shall be installed between pole base and cabinet in a continuous run. In no case shall any shellac compounds be used. All connections shall be "BUCHANAN" connectors. Connections shall be DIAPERED and sealed with nonconducting silicone at all splices. Splices in underground systems shall be waterproofed. A minimum of twelve (12) inches of slack shall be left at each splice except within handholes where twenty four (24) inches shall be left.

When conductors and cables are pulled into the conduit, all ends of conductors and cables shall be taped to exclude moisture and shall be so kept until the splices are made or terminal devices attached. Ends of spare conductors shall be taped and marked. A small permanent tag with permanent markings on which the direction and phase is printed, in the order named, using the codes given in "Cable Schedule", shall be securely attached near the end of each conductor at each controller, standard, or pull box where conductors are separated. Where direction and phase are not clearly indicated by conductor insulation, additional tags shall be used.

CABLE SCHEDULE

<u>Color of Tape</u>	<u>Wire Tag</u>	
Northbound Left Turn	Red/White	NBLT
Northbound	Red	NB
Northbound Left Turn	Green/White	SBLT
Southbound	Green	SB
Eastbound Left Turn	Orange/White	EBLT
Eastbound	Orange	EB
Westbound Left Turn	Blue/White	WBLT
Westbound	Blue	WB
Pedestrian	Yellow	PED

NOTE: This is a typical cable schedule and shall be used for the wiring of all signal installations. A new cable schedule will be noted on the plans at each intersection where different phasing and/or special equipment is required. It should be noted that a band of white is used to indicate a left turn and yellow for a pedestrian movement. This is in addition to directional tape for the phase. For cable size and number of conductors, see Traffic Signal Material Specifications and/or Standard Drawings.

(k) Bonding and Grounding Metallic cable sheaths, conduit, metal poles and pedestals shall be made mechanically and electrically secure to form a continuous system and shall be effectively grounded. Interconnect cable shall be grounded only at one end. Bonding and grounding jumpers shall be solid copper wire, #6 AWG for all systems. Belden Cable Sheath for loop detectors shall be grounded in control cabinet only. The other end of the sheath shall be left ungrounded in the pull box.

At each pole and cabinet base, the ground electrode shall be a one-piece copper ground rod of five-eighths (5/8) inch diameter and eight (8) feet in length, driven into the ground so as the top is two (2) inches above the bottom of the pull box. The ground rod connector will be placed so that the bare solid copper wire (#6) can be pulled into a pole, pedestal, or attached to the control cabinet ground buss.

(l) Maintenance and Field Testing The contractor shall have full maintenance responsibility of the traffic signal installation from the date of the written Notice to Proceed to the Final Inspection and written approval of the work performed under the contract. Prior to completion of the work, the contractor shall cause the following tests to be made on all traffic signals in the presence of the engineer or his designee.

- (1) each circuit shall be tested for continuity prior to signal turn-on.
- (2) each circuit shall be tested for grounds prior to signal turn-on.
- (3) Signal turn-on shall be made between the hours of 9:00 am and 2:00 pm. Prior to the functional test, the system shall be operated on flash for 7 calendar days.
- (4) a functional test shall be made in which it is demonstrated that each and every part of the system functions as specified or intended herein. The functional test shall not be started on Fridays, weekend days or the day before a holiday.
- (5) The functional test for each traffic signal system shall consist of not less than fourteen (14) calendar days of continuous, satisfactory operation.
- (6) During the seven day signal flash time and the fourteen day functional test period, the contractor will maintain the system or systems. The cost of any maintenance necessary, except electrical energy, shall be borne by the contractor and will be considered as included in the price paid for the contract items involved and no additional compensation will be allowed therefore.

(m) Controller and Cabinet Each control cabinet shall be mounted on a concrete base as shown on the drawings. All electrical conduits running to the control cabinet shall enter from the bottom. No holes shall be drilled in any part of the cabinet other than the bottom unless otherwise called for on the drawings. All controller cabinets and control equipment shall be factory wired, ready for operation, field work will be limited to placing cabinets and equipment and the connecting of field wiring to field to field terminal strips. All cabinet wiring shall be neat and firm and all harness and cabinet wiring shall be brought out to a backboard and terminated.

The model and/or serial number shall appear on the controller and cabinet. All auxiliary equipment shall be of the most current design.

At the contractors request, the Director will provide, during the construction period, an additional external lock for the controller cabinet to maintain security of the controller cabinet.

Flashing operation shall be set for flashing yellow on main street approaches and flashing red on all other approaches in accordance with the "Manual on Uniform Traffic Control Devices". The flashing mechanism shall remain operational during removal of the controller.

(n) Traffic Signals and Mastarms Traffic signal heads requiring back-plates shall be pre-drilled for rivets or self tapping screws. If the manufacturer fails to supply as described, it will be the contractor's responsibility to do so. Mastarm brackets shall be installed 90 degrees to the roadway.

(o) Detector Loop Installation

- (1) Loop Detector (Sawcut)

Each individual detector loop is to be terminated within a pull box or water valve housing as specified on the construction drawing and each loop shall consist of one continuous wire, without splicing, to this termination point. Any required series or parallel connections are to be at the termination point.

Detector loops are to be constructed using DETECTADUCT 14 gauge one conductor IMSA Spec #51-5. The loop run shall go through the water valve pull box unspliced to the a Quazite pull box located off the roadway. Canoga lead in wire between the Quazite box and the controller cabinet shall be continuous through intermediate pull boxes without splices. All field wires shall be tagged and color coded with permanent markings in the cabinet.

All loops shall have a tag attached to the leading clockwise lead of the loop. This tag shall be marked to indicate the relative location of the loop. This marking shall correspond directly to the loop designations on the intersection drawing provided in the contract.

Detector loop roadway slots shall be sealed to the surface level of the original roadway with 3M Loop Sealant or approved equal. This sealant is to be used whether or not the roadway is to be overlaid.

The contractor shall include cost for loopwire, saw cutting and sealant for a complete installation of the loop to the termination point for the pay item price.

All presence detector loops shall be quadripole type, dimensioned as shown on the plans or located in the field, and shall be installed with 2-4-2 turns.

(2) Loop Detector (Preformed)

Preformed loop detectors shall be placed under the surface course of hot bituminous pavement where shown on the plans or as directed by the Engineer. Detector loops shall be High Temperature Detector Loops, Model 1700 Series as supplied by Detector Systems, Inc.

Loop and lead-in wire shall be place and secured by the Contractor and approved by the Engineer prior to placement of the surface course.

614.13 Method of Measurement. Revise Subsection 614.13 as follows

Loop detectors (sawcut or preformed) shall be measured as each unit installed to include loop wire, lead-in wire and all other work as necessary to complete the item.

614.14 Basis of Payment. Add the following to Subsection 614.14

Payment for sawcutting, pavement removal, excavation, incidental materials, backfill, structure backfill (flowfill) and patching shall be included in the contract unit prices for the traffic control devices. Additional pay items include:

<u>PAY ITEM</u>	<u>PAY UNIT</u>
Loop Detector (Sawcut) (____' x ____')	Each
Loop Detector (Preformed) (____' x ____')	Each
____" Electrical Conduit	LF
Signal Wiring	LS
Rewire Signal	LS
Pull Box (Small & Medium)	Each
Pull Box (Large)	Each

**SECTION 619
WATER LINES**

619.03 Construction Requirements. Add the following to Sec. 619.03:

All waterline materials and construction shall be in conformance with the standards and specifications of the owning utility company. Contractor shall notify the utility company at least forty-eight (48) hours in advance of commencing construction on the utility company's system. All work shall be inspected and approved by the owning utility company.

There shall be a minimum cover of five (5) feet above all water mains.

The Contractor shall notify all water utility customers affected by a scheduled water service outage a minimum of twenty-four (24) hours in advance of the service disruption.

**SECTION 627
PAVEMENT MARKING**

627.08 **Preformed Plastic Pavement Marking.** Replace the sixth paragraph of Subsection 627.08 with the following:

When preformed plastic pavement marking is to be installed on a new asphalt surface, it shall be done so in accordance with the manufacturer's recommendations. The material shall be applied prior to the finish rolling operation and when the surface temperature is between 135°F and 150°F to ensure that 50% of the material is embedded in the asphalt surface. If the surface temperature drops below 135°F prior to placement of the marking material, the paving operation shall be suspended until corrective measures have been taken. The material shall be rolled in using a 3- to 5-ton static steel drum roller. Care should be used to avoid turning on the pavement marking material. Any deviations from the intended alignment shall be corrected while the pavement is still warm.

627.13 **Basis of Payment.** Add the following to Subsection 627.13:

Pay Item	Pay Unit
Preformed Plastic Pavement Marking (Type A)	Square Foot
Preformed Plastic Pavement Marking (Type B)(Word/Symbol)	Square Foot
Preformed Plastic Pavement Marking (Type B)(Xwalk/Stop Line)	Square Foot
Preformed Plastic Pavement Marking (Type C)	Square Foot
Preformed Plastic Pavement Marking (Type D)	Square Foot

**SECTION 630
CONSTRUCTION ZONE TRAFFIC CONTROL**

- 630.10 Traffic Control Plan.** Add the following to the first paragraph of Subsection 630.10:

If the Contract Documents do not include a Traffic Control Plan (TCP), the Contractor shall submit a TCP for approval. Applicant request must be made (7) days prior to lane closure and (21) days prior to street closure.
- 630.10 Traffic Control Plan.** Add the following to the first paragraph of Subsection 630.10(a):

If the Contract Documents do not include a Traffic Control Plan (TCP), the Contractor shall submit a TCP for approval. Applicant request must be made (7) days prior to lane closure and (21) days prior to street closure.
- 630.10 Traffic Control Plan.** Add the following to the third paragraph of Subsection 630.10(a):

Approval of the MHT does not relieve the Contractor of traffic control liability specifically assigned to him under this Contract. A copy of the approved MHT shall be available at the Project site in order that Town personnel may verify compliance with the specified traffic control requirements.
- 630.11 Traffic Control Management.** Add the following to the first paragraph of Subsection 630.11:

The Contractor shall provide a traffic control supervisor for the duration of the Project.
- 630.11 Traffic Control Management.** Add the following to Subsection 630.11:

The Traffic Control Supervisor's duties shall NOT include traffic control signal operations. Any changes required for traffic signals operations shall be completed by Town of Castle Rock or CDOT personnel. All traffic shall be directed by a Licensed Law Enforcement Office when working within a signalized intersection when the traffic signal has been put to flash, disabled, modified or left unchanged.
- 630.12 Temporary Masking Signs.** Add the following to Subsection 630.12:

The standard of quality for work zone devices shall be the *Quality Standards For Work Zone Traffic Control Devices*, as published by the American Traffic Safety Service Association (ATSSA). Devices in the "Unacceptable" category shall not be delivered to the jobsite and when found in the work zone, shall be replaced or repaired within twelve (12) hours of notification.

All warning and construction zone traffic control devices shall bear the name, address and phone number of the barricade company that owns them. The phone number shall be a 24-hour-a-day dispatched hotline in the event an emergency situation occurs where additional devices are needed or existing devices must be removed.

The Contractor shall install construction zone traffic control devices in locations where they do not block or impede sidewalks for pedestrians, disabled persons, bicyclists or other existing traffic control devices. This strategy shall include, but not be limited to, strapping signs to street light poles or utility poles where available and clamping signs posts to guard rails. A minimum four-foot wide, unobstructed sidewalk area is to be maintained where possible. In the event that a minimum four-foot wide sidewalk area with a minimum overhead clearance of 7 feet, 6 inches cannot be maintained, a pedestrian/bicycle detour plan shall be submitted in conjunction with the traffic control plan.

All existing traffic control devices including traffic signals, signs, and pavement markings that are compatible with the construction zone traffic control shall remain visible and fully operational. If these devices are incompatible with the temporary construction, they shall be covered, relocated or removed.

Whenever the Contractor removes, obliterates or covers in any way, any pavement markings including lane lines and crosswalks, he shall replace them on a daily basis. Prior to opening affected areas to traffic, all pavement marking shall be placed in accordance with the Plans and Specifications or as directed by the Director.

The Contractor shall equip all vehicles operating within the moving lanes with flashing amber lights visible from all directions.

630.13 **General.** Add the following to Subsection 630.13:

Contractor shall provide Variable Message Sign (VMS) with the minimum screen dimensions of 11' (h) x 6' (d).

630.14 **Flagging and Pilot Car Operation.** Add the following to Subsection 630.14(d):

The flagger's STOP/SLOW sign paddle shall be at least 18 inches wide with letters 6 inches high.

630.15 **Method of Measurement.** Replace Subsection 630.15 with the following:

Traffic channelizing devices and flashing beacons (portable) will not be measured by the unit but will be included in the lump sum price for traffic control management.

When Traffic Control Management and flagging are not separate pay items, they will not be measured and paid separately but will be included in the pay item for traffic control management.

When there is a pay item for Traffic Control Management, "on call" and Project inspections on all days other than an authorized 24-hour day will not be measured but will be included in the pay item for traffic control management.

Signs, barricades, traffic channelizing devices, flashing beacons (portable), method of handling traffic, traffic control supervisor, flagging and all other requirements of Section 630 are included in the pay item for traffic control management unless they are identified in the Bid Schedule as separate pay items.

No payment will be made under Section 630 until the method of handling traffic (MHT) has been submitted and accepted.

Traffic control management, as determined by the method of handling traffic (MHT), will be paid as follows: 50% of the Contract item amount upon first utilization, an additional 40% of the Contract item amount when 75% of the original Contract amount has been earned, and the final 10% when the Project has been completed, in accordance with Subsection 105.20, exclusive of any maintenance periods.

630.16 **Basis of Payment.** Add the following to Subsection 630.16:

PAY ITEM	PAY UNIT
Traffic Control Management	Lump Sum
Variable Message Sign (VMS)	Daily

SECTION 631
MODULAR CONCRETE RETAINING WALL (Added Section)

DESCRIPTION

631.01 This work consists of furnishing and installing modular block retaining wall units to the lines and grades in accordance with these specifications and details shown on the plans. These specifications describe the KeyStone Retaining Wall System supplied by Best Block Company, 8227 Blakeland Drive, Littleton, CO 80125. Contractors and suppliers are encouraged to provide other wall modular wall systems of a similar nature for consideration.

Wall drawings and details included in the plan set are conceptual and for informational purposes only. Design of the modular retaining wall and preparation of construction details are the **SOLE** responsibility of the Contractor. Details are expected to vary depending upon different vendor's products requirements. The design of the wall, whether reinforced or not or whether modular units are full sized or compact shall be prepared by a Colorado Registered Professional Engineer proficient and experienced in design work of this nature. Shop drawings in accordance with Section 105.02 shall be submitted and approved prior to construction of items relating to wall work.

MATERIALS

631.02 Masonry units shall be brown colored precast concrete blocks with sculptured rock face. Concrete used in the masonry units shall have a minimum 28 day compressive strength of 3000 psi. The maximum absorption of water shall be 6 to 8 lbs. per cubic foot. Exterior dimensions may vary in accordance with ASTM C90-85. Units shall have angled faces and be capable of fitting a minimum radius of 4 feet.

Connector pins shall be made of non-corrodible material.

Cap unit adhesive shall be Keystone Kapstone Adhesive or approved equal.

Base and leveling material shall be compacted Class 6 Aggregate Base Course or otherwise approved equal such as recycled concrete or asphalt.

Filter material shall be Class C in accordance with Subsection 703.09, Table 703-7.

Unit fill for the units shall be a Class C filter material or Class 6 aggregate base course.

Back fill material for geogrid reinforced areas shall Class 6 aggregate base course in accordance with Subsection 703.03, Table 703-3. Recycled asphalt or concrete is not acceptable within this area.

Geogrid reinforcing material shall be high density polyethylene expanded sheet as supplied by TENSAR or approved equal.

CONSTRUCTION

631.03 The Contractor shall excavate to the lines and grades shown on the plans or as directed by the Director. The base of the excavation shall be compacted to 95% of AASHTO T99 prior to placement of foundation material. Areas of unsuitable soil shall be excavated as directed by the Director and suitable material placed prior to placement of foundation material. Excess material removed to stabilize the foundation shall be paid for at the unit price for unclassified excavation. Over excavated areas caused by the contractor's operations shall be filled with foundation material at the Contractor's expense.

The minimum depth of foundation material shall be 6 inches of free draining granular material compacted to 95% of standard proctor for the material. The material shall be placed and compacted to provide a hard level surface on which to place the first course of wall units and ensure full contact between the surface and the base of each wall unit.

631.04 The first course of wall units shall be placed upon the compacted foundation material. Care shall be taken to insure complete contact between each unit and the foundation. The units shall be placed side by side for the full length of the wall section. Each unit shall be checked for level and alignment which may be set by a string line or off set line. Maximum deviation from horizontal alignment shall not exceed 1/8th inch. Install the connecting pins and place unit fill

in all voids and tamp level with the top of the unit. Strike excess unit fill material and sweep all excess material from the top of the unit prior to placement of the next course of wall units. Batter per course shall be established on the plans.

Cap units shall be secured to the wall units according to manufacturer's written instructions using an approved adhesive.

Geogrid reinforcement shall be placed as required by shop drawings during placement of the individual courses of wall units. Geogrid reinforcement shall be laid horizontally on compacted layers relatively free of vertical deviations. Each section of geogrid shall be connected to the wall units by placing the geogrid over the connecting pins. The geogrid shall be tightened so there is no slack at the back of the wall units and the back of the geogrid stacked to maintain tension in the geogrid during placement of subsequent fill and wall units. Care shall be taken to place the geogrid material in accordance with manufacturer's recommendations for uniaxial and biaxial grids.

- 631.05** Material within one foot of the wall shall be Class C filter material. Backfill behind the filter material and within the geogrid reinforced areas shall be Class 6 aggregate base course. Backfill shall be placed in 8 inch lifts, leveled and compacted to 95% standard proctor prior to placement of the next lift of material. Backfill shall be placed from the wall backwards to insure adequate tension in the geogrid material. Tracked or rubber tired equipment shall not be allowed to operate on the geogrid material until at least 6 inches of fill material has been placed. Rubber tired equipment may operate on the geogrid but care shall be taken to prevent damage or displacement of the geogrid. In no event shall non hand operated power equipment or vehicles be allowed within 3 feet of the back surface of the wall units at any time during the life of the project. **REPAIRS TO THE WALLS AS A RESULT OF DAMAGE TO OR DISPLACEMENT OF THE WALLS DURING CONSTRUCTION OF THE PROJECT DUE TO ANY CAUSE ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.**

METHOD OF MEASUREMENT

- 631.06** Modular Retaining Wall shall be measured by the surface foot of wall constructed as shown on the plans or as directed by the Director. Surface area shall be measured from the base of the wall to the caps and from end to end. Curved sections shall be measured along the exposed face of the curve.

Excavation and backfill outside the above limits not other wise shown in the plans or directed by the Director shall be the responsibility of the Contractor.

BASIS OF PAYMENT

- 631.07** The unit price for Modular Retaining Wall shall include all modular wall units, connecting pins, cap unit adhesive, geogrid soil reinforcement, reinforcement area fill, unit fill, structure excavation and backfill, free draining filter material, foundation fill and all other labor, equipment, materials and incidental items required to complete the pay item. Payment will be made under:

Pay Item	Pay Unit
Modular Retaining Wall	Square Feet

**SECTION 713
TRAFFIC CONTROL MATERIALS**

713.11 **Traffic Signals.** Add the following to Subsection 713.11:

Visors shall consist of a vented louver on top, with the bottom portion of the visor open to minimize or reduce snow build up. The visor dimensions should be 12" in diameter by 10.5" in length. The louvered slot on top should be 8" wide by 4" deep by 1.5" high and shall match the curvature of the visor itself. The color shall match that of the signal housing and shall resist corrosion. The visor shall have a minimum tilt of 3-degrees downward.

713.13 **Preformed Plastic Materials.** Add the following to Subsection 713.13:

Preformed Plastic Pavement Marking (Type A) shall be 3M "Stamark" Pavement Marking, Series 380-I or 381-I Tape or any other equivalent and approved product.

Preformed Plastic Pavement Marking (Type B) shall be 3M "Stamark" Pavement Marking, Series A420I Tape or any other equivalent and approved product.

Preformed Plastic Pavement Marking (Type C) shall be 3M "Stamark" High Performance Contrast Marking Tape, Series 380I-5 or 381I-5 Tape or any other equivalent and approved product.

Preformed Plastic Pavement Marking (Type D) shall be 3M "Stamark" Pavement Marking, Series 5730 or 5731 Tape or any other equivalent and approved product.

**SECTION 715
LIGHTING AND ELECTRICAL MATERIALS**

715.04 **Luminaires and Lamps.** Add Subsection 715.04(a) 5. as follows:

Adaptations to this section to accommodate LEDs may be permitted only when technically infeasible to support LED operations. The vendor must provide documentation that states what specifications can't be met, and how intent of the specification is addressed.

715.04 **Luminaires and Lamps.** Replace Subsection 715.04(b) with the following:

Roadway luminaires shall be LED. Induction, or metal halide may be substituted only with the engineers written approval or as shown on the plans. All luminaires for the project shall be the same type and design unless the plans specify otherwise. Housings for luminaires on signals may be cobra head style, shoebox style, or hockey puck style.

715.04 **Luminaires and Lamps.** Replace the first paragraph of Subsection 715.04(e) with the following:

Lamps for luminaires shall be LED. The LED must be of the equivalent metal halide wattage as specified on the plans. Other lamps may be permitted as called for on the plans. Mercury vapor shall not be used.

SECTION 720
MATERIALS SAMPLING AND TESTING (Added Section)

DESCRIPTION

720.01 Materials sampling and testing shall be performed under the Contract by an independent materials testing company. This Work shall include all necessary labor, equipment and material required for sampling and testing materials or finished products in accordance with the specifications of this Section. Unless otherwise designated, all referenced specifications, standards or policies shall be the latest edition as revised or updated by approved supplements published and issued prior to the date of the advertisement for bids.

CONSTRUCTION REQUIREMENTS

720.02 All materials sampling and testing shall be performed by certified, experienced and qualified materials testing technicians who work under the supervision of a registered professional engineer in the State of Colorado. At the request of the Engineer, the Contractor shall require the materials testing company to replace any technician who cannot satisfactorily perform the testing duties.

All materials sampling and testing equipment shall be serviceable and calibrated. At the request of the Engineer, the Contractor shall require the materials testing company to replace any testing equipment that is not satisfactory.

Soil classifications and moisture-density curves shall be provided to the Engineer prior to in-place density testing. Materials testing technicians shall furnish copies of failed test results to the Engineer promptly as the results become available. On a weekly basis, the Contractor shall furnish the Engineer with copies of all test results taken during the prior week and a cover letter signed by the supervising registered professional engineer, which summarizes the results and discusses any failed tests or inconsistencies.

Retesting the density of subgrade and base course materials shall be required at the Contractor's expense if they are reworked or weather causes the materials to become wet, dry or frozen.

In place densities for Hot Bituminous Pavement shall be determined using a nuclear density gauge. Nuclear densities shall be taken in accordance with CP 81-01. The nuclear density gauge shall be calibrated to a minimum of six (6) cores taken from the same material.

Core samples shall be neatly cut with a core drill and have a minimum diameter of three (3) inches. Samples that are clearly defective as a result of sampling shall be discarded and another sample taken. Cored holes shall be filled in a manner acceptable to the Town within 24 hours.

The Town materials testing requirements are provided in Table 720-1. All testing procedures, point of verification and central lab requirements shall be as specified in the *Frequency Guide Schedule* of the Colorado Department of Transportation Field Materials Manual. Without increasing the total number of tests or samples required, the Engineer or Inspector may change the test locations from the frequency spacing shown in Table 720-1. One (1) test is required for any fraction of the specified frequency. Concrete testing shall be performed on the first three (3) trucks delivered for each mix design and continue, per Table 720-1.

Table 720-1
Town of Castle Rock Materials Testing Requirements

Type of Test	Frequency	Remarks
Soil Survey (Classification), AASHTO M145	1 per 1000 feet of roadway, sidewalk or pipe trench	Surveys for roadway, sidewalk and trench may be combined
Moisture-Density Curve, AASHTO T99 or T180	1 per on-site soil type 1 per import material source	AASHTO method determined by soil or materials type
Gradation Analysis, aggregate for base course	1 per 1500 ton	Within specifications, Section 304.02.
Gradation Analysis, aggregate for stabilization material	1 per 1500 ton	Within specifications, Section 304.02.
Gradation Analysis, aggregate for trench foundation material	1 per 1500 ton	Within specifications, Section 304.02.
Gradation Analysis, aggregate for bedding material	1 per 1500 ton	Within specifications, Section 206.02.
Gradation Analysis, aggregate for seal coat.	1 per 10,000 square yard	Within specifications, Section 409.03.
Gradation Analysis, aggregate for slurry seal.	1 per 10,000 square yard	Within specifications, Section 410.03.
In-place density, Embankment, Colorado Procedures.	1 per 300 feet per lane per 8 inch loose lift	Minimum density per soil classification, Section 203.07
In-place density, Roadway subgrade, Colorado Procedures.	1 per 300 feet per lane	Minimum density per soil classification, Section 203.07
In-place density, Sidewalk subgrade, Colorado Procedures.	1 per 300 feet of sidewalk	Minimum density per soil classification, Section 203.07
In-place density, Pipe trench, Colorado Procedures.	1 per 200 feet of trench per 1 foot vertical interval	Minimum density per soil classification, Section 203.07
In-place density, Aggregate base course, Colorado Procedures.	1 per 300 feet per lane	Minimum 95% of maximum density, T180
In-place density, Lime treated subgrade, Colorado Procedures.	1 per 300 feet per lane	No less than 95% of std. dry density and opt. moisture, T99
In place density, Cement treated base, Colorado Procedures.	1 per 300 feet per lane	Density in accordance with Contract documents, T134
In-place density, Hot Bituminous Pavement, Colorado Procedures.	1 per 250 feet per lane per lift	92-96% of maximum theoretical density
Asphalt content, gradation, and RICE, Hot Bituminous Pavement.	1 per ea HBP grade/binder grade specified/1000 ton	Within specifications of approved mix design
Temperature, Hot Bituminous Pavement	2 per day minimum	Dryer, Binder in storage tank, Mixture at plant and job site
Core for thickness, Hot Bituminous Pavement	1 per 500 feet, alternating lanes	Thickness as indicated in Contract documents.
Compressive strength, Concrete, AASHTO Procedures	1 per 50 cubic yards/mix design	PCC pavement, structural concrete, sidewalks and curbing
Air content and slump, Concrete, AASHTO Procedures	1 per 50 cubic yards/mix design	PCC pavement, structural concrete, sidewalks and curbing

BASIS OF PAYMENT

720.03

Partial payments for materials sampling and testing will be made once each month as the sampling and testing work progresses and in proportion to the bid price. Contingency items shall be paid when additional services are required by the Engineer.

Payment will be made under:

Pay Item
Materials Sampling and Testing

Pay Unit
Lump Sum