Section 1 – General

Project Description

The existing facility is an interchange consisting of a six-lane urban highway bridge over a city street. The bridge has been rated in poor condition by CDOT and has been funded for replacement by the Colorado Bridge Enterprise program. The existing bridge is a three span steel plate girder structure that has non-standard shoulders and non-compliant sight distances. There are large CIP Concrete Cantilevered Retaining Walls in the Northwest and Southeast quadrants of the interchange that will need to be replaced.

The intent of the proposed project is to increase safety and mobility by replacing the bridge providing improved shoulder widths and standard sight distance. Maintenance of vehicular traffic on US 6 and Garrison Street, full access to and from Garrison Street, as well as safe passage for the heavy pedestrian traffic on Garrison Street will be required. Region Lane Closure Policy must be followed.

Project Location

The Project is located on US 6 in Lakewood, CO in Jefferson County. The project limits have been defined from mile marker (MM) 297.54 to MM 280.15.

Construction Configuration

The Construction Configuration is defined as all Work that the Contractor is required to construct as defined by the Contract documents. Bidders are directed to Project Technical Requirements described within in the Contract.

The Major Elements of the Construction Configuration are as follows**:**

1. Replace structure F-16-ER carrying US 6 over Garrison Street. See plan details in Reference Documents and accompanying Technical Requirements.

2. Replace CIP retaining walls in the NW and SE quadrants as needed. See plan details in Reference Documents and accompanying Technical Requirements.

3. Construct roadway approaches/wall structures to accommodate standard sight distances on US 6, 4’ inside shoulders and 12’ outside shoulders on US 6, four 11’ lanes, sidewalks and bike path on Garrison Street. See plan details in Reference Documents and accompanying Technical Requirements.

4. Maintain minimum overhead clearance of 14’-6” on Garrison Street. See plan details in Reference Documents and accompanying Technical Requirements.

Section 1 – General

5. Maintain traffic signal operation on Garrison Street during construction; replace signals to accommodate reduced vertical clearance on Garrison Street. See plan details in Reference Documents and accompanying Technical Requirements.

6. Construct drainage improvements as required. See plan details in Reference Documents and accompanying Technical Requirements.

7. Construct signing and pavement marking. See plan details in Reference Documents and accompanying Technical Requirements.

8. Implement construction staging, traffic detours and traffic control during construction. Maintain rideability and full compliance striping of detours. See plan details in Reference Documents and accompanying Technical Requirements.

9. Preparation of the Storm Water Management Plan, including obtaining Colorado Discharge Permit System-Stormwater Construction Permit and design and construction of all structures to accommodate requirements. See plan details in Reference Documents and accompanying Technical Requirements.

10. All work shall be completed within existing CDOT ROW.

11. Coordination of Design and Construction with CDOT, City of Lakewood and Utility Owners.

12. At a minimum, resurface pavement on US 6 to a depth of 2 ½" with SMA to meet the recent overlay from approximately mileposts 279.78 to 280.15.

13. Provide ADA compliant curb ramps on Garrison Street at all four quadrants.

The Contractor and its design team may adjust the alignments of Construction Configuration elements within the limits listed below:

A. Any geometric changes must meet all Contract design criteria.
B. If additional ROW is required to accommodate the Construction Configuration, this will be done at the Contractor's expense following CDOT procedures.
C. Any grade changes increasing the profile by 5 feet will require a noise study in compliance with CDOT requirements. If required, the cost of the noise study, and any mitigation will be at the Contractor's expense.
D. Increase of impervious surface in the project limits by more than 20% will require design, permitting and construction of Permanent Water Quality features to comply with CDOT requirements. If required, this work will be at the Contractor's expense.
E. No Horizontal Shift of US 6 will be allowed.

Section 1 – General

F. No lowering or horizontal shift of Garrison Street will be allowed.

Contract Components

The Contract consists of the following items. Construction shall be governed by the 2011 "CDOT Standard Specifications for Road and Bridge Construction", as revised by the contract:

1. Contractor's Proposal
2. Instructions to Proposers and Notice to Bidders
3. Technical Requirements
    - Section 1 – General
    - Section 2 – Project Management
    - Section 3 – Quality Management
    - Section 4 – Public Information
    - Section 5 – Environmental Requirements
    - Section 6 – Third Party Agreements
    - Section 7 – Utility Relocations
    - Section 8 – Right-of-Way
    - Section 9 – Survey
    - Section 10 – Geotechnical and Roadway Pavements
    - Section 11 – Earthwork
    - Section 12 – Hydraulics
    - Section 13 – Roadway Design
    - Section 14 – Signing, Pavement Markings, and Lighting
    - Section 15 – Structures
    - Section 16 – Maintenance of Traffic
    - Section 17 – Landscaping
    - Section 18 – Maintenance During Construction
    - Section 19 – ITS
    - Section 20 – Modifications to Standard Specifications
4. Contract Drawings (Survey)
5. Contractor prepared Project Plans, drawings and details
6. 2011 CDOT Standard Specifications for Road and Bridge Construction
7. 2012 M & S Standard Plans with most recent revisions

Contract Hierarchy

Each of the Contract Documents is an essential part of the Contract and a requirement occurring in one is as binding as though occurring in all. The Contract Documents are intended to be complementary and to describe and provide for a complete Contract. If there is any conflict among the Contract Documents, the order of precedence shall be as set forth below:

Section 1 – General

1. Instructions to Proposers
2. Technical Requirements
3. Standard Special Provisions
4. 2011 CDOT Standard Specification for Road and Bridge Construction
5. M & S Standard Plans
6. The Proposal Documents, to the extent that they meet or exceed the requirements of the other Contract Documents. In other words, if the Proposal Documents include statements that can reasonably be interpreted as offers to provide higher quality items than otherwise required or to perform services in addition to those otherwise required or otherwise contain terms which are more advantageous to CDOT than the requirements of the Contract Documents, the Contractor's obligations hereunder shall include compliance with all such statements, offer, and terms.

Notwithstanding the foregoing, in the event of conflicting requirements involving any requirement within the Contract Documents or reference documents, CDOT shall have the right to determine, in its sole discretion, which requirement(s) apply. The Contractor shall request CDOT's determination respecting the contract hierarchy among conflicting provisions promptly upon becoming aware of any conflict.

Design Requirements

Design Surveys

The Contractor shall arrange for all supplemental survey information and utility locations necessary to complete the design and construction. Surveying shall be performed in accordance with the CDOT Survey Manual. Traffic control and permits necessary to complete the survey shall be the responsibility of the Contractor. The Contractor will deliver the data (in InRoads TMOSS survey format) and field notes to CDOT for review upon completion of the survey. Errors and omissions found by the CDOT Project Manager shall be corrected by the Contractor and resubmitted.

General

Items designed as shown in the Reference Documents (Plan Sheets) that the Contractor determines may remain the same will be signed and sealed by the Contractor. The Contractor's Design Manager will be responsible to sign and seal all design elements that have been modified.

The Contractor shall perform the design work as described herein. Clarification, if required, will be provided by the CDOT Project Manager. Specific design criteria are required for Professional Engineering Services, including Roadway, Hydraulics, Traffic and Structural elements.

Section 1 – General

Bidders will not be compensated by CDOT for any design required to prepare the Proposal or the bid for the work, except for the stipend, if awarded. Bidders who will have performed design work before award, but who do not get the award, for any reason, will have performed that work solely at their own cost, not subject to reimbursement by CDOT.

All designs provided by the Contractor shall be completed under the responsible charge of a Professional Engineer registered in the State of Colorado. The designs and plans shall be sealed in accordance with the bylaws and rules of procedure of the Colorado State Board of Registration for Professional Engineers and Professional Land Surveyors by the responsible engineer in charge.

The Contractor shall ensure that the design meets all applicable design criteria including but not limited to the safety and serviceability, as described herein and as shown on the Plans. The Contractor shall use the plans, references and guidelines indicated herein for the design criteria.

Designs predicated on any errors or omissions in the Contract will be rejected. If any such error, omission or discrepancy is discovered, the Contractor shall notify CDOT immediately. Failure to notify CDOT will constitute a waiver of all claims for misunderstandings, ambiguities, or other situations resulting from error, omission, or discrepancy.

Major structure designs provided by the Contractor shall include an independent design review and check by an engineer registered in the State of Colorado other than the engineer-of-record.

Some activities such as exploratory drilling on existing pavement or access to the State Highway system may require a Utility Permit from CDOT. Permits shall be obtained by the Contractor and copies shall be submitted to the CDOT Project Manager.

Roadway Engineering

All drawings/plan sets will be produced using CDOT's CADD standards. All electronic drawings and Roadway modeling will be developed in MicroStation/ InRoads using CDOT's latest configuration, workspace and drafting standards. CDOT's configuration and workspace can be downloaded from CDOT's website at: http://www.coloradodot.info/business/designsupport/cadd/microstation-inroads-configuration/v8i-ss2-configuration. All drawings/plan sets will be submitted in a PDF format and the appropriate electronic format (DGN, DTM, etc.). CDOT's configuration and workspace for MicroStation and InRoads can be downloaded from the CADD Website at no cost to the project or consultants.

All roadway design plans provided by the Contractor shall be in accordance with and meet all criteria specified in the CDOT Roadway Design Guide found at: http://www.coloradodot.info/business/designsupport/bulletins_manuals/roadway-design-guide.

Section 1 – General

Plan sheets and details shall be prepared in accordance with the CDOT Drafting Manual. The Contractor shall use references listed herein when necessary design criteria are not available in the CDOT Roadway Design Guide.

The completed survey contains information necessary to approximate the extent of the roadway fills or cuts. Guardrail shall be added as described in the Contract. The Contractor shall prepare roadway design plans and details for acceptance by the CDOT Project Engineer.

The Project design plans shall include the following:

- Plan and profile sheets including all horizontal and vertical alignment information
- Bridge plans
- Wall Plans
- Structure Cross Sections / Drainage Details
- Quantity tabulations and summaries
- Detour details
- Maintenance of Traffic details
- Roadway cross sections including earthwork information
- Typical sections and locations
- Stormwater Management Plan
- Details of all additional work the Contractor determines necessary to complete the Contract.

Reference Documents

Reference documents listed in the Technical Requirements can be found at:

http://www.coloradodot.info/projects/us6overgarrison

Definitions

Accept or Acceptance	Formal conditional determination in writing by the CDOT Project Manager that a particular matter or item appears to meet the requirements of the Contract Documents.

Section 1 – General

Approve or Approval	Formal conditional determination in writing by the CDOT Project Manager that a particular matter or item is good or satisfactory for the Project. Such determination may be based on requirements beyond those set forth in the Contract Documents without payment of additional compensation or a time and may reflect preferences of CDOT.
Nonconforming Work	Work performed that does not meet the requirements of the Contract Documents.
Punch List	The list of Work items with respect to the Project which remain to be completed after achievement of each Milestone Completion, each Segment Completion, or the Project Completion, generally limited to minor incidental items of Work necessary to correct imperfections which have no adverse effect on the safety or operability of the Project.
Quality Assurance (QA)	All those planned and systematic actions necessary for the Contractor to certify to CDOT that all Work fully complies with the requirements of the Contract Documents and that all materials incorporated in the Work, all equipment used, and all elements of the Work will perform satisfactorily for the purpose(s) intended.
Quality Control (QC)	The activities performed by the Contractor, designer, producer or manufacturer to ensure and document that a product meets the requirements of the Contract Documents. Activities may include checking, materials handling and construction procedures, calibrations and maintenance of equipment, shop drawing review, document control, production process control, and any sampling, testing, and inspection done for these purposes.
Work	All duties and services to be furnished and provided by Contractor as required by the Contract Documents, including the administrative, design, engineering, quality control, quality assurance, Relocation, procurement, legal, professional, manufacturing, supply, installation, construction, supervision, management, testing, verification, labor, Materials, equipment, documentation and other efforts necessary or appropriate to achieve Final Acceptance

Section 1 – General

except for those efforts which the Contract documents specify will be performed by CDOT or other Persons. In certain cases the term is also used to mean the products of the Work.

Deliverables

The Contractor shall submit the following to the CDOT Project Manager:

Deliverable	Acceptance or Approval	Schedule
Supplemental Design Survey (if required for Design-Build Design)	Acceptance	Before Final Acceptance
Field notes	Acceptance	Before Final Acceptance
Independent Design Review and Check by an Engineer	Acceptance	Before Final Acceptance

Section 1 – General

Project Special Provisions

Disadvantaged Business Enterprise (DBE) Contract Goal

This is a federally-assisted construction project. As described in the CDOT DBE Standard Special Provision, the Bidder shall make good faith efforts to meet the following contract goal:

10.5% Percent DBE participation

Section 1 – General

COMMENCEMENT AND COMPLETION OF WORK
MULTIPLE BID SCHEDULEs

The Contractor shall select the date that work begins for this project. The Contractor shall notify the Engineer, in writing, at least 20 days before the proposed beginning date. The date that work begins shall be subject to the Region Transportation Director's approval. A different date may be authorized in writing by the Chief Engineer in the "Notice to Proceed."

The Contractor shall achieve project completion by the date set in the accepted bid submittal and shall complete all work in accordance with the "Notice to Proceed."

Stockpiling of materials before the beginning date is subject to the Engineer's approval. If such approval is given, stockpiled material will be paid for in accordance with Sections 109 and 626.

Salient features to be shown on the Contractor's progress schedule shall be as shown in Section 2 – Project Management of the Technical Requirements.

The work will be considered completed when it conforms to the Contract and has been accepted in accordance with subsection 105.21(c).

There are 2 separate bid schedules for this project. The Bidder shall submit a bid for each schedule. The schedules for this project are as follows:

Schedule A: Complete all project work by October 31, 2015.

Schedule B: Substantially complete by October 31, 2015. Substantially complete is defined as all major items including full width bridge, guardrail, vertical curve correction on US 6, drainage systems, lighting and signals, and all ramps and local roadways open to traffic in the final configuration by October 31, 2015. Final wear course paving, membrane, and structure coating may be included in final project work which must be completed by June 1, 2016

The Bidder’s proposal shall specify a unit bid price for each pay item in all bid schedules. Failure to include unit bid prices for each bid item in all bid schedules shall be cause for rejection of the Bidder’s proposal. If a bidder does not bid on all schedules, his bids will be rejected and set aside.

The bid opening process will be as follows:

(1) Bids will only be read from proposers that receive a pass rating on the technical proposal.
(2) The maximum acceptable bid for the project will be announced immediately prior to the bid opening.
(3) The total bid for Schedule B will be read for each bidder.
(4) If none of the bids for Schedule A is at or below the maximum acceptable bid, the bids for Schedule A will not be read, and the apparent low bidder for Schedule B will be announced.
(5) If one or more of the bids for Schedule A is at or under the maximum acceptable bid, the total bid for Schedule A will be read for each bidder.

Section 1 – General

(6) After all Schedule A bids have been read the apparent low bidder for Schedule A will be announced.

Section 1 – General

-2-
COMMENCEMENT AND COMPLETION OF WORK
MULTIPLE BID SCHEDULEs

The Department will award the Contract to the lowest responsible bidder of the earliest completion bid schedule that results in a low bid at or less than the maximum acceptable bid. If none of the schedules results in a low bid at or less than the maximum acceptable bid, the Department will award the Contract to the lowest responsible bidder on schedule B provided that it results in a total project cost less than 110 percent of the Project Budget. If the low bid for Schedule B does not result in a total cost under 110 percent of the Project Budget, the Department may supplement the Project Budget in order to award the Schedule B project. The possibility of having different low bidders on different schedules is recognized.

In accordance with 24-109-102 CRS, protests, if any, must be submitted in writing within seven working days after contract award. Pursuant to 24-109-104 CRS, if a protest is sustained and the protesting bidder should have been awarded the contract and was not, the protestor shall be entitled to recover only the reasonable costs incurred in connection with the solicitation, including bid preparation costs. Reasonable costs shall not include attorney fees. The protestor shall not be entitled to recover any other costs.

If the completion of the work is past the fixed completion date set by the awarded bid, liquidated damages will be deducted from payments made to the Contractor. This disincentive will equal the actual number of calendar days required to complete the work past the completion date. The daily cost will be $5,000. If schedule A is chosen and the Contractor has not completed all project work by October 31,2015, liquidated damages of $5,000 per day will be assessed until all work is completed to the satisfaction of the Engineer. If schedule B is chosen and the Contractor has not completed the major work items described for completion by October 31, 2015, liquidated damages of $5,000 per day will be assessed until this work is completed to the satisfaction of the Engineer. If schedule B is chosen and the Contractor has not completed all project work by June 1, 2016, liquidated damages of $5,000 per day will be assessed until this work is completed to the satisfaction of the Engineer.

Section 1 – General

ON THE JOB TRAINING CONTRACT GOAL

The Department has determined that On the Job Training shall be provided to trainees with the goal of developing full journey workers in the types of trade or classification involved. The contract goal for On the Job Trainees working in an approved training plan in this Contract has been established as follows:

Minimum number of total On the Job Training required 1600 hours.

Section 1 – General

REVISION OF SECTION 102
BIDDING REQUIREMENTS AND CONDITIONS

Section 102 of the Standard Specifications is hereby revised for this project as follows:

Subsection 102.01 shall include the following:

Only bidders whose Professional Engineering Firm for Design Services is prequalified with the Department will be allowed to bid on the project.

In Subsection 102.02, delete the second sentence and replace with the following:

This form will state the location and description of the contemplated construction, and will have an item for which a lump sum bid is invited.

Delete subsection 102.03 (b) and replace with the following:

(b) *Measurement Not Required.* When the Contract does not require quantities of work performed or material furnished to be measured, payment will be made by lump sum, as amended elsewhere in the Contract.

Subsection 102.05 shall include the following:

The following information will be available for review on the website at http://www.coloradodot.info/projects/us6overgarrison

Instructions to Proposers and Notice to Bidders
Index of Technical Requirements, Contract Documents and Reference Documents
Technical Requirements / Project Special Provisions
Standard Special Provisions
Contract Documents
Reference Documents

In Subsection 102.07 delete subsections (4) and (5).

Section 1 – General

REVISION OF SECTION 104
FINAL CLEAN UP

Section 104 of the Standard Specifications is hereby revised for this project as follows:

In subsection 104.06 shall include the following:

Final cleaning up shall include all items or results of work necessary for the performance of work but temporary in nature. These items shall include but not be limited to removal of construction stakes, temporary earth berms for containment sites, shaping and restoration of temporary facility sites.

All costs incidental to the foregoing requirements shall be included in Work.

Section 1 – General

REVISION OF SECTION 107
PROTECTION OF LANDSCAPE

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

Subsection 107.12 shall include the following:

The Contractor shall save all existing vegetation and other environmental features except for those which must be removed or altered to accommodate the roadway and related structures.

Material storage, equipment parking, vehicle parking, and stockpiling excavated material will be allowed only in those areas designated by the Engineer. Specified areas of vegetation and other environmental features to be protected will be staked, fenced, or otherwise marked in the field by the Engineer. However, the fact that areas of vegetation and other environmental features are not marked does not necessarily mean that these items are expendable. The Contractor shall perform all his activities in such a manner that the least environmental damage will result. Any questionable areas or items shall be brought to the attention of the Engineer for approval prior to removal or any damaging activity. Damage or destruction of unmarked trees and shrubs which could reasonably have been saved shall therefore be subject to the provisions of this Special Provision.

If the fence, staking, or marking is knocked down or destroyed by the Contractor, the Engineer will suspend work wholly or in part, until the fence or other protection is repaired to the Engineer's satisfaction at the Contractor's expense. Time lost due to such suspension will not be considered a basis for adjustment of time charges, but will be charged as contract time.

If the Contractor disturbs any of the landscape designated to remain, he shall restore those areas as directed by the Engineer at the Contractor's expense. Vegetation damage for any reason, outside of the staked limits, is the responsibility of the Contractor.

The Department may require that the Contractor replant an area that is damaged. The work shall be done as directed by the Engineer. If the Contractor is deemed to be responsible, then the replanting is to be done at the Contractor's expense.

With respect to replacement of trees and shrubs that have been damaged or destroyed, the following conditions will apply:

1) Trees and shrubs of replaceable size shall be replaced at the Contractor's expense. If the Contractor fails to do so within a reasonable amount of time as determined by the Engineer, the replacement value of the trees or shrub will be deducted from any moneys due to the Contractor.

Section 1 – General

-2-
REVISION OF SECTION 107
PROTECTION OF LANDSCAPE

2) When trees or shrubs beyond replaceable size have been damaged or destroyed, the value of each tree or shrub shall be determined by the Engineer, based on the "Guide for Established Values of Tree and Other Plants" prepared by the Council of Tree and Landscape Appraisers, published under the auspices of the International Society of Agriculture. The value will be deducted from any money due to the Contractor. This deduction will not be considered a penalty, but as liquidated damages.

The determination as to whether a plant is of replaceable size or beyond will be made by the Engineer. If the plant has been disposed of, the value will be placed as if it were beyond replaceable size, based upon average spacing of like kind in an adjoining area of similar vegetation.

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 the Department, traveling public, or other contractors.

Section 1 – General

REVISION OF SECTION 107
PERFORMANCE OF SAFETY CRITICAL WORK

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

Add subsection 107.061 immediately following subsection 107.06 as follows:

107.061 Performance of Safety Critical Work. The following work elements are considered safety critical work for this project:

(1) Overhead girder erection for bridge F-16-EW
(2) Demolition of Structure F-16-ER
(3) Demolition of existing CIP Concrete Cantilever Walls
(4) Overhead structure construction
(5) Temporary works: falsework, shoring that exceeds 5 feet in height, cofferdams, and temporary bridges
(6) Work requiring the use of cranes or other lifting equipment
(7) Excavation and embankment adjacent to the roadway, especially if it requires shoring
(8) Work impacting, or immediately adjacent to the 60” Denver Water main shown on the plans

The Contractor shall submit, for record purposes only, an initial detailed construction plan that addresses safe construction of each of the safety critical elements. When the specifications already require an erection plan or a bridge removal plan, it shall be included as a part of this plan. The detailed construction plan shall be submitted two weeks prior to the safety critical element conference described below. The construction plan shall be stamped “Approved for Construction” and signed by the Contractor. The construction plan will not be approved by the Engineer but shall be subject to acceptance.

The Construction Plan shall include the following:

(1) Safety Critical Element for which the plan is being prepared and submitted.
(2) Contractor or subcontractor responsible for the plan preparation and the work.
(3) Schedule, procedures, equipment, and sequence of operations, that comply with the working hour limitations
(4) Temporary works required: falsework, bracing, shoring, etc.
(5) Additional actions that will be taken to ensure that the work will be performed safely.
(6) Names and qualifications of workers who will be in responsible charge of the work:
    A. Years of experience performing similar work
    B. Training taken in performing similar work
    C. Certifications earned in performing similar work

Section 1 – General

-2-
REVISION OF SECTION 107
PERFORMANCE OF SAFETY CRITICAL WORK

(7) Names and qualifications of workers operating cranes or other lifting equipment
Years of experience performing similar work

A. Training taken in performing similar work
B. Certifications earned in performing similar work

(8) The construction plan shall address how the Contractor will handle contingencies such as:
A. Unplanned events (storms, traffic accidents, etc.)
B. Structural elements that don't fit or line up
C. Work that cannot be completed in time for the roadway to be reopened to traffic
D. Replacement of workers who don't perform the work safely
E. Equipment failure
F. Other potential difficulties inherent in the type of work being performed

(9) Name and qualifications of Contractor's person designated to determine and notify the Engineer in writing when it is safe to open a route to traffic after it has been closed for safety critical work.

(10) Erection plan when submitted as required elsewhere by the specifications. Plan requirements that overlap with above requirements may be submitted only once.

A safety critical element conference shall be held two weeks prior to beginning construction on each safety critical element. The Engineer, the Contractor, the safety critical element subcontractors, and the Contractor's Engineer shall attend the conference. Required pre-erection conferences or bridge removal conferences may be included as a part of this conference.

After the safety critical element conference, and prior to beginning work on the safety critical element, the Contractor shall submit a final construction plan to the Engineer for record purposes only. The Contractor's Engineer shall sign and seal temporary works related to construction plans for the safety critical elements, Removal of Portion of Bridge and Temporary Works. The final construction plan shall be stamped "Approved for Construction" and signed by the Contractor.

The Contractor shall perform safety critical work only when the Engineer is on the project site. The Contractor's Engineer shall be on site to inspect and provide written approval of safety critical work for which he provided stamped construction details. Unless otherwise directed or approved, the Contractor's Engineer need not be on site during the actual performance of safety critical work, but shall be present to conduct inspection for written approval of the safety critical work.

Section 1 – General

-3-
REVISION OF SECTION 107
PERFORMANCE OF SAFETY CRITICAL WORK

When ordered by the Engineer, the Contractor shall immediately stop safety critical work that is being performed in an unsafe manner or will result in an unsafe situation for the traveling public. Prior to stopping work, the Contractor shall make the situation safe for work stoppage. The Contractor shall submit an acceptable plan to correct the unsafe process before the Engineer will authorize resumption of the work.

When ordered by the Engineer, the Contractor shall remove workers from the project that are performing the safety critical work in a manner that creates an unsafe situation for the public in accordance with subsection 108.06.

Should an unplanned event occur or the safety critical operation deviate from the submitted plan, the Contractor shall immediately cease operations on the safety critical element, except for performing any work necessary to ensure worksite safety, and provide proper protection of the work and the traveling public. If the Contractor intends to modify the submitted plan, he shall submit a revised plan to the Engineer prior to resuming operations.

All costs associated with the preparation and implementation of each safety critical element construction plan will not be measured and paid for separately, but shall be included in the work.

Nothing in the section shall be construed to relieve the Contractor from ultimate liability for unsafe or negligent acts or to be a waiver of the Colorado Governmental Immunity Act on behalf of the Department.

Section 1 – General

REVISION OF SECTION 108
PROJECT SCHEDULE

Section 108 of the Standard Specifications is hereby revised for this project as follows:

Subsection 108.03 shall include the following:

The Engineer will review schedule submittals; such review shall not constitute an Approval of the Contractor's construction means, methods, sequencing, or its ability to complete the Work in a timely manner.

Subsection 108.03 (c) delete the first sentence of the second paragraph and replace with the following:

The Contractor shall use Microsoft Project software to develop and manage the Critical Path Method Schedule.

Subsection 108.03 (c) shall include the following:

Changes in logic and/or durations shall not be made without first providing written notification to Engineer for Contractor's need to change. No work/activity shall commence without written Approval from the Engineer accepting said changes.
Consideration will be given for Contractor changes as they are determined to be reasonable by narrative explanation. Acceptance or rejection of such changes is without liability. Logic or Duration changes to simply accommodate a perception of still being on-schedule will not be accepted.

A revision of the Schedule may include a Recovery Schedule. At the discretion of the Engineer, when the most current Accepted Schedule Update no longer represents the actual prosecution and progress of the work, the Engineer shall require a Recovery Schedule. If it is determined that a Recovery Schedule is required, it shall be provided to the Engineer for review within 15 calendar days of written notification. The Recovery Schedule shall include the original Contract work and all Approved Change Order work. The Engineer's review of the Recovery Schedule will not exceed seven calendar days. Revisions required as a result of the Engineer's review shall be submitted within seven calendar days. When accepted by the Engineer in writing, the Recovery Schedule shall become the Project Schedule. All cost related to performing the work in the Recovery Schedule will not be paid for separately, but shall be included in the work. Failure to provide the required schedule information at the required times will result in denial of the relative portion of progress payments until such time that the schedule information is submitted in the correct format at the sole option of the Engineer.

Section 1 – General

-2-
REVISION OF SECTION 108
PROJECT SCHEDULE

The following requirements have been defined to create consistency across all project schedules for purpose of analysis.

(1) Dependencies between activities shall be indicated so that it may be established as to the effect the progress of any one activity would have on the Schedule. Dependencies shall make use of Finish-to-Start (FS), Start-to-Start (SS), or Finish-to-Finish logic ties. Use of Start-to-Finish (SF) logic ties shall not be allowed without written justification and Acceptance prior to implementation. Leads or lags will not be used when the creation of an activity will perform the same function (e.g., concrete cure time). Dependencies shall not make use of negative lags. The use of any lead or lag shall require a written explanation by the Contractor in a narrative.

(2) All activities, except Notice-to-Proceed and Final Completion, are required to have at least one predecessor and one successor.

(3) Date and time constraints, other than those required by the contract, will not be allowed unless accepted by the Engineer.

(4) Calendar day shall demonstrate conformance to Section 108.08 of Standard and Specifications for Road and Bridge Construction.

(5) The schedule should be broken down into logical areas of work.

(6) Summary of Activities

i. The Contractor shall include special activities that are a Summary of a chain of activities. The start of the activity will be the start date of the first activity in the chain and the finish date will be the finish date of the last activity in the chain.

ii. Included in the Summary area should be a Summary activity designated as Contract Time. The summary activity shall have Notice-to-Proceed as its predecessor, with a SS 0 relationship; and Contractual Completion as its successor, with a FF 0 relationship. The Calendar day schedule shall be used for all Summary activities. The duration of this activity must not exceed the contract time.

iii. The purpose of these Summary activities is to provide monitoring of the contract time and Area progress.

Section 1 – General

-3-
REVISION OF SECTION 108
PROJECT SCHEDULE

(7) Tasks related to the submittal/procurement of material or equipment shall be included as separate activities in the project schedule.

(8) Contractor's original network diagram submittal shall become the Project Schedule, once it is accepted by the Engineer. The Project Schedule shall be duplicated and utilized as the Schedule Update and shown graphically over the Project Schedule.

(9) The following logic relationships will be required in any precedence diagram method used:

i. All logical relationships shall be Finish-to-Start (FS), with the following exceptions:
   - at the start or origin, activities may be start to start (SS)
   - at a milestone or at the conclusion of the network, activities may be Finish-to-Finish (FF)
   - use in Summary activities

ii. Lag factor use should be limited. When used, they should be identified as a functional activity (i.e., concrete curing).

iii. Accepted Schedules shall only contain Contract Required Early Start and/or Early Finish Constraints.

iv. The retained logic mode is required for schedule calculations.

Any deviations / change from these logic specifications require written request to be reviewed for Acceptance from the Engineer prior-to implementation, to prevent manipulations to give false results.

Use of float suppression techniques, such as preferential sequencing (arranging critical path through activities more susceptible to CDOT caused delay):

a. Special lead/lag logic restraints,

b. Zero total or free float constraints,

c. Imposing constraint dates other than as required by the contract, shall be cause for rejection of the Project Schedule or its Updates. The use of Resource Leveling or similar software features used for the purpose of artificially adjusting activity durations to consume float and influence the critical path is expressly prohibited.

Section 1 – General

-4-
REVISION OF SECTION 108
PROJECT SCHEDULE

Definitions of Float (or Slack):

a. Free Float is the length of time the start of an activity can be delayed without delaying the start of a successor activity.

b. Total Float is the length of time along a given network path that the actual start and finish of an activity or activities can be delayed without delaying the project completion date.

c. Project Float is the length of time between the Contractor's Early Completion or Completion and the Contract Completion Date.

d. Project Float is for the benefit of the Project and for the mutual use of the CDOT and the Contractor.

Negative float will not be a basis for requesting time extensions. Any extension of time will be addressed in accordance with the Section 108.08, Determination and Extension of Contract Time. Scheduled completion dates that extend beyond the contract or phase completion dates (evidenced by negative float) may be used in computation for assessment of payment withholdings. The use of this computation is not to be construed as a means of acceleration.

In Subsection 108.03 (c) delete subsection (1)

In Subsection 108.03 (c) (2), delete the first paragraph and replace with the following:

The Project Schedule submittal shall consist of a Time Scaled Logic Diagram Schedule Report. It shall be prepared in full and submitted to the Engineer within 30 calendar days of receiving the Notice to Proceed for Design. The Engineer's review of the Project Schedule will not exceed seven calendar days. Revisions required as a result of the Engineer's review shall be submitted within seven calendar days.

Subsection 108.03 (c) (2) Project Schedule shall include the following:

The schedules shall include all activities required for contract completion. The Project Schedule shall be submitted to the CDOT Project Engineer for Acceptance.

a. Within seven calendar days after receipt of the complete Project Schedule, the Engineer will communicate in writing, its comments and concerns to the Contractor. Within seven calendar days, Contractor shall adjust the Schedule to incorporate comments from the Engineer and re-submit.

Section 1 – General

REVISION OF SECTION 108
PROJECT SCHEDULE

b. Upon Engineer's receipt and Acceptance of revisions to the Project Schedule, it shall become part of the Contract Documents. Payment to the Contractor shall be withheld until such schedule, satisfactory in form and substance to the Engineer, has been Accepted.

Subsection 108.03 (c) (3) Schedule Updates shall include the following:

Updated Schedules shall accompany the monthly Application for Payment, reflecting physical progress since previous month's submittal.

One plotted copy at least 24 inches wide and long enough to show the full Time Scaled Logic Diagram and the following columns: Task ID, Description, Duration, Total Slack, Percent Complete, Early Start and Finish, Late Start and Finish, Actual Start, and Actual Finish dates. In addition one electronic copy containing the Microsoft Project Schedule Update shall be submitted.

The Schedule Update shall show the actual status of all activities, including those in progress, completed, or not started, by the use of Actual start and Actual finish dates. For all Activities that have a Contractor remaining duration equal to zero days, the Activity shall be shown as 100% complete. Any percentage less than 100% shall have a remaining duration in whole 1 day increments. In addition Activities having a remaining duration of zero cannot be claimed as less than 100% complete.

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in the CPM scheduling software system. Actual Start and Actual Finish dates on the CPM schedule shall match the dates of actual work accomplished in the field and not on projected completion dates.

Upon Engineer request, the Contractor shall provide a computer generated report using a recognized schedule comparison software listing ALL changes made between the previous schedule and current updated schedule. The report will identify the name of the previous schedule and name of the current schedule being compared.

The Contractor shall utilize and conform to the current Accepted Project Schedule.

Section 1 – General

REVISION OF SECTION 108
LIMITATIONS OF OPERATIONS

Section 108 of the Standard Specifications is hereby revised for this project as follows:

Subsection 108.05 shall include the following:

The Contractor shall protect existing fences and in under no circumstance shall trespass outside of CDOT ROW, temporary easements and permanent easements. In the event the Contractor causes damage to the existing fences, the Contractor shall immediately replace it in kind, at his own expense.

Section 1 – General

REVISION OF SECTION 108
PROSECUTION AND PROGRESS

Section 108 of the Standard Specifications is hereby revised for this project as follows:

Subsection 108.05 shall include the following:

Contractor will be restricted to conducting all work, except for traffic control set up and tear down, from one hour after sunrise to one hour before sunset, unless otherwise approved in writing by the Engineer.

The Contractor shall cease work on the project and have all personnel and equipment off the roadway by 1:00 P.M. on work days preceding holidays recognized by the State of Colorado, as described in Standard Specification 101.36. For example, this directive applies to Friday, August 29, 2014 for the Labor Day holiday, Wednesday, November 26th for the Thanksgiving Day holiday, and Wednesday, December 24th for the Christmas Day holiday.

Price reductions for failure to comply with this requirement will be as specified in the Standard Special Provision entitled “Revision of Section 105 – Violation of Working Time Limitation”.

All costs incidental to the foregoing requirements shall be included in the Work.

Section 1 – General

REVISION OF SECTION 109
MEASUREMENT AND PAYMENT

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

Subsection 109.02 shall include the following:

The intent of this project is to provide the work in a lump sum (LS) basis for work related to the complete the entire project for both 631-00100 Highway Design & Construction and 631-10002 Bridge Design and Construction. All items necessary for the completion of the work shall not be measured and paid for in the listed pay items for each Basis of Payment section of the Standard Specifications but shall be included in the Lump Sum price to complete either the roadway item or structure item.

Sections of Basis of Payment within the Standard Specifications and Standard Special Provisions will be disregarded.

Section 620 Field Facilities of the Standard Specifications shall not modified by this revision.

Section 1 – General

FORCE ACCOUNT ITEMS

DESCRIPTION

This special provision contains the Department's estimate for force account items included in the Contract. The estimated amounts marked with an asterisk will be added to the total bid to determine the amount of the performance and payment bonds. Force Account work shall be performed as directed by the Engineer.

BASIS OF PAYMENT

Payment will be made in accordance with subsection 109.04. Payment will constitute full compensation for all work necessary to complete the item.

Force account work valued at $5,000 or less, that must be performed by a licensed journeyman in order to comply with federal, state, or local codes, may be paid for after receipt of an itemized statement endorsed by the Contractor.

Force Account Item	Estimated Quantity	Amount
F/A Minor Contract Revisions	F.A.	$ 650,000.00*
F/A Partnering	F.A.	$10,000.00
F/A Fuel Cost Adjustment	F.A.	$60,000.00
F/A Roadway Smoothness Incentive	F.A.	$32,000.00
F/A Asphalt Cement Cost Adjustment	F.A.	$60,000.00
F/A Asphalt Pavement Incentive	F.A.	$70,000.00
F/A On-The-Job Trainee	F.A.	$4,800.00
F/A Dispute Resolution Board	F.A.	$5,000.00
F/A Environmental H&S	F.A.	$50,000.00
F/A Erosion Control	F.A.	$50,000.00

Section 2 – Project Management

Administration

The Contractor has the responsibility for management and performance of the Work. CDOT will perform all Quality Assurance testing and Verification on the project.

Work Breakdown Structure (WBS)

The Contractor shall submit to the CDOT Project Engineer a Project Schedule for Acceptance, including a detailed and organized hierarchical division of the Work Breakdown Structure (WBS) for completing each element of the Work.

The following list represents the minimum levels of the WBS that all cost and schedule information shall roll-up. The schedule shall also address review and response times, procurement (submittals, reviews, approvals, and delivery) and all Safety Critical elements. Further detail may be provided by the Contractor to ensure a clear understanding of the Contract. The Contractor shall submit its Project Schedule broken down to the WBS activities and proposed Work segments within 30 calendar days of receiving the Notice to Proceed for Design.

The Accepted WBS shall be the basis for organizing all Work under the Contract, and shall be used to structure the Project Schedule, and other cost control systems.

The WBS Breakdown of Design and Construction Components shall include:

- US 6 over Garrison Street
    - Design
        - Highway and Road Approaches
        - Bridge
        - Retaining Walls
        - Drainage
        - Wall
    - Construction
        - Highway
            - Highway and Road approaches
            - Drainage
            - Earthwork
            - Guardrail
            - Fencing
            - Signing and Striping
            - Traffic Control
            - Detours
            - Water Quality/Environmental Management
            - Public Information

Section 2 – Project Management

        - Bridge Removals
        - Elements which require conformance to Safety Critical Elements of Work
    - Retaining Walls
        - Removals
        - Elements which require conformance to Safety Critical Elements of Work
- Mobilization
- Field Facilities

Work Activities

The WBS breakdown shall include at a minimum the components listed above and shall be broken down into further subcomponents in order to accurately track production on the project. The Project Engineer shall have the discretion to request further breakdown of the WBS into the "level of detail" deemed fit. Monthly payment to the Contractor shall be based on the percent completed of each of the WBS work activities, as a percentage of the Contract Lump Sum.

The Contractor shall prepare and submit to the CDOT Project Engineer the following schedules:

- Method Statements
- Project Critical Path Method (CPM) Schedule
- CPM Schedule Updates
- Job Progress Narrative Report

Each of the CPM schedules shall be cost loaded for the WBS indicated above.

Allocation of Contract Price

Contractor shall allocate the lump sum Contract Price among the WBS such that each structure activity including design, construction, and related work has a price allocation that accurately indicates the cost of each activity. The Contractor's allocation of the lump sum Contract Price shall be Approved by the CDOT Project Engineer. Each of the activities shall be allocated a cost and a physical unit that will allow objective determination of activity completion. The cost of Water Quality / Environmental Management, and Public Information shall be paid by straight line calculation through the life of the project. The cost of Public Information shall not exceed $23,000. The cost of Mobilization shall not exceed 7 percent of the lump sum Contract. Field Facilities shall only include the cost of obtaining and maintaining the Field Facilities and not exceed 0.8 percent of the lump sum.

Section 2 – Project Management

Requests for unbalanced costs will be rejected if the Department determines that any of the allocated costs are materially unbalanced to the potential detriment of the Department. Unbalanced costs are defined in subsection 102.07 of the Standard Specifications for Road and Bridge Construction.

Methods Statement

A Methods Statement shall be prepared for each of the level four work activity listed in the schedule, for any critical path items in the schedule, for all safety critical elements, and for any feature not listed in the schedule that the Contractor considers a controlling factor for timely completion. The Methods Statement shall be completed in accordance with subsection 108.03 of the Standard Specifications for Road and Bridge Construction.

Cost Management

Progress Payment Calculations

CDOT will base progress payments on the percent completed of each of the WBS work activities and not on measured quantities. The Contractor shall progress the activities identified on the Project Schedule for determining the Monthly Progress Schedule. The accepted Monthly Progress Schedule will determine the amount of the Contractor's progress payments, based on the work activities identified by the Contractor. Percent complete shall be calculated using project scheduling software meeting the requirements of this section, where progress is measured based on physical percent of work that is complete considering labor, materials equipment resources utilized, design hours, or other physical units acceptable to the CDOT Project Engineer. Such progress payments to the Contractor shall be computed accurately from the updates of the WBS schedule.

Partial payment for stockpiled materials shall only be made per subsection 109.07 of the Standard Specifications for Road and Bridge Construction. Payment shall not be made for stockpiled materials to be installed within 90 days.

The Contractor's invoice shall not include a request for payment for documented nonconforming work. The payment to the Contractor will be the amount shown on the Contractor's approved invoice as modified for appropriate price reductions for nonconforming work, if any, retainage, incentive/disincentive payments, and any deductions.

Payment Schedule

The Contractor shall provide an additional payment schedule in accordance with Standard Special Provision Revision of Section 108 and 109 Payment Schedule (Multiple Year Construction).

Section 2 – Project Management

Invoice Submittals

The Contractor shall submit invoices to the CDOT Project Engineer each month. Each monthly invoice shall first be submitted in draft form for review in a Progress Status Meeting on a date mutually agreeable to the Contractor and CDOT Project Engineer. Draft monthly invoice submittals shall be transmitted with at least one paper copy and an electronic format.

The Contractor shall submit to the CDOT Project Engineer, for Approval, a final monthly invoice within five calendar days after each progress status meeting, defined below. Final invoice submittals shall include one paper copy and one electronic copy.

Invoice Documents

Invoice Content

The invoice documents shall include:

1. Invoice Cover Sheet

   The cover sheet shall indicate the following information:

   A. Project number and title

   B. Invoice number (numbered consecutively starting with “1”)

   C. Period covered by the invoice (specific calendar dates)

   D. Total earned to date for the Project as a whole and for each Work activity as a percentage of the total dollars expended to the total amount of the item. The breakdown is required because retainage will be calculated and withheld on each work item, and partially released upon achievement of item completion of each Work item. Provide percentages to three (3) decimal places.

   E. Date that invoice was signed

2. Updated Monthly Progress Schedule

   No invoice shall be Approved nor payment shall be made if there is not a current Accepted Monthly Progress Schedule in place. The status date of the Monthly Progress Schedule, coinciding with the payment invoice date, is the last date of each month. The data date for use in calculating the monthly progress schedule shall be the first Calendar Day of the following month.

   The Contractor shall make all corrections to the Monthly Progress Schedule requested by the CDOT Project Engineer and resubmit the Monthly Progress Schedule within seven calendar days. If the Contractor does not agree with the CDOT Project Engineer’s comments, the Contractor shall provide written notice of disagreement within

Section 2 – Project Management

seven calendar days from the receipt of the comments. If necessary, the items in disagreement shall be resolved in a meeting held for that purpose.

No invoice will be reviewed or processed until all invoice documents are received by the CDOT Project Engineer.

Progress Status Meetings

A progress status meeting shall be conducted each time a draft monthly invoice submittal is made. The meeting shall be used to verify, address and finalize the following:

1. Actual start dates
2. Actual and Planned Completion Deadlines
3. Earned value of Work that has been accepted in-place
4. Activity percent complete
5. Incorporation of approved Change Orders
6. Status of outstanding Nonconforming Work
7. Completion of Value Engineering Change Proposals, if any
8. Work performance
9. Project Schedule narrative that discusses all changes from previous month
10. Critical Path(s)

Following the progress status meeting, and upon approval of the final monthly invoice, payment shall be Approved by the Project Engineer within seven calendar Days.

WBS Activities and Schedule Modifications

When it becomes necessary to add, combine, eliminate, or modify Contract specified WBS Activities to reflect modifications to the Work, such changes shall be reviewed and Accepted by the CDOT Project Engineer in accordance with the Contract and shall be consequently reflected in subsequent schedule submittals.

Field Facilities

The Contractor shall provide all office space and equipment as required for the Project.

The Contractor shall make available a fully operational Field Office and Field Materials Lab facilities three calendar days prior to beginning any Construction Activities. CDOT shall return possession of each to the Contractor no later than 20 calendar days after Final Acceptance of the Project.

Section 2 – Project Management

The Contractor shall secure sites, obtain all site permits, install, set up, and provide utility services, and maintain the facilities as part of the Work. The Contractor may consult with the CDOT Project Engineer for the availability of suitable local sites. The Field Materials Lab shall be placed adjacent to the Contractor's Quality Control lab. These facilities, including the Field Office, shall be located within 1 mile of the project location.

If office appurtenant facilities are stolen, destroyed, or damaged during the Work, except by fault of CDOT, the Contractor shall at, its expense, repair or replace those items provided to their original condition within three calendar days. If loss or damage is caused by CDOT personnel, the Contractor shall replace the facilities within 3 calendar days, but CDOT shall be responsible for costs incurred.

The Contractor shall provide:

1 – Field Office Class 2
1 – Field Laboratory Class 2
1 – Sanitary Facility for CDOT staff use

All field facilities shall conform to CDOT Standard Specifications and Standard Plans in effect at the time of bidding. In addition to the Standard Plans and Specifications the Field Office and Laboratory shall include the following:

1. High Speed Internet: The type of high speed connection shall preferably be of DSL type. The throughput shall be a minimum of 1.5Mbps download/896 Kbps upload speed. IP addressing shall be DHCP. If DSL is not available, Cable or w/DSL (Wireless DSL) may suffice if above specified throughput speeds are achieved. Note that satellite type broadband will NOT work for CDOT purposes.

2. Field Office and Field Laboratory shall be provided with all-weather access with adequate area to accommodate at least six state vehicles.

3. The Contractor shall provide insurance for full replacement of all contents of the Field Office and Field Laboratory due to theft, fire or any other cause. Insurance shall be provided at all times that the office or laboratory is on the Project.

Section 2 – Project Management

Deliverables

The Contractor shall submit the following to the CDOT Project Engineer.

Deliverable	Acceptance or Approval	Schedule
Project CPM Schedule	Acceptance	30 days after Notice to Proceed for Design
Method Statements	Acceptance	20 days Prior to Construction
Schedule Updates including Job Progress Narrative	Acceptance	Monthly
Invoice Documents	Approval	Monthly

Section 3 – Quality Management

Administrative Requirements

The Contractor shall be responsible to develop, document, establish, and implement a Quality Control Document (QCD) for the project. Before any Release for Construction Documents (RFC) are issued, and within fifteen (15) Days following Notice to Proceed for Design, the Contractor shall submit the QCD to CDOT for Approval. The Contractor shall implement the Approved QCD prior to performing any Project activities. Any CDOT directed revisions to the QCD prior to Approval shall be made within three (3) Days.

Quality Control Document Requirements

The Contractor shall develop a Quality Control Document (QCD) to illustrate the Contractor's quality process and provide any supplemental descriptions needed to clarify the Contractor's quality process. This shall include the Contractor's approach to: Design Quality Control, Design Quality Assurance, Construction Quality Control, the interface with Construction Quality Assurance, the interface to resolve Design issues and changes, show the lines of authority, and effective team communications. The QCD shall illustrate the process for meeting all requirements of the Contract Documents. The Design Quality Manager shall instruct the Contractor, CDOT and Outside Agency personnel in the quality processes outlined in the QCD at the pre-construction conference so all parties can collaborate and understand roles and responsibilities effectively. The QCD should not exceed 15 pages.

At a minimum the QCD shall address the following:

1. The Contractor's Organization Chart including the Design Consultant.
   The Contractor's Organization Chart shall illustrate: lines of authority, lines of communication, interface positions with CDOT and Outside Agencies.

2. Process Diagrams for:
   - Design
     - Quality Control
     - Quality Assurance
     - Design Review
     - Released for Construction Documents
       - Roadway Plans
       - Structure Plans
       - Traffic Control Plans (TCP)
       - Storm Water Management Plans (SWMP)
     - Final Design Documents
     - As Built Documents
   - Construction
     - Quality Control

Section 3 – Quality Management

- Product Data Control
- Quality Assurance Interface
- Design Interface
  - Request For Information (RFI)
  - Field Design Changes (FDC)
  - Methods of Handling Traffic (MHT)
  - Public Information (PI)
  - Completion Punch List Resolution

The Contractor's Process Diagrams shall illustrate the processes with a flow chart style depiction, and should minimize the written descriptions as much as possible.

As changes are made to the Contractor's Organization chart or Process Diagrams; updates shall be provided within five (5) Days.

Design Quality Control

The Quality Control Document (QCD) shall illustrate the process necessary for the Contractor to control the quality of their Design process in order to produce products that meet the requirements of the Contract Documents. The Contractor shall develop, and share with CDOT, their design review schedule to ensure quality control of the Design process.

Design Quality Assurance

In the QCD the Contractor shall illustrate the process to certify the Work as compliant with the requirements of the Contract Documents. The Contractor shall collaborate with CDOT during the Design process to ensure the appropriate product is produced and requirements are met. During Construction the Design Quality Manager (DQM) shall ensure that Release for Construction (RFC), Traffic Control Plans (TCP), Method of Handling Traffic (MHT), Request for Information (RFI), Storm Water Management Plans (SWMP), and Public Information (PI) release documents are compliant with the requirements of the Contract Documents.

The QCD shall include the process to address applicable elements of design including, civil, structural, geotechnical, survey, hydraulic, environmental, traffic, safety, public information, and temporary work. The Contractor shall identify in the QCD all applicable computer programs to develop and check designs. The QCD shall illustrate the design effort, including design reviews, constructability reviews, design meetings, independent design checks, and a basic schedule for Release for Construction Documents and Final Design Documents.

The Contractor shall identify in the QCD design input requirements. The Contractor shall illustrate how changes to design inputs are identified, reviewed, and approved by authorized personnel prior to their implementation.

The Design Process Diagram shall also include:

Section 3 – Quality Management

1. Process to control and independently ensure that the design meets the requirements of the Contract Documents, including provisions for Subconsultant's designs and configuration management Activities.Process for approval of Released for Construction Documents and revision control.
2. Process to identify and track Design Document deliverables.
3. Process to identify, record, and track Field Design Changes (FDC), and Request for Information (RFI) responses.

Design Quality Program

The Contractor's design quality program shall include:

1. Design Progress Meetings: The Contractor shall conduct meetings to coordinate the design development within the Contractor's organizations, CDOT, the City of Lakewood and other affected agencies. As a minimum, the Contractor shall prepare an agenda and conduct each meeting to discuss the status of the design, coordinate the design development between design disciplines, discuss constructability issues, and identify any questions associated with design requirements. The Contractor shall take meeting minutes and provide meeting minutes to CDOT's Project Engineer within four (4) Working Days after the meeting. These meetings shall a minimum of be bi-weekly or as requested by CDOT.

2. Released for Construction (RFC) Documents: Released for Construction Documents allow the Contractor to initiate construction in advance of Acceptance of the Final Design Documents by CDOT. The RFC Documents shall include all plans, quantities, method statements, and schedule required to complete a given portion of Work. The schedule shall include: submittal date, planned construction start date, inspection hold points, and planned duration. Failure to provide RFC Documents that comply with the Contract in a timely manner shall be cause for the Contractor not being permitted to work on that portion of the project until a proper submittal is made. All schedule delays due to incomplete RFC Documents shall be the responsibility of the Contractor. The Contractor's Design Quality Manager shall approve RFC Documents prior to submittal to CDOT. Each RFC Documents submittal shall be submitted to the CDOT Project Engineer a minimum of two (2) weeks before planned construction. Written Acceptance of the quantities and schedule must be received from CDOT before the Work begins on that portion of the RFC. The Contractor shall include in the QCD a process for the Engineer responsible for the design to prepare, review, approve, and seal (if required) all changes, including Field Design Changes (FDC), and Request for Information (RFI) responses. FDC and RFI responses must meet the requirements of RFC documents, except the submittal timeline will be as soon as possible.

Section 3 – Quality Management

3. Final Design Documents: The Contractor shall submit Final Design Documents to CDOT's Project Engineer for Acceptance. CDOT will not Accept the Final Design Documents until the Contractor has completed all design and has addressed, resolved, and incorporated, to the satisfaction of CDOT, any prior Contractor, CDOT, or Outside Agency Acceptance Review comments. The Design Quality Manager shall ensure and provide documentation to CDOT that all review comments have been addressed.

4. Final Design Record Drawings: The final record set of drawings shall include the original Released for Construction drawings and incorporate all Field Design Changes. Each drawing shall be stamped by the Engineer of Record as responsible for the specific design element represented on said drawing.

5. As-Built Documents: As-Built Documents shall meet the requirements listed in these technical requirements. As-Built Documents shall be maintained and completed by the Contractor with final drawings updated in the electronic format of CDOT's latest CADD configuration and submitted to CDOT for Acceptance. CDOT may audit As-Built Documents to ensure completeness and compliance with the requirements of the Contract Documents.

The Contractor shall maintain a master list of approved design changes. The QCD shall include a process to communicate design changes to the construction site on a timely basis consistent with the progress of construction Activities.

Design Deliverables

The Contractor shall submit to CDOT all Structure Concept Plans, Release for Construction Documents, Final Design Documents, Final Design Record Drawings and As-Built Documents.

The Contractor shall identify on its Contract Schedules when the design deliverables identified above will be submitted to CDOT. The Contractor shall provide two 11 by 17 inch hard copies and one set of electronic files on CD-ROM of the design deliverables to CDOT. As-Built Documents shall show all field installed changes from the Final Design Documents. All changes shall be noted using CADD. Hand-drawn changes will not be Accepted.

The design deliverables shall be delivered to CDOT indexed and clearly marked to indicate the date of issue and stage of development (e.g., Released for Construction, Submittal). The Final Design Documents submittal is required to facilitate CDOT's review and Acceptance of the design while the Contractor still has significant design resources on the Project.

The form of all design deliverables shall include a title block, consistent with standard project drawing format, with the following information included as a minimum:

1. Date of issuance and including all prior revision dates.

2. Contract title and number.

Section 3 – Quality Management

3. The names of the Contractor, Subconsultants, Subcontractors, Suppliers, and manufacturers as applicable.

4. Subject identification by Contractor drawing or Contract reference.

All design deliverables shall be sealed by the Engineer consistent with applicable Legal Requirements. All design deliverables shall include a sufficient blank space, in the lower right corner, just above the title block on the drawings, and in the lower right corner of the title page of specifications and calculations, in which the Contractor's Engineer may indicate the action taken, indicating their review and approval.

If a design deliverable requires review approval from an Outside Agency or permitting authority, the Contractor shall gain written concurrence prior to submitting the design deliverable to CDOT. See Section 6 for requirements for third party agreements.

When calculations accompany drawings in a submittal, the body of the calculations shall contain cross-references to the individual drawing to which the pages of the calculations pertain. Calculations required shall demonstrate conformance with the requirements of the Contract Documents.

The CADD drawings and associated documents shall be organized in a logical manner, have a uniform and consistent appearance, and clearly depict the intent of the design and construction, in addition:

A. All electronic drawings and Roadway modeling for the Project shall be developed in MicroStation/InRoads using CDOT's latest configuration

B. All design deliverables shall be in English units. The Project coordinate system shall comply with the CDOT Survey Manual.

C. The Final Design Documents and As-Built Documents shall be compiled in sequential order. All drawings/plan sets be produced using CDOT's CADD standards. The Final Design Documents and As-Built Documents submittal shall include, as a minimum:

(1) All design plans.

(2) Design and design check calculations.

(3) Design reports.

(4) Specifications.

(5) Quantities.

a. Estimated Quantities for Final Design Documents
b. Actual Quantities for As-Built Documents

Section 3 – Quality Management

(6) Shop Drawings, design, and design check calculations

(7) Electronic CADD files as specified elsewhere in the Contract Documents.

D. The Utility As-Built Documents for Utility work shall be submitted to the Utility Owner for Utility Work constructed by the Contractor, within 90 Days after the Utility Owner has accepted the Utility Work. These electronic deliverables shall conform to those requirements set forth in the Contract for CADD requirements, except as modified by the specific requirements of the individual Utility Owners. The Utility As-Built Documents shall show locations of existing Utilities, structures, trees, streets, and existing highway right-of-way limits. Additionally, the Utility Owner when performing its own construction will provide the Contractor, Utility as-built drawings for their Utility Work showing the foregoing information and with one 11 by 17 inch hard copy and one set of electronic files on CD-Rom to CDOT.

All drawings/plan sets be produced using CDOT's CADD standards. CADD files shall be in accordance with the current CDOT configuration and workspace. All CADD Files shall be documented in a tabular format describing the path, file name, and description. All As-Built Documents electronic files shall be submitted in *.dgn, *.dtm and *.pdf format.

Document and Data Approval

The Design Quality Manager shall ensure that all deliverables include a signed and dated certification by the originator of the deliverables, that the deliverable is complete, and meets the requirements of the Contract Documents.

Document and Data Changes

The Design Quality Manager shall ensure that any changes to deliverables provided to CDOT as revised are in a format that can enable changes to be readily apparent and trackable (e.g., documents use the redline/strikeout method).

Construction Quality Control

The Quality Control Document (QCD) shall illustrate the process necessary for the Contractor to control the quality of their Construction process in order to produce Work that meets the requirements of the Contract Documents. The Contractor shall be responsible for and shall perform all Materials Quality Control Testing in accordance with their QCD and the requirements of the CDOT Field Materials Manual in effect at the time of advertisement.

Quality Personnel

The Contractor shall designate a Design Quality Manager (DQM), who shall review and approve all design submittals required by CDOT before such submittal. The Design Quality Manager shall be a Professional Engineer Registered in the State of Colorado.

Section 3 – Quality Management

The Design Quality Manager shall have responsibility for the success of the Contractor's quality program, and shall ensure that authority and responsibilities are defined in the QCD and communicated within their organization.

Field changes to any Contractor designed roadway, bridge, wall, or structural detail shall be stamped by the Contractor's Engineer, and also stamped "Release for Construction" by the Contractor's DQM and submitted to the CDOT Project Engineer 3 days prior to the construction of that portion of the Work may commence. These stamped drawings incorporating field changes shall be included in the Final Design Record Drawings. The Contractor shall develop and document procedures, instructions, and process controls to ensure the Work being produced by the Contractor meets the requirements of the Contract Documents.

All construction Quality Control testing personnel performing construction materials testing shall be qualified in accordance with Section CP-10 of the CDOT Field Materials Manual.

The Contractor shall ensure that personnel performing Work shall have the education, training, skills, experience, and certifications to meet the requirements of the Contract Documents. The Contractor shall maintain appropriate personnel records and have them available for examination by CDOT upon request.

Construction Quality Assurance

The Contractor shall be responsible for all quality control testing. CDOT will provide the quality assurance testing and inspections on the Project. All payments for items accepted on the Project shall be based on current CDOT testing and inspection procedures. Minimum sampling and testing frequencies of the product will be based on the CDOT Field Materials Manual and any Project Special Provisions in effect at the time of project advertisement.

The Contractor shall ensure the compatibility of design, construction, installation, traffic management, and public information with CDOT's inspection and testing procedures.

Materials accepted on the basis of a Certificate of Compliance (COC) may be sampled, inspected, and tested by CDOT at any time.

The Contractor shall collaborate with CDOT during the Construction process to ensure that the appropriate Work is produced and requirements are met.

CDOT Independent Assurance Testing (IAT)

CDOT will perform Independent Assurance Tests to ensure that:

1. CDOT Quality Assurance personnel and Contractor Quality Control personnel are trained, certified and demonstrate they understand the test procedures they are performing and;

Section 3 – Quality Management

2. The test equipment used by the Quality Assurance personnel and Contractor Quality Control personnel is calibrated and;

3. Split sample test results correlate.

IAT results may also be used as referee tests to assess statistically significant differences, determined by CDOT in its sole discretion, between Contractor Quality Control tests and CDOT Quality Assurance test results.

Outside Agency Inspections

Outside Agencies such as FHWA or City of Lakewood shall have the right to inspect the Work, provided that the Outside Agency has jurisdiction over the Work and as required by Applicable Law.

Deliverables

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

Deliverable	Acceptance or Approval	Schedule
Quality Control Document	Approval	15 Days following NTP
Quality Control Document Updates	Approval	Within 5 Days of change
Design Progress Meeting Minutes	Acceptance	4 Working Days after Meeting
Other Meeting Minutes (as defined in QCD)	Acceptance	4 Working Days after Meeting
Released for Construction Documents (schedule and quantities portions)	Acceptance	Two Weeks prior to Work
Final Design Documents	Acceptance	As defined in Contract Schedules
Final Design Record Drawings	Acceptance	As defined in Contract Schedules
As-Built Documents	Acceptance	As defined in Contract Schedules
Utility As-Built Documents	Acceptance	Within 90 Days after Work Completion

Section 4 – Public Information

Public Information Plan

The Contractor shall prepare and maintain a Public Information Plan (PIP) to address the construction impacts of the project to the public and stakeholders. These impacts can be related to, but not limited to, lane closures, detours, durations of impacts, access, construction noise, overall progress, bridge construction, or anything the Contractor and/or CDOT believe important. This plan shall be used throughout the project by the Contractor to manage, document, and implement all aspects of the public information process.

At the preconstruction conference the Contractor shall introduce the Public Information Manager (PIM) for the project and present a public information plan and strategies or methods for communicating project activities. The Contractor shall prepare and submit a preliminary list of stakeholder groups and specific stakeholders that need to receive ongoing communication about the project.

The Contractor's PIM may be the Contractor Project Superintendent if approved by the CDOT Project Engineer after consulting with the Region Public Relations Manager, or it may be another approved project staff person. The PIM shall have good verbal and written communications skills. The identity of the PIM and the PIM's qualifications shall be submitted to the CDOT Project Engineer five days in advance of the preconstruction conference.

The PIM shall be available every calendar day, accessible and on call by cell phone or pager at all times and available upon the request of the CDOT Project Engineer at other than normal working hours. The PIM shall communicate with the CDOT Project Engineer daily.

The Contractor shall establish a Public Information Office (PIO) equipped with a telephone and an answering machine or answering device with the capability to record a message from the caller. This may be a cell phone, but must be a local number. The PIO shall be equipped with a computer and an e-mail account. The PIO may or may not be located within the Contractor's regular office provided that the telephone has a local call number. The PIM shall record a friendly greeting on the project's published phone line each week, updating the message throughout the week, as necessary, depending on changes in work schedule, activities and traffic impacts. The recording shall include each week's forthcoming activities including work days, hours and expected traffic delays, posted detours, project completion date, and office hours. The PIM shall check the answering machine at least twice every calendar day in the early morning and mid-afternoon, including weekends. The PIM shall respond to callers and e-mail inquiries as soon as possible, but at least within 24 hours. The PIM shall keep a logbook of all calls including the contact name, date of contact, date responded, the contact's comments, and the action the PIM took. A copy of this log shall be submitted to the Engineer every two weeks or more frequently, as requested by the Engineer.

Section 4 – Public Information

The PIM shall maintain communications with businesses and individual residences, commuters, local government entities and all other stakeholders that are directly adjacent to and affected by the project. Using a communications method or strategy approved by the CDOT Project Engineer, the Contractor shall notify stakeholders about the project two weeks prior to beginning any lane restrictions or project activities. Depending upon project impacts, contact with stakeholders may be required daily, weekly, monthly or periodically throughout the duration of the project. Communications tools may include hand flyers, door hangers, newsletters, mailers, using e-mail distribution lists, etc. All public information correspondence and subsequent updates shall be supplied to the CDOT Project Engineer 48 hours before distribution.

Stakeholders

The Contractor shall communicate and coordinate with the stakeholders listed below.

1. Jefferson County
2. City of Lakewood
3. Emergency response agencies, such as the Colorado State Highway Patrol, Police Departments, AMR (ambulance), Fire Departments, Hospitals, etc.
4. Commercial vehicle operators, Colorado Motor Carriers Association
5. CDOT Traffic Operation Center
6. School Districts
7. Area Residents, local businesses, and local Homeowner and Property Owner groups within a half mile radius of the project.
8. US 6 Commuters
9. Utility Owners
10. CDOT

Each communication tool shall include contact information, PIM's name, office phone, CDOT Web-site address http://www.coloradodot.info/projects/us6overgarrison with CDOT logo. Cell phone numbers and e-mail addresses shall be provided where service is available. The communication shall include the description of work, lane restrictions, a detour map if warranted, the anticipated start and completion dates, hours of operation and work schedule, and a Slow for the Cone Zone message.

The Contractor shall erect construction traffic signs with the dates the Contractor expects to initiate and complete construction and with the Contractor's public information office's or PIM's phone number at each major approach to the project. The signs shall conform to the requirements of Section 630 and shall be erected at least one week prior to the beginning of construction.

Section 4 – Public Information

An individual project Web-site has been developed and will be hosted on CDOT's web site using the CDOT template. The Contractor shall coordinate with the Region Public Relations Manager to update the website in accordance with the CDOT standard template. The site will be revised as directed by the CDOT Project Engineer. The Contractor shall provide updates to the CDOT Project Engineer for acceptance and addition to the website.

Public Information Services Contact Sheet

Owners:

Colorado Department of Transportation Resident Engineer
Name: Kevin Brown, P.E.
Address: 425B Corporate Circle, Golden, CO 80401
Phone: (720) 497-6954 Fax: (720) 497-6951 Cell: (303) 883-3524
Email: kevin.brown@state.co.us

Colorado Department of Transportation, Region Public Relations Manager
Name: Crystal Morgan
Address: 4201 E. Arkansas Ave., Denver, CO 80222
Phone: (303) 757-9288
Email: crystal.morgan@state.co.us

Colorado Department of Transportation, Colorado Traffic Management Center
425-C Corporate Circle, Golden, CO 80401
Phone: (303) 512-5830 Fax: (303) 274-9394

Emergency Information Dissemination – Telephone List

The Contractor shall establish and manage an emergency response contact list. All appropriate personnel shall be included on this list for immediate response in the event of an emergency. The list shall be divided into areas of expertise so the proper people are called for specific emergency situations. CDOT Project Engineer, CDOT public information staff, and the Contractor's Project Manager shall be included on the list for notification of any emergency that may arise. The Contractor shall develop and maintain a contact list of emergency service providers as part of this list. Contractor shall submit the emergency response telephone list to the CDOT Project Engineer for Acceptance prior to beginning any construction activities and when any changes are made to the list.

Section 4 – Public Information

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

Deliverable	Acceptance or Approval	Schedule
PIP Plan	Acceptance	Prior to Construction and maintain as needed
Communication Tools	Approval	One week before distribution to public
Communication log	Acceptance	Maintain as needed
Telephone list	Acceptance	Maintain as needed
Website Updates	Acceptance	Maintain as needed
Emergency Response Contact List	Acceptance	Prior to Construction and maintain as needed

Section 5 – Environmental

Environmental Requirements

The Contractor shall comply with all environmental laws, regulations, approvals, and conditions required for the project, whether obtained by CDOT or by the Contractor. Actions listed within each environmental resource below are clarifications of, and additions to: CDOT Standard Specifications for Road and Bridge Construction, dated 2011; CDOT Project Special Revisions developed; and Standard Special Revisions.

The Contractor shall prepare an Environmental Compliance Work Plan (ECWP) for the Project, specifically identifying all of the environmental compliance requirements for the Project and the Contractor's approach for complying with the requirements. The ECWP shall include a table to track milestones including Contractor and CDOT roles, due dates, and completion dates. The ECWP shall be submitted to CDOT for Acceptance within 60 Days after Notice to Proceed for Design and prior to any construction activities.

The Contractor shall provide an Environmental Compliance Manager. It is acceptable for the Environmental Compliance Manager to serve as the Transportation Erosion Control Supervisor (TECS) if the Manager has been trained by CDOT and earned the new TECS certification. The compliance manager shall lead an environmental review meeting with CDOT environmental staff to discuss environmental issues every two weeks for the first 60 days following Notice to Proceed for Design, and at least monthly thereafter. The compliance manager shall have the authority to stop construction if Work activities jeopardize environmental laws, policy, or human health and safety. The ECWP tracking table and documentation of any pertinent events or discussions that occur during the environmental field reviews (including, but not limited to, meeting minutes of environmental review meetings) will be submitted to CDOT for Acceptance every quarter prior to Approval of progress payment. Please note, all items described in this section will not be paid for separately but will be included in the Work, unless noted otherwise.

Environmental Resources Requirements

Air Quality/Fugitive Dust

The Contractor shall ensure that all CDPHE-APCD air quality related approvals are in place prior to beginning demolition and/or construction work on the bridge. The contractor shall coordinate directly with the regulatory agencies issuing these approvals to obtain an Air Pollution Emission Notice (APEN), including a Fugitive Dust Control Plan and construction and demolition permit from the Colorado Department of Public Health and Environment (CDPHE) Air Pollution Control Division (APCD) prior to construction. All resulting air quality mitigation requirements and the costs to implement such mitigation that is a result of demolition or construction activity at the bridge or other areas of this project shall be included in the Work. This includes obtaining permits and approvals prior to the Work as well as the costs associated with ensuring compliance of these permits.

Section 5 – Environmental

The Contractor shall implement procedures for reducing and managing dust control which shall include BMPs consistent with the Fugitive Dust Control Plan, including but not limited to:

- Use of wind barriers and/or wind screens to minimize the spread of dust where large amounts of Material are stored
- Use of a wheel wash station and/or large diameter cobble apron at egress/ingress areas to minimize dirt being tracked onto public streets
- Use of water systems for street cleaning equipment capable of diminishing dust during sweeping operations on public streets
- Covering of all trucks hauling dirt/sand or other loose material leaving or being brought onto the Site
- Watering or cover of excavated materials or other materials which remain on the Site and have the potential to become airborne to levels which create a non-compliance condition with any permits or fugitive dust control plans.
- Use of engine pre-heater devices during wintertime construction

All non-road equipment shall use ultra-low sulfur diesel fuel. The Contractor shall minimize excessive idling of inactive equipment or vehicles. If construction equipment is creating excessive air quality emissions that have a potential to affect air quality for operators or persons working/living in the area, equipment shall be taken out of operation until fixed or replaced. The Contractor shall also locate any stationary emissions equipment that may be used in a manner that considers public health and environment.

Noise

CDOT reviewed the based configuration design for this project and determined that none of the design changes for this work would trigger a TYPE I noise action as defined in the current version of CDOT's Noise Analysis and Abatement Guidelines 2012. If any changes to the contractors design result in changes that trigger a TYPE I noise analysis to be completed, the analysis along with any new mitigation required under the TYPE I category and the costs to implement such mitigation that is a result of a design change, shall be included in the Work and must be approved by CDOT prior to the completion of the project. Any and all requirements of the CDOT Noise Analysis and Abatement Guidelines shall apply to this project through final design and construction for any changes proposed by the contractor.

Existing Barriers

Any existing noise barriers or other structures providing noise reduction benefit such as buildings, earthen berms, etc. and creates a direct line of sight barrier between the roadway and the noise sensitive receptor(s) (that are removed or modified by this project) will be required to undergo an evaluation for replacement barriers. This evaluation shall ensure that equivalent noise reduction benefit is maintained after the project is completed the same as it was benefiting before the project started. It is the responsibility of the contractor to provide documentation that will be approved by CDOT if these conditions are created through design changes in the project.

Section 5 – Environmental

No new lines of sight from a residential property or sensitive land use to traffic shall be created as part of this project without mitigation. These requirements are described within the current CDOT Noise Analysis and Abatement Guidelines.

Construction Noise

The Contractor shall comply with all Local Agency(s) noise ordinances and/or other restrictions applicable to nighttime construction activities for projects within the local municipal coverage areas. Projects falling within unincorporated areas of a County will be governed by County Code. The Contractor shall coordinate with the Local Agency(s) and/or CDOT for all necessary noise exemptions or notices, noise permit variances, and approvals to do night work as required. If Local Agency nighttime noise restrictions do not exist and/or there are no noise sensitive receptors in the project area, the approvals to do nighttime work shall be Approved through the CDOT engineer. Standard noise controls and best management practices for reducing equipment and construction activity noise levels shall be utilized in all cases and will be the responsibility of the contractor to consistently employ when working in noise sensitive areas after 9 p.m.

For this project, the Contractor is required to review and understand all local agency ordinances with project applicable night restrictions. When conditions apply, the contractor shall submit a nighttime noise ordinance memorandum(s) to all jurisdictional local authorities. This memorandum shall request construction noise exemptions for night work operations (at least two weeks prior to the proposed night work start date) where construction work is scheduled between the hours of 9:00 p.m. and 7:00 a.m. The following information should be included in the exemption request submittals and sent to the City/County Engineer:

1. Requesting entity
2. Contact person and phone number
3. Location of the work
4. Reasons night work is being requested
5. Type of activities proposed to occur at night
6. Equipment proposed to be used at night
7. Start and end date propose
8. Total number of nights work is proposed to occur

All nighttime construction activities subject to noise level restrictions cannot begin until the necessary documentation and notifications have been approved by the local agency authority, the CDOT Engineer and/or the Region 1 Noise Specialist. All Work required for complying with the Local Agency requirements including the Work associated with the exemption requests and permitting requirements will not be paid for separately, but will be included in the Work.

Section 5 – Environmental

Migratory Bird Treaty Act

The Contractor shall comply with the Migratory Bird Treaty Act (MBTA) at all times. The Contractor shall schedule clearing and grubbing operations and Work on Structures to avoid taking (pursue, hunt, take, capture or kill, attempt to take, capture, kill or possess) migratory birds protected by the MBTA. Project Special Specification 240 "Protection of Migratory Birds" is included at the end of this section. The Migratory bird nest survey memorandum shall be submitted to CDOT for Review prior to impacting existing structures that may contain active bird nests and prior to completing clearing/grubbing tasks. If an active nest is identified, the Contractor shall notify the Environmental Compliance Manager and CDOT Project Engineer within 24-hours.

Threatened and Endangered Species

No threatened and endangered species are located in the Project limits; therefore, no threatened and endangered species will be impacted.

Prairie Dog Mitigation

At the time of the Categorical Exclusion, prairie dogs were not identified within the Project limits. If prairie dogs will be impacted by the project, the Contractor shall follow the CDOT Impacted Black-Tailed Prairie Dog Policy (January 15, 2009). Delays due to prairie dog activity may result in compensable time extension Contract change order issued by CDOT.

Western Burrowing Owls

Prairie dog burrows were not identified within the Projects limits; therefore, there is no habitat for burrowing owls. If prairie dogs are identified prior to construction activities, a burrowing owl survey shall be completed by the Contractor. This survey shall be conducted in concurrence with the Protection of Migratory Birds field investigation as outlined in Project Special Revision 240. The reporting requirements shall also follow the requirements as set forth in Project Special Revision 240. The survey will be required for any construction activities occurring between March 15th and October 31st.

If burrowing owls are confirmed to be present the Contractor is directed to:

- Monitor the activities of the owls, noting and marking which burrows they are using. When all active burrowing owl burrows have been located and marked, construction activity may proceed within areas greater than 150 feet from the burrows until the owl has moved out, at which time all construction activities may commence.
- Delays due to Burrowing Owl activity may result in a compensable time extension Contract change order issued by CDOT.

Section 5 – Environmental

Wetlands

Wetlands and Waters of the US were not identified within the Project limits; therefore, a Section 404 permit is not required for this project. Should the project impact wetland and Waters of the US, the Contractor shall obtain a Section 404 permit.

SB 40

Senate Bill 40 resources were not identified within the Project limits; therefore, a Senate Bill 40 certification is not required for this project. Should the project impact a Senate Bill 40 resource, the Contractor shall obtain the Senate Bill 40 certification.

Archaeology and Paleontology

A review of the project area for archaeological resources has been completed. There are no known archaeological sites within or near the project areas. Archaeological resource monitoring is not required. However, if any archaeological resources are uncovered during construction the Contractor shall immediately cease work and notify the Environmental Compliance Manager and the CDOT Project Engineer. Steps may need to be taken to document, protect, and/or remove the resources as directed by CDOT. The Contractor shall not resume work within the area until coordination has occurred with the Environmental Compliance Manager and receiving written notification from the CDOT Project Engineer.

Paleontology

Fossils may be uncovered during excavation for the project (refer to the Paleontological Memorandum [US 6 and Garrison Paleontology Memorandum_071514.pdf] in the Reference Documents for further information). CDOT will furnish a paleontologist to monitor project excavations. The Contractor shall notify the Engineer 10 working days prior to the start of excavation operations to allow for scheduling of the monitor. If paleontological resources are uncovered during construction, steps may need to be taken to document, protect, and/or remove the resources as directed by CDOT. The Contractor shall not resume work within the area until coordination has occurred with the Environmental Compliance Manager and receiving written notification from the CDOT Project Engineer. See Revision of Section 107 at the end of this section.

Historic Resources

Historic review and consultation under Section 106 (36 CFR 800) of the National Historic Preservation Act (NHPA) has been completed for the project. Two historic resources were identified within the project Area of Potential Effect (APE): Bridge Structure F-16-ER (5JF4804) and the Meadowlark Hills Historic District (5JF4684). Bridge Structure F-16-ER is *not eligible* to the National Register of Historic Places (NRHP) and its replacement, therefore, results in *no historic properties affected* under Section 106.

Section 5 – Environmental

The Meadowlark Hills Historic District is *eligible* for inclusion on the NRHP, however it was determined that the project will not directly or indirectly effect the defining features of the resource, resulting in a determination of *no historic properties affected* under Section 106. If the project scope, limits, or design features change or if post-review discoveries are uncovered during construction the Region 1 Historian will need to be contacted to update the historic clearance.

Vegetation

Vegetation replacement shall follow Section 17.

Noxious Weeds

The Contractor shall conduct a survey for state and county listed weeds within the project area. If listed weeds are found, they shall be mapped and an Integrated Noxious Weed Management Plan developed to eliminate them from the project site and prevent them from spreading. The Contractor shall be responsible for implementing the plan prior to construction, upon coordination with the Environmental Compliance Manager and Acceptance by the Project Engineer.

Recognized Hazardous Materials

Recognized Hazardous Materials (RHM) are defined as the presence or suspected presence of hazardous substances which may require management and/or disposal. Hazardous substances may exist on the surface or subsurface, in groundwater or surface water, or on structures to be demolished or modified as part of the work; and may be mixed with soil, water, building matrices, and/or other waste materials. Recognized hazardous material research did not identify asbestos containing building materials on the bridge; however, lead-based paint was identified (refer to the Hazardous Materials Documentation [US 6 and Garrison Recognized Hazardous Materials Documentation_073014.pdf] in the Reference Documents for further information). All painted bridge components shall become the property of the Contractor and shall be recycled in accordance with CDOT Specification 250 (subsection 250.04).

Soil and groundwater sampling did not identify any constituents of concern. Depth to groundwater is approximately 10-14 feet below ground surface. Groundwater shall not be directly discharged into a storm sewer, ditch, wetlands or any Water of the State without a permit. See revision of Section 250 at the end of this section.

Bike Lanes

Bike lanes are located on both northbound and southbound lanes of Garrison Street. The Contractor shall coordinate with the City of Lakewood to develop a detour plan for the bike lanes during construction activities. This detour plan shall be approved by the City of Lakewood prior to impacting the bike lanes.

Section 5 – Environmental

NEPA Reevaluation

If the Contractor proposes or creates the need for any environmentally significant project change (scope, design, realignment of project beyond NEPA project study limits, construction technique, acquisition of additional right of way, or schedule, etc.) as defined by each resource's policies, procedures, guidelines or regulatory requirements that results in a potential change to the environmental impact or for need for environmental permitting, the Contractor shall be responsible for completing the additional environmental approvals/permitting.

Environmental Permits

This Work may require several environmental permits from various Federal, State and Local agencies.

Contractor Obtained Permits:

The Contractor shall be responsible for obtaining all governmental and agency permits required for the described Work, not otherwise obtained by CDOT, including but not limited to the following environmental permits:

Permit/Approval	Permitting Agency
Air Pollution Emission Notice	CDPHE, APCD
Nighttime Noise Memorandum (Exemption Request)	City of Lakewood
Construction Dewatering Permit	CDPHE Water Quality Control Division
Colorado Discharge Permit System (CDPS) Stormwater Construction Permit (SCP)	CDPHE, Water Quality Control Division
City of Lakewood Stormwater Permit	City of Lakewood
Fugitive Dust Permit (bridge Demolition)	Colorado Department of Public Health and Environment – Air Pollution Control Division
Demolition Permit (Bridge/Structure Demolition)	Colorado Department of Public Health and Environment – Air Pollution Control Division

The Contractor shall deliver copies of these permits to the Engineer.

Stormwater

The Contractor shall be cognizant of, adhere to, and implement all requirements of the various environmental and stormwater permits that are necessary for construction and operation of the Project. The Contractor shall follow the requirements of the latest CDOT Stormwater Management Plan (SWMP) template and appropriate specifications. The Contractor shall be required to obtain all permits, unless otherwise indicated. The listing herein is not all-inclusive and it shall be the responsibility of the Contractor to determine all of the permits required to perform the Work. Because CDOT is the landowner, CDOT is partially liable for any Contractor negligence.

Section 5 – Environmental

Fines may be incurred upon the Project for permit non-compliance by CDOT or other regulatory agencies. Any non-compliance fines will be passed onto the Contractor. If conflicts exist between requirements of Section 5 and Section 12, the more stringent shall apply.

Colorado Discharge Permit System, Stormwater Construction Permit (CDPS-SCP)

Implementation of the permit requirements (i.e., SWMP, SWMP Site Map, and SPCC Plan) shall be a first construction item. Construction cannot begin until these items have been Accepted by CDOT. CDOT will review the Contractor's stormwater management activities throughout the duration of the Project for verification of compliance with the CDPS-SCP, CDOT's construction section of the MS4 Permit. The Contractor shall comply with CDOT *Standard Specifications,* Sections 101, 107 and 208.

The Contractor shall obtain a CDPS-SCP from the Colorado Department of Public Health and Environment (CDPHE) for construction of the Project prior to Work commencing. The CDPS-SCP shall be in the Contractor's name. The Contractor shall adhere to all requirements of the CDPS-SCP and the Construction Section of CDOT's MS4 Permit. Most, but not all, non-compliance issues and necessary Best Management Practices (BMP) maintenance will be noted during Monthly Inspections by CDOT, Regional Erosion Control Advisory Team (RECAT) inspections, in the 1176 inspection forms by the Transportation Erosion Control Supervisor (TECS), or in the daily stormwater log. The Contractor shall prevent the discharge of any sediment or pollutants into any storm drains or receiving waters during the life of the CDPS-SCP. The Erosion Control Supervisor (ECS) must have a TECS certification from CDOT in order to work on this project.

Storm Water Management Plan (SWMP)

The SWMP work shall include the CDOT SWMP template and a SWMP Site Map that documents the detailed erosion/sediment control BMPs and their locations. The Contractor shall submit a SWMP and SWMP Site Map for Acceptance by CDOT. The Contractor shall submit a SWMP and SWMP Site Map for Acceptance by the Local Agency for work outside CDOT ROW. The Contractor shall fill out the current CDOT SWMP template, including BMP narratives. The SWMP shall clearly describe the relationship between the phases of construction and the implementation and maintenance of the stormwater management controls. Any major modifications (i.e., change modification orders or minor changes revisions) to the CDOT SWMP template shall be submitted to CDOT for Acceptance. The Contractor shall revise the SWMP Site Map as necessary based on actual construction activities throughout the duration of the CDPS-SCP. All BMPs shall be listed on the SWMP Site Map per the requirements of the CDPS-SCP.

All documents pertaining to the CDPS-SCP shall be kept on-site in the CDOT Stormwater Management Plan (SWMP) Notebook (provided by CDOT) to maintain compliance with the SCP. Upon permit inactivation, the SWMP Notebook shall be turned over to CDOT and become the property of CDOT Project files.

Section 5 – Environmental

Best Management Practices (BMPs)

The Contractor shall install and maintain the construction BMPs for the Project in accordance with the CDOT *Erosion Control and Stormwater Quality Guide* and Sections 101, 107, and 208 of the *Standard Specifications*. Construction BMPs for the Project shall include, but are not limited to, those listed in the *Standard Specifications*, as well as, preservation of existing vegetation, surface roughening, tackifier or soil binder, soil retention blankets, temporary clean water diversions, storm drain and basins, protection of trees, hazardous waste and spill containment and saw water disposal, stabilized construction entrances, and pavement sweeping of the affected Project areas. The Contractor shall add a BMP narrative to the SWMP on how it is being used, and shall supply the manufacturer details to be placed in the SWMP Notebook. The Contractor shall have a complete supply of all necessary construction BMP Materials on Site at all times in preparation for construction water quality control emergencies.

Where permanent seeding operations are not feasible because of seasonal constraints (e.g., summer and winter months), the Contractor shall have mulch and mulch tackifier applied to disturbed areas to prevent erosion.

The Contractor shall use erosion control blankets on slopes steeper than 4H:1V, newly seeded slopes to control erosion, and to promote the establishment of vegetation.

Slopes shall be roughened at the end of each day. Concrete washout shall be contained.

Non-structural BMPs include, but are not limited to, litter and debris control, street sweeping, and landscaping and vegetative practices.

Spill Prevention Control and Countermeasures Plan (SPCC Plan)

The Contractor shall prepare a SPCC Plan for Acceptance by CDOT and submitted 21 Days prior to Construction will be in accordance with *Standard Specifications Section 208*. The SPCC shall establish operating procedures for handling pollutants and preventing spills. Pollutant sources include, but are not limited to, exposed and stored soils, paints, solvents, fertilizers or chemicals, vehicle tracking, management of contaminated soils, loading and unloading operations, outdoor storage activities, vehicle/equipment maintenance and fueling, significant dust or particulate generating processes, on-Site waste management practices, concrete truck/equipment washing, dedicated asphalt and concrete batch plants, and non-industrial waste sources that may be significant such as trash and portable toilets.

Drainage

The Contractor shall be responsible for temporary drainage of the Project area during construction of the Project. The Contractor shall keep all existing storm drainage systems used for temporary drainage of the Project in operating condition during construction. Prior to the start of construction, the Contractor shall locate and clean all existing storm drainage systems in accordance with Section 202 of CDOT *Standard Specifications*.

Section 5 – Environmental

Throughout the duration of the permit, the Contractor shall continually protect inlets from sediment and pollutants and, if needed, shall remove any material deposited in the systems as a result of the Contractor's activities. All inlets shall be identified on the SWMP Site Map and shall follow the requirements of Section 208 of CDOT *Standard Specifications*.

Transportation Erosion Control Supervisor

The Contractor shall assign to the Project an employee or subcontractor to serve in the capacity of the Transportation Erosion Control Supervisor (TECS). The TECS shall be a person other than the Superintendent and shall be a person dedicated solely to erosion/sediment control. The TECS shall be experienced in all aspects of construction and have satisfactorily completed a TECS training program authorized by CDOT. Certification that this requirement has been met shall be submitted to CDOT at NTP. A list of authorized TECS training programs will be provided by CDOT upon request by the Contractor.

The Contractor's TECS responsibilities shall follow the duties as laid out in *Standard Specifications,* Section 208, in addition to the following:

1. Direct the removal of sediment, trash, and debris from the construction BMPs and other drainage facilities within the affected areas of the Project.
2. Prepare a written report documenting that BMPs are adequate for the Site conditions of the Project and are in good working condition after inspections requiring documentation. The reports shall be kept with the SWMP inspection documentation and submitted to the CDOT Region Water Quality Manager. The appropriate form for this report will be supplied by CDOT. The inspections shall be made during the progress of the Work, during Work suspensions, and for the duration of the CDPS-SCP. During Project Work stoppages, inspections shall take place at least once every 30 Days, and within 48 hours after each event that causes surface runoff. After construction is complete, inspections shall take place at least once every 30 Days until the permit can be closed.
3. When Work is occurring in a Local Agency's jurisdiction, conduct inspections according to the required intervals of the Local Agency.
4. Implement the necessary actions to reduce anticipated or presently existing water quality or erosion problems resulting from construction Activities. The criteria for this action shall be based on water quality data derived from any inspections and monitoring operations or by any anticipated conditions (e.g., predicted storms) that could lead to unsuitable water quality situations.

Inspections

During the Project, multiple inspections by CDOT and the Contractor and their TECS will be occurring. Inspections shall be on the appropriate CDOT Forms and shall follow the requirements in *Standard Specifications,* Section 208.

Section 5 – Environmental

Prior to work commencing, a pre-construction conference shall be held with the CDOT's Region Water Quality personnel. In addition, when the first phase of BMPs has been installed, the Contractor shall notify CDOT's Region Water Quality personnel to come out and inspect the BMPs for proper installation. Work shall not begin until the BMP installation inspection has occurred. CDOT's Region Water Quality personnel will be inspecting the Site on a monthly basis, as well as during the surprise Regional Erosion Control Assessment Team inspections. The Region Water Quality personnel may inspect the Project at any time and document any non-compliance issues that need to be resolved immediately by the Contractor. Fines may be assessed to the Contractor with the potential of Project shut downs, depending on the severity of the non-compliance. Prior to Final Acceptance of the Project construction, CDOT's Region Water Quality personnel shall be notified to perform a final walkthrough inspection. Any items identified for maintenance, replacement, or removal shall be done immediately or liquidated damages may be incurred upon the Contractor.

Based on the Consent Order, the Project Superintendent or TECS shall perform daily inspections of all BMPs to observe, record, and determine the effectiveness of all BMPs and to order their maintenance if needed. The results of the daily inspections shall be recorded in a daily stormwater log, which will be provided by CDOT. The Contractor shall cooperate with Local Agencies that may perform their own stormwater inspections on this Project.

Colorado Discharge Permit System, Stormwater Construction Permit Closure

The Contractor shall be responsible for all stormwater permit requirements until the Project has achieved final stabilization (see Book 2, Section 17, Landscaping) and the CDPS-SCP permit can be closed. This includes the maintenance of all BMPs, maintenance of all seeded/landscaped areas, and removal of all BMPs once all erosion potential has been eliminated.

Construction Dewatering Permit

Dewatering may be required as a result of caisson construction. If required, the Contractor shall obtain the Construction Dewatering Permit from CDPHE for any dewatering of ground water during construction. The Contractor shall obtain this permit at least 30 days prior to the start of discharge. The Contractor shall assume all responsibilities of the permit. If groundwater contamination is encountered during construction activities, work will stop immediately at that location and the procedures outlined in Specification 250 shall be followed.

Deliverables

At a minimum, the Contractor shall submit the following to CDOT for review, Approval and/or Acceptance as part of this Work:

Section 5 – Environmental

Deliverable	Acceptance or Approval	Schedule
Environmental Compliance Work Plan	Acceptance	Within 60 Days of NTP-Design
Environmental Compliance Work Plan Updates	Acceptance	Quarterly
Fugitive Dust Permit	Acceptance	Prior to Construction
Nighttime Noise Memorandum (Exemption Request)	Approval	Prior to Construction
Integrated Noxious Weed Management Plan	Acceptance	Prior to Construction
Stormwater Management Plan (SWMP) and Site Map	Acceptance	Prior to Construction
Stormwater Management Plan Notebook	Acceptance	Prior to Construction
Spill Prevention, Control, and Countermeasure Plan (SPCC)	Acceptance	Prior to Construction
Colorado Discharge Permit System (CDPS) Stormwater Construction Permit (SCP)	Acceptance	Prior to Construction
Construction Dewatering Permit	Acceptance	30 Days Prior to Dewatering
Environmental permits (See Environmental Permits above)	Acceptance	Per the requirements of the permit and the Contract Documents)
Migratory bird nest survey memorandum	Review	Prior to impacting existing structures that may contain active bird nests and completing clearing and grubbing tasks
Detour Plan	Approval (City of Lakewood	Prior to impacting bike lanes

Section 5 – Environmental

Project Special Provisions

REVISION OF SECTION 107
ARCHAEOLOGICAL AND PALEONTOLOGICAL DISCOVERIES

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

Subsection 107.23 shall include the following:

Fossils may be uncovered during excavation for the project. CDOT will furnish a paleontologist to monitor project excavations. The Contractor shall notify the Engineer 10 working days prior to the start of excavation operations to allow for scheduling of the monitor.

If fossils are encountered, they will be evaluated and, if deemed important, removed prior to further excavation. When directed, the Contractor shall excavate the site in such manner as to preserve the fossils uncovered and shall remove then as directed by the Engineer. Such excavation will be paid for as extra work according to the provisions of Subsections 104.02 and 104.03.

For project FBR 0063-046 (US 6 Bridge over Garrison St.), as with similar projects impacting the Denver and Dawson Formations, intermittent spot monitoring will be appropriate for caisson drilling. Based on geologic maps of the project area, spot monitoring should take place when drilling extends deeper than approximately 10 feet or the current footprint of previously disturbed ground, whichever is deeper. Spot monitoring involves the paleontologist being on site only when drilled bedrock has accumulated in a ‘spoils pile’ and may be searched through. The paleontologist may determine when on site the necessary frequency of these spot checks. Continuous monitoring may be appropriate for any open excavation that extends into previously undisturbed bedrock. Both types of monitoring will require as much advance notice of the drilling and excavation schedules as possible.

Delays caused the Contractor for paleontological salvage may be cause for extension of contract time according to the provisions of Subsection 108.06.

SECTION 240
PROTECTION OF MIGRATORY BIRDS BIOLOGICAL WORK PERFORMED BY THE CONTRACTOR'S BIOLOGIST

Section 240 is hereby added to the Standard Specifications for this project as follows:

DESCRIPTION

240.01 This work consists of protecting migratory birds during construction.

MATERIALS AND CONSTRUCTION REQUIREMENTS

240.02 The Contractor shall schedule clearing and grubbing operations and work on structures to avoid taking (pursue, hunt, take, capture or kill; attempt to take, capture, kill or possess) migratory birds protected by the Migratory Bird Treaty Act (MBTA). The Contractor shall retain a qualified wildlife biologist for this project. The wildlife biologist shall have a minimum of three years' experience conducting migratory bird surveys and implementing the requirements of the MBTA. The Contractor shall submit documentation of the biologist's education and experience to the Engineer for acceptance. A biologist with less experience may be used by the Contractor subject to the approval of the Engineer based on review of the biologist's qualifications.

The wildlife biologist shall record the location of each protected nest, bird species, the protection method used, and the date installed. A copy of these records shall be submitted to the Engineer.

a) Vegetation Removal. When possible, vegetation shall be cleared prior to the time when active nests are present. Vegetation removal activities shall be timed to avoid the migratory bird breeding season which begins on April 1 and runs to August 31. All areas scheduled for clearing and grubbing between April 1 and August 31 shall first be surveyed within the work limits for active migratory bird nests. The Contractor's wildlife biologist shall also survey for active migratory bird nests within 50 feet outside work limits. Contractor personnel shall enter areas outside CDOT right of way only if a written, signed document granting permission to enter the property has been obtained from the property owner. The Contractor shall document all denials of permission to enter property. The Contractor shall avoid all active migratory bird nests. The Contractor shall avoid the area within 50 feet of the active nests or the area within the distance recommended by the biologist until all nests within that area have become inactive. Inactive nest removal and other necessary measures shall be incorporated into the work as follows:

    1) *Tree and Shrub Removal or Trimming.* Tree and shrub removal or trimming shall occur before April 1 or after August 31 if possible. If tree and shrub removal or trimming will occur between April 1 and August 31, a survey for active nests shall be conducted by the wildlife biologist within the seven days immediately prior to the beginning of work ineach area of tree and shrub removal or trimming. The survey shall be conducted for each phase of tree and shrub removal or trimming.

-2-
SECTION 240
PROTECTION OF MIGRATORY BIRDS BIOLOGICAL WORK PERFORMED BY THE CONTRACTOR'S BIOLOGIST

If an active nest containing eggs or young birds is found, the tree or shrub containing the active nest shall remain undisturbed and protected until the nest becomes inactive. The nest shall be protected by placing fence (plastic) a minimum distance of 50 feet from each nest to be undisturbed. This buffer dimension may be changed if determined appropriate by the wildlife biologist and approved by the Engineer. Work shall not proceed within the fenced buffer area until the young have fledged or the nests have become inactive.

If the fence is knocked down or destroyed by the Contractor, the Engineer will suspend the work, wholly or in part, until the fence is satisfactorily repaired at the Contractor's expense. Time lost due to such suspension will not be considered a basis for adjustment of time charges, but will be charged as contract time.

2) *Grasses and Other Vegetation Management.* Due to the potential for encountering ground nesting birds' habitat, if work occurs between April 1 and August 31, the area shall be surveyed by a wildlife biologist within the seven days immediately prior to ground disturbing activities.

The undisturbed ground cover to 50 feet beyond the planned disturbance, or to the right of way line, whichever is less, shall be maintained at a height of 6 inches or less beginning April 1 and continuing until August 31 or until the end of ground disturbance work, whichever comes first.

If birds establish a nest within the survey area, an appropriate buffer of 50 feet will be established around the nest by the contractor biologist. This buffer dimension may be changed if determined appropriate by the CDOT biologist and approved by the Engineer. The Contractor shall install fence (plastic) at the perimeter of the buffer. Work shall not proceed within the buffer until the young have fledged or the nests have become inactive.

If the fence is knocked down or destroyed by the Contractor, the Engineer will suspend the work, wholly or in part, until the fence is satisfactorily repaired at the Contractor's expense. Time lost due to such suspension will not be considered a basis for adjustment of time charges, but will be charged as contract time.

b) The Contractor's Wildlife Biologist will conduct raptor nest surveys within 0.5 mile of the construction site prior to the start of construction and prior to each construction phase. This survey can be done with binoculars. If construction activities are located within the Colorado Division of Wildlife (CDOW) recommended buffer zone for specific raptors, "NO WORK" zones shall be established according to the CDOW standards or by the CDOT Wildlife Biologist in consultation with the CDOW around active sites during construction.

-3-

SECTION 240

PROTECTION OF MIGRATORY BIRDS BIOLOGICAL WORK PERFORMED BY THE CONTRACTOR'S BIOLOGIST

c) The "NO WORK" zone shall be marked with either fencing or signing. Work shall not proceed within a “NO WORK” zone until the CDOT Biologist has determined that the young have fledged or the nest is unoccupied.

d) *Work on structures.* The Contractor shall prosecute work on structures in a manner that does not result in a taking of migratory birds protected by the Migratory Bird Treaty Act (MBTA). The Contractor shall not prosecute the work on structures during the primary breeding season, April 1 through August 31, unless he takes the following actions:

1) The Contractor shall remove existing nests prior to April 1. If the Contract is not awarded prior to April 1 and CDOT has removed existing nests, then the monitoring of nest building shall become the Contractor’s responsibility upon Notice to Proceed.

2) During the time that the birds are trying to build or occupy their nests, between April 1 and August 31, the Contractor shall monitor the structures at least once every three days for any nesting activity.

3) (3) If the birds have started to build any nests, they shall be removed before the nest is completed. Water shall not be used to remove the nests if nests are located within 50 feet of any surface waters.

4) (4) Installation of netting may be used to prevent nest building. The netting shall be monitored and repaired or replaced as needed. Netting shall consist of a mesh with openings that are ¾ inch by ¾ inch or less.

If an active nest become established, i.e., there are eggs or young in the nest, all work that could result in abandonment or destruction of the nest shall be avoided until the young have fledged or the nest is unoccupied as determined by the wildlife biologist and approved by the Engineer. The Contractor shall prevent construction activity from displacing birds after they have laid their eggs and before the young have fledged.

If the project continues into the following spring, this cycle shall be repeated. When work on the structure is complete, the Contractor shall remove and properly dispose of netting used on the structure.

-4-

SECTION 240
PROTECTION OF MIGRATORY BIRDS BIOLOGICAL WORK PERFORMED BY THE CONTRACTOR'S BIOLOGIST

e) *Taking of a Migratory Bird.* The taking of a migratory bird shall be reported to the Engineer. The Contractor shall be responsible for all penalties levied by the U. S. Fish and Wildlife Service (USFWS) for the taking of a migratory bird.

Section 5 – Environmental

REVISION OF SECTION 250

ENVIRONMENTAL, HEALTH AND SAFETY MANAGEMENT

Section 250 of the Standard Specifications is hereby revised for this project as follows:

Subsection 250.01 shall include the following:

Project construction operations below ground surface, particularly caisson excavations, have potential to encounter hazardous materials in soils and groundwater due to previous petroleum hydrocarbon release events in the project area. If contaminants are encountered low concentrations are expected. The Contractor will review the environmental field testing report prepared by Pinyon Environmental listed under Section 102 Revision. Workers shall be alert during excavations for visual and olfactory signs of contamination. If soil and/or groundwater contamination is encountered during construction activities, work will stop immediately at that location and the procedures outlined in this spec shall be followed.

The Contractor shall be responsible for the workers' health and safety, the general public and environment. The Contractor Health and Safety Office (HSO) and/or Monitoring Technician shall be on site as necessary to ensure proper handling, testing and disposal of any contaminated media, as detailed in the CDOT Standard Specification 250 and subsection 107.25.8 and all applicable local, state and federal regulations.

Contaminated water brought to the surface shall be contained in tank(s) or drums and disposed of properly. Contaminated groundwater shall not be directly discharged into a storm sewer, ditch, or any Waters of the State without a permit. Contaminated soils shall be properly handled, tested, and disposed of properly. All work including monitoring, sampling, testing, hauling and disposal will be paid using the Environmental Health and Safety Management Force Account.

Subsection 250.04 shall include the following:

Laboratory results confirmed that lead-based paint is present in the coatings of the steel bridge components, mainly girders. All painted steel items will become the property of the Contractor. Removal and recycling of the painted components shall be done in compliance with CDOT Spec 250 (subsection 250.04) and all applicable local, state and federal regulations. OSHA Regulation 1926.62 should be consulted for worker protection prior to removal of painted components.

Any paint chips that come loose shall be collected and disposed of properly. Engineering and administrative controls to minimize paint flaking and limit the generation of lead dust and fumes during torching and demolition shall be in place.

Section 6 – Third Party Agreements

General

The Contractor shall be responsible for obtaining all third-party approvals required to complete the Work, except as otherwise specified in the Contract Documents. Third-party coordination and approvals will be required from, but not limited to, the following agencies: Local Agencies, Public Utility Owners and Private Utility Owners. Utility Company requirements are addressed in Section 7, Utility Relocations. Coordination and approval requirements of Local Agencies are addressed in this Section.

Local Agency

The Contractor shall meet the requirements of any intergovernmental Agreement (IGA) pertaining to the project with any Local Agency obtained prior to construction.

Deliverables

At a minimum, the Contractor shall submit the following for review, approval, and/or acceptance:

Deliverable	Acceptance or Approval	Schedule
Utility Crossing Permit	Acceptance	Prior to commencing any Work which impacts a Utility

Project: US 6 & Garrison
Project Sub Acct. No: 19478
July 31, 2014
Technical Requirements

Section 7 – Utilities

General Utility Work Obligations

This Section addresses the Utility Company (or Utility Owner) requirements. It does not apply to existing stormwater facilities, irrigation ditches, Intelligent Transportation Systems, video and video detection systems, traffic signals, or street lighting, all of which shall be installed, removed, relocated and/or protected in place by the Contractor and/or the Utility Owners pursuant to other sections of the Contract Documents.

The Project will have impacts to existing utilities within the Project limits. The Contractor shall coordinate and cooperate with CDOT and the Utility Owners to ensure that all Utility Work (whether performed or furnished by the Utility Owners or by the Contractor) is performed in accordance with the executed Utility Relocation Agreements (URA). The physical limits of the Contractor's obligation for the performance of Utility Work shall extend as far as is necessary to permit construction of the Project (taking into account the requirements of the Utility Owners, Governmental Persons with jurisdiction, and adjacent property owners), whether inside or outside the ROW.

The Contractor shall use reasonable efforts to anticipate and avoid Utilities, and to otherwise minimize and/or mitigate the consequences of the Utility Relocations.

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

The work described in these plans and specifications requires full cooperation between the Contractor and the Utility Owners in accordance with subsection 105.11 in conducting their respective operations so the utility work can be completed with minimum delay to all parties concerned.

Performance Standards

Utility Owners

All Utility Relocation designs and construction of relocations furnished or performed by the Contractor shall be consistent with the Utility Owner's written specifications, standards of practice (which may include design format), and construction methods that are current at the Proposal Due Date, except as otherwise provided in the Utility Relocation Agreements. The Contractor shall obtain all such written specifications, standards of practice, and construction methods from the Utility Owners. In the event of a conflict between the requirements of the Utility Owner and the requirements of the Contract Documents, CDOT in its sole discretion will determine which shall govern. The Contractor shall be responsible for resolution of any unresolved ambiguity prior to proceeding with any Utility Work.

Section 7 – Utilities

Replacements for any existing Utilities shall be designed and constructed to provide service at least equal to that offered by the existing Utility, unless the Utility Owner approves a lesser replacement.

In performing the Utility Work, the Contractor shall ensure that all Utility Work results in Utilities being located in a manner to allow future Utility maintenance to be performed by the relevant Utility Owners without disruption to the operation or maintenance within the completed Project limits.

Identification of Utilities

CDOT has completed an initial utility investigation and has identified all known Utilities that may be impacted by the Project. CDOT has not performed a complete investigation of service lines. The results of CDOT's investigations are shown in the Reference Documents.

Known Utilities

Utility Company	Contact Name/Email Address	Telephone/ Address
AT&T	Tom Jakse tjakse@clearwaterconsulting.net	720-289-5471 6510 S. Quebec St. Englewood, CO 80111
Centurylink (CTL)	Jodie Leonard Jodie.leonard@centurylink.com	303-451-2379 5325 Zuni St., STE 728 Denver, CO 80221
City of Lakewood (COL) – Sanitary	Duane Rivard duariv@lakewood.org	303-987-7965 850 Parfet St. Lakewood, CO 80215-5599
City of Lakewood (COL) – Storm	A.J. Sandoval artsan@lakewood.org	303-987-7956 850 Parfet St. Lakewood, CO 80215-5599
City of Lakewood (COL) – Traffic	John Padon johpad@lakewood.org	303-987-7986 480 S. Allison Parkway Lakewood, CO 80226
Colorado Dept. of Transportation (CDOT) ITS	Jill Scott Jill.Scott@state.co.us	303-512-5805 425 C Corporate Circle, Rm 156 Golden, CO 80401
Comcast Communications (Comcast)	Patrick Peak **Pat_Peck@cable.comcast.com**	303-603-5441 6850 S. Tucson Way Englewood, CO 80112
Consolidated Mutual Water (CMW)	Andy Rogers arogers@cmwc.net	303-238-0451 12700 W. 27th Ave.

Section 7 – Utilities

		Lakewood, CO 80125
Denver Water Department (DWD)	Don Wyman don.wyman@denverwater.org	303-628-6628 1600 W. 12th Ave. Denver, CO 80204
XCEL Energy-Electric Distribution	Brandon Allen Jonathan.b.allen@xcelenergy.com	303-592-2748 555 Zang Street, Suite 250 Lakewood CO 80228
XCEL Energy-Gas	Brandon Allen Jonathan.b.allen@xcelenergy.com	303-592-2748 555 Zang Street, Suite 250 Lakewood CO 80228

See Reference Documents (Utility Sheets) for approximate locations

Unknown Utilities

Unknown utilities not shown on the plans and discovered during construction that require relocation will be paid for by Change Order per section 109.04 of the Standard Specifications.

Abandoned Utilities

All abandoned public utility materials within the project limits will become property of the Contractor. All abandoned private utility materials within the project limits will be removed the private utility owner and coordinated with Contractors work. The Contractor shall verify with the utility owner that the utility material is abandoned before removal. The Contractor shall be responsible for removal and disposal of the materials for public utilities. The cost for removal and disposal of the abandoned public utility materials shall not be paid for separately but shall be included in the work.

Contractors Investigations

The Contractor shall take all actions reasonably practicable to identify and confirm the existence, exact location, size, and type of all Utilities within the Project limits or otherwise potentially impacted by the Project, whether or not such Utilities are shown in the Utility Data, including all potentially impacted service lines, without limiting its ability to negotiate a Change Order with respect to any Unidentified Utility. Such actions shall include making diligent inquiry at the offices of the Utility Owners, consulting public records, and conducting field studies (such as subsurface utility engineering, potholing), as appropriate, taking into consideration the possibility that Utility Owners may provide inaccurate or inexact information with regard to their Utilities. If the Contractor's investigations identify Unidentified Utilities, the Contractor shall notify CDOT and the relevant Utility Owner immediately upon discovery.

Section 7 – Utilities

Thereafter, CDOT, the Contractor, and the relevant Utility Owner shall execute a Utility No Conflict Close-Out Form, or pursuant to a Utility Work Authorization treat an Unidentified Utility as either a Contractor-Relocated Utility or an Owner-Relocated Utility.

Damage to Utilities Caused by the Contractor

The Contractor shall be responsible for any damage caused by the Contractor or its Subcontractors, employees, or agents to property, Utilities, Structures, or Subcontractors, employees, or agents of the Utility Owners. The Contractor shall immediately notify the affected Utility Owner of any utility damaged by the Contractor during performance of the Work.

Promptly after the Contractor's discovery of such damage, or the Contractor's receipt of notice of any such damage from the Utility Owner or from any other source: (a) the Contractor shall repair the damage to the Utility Owner's satisfaction; or (b) at the Utility Owner's election, the Utility Owner may make such repairs at the Contractor's expense. The Contractor shall make payment to a Utility Owner within 60 Days of receipt of the Owner's invoice.

Multiple Moves

The Contractor shall be responsible for all costs incurred by CDOT, the Contractor, or the Utility Owner to subsequently relocate any Utility already Relocated to accommodate the Project.

Utility Coordination

General

The Contractor shall be responsible for all coordination with the affected Utility Owners to accomplish each Utility Relocation in accordance with the applicable Utility Relocation Agreements. In the discharge of its coordination responsibilities, the Contractor shall:

1. Keep Utility Owners fully informed of schedules with regard to Utility Work. The Contractor shall provide to the Utility Owners, as soon as practicable, an estimated schedule for their respective Utility Work and shall notify the Utility Owners of any significant changes to the schedule as soon as practicable.
2. Keep Utility Owners fully informed of changes that affect their Utilities.
3. Consider, to the extent practicable, Utility Owners' needs for the allocation of resources to perform their respective Utility Work in a timely manner.
4. Keep Utility Owners involved in making decisions that affect their Utilities so Utility Owners are able to provide uninterrupted service to their customers, or to be subject to the least interruption practicable as approved by the Utility Owner.
5. Avoid multiple Relocations of the same Private Utility, in accordance with the Contract Documents.

Section 7 – Utilities

Known Utility Coordination:

- **DENVER WATER**

  Denver Water has a 60 inch water line crossing 6th Ave west of Garrison Street. The water line was installed in approximately 1957 and is a pre stressed wire wound conduit with a steel cylinder and concrete wrap that should not be day lighted to avoid damaging it. The proposed construction may impact the cover over this line. Denver Water shall be notified and approve changes to the proposed grade of more than 2 feet plus or 1 foot minus from the existing grade over the existing 60 inch water line.

  Denver Water is considering installing a 90" steel sleeve for future replacement of the existing water line. If Denver Water determines they want to include this work, a separate utility agreement between the Contractor and CDOT will be executed. CDOT will execute an agreement with Denver Water.

  Contractor Responsibilities –

  The Contractor shall be responsible for any impacts to the existing 60 inch water line, including costs, associated with the Contractor's work.

  Utility Company Responsibilities –

  Denver Water Department shall review the proposed design over the water line. Denver Water Department shall inspect utility work performed by Contractor.

- **CENTURY LINK**

  Century Link's facilities crossing 6th Ave west of Garrison are believed to be abandoned.

  Contractor Responsibilities –

  The Contractor shall confirm with Century Link that the facilities are abandoned prior to any construction activities that impact these facilities.

  Utility Company Responsibilities –

  Century Link will determine if their facilities are abandoned.

- **CITY of LAKEWOOD – SANITARY SEWER**

  The City of Lakewood has numerous sanitary sewer facilities within the limits of the project which may be impacted by construction.

  Contractor Responsibilities –

  Contractor shall coordinate with the City of Lakewood on all impacts to sanitary sewer facilities.

Section 7 – Utilities

Construction may impact the sanitary sewer line along the northeast side of the 6th Ave Garrison intersection and other manholes within the project limits. A minimum of 18 inches of vertical separation will be required between any wall footing and the existing sanitary sewer line. If this separation is not possible a minimum of 12 inches of vertical separation will be allowed if the pipe is replaced with new C900 PVC pipe with approved couplings. Any manhole relocations, modifications or adjustments shall meet the City of Lakewood standards. Access to manholes shall be provided as required by the City of Lakewood.

All proposed changes to the City of Lakewood sanitary sewer facilities shall be design in accordance with the City of Lakewood's Water and Sewer Rules and Regulations (latest version). Proposed changes will be submitted to the City for review and approval prior to Construction. The Contractor shall include review time in the Project schedule for review and approval by Lakewood.

Utility Company Responsibilities –

The City of Lakewood shall review and approve impacts to their facilities.
The City will assist with determining the locations of their facilities.
The City of Lakewood shall inspect utility work performed by the Contractor.

- **CITY of LAKEWOOD – TRAFFIC**
  The Contractor shall coordinate any traffic signal and street lighting impacts with the City of Lakewood. See Section 14 for additional requirements.

- **XCEL –ELECTRIC**
  Xcel has overhead electrical lines crossing 6th Ave just east of Garrison. Xcel will underground the overhead lines from pole to pole on the north east corner of the frontage road to the south east corner of the frontage road. The lines will be relocated underground in Garrison St. Comcast also has facilities on the existing poles that will be relocated.

  Other overhead and electrical lines provide service to the traffic signal and street lighting. These will be impacted as determine by the Contractors design.

  Electrical power is required for street lights and traffic signals.

  Contractor Responsibilities –

  Contractor shall coordinate with Xcel to avoid impacts to any overhead or underground lines. The contractor shall coordinate with Xcel to identify power source locations. New meters will be required for street lights and traffic signals.

Section 7 – Utilities

A Builder's Call Line application shall be submitted by the Contractor for power source connections. The Contractor shall contact City of Lakewood Traffic Engineer for addresses for new meters.

Utility Company Responsibilities –
Xcel will underground their overhead facility prior to the start of construction.
Xcel will identify power sources and meter locations.
Xcel Energy forces shall coordinate this work with Comcast Cable.

- **COMCAST**
  COMCAST has overhead and underground lines crossing US 6 under the existing bridge on the east side Garrison. COMCAST will relocate these overhead lines to Garrison Street prior to the start of construction.

  Contractor Responsibilities –
  Contractor shall coordinate with Comcast to avoid impacts to any overhead or underground lines.

  Utility Company Responsibilities –
  Comcast will relocate their facilities prior to the start of construction.
  Comcast forces shall coordinate this work with Xcel Energy.

- **XCEL –GAS**
  Xcel Gas has a multiple gas lines within the project limits.

  Contractor Responsibilities –
  The Contractor shall provide Xcel with their proposed design and coordinate construction impacts with Xcel –Gas and notify CDOT of any impacts. Xcel shall determine if relocation of their facilities is necessary. The contractor shall include time for Xcel to design and construct new or relocated facilities impacted by the proposed construction.

  Utility Company Responsibilities –
  Xcel will determine if proposed construction requires relocation of Xcel's facilities. Xcel will design and construct any new or relocated gas lines impacted by the project.

- **CONSOLIDATED MUTUAL WATER**
  Consolidated Mutual Water has a 6inch line in the north frontage road and other water line in Garrison St.

Section 7 – Utilities

Contractor Responsibilities –

The Contractor shall determine if their proposed design and construction impact the water line. If impacts occur, the Contractor shall coordinate impacts with Consolidated Mutual Water. New water lines will be designed in accordance with Consolidated Mutual Water standards by Consolidated Mutual Water.

Utility Company Responsibilities –

CMW will determine if proposed construction requires relocation of CMW facilities. CMW will design and construct any new or relocated water lines impacted by the project

Utility Meetings

Between the Contractor and Utility Owners

The Contractor shall schedule regular meetings with the relevant Utility Owners to complete the Utility Work pursuant to the terms of the Utility Work Authorization. The Contractor shall not unreasonably deny any request by a Utility Owner to meet regarding any Utility Work. The Contractor shall provide CDOT with at least 5 Days prior notice of any meeting with a Utility Owner, which CDOT may attend in its discretion, unless a shorter notice period is agreed to by CDOT and is reasonably necessary under the circumstances.

The Contractor shall be required to meet with each utility owner impacted by the work a minimum of thirty (30) days in advance of any construction operations to coordinate required utility work with the construction activity.

Between CDOT and the Contractor

The Contractor and CDOT shall meet as necessary and otherwise as reasonably requested by the other party to discuss and resolve matters relating to the Utility Work.

The party proposing a meeting shall provide the other party with a minimum of 5 Days prior notice of any proposed meetings, unless a shorter notice period is agreed to and reasonably necessary under the circumstances.

Meeting Minutes/Correspondence

The Contractor shall produce meeting minutes of all Utility Work meetings with Utility Owners and/or CDOT and shall distribute copies of the meeting minutes to CDOT for Review and, when such meetings were attended by a Utility Owner, to the relevant Utility Owner, not later than 7 Days after each meeting date. The Contractor shall provide copies of all correspondence between the Contractor and any Utility Owner to CDOT for Review no later than 7 Days after delivery.

Section 7 – Utilities

Review Schedules

In developing the Project schedule, the Contractor shall allow appropriate time periods for the performance of all utility work and reviews identified.

The Contractor shall keep each utility owner advised of any work being done to its facility so that each utility owner can coordinate its inspections for final acceptance of the work with the Engineer.

The contractor shall provide written notice to each utility owner, with a copy to the Engineer, immediately prior to each utility work element expected to be coordinated with construction, and shall allow the expected number of working days for utilities to complete necessary work.

Notices

UNCC Requirements

The Contractor shall comply with Article 1.5 of Title 9, CRS ("Excavation Requirements") when excavation or grading is planned in the area of underground utility facilities. The Contractor shall notify all affected utilities at least two (2) business days, (NOT INCLUDING THE DAY OF NOTICE OR THE DAY OF EXCAVATION) prior to commencing such operations. Contact the Utility Notification Center of Colorado (UNCC) at 811 or 1-800-922-1987 to have locations of UNCC registered lines marked by member companies. All other underground facilities shall be located by contacting the respective company. For CDOT owned utility facilities the Contractor shall call Jeff Lancaster of the Region 1 Traffic Section at 303-757-9950 to request locates. CDOT is not contacted when locates are requested through the UNCC. Utility service laterals shall also be located prior to beginning ANY excavation or grading.

Failure of Utility Owner to Cooperate or Timely Perform

The Contractor shall use reasonable efforts to obtain the cooperation of each Utility Owner as necessary for carrying out the Utility Work. The Contractor shall provide written notice to CDOT immediately for review if:

1. The Contractor becomes aware that any Utility Owner is not cooperating in identifying Utilities, negotiating, performing or approving any Utility Work.
2. A Utility Owner fails to complete design and/or construction work for which it is responsible on or before the deadline established
3. Based on the progress made by the relevant Utility Owner, the Contractor believes that there is a possibility that the Utility Owner will not complete the Relocation of an Owner-Relocated Utility or any other Utility Work as required within the time limits set and
4. In each case (1), (2), or (3) advising CDOT whether the Utility Owner has complied in all respects with the requirements of this Section, including compliance with the applicable and the applicable UWO with respect to the relevant portion of the Utility Work.

Section 7 – Utilities

After delivery of such notice, the Contractor shall continue to diligently pursue the Utility Owner's cooperation and shall assist CDOT in any attempts to reach a solution through the dispute resolution procedure outlined in the applicable URA. The Contractor shall document any incurred costs as a direct result of the Utility Owner's failure to cooperate or perform its obligations under the applicable URA in a timely manner.

In the event that CDOT pursues legal action against a Utility Owner pursuant to Section 43-1-1411, Colorado Revised Statutes, the Contractor shall cooperate as reasonably requested by CDOT in connection with such legal actions, including having the Contractor's staff and Subconsultants act as witnesses in such legal actions and providing information, reports, graphs, photos, plans, renderings, and similar materials to CDOT's counsel at the Contractor's expense.

Utility Work Procedure

Utility Agreements

CDOT is finalizing Utility Relocation Agreement with Utility Owners whose Utilities are, or may be affect by the Project. Final URA's will be provided when complete. URA are expected to generally follow the Known Utility Coordination: descriptions.

Known Utility Coordination.

If the Contractor identifies Utility Work that is required from a Utility Owner without an agreement, CDOT may enter into an agreement with such Utility Owner. The Contractor shall not be a party to any agreement and shall not be responsible for negotiating such agreement. CDOT will be responsible for drafting and negotiating the agreement. The Contractor shall be responsible to coordinate with such Utility Owner as if it had an executed URA.

Exhibits -None

Deliverables

At a minimum, the Contractor shall submit the following for Review, Approval, or Acceptance:

Section 7 – Utilities

Deliverable	Review, Acceptance, or Approval	Schedule
As-Built plans	Acceptance	As required per Section 7.
Meeting minutes	Acceptance	As required per Section 7.
Correspondence between Contractor and any Utility Owner	Review	As required per Section 7.

All deliverables shall also conform to the requirements of Section 3, Quality Management.

The locations of utility facilities as shown on the Reference documents, and/or herein described, were obtained from the best available information.

Section 8 – Right-of-Way

Administrative Requirements

CDOT will retain possession of each parcel and all improvements, if any, made thereon by the Contractor. The Contractor's access and use of the Right-of-Way (ROW) arises solely from the permission granted by CDOT under the Contract.

Acquisition and Relocation Standards

All ROW acquisition and relocations shall be performed in accordance with all applicable federal and state laws, including:

1. The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended.
2. Design/Build Projects, 23 CFR 710.313(d).
3. The Colorado Relocation Assistance and Land Acquisition Policy, CRS 24-56-101, et seq., as supplemented.
4. CDOT's Right-of-Way Manual dated January 2011. CDOT's authority to acquire property is contained in Sections 43-1-208, 210 and 43-3-106 CRS (1984).

Status of Right-of-Way

All work shall be completed within the existing CDOT ROW. The Contractor shall be responsible for any additional ROW (Fee, Permanent Easement (PE), or Temporary Easements (TE)) required to construct the Work for the Project. The Right-of-Way Plans in Reference files included shows existing CDOT ROW.

The Contractor shall not trespass on private property. In the event trespass occurs, the Contractor shall be liable for all mitigation costs and damages as provided by law.

Acquisition and Relocation Requirements

Fee, Permanent Easements, and Temporary Easements

The Contractor, at its sole cost and expense, shall be responsible for acquiring any Fee, PE, or TE. The acquisition of Fee, PE, or TE requires Approval in writing by the CDOT Project Engineer. Once Approval is obtained, the Contractor may begin the valuation/appraisal process for the Fee, PE or TE. All Fee, TE, or PE shall be appraised and/or valued in accordance with CDOT's Right-of-Way Manual and shall comply with the requirements of Section 5 Environmental (which shall be completed at the contractor's expense). CDOT shall Approve the determination of value prior to any offers to property owners. After each Fee, TE, or PE is acquired, the Contractor shall submit a complete parcel acquisition file, which includes, but is not limited to, copies of offer letters, correspondences, appraisals, fair market value determinations, fully executed Fee, PE, or TE agreements, the negotiator's signed diary, and a statement signed by the property owner acknowledging receipt of payment in full. Parcel acquisition files shall be submitted to the CDOT Project Engineer for Acceptance no later than two working days following tender of payment to the landowner. If the Contractor cannot reach

Section 8 – Right-of-Way

an agreement with a property owner for the acquisition, the Contractor may request in writing that CDOT acquire the Fee, PE or TE through condemnation proceedings. The Contractor shall prepare and submit to the CDOT Project Engineer for Approval, a properly completed Condemnation Memorandum and Check List Form in accordance with the instructions contained in the CDOT Right-of-Way Manual. The condemnation request shall include a certified check payable to the Clerk of the District Court of Jefferson County in the amount of the approved fair market value. The Contractor shall not enter any properties until notified in writing that legal possession has been obtained. All costs or time delays as a result of condemnation proceedings shall be borne by the Contractor. The Contractor may be required to provide personnel for pre-trial and court hearing testimony for each condemnation request.

Permission to Enter Property

The Contractor shall secure Permission to Enter Property Forms prior to entering any property outside the ROW for surveying, environmental or any other purposes. It shall be the Contractor's sole responsibility to obtain the forms and the Contractor shall be responsible for any and all damages and claims. The Contractor shall submit copies of all Permission to Enter Property Forms to the CDOT Project Engineer for acceptance.

Construction Requirements

Restoration of Property and Landscape

Should the Contractor damage, injure or destroy property or landscaping for which the owner has not been compensated, the Contractor shall, at its sole cost and expense, repair and/or replace or restore the damage to a condition similar or equal to that existing prior to the damage. Restoration may include, but is not limited to, repair, replacing in kind, rebuilding, or replanting.

Protection of Property

Once easements have been acquired for a property in accordance with the requirements herein, the Contractor shall manage and minimize losses to the property in accordance with the Technical Requirement Section 18 - Maintenance during Construction. This shall include the installation of temporary security fencing sufficient to contain animals, people, and to delineate leach fields. The temporary fencing shall be installed prior to removing any ROW fencing in place within the Project limits.

Section 8 – Right-of-Way

RIGHT OF WAY

The FIR Plans (6th&Garrison-FIR Level Plans.pdf) included in the Reference Documents depict the Right-of-Way. These plans are available on the website at http://www.coloradodot.info/projects/us6overgarrison until the date set for opening bids.

The Department anticipates no delay toward completion of the project due to the restrictions imposed herein.

Section 9 – Survey

Administrative Requirements

Standards

The Contractor shall comply with the requirements of the Contract Documents and shall meet all applicable federal, state, and local requirements related to surveys, records, and monuments.

Project Survey Coordinator

The Contractor shall designate a Colorado Registered Professional Land Surveyor as the Project Survey Coordinator. The Project survey coordinator shall be in responsible charge of all Contractor survey Activities on the Project. The Project Survey Coordinator shall direct and review all survey Work and shall be the point of contact for all survey related Activities. Contractor survey staff shall perform Work under the direct supervision of the Project Survey Coordinator.

CDOT Supplied Survey Data

The full extent of survey and mapping information to be supplied by the Colorado Department of Transportation (CDOT) is available and is for the Contractor's use. The Contractor shall be responsible for any supplemental survey and mapping necessary to complete the work.

Any discrepancies in information provided shall be reported to the CDOT Project Engineer.

The survey and mapping information including DGN and DTM data is included in the Contract Documents.

Contractor Supplied Survey Data

Except as provided by CDOT above; the Contractor shall provide all other survey required for completion of the work.

Preservation of Survey Monuments

The preservation of survey markers and monuments is mandatory and affects all governmental agencies. The Contractor shall notify the agency affected as soon as it becomes known that a marker is in a position that will interfere with new construction or with Contractor operations. The marker position shall be accurately preserved prior to disturbing any such marker.

Section 9 – Survey

CDOT Monuments

If any survey monuments are at risk of being destroyed at any time within the Right-of-Way (ROW), the Contractor shall immediately notify the CDOT Project Engineer. The Contractor shall coordinate with the affected agency for a replacement marker disk, which has been properly stamped together with instructions for establishment of the new marker. The Contractor shall have the new marker set in accordance with the provided instructions and the requirements of the Contract. The new marker shall be set under the direct supervision, and responsible charge of the Project Survey Coordinator or other Colorado Registered Professional Land Surveyor, and where required by Colorado statute shall bear the registration number of the responsible Professional Land Surveyor.

Other Agency Monuments

The Contractor shall coordinate with all other agencies with monuments on the Project to protect and restore their monuments as required to complete the Work.

Survey Records

The Contractor shall prepare and maintain supporting documentation, including but not limited to field notes, drawings, and calculations for all survey Work on the Project.

All survey records shall conform to the formats shown in the CDOT Survey Manual. Such records shall be neat, legible, accurate, and maintained by the Contractor in a neat and orderly manner.

The Contractor's Project Survey Coordinator shall be required to sign and seal all survey documentation in accordance with state law. All such documentation shall be transmitted to the CDOT Project Engineer at the completion of the Work.

Design Requirements

Design Control Surveys

The Contractor shall plan, schedule, and perform all surveys and monumentation necessary to maintain and supplement the Project control network for the design of the Project.

The Contractor shall submit to the CDOT Project Engineer a revised Project control diagram showing all modifications to the Project control network.

Design Surveys

The Contractor shall arrange for all supplemental survey information and utility locations necessary to complete the design. Design surveys shall provide sufficient detail to verify actual field locations of existing drainage improvements as well as for the final design of drainage improvements.

Section 9 – Survey

Surveying shall be performed in accordance with the CDOT Survey Manual.Traffic control and permits necessary to complete the survey shall be the responsibility of the Contractor. The Contractor shall deliver the data (in InRoads TMOSS survey format) and field notes to the CDOT Project Engineer for review upon completion of the survey. Errors and omissions found by the CDOT Project Engineer shall be corrected by the Contractor and resubmitted.

Construction Control Surveys

The Contractor shall plan, schedule, and perform all surveys and monumentation necessary to maintain and supplement the Project control network for the construction layout of the Work.

Construction Layout Surveys

The Contractor shall plan, schedule and perform all staking and construction layout required for the Work in accordance with the conventional staking requirements as described in the CDOT Survey Manual.

As-Built Surveys

The Contractor shall plan, schedule and perform all surveys required to document the location of as-built features on the Project.

The Contractor shall deliver the data (in InRoads TMOSS survey format) and field notes to CDOT for review upon completion of the survey. Errors and omissions found by CDOT shall be corrected by the Contractor and resubmitted. All work in completing the As-Built survey shall be at the responsibility of the Contractor and shall be completed in accordance with the CDOT Survey Manual.

ROW Monumentation

The Contractor shall replace all ROW monumentation lost or destroyed during the progression of the Work.

The Contractor shall submit to the CDOT Project Engineer for acceptance a revised ROW monumentation sheet listing all ROW monumentation reset by the Contractor.

Section 9 – Survey

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

Deliverable	Acceptance or Approval	Schedule
Any discrepancies in control point information provided that is reported to CDOT	review	Within 60 Days of NTP
All Survey Records and Files	Acceptance	Prior to Final Acceptance
Documentation for the preservation or re-monumentation of any survey monument	Approval by the affected agency	Submit with As-Built Documents
Revised ROW Monumentation Sheet	Acceptance	Prior to Final Acceptance
Documentation/date of the location of As-Built features on the Project (in InRoads TMOSS survey format) and field notes	Acceptance	Prior to Final Acceptance

Section 9 – Survey

Project Special Provisions

REVISION OF SECTION 629
SURVEY MONUMENTATION

Section 629 of the Standard Specifications is hereby revised for this project as follows:

In subsection 629.09 delete the fourth paragraph and replace with the following:

Before final payment is made, the following three items shall be completed, bear the seal and signature of the PLS in responsible charge, and have copies submitted to the Engineer for review prior to being deposited with the county in accordance with Section 38-51-107, CRS:

(1) All survey records.
(2) The Control and Monumentation sheet of the R/W plans.
(3) The Survey Control Diagram.

Section 10 – Geotechnical and Roadway Pavements

Geotechnical Investigations

Geotechnical investigations are provided and available in the Reference Documents. See project website at http://www.coloradodot.info/projects/us6overgarrison.

The Contractor has, prior to submitting its Proposal, in accordance with prudent and generally accepted engineering and construction practices, reviewed the boring logs provided in the Reference Documents, inspected and examined the Site and surrounding locations, and undertaken other appropriate activities sufficient to familiarize itself with surface conditions and subsurface conditions affecting the Project, to the extent the Contractor deemed necessary or advisable for submittal of a Proposal. As a result of such review, inspection, examination and other activities, the Contractor is familiar with and accepts the physical requirements of the Work. The Contractor acknowledges and agrees that changes in conditions at the Site may occur after the Proposal Due Date, and that the Contractor shall not be entitled to any Change Order. Before commencing any Work on a particular aspect of the Project, the Contractor shall verify all governing dimensions and conditions at the Site and shall examine all adjoining work, which may have an impact on such Work. The Contractor shall be responsible for ensuring that the Design Documents and Construction Documents accurately depict all governing and adjoining dimensions and conditions.

The Contractor shall be responsible for any supplemental subsurface investigation necessary to complete the Work. Geotechnical investigations shall comply with the requirements of the CDOT Field Materials Manual, the CDOT Pavement Design Manual, and the AASHTO LRFD Bridge Design Specifications, Section 10 in effect at the time of bidding. All supplemental investigations made by the Contractor shall be documented in a geotechnical investigation report and submitted to CDOT and the CDOT Geotechnical Program for Acceptance. Supplemental investigations (geotechnical and pavement) must be signed and stamped by a professional engineer, licensed in the State of Colorado, and with a CDOT-prequalified firm.

Roadway Embankment Requirements

The existing embankment material is classified as AASHTO A-6 and A-7-6 material with R-Value test results of approximately 5. Imported roadway embankment material shall have a minimum R-Value of 10, meet soil embankment criteria of Standard Specifications Section 203.03, and be compatible with structures constructed on and adjacent to the embankment.

Roadway Pavement Analysis and Design

CDOT has performed the US 6 pavement design to determine the pavement type, SMA and HMA grading, design gyrations, binder requirements, pavement thickness, and minimum sub-grade stabilization requirements for new pavement construction. The Contractor shall be responsible for all other aspects of pavement design.

Section 10 – Geotechnical and Roadway Pavements

Construction of multiple-lift overlay over existing pavement to achieve final pavement grade shall require submittal of a pavement design by the Contractor, in conformance with the CDOT 2015 M-E Pavement Design Manual, for acceptance by CDOT. All pavement designs for CDOT roadways submitted by the Contractor shall utilize DARWin ME and the CDOT calibration model. All submittals shall include a hard copy and accompanying DARWin ME file. LTPPBind shall be used to determine the appropriate binder. The analysis shall utilize 98% reliability and slow conditions. LTPPBind output showing the selection of the binder under slow conditions shall be included.

Pavement designs for local roads shall be prepared by the contractor and shall meet the requirements of the local agency to which the road belongs.

Pavement Structure

The Pavement Structure is defined as the thickness of the Stone Matrix Asphalt (SMA), Hot Mix Asphalt (HMA) plus the Aggregate Base Course (ABC). See Reference Documents for Pavement Structure recommendation report.

Construction Requirements

The Contractor shall construct the Pavement Structure in accordance with the Technical Requirements.

All pavement shall be constructed full width, including inside and outside shoulders.

Any layer of HMA that is to have a succeeding layer placed thereon shall be completed to full width before the succeeding layer is placed.

Roadway Pavement Types

Flexible pavement consisting of SMA for the top lift and HMA for the intermediate and bottom lifts will be required on US 6.

Smoothness Requirements

Smoothness requirements for new full depth pavement construction shall be HRI Category II. Overlay sections shall meet the smoothness requirements for HRI Category I.

New Hot Mix Asphalt Construction

Full depth pavement reconstruction is required for US 6.

Section 10 – Geotechnical and Roadway Pavements

The Contractor shall use SMA for the top lift and HMA (Grading S) (100)(PG 64-22) for the roadway HMA pavement. The Contractor shall use SMA on the bridge surface. Pavement shall comply with the specifications in this Section.

The Contractor shall use the following lift thicknesses when placing HMA pavement on prepared subgrade and base course.

Table 10.1 – Recommended HMA Pavement Lift Summary (US 6 EB and WB)

Lift Description	Lift Thickness (inches)	Grading	Binder
Top Lift	2	SMA(Fibers)(Asphalt)	PG 76-28
Intermediate Lift 3	2.5	S	PG 64-22
Intermediate Lift 2	2.5	S	PG 64-22
Intermediate Lift 1	2.5	S	PG 64-22
Bottom Lift	2.5	S	PG 64-22

Table 10.2 – Recommended HMA Pavement Lift Summary (US 6 EB Off-Ramp)

Lift Description	Lift Thickness (inches)	Grading	Binder
Top Lift	2	SMA(Fibers)(Asphalt)	PG 76-28
Intermediate Lift 2	2.5	S	PG 64-22
Intermediate Lift 1	2.5	S	PG 64-22
Bottom Lift	3.0	S	PG 64-22

Bridge deck paving shall be placed to a compacted thickness of 3 inches, or as otherwise indicated on the plans. A waterproofing membrane shall be used beneath the bridge deck paving.

The Contractor shall use HMA (Grading S)(100)(PG 64-22) for any leveling and patching required.

The nominal aggregate size of the SMA shall be ½-inch. All references to SMA shall be taken as Stone Matrix Asphalt (Fibers)(Asphalt) or SMA(Fibers)(Asphalt). SMA shall not contain any reclaimed asphalt pavement.

The lift thickness of the intermediate and bottom lifts shall follow the guidelines established in Table 3.7 of the 2015 CDOT Pavement Design Manual. The thickness of each overlying lift shall be equal to or less than the thickness of the lift below. Any flexible pavement alternative offered by the contractor shall indicate the type of mix, asphalt binder, and thickness of all lifts that comprise the pavement section.

The contractor shall be responsible for all detour pavement designs.

Section 10 – Geotechnical and Roadway Pavements

Pavement Thickness

The Contractor shall construct the Pavement Section to the thickness requirements shown on the plans for the Project, as set forth in the Table below:

Location	Required Pavement Section Thickness (inches)			Pavement Smoothness Category (i)
	SMA plus HMA	ABC Class 6		
US 6 (Full depth)	12	6		HRI Category II
EB US 6 Off-Ramp at Garrison Street	10	6		HRI Category II
Bridge	3	NA		NA

Section 10 – Geotechnical and Roadway Pavements

Deliverables

Deliverable	Acceptance or Approval	Schedule
Technical Memorandum that indicates the Contractor has reviewed and accepts the provided Geotechnical Reports and that the Contractor has no exceptions and/or the Contractor provides the following changes. Technical Memorandum must be stamped by the Contractor's Design Professional Engineer	Acceptance	Prior to Design
Supplemental Geotechnical Investigations	Acceptance	N/A
Pavement Design Report	Acceptance	Submitted with Design Packages
Detour Pavement Design	Acceptance	At the Pre-paving Conference and at least 14 Days prior to the use of any Detour Pavement on the Project
Paving Quality Control Plan	Acceptance	At the Pre-Paving Meeting and at least 2 weeks prior to beginning paving operations.
HMA Mix Design.	Acceptance	At the Pre-paving Conference and at least 4 weeks prior to the use of any HMA pavement on the Project. Mix Submittals shall follow all requirements in CP 52 and CP 59.
SMA Mix Design.	Acceptance	At the Pre-paving Conference and at least 4 weeks prior to the use of any SMA pavement on the Project. Mix Submittals shall follow all requirements in CP 52 and CP 59.

Section 10 – Geotechnical and Roadway Pavements

Project Special Provisions

REVISION OF SECTION 106
CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT

Section 106 of the Standard Special Provisions is hereby revised for this project as follows:

Subsection 106.05 shall include the following:

For this project, Contractor process control testing of hot mix asphalt is mandatory.

Section 10 – Geotechnical and Roadway Pavements

REVISION OF SECTION 202
REMOVAL OF ASPHALT MAT

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

Subsection 202.01 shall include the following:

This work includes removal and disposal of existing asphalt mat within the project limits as shown on the plans or at locations directed by the Engineer.

In subsection 202.02 delete the seventh paragraph and replace with the following:

The existing asphalt mat shall be removed in a manner that minimizes contamination of the removed mat with underlying material. The removed mat shall become the property of the Contractor and shall be either disposed of outside the project site, or used in one or more of the following ways:

1. Used in embankment construction in accordance with subsection 203.06.
2. Placed in bottom of fills as approved in advance by CDOT.
3. Recycled into the hot mix asphalt in accordance with CP52.
4. Placed in the subgrade soft spots as approved in advance by CDOT.

Subsection 202.11 shall include the following:

The removal of the existing asphalt mat will be measured by the square yard of mat removed to the required depth and accepted.

Section 10 – Geotechnical and Roadway Pavements

REVISION OF SECTION 202
REMOVAL OF ASPHALT MAT (PLANING)

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

Delete subsection 202.09, and replace with the following:

202.09 Removal of Asphalt Mat (Planing). Prior to beginning planing operations, the Contractor shall submit a planing plan and a Quality Control Plan (QCP) for approval by CDOT. The planing plan shall include at a minimum:

(1) The number, types and sizes of planers to be used.
(2) The width and location of each planing pass.
(3) The number and types of brooms to be used and their locations with respect to the planers.
(4) The proposed method for planing and wedging around existing structures such as manholes, valve boxes, and inlets.
(5) The longitudinal and transverse typical sections for tie-ins at the end of the day.
(6) If requested by CDOT, a plan sheet showing the milling passes.

The QCP shall include as a minimum:

(1) The schedule for replacing the cutting teeth.
(2) The daily preventive maintenance schedule and checklist.
(3) Proposed use of automatic grade controls.
(4) The surface testing schedule for smoothness.
(5) The process for filling distressed areas.
(6) The schedule for testing macrotexture of the milled surface.
(7) Corrective procedures if the milled surface does not meet the minimum macrotexture specification.
(8) Corrective procedures if the milled surface does not meet the minimum transverse or longitudinal surface finish when measured with a 10 foot straightedge.

The Contractor shall not start the planing operation until the hot mix asphalt (HMA) mix design has been approved and a Form 43 has been signed by CDOT.

The existing pavement shall be milled to the cross-slope as shown on the plans, and shall have a surface finish that does not vary longitudinally or transversely more than 3/8 inch from a 10 foot straightedge. A 10 foot straightedge shall be supplied by the Contractor.

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

Section 10 – Geotechnical and Roadway Pavements

-2-
REVISION OF SECTION 202
REMOVAL OF ASPHALT MAT (PLANING)

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

The milled surface shall have a macrotexture equal to or less than 0.170 inches for single-lift overlays and 0.215 inches for multiple-lift overlays as tested in accordance with CP 77. Milled surfaces that do not meet these criteria shall require corrective action in accordance with the QCP. The Contractor shall be responsible for testing the macrotexture of the milled surface at the location directed by CDOT in accordance with CP 77 at a stratified random frequency of one test per 10,000 square yards or a minimum of once per work day.

At the completion of each day's work, longitudinal vertical edges greater than 1 inch shall be tapered. No transverse vertical edges will be allowed. Longitudinal milled surface tie-ins to existing pavement shall be tapered to not less than a 3:1 slope, transverse milled surface tie-ins to existing pavement shall be tapered to not less than a 50:1 slope. Transverse tapered joints may be tapered with the planing machine, a temporary asphalt ramp, or other methods approved by CDOT. No longitudinal joint between the milled and existing surfaces shall fall between 1 to 5 feet of any lane line.

If the transverse joint is tapered with a temporary asphalt ramp, the milled surface at the joint shall be constructed as a butt joint the full depth of the lift of asphalt to be placed on the milled surface. The Contractor shall be responsible for maintaining this asphalt ramp until all corresponding HMA is placed. All work associated with this joint will not be paid for separately, but shall be included in the cost of planing.

If the transverse joint is tapered with a planing machine, a butt joint shall be cut into the taper the full depth of the lift of asphalt to be placed on the milled surface prior to commencement of resurfacing. All work associated with this joint will not be paid for separately, but shall be included in the cost of planing.

Other approved transverse joint tapers shall be maintained at the expense of the Contractor, and at a minimum shall incorporate a butt joint the full depth of the lift of asphalt to be placed on the milled surface prior to commencement of resurfacing.

Distressed or irregular areas identified in the planed surface by CDOT shall be patched.

The roadway shall be left in a safe and usable condition at the end of each work day. The Contractor shall take appropriate measures to ensure that the milled surface does not trap or hold water. All required pavement markings removed by the planning shall be restored before the roadway is opened to traffic.

Section 10 – Geotechnical and Roadway Pavements

-3-
REVISION OF SECTION 202
REMOVAL OF ASPHALT MAT (PLANING)

All planing shall be completed full width and parallel to the travel lanes before resurfacing commences unless otherwise directed by CDOT.

All material generated by the planning operation shall become the property of the Contractor unless otherwise noted in the Contract.

Add subsection 202.091 immediately following subsection 202.09 as follows:

202.091 Equipment

Each planer shall conform to the following:

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

The planer shall be capable of operating with automatic grade controls (contact or non-contact) on both sides of the machine using a 30 foot averaging system or other approved grade control systems. The use of such controls shall be described in the Contractor's QCP.

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

Subsection 202.12 shall include the following:

Macrotexture testing, macrotexture corrective actions, planers, brooms and all other work necessary to complete the item will not be measured and paid for separately, but shall be included in the work.

Section 10 – Geotechnical and Roadway Pavements

REVISION OF SECTION 304
AGGREGATE BASE COURSE

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

Subsection 304.02 shall include the following:

Materials for the base course shall be Aggregate Base Course (Class 6) as shown in subsection 703.03.

The aggregate base course (Class 6) shall meet the gradation requirements and have a resistance value of at least 78 respectively when tested by the Hveem Stabilometer method.

Recycled Asphalt Pavement (RAP), asphalt millings, or asphalt in any form whatsoever shall not be substituted for ABC Class 6.

Section 10 – Geotechnical and Roadway Pavements

REVISION OF SECTION 401
PLANT MIX PAVEMENT COMPACTION
(PNEUMATIC TIRE ROLLERS)

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

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

Both steel wheel and pneumatic tire rollers will be required on this project. If the Contractor has demonstrated that all of the manufacturer's recommendations were followed and the pneumatic tire roller is detrimental to the finished surface of the HMA, CDOT, in cooperation with the Contractor and the Region Materials Engineer, may waive the pneumatic tire roller requirement. Pnuematic tire rollers shall not be used on SMA pavement. Steel wheel rollers shall not be used in vibratory mode when compacting SMA on bridge decks.

Section 10 – Geotechnical and Roadway Pavements

REVISION OF SECTION 304 & 403
WEIGHT TICKET COLLECTION

Section 304 and 403 of the Standard Specifications is hereby revised for this project as follows:

Subsection 304.08 and 403.05 shall include the following:

The Contractor shall collect the original scale ticket on each load when it is delivered to the project site, and ensure that the information required in subsection 109.01 is shown on each ticket. The Contractor's representative assigned this project function shall not be responsible for any other duties. The scale tickets shall be available on site for CDOT personnel to inspect.

At the close of each workday, the Contractor shall provide CDOT envelopes, which contain that day's signed tickets and the following:

1. On each envelope: Project number, date of paving, type of material, daily total, and cumulative total.

2. One of the following:

    a. Two adding machine tape tabulations of the weight tickets with corresponding totals run and signed by different persons.
    b. One signed adding machine tape tabulation of the weight tickets that has been checked and signed by a second person.
    c. Signed check tape of computer scale tickets that have a cumulative total. These scale tickets shall be consecutive and without voids adjustments.

3. A listing of any overweight loads on the envelope, including ticket numbers and amount over legal limit.

4. A comparison of the actual yield for each day's placement to the theoretical yield. Theoretical yield shall be based on the actual area paved, the planned thickness, and the actual density of the mixture being placed. Any variance greater than +2.5% shall be indicated on the envelope and a written explanation included.

5. Asphalt Paving Inspector Daily Report (CDOT Form 282) shall be completed, in its entirety, by the contractor as work progresses.

Section 10 – Geotechnical and Roadway Pavements

-2-
REVISION OF SECTION 304 & 403
WEIGHT TICKET COLLECTION

Each day, the Contractor shall provide a vehicle identification sheet that contains the following information for each vehicle:

(1) Vehicle number
(2) Length
(3) Tare weight (Tractor and Trailer Combination – Tare Separately)
(4) Number of axles
(5) Distance between extreme axles
(6) All other information required to determine legal weight
(7) Legal weight limit

Should the Contractor fail to weigh each vehicle daily, CDOT may reject HMA loads until the Contractor complies with these requirements. All costs incidental to the foregoing requirements shall be included in the original contract prices for the project.

Section 10 – Geotechnical and Roadway Pavements

REVISION OF SECTION 401 AND 403
HOT MIX ASPHALT

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

In Subsection 401.22 under Basis Of Payment, delete the fifth paragraph.

Section 403 of the Standard Specifications is hereby revised for this project as follows:

Subsection 403.02 shall include the following:

The design mix for hot mix asphalt shall conform to the following:

TABLE 403-1

Property	Test Method	Value For Grading			
		S (100)			Patching
Air Voids, percent at: N (initial) [for information only] N (design)	CPL 5115	3.5 – 4.5			3.5 – 4.5
Lab Compaction (Revolutions): N (initial) [for information only] N (design)	CPL 5115	8 100			8 100
Stability, minimum	CPL 5106	30			30
Aggregate Retained on the 4.75 mm (No. 4) Sieve with at least 2 Mechanically Induced fractured faces, % minimum	CP 45	70			70
Accelerated Moisture Susceptibility Tensile Strength Ratio (Lottman), minimum	CPL 5109 Method B	80			80
Minimum Dry Split Tensile Strength, kPa (psi)	CPL 5109 Method B	205 (30)			205 (30)

Section 10 – Geotechnical and Roadway Pavements

Grade of Asphalt Cement, Top Layer					PG 76-28
Grade of Asphalt Cement, Layers below Top		PG 64-22			PG 64-22
Voids in the Mineral Aggregate (VMA) % minimum	CP 48	See Table 403-2			See Table 403-2
Voids Filled with Asphalt (VFA), %	AI MS-2	65-75			65-75
Dust to Asphalt Ratio Fine Gradation Coarse Gradation	CP 50	0.6 – 1.2 0.8 – 1.6			0.6 – 1.2 0.8 – 1.6

Note: AI MS-2 = Asphalt Institute Manual Series 2

Note: Mixes with gradations having less than 40% passing the 4.75 mm (No. 4) sieve shall be approached with caution because of constructability problems.

Note: Gradations for mixes with a nominal maximum aggregate size of one-inch or larger are considered a coarse gradation if they pass below the maximum density line at the #4 screen.
Gradations for mixes with a nominal maximum aggregate size of 3/4” to 3/8” are considered a coarse gradation if they pass below the maximum density line at the #8 screen.
Gradations for mixes with a nominal maximum aggregate size of #4 or smaller are considered a coarse gradation if they pass below the maximum density line at the #16 screen.

*Fractured face requirements for SF may be waived by RME depending on project conditions.

Section 10 – Geotechnical and Roadway Pavements

-3-
REVISION OF SECTIONS 401 AND 403
HOT MIX ASPHALT

Note: Gradations for mixes with a nominal maximum aggregate size of one-inch or larger are considered a coarse gradation if they pass below the maximum density line at the #4 screen.

Gradations for mixes with a nominal maximum aggregate size of ¾ inch or smaller are considered a coarse gradation if they pass below the maximum density line at the #8 screen.

All mix designs shall be run with a gyratory compaction angle of 1.25 degrees and properties must satisfy Table 403-1. CDOT Form #43 will establish construction targets for Asphalt Cement and all mix properties at Air Voids up to 1.0% below the mix design optimum.

TABLE 403-2

	Minimum Voids in the Mineral Aggregate (VMA)			
Nominal Maximum Size*, mm (inches)	*****Design Air Voids ****			
	3.5%	**4.0%**	**4.5%**	**5.0%**
37.5 (1½)	11.6	11.7	11.8	N/A
25.0 (1)	12.6	12.7	12.8	
19.0 (¾)	13.6	13.7	13.8	
12.5 (½)	14.6	14.7	14.8	
9.5 (⅜)	15.6	15.7	15.8	
4.75 (No. 4)	16.6	16.7	16.8	16.9
	* The Nominal Maximum Size is defined as one sieve larger than the first sieve to retain more than 10%. ** Interpolate specified VMA values for design air voids between those listed. *** Extrapolate specified VMA values for production air voids beyond those listed.			

Section 10 – Geotechnical and Roadway Pavements

-4-
REVISION OF SECTIONS 401 AND 403
HOT MIX ASPHALT

The Contractor shall prepare a quality control plan outlining the steps taken to minimize segregation of HMA. This plan shall be submitted to CDOT and approved prior to beginning the paving operations. When CDOT determines that segregation is unacceptable, the paving shall stop and the cause of segregation shall be corrected before paving operations will be allowed to resume.

CDOT approved Warm Mix Asphalt (WMA) may be allowed on this project in accordance with CP-59. The WMA shall utilize additives from the Approved Products List. Unique requirements for WMA design, production and acceptance testing as documented during CDOT WMA approval shall be submitted and approved prior to creation of the Form 43 and before any WMA production on the project. Any delays to the project due to WMA submittal and review shall be considered within the Contractor's control and will be non-excusable.

A minimum of one percent hydrated lime by mass (weight) of the combined aggregate shall be added to the aggregate for all hot mix asphalt.

The Contractor shall use an approved anti stripping additive. The amount of additive used shall be a minimum of 0.5 percent by weight of the asphalt cement. The additive shall be added at the refinery or at the hot plant. If liquid anti stripping additive is added at the plant, an approved in line blender must be used. The blender shall be in the line from the storage tank to the drier drum or pugmill. The blender shall apply sufficient mixing action to thoroughly mix the asphalt cement and anti-stripping additive.
Acceptance samples shall be taken at the location specified in either Method B or C of CP 41, as determined by the Region Construction and Materials personnel.

Aggregate, asphalt cement, additives, hydrated lime, and all other work necessary to complete each Hot Mix Asphalt item will not be paid for separately but shall be included in the Work.

Section 10 – Geotechnical and Roadway Pavements

REVISION OF SECTION 401, 403, AND 703
STONE MATRIX ASPHALT PAVEMENT

Sections 401 and 703 of the Standard Specifications are hereby revised for this Project as follows:

Subsection 401.02 shall include the following:

Recycled Asphalt Pavement (RAP) shall not be used in Stone Matrix Asphalt (SMA) mix.

Subsection 401.09 shall include the following:

Each SMA load shall be completely covered and securely fastened with a full tarp.

Subsection 401.16 shall include the following:

The SMA mixture shall be transported and placed on the roadway without drain-down or flushing. All flushed areas behind the paver shall be removed immediately upon discovery. If more than 50 square feet of flushed SMA pavement is ordered removed and replaced in any continuous 500 linear feet of paver width laydown, operations shall be discontinued until the source of the flushing has been found and corrected. CDOT shall designate the depth and area of all flushed areas requiring removal and replacement. All costs associated with the removal and replacement of the flushed areas shall be at the Contractor's expense.

Subsection 401.17 shall include the following:

Rollers shall not be used in a vibratory mode on SMA unless they are first used successfully in the demonstration control strip specified in subsection 403.03. Pneumatic wheel rollers shall not be used on SMA mix.

The relative compaction for all SMA mixtures will be measured from roadway cores in accordance with CP 44, Method B, unless the SMA mixture is being placed on a structure (bridge deck) in which case nuclear gauge measurements may be used. When cores are used, the Contractor shall provide all labor and equipment for the coring operation and filling the core holes. When nuclear density gauges are used, the tests will be performed in accordance with CP 81 and CP 82.

In-place density for SMA not placed on a bridge shall be 93 to 97% of the SMA mix maximum specific gravity as measured according to CP 51.

Section 10 – Geotechnical and Roadway Pavements

-2-
REVISION OF SECTION 401, 403, AND 703
STONE MATRIX ASPHALT PAVEMENT

At a minimum frequency of once per day, the in-place density for SMA placed on the bridge deck shall be measured according to CP 81. The in-place density of SMA shall be a minimum of 94 percent of the SMA mix maximum specific gravity as measured according to CP 51

Subsection 401.22 shall include the following:

The specifications for gradation acceptance shall be applied for all SMA placed on the project.

Subsection 703.06 shall include the following:

Mineral filler for the Stone Matrix Asphalt pavement shall be limestone dust and shall meet the requirements of this subsection and the following:
Plasticity Index (AASHTO T90) 4% Maximum
The Contractor shall submit hydrometer analysis (AASHTO T88) for the mineral filler used in the SMA mix.

Section 403 of the Standard Specifications is hereby revised for this Project as follows:

Subsection 403.01 shall include the following:

This work includes placing a Stone Matrix Asphalt (SMA) pavement as shown on the plans.

Subsection 403.02 shall include the following:

The SMA gradation for this Project shall be ½ inch.
Mixture design and field control testing of SMA shall be performed using SuperPave (CPL 5115, 100 Gyrations)

Section 10 – Geotechnical and Roadway Pavements

-3-
REVISION OF SECTION 401, 403, AND 703
STONE MATRIX ASPHALT PAVEMENT

The Contractor shall submit a mix design meeting the appropriate specification requirements for the following to CDOT at the Pre-paving Conference.
The SuperPave SMA mix design shall conform to the requirements of Table 403-1a:

Table 403-1a

Property	Test Method	Value for SMA
Air Voids, percent at: N(Design)	CPL 5115	3.0 – 4.0
Lab compaction (Revolutions) N(Design)	CPL 5115	100
Accelerated Moisture Susceptibility, tensile strength Ratio, (Lottman), minimum	CPL 5109, Method B	70
Minimum Dry Split Tensile Strength, psi	CPL 5109, Method B	30
Grade of Asphalt Cement		PG 76-28
Voids in the Mineral Aggregate (VMA) %, minimum	CP 48	17
Draindown at Production Temperature	AASHTO T305	0.3 maximum
% VCA^{1}_{MIX}	AASHTO R 46	Less than VCA_{DRC}[2]

Note: The current version of CPL 5115 is available from CDOT
Note: Copies of AASHTO R 46 and M 325 can be obtained from CDOT
Note: [1]Voids in the Coarse Aggregate
Note: [2]Dry-rodded condition

Form 43 will establish construction targets for asphalt cement and all mix properties at air voids up to 1.0% below the mix design optimum.

A minimum of 1% hydrated lime by weight of the combined aggregate shall be added to the aggregate for all Stone Matrix Asphalt.

Section 10 – Geotechnical and Roadway Pavements

-4-
REVISION OF SECTION 401, 403, AND 703
STONE MATRIX ASPHALT PAVEMENT

The SMA mix design must be Approved by CDOT before any pavement is placed on the project. In addition, the Contractor shall provide field control testing during production of the SMA mix and for the demonstration control strip. The Contractor shall perform the following tests and provide the results to CDOT during production:

For the SMA mix design, the Contractor shall perform the following tests and provide the results to CDOT during production:

Superpave Mix Property	Frequency
Draindown (AASHTO T 305)	1/1000 tons or fraction thereof
Percent Voids in the total mix @ $N_{(design)}$	1/1000 tons or fraction thereof
VMA (Percent Voids in the Mineral Aggregate) @ $N_{(design)}$	1/1000 tons or fraction thereof
Lottman, CPL 5109, Method B	1/5000 tons or fraction thereof
Dry Tensile Strength, CPL 5109	1/5000 tons or fraction thereof
Percent AC & Aggregate Gradation CP 5120	1/1000 tons or fraction thereof

CDOT approved Warm Mix Asphalt (WMA) may be allowed on this project in accordance with CP-59. The WMA shall utilize additives from the Approved Products List. Unique requirements for WMA design, production and acceptance testing as documented during CDOT WMA approval shall be submitted and approved prior to creation of the Form 43 and before any WMA production on the project. Any delays to the project due to WMA submittal and review shall be considered within the Contractor's control and will be non-excusable.

Subsection 403.03 shall include the following:

The mineral filler for SMA shall be stored in a separate silo and added automatically in the correct proportion. The mineral filler addition equipment shall be electronically or mechanically interlocked to the aggregate feed sensors so that the proper amount of mineral filler is added whenever SMA is produced.

Section 10 – Geotechnical and Roadway Pavements

-5-
REVISION OF SECTION 401, 403, AND 703
STONE MATRIX ASPHALT PAVEMENT

The SMA mineral filler shall be added at the same point the asphalt cement is added to the aggregate.

Tack coat between the existing pavement and Stone Matrix Asphalt pavement shall be placed at a rate between 0.03 and 0.05 gallons per square yard.

Before proceeding with SMA placement, the Contractor shall demonstrate the ability to produce and place a satisfactory mix in a Demonstration Control Strip (DCS). The Contractor will coordinate with the Quality Control Manager on the proposed location of the DCS. The DCS shall consist of a minimum quantity of 500 tons placed in one lane, full width. Within the last 200 tons of SMA placed in the DCS, the Contractor and CDOT shall determine properties (VMA, Voids, in-place density, AC content, and gradation of the project produced SMA mix used in the DCS and provide the results to the Contractor's Quality Control Manager. The Contractor may proceed with full production if all mixture properties are within the specified tolerances and the project compaction is established and approved by CDOT.
If a DCS will be placed on the actual roadway, it shall be full width and shall extend for a minimum distance of 150 feet. The location of the DCS shall be no closer than 100 feet to the expansion joint of any bridge with concurrent deck rehabilitation or construction. To determine the in-place density and roller pattern, one core shall be taken at three random locations within the last 200 tons of the DCS. As part of the Contractor's QMP, the coring locations shall be determined using a stratified random sampling process. The cores shall be immediately submitted to the Contractor's Quality Manager and will be used for determining acceptance of the DCS. Densities of the random samples will be determined by cores according to CP 44. Coring shall be performed by the Contractor under the Quality Manager's observation.

The DCS will be designated as a separate process.

Subsection 403.04 shall include the following:

Stone Matrix Asphalt will be measured by the actual number of tons that are completed and accepted.

Subsection 403.05 shall include the following:

Section 10 – Geotechnical and Roadway Pavements

-6-
REVISION OF SECTION 401, 403, AND 703
STONE MATRIX ASPHALT PAVEMENT

Mix design, furnishing, hauling, preparing, and placing all materials, including aggregates, asphalt cement, limestone dust, hydrated lime, tack coat, and approved demonstration control strip; labor, equipment tools, setting of lines and guides where specified, and all other work necessary to complete the item will not be paid for separately but shall be included in the work.

Stone Matrix Asphalt will be measured by the actual number of tons that are completed and accepted.

Section 10 – Geotechnical and Roadway Pavements

REVISION OF SECTIONS 403 AND 620
HOT MIX ASPHALT TESTING, IGNITION FURNACE

If Reclaimed Asphalt Pavement is to be included in the Hot Mix Asphalt supplied on this project then the following shall apply:

Section 620.03 of the Standard Specifications is hereby revised for this project as follows:

In addition to the details shown in the plans for this project the field laboratory Class 2 shall include a forced air ignition furnace as described in CPL 5120. The Forced Air Ignition Furnace shall be installed per manufacturer's recommendations.

The 403 Pay Item of the Quality Assurance Schedule in the Field Materials Manual is hereby revised for this project as follows:

Asphalt content shall be measured following CPL 5120. Residual aggregate obtained by this method shall be used for gradation analysis according to CP 31.

10.3.8 Detour
Section 621 is hereby added to the Standard Specifications for this Project and shall include the following:
621.01 This work consists of constructing detours as shown in the plans for all phases of construction on US 6 and all applicable side streets; maintenance of the detours; removal of the detours; and removal and replacement of appurtenances required to construct and operate the detours including but not limited to guardrail, curb and gutter, detour pavement, embankment material and unclassified excavations.
621.02 All materials required for detour shall comply with project standard specifications and special provisions.
The Contractor shall be responsible for quality control required to assure adequate quality of embankment material, aggregate base course, HMA used in the construction of the detour.
621.03 The detour locations and dimensions for all phases of construction shall be as shown on the plans.
If the materials and thickness furnished for the detour pavement result in an inadequate detour structure, the Contractor will provide additional thickness, materials, or other measures necessary to provide a satisfactory pavement for the life of the detour. These additional improvements shall be furnished at no additional cost. All necessary signs, pavement markings and other traffic control devices shall be provided in accordance with the traffic control plan.
621.04 The Contractor shall maintain the detour for the entire period that it is open to traffic. Any distress that affects the ride, safety, or serviceability of the detour roadway shall be corrected to the satisfaction of CDOT at the expense of the Contractor.

Section 10 – Geotechnical and Roadway Pavements

-2-
REVISION OF SECTIONS 403 AND 620
HOT MIX ASPHALT TESTING, IGNITION FURNACE

The Contractor shall have a maintenance plan for all hours of the day (7 days a week) for executing a long term patch of damaged detour pavement, and have forces available to perform this work within 2 hours of notice of such damage. The Contractor shall designate a person to be “on call” during all non-working hours, including no work periods as a point of contact for this work.

If CDOT determines the detour has deteriorated to the point where the safety of the traveling public is compromised (i.e. potholes), the lane(s) in question shall be closed and the Contractor shall be directed to execute their maintenance plan. If the Contractor is unresponsive to this order by CDOT, CDOT maintenance forces will be mobilized to close the lane and maintain the closure until such time as the Contractor is available to perform this work. CDOT Maintenance forces will be responsible for the lane closure only, and only until such time as the Contractor arrives on site and relieves them. CDOT Maintenance will not be responsible for repair of any of the contract installed detour. All time and expense for CDOT Maintenance work will be tracked by CDOT and deducted from money due to the Contractor. Any lane closures that are required outside of the allowable lane closure hours will be charged as 'working time violation' as established in this contract.

Section 11 – Earthwork

Construction Requirements

Clearing and Grubbing

Trees, logs, limbs, stumps, brush, and trash and etc. cleared and grubbed from the Project shall be removed from the Site to an offsite location selected by the Contractor.

Removal of Existing Pavement

Existing pavement removed as part of this project, where required, shall first be saw cut vertically, full depth at the limits of removal. The cost of saw cutting and removal of the pavement, where required, shall be included in the cost of the work.

Excavations and Embankments

Embankment Material shall be in accordance to Technical Requirements Section 10 – Geotechnical and Roadway Pavements.

Benching Requirements

New embankment shall be benched into the existing slopes, where required in accordance with Section 203.06 of the Standard Specifications.

Compaction Requirements

The type of compaction for the Project shall be per Revision of Sections 203, 206, 304 and 613 – Compaction or as otherwise specified in the standard special provisions or by CDOT.

Depth of moisture-density control for this Project shall be as follows:

Full depth of all embankments

6 inches for bases of cuts and fills

Reuse of Existing Materials

Asphalt millings are allowed to be used for embankment material and shall be placed in accordance with the Standard Specifications. Recycled Asphalt Pavement (RAP), asphalt millings, or asphalt in any form whatsoever shall not be substituted for ABC Class 6 below HMA pavement.

Section 11 – Earthwork

Project Special Provisions

REVISION OF SECTIONS 105, 106, AND 203

CONFORMITY TO THE CONTRACT OF EMBANKMENT

Sections 105, 106 and 203 of the Standard Specifications are hereby revised for this project as follows:

Subsection 105.03 shall include the following:

Conformity to the contract of embankment construction shall be determined in accordance with the following:

(a) *Quality Control Plan.* The Contractor shall be responsible for Quality Control (QC) for all embankment material on this project. The Contractor shall submit a written Quality Control Plan (QCP), including a methods statement, to the Engineer for acceptance. The QCP shall include but not be limited to the following:

(1) Maximum lift thickness of eight inches in accordance with subsection 203.06 or as directed.
(2) Compaction equipment capable of obtaining the specified compaction.
(3) Water trucks with an adequate distribution system that will apply water evenly.
(4) List of all inspection and materials testing forms and procedures to be utilized by the Contractor.
(5) Adherence to Table 106-4 requiring minimum testing frequency.

The Contractor shall submit the QCP at least five working days prior to the start of any embankment work. The Engineer's review of the QCP will not exceed two working days. Work shall not begin until the QCP has been accepted in writing by the Engineer.

(b) Documentation. The Contractor shall maintain current records of quality control operation activities, and tests performed. These records shall be on the forms shown in the QCP, and shall include as a minimum, the Contractor, or subcontractor, the number of personnel working, weather conditions, type of equipment being used, delays and their cause, and deficiencies along with corrective action taken. Such records shall cover both conforming and defective or deficient features. Additional documentation to the Engineer shall include all daily test results, daily inspection reports, daily non-compliance reports, and monthly certification reports. Copies of these records and a statement that work incorporated in the project complies with the Contract shall be submitted to the Engineer prior to payment for the work or upon request. Monthly certification reports shall be stamped with the seal of a Professional Engineer registered in Colorado. Failure to provide the Engineer with the necessary documentation shall result in the suspension of payments on embankment until the documentation has been completed and accepted by the Engineer. CDOT Quality Assurance documentation shall not be used as supporting documentation for the contractor's certification.

Section 11 – Earthwork

-2-

REVISION OF SECTIONS 105, 106, AND 203
CONFORMITY TO THE CONTRACT OF EMBANKMENT

CDOT or CDOT's certified representative will be responsible for Quality Assurance (QA) and Independent Assurance Testing (IAT).

Subsection 106.03 shall include the following:

Testing of embankment construction shall conform to the following:

The supervisor responsible for the direct supervision for the process control sampling and testing shall be identified in the QCP and be qualified according to the requirements of CP-10 (Note: this will require a PE or a NICET Level III certification).

The technicians taking samples and performing tests must be qualified according to requirements of CP 10 (Note: this will require WAQTC qualification).

A process control technician shall be required to be on-site full time whenever earthwork activities are taking place.

The following frequency guide schedule for minimum materials sampling, testing and inspection shall be used for the elements shown in Table 106-4. The project verification sampling and testing procedures shown in the CDOT Field Materials Manual under the frequency guide schedule for minimum materials sampling, testing and inspection shall be used for all other items not shown.

Section 11 – Earthwork

-3-

REVISION OF SECTIONS 105, 106, AND 203
CONFORMITY TO THE CONTRACT OF EMBANKMENT

Table 106-4

EXCAVATION AND EMBANKMENT TESTING SCHEDULE

Item	Minimum Testing Frequency Contractor's Process Control	Element	Minimum Testing Frequency CDOT verification Testing
203 EMBANKMENT	None Required	Soil Survey (Classification)	See CDOT Field Materials Manual for Frequency
	1 per soil type	Moisture – Density Curve	1 per soil type
	1 per 500 cubic yards or fraction thereof.	In-Place Density	1 per 1,000 cubic yards or fraction thereof.
	1 per 100 cubic yards or fraction thereof.	In-Place Density when within 100 ft. of Bridge Approach(s).	1 per 250 cubic yards or fraction thereof.
	1 per 5,000 cubic yards or fraction thereof.	1 Point Check	1 per 10,000 cubic yards or fraction thereof.

Qualifications for testing and personnel are contained in Section 203, Chapter 200 of the CDOT Field Materials Manual, CP-10, CP 13, CP 15, and CP 80, and the CDOT Inspectors Checklist.

Subsection 203.02 (a) shall include the following:

Unclassified Excavation shall include removal of unstable or unsuitable material within the roadway as determined and directed by the Engineer.

Section 11 – Earthwork

REVISION OF SECTION 206
SHORING

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

Subsection 206.03 shall include the following:

Shoring is defined as any temporary construction used to support the loads adjacent to any excavation or embankment.

The Contractor shall be responsible for locating, sizing, designing, and constructing shoring which provides all necessary rigidity, and supports the loads as required to facilitate construction.

When the height of shoring exceeds 4 feet above the base of the footing excavation, the Contractor shall provide shoring drawings to the Engineer for information only. The drawings shall be prepared by, and contain the seal and signature of a Professional Engineer registered in the State of Colorado. These drawings shall be approved and signed by the Contractor, and shall be provided to the Engineer at least ten days prior to construction.

Prior to placing construction and/or traffic loads, the Contractor's Professional Engineer shall certify in writing that shoring materials and construction have been inspected, and that all shoring and construction are in conformity with the approved shoring drawings. A copy of the certification shall be provided to the Engineer.

If embankment, construction, traffic, or other surcharge loads in excess of the original shoring design are to be placed adjacent to any shoring, the Contractor shall provide a signed letter from the Contractor's Professional Engineer prior to the load placement stating that the shoring will support the additional loads.

Shoring drawings shall include as a minimum, the following:

1. The size and grade of all structural materials.
2. Design notes, including design assumptions, and construction details.
3. Where applicable, shoring drawings shall restrict heavy equipment placement at specific locations adjacent to the shoring.
4. The Contractor's Professional Engineer shall determine whether de-watering of the shored excavation will be required; and, if so, shall describe the requirements (i.e., head added by the pump, flow rate, minimum pump size, etc.) and methods to be used for dewatering.
5. All other information determined by the Contractor's Engineer to be pertinent to the design and construction of the shoring.

Section 11 – Earthwork

-2-
REVISION OF SECTION 206
SHORING

It is up to the Contractor to provide necessary shoring in order to build the retaining walls safely and to keep the disturbance from adversely affecting the soil mass outside the CDOT right of way.

Whether shoring is planned for use or not, the Contractor shall have a shoring plan ready for implementation should shoring become necessary due to back slope failure or the appearance of instability. This shoring plan shall be presented to the Engineer prior to beginning excavation for the retaining wall work.

Section 12 - Hydraulics

General

The Project shall include all Work for the modification of existing drainage facilities, construction of new drainage facilities, construction of permanent Best Management Practices (BMPs), comply with CDOT Municipal Separate Storm Sewer System (MS4) permit, the City of Lakewood MS4 Permit, the requirements of this section 12 and all other applicable permits and standards as included in the Contract Documents to provide adequate highway drainage for this Project. The project shall be designed to accommodate the design flows and to meet project design criteria.

This project is not located within a FEMA floodplain.

The drainage design requirements for all proposed and existing structures shall be in accordance with the CDOT Drainage Design Manual and City of Lakewood Storm Drainage Design Manual, where applicable.

The Contractor shall design drainage facilities to be compatible with existing or proposed drainage systems on adjacent properties, and shall maintain existing drainage patterns. If the Contractor proposes that existing drainage patterns must be changed, the Contractor shall design a solution that does not adversely impact property owners outside the ROW; shall obtain approval from CDOT prior to construction; and shall secure all other necessary approvals, permits, and easements.

Stormwater Permits

The Contractor shall be cognizant of and adhere to the requirements of the various environmental and stormwater permits that will be necessary for construction and operation of this Project. Fines may be incurred upon the project for permit non-compliance by CDOT or other regulatory agencies. Any non-compliance fines shall be passed onto the Contractor. See Section 5 – Environmental for more information.

Coordination with Other Agencies and Disciplines

The Contractor shall coordinate all water resource issues with affected regulatory agencies, where appropriate. The Contractor shall include CDOT in all meetings with the water resource regulatory agencies.

The Contractor shall acquire approvals through the permit processes as required by the City of Lakewood and pay any associated fees. The Contractor shall submit the required design documents to the City of Lakewood for approval and obtain acceptance of the design from the City of Lakewood including construction stormwater permits.

Hydrology

Hydrology calculations shall be in accordance with CDOT Drainage Design Manual and the City of Lakewood Drainage Design Manual. Hydrologic analysis is provided in the Reference Documents.

Section 12 - Hydraulics

Hydraulic Design Requirements

Drainage Design Software

The following software (most recent versions) may be used in performing drainage design calculations.

1. USACE, HEC-RAS
2. FHWA, HY-8
3. Haestad Methods, StormCAD
4. Haestad Methods, Flow Master
5. Haestad Methods, Culvert Master
6. EMS-I, WMS
7. Inroads Storm and Sanitary
8. UDFCD Spreadsheets

Data Collection

The Contractor shall be responsible for all additional mapping and surveys necessary to meet the Contract Requirements. The contractor shall be responsible for verifying utility locations and avoiding or relocating utilities due to design of drainage facilities.

The Contractor shall design drainage facilities compatible with existing or proposed drainage systems on adjacent properties, and shall preserve existing drainage patterns wherever possible. If existing drainage patterns must be changed due to design of the Project, the Contractor shall design and construct a solution that does not adversely impact property owners outside the ROW. The contractor's hydraulics design approach shall meet CDOT and FHWA requirements.

Roadways

Roadway component geometric configurations shall be designed to provide adequate drainage and minimize hydroplaning and icing problems.

Roadway Ditches

The roadway ditch design shall minimize erosion risk with the appropriate design and erosion control measures. The design shall be in accordance with the CDOT Drainage Design Manual and City of Lakewood requirements where applicable.

Bridge Deck Drainage

Bridge deck drainage requirements shall be determined according to criteria in the CDOT Drainage Manual.

Pipe Material Selection

Drainage pipes shall have water tight joints and comply with the current CDOT Pipe Material Selection

Section 12 - Hydraulics

Policy. If the pipe is part of a storm sewer system with concrete manholes and inlets then concrete pipe shall be used for uniformity of material.

Municipal Separate Storm sewer System (MS4)

CDOT has obtained an MS4 Permit for the storm sewer systems that it owns and maintains (Permit Number COS-000005). CDOT submitted a modification request for the permit on April 17, 2014. The Water Quality Control Division conditionally approved CDOT's request on April 22, 2014, and further clarified the Interim Program Modificaton on May 22, 2014. The Contractor shall be responsible for complying with the terms and conditions of the CDOT MS4 Permit and the Interim New Development and Redevelopment Program Modification that pertains to the Project.

The 6th and Garrison Project falls under the Interim Program Modification. This project does not have an EA/EIS associated with it, it does not discharge to an impaired water as defined in the Requirements for CDOT's Interim New Development and Redevelopment Program Description, and as designed in the reference documents, does not increase the imperviousness within the project limits by 20%. Therefore this is a Nonpriority Project and no permanent water quality BMP's at the project site are required to meet CDOT's MS4 permit. The Construction Program of CDOT's MS4 Permit remains unchanged, the Contractor shall follow all requirements for temporary erosion control BMPs, and will complete the NDRD Evaluation and Tracking Form, as part of the cost of the Work and as discussed in Sections 5 and 17.

Any impacts to the City of Lakewood ROW will need to comply with the City of Lakewood's MS4 permit, and be approved by the City of Lakewood.

Preliminary Hydraulic Report

A Preliminary Hydraulics Report is provided in the Reference Documents. The report illustrates a summary of pertinent hydraulic information in accordance with the CDOT Drainage Design Manual.

Deliverables:

Final Hydraulic Report

The Final Hydraulic Report (or addenda to previously Accepted reports), shall be prepared by the Contractor and submitted for acceptance prior to Final Project Acceptance. The Final Hydraulic Report shall follow the report outline in the CDOT Drainage Design Manual, and shall include references to relevant design criteria, circumstances influencing design, discussion of all drainage issues and drainage facilities, permanent water quality features, detailed design calculations, computer printouts, and appropriate maps and plans. The final drainage reports shall be sealed by a Colorado Licensed Professional Engineer, and one copy shall be submitted to the CDOT Project Engineer for Acceptance.

At a minimum, the Contractor shall submit the following to the CDOT Project Engineer for review, approval and/or acceptance:

Section 12 - Hydraulics

NDRD Evaluation and Tracking Form

The NDRD Evaluation and Tracking Form is to be completed and submitted for all projects that disturb an acre or more within CDOT's MS4 area. The Form is included in the Reference Document Section of the RFP.

Drainage Design Deliverables

The Contractor shall prepare plans for all drainage related facilities for the Project in a format that follows the documentation procedure in chapter 4 of the *CDOT Drainage Design Manual,* and the *CDOT CADD Manual* and *CDOT Drafting Manual*. The Contractor shall submit all applicable plans with each Drainage Report. All deliverables shall follow the Quality Management Plan for the Project as described in Book 2, Section 3, Quality Management. The Contractor shall include the following for all drainage plan deliverables:

PLAN VIEW

1. Provide the location of all existing and proposed Storm Drains. Provide a label for each proposed Storm Drain location. The Contractor shall establish a labeling system that is specific to each proposed Storm Drain system and provide a table to summarize all pertinent information. The table shall include at a minimum the Drain Line and Sheet Number where the profile can be found.

2. Provide the location of all existing and proposed inlets, manholes, end sections, and outlet protection. Provide a label for each proposed inlet, manhole, end section, outlet Structure and outlet protection. Include a table that summarizes all pertinent information. The table shall include, at a minimum, the Label ID, Station & Offset, Item, Length, Pay Depth, and Notes.

3. Provide all existing and proposed grading.

4. Provide all Utility locations.

5. Provide location of ROW lines.

PROFILES

1. Provide profiles for all proposed Storm Drains. Include the Label ID from plan view sheets, station and offset, invert elevations, rim elevations, Structure depth, slopes, sizes, material, Utility crossings, existing and proposed finished grade lines, the design flow for the 10-year and 100-year event, and the calculated HGL for the 10-year and 100-year event.

2. Provide profiles for all proposed Cross Drains. Include the Label ID from plan view sheets, station and offset, invert elevations, slopes, sizes, material, Utility crossings, and existing and proposed finished grade lines. Provide the drainage area of contributing basin, 100-year discharge, and headwater elevation on all applicable profile sheets for Cross Drains.

Section 12 - Hydraulics

DRAINAGE DETAILS

1. Include details for all non-standard CDOT items.

Deliverable	Acceptance or Approval	Schedule
Final Hydraulic Report	Acceptance	Prior to Construction
Pipe Selection Report	Acceptance	Prior to Construction
NDRD Evaluation and Tracking Form	Acceptance	Prior to Construction
Drainage Plans, Profiles and Details	Acceptance	Prior to RFC

Section 13 – Roadway Design

Administrative Requirements

The horizontal and vertical alignment may be adjusted to provide a more economical design that meets project constraints identified within this document.

The horizontal and vertical alignment shall tie into existing US 6 at the same approximate limits as shown in the Reference Documents.

US 6

The primary requirements for the design and construction of highways shall include, but are not limited to, the following documents (latest versions at project advertisement):

- CDOT, CDOT Design Guide, 2005.
- AASHTO, A Policy on Geometric Design of Highways and Streets, 2011 (PGDHS).
- AASHTO, Roadside Design Guide, Fourth Edition, 2011.
- CDOT, Standard Plans, M & S Standards, July 2012.
- CDOT, Standard Specifications for Road and Bridge Construction, 2011.
- United States Access Board, ADA Accessibility Guidelines for Buildings and Facilities.
- State of Colorado, State Highway Access Code

Local Roadways

The requirements for the design and construction of local roadways shall include, but are not limited to, the following documents:

- Local Agency Design Standards.
- AASHTO, A Policy on Geometric Design of Highways and Streets, 2011 (PGDHS).
- AASHTO, Roadside Design Guide, Fourth Edition, 2011.
- State of Colorado, State Highway Access Code.
- Local Agency Standard Drawings.
- United States Access Board, ADA Accessibility Guidelines for Buildings and Facilities.

Other requirements provided on the plans shall govern the design and construction as applicable.

Section 13 – Roadway Design

Design Requirements

Design of the Project shall be in accordance with the Technical Requirements Section 1 - General.

Design and Plan Submittals

In addition to the submittal requirements specified in this Section, the Contractor shall submit all design and plan documents to the CDOT Project Engineer for Acceptance as required in Section 3 – Quality Management.

Traffic Lighting Analysis

The contractor may use passenger comfort criteria to determine the length of sag vertical curves in place of the headlight stopping sight distance requirements in the design criteria, provided the final lighting within the project limits meets current design standards. The contractor shall perform and submit a lighting assessment of the existing lighting for acceptance. If additional lighting is required the contractor shall coordinate with CDOT and local agencies to provide a lighting design that meets current design standards.

Roadway Requirements

General

The Contractor shall provide a design alignment, to the CDOT Project Engineer during the design review, which demonstrates the ability to meet all design criteria and requirements.

The design speed for US 6 shall be 70 mph.

Typical Section

The US 6 typical section shall consists of three 12-foot lanes with 4-foot inside and 12-foot outside shoulders in each direction as shown in the Reference Documents. The Structure typical section shall include bridge rail and chain link fence. The Garrison typical section shall consist of four 11-foot lanes with bike path and sidewalks. See Reference Documents for roadway typical sections.

Section 13 – Roadway Design

Cross Slope and Superelevation

Normal Cross Slope

All new and reconstructed pavement sections shall have a normal cross slope of 2 percent.

For pavement widening sections, the widened section shall have a normal cross slope of 2 percent.

Superelevation Rates

The maximum superelevation rate shall be 6%.

Stopping Sight Distance

For US 6, the stopping sight distances and decision sight distances shall meet or exceed the requirements of CDOT Roadway Design Guide Table, Exhibit 3-1. Stopping sight distances shall be determined in accordance with the PGDHS.

Fill and Cut Slopes and Clear Zones

The Contractor shall design cut and fill slopes to obtain clear zones and shall exhaust all design efforts to eliminate the use of guardrail. Where clear zones cannot be obtained within CDOT right-of-way, the use of guardrail shall be allowed as an option, subject to CDOT's evaluation and acceptance.

Clear zones shall be designed in accordance with the recommendations of AASHTO, Roadside Design Guide.

A City of Lakewood Grading Permit may be required for grading and earthwork construction including excavations, fills, and embankments. The Contractor shall coordinate with the City of Lakewood to determine if their proposed design requires a Grading Permit. When required, the Contractor shall obtain and adhere to the requirements outlined in the Permit.

Roadside Slopes Adjacent to Pavement

(Note: All slopes stated herein are in terms of horizontal: vertical)

The Point of Slope Selection (POSS) is defined as the location at which the roadside slope adjacent to the pavement ends and the cut or fill slope begins. Width and slope of the area between the edge of pavement (or sidewalk) and the POSS shall be as follows:

1. Mainline US 6: 12 feet minimum at a 6:1 slope
2. Ramps: 12 feet at a 6:1 slope

Section 13 – Roadway Design

3. Curb and sidewalk areas: 2 feet at a 50:1 slope

Typical sections shall include a hinge point and maintain 2% positive drainage in the base course material as described in the CDOT Roadway Design Guide, Section 4.4 Typical Sections.

Fill Slopes

Fill slopes beyond the POSS shall be designed and constructed in accordance with the following priority.

1. Use 6:1 slopes where fill heights are less than 4 feet, and matches with existing conditions that can be obtained within the Project limits.
2. Use 4:1 slopes where fill heights are greater than 4 feet but less than 10 feet, and matches with existing conditions that can be obtained within the Project limits.
3. Use 3:1 slopes where fill heights are less than 10 feet and slopes steeper than 4:1 are required to match existing conditions within the Project limits.
4. Use 3:1 slopes where fill heights exceed 10 feet, and matches with existing conditions can be obtained within the Project limits and clear zone can be obtained within the Project limits.
5. Where the above conditions cannot be obtained, the Contractor may use any of the following design approaches:

    a. Use 3:1 to 2.5:1 slopes with guardrail protection. Slopes 3:1 or steeper shall incorporate the use of soil retention blankets in compliance with the requirements of Section 17, Landscaping.

    b. Use retaining walls as necessary, with guardrail protection. Where retaining walls are used, provide a traversable surface with a maximum 6:1 cross slope and minimum 10 feet width between face of wall and ROW or permanent easement line, fence line, or other obstruction.

Fill slope areas shall be designed to prevent Roadway and slope drainage from flowing onto adjacent properties.

All breakpoints shall be rounded to provide for a pleasing appearance.

Cut Slopes

Cut slopes beyond the POSS shall be designed and constructed in accordance with the following priorities:

Section 13 – Roadway Design

1. Cut slopes must be transitioned at the match with the 6:1 slopes adjacent to Roadway pavement in such a manner to comply with the recommendations of the AASHTO Roadside Design Guide.
2. Use 4:1 or flatter slopes for cut slopes where matches with existing conditions can be obtained within the Project limits.
3. Use 3:1 slopes for cut slopes where such slopes steeper than 4:1 are necessary to obtain matches with existing conditions within the Project limits.
4. Where the above conditions cannot be obtained, the Contractor may use any of the following design approaches:

    a. Use 3:1 to 2.5:1 slopes with guardrail protection. Slopes 3:1 or steeper shall incorporate the use of soil retention blankets in compliance with the requirements of Section 17, Landscaping.

    b. Use retaining walls as necessary, with guardrail protection. Where retaining walls are used, provide a traversable surface with a maximum 6:1 cross slope and minimum 10 feet width between face of wall and ROW or permanent easement line, fence line, or other obstruction.

Cut slope areas shall be designed to prevent Roadway and slope drainage from flowing onto adjacent properties.

All breakpoints shall be rounded to provide for a pleasing appearance. Cut slopes shall include a brow ditch at the top to control offsite storm water from eroding cut slope.

Guardrail

Guardrail along outside shoulders shall only be allowed, with CDOT's evaluation and acceptance, wherever clear zone requirements cannot be achieved with cut/fill slope configuration within the ROW.

The Contractor shall design the guardrail needed for the structure approaches and other areas that do not meet clear zone requirements. All outside shoulder guardrail type 3 shall be galvanized steel. All Posts shall be galvanized steel with composite blocks. All work shall be as specified in CDOT Standard M-606-1. The Contractor shall pave asphalt a minimum of 1-foot behind all Type 3 guardrail installed as part of the Work.

Median barrier is required along the entire length of US 6. Median barrier shall be concrete barrier in accordance with CDOT Standard M-606-13. All concrete barriers shall be cast-in-place. Precast barrier is not allowed for permanent installations.

Approach Roads

Roadway approaches shall be designed to have sufficient sight distance as per reference Standards.

Section 13 – Roadway Design

Sidewalks

The contractor shall provide curb ramps at all four quadrants on Garrison Street that are ADA compliant. The contractor shall verify ADA compliance of existing curb ramps to remain.

Design Exception Process

Design Exceptions in addition to those identified herein shall be subject to the Approval of CDOT. If determined to be necessary by CDOT, Design Exceptions may be subject to the Approval of FHWA.

The Contractor shall comply with the following requirements when requesting a Design Exception to the requirements herein:

1. The Contractor shall submit Design Exception requests in the form of a letter addressed to the CDOT Project Director for Approval prior to issuance of applicable Released for Construction Documents.
2. The Design Exception request shall consist of the following items:

    A. A letter identifying the exception(s) by number, Project number, location, and status (new submittal, resubmittal, etc.)
    B. A completed CDOT Form 464a
    C. Supporting documentation indicating the justification for the Design Exception. Justification shall address the following items:
        (1) Site conditions of the exception.
        (2) Compelling reason for the exception, including which standard is not being met. If the exception affects any other standards, state what will be done to mitigate the effects of the exception.
        (3) Effects of the exception on safety and operation of the facility.
        (4) Previous crash history near the location of the exception.
        (5) Calculations estimating the cost of attaining the design standard and costs of exception as proposed.
        (6) Effect on scenic, historical, or other environmental features.
        (7) Plan and profile drawings depicting the exception.

Construction Requirements

Removals

The Contractor shall be responsible for the removal of all items on the project designated for removal or found to conflict with project design elements. Removal items shall become the property of the Contractor unless designated to remain property of CDOT. Removal items shall include, but not be limited to: structures/portions of structures and obstructions, signs designated for removal, asphalt mat, culverts, and fencing. All removals shall be performed in accordance with Standard Specification 202.

Section 13 – Roadway Design

Fencing/Gates

Temporary Fencing

Installation of temporary fencing will be required to protect adjacent private property. In remaining areas, temporary fencing should be considered to control construction operations and avoid impacts beyond ROW limits. Temporary fence shall be placed as may be required in any other section of the Contract.

Permanent Fencing

Fencing shall be provided to delineate ROW along the US 6 Corridor. The fence shall be 72" chain link. The fence shall be protected with a 2 foot wide asphalt weed barrier, with the posts placed at the centerline of the barrier.

Gates

Provide gates in fences at locations, width, and type as specified by requirements of the Contract or other maintaining entities for maintenance access, including CDOT. Field locations of gates shall be approved by CDOT.

Deliverables

The Contractor shall submit the following to the CDOT Project Engineer.

Deliverable	Acceptance or Approval	Schedule
Design Exceptions	Approval	30 days Prior to issuance of applicable Released for Construction Documents
Lighting Assessment	Acceptance	Prior to issuance of applicable Released for Construction Documents
City of Lakewood Grading Permit (If required)	Acceptance	Prior to Construction

All Deliverables shall also conform to the requirements of Section 3 Quality Management.

Exhibits

Exhibits are as follows:

A. Roadway Design Criteria
B. CDOT Design Exception Variance Request Form 454A

Section 13 – Roadway Design

Exhibit A: Roadway Design Criteria

Section 13 – Roadway Design

Design Element	Ramp			US 6	Garrison	Remarks
	Garrison Terminal	Ramp Proper	US 6 Terminal			
HIGHWAY FUNCTIONS						
Functional Classification	N/A	N/A	N/A	Urban Principal Arterial	Urban Collector	
Access Control Classification	N/A	N/A	N/A	Expressway, Major Bypass	N/A	
TRAFFIC DATA AND CONTROLS						
Design Speed, mph	25	45	60	70	35	
Terrain	Rolling	Rolling	Rolling	Rolling	Rolling	
HORIZONTAL GEOMETRY						
Use of Spirals	N/A	N/A	N/A	Permitted	N/A	Use spirals where identified as desirable in PGDH
Minimum Radius	154	643	1330	2040	333	
Normal Cross-slope, %	2%			2%	2%	
Maximum Superelevation, e_{max}	4%	6%	6%	6%	Normal Crown	
Axis of Rotation, Location of Pivot Point	HCL	HCL	HCL	HCL	HCL	
Redirect Taper	N/A	45:1 Min.	N/A	65:1 Min.	15:1 Min.	
VERTICAL GEOMETRY						
Maximum Grade	5%			4%	5%	
Minimum Grade	0.30%			0.50%	0.30%	
Minimum K Value, Crest	12	61	151	247	29	
Minimum K Value, Sag	26	79	136	181	49	
SIGHT DISTANCE						
Level Stopping Sight Distance, feet	155	360	570	730	250	Grades ≥ 3% shall conform to Table 3-2 of the PGDHS
Decision Sight Distance, feet	520	930	1280	1445	720	
VERTICAL CLEARANCE						
Underpass, feet	N/A			14.5	N/A	
Overhead Sign Structures, feet	17.5			17.5	N/A	

Section 13 – Roadway Design

Design Element	Ramp			US 6	Garrison	Remarks
	Garrison Terminal	Ramp Proper	US 6 Terminal			
CROSS SECTION						
Lane Width, feet	12			12	11	
Inside Shoulder/Median, feet	4			4	N/A	
Outside Shoulder, feet	8			12	4	
Z-Slope, feet	12			12	N/A	
Normal Cross-slope	2%			2%	2%	
Maximum Algebraic Difference at Crossover Line	4 to 5%			4 to 5%	4 to 5%	
Design Vehicle	WB-67			WB-67	WB-50	
Sidewalk Width, feet	N/A			N/A	8	
RAMP TERMINALS						
Deceleration Length	Per CDOT Design Guide Table 10-3			N/A	N/A	
Acceleration Length	Per CDOT Design Guide Table 10-4			N/A	N/A	
Entrance Ramp Type	Parallel			N/A	N/A	
Exit Ramp Type	Parallel			N/A	N/A	
Gore Nose Width, feet	*21 Min.			N/A	N/A	*In accordance with Figure 10-15 of CDOT Design Guide

Section 13 – Roadway Design

Exhibit B: CDOT Design Exception Variance Request Form 454A

COLORADO DEPARTMENT OF TRANSPORTATION

DESIGN EXCEPTION VARIANCE REQUEST

FHWA Oversight ☒ Yes ☐ No

Project Code

Project name

Date

Project Number

Type (check all that are applicable)

☐ New construction ☐ Restoration ☐ Resurfacing ☐ Rehabilitation ☐ ____
☐ Reconstruction ☐ Safety ☐ Enhancement ☐ ____ ☐ ____

Revised

Region

Part 1 – Complete A through H for all projects.

A. Short project description (☐ see CDOT Form 463 for more detailed description)

☐ AASHTO standards apply
☐ 3R standards apply
☐ Other: ____

B. Description of standard(s) reduced

C. Rational need for exception(s)

D. Mitigation measures proposed (include safety discussion)

E. Description of adjoining sections: (☐ see CDOT Form 463)
Other:

☐ same as existing project
☐ same as proposed project

F. Accident data Source:

Most recent statewide accident rate (calendar year) for this functional class / facility: (per million vehicle-miles of travel)
a) ____ b) ____
Latest accident rate for this highway (usually 3 years): ____
a) ____ b) ____

G. Cost

Estimated item cost if built to full standard $ ____
Estimated item cost with exception $ ____
± difference in cost: $ ____

H. Other (as needed)

Part 2 – Appropriate signatures required.

A. Submitted by (Project Manager) | Date | Program Engineer Approval | Date

Resident Engineer Approval | Date

Required for Federal-oversight projects only

Approved by (FHWA Division Administrator) | Date

B. ☐ Not approved
☐ Approved with conditions

Conditions/comments

Previous editions are obsolete and may not be used.

Distribution: Project Manager
Program Engineer
Resident Engineer
HQ Records Center
FHWA, if applicable

CDOT Form #0464 11/04

Section 14 – Signing, Pavement Marking, Signalization, and Lighting Infrastructure

SIGNING, PAVEMENT MARKING, SIGNALIZATION, AND LIGHTING INFRASTRUCTURE

The Contractor shall provide permanent signing, pavement marking, traffic signalization, and lighting for the Project.

The Contractor shall be responsible for the design and installation of the Project permanent signing, pavement marking, traffic signalization, and lighting elements within the limits of the Project and comply with the requirements of this Section 14.

Design Requirements

The Contractor shall prepare signing, pavement marking, and traffic signal designs and plans for all areas on the Project in accordance with the requirements of the following sections. These plans shall be a component of all Released for Construction Documents where any signing, pavement marking, traffic signal, or lighting element is required for the Work. No material, part, or attachment of any equipment shall be substituted or applied contrary to the manufacturer's recommendations and standard practices.

The Contractor shall provide permanent signing, pavement marking, delineation, and other traffic control devices that facilitate safe flow of traffic through the completed Project elements.

The Contractor shall prepare lighting, electrical designs, and plans for all areas on the Project. The electrical designs shall include the electrical and power requirements for the Intelligent Transportation Systems (ITS) as described in Book 2, Section 19, ITS. The Contractor shall coordinate with the electrical utility company to determine electric power requirements for the Project and to develop the Project lighting design and construction requirements.

The Contractor shall obtain approval of the power service design from the power service provider and coordinate and meet all requirements as specified by the power service provider for the complete and operational power service to all required locations. All power connections to devices shall include a quick-disconnect.

The Contractor shall be responsible for the coordination of power source work to be performed by Xcel Energy. The Contractor shall contact the Xcel Energy Builder's Call Line at 1-800-628-2121 to request, and process to completion, the required coordination to establish the power sources for traffic signals, traffic signal pole mounted lighting and all roadway and street lighting. The Contractor shall perform all work necessary to maintain existing or establish new power sources for traffic signals and lighting. All cost charges from the power service provider, and all necessary materials, including meter (if required), labor, and coordination required to maintain existing or establish new power sources shall be included in the Work.

Section 14 – Signing, Pavement Marking, Signalization, and Lighting Infrastructure

The Contractor shall design and construct signing, pavement marking, traffic signal, and lighting elements in accordance with the requirements of the standards listed in Table 14.1-1 as appropriate for the jurisdictional ownership, oversight and approval of the Work.

Table 14.1-1
LIGHTING STANDARDS

	Author	Title
1	CDOT	Special Provisions included in Section 14
2	CDOT	*Standard Specifications for Road and Bridge Construction Section 613*
3	Excel	*Excel Outdoor Lighting Standards*
4	CDOT	*Sign Design Manual* – May 21, 2010
5	FHWA	*Manual on Uniform Traffic Control Devices* (Current Edition)
6	AASHTO	*A Policy on Geometric Design of Highways and Streets*
7	AASHTO	*Roadside Design Guide*
8	AASHTO	*Standard Specifications for Highway Bridges*, 16th Edition
9	Local Jurisdiction	*Design Standards, Details, and Specifications*

Permanent Signing

Signing Design

The Contractor shall prepare signing designs and plans for the Project area. These plans shall include all necessary guide, warning, supplemental, and regulatory signs, and additions, removals, or modifications to existing signs and appurtenances. Plans shall also include a preliminary layout of signs, which will be required for future phases of the Project and that may affect placement and configuration of signs placed as a part of the Basic Configuration.

Signing design shall comply with the requirements of the most current publications of the CDOT *Standard Specifications for Road and Bridge Construction*, *M & S Standard Plans*, and *Sign Design Manual*; and the FHWA *Manual for Uniform Traffic Control Devices* (MUTCD). The requirements of the MUTCD shall include both the standard requirements and the guidance recommendations of the manual. The design and plans shall address modifications to permanent signing inside and outside the Project that is rendered inaccurate, ineffective, confusing or unnecessary by the Project. Signing plans shall provide layouts showing the locations of ground-mounted and overhead signs, special sign details, and structural and foundation requirements.

Signing design for the intersections, local streets and Garrison shall comply with the City of Lakewood Traffic Engineering Standards of Signs and Markings.

The Contractor shall submit plans for all Class III, major overhead signs, and regulatory and guide signs to CDOT for Approval. These plans shall identify the location and legend for each

Section 14 – Signing, Pavement Marking, Signalization, and Lighting Infrastructure

sign. Sign legends shall be consistent with the Project Signing Concept Plan in the Reference Documents and the CDOT Sign Design Manual. Sign locations in the Signing Concept Plan are for reference only. The Contractor shall submit sign layouts for all special signs of any size to CDOT for Approval.

Where CDOT sign structure standards cannot be met, provide custom-designed monotube sign structures and foundations for approval from CDOT Staff Bridge. Permanent signage on bridges shall not be hung from or be attached to the face of bridge superstructures. Existing signs attached to bridge superstructures shall be removed and replaced with monotube sign bridges or cantilever structures if signs are to remain.

The Contractor shall mount all overhead signs with a vertical clearance consistent with current CDOT Standard S-614-50 measured from the high point on the roadway surface under the sign panels to the bottom of the VMS, VTMS, or guide sign (whichever is lowest) to allow for the future installation of lane control signals.

Sign lighting and walkways shall not be used on overhead guide signs.

Sign structures and foundations shall be designed in accordance with CDOT Standard S-614-50.

All ground mounted signage, delineators, etc., shall be installed within a full depth PVC sleeve at locations where the device is installed within concrete sidewalk, median cover material, concrete pavement, slope paving, etc.

Materials

The Contractor shall use schedule 80 tubular steel posts per CDOT *S-Standard Plans* for all Class I and Class II ground signs. Wood posts for mounting ground signs shall not be used. All delineators shall have metal posts.

All ground signs shall include breakaway devices per CDOT *S-Standard Plans*.

Sign panel materials shall conform to CDOT *Standard Specifications* Section 713. Sheeting shall be Type IV and Type XI as defined in the CDOT Retroreflective Sheeting Materials Guide, and shall conform to Subsections 713.04 and 713.06 when applicable. For all permanent signs, the legend, borders, and background shall be Type XI.

The Contractor shall not reuse any existing sign structures, ground signs or their components.

Lakewood Standards of Signs and Markings shall be utilized for all signs on Garrison Street.

Permanent Pavement Marking

Pavement Marking Design

The Contractor shall prepare pavement marking designs and plans for roads affected by the construction of the Project. These plans shall include, all striping required for center lines, edge lines, lane lines, gore areas, lane drops, merging lanes, transition lanes, bike lanes, arrows,

Section 14 – Signing, Pavement Marking, Signalization, and Lighting Infrastructure

legends, symbols, object markings, delineation, and other striping, as well as any modifications required for transitions to existing pavement markings.

Pavement marking design CDOT facilities shall comply with the requirements of the most current publications of the CDOT *Standard Specifications for Road and Bridge Construction* and *M & S Standard Plans*; and the FHWA MUTCD. The requirements of the MUTCD shall include both the standard requirements and the guidance recommendations of the manual.

Striping design for the local streets, intersections Garrison Street shall comply with City of Lakewood Traffic Engineering Standards of Signs and Markings.

The conceptual mainline and other roadway striping as shown in the Reference Documents is for information and reference only.

Materials

The Contractor shall use the pavement-marking materials on US 6 and Frontage Roads specified in Table 14.1-2.

Table 14.1-2
PAVEMENT MARKING MATERIALS

Location	Pavement Marking Type
Edge lines	Epoxy Pavement Marking
Skip lines, challelizing lines, and lane drop lines on Portland concrete cement pavement (PCCP)	Preformed Plastic Pavement Marking Type II (contrast)(Inlaid)
Skip lines, channelizing lines, and lane drop lines on Hot Mix Asphalt (HMA)	Preformed Plastic Pavement Marking Type I
Words/symbols/cross walks/stop lines	Preformed Plastic Pavement Marking Type I

The City of Lakewood requires the use of Preformed Thermoplastic for all Xwalks, stop bars, and symbols.

The Contractor shall refer to CDOT's Material Striping Chart as shown below for pavement marking materials for US6 and Frontage Roads.

Section 14 – Signing, Pavement Marking, Signalization, and Lighting Infrastructure

Freeway / Expressway Striping Materials

Surface	Line	Material
New Asphalt*	4" White Edge Line	Epoxy
	4" Yellow Edge Line	Epoxy
	4" Double-Yellow Centerline	Epoxy
	4" White Lane Line	Preformed Plastic Type I (Inlaid)
	4" White Extension Line	Preformed Plastic Type I (Surface Applied)
	8" White Gore Area	Preformed Plastic Type I (Surface Applied)
	8" White Channelizer	Preformed Plastic Type I (Surface Applied)
	8" White Lane Drop	Preformed Plastic Type I (Inlaid)
	8" White Double-Left Guide	Preformed Plastic Type I (Surface Applied)
	Stop Bar / Crosswalk	Preformed Plastic Type I (Surface Applied)
	Word Message	Preformed Plastic Type I (Surface Applied)
Old Asphalt	4" White Edge Line	Epoxy
	4" Yellow Edge Line	Epoxy
	4" Double-Yellow Centerline	Epoxy
	4" White Lane Line	Preformed Plastic Type II (Inlaid)
	4" White Extension Line	Preformed Plastic Type II (Inlaid)
	8" White Gore Area	Preformed Plastic Type II (Surface Applied)
	8" White Channelizer	Preformed Plastic Type II (Surface Applied)
	8" White Lane Drop	Preformed Plastic Type II (Inlaid)
	8" White Double-Left Guide	Preformed Plastic Type II (Inlaid)
	Stop Bar / Crosswalk	Preformed Thermoplastic**
	Word Message	Preformed Thermoplastic**
New Concrete*	4" White Edge Line	Epoxy
	4" Yellow Edge Line	Epoxy
	4" Double-Yellow Centerline	Epoxy
	4" White Lane Line	Preformed Plastic Type II (Inlaid)
	4" White Extension Line	Preformed Plastic Type II (Inlaid)
	8" White Gore Area	Preformed Plastic Type II (Surface Applied)
	8" White Channelizer	Preformed Plastic Type II (Surface Applied)
	8" White Lane Drop	Preformed Plastic Type II (Inlaid)
	8" White Double-Left Guide	Preformed Plastic Type II (Inlaid)
	Stop Bar / Crosswalk	Preformed Plastic Type I (Surface Applied)
	Word Message	Preformed Plastic Type I (Surface Applied)
Old Concrete	4" White Edge Line	Epoxy
	4" Yellow Edge Line	Epoxy
	4" Double-Yellow Centerline	Epoxy
	4" White Lane Line	Preformed Plastic Type II (Inlaid)
	4" White Extension Line	Preformed Plastic Type II (Inlaid)
	8" White Gore Area	Preformed Plastic Type II (Inlaid)
	8" White Channelizer	Preformed Plastic Type II (Inlaid)
	8" White Lane Drop	Preformed Plastic Type II (Inlaid)
	8" White Double-Left Guide	Preformed Plastic Type II (Inlaid)
	Stop Bar / Crosswalk	Preformed Plastic Type I (Surface Applied)
	Word Message	Preformed Plastic Type I (Surface Applied)

* Inlaid markings are preferred on new construction but not required.
**Preformed Plastic Type I markings may be acceptable depending on pavement condition.
-Typical first application of Preformed Plastic markings is surface-applied; consecutive applications are inlaid.

Section 14 – Signing, Pavement Marking, Signalization, and Lighting Infrastructure

Temporary and Permanent Traffic Signalization

Traffic Signal Design

New traffic signals are required at the two intersections of Garrison Street with the US 6 Frontage roads. Existing traffic signals at these locations are currently owned and maintained by the City of Lakewood. The Contractor shall prepare traffic signal plans that include existing and proposed intersection plan details, traffic signal pole locations, mast arm and signal head locations, signal pole mounted overhead lighting (luminaires), pedestrian button and signal locations, approach striping and marking locations and types, cabinet and power source locations, conduit and pull boxes, detection systems and locations, and all other plan and component details for complete traffic signal installation in accordance with City of Lakewood Traffic Signal Standards, and shall include Xcel Standards for all traffic signal poles and all non-signal lighting placed on the poles.

All temporary and permanent traffic signals shall be designed and constructed in conformance with City of Lakewood and are subject to Lakewood's review. The Contractor shall coordinate all traffic signal design and installations with the City of Lakewood.

Permanent traffic signalization appurtenances shall not be allowed to hang from, or be attached to the face of bridge superstructures.

One reason traffic signal replacement is required is to that red signal faces are at a location that meet stopping sight distance for approaching drivers. Contractor must consider stopping sight distance and visibility of signal heads in design of the replacement signal and design of the bridge structure.

Lighting

Permanent Lighting Design

The Contractor shall prepare lighting designs and plans for US 6 and all existing permanent lighting conditions on roadways impacted by the Project. All permanent lighting within the Project shall be designed and constructed to be consistent with current City of Lakewood guidelines, including guidelines for required lighting values, CDOT Road and Bridge Construction Specifications and Xcel Standards for Outdoor Lighting.

Lighting plans shall address both temporary and permanent Work and shall include existing topography, right of way, utilities, drainage facilities, structures, and all other existing and proposed facilities. The plans shall include location and orientation of standards and luminaires, wiring, conduits, pedestals, power sources, and all other lighting components required to construct the lighting on the Project.

Roadway lighting shall be provided on US 6 for the entire length of highway being constructed by the Project.

High-mast lighting or any lighting equipment installed in, or integrated with, the median will not be permitted.

Section 14 – Signing, Pavement Marking, Signalization, and Lighting Infrastructure

The Contractor shall submit to the City of Lakewood and CDOT for Acceptance software-based lighting calculations showing that the lighting design meets the Luminance Design Method criteria defined in the *CDOT Lighting Design Guide (February 2006, adopted by CDOT September 2008)*). The calculations must show that the proposed design meets the average luminance (L_{avg}), the average-to-minimum uniformity ($L_{avg/min}$), and the veiling luminance ratio (L_{vmax}/L_{avg}).

The *CDOT Lighting Design Guide* can be found on the CDOT website at:

http://www.coloradodot.info/topcontent/searchpage#gsc.tab=0&gsc.q=lighting%20design%20guide&gsc.page=1

The extents of the luminance calculation area shall be defined by the limits of the pavement overlay on US 6 within the Project.

The Contractor shall submit to the City of Lakewood and CDOT voltage-drop calculations for each lighting circuit which show that the electrical design is within the allowable voltage drop limits for the Project.

The Electrical design shall include, and the Plans shall indicate, additional spare conduit and pull boxes within the new bridge structures for future use.

Lighting designs and plans for the Project shall be subject to review and approval by the City of Lakewood, CDOT, and Xcel Energy.

Permanent Lighting Materials

All materials and methods associated with lighting and electric power distribution shall comply with all applicable standards of the City of Lakewood, CDOT and Xcel Energy.

New luminaires installed on the Project, except underdeck luminaires, shall be in conformance with the Colorado Revised Statutes #24-82-901 (Dark Sky statute). All luminaires whose lamp or total lumen output is greater than 3,200 lumens shall be classified as Full Cutoff or have a U-rating in the BUG system (per IESNA TM-15-11) no greater than U0.

All LED type luminaires to be used for roadway lighting shall conform to the current CDOT *LED Roadway Luminaire* standard special provision (January 2014).

Underdeck luminaires shall be a wall or pendant-mounted area luminaire with a 150-watt high pressure sodium lamp, integral ballast, mogul-base socket and accessory glare hood. Color to be Gray. The Xcel catalog identification number for the luminaire is #53993.

The Contractor shall obtain approval for all lighting and electrical equipment from the agency responsible for maintenance. The City of Lakewood is responsible for street lighting maintenance. Xcel Energy owns and maintains the street lighting in accordance with their franchise agreement with the City. Lighting Plans for which the lighting is the responsibility of the City of Lakewood shall be provided to the City and CDOT for review and approval before any materials are ordered.

Section 14 – Signing, Pavement Marking, Signalization, and Lighting Infrastructure

Xcel Energy is responsible for lighting maintenance for the entire project. The Contractor shall submit a list of materials to be used in the proposed lighting system, including under-deck lighting, for review and approval by Xcel Energy prior to ordering material. The Contractor shall contact the Xcel Energy Builder's Call Line at 1-800-628-2121 to request, and process to completion, the required coordination to review and approve the lighting equipment. All cost charges from Xcel Energy for review and approval shall be included in the Work.

Temporary Lighting

The Contractor shall provide installation, maintenance, and removal of all temporary lighting devices. The Contractor shall maintain temporary lighting at a level equivalent to existing lighting provided within the Project limits.

Construction Requirements

Permanent Signing

The Contractor shall remove and dispose of all existing sign structures, ground-mounted signs, and delineators within the Project area, and they shall become the property of the Contractor.

Permanent Pavement Marking

New PCCP shall be sandblasted prior to placement of any primer or pavement-marking material.

Permanent Traffic Signalization

Contractor Requirements

The Contractor shall purchase cabinets, controllers, CCTV's and associated traffic signal equipment, and shall deliver the equipment to the City of Lakewood, Traffic Engineering Services Department a minimum of 6 weeks prior to the scheduled installation date. The Contractor shall transport the devices to the project site for the Contractor's installation after the City of Lakewood staff have completed City performed tasks as identified below.

All existing signalization equipment removed by the Contractor is the property of the City of Lakewood. The Contractor shall deliver in good condition all equipment removed to the City of Lakewood Public Works.

Operational

The City of Lakewood will provide timing plans for the permanent traffic signals for the Contractor to initiate and install with the initial startup.

The Contractor shall coordinate with the City of Lakewood to ensure timing plans function properly, and to ensure they minimize intersection approach delays and accommodate pedestrians.

Section 14 – Signing, Pavement Marking, Signalization, and Lighting Infrastructure

All signal timing plan modification requests shall be approved and completed by the City of Lakewood. The Contractor shall allow 28 Days prior to implementation of any signal timing plan modification for review and approval by the City of Lakewood.

Permanent Lighting

Xcel Energy will remove the existing lighting as required within the Project area only for lighting that is owned by Xcel Energy. The Contractor shall be responsible for the coordination of lighting removal and lighting relocation work to be performed by Xcel Energy. The Contractor shall contact the Xcel Energy Builder's Call Line at 1-800-628-2121 to request, and process to completion, the required coordination for Xcel Energy lighting removal or lighting relocation Work. The Contractor shall remove the existing lighting as required within the Project area that is not owned by Xcel Energy, and shall become the property of the Contractor.

Project Special Provisions

The following specifications modify and take precedence over the Standard Specifications.

REVISION OF SECTION 627 - EPOXY PAVEMENT MARKING (SPECIAL) -

Section 627 of the Standard Specifications is hereby revised for this project to include the following:

Delete subsection 627.05 and replace with the following:

Epoxy Pavement Marking (Special). Epoxy Pavement Marking (Special) shall be applied to the road surface according to the epoxy manufacturer's recommendations at 20 mils minimum thickness. Bead system shall be applied into the epoxy pavement marking by means of a pressurized bead applicator at the manufacturer's recommended application rate.

The surface area receiving marking shall be ground prior to placement of the Epoxy Pavement Marking (Special). This applies to new or existing concrete or asphalt pavements. The ground surface shall then be cleaned with a high pressure air blast to remove loose material prior to placement of the Epoxy Pavement Marking (Special). The grooved width for inlaid pavement marking shall be between 4 and 4-1/4 inches in width The depth of the inlaid grooves shall be 80 mils ± 5 mils below the surface of the existing pavement.

Grooves shall be clean, dry and free of laitance, oil, dirt, grease, paint or other foreign contaminants. The Contractor shall prevent traffic from traversing the grooves, and shall re-clean grooves, as necessary, prior to application of the Epoxy Pavement Markings (Special).

Section 14 – Signing, Pavement Marking, Signalization, and Lighting Infrastructure

The Contractor shall grind only those locations on which pavement marking shall be applied on a daily basis.

If a rain event occurs during grinding and marking application, a temporary lane line marking tab shall be placed while the pavement is drying prior to the marking application. Marking application can proceed when pavement is dry and has had no moisture for a minimum of 24 hours. The placement of tabs shall be every other lane line/ skip or approximately 80 feet.

The primary and secondary beads shall be applied in a two drop operation in accordance with the manufacturer's recommendations. If manufacturer recommendations do not address this operation, then the rate of primary beads shall be 10 to 11 pounds per gallon of epoxy. The primary composite cluster shall be applied first from the bead dispenser directly behind the Epoxy binder application gun followed immediately by the application of the secondary beads from a second bead dispenser. The application rates of the primary and secondary beads shall be adjusted from these starting values until the minimum retroreflectivity values have been consistently achieved. The beads shall be applied in such a manner that the beads shall adhere and be embedded within the epoxy binder to produce a high reflective all weather pavement marking.

There shall be two types of glass and/or ceramic beads used for the Epoxy Pavement Marking (Special) reflective elements, a Primary bead which is a high performance, high reflective all weather bead and a Secondary standard glass bead. Beads will be accepted on the project by certificates of compliance (COC). The COC shall be in conformance with subsection 106.02 in addition to the following requirements:

1) The primary bead shall be a composite cluster comprised of a core element and shall contain an outer shell containing elements surrounding it. The shell elements shall be permanently attached to the core element. The core and shell elements shall be manufactured from glass, ceramic, or silica. The primary element shall be coated by manufacturer's recommendations for application within Epoxy binder.

2) The secondary bead shall conform to the following specifications: Gradation:

U.S. Mesh	Microns	% Retained	%Passing
18	1000	20 – 35	65 – 80
30	600	50 – 70	30 – 50
50	300	95 – 100	0 – 5

Roundness: Shall be a minimum of 85 % true spheres above the sieve 20 by visual inspection using test method FLH-520. All beads below the 20 sieve, must meet a minimum of 80% true spheres by ASTM Method D 1155.

Section 14 – Signing, Pavement Marking, Signalization, and Lighting Infrastructure

Color / Clarity: Beads shall be colorless / clear and free of carbon residues.

Refractive Index: Minimum 1.50 by oil immersion method.

Air Inclusions: < 5% by visual count.

Hardness: All beads above the 20 sieve shall exhibit an average hardness of C70.5 when measured using the Rockwell C scale method and with a minimum sampling of 100 glass beads.

Crushing Strength: Beads above the 20 sieve shall exhibit an average crushing strength of not less than 60,000 psi when measured with the L/D^2 method and with a minimum sampling of 100 glass beads.

Coatings: Shall use manufacturer's recommended adhesion coating for optimum adhesion and embedment.

Chemical Resistance: Both the primary and secondary beads shall be resistant to hydrochloric acid, water, calcium chloride, sodium sulfide, acid, and magnesium chloride, and shall not develop any haze, dulling or darkening of the bead as tested per methods outlined in sections 4.3.6 to 4.3.9 of the TT-B Federal Spec. 1325C.

3) Primary and secondary glass beads shall be furnished in fully identified, separate containers and shall be free of extraneous materials or clumps. If the use of recycled post consumer glass is used in manufacturing of beads those recycled glass beads shall be manufactured from North American glass waste streams. The bead manufacturer shall submit a notarized certification to the department stating that North American glass waste streams were used in the manufacture of this specification.

Products will be accepted on the project by certificates of compliance (COC). The COC shall be in conformance with subsection 106.02, and shall include that the materials conform to the following:

1) Retroreflectivity. The applied finish system shall have an initial minimum dry retroreflectivity reading of 700 mcd·m-2·1x-1 for white and 500 mcd·m-2·1x-1for yellow. The Contractor shall use an industry accepted and available Retro-meter for retroreflectivity readings and it shall be calibrated each day testing occurs. For information: (CDOT will be using a Delta LTL-X Retro-meter for retroreflectivity readings). CDOT will obtain retroreflectivity readings from the Contractor for each 1 mile of line placed or fraction thereof. CDOT will determine a random testing location for each 1 mile section of line placed or fraction thereof. Each test location shall represent

Section 14 – Signing, Pavement Marking, Signalization, and Lighting Infrastructure

that 1 mile of line placed or fraction thereof. At each random testing location two reflectivity readings will be taken on 11 different skip lines or 22 readings will be taken with a 440 foot section of the continuous line. Of those 22 readings the highest and lowest will be disregarded and the remaining 20 readings will be averaged and that average value will represent the reflectivity of that 1 mile section or fraction thereof. The contractor shall remove and replace at their expense each 1 mile of line placed or fraction thereof where the test result from that random location fails the minimum retro reflectivity reading.

The retroreflectivity readings shall be taken between two and three days after the marking is tack free. Prior to taking reflectivity readings, the Contractor shall remove at the retroreflectivity reading locations any excess beads placed during marking application.

Applied markings shall have uniform mil thickness and bead distribution across the entire width of the line. Unless otherwise shown on the plans, typical pavement markings shall conform to the shapes and sizes as shown on Standard Plan S-627-1.

The Contractor will be required to submit to CDOT certification from the manufacturer that the installed epoxy binder and both the primary and secondary beads have been installed in accordance with this specification and with their recommendations and has achieved the minimal retroreflectance values stated herein. If the pavement marking system is comprised of multiple manufacturers, then all manufacturers will be required to affirm to the certification. A manufacturer's representative shall be onsite at the installation of the epoxy binder, primary bead, and secondary bead materials to identify areas of the installation falling below the minimum manufacturer's recommendations and these specifications to assist in the calibration of equipment, set up of equipment and the proper adjustment of equipment during installation to achieve the minimums outlined herein. The cost of the manufacturer(s) representation will not be measured and paid for separately but shall be included in the cost of the work.

Subsection 627.13 shall include the following:

Pay Item	Pay Unit
Epoxy Pavement Marking (Special)	Gallon

The work to groove the asphalt or concrete and clean the grooving residual or debris will not be measured and paid for separately but shall be included in the work.

The primary and secondary beads will not be measured and paid for separately but shall be included in the cost of the Epoxy Pavement Marking (Special).

Temporary markings will not be measured and paid separately, but shall be included in the cost of work.

Section 14 – Signing, Pavement Marking, Signalization, and Lighting Infrastructure

Deliverables

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

Deliverable	Review, Acceptance, or Approval	Schedule
Pavement Marking Plans	Approval	60 Days prior to issuance of Released for Construction Documents
Class III, major overhead signs, and regulatory and guide signs plan	Approval	90 Days prior to issuance of Released for Construction Documents
Sign layouts for all special signs of any size	Approval	90 Days prior to issuance of Released for Construction Documents
Custom-designed monotube sign structure and foundation plans	Approval	90 Days prior to issuance of Released for Construction Documents
All temporary and permanent traffic signal plans within CDOT ROW	Approval	90 Days prior to issuance of Released for Construction Documents
All temporary and permanent traffic signal plans within Lakewood ROW	Review	90 Days prior to issuance of Released for Construction Documents
All permanent lighting plans at intersections and local streets owned and maintained by Lakewood	Review	60 Days prior to issuance of Released for Construction Documents
Traffic Signal Timing Plans and associated electronic timing plan software files (by Lakewood)	Approval	28 Days prior to implementation
Lighting and electrical design calculations (by Lakewood)	Acceptance	90 Days prior to issuance of the Released for Construction Documents

Section 15 - Structures

Administrative Requirements

The Contractor shall design, and construct all of the following structures required to make the Project fully functional and economical, in accordance with the Contract Requirements.

1. Structure number F-16-EW (6th Ave over Garrison St)
2. North West Wall – Wall between west bound on ramp and 6th Ave
3. South East Wall – Wall between East bound on ramp and 6th Ave
4. Abutment Walls – As required at both abutments
5. Other Walls – As required

The bridge and walls shall be designed and constructed in accordance with the project specifications and referenced standards.

Standards

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

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

Standards referenced by this section include:

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

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

http://www.coloradodot.info/library/bridge/bridge-manuals/bridge-rating-manual

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

http://www.coloradodot.info/library/bridge/bridge-manuals/metric-bridge-geometry-manual

http://www.coloradodot.info/library/bridge/miscbridgedocs/techmemos/design-memos

http://www.coloradodot.info/library/bridge/miscbridgedocs/techmemos/rating-memos

http://www.coloradodot.info/library/bridge/design-standards

http://www.coloradodot.info/business/designsupport/bulletins_manuals/construction-bulletins/current

http://www.coloradodot.info/business/designsupport/construction-specifications/2011-Specs/2011-specs-book

http://www.coloradodot.info/business/designsupport/construction-specifications/2011-Specs/standard-special-provisions

http://www.coloradodot.info/library/bridge/miscbridgedocs/accelerated-bridge-construction

Section 15 - Structures

AASHTO LRFD Bridge Design Specifications, Customary U.S. Units, 7th Edition, 2014, and any documents referenced therein.

AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2nd Edition, with 2012 and 2014 Interim Revisions. Seismic design may be done using either the AASHTO Guide

Specification for LRFD Seismic Bridge Design or the AASHTO LRFD Bridge Design Specifications, but shall be consistent and use one or the other for the design of all components of the bridge.

AASHTO Manual for Bridge Evaluation, 2nd Edition, 2010 with 2013 Interim Revisions

AASHTO LRFD Bridge Construction Specifications, 3rd Edition, 2010 with 2014 Interim Revisions

The 2011 Edition of the Standard Specifications for Road and Bridge Construction as published by the Colorado Department of Transportation and any documents referenced therein. This includes the Standard Special provisions which include revisions to the 2011 Edition of the Standard Specifications for Road and Bridge Construction and any documents referenced therein.

Software

The following software shall be used for this Project:

AASHTOWare Bridge Rating, BrR (Version 6.5.0),

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

Design Requirements

Structure Concept Memorandum with Preliminary General Layout

The General Layout drawings provided in the Referenced Documents shall be considered preliminary. The Contractor shall submit a Structure Concept Memorandum for the bridge and each wall outlining how the proposed structures meet the project specifications, AASHTO specifications and the requirements of the CDOT Bridge design Manual. Along with the memorandum, the contractor shall submit the following Drawings:

- General Layout and Typical Section for the bridge
- Wall Layout and Typical Section for each wall

Section 15 - Structures

Materials

Concrete

Concrete shall be in accordance with the Referenced Standards.

Concrete shall include Structural Concrete Coating as described in CDOT Standard Specification 601.14.

Prestressing Steel

Prestressing Steel shall be in accordance with the Referenced Standards.

Post-Tensioning Steel Systems

Post Tensioning Steel Systems shall be in accordance with the Referenced Standards.

Reinforcing Steel

Reinforcing Steel shall be Grade 60 reinforcing steel. All reinforcing steel shall be epoxy coated unless otherwise noted in accordance with the Referenced Standards.

Structural Steel

Structural Steel shall be Weathering Steel: AASHTO M270 Grade 50W (ASTM A709 Grade 50W) unless otherwise noted in accordance with the Referenced Standards.

Design Parameters

General

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

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

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

Section 15 - Structures

Loads and Forces

Load and Forces for bridge design shall be in accordance with the Referenced Standards and the requirements contained in this section.

1. Dead loads

   Utilities (future and existing): As Required

   3" HMA Overlay (future and initial): 36 psf

   Unit Weight Prestressed Concrete:

   Shall be in accordance with the referenced Standards

2. Live Loads
   Shall be in accordance with the referenced Standards

3. Thermal Forces

   The following thermal coefficient and temperature ranges shall be used for designing the new structures:

   Thermal Coefficient: 0.000006/°F concrete, 0.0000065/°F steel

   Design Temperatures: shall be in accordance with the referenced Standards

4. Load Rating

   The Contractor shall load rate all highway bridges in accordance with the AASHTO Manual for Bridge Evaluation, and the CDOT Bridge Rating Manual, latest revisions.

Load and Forces for wall, and drainage and irrigation structure designs shall be in accordance with the Referenced Standards and Documents.

Geotechnical Data

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

Bridge Foundations:

The report titled "Geotechnical Investigation, US 6 Bridge over Garrison Street" prepared by RockSol Consulting Group, Inc, dated July 3, 2014 is supplied for information only. The Contractor shall perform a geotechnical investigation and prepare a report for the Bridge Foundations. The report shall prepared by a licensed Professional Engineer in the State of Colorado.

Section 15 - Structures

Retaining Walls:

The report titled “Preliminary Geotechnical Investigation – Retaining Wall Structures, US 6 Bridge over Garrison Street” prepared by RockSol Consulting Group, Inc, dated July 3, 2014 for the retaining walls is supplied for information only. The Contractor shall perform a geotechnical investigation and prepare a report for the retaining walls. The report shall prepared by a licensed Professional Engineer in the State of Colorado.

Bridges

Geometry

Bridge Geometry shall be in accordance with the referenced Standards and the requirements contained in this section.

See Section 13 - Roadway and Section 12 - Hydraulics for additional structure requirements.

In addition to bridge rails, the bridge width shall have a minimum section that will accommodate the following in each direction of 6th Ave.

- 4’-0” inside shoulder
- 3 – 12’-0” lanes
- 12-0” outside shoulder

Additional width required for phasing will be allowed if the design of the approach roadway, ramps and retaining walls meets all requirements of the specifications. If additional width is required, the bridge rails shall be constructed at the outside of the bridge.

The length of the bridge shall accommodate the following section of Garrison Street.:

- 8’-0” sidewalk for each direction
- 2’-6” curb and gutter for each direction
- 4’-0” bike lanes in each direction (exclusive of the gutter pan)
- 4 – 11’-0” lanes

This section is to be a minimum of 73’-0” measured normal to Garrison Street. No bridge piers will be allowed within this section.

The minimum final vertical clearance from Garrison Street to the low chord of the new bridge shall be 14’-6”. This is to be measured from top of sidewalk or roadway, whichever is higher.

The profile of the bridge shall meet the requirements of Section 13 Roadway

Section 15 - Structures

Type

Bridge Type shall be in accordance with the referenced Standards and the requirements contained in this section. Structure type will not be restricted to those typically used by CDOT. Other types and components may be used, but will be allowed only if they have been accepted for general use by other transportation authorities and the Contractor can demonstrate that the design of the bridge type and components will perform well under the Project's environmental conditions, including frequent freeze-thaw cycles and anti-icing chemicals.

Experimental bridge types, timber bridges, masonry bridges, haunched girder bridges, all types of truss bridges and structural plate arches are not permitted.

The Contractor shall submit, to the Engineer for Approval, non-typical bridge types in the Structure Concept Plan.

The following structural requirements are to be met when new and innovative concepts or accelerated bridge construction (ABC) techniques are employed:

- A corrosion engineering consulting firm as approved by CDOT's Project Engineer with expertise in the prevention of corrosion for civil engineering structures shall be retained by the Contractor to review the integrity of the proposed connection details for a 75 year design life. The Contractor shall submit the results of this evaluation to the CDOT Project Engineer for CDOT's use in determining the acceptability of the proposed connection details.
- Field welded plates can only be used as temporary supports for bridge elements during erection and shall not be placed in a prestressed load path to prevent elements from seating properly.
- Match casting in prestressed elements shall be used to eliminate joint shifting in post-tensioned connections. Additionally, post-tensioning strands and bars shall be long enough to provide sufficient force for ultimate strength and service strength stress requirements after anchor set and long term losses have occurred.

Inspection Access

Bridge Inspection Access shall be provided in accordance with the referenced Standards.

Structure Components

Structure Components shall be in accordance with the referenced Standards and the requirements contained in this section.

Section 15 - Structures

Bridge Rails

Bridge Rail Type 7 shall be used with 36 inch splash guard attached on the outside of the bridge as shown in the Project Reference Documentation.

The median bridge rail shall be CDOT Guardrail Type 7, Style CC per M Standard M-606-13

The final finish for the surfaces of the type 7 bridge rail and curbs shall be Class 2. All other exposed concrete surfaces shall receive a Class 1 final finish to one foot below the ground line.

A colored structural concrete coating shall be provided on the exposed bridge rails.

Approach Slabs

Bridge approach slabs are required and shall be in accordance with the referenced standards. All the provisions for bridge deck concrete shall also apply to approach slab concrete. The approach slabs shall have a 20'-0" minimum length.

Decks

The Contractor shall provide a minimum concrete deck thickness of 8 inches in accordance with the Referenced Standards.

Open or filled grating decks and orthotropic decks will not be permitted.

Concrete decks designed to the simplified "Ontario", or any empirical methods, will not be permitted.

Precast Full-Depth Transverse Deck slabs if it is selected for accelerated bridge construction by the Contractor, shall be match cast or provided with an approved cast-in-place closure pour and longitudinally post-tensioned for continuous span bridge.

Precast pre-tensioned concrete deck forms with partial C-I-P concrete deck as an alternative of the ABC shall be temporarily supported on blocking with a 1:1 aspect ratio and in accordance with the Referenced Standards and Documents.

Permanent Steel Deck Forms are allowed for precast concrete girders and steel girders. If used, ten 12" x 12" future deck inspection windows shall be provided in locations as directed by the Engineer.

Permanent deck forms shall not be allowed for T-girder deck slabs, or cantilevered portions of decks.

Section 15 - Structures

In order for the cast-in-place portion of concrete placed on top of the top flange of a Precast Box Girders to be considered composite with the precast top flange, the total laminated deck thickness shall be 8 inches minimum, the cast-in-place thickness shall be 4-3/4 inches minimum, and the top surface of the precast top flanges shall be roughened.

Precast Double Tees, Precast Box Girders or longitudinal Precast Slabs without a cast-in-place deck placed on top will not be allowed. If any part of a deck resists tension the stress in the deck in this area shall not exceed 3-sqrt f'c. Minimum longitudinal steel in the top mat of cast in place decks shall be No. 4's at 6 inch spacing. This reinforcing shall be spliced to the negative moment steel reinforcing for a multi span bridge.

Other joint and connection details shall be used upon approval by CDOT Project Engineer.

Concrete deck of the bridge shall be able to be replaced in the future deck rehabilitation project as required by the Referenced Standards.

Girders

Girders shall be in accordance with the referenced standards.

Negative camber is prohibited in Precast Concrete Members under full dead load, without live load and after all losses.

Expansion Joints

If all of the following conditions are met, expansion joints are not required:

- The bridge is constructed with precast, prestressed concrete girders
- The bridge length is less than 140 feet from abutment to abutment
- The bridge abutments are integral
- The initial bridge overlay is 3" SMA

If these conditions are not meet, Expansion Joints shall be required. They shall be at the end of the approach slab as shown in the CDOT structural worksheets. The gland shall be continuous from crown of roadway to edge of deck.

Overlays

The bridge shall have an initial overlay. It shall be either of the following two options:

1. 3" SMA surface over waterproofing membrane. The waterproofing membrane shall be applied in accordance with Section 515 of the CDOT Standard Specifications.
2. 1" Polyester Concrete overlay meeting the project special provision.

Section 15 - Structures

If the contractor elects to place the 3" SMA option, it shall be constructed after all phases of bridge construction are complete. The overlay shall be placed continuously with the top lift of the roadway approach pavement.

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

Bearings

Bearings shall be designed and installed in accordance with the Referenced Standards.

Piers and Pier Caps

Piers and Pier Caps shall be in accordance with the Referenced Standards. No Piers are allowed within the 73'-0" Garrison Street Section.

Abutments

Structure backfill in abutments shall be mechanically stabilized backfill and in accordance with the Referenced Standards. The length of cantilevered wingwalls and/or retaining walls from the end of the abutments of U-type abutment shall be 4 feet longer than the point of intersection of the embankment slope, along outside face of cantilevered wingwalls or retaining walls, with the roadway finished grade. If the required length of cantilevered wingwalls is longer than 16 feet from the end of U-type abutment diaphragms as recommended by the Reference Standards, the Contractor shall submit the detail and design for the Engineer Approval.

Structural Color

A colored Structural Concrete Coating finish will be required on exposed concrete surfaces. The color sample panel shall be equivalent to Federal Standard 595C Color, and is to be selected from test panels provided by the Contractor. All exposed surfaces shall receive Structural Concrete Coating to one foot below the ground line.

All structural steel shall be painted in accordance with Section 509 of the Standard Specifications. The color shall be equivalent to Federal Standard 595C color and is to be selected from test panels provided by the Contractor.

Slope Protection

Slope Protection shall be in accordance with the referenced Standards. The Contractor shall provide concrete slope paving on embankment slope to protect erosion around the abutments and wingwalls.

Foundations

Foundations of the bridge shall be in accordance with the Referenced Standards.

Section 15 - Structures

Drainage

See Section 12 – Hydraulics for bridge drainage requirements. No deck drains are allowed. No bridge rails with scuppers are allowed.

Utilities

2 – 2" Conduits per side of bridge are required for future utilities. They shall be placed in the bridge rail and extend 20 feet beyond the end of the approach slab. They shall terminate into an electrical box.

Hanging of electrical or telephone conduits or utilities is not permitted under deck overhangs or on bridge rail.

Protection of utility conduits from the settlement of the abutment backfill shall be provided.

Utility placement and loads on bridge structures shall be approved by the Engineer.

Lighting

Under Deck Lighting is required. See Section 14 for requirements

Retaining Walls

General

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

Geometry

Retaining Wall geometry shall be in accordance with the Referenced Standards. The Contractor is allowed to modify wall geometry to meet the project constraints and current design requirements.

Design and construction shall consider surface and subsurface drainage. A system shall be provided to intercept or prevent surface water from entering behind walls. Lengths of wall without relief joints shall be limited to lengths which control the differential settlement.

For retaining walls in front of bridge abutments, provide a minimum clear distance of 3 feet between precast wall panels and bridge abutments. Concrete slope protection is required between the retaining wall and bridge abutment.

Section 15 - Structures

A fence or pedestrian railing shall be provided at the top of walls over 30 inches high, and shall otherwise meet current OSHA and building code safety requirements for all retaining wall installations.

Type

The following Retaining wall types shall be allowed:

- MSE (Mechanically Stabilized Earth) with Concrete Facing
- Soil Nail Walls with Concrete Facing
- Cast in Place Concrete walls on either spread footings or deep foundations
- Tangent Caisson Walls with Concrete Facing

Wall Facing Requirements

All walls will have either a Precast Concrete or Cast in Place Concrete facing. No Block Facing will be allowed. The facing of all walls on the project shall be of a consistent type including surface treatments, pattern, texture, color, and jointing layout. The face of all exposed walls shall have a vertical fractured fin finish appearance with a cast-in-place or precast concrete cap. All surfaces of retaining walls shall have a surface treatment of concrete coating. The concrete coating shall be consistent with Federal Standard 595C Color No. 32630 (Tan) and shall be applied to all exposed surfaces and to 1'-0" below finished grade.

Design Requirements

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

Fencing on walls shall satisfy OSHA, and/or CDOT maintenance requirements.

Characteristics

Retaining Wall characteristics shall be in accordance with the referenced Standards.

Design Reviews

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

CDOT Bridge Rating Manual shall be used for the bridge rating package submittals.

Section 15 - Structures

Construction

General

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

Deliverables

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

Deliverable	Acceptance or Approval	Schedule
Structure Concept Memorandum	Approval	60 days before submitting RFC plans
RFC Structural Plans & Specifications Package (Structural Plans to be provided in both pdf and dgn formats) (see description below)	Acceptance	Prior to Construction
Bridge Rating Package prepared in accordance with the current CDOT Bridge Rating Manual	Acceptance	Prior to Construction

Section 15 - Structures

RFC Plans and Specification Package

The independent design check shall have been completed, and the original final structural design calculations shall be revised and corrected based on comments from the independent design check. Project aesthetic details shall have been incorporated into the Contractor's Drawings. The summary of quantities of all structures shall be included in structure drawing packages for information only in accordance with the Referenced Standards. All structural drawings shall have been completed and the final independent plan check of all the drawings shall be complete. Project special specifications shall have been completed. All changes or revisions resulting from the in-process design review shall be incorporated into the Final Design Documents. If required by earlier review comments, the final foundation report shall be updated and resubmitted with this package.

The Final Plans shall include as many Geology sheets as necessary for each bridge and retaining wall on the Project. Test holes that were done previous to the Project should be shown with a disclaimer. The Final Plans shall also include Hydraulics sheets for all bridges, and Bridge Deck Elevation sheets.

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

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

Section 15 - Structures

Project Special Provisions

REVISION OF SECTION 202
REMOVAL OF PORTIONS OF PRESENT STRUCTURE

DESCRIPTION

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

Subsection 202.01 shall include the following:

> This work shall include the removal of portions of the following as shown on the plans or as directed by the Engineer: arch culvert walls, headwall, footings, toewall, and bottom slab; culvert wingwalls, footings, and toewalls.

CONSTRUCTION REQUIREMENTS

Subsection 202.02 shall include the following:

> At least 10 days before beginning culvert removal the Contractor shall submit to the Engineer details of the removal operations showing the methods and sequence of removal and equipment to be used. If additional removal of unsound concrete is required, it shall be included in the work. All methods and equipment used to accomplish this item shall be approved by the Engineer.

In subsection 202.02 delete the sixth paragraph and replace with the following:

> A saw cutting approximately one inch deep shall be made to a true line along the limits of all removals. The minimum depth of a saw cut shall be 1 inch, or to the depth of the reinforcing steel, whichever occurs first. A saw cutting shall also be made along the limits of removal on all concrete faces which may be visible in the completed work.

Subsection 202.08 paragraph 3 shall include the following;

> Within 24 hours before new concrete is placed, surfaces upon which new concrete is to bond shall be sandblasted to roughen the surface and remove all fractured or loose particles in order to promote good bond with the new concrete.

Section 15 - Structures

REVISION OF SECTION 206
STRUCTURE BACKFILL

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

Delete subsection 206.02, and replace with the following:

206.02 General. All structure backfill, bed course material, and filter material will be accepted in place.

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

Structure backfill (flow-fill) meeting the following requirements shall be used to backfill bridge abutments and culverts. The Contractor may substitute structure backfill (flow-fill) for structure backfill (class 1) or structure backfill (class 2) in other backfill areas of the project.

Ingredients	**Lbs./Cu.Yd**
Cement	50
Coarse Aggregate (AASHTO No. 57 or 67)	1700
Fine Aggregate (AASHTO M 6)	1845
Water	325 (or as needed)

The amount of water shall be such that the structure backfill (flow-fill) flows into place properly without excessive segregation. Approximately 39 gallons of water per cubic yard of structure backfill (flow-fill) is normally needed.

The Contractor may substitute 30 pounds per cubic yard of cement and 30 pounds per cubic yard of fly ash for 50 pounds per cubic yard of cement or may substitute 60 pounds per cubic yard of cement and 60 pounds per cubic yard of fly ash for 100 pounds per cubic yard of cement.

Recycled broken glass (glass cullet) is acceptable as part or all of the aggregate. Aggregate including glass must conform to the required gradations. All containers used to produce the cullet shall be empty prior to processing. Chemical, pharmaceutical, insecticide, pesticide, or other glass containers containing or

Section 15 - Structures

-2-
REVISION OF SECTION 206
STRUCTURE BACKFILL

having contained toxic or hazardous substances shall not be allowed and shall be grounds for rejecting the glass cullet. The maximum debris level in the cullet shall be 10 percent. Debris is defined as any deleterious material which impacts the performance of the flowfill including all non-glass constituents.

(b) *Bed Course Material.* Material shall conform to the requirements of subsection 703.07. Upon approval, aggregate base course conforming to the requirements of subsection 703.03 may be used in lieu of bed course material.

(c) *Filter Material.* Class A, Class B, and Class C filter material shall conform to the requirements of subsection 703.09. Class of material shall be as specified or designated.

Delete paragraphs 13 and 14 of subsection 206.03 and replace with the following:

The maximum layer thickness for structure backfill (flow-fill) shall be 3 feet. The structure backfill (flow-fill) shall be consolidated with suitable mechanical vibrators operating within the flow-fill.

Vibrators shall be of a type and design approved by the Engineer. They shall be capable of frequencies of at least 10,000 vibrations per minute, in air. The vibration at any point shall be of sufficient duration to accomplish consolidation, but shall not be prolonged to the point where segregation occurs.

Subsection 206.07 shall include the following:

Structure excavation and structure backfill required for all culverts and extensions will not be measured and paid for separately, but shall be included in the work

Section 15 - Structures

REVISION OF SECTION 503
DRILLED CAISSONS

Section 503 of the Standard Specifications is hereby revised as follows:

Add Subsection 503.071 immediately following Subsection 503.07 as follows:

503.071 Cross-Hole Sonic Logging

(a) *General Requirements.*

The nondestructive testing method called Cross-hole Sonic Logging (CSL) shall be used on drilled caissons for the bridge piers.

The testing shall not be conducted until 48 hours after the placement of all concrete in a caisson, and must be completed within 20 calendar days after placement on production drilled caissons. The Engineer may specify a longer minimum time if special retarders, mix designs, or other factors result in slower-setting concrete.

The CSL tests shall be conducted by an experienced independent testing organization retained by the Contractor and approved by the Engineer prior to testing.

The CSL tests measure the time it takes for an ultrasonic pulse to travel from a signal source in one access tube to a receiver in another access tube. In uniform, good quality concrete, the travel time between equidistant tubes will be relatively constant and correspond to a reasonable concrete pulse velocity from the bottom to the top of the foundation. In uniform, good quality concrete, the CSL test will also produce records with good signal amplitude and energy. Longer travel times and lower amplitude/energy signals indicate the presence of irregularities such as poor quality concrete, voids, honeycomb and soil intrusions. The signal will be completely lost by the receiver and CSL recording system for the more severe defects such as voids and soil intrusions.

Upon completion of CSL testing all water shall be removed from access tubes and any other drilled holes. After the CSL results have been evaluated, required repair of defects has been conducted and the repair has been evaluated with another CSL survey, the CSL tubes shall then be grouted at the direction of the Engineer with an approved prepackaged grout having a minimum compressive strength of 4000 psi.

Section 15 - Structures

-2-
REVISION OF SECTION 503
DRILLED CAISSONS

(b) *Preparation for Testing*

The greater of a minimum of four (4) CSL tubes or one (1) CSL tube per linear foot of the drilled caisson diameter, which maximum number of CSL tubes controls, shall be installed in each drilled caisson, equally spaced around the perimeter of the caisson at 90 degrees.

The CSL tubes shall be Schedule 40 steel with an inside diameter of 1 ½ inches. Galvanized steel will not be permitted. Substitution will not be permitted. Pipes shall have a round, regular internal diameter free of defects or obstructions, including any at pipe joints (all pipe joints shall be threaded without any couplings), in order to permit the free, unobstructed passage of a 1.35 inch diameter source and receiver probe. Tubes shall be watertight and free from corrosion with clean internal and external faces to ensure passage of the probes, and to provide good bond with the concrete.

CSL tubes shall be fitted with a watertight shoe on the bottom and a removable cap on the top. The tubes shall be securely attached to the interior of the reinforcement cage with a minimum cover of 3 inches.

CSL tubes shall be installed in each caisson in a regular, symmetric pattern such that each tube is placed the maximum distance possible from each adjacent tube, with a spacing of 90 degrees around the perimeter of the cage as specified above or as shown in the plans. The tubes shall be as near to parallel as possible, and are typically wire-tied to the reinforcing cage every 3 feet, or are otherwise secured such that the tubes stay in position during placement of the rebar cage and concrete.

The tubes shall extend from ½ foot above the caisson bottoms to at least 3-feet above the caisson tops. Under no circumstances shall the tubes be allowed to rest on the bottom of the drilled excavation. If the caisson top is sub-surface, the tubes shall extend at least 3 feet above the ground or water surface.

All joints in the tubes required to achieve full-length shall be made watertight. Care shall be taken during reinforcement installation operations in the drilled caisson hole so as not to damage the tubes. After placement of the reinforcement cage and prior to concreting the caisson, the tubes shall be filled with clean water as soon as possible (no later than 4 hours after placement of cage) and the tube tops capped or sealed to keep debris out of the tubes. Care shall be exercised in the removal of caps or plugs from the tubes after installation so as not to apply excess torque, hammering, or other stresses which could break the bond between the tubes and the concrete.

Section 15 - Structures

-3-
REVISION OF SECTION 503
DRILLED CAISSONS

The Contractor shall submit to the Engineer for review the proposed CSL system including equipment schematics, material specifications, tube size, installation details, testing procedures, and joint connections at least 14 days prior to starting drilled caisson construction.

(c) *Typical CSL Test Equipment. Typical CSL test equipment consists of the following components:*

1. A microprocessor based CSL system for display of individual CSL records, analog-digital conversion and recording of CSL data, analysis of receiver responses and printing of CSL logs.

2. Ultrasonic source and receiver probes for 1-½ inches to 2-inch inside diameter pipe, as appropriate.

3. An ultrasonic voltage pulsar to excite the source with a synchronized triggering system to start the recording system.

4. A depth measurement device to determine and record depths.

5. Appropriate filter/amplification and cable systems for CSL testing.

(d) *CSL Logging Procedures*

Before the placement of concrete, a minimum of one tube per caisson shall be plumbed and the tube length recorded, including a notation of the tube projection above the caisson tops. Information on the caisson bottom and top elevations and/or length, along with construction dates shall be provided to the Engineer before the CSL tests.

CSL tests shall be conducted between the pairs of tubes encompassing the perimeter and the major diagonals. Testing shall be in accordance with ASTM D 6760. Additional logs shall be conducted at no additional cost to the Department in the event anomalies are detected.

The CSL tests shall be carried out with the source and receiver probes in the same horizontal plane unless test results indicate potential defects, in which case, the questionable zone may be further evaluated with angled tests (source and receiver vertically offset in the tubes). CSL measurements shall be made at depth intervals of 0.5 feet or less, and shall be done from the bottom of the tubes working upward to the top of each caisson. Probes shall be pulled simultaneously, starting from the bottoms of the tubes, over a depth-measuring device.

Section 15 - Structures

-4-
REVISION OF SECTION 503
DRILLED CAISSONS

Any slack shall be removed from the cables prior to pulling to provide for accurate depth measurements of the CSL records. Any defects indicated by longer pulse arrival times and significantly lower amplitude/energy signals shall be reported to the Engineer, and further tests shall be conducted as directed by the Engineer to evaluate the extent of such defects.

Additional NDT methods may be used to evaluate possible caisson defects including Single hole Sonic Logging, Gamma-Gamma Nuclear Density Logging, 3D Tomography, and/or Surface Sonic Echo and Impulse Response tests.

(e) *CSL Testing Results*

CSL results shall be presented to the Engineer in a report. The test results shall include CSL logs with analyses of:

1. Initial pulse arrival time versus depth
2. Pulse energy/amplitude versus depth

A CSL log shall be presented for each tube pair tested, with any defect zones indicated on the logs and discussed in the test report as appropriate.

Additional needed NDT results shall also be presented to the Engineer in a report format.

Copies of all data (written, electronic, etc.) obtained from the CSL and NDT inspections shall be submitted to the Department in an expedient manner. These submitted copies shall become the property of the Department.

(f) *Evaluation of CSL Test Results*

The Engineer will evaluate the CSL and NDT (if needed) results within 7 days of receipt from the Contractor and determine whether or not the drilled caisson construction is acceptable. The concrete condition shall be evaluated using the methodology described in Section 20.2.1 of the FHWA Geotechnical Engineering Circular Number 10 (Publication No. FHWA-NHI-10-016 Drilled Shafts: Construction Procedures and LRFD Design Methods, FHWA 2010). The Contractor shall provide consultants and/or personnel, on an as needed basis, who are experienced and competent performing the above NDT methods. If a defect is found by the additional NDT, then the cost of the additional NDT shall be the responsibility of the Contractor.

Section 15 - Structures

-5-
REVISION OF SECTION 503
DRILLED CAISSONS

If the NDT records are complex or inconclusive, the Engineer may require coring in accordance with subsection 503.071(g) below, or excavation of the caisson to verify caisson conditions. If a defect is confirmed, the Contractor shall pay for all coring or excavation costs, including grouting of all core holes.

The acceptance of each drilled caisson shall be the decision of the Engineer, based on the results of the caisson integrity testing report(s), including caisson coring, and other information on the caisson placement. Rejection of a caisson based on the caisson integrity testing shall require conclusive evidence that a defect exists in the caisson which will result in inadequate or unsafe performance under expected loads.

In the case that any caisson is determined to be unacceptable, the Contractor shall submit a plan for remedial repairs to the Engineer for approval. Any modifications to the foundation caissons and load transfer mechanisms caused by the remedial action will require calculations and working drawings stamped by a Professional Engineer registered in the State of Colorado for all foundation elements affected. All labor and materials required to perform remedial caisson repairs shall be provided at no cost to the Department and with no extension of the contract time.

(g) *Core Drilling of Drilled Caisson Concrete*

When directed by the Engineer, production drilled caissons that are determined to be unacceptable by the CSL tests shall be cored to determine the quality of the concrete. One core sample shall be taken from each defective caisson for the full depth of the irregularities and for three (3) feet above and below the irregularity.

Because it is desired to obtain a high percentage of core recovery for visual inspection and testing methods, equipment shall be as follows:

6. The core drill shall be in good condition and capable of delivering a smooth flow of power to the bit, both in rotation and down thrust. The pump shall be in good condition and of the positive displacement type. The pump shall be capable of delivering a minimum of 15 gallons of water per minute at 200 psi. It shall be equipped with a relief valve set to release at a maximum of 200 psi. It shall be equipped with a pressure gauge with range from 0 psi to 1,000 psi.

Section 15 - Structures

-6-
REVISION OF SECTION 503
DRILLED CAISSONS

7. The drill shall be size HW or larger. The core barrel shall be size HW or larger, M series, double-tubed, with a chromed inner barrel. The diamond set bit for each hole shall be of best quality, new, and with a minimum of four waterways. The Engineer may require a new bit or replacement of the core barrel at any time inspection indicates excessive wear or loss of diamonds.

8. The core drill machine shall be set so that the drill force will be exactly vertical and so there will be not more than five (5) feet of laterally unsupported drill rod between the bottom of the drill spindle (chuck) and the top of the caisson concrete when the hydraulic feed is in the up position. When longer laterally unsupported sections of drill stem are necessary, braced casing or rigidly braced guides must be used to prevent lateral whip.

An accurate log of cores shall be kept and the cores shall be placed in a suitable wooden crate and properly marked showing the caisson depth at each interval of core recovery. The cores along with two (2) copies of the coring log shall be turned over to the Engineer for inspection and testing.

Construction shall not proceed above the drilled caisson until the quality of the concrete in the caisson, as represented by the core samples, is determined to be acceptable and notification to continue construction is given by the Engineer.

If the quality of the concrete in a drilled caisson is determined to be acceptable, or after caisson remedial repairs are complete and accepted by the Engineer, the Contractor shall grout the core hole with an approved prepackaged grout having a minimum compressive strength of 4000 psi.

Subsection 503.09 shall include the following:

Cross-Hole Sonic Logging, including but not limited to all preparation, materials, labor, equipment testing, analysis of results, and reporting will not be measured and paid for separately and shall be included in the work.

Section 16 – Maintenance of Traffic

MAINTENANCE OF TRAFFIC

The Contractor shall conduct all Work necessary to meet the requirements associated with Maintenance of Traffic (MOT), including provisions for the safe and efficient movement of people, goods, and services through and around the Project while minimizing impacts to local residents and business and commuters.

Administrative Requirements

Traffic Operations

Maintenance of Traffic Task Force

The Contractor shall establish a MOT Task Force to assure proper coordination with affected agencies. The MOT Task Force shall include, at a minimum, the Contractor's Public Information Officer, Traffic Control Supervisor, Superintendent, CDOT, and City representatives. The Contractor shall submit the proposed list of task force members to CDOT for Acceptance within 30 Days after NTP.

The MOT Task Force shall meet weekly, and shall be an integrated element of the Public Information Plan (PIP).

In addition to regular MOT Task Force meetings the Contractor schedule and conduct MOT Task Force Meetings to present and discuss Contractor prepared narratives identifying processes and critical elements of all full closures and coordination activities.

Within 14 Days after Acceptance of the MOT Task Force members, the Contractor shall convene a TMP kick-off meeting. The meeting will be used to develop agreement upon the level of detail required for the TMP as identified in this Section 16.

Transportation Management Plan (TMP)

The Contractor shall prepare a TMP that defines the strategic plan for transportation management on the Project. The TMP shall address major aspects of the Work for individual construction areas, phases, and stages. The Contractor shall use the TMP as a planning and policy guide to develop and execute the project MOT program.

These major aspects shall include, but are not limited to:

1. An overview and description of the proposed construction, subdivided as applicable, into the following components:

Section 16 – Maintenance of Traffic

A. Area: A specific grouping of Work along the Project defined by the Contractor that creates segments of the Project for the purpose of planning and executing the Work.

B. Phase: A specific sequence of the construction Work in an area during which a major traffic movement is undertaken (e.g., a detour) and left in place until the Work is complete and traffic is redirected to another location. This shall require development of a specific Traffic Control Plan (TCP). In some cases, multiple TCPs may be necessary.

C. Stage: A subdivision of Work within a phase that combines similar components of Work to maintain efficiency.

2. A detailed approach to the development of TCPs and MHTs on the Project

3. A list of known or potential roadway, ramp, and lane closures, including the following information

   A. Description of traffic shift

   B. Description of detour

      a. Identification of detour limits to be used in each construction phase.

      b. Contractors' identification and coordination with other construction projects, within the vicinity of the proposed detour route. The impact of these construction projects shall be incorporated into the detour route planning and scheduling.

   C. Number of shifts expected

   D. Duration of shifts and detours

4. A description of proposed detour routes, including:

5. An approach to Travel Demand Management (TDM) strategies

6. An approach to the use of Intelligent Transportation System/Variable Message Sign (ITS/VMS) boards and traffic signals, including coordination with the affected Local Agency's Traffic Management Center or the CDOT Traffic Operations Center (CTMC), and the Contractor's representative.

Section 16 – Maintenance of Traffic

7. The Contractor's plan for coordinating the TMP Activities with those Activities required under Book 2, Section 4 - Public Information.

    A. A checklist identifying specific items that shall be provided both to the Contractor's Public Information Officer, the CDOT Public Information Officer and City Traffic Engineer every Thursday by 10:30 a.m. for public information data collection and management activities on the Project. The checklist shall provide the inclusion of supporting information relevant to coping messages and public awareness and shall be included in the Public Information Plan (PIP) required in Book 2, Section 4.

8. Additional Elements

    A. An approach to coordination and cooperation with construction being performed by projects adjacent to the Project limits.

    B. An approach to coordination with RTD.

    C. An approach to traffic access management, including restrictions, bicycles, pedestrians, and potential impacts to handicapped mobility.

    D. Relevant portions of the Incident Management Plan (IMP), described below.

    E. An approach to special event coordination.

9. Typical section requirements

10. Emergency requirements

    A. Pull-out locations
    B. Emergency access
    C. Courtesy patrol

11. Temporary closure scenarios

    A. Location
    B. Time and Duration

12. Access

    A. Pedestrian/bike
    B. Business
    C. Work Site (area)

Section 16 – Maintenance of Traffic

D. Bus/Transit

13. Construction Zone Temporary Speed Reduction

Temporary speed reduction, if warranted, must be authorized by a Form 568 approved by the R6 Traffic Engineer. Temporary speed reduction may be authorized during the construction phasing of the US 6 Project when the following conditions exist:

A. Restricted shoulder widths and TCD placement within 2' of the travel way
B. Lane closures adjacent to live traffic
C. Traffic phasing where corridor geometrics restrict design speed to less than posted speed
D. Other safety concerns as documented by Contractor's Engineer14. MHT Requirements

The Contractor shall use barriers to positively separate traveled lanes and work zones. All work zone traffic control devices, barriers and crash cushions/impact attenuators shall meet NCHRP 350 Test Level 3 requirements.

The TMP shall be submitted to CDOT (and City of Lakewood if Garrison Street is affected) for Acceptance at least 30 Days prior to construction. No Work that impacts traffic shall commence until the TMP is Accepted.

Coordination with CDOT Traffic Management Center (CTMC)

Routine requests for use of the CTMC VMS boards shall be submitted to CDOT by 10:30 a.m. on Thursday of the week prior to when the VMS boards will be needed (Monday through Sunday of the following week). Requests for routine use of the VMS will be reviewed by noon Friday of the same week of the submittal. The Contractor shall coordinate directly with the CTMC following review by CDOT.

For after-hours operations only, the Contractor shall coordinate directly with the CDOT Traffic Management Center (CTMC). The CTMC is available to the Contractor to modify VMS messages 24 hours a day, 7 days a week.

The Contractor shall coordinate with CDOT and the CTMC, and City of Lakewood for emergencies in accordance with the Accepted Incident Management Plan

Section 16 – Maintenance of Traffic

Incident Management Plan

The Contractor shall develop a detailed Incident Management Plan (IMP) as a companion to the TMP to manage traffic incidents and emergency operations on the project Site.

The IMP shall, comply with the CDOT *Guidelines for Developing Traffic Incident Management Plans for Work Zones*.

At a minimum, the IMP shall include the following components:

1. Coordination with the Public Information Plan (PIP)
2. Incident detection and identification
3. Incident response
4. Incident site management
5. Incident clearance
6. Dissemination of traveller information regarding incidents
7. Courtesy patrol
8. Emergency services notification, including local area Police Departments, the Colorado State Patrol (CSP), local area fire departments, ambulance services, and any other emergency response providers.
9. Notification of local school districts about possible impacts to school bus routes, student drop-offs, and/or pedestrian facilities
10. Geographic and other special constraints
11. Available resources
12. Operational procedures

The IMP shall be submitted to CDOT for Acceptance at least 30 Days prior to construction. No Work that impacts traffic shall commence until the IMP is Accepted.

Business and Private Access

The Contractor shall maintain public and private access to the local street system at all times.

TCPs and MHTs shall incorporate stakeholder information from the PIP, available surveys, and other pertinent studies relating to business and private access to the local

Section 16 – Maintenance of Traffic

street system and the highway facility. At a minimum, the Contractor shall communicate and document the following information relevant to business and private access:

1. Access points impacted by a particular construction phase or stage
2. All notifications of affected businesses and land owners
3. Schedule of closures and estimated durations
4. Site-specific access or delivery requirements for local businesses (deliveries, wide load vehicles, etc.)
5. Proposed mitigation efforts

Maintenance of Traffic Variance Process

The Contractor may request a MOT variance for any closure, detour, or other restriction beyond the specified limits defined herein. The following information shall be included in each MOT variance request:

1. Summary of the variance request
2. Justification for the variance request, including a list of the criteria that cannot be met and the reasons for not being able to meet the criteria
3. Public notification methods and schedule
4. List of affected emergency services and the schedule for notification
5. List of affected agencies or private owners and the method(s) and schedule for notification
6. Description of additional public information surveys to be performed, if required
7. List of any potential safety hazards to which the public may be exposed
8. Proposed revisions to the Accepted TCP or current MHT
9. Proposed duration of closure, detour, or phasing change for which a variance is requested

The Contractor shall allow CDOT a minimum of 14 Days for review and Approval of any MOT variance requests. The Contractor shall obtain Local Agency approval for detours utilizing non-State owned facilities. If Local Agency approvals are necessary, they shall be obtained prior to submittal of the MOT to CDOT.

Section 16 – Maintenance of Traffic

Contractor Response Time

The Contractor shall have at least one employee on call, via cellular phone, that can respond to an incident within 30 minutes. Upon arrival at the incident site, that employee shall assess the situation and immediately notify the appropriate personnel to implement the IMP. Upon notification of the incident, the Contractor shall immediately undertake actions necessary to restore traffic operations to the maximum extent practicable.

Special Events

The Contractor shall coordinate with CDOT, the City and all other local agencies, along with the Public Information Officer as specified in Book 2 Section 4 to develop a list and schedule of special events. The Contractor shall update the list as events are identified or scheduled. The special event calendar shall be a standing agenda item at the Maintenance of Traffic Task Force meetings.

The Contractor shall identify and implement necessary changes in Work progress to accommodate traffic to and from special events. No lane closures shall be permitted on the day of the event unless Approved by CDOT. Work outside the travel lanes, ramps and shoulders will be permitted during special events.

RTD Transit System

The Contractor shall coordinate with RTD to minimize any impacts to the RTD Transit System including bus routes, station access, bus stop locations, and other RTD services.

The Contractor shall maintain access to all RTD stations within the Project limits during construction. Any modifications to RTD station access or bus stop locations shall be submitted to CDOT for Approval.

Coordination with Adjacent Projects

The Contractor shall coordinate with CDOT, RTD, City of Lakewood, and their contractors to coordinate construction traffic and detour impacts and minimize simultaneous closures or impacts to adjacent or alternate routes.

Design Requirements

The Contractor's Professional Engineer in responsible charge of the MOT design shall prepare, Review, and Approve: field design changes; Released for Construction documents; and TCP and MHT plans.

Section 16 – Maintenance of Traffic

Traffic Control Plans (TCP)

The Contractor shall prepare a TCP to control traffic on the Project. The TCP shall conform to the requirements specified herein and the CDOT Standard Specifications for Road and *Bridge* Construction and the most current version of the MUTCD. The TCP shall generally describe all lane and shoulder configurations, including widths, traffic control signing, pavement markings, traffic control devices, temporary signalization, construction access, construction parking, emergency access, work areas, and pedestrian/bicycle requirements necessary for each construction phase. Temporary traffic signals shall be installed in conformance with standards set forth in Book 2, Section 14, Signing, Pavement Marking and Signalization & Lighting.

The TCPs shall be submitted to CDOT for Acceptance 14 Days prior to implementation of the particular TCP.

TCPs for local streets shall be submitted to Lakewood for Acceptance 14 Days prior to implementation of the particular TCP.

Any major revision to the TCP, as determined by CDOT, shall require submission of a new TCP for Acceptance.

Method of Handling Traffic (MHT)

The Contractor shall prepare MHTs in accordance with the Project Special Provisions included in this Section 16.

Temporary traffic signals, if determined necessary by the Contractor, shall be installed in conformance with standards set forth in Book 2, Section 14, Signing, Pavement Marking, and Signalization & Lighting.

Design Vehicle

The design vehicle shall be as described in Book 2, Section 13, Roadways, Exhibit 13-1.

Section 16 – Maintenance of Traffic

Design Speed and Posted Speed

Minimum design and posted speeds for Work zones shall conform to Table 16.2.

Table 16.2
DESIGN AND POSTED SPEEDS FOR WORK ZONES

Location	Design Speed (mph)	Posted Speed (mph)
US 6 Mainline	60	55
Ramps and collector-distributor roads	25	25
Local Streets*	25	25

* The Contractor shall provide existing design and posted speed whenever it can be reasonably maintained on the local system.

Minimum Lane Requirements

Lane Restrictions

Before any travel lanes or shoulders are closed, the Contractor shall submit an appropriate MHT or TCP to CDOT for Acceptance. The MHT/TCP shall be developed in accordance with CDOT Regions 6 Lane Closure Strategies and Local Agency guidelines.

Lane restrictions must be submitted to CDOT by the Contractor by Thursday 10:30 a.m. of the week in advance of the work (for work Sunday through Saturday), unless required by construction emergencies or other reasonably unforeseen events.

Lane Restrictions

Minimum lane widths for travel lanes on US 6 shall be 11 feet. Minimum outside shoulder widths on US 6 in the vicinity of Garrison Street are allowed to the minimum shoulder width of 2 feet. Inside shoulder widths shall be a minimum of 2 feet.

Three lanes in each direction of US 6 shall remain open at all times, except as allowed per the Region 6 Lane Closure Strategy. During all non-working hours the contractor shall maintain three through lanes at all times on eastbound and westbound US6.

When travel on US 6 mainline is reduced to a single lane in one direction, the Contractor shall provide a minimum clear width of 16 feet to accommodate oversize vehicles.

Section 16 – Maintenance of Traffic

All lane closures on US6 shall be consistent with the Region Six Lane Closure Strategy.

Ramps, Collector-distributor and Frontage Roads

Minimum lane widths for ramps, collector-distributor and frontage roads shall be 11 feet. Minimum shoulder width is 2 feet.

A minimum of one lane in each direction shall remain open on all frontage roads. At the Garrison Street intersections of the ramps/frontage roads, in the EB and WB directions, a minimum of two approach lanes to each signal shall remain open at all times to provide for a separate left turn lane and a thru-right lane at the signal. The two lanes shall be minimum 11 ft. width extending 250 ft. back from the intersection stop line.

Local Roads

The contractor shall maintain one through lanes of traffic on Garrison Street at all times.

Minimum lane widths for through lanes and turn lanes on Garrison shall be 10.5 feet with additional 1 foot inside and outside shoulders.

A left turn lane from Garrison to each US6 frontage roads shall be provided for at all times.

Any and all variances for Garrison Street lane closures and lane reductions shall be Approved by the City of Lakewood.

One lane in each direction shall remain open on all Local Streets at all times. Minimum lane widths shall be 11 feet with minimum shoulder widths of 2 feet.

Queue Lengths During Construction

The Contractor shall monitor queue lengths on all roads within the Project limits whenever a lane closure is in effect. The Contractor shall adjust the traffic control devices, including advance signing; to provide advance warning to motorists, of stopped traffic.

Working Time Violations Incidents (WTVI)

If there is a violation of the working time limitations for traffic control as allowed for in this Section 16, a written notice to stop Work will be imposed on the Contractor at the start of the next Working Day. Work shall not resume until the Contractor assures CDOT, in writing, that there will not be a reoccurrence of the working time violation. If more violations take place, CDOT will notify the Contractor in writing that there will be a price reduction charge for each WTVI. This WTVI price reduction charge shall be reflected on the Contractor's monthly invoice. This price reduction will not be considered

Section 16 – Maintenance of Traffic

a penalty, but will be a price reduction for failure to perform traffic control in compliance with the Contract.

A WTVI is any violation up to 30 minutes in duration. Each 30 minutes or increment thereof will be considered as a WTVI. A price reduction will be assessed for each successive or cumulative 30-minute period in violation of the working time limitations, as determined by CDOT. A 15-minute grace period will be allowed at the beginning of the second WTVI on the Project before the price reduction is applied. This 15-minute grace period applies only to the second WTVI.

WTVI charges shall be as follows:

1. US 6 - $4,600 per WTVI
2. All local street WTVI charges will be consistent with the Local Agency policy

Interchange Closures

Interchanges

1. Construction at all interchanges shall be consistent with the CDOT Region 6 Lane Closure Strategies.

2. The Contractor shall coordinate phasing of the construction at Garrison Street interchange ramps so as to provide full access movements at all times to and from US6 during construction. Detours may be utilized to provide full access requirements to and from US6. Local Streets shall not be utilized as detours. Detour routes shall be state highways including Alameda Avenue, Colfax Avenue, Kipling Street, and Wadsworth Blvd.

Ramp Closures

The CDOT Region 6 Lane Closure Strategy and Ramp Closure Policy shall be adhered to for all ramp closures at Interchanges.

1. The Garrison Street eastbound off-ramp closure for final grading and paving will be allowed for up to one week, and a temporary detour shall be required.
2. If the contractor requires a closure of the EB Frontage Road, the contractor shall place additional signs at the intersections of Garrison Street and:

- West 5th Place
- West 5th Avenue
- West 4th Place
- West 4th Avenue
- West 3rd Place

Section 16 – Maintenance of Traffic

- West 2nd Avenue

The legend of these signs shall contain a message similar to "ROAD CLOSED TO THRU TRAFFIC" and "NO ACCESS TO 6TH AVENUE". Additional ""NO ACCESS TO EAST 6TH AVENUE" signs shall be placed at the intersection of Garrison and 1st Street, Garrison and Alameda, and Garrison and 10th Streets.

Detour Routes

Unless otherwise specified, only State Highways shall be used for detour routes and haul routes. Local Agency local streets shall not be used as detours, haul routes, staging areas or for parking of contractor personal or work vehicles. Use of Local Agency non-local streets for detours, haul routes or staging areas shall be approved by the Local Agency.

All detour routes shall be the shortest length possible utilizing the State Highway System including Alameda Avenue, Colfax Avenue, Kipling Street, and Wadsworth Blvd.

Trail and Pedestrian Impacts

Existing trail systems, temporary trails, sidewalks, and pedestrian routes must be maintained at all times. The Contractor shall meet all requirements of ADA as specified in Book 1 Section 2.2.

The following restrictions shall apply to existing trail systems in the vicinity of the Project:

1. No trail closures shall be allowed from 5:00 a.m. to 8:00 p.m. any day of the week.
2. Temporary trail detours will be allowed under the following conditions:

    A. PIP requirements shall be identified and appropriate public notifications provided.

    B. The Contractor shall comply with the CDOT *Construction Detour Standards for Multi-Use Trails*.

Section 16 – Maintenance of Traffic

Emergency Pullouts

Section deleted

Courtesy Patrols

Section deleted

Construction Requirements

The Contractor shall provide installation, maintenance, and removal of all temporary traffic control devices.

Temporary Traffic Control Devices

Construction Signing

Construction signing within the Project limits and all detours shall comply with CDOT *Standard Specifications*, the MUTCD and all other applicable standards set forth herein. Construction signing and construction signing maintenance shall be the responsibility of the Contractor.

Wood signposts conforming to CDOT *Standard Specifications* will be allowed for installation of temporary signs.

Temporary Traffic Signals

Temporary traffic signals, if determined necessary by the Contractor, shall comply with Book 2, Section 14, Signing, Pavement Marking, Signalization & Lighting. The Contractor shall operate the temporary signals and respond to malfunctions during the duration of the project.

Temporary signal timing shall be designed and submitted to CCD TES 14 days prior to implementation for their approval. Timing for the temporary signal(s) will be provided by CCD TES. Maintenance of the temporary signal(s) shall be the responsibility of the Contractor.

Temporary Marking Paint and Signs

The Contractor shall furnish, apply and remove temporary pavement marking paint in accordance with CDOT *Standard Specifications*. Temporary paint striping shall meet the conformity of lines (including no overspray), dimensions, patterns, locations and details established in the Contractor's TCP and MHT.

Section 16 – Maintenance of Traffic

1. Temporary pavement paint striping shall be re-striped once a month, or as required to maintain safe traffic operations.
2. Epoxy-based paint shall not be allowed on concrete pavement surfaces for temporary striping.
3. Hydro blasting, or other methods that do not result in scaring of permanent pavements shall be used for removal of temporary striping.

Glare Screens

Glare Screens shall be designed and installed on all opposing traffic permanent median barrier within the project construction limits on US6. Glare screens shall be of industry standards.

Glare screen shall be designed and installed on all opposing traffic temporary barrier through sections where opposing traffic lanes are shifted.

The Contractor shall evaluate the applicability of glare shields in all cross overs.

All work zone traffic control devices shall meet NCHRP 350 Test Level 3 requirements.

Maintenance of Temporary Traffic Control Devices

The Contractor shall be responsible for the maintenance of all temporary traffic control devices within the Project limits, including the local street system.

Detour Pavement

The Contractor shall provide a paved surface for all detours. Detour pavement locations shall be generally described in the Contractor's TMP and detailed in the Accepted TCP. The Contractor shall determine the type and thickness of pavement that shall be used to accommodate existing traffic loadings.

The Contractor shall maintain the detour pavement for the entire period that it is open to the traveling public, including all temporary approaches, accesses, crossings, and intersections with adjacent roads and streets. Detour pavements shall be maintained in good operating condition devoid of potholes, uneven surfaces, and rutting. CDOT may direct the Contractor to repair or replace detour pavements if, in CDOT's sole discretion, detour pavements are determined to be in poor condition.

Detours that use existing streets pavements shall be subject to pavement repair or replacement where it is determined that the condition of the existing pavement has noticeably deteriorated over the duration of its use as a detour. The Contractor shall obtain written approval from the affected Local Agency prior to use of any local streets for detours.

Section 16 – Maintenance of Traffic

The Contractor shall be responsible for the complete removal and disposal of all temporary detour pavement.

Deliverables

The Contractor shall submit the following to CDOT (and CCD TES when applicable) for review, Approval, and/or Acceptance:

Deliverable	review, Acceptance, or Approval	Schedule
List of MOT Task Force members	Acceptance	Within 30 Days following NTP
Transportation Management Plan (TMP)	Acceptance	30 Days prior to Construction
Requests to CDOT CTMC and Local Agencies for modifications to traffic signals, timing, and VMS messages	review	14 Days prior to the requested date for modifications
Incident Management Plan (IMP)	Acceptance	30 Days prior to Construction
MOT variance request	Approval	14 Days prior to the requested date for the change
Traffic Control Plan (TCP)	Acceptance	At least 14 Days prior to implementation of the TCP
Method of Handling Traffic (MHT)	Acceptance	At least 2 Days prior to implementation of the MHT requiring a lane closure
Temporary Signal Timing	Approval	At least 14 days prior to implementation of timing

All deliverables shall also conform to the requirements of Book 2, Section 3, and Quality Management.

Section 17 – Landscaping

Design Requirements

Landscape Plan

The Contractor shall prepare a Landscape Plan for all existing plant material in all disturbed areas on the Project. The Landscape Plan shall address both temporary and permanent work. The Landscape Plan shall include the areas to be final seeded and the locations, mitigations, removals, and replacements of Project-impacted trees, shrubs, landscapes and irrigation.

The Landscaping Plan shall be required for any area of the Work where construction disturbance occurs including permanent Right-of-Way (ROW), temporary easements, staging, haul road, locations of borrow, or other areas that are disturbed as part of the Project or Work.

The Landscape Plan shall identify the locations of protected areas. The Contractor shall save, protect, and maintain all existing vegetation in the Project except for the vegetation that must be removed to accommodate construction of the Project. All construction operations shall be performed in such a manner that will avoid these protected areas.

The Landscape Plan shall be developed in conjunction with erosion control requirements, as defined in, Section 12 Drainage, of the Contract. The Landscape Plan shall be phased to promote the protection of existing vegetation and working-an-area-to-completion for final stabilization.

The Landscape Plan shall document the vegetation location and identification. This shall include species, location, condition, size, health, and a recommendation for remaining undisturbed, pruning, removal, transplanting, or replacement.

The Landscape Plan shall include photo documentation of the vegetation, including grass coverage for the extent of the Project limits.

The Landscape Plan shall include the proposed locations of replacement or proposed locations of transplanted vegetation within Project boundaries.

The Landscape Plan shall make recommendations for tree species based on the species and conditions as outlined by the State of Colorado portion of *The Roadside Use of Native Plants*, August 2000 USDOT, FHWA publication as edited by Bonnie Harper-Lore and Maggie Wilson.

Section 17 – Landscaping

All non-Colorado Senate Bill 40 (SB 40) trees removed shall be replaced within the Project boundaries on a 1:1 basis. Replacement species shall match existing except for Elms or Russian Olive species. The Contractor shall comply with Local Agency planting requirements for both size and species for trees impacted or planted on local agency property.

No plantings shall include any noxious weed species.

Replaced materials shall comply with Section 214 of the *Standard Specifications* and be equal or better to the existing materials in type and function.

Project impacted trees/shrubs within a riparian area (i.e., SB 40 trees and shrubs) shall be mitigated in accordance with Section 5, Environmental Requirements, of the Contract.

The Landscape Plan shall identify the landscape and irrigation systems impacted by the Project. The Contractor shall repair, replace, relocate, or adjust all irrigation system components on Project impacted property that are disturbed by the Work. Replaced materials shall comply with

Sections 214 and 623 of the Standard Specifications and be equal or better to the existing materials in type and function.

The Landscape Plan shall include a schedule of when Work shall take place.

A watering schedule listing the Calendar Days chosen to complete the required watering shall be included as part of the Landscape Plan to facilitate reviews by the CDOT. A field review shall be necessary as part of the Acceptance of the Landscape Plan.

The Contractor shall prepare and submit drawings and narrative as part of the Landscape Plan.

The Integrated Noxious Weed Management Plan, described in this Section 17, shall be included in the Landscape Plan.

All work shall be completed by a registered landscape architect in the State of Colorado.

Seeding

All disturbed areas within the Right-of-Way that are not surfaced shall be re-vegetated to replicate or enhance native vegetative communities.

Section 17 – Landscaping

Slopes shall be designed to be 4:1 or flatter as typical, unless otherwise accepted as a variance by the Contractor's Engineer. Slopes steeper than 4:1 shall be constructed according to additional requirements of the Section 17 of the Contract. All areas to be seeded shall be accessible to maintenance activities as Accepted by CDOT.

Native grass seed mix shall contain low growing or slow growing, cool and warm season grass seed mix appropriate for the Colorado, Denver metropolitan area and as per CDOT's Policy Directive 503 for landscaping with native grass material. Noxious weeds and re-vegetation species that attract wildlife to the Project shall not be used. The proposed native seed mix shall be included in the Landscape Plan.

Slopes in detention facilities shall be planted with a grass mix that has been successfully implemented on other CDOT projects.

Integrated Noxious Weed Management

The Contractor shall use industry standard protocol for weed management, including the development of a Integrated Noxious Weed Management Plan (INWMP) to mitigate the potential adverse effects of earth disturbance. Noxious Weeds lists from CDOT, the State of Colorado, and the Local County and City shall be used.

The INWMP shall include a component to eradicate Tamarisk on the Project. The INWMP shall also incorporate appropriate methods, such as herbicides, mechanical removal, and (potentially) biological controls. Appropriate control methods shall be selected carefully, especially in sensitive areas, such as wetlands, riparian and habitat corridors.

Noxious weeds shall be spot sprayed. In locations where spot application is not practicable, a wildlife biologist will inspect the area prior to spraying to ensure crucial habitat will not be impacted. The INWMP is further described in Book 2, Section 5 - Environmental.

Construction Requirements

Landscape Plan

Once the Landscape Plan is Accepted, the Contractor shall clearly tag all existing plant material that will remain undisturbed, pruned, removed or transplanted per the Accepted Landscape Plan and prior to the start of all construction activities. The Contractor shall also conduct a landscape walkthrough with the CDOT Landscape Architect prior to the start of construction. After Acceptance of the walkthrough, plant material shall be transplanted to areas, protection installed and pruning finished, as Accepted in the Landscape Plan and walkthrough. Removals may take place over the life of the Project.

Section 17 – Landscaping

Clearing and Work Area Limits Identification and Protection

The Contractor shall delineate the clearing and work limits in areas adjacent to existing wetlands, trees, and significant vegetation for Acceptance by CDOT. Upon Acceptance, the Contractor shall install temporary orange fencing in these areas to identify the clearing boundary. The Contractor shall flag those trees adjacent to the boundary that are to remain in place. The Contractor shall use all appropriate care to avoid damage or removal of the flagged trees. Flagged trees that are damaged shall be replaced in-kind at the Contractor's expense. Trees that are damaged and assessed as salvageable shall be promptly repaired, pruned, wrapped, and protected from further damage at the Contractor's expense. All replacement trees and shrubs shall be native species per the State of Colorado portion of FHWA's *The Roadside Use of Native Plants*, August 2000.

The Contractor shall repair or replace in-kind all landscape material and vegetation that is disturbed by the Work. Replaced materials shall be equal or better than the existing materials in size, type and, condition. Re-vegetation plans for these areas shall be coordinated with the maintaining entity.

The Contractor shall repair, replace, relocate, or adjust all irrigation system components that are disturbed by the Work. Replaced materials shall be equal or better than the existing materials in type and function. Irrigation system modifications for these areas shall be coordinated with the maintaining entity.

Protection Areas

The Contractor shall install temporary fencing for the protection of all existing vegetation that is designated to remain undisturbed, for Acceptance by CDOT. Fencing shall be placed at twice the drip line for trees. The Contractor shall use all appropriate care to avoid damage or removal of the tagged trees. Tagged trees that are damaged shall be replaced in-kind at the Contractor's expense. Trees that are damaged and assessed as salvageable shall be promptly repaired, pruned, wrapped, and protected from further damage at the Contractor's expense.

Construction activities, such as earth disturbance, storage, staging, or parking inside the drip line shall be prohibited. No chemicals shall be applied or used around or near these areas that would be detrimental to vegetation health.

The Contractor shall immediately report damage to any tree within the Work area designated to remain undisturbed, to CDOT, for assessment of the damage and survivability. Trees that are damaged which, at the sole discretion of CDOT, are determined will not survive, shall be replaced at the Contractor's expense. Trees that are damaged and are assessed as salvageable shall be promptly repaired, pruned, wrapped, and protected from further damage at the Contractor's expense.

Section 17 – Landscaping

Irrigated areas to remain shall be designated in the Landscape Plan and secured to prevent access for parking, staging, or other related Work elements, to ensure there is no damage to the system.

Trees and Shrubs

Removal of Trees and Shrubs

Tree stumps within the roadway prism or within 10 feet of the edges of roadway pavements shall be completely removed and disposed of off the Project Site. All other tree stumps within the Project shall be ground 3 feet below finished grade.

All trees or shrubs removed from the Project shall become the property of the Contractor and shall be completely disposed of off-Site by the Contractor.

Tree and Shrub Transplanting

The Contractor shall transplant trees and shrubs impacted in existing landscaped areas to adjacent landscaped areas, if requested by CDOT. The Contractor shall coordinate with the CDOT and maintainers of existing landscaped areas to determine if transplanting trees or shrubs is desired. Transplanted trees and shrubs will not be subject to the warranty applicable to newly planted material. Trees and shrubs not transplanted shall be replaced on a 1:1 basis in adjacent landscape areas.

Pruning

The Contractor shall have all root and branch pruning that interfere with the Work completed by a licensed and certified tree surgeon. All Work shall be in accordance with American National Standard Institute – ANSI A300-1995, Section 5.3.3.2.

Root Pruning: Tree roots 2 inches or greater in diameter shall not be removed. The Contractor shall not prune roots at a depth greater than the excavation.

Branch Pruning: The Contractor may prune branches that will interfere with the Work per the Approved Landscape Plan.

The Contractor shall remove weak or dead branches on trees that are to remain within the ROW.

Section 17 – Landscaping

Removal

All trees and shrubs removed from the Project shall be completely disposed of off Site by the Contractor.

Tree stumps within the roadway prism and 10 feet of the edges of roadway pavements shall be completely removed and disposed of off the Project Site. All other tree stumps within the Project shall be ground to a depth of 3 feet below the finished surface.

Transplanting

Transplanting shall not take place in those times where it is detrimental to the plants health. Evergreen species shall not be transplanted in the fall. All transplanted plant material shall receive wood chip mulch per *M-Standard* M-214-1 and Section 213 Mulch of the *Standard Specifications*.

Replacement Plant Material

The Contractor shall provide the following minimum tree sizes for trees to be planted or provided as part of the Work:

1. Deciduous trees: 2-inch caliper
2. Evergreen trees: 8 feet in height
3. Deciduous shrubs: 5 gallon
4. Evergreen shrubs: 5 gallon

All trees shall be balled and burlapped in accordance with M-Standard M-214-1 and Section 214 of the Standard Specifications. The Contractor shall be responsible for delivery and storage of trees per Section 214 of the Standard Specifications. Trees shall be protected from damage and deterioration during delivery and storage.

Trees will not be Accepted if the ball of earth surrounding the roots is cracked or broken during delivery and planting. Plants that have been cut back from a larger size to meet specifications (not the specified size), were improperly pruned, or have disease or insect infestation, shall not be Accepted.

All replacement tree/shrubs shall receive wood chip mulch per M-Standard M-214-1 and Section 213 Mulch of the Standard Specifications.

Section 17 – Landscaping

Staking and Watering

New replacement and transplanted trees shall be guyed in accordance with M-Standard Plans M-214-1 and Section 214 of the Standard Specifications. Trees shall be staked for two growing seasons. Guying material shall be removed at completion of the establishment period by the Contractor. Plants should be fully established at the end of three years.

The Contractor shall water new, transplanted, and protected trees on the Project until the Project has completed the establishment period. The Contractor shall water the plant material once a week at the rate of 50 gallons per tree per watering for the months May through October, and shall be watered twice per month at the rate of 70 gallons per tree for the months November through April, or as needed.

Topsoil

All topsoil, either imported or salvaged on Site, shall be treated with an herbicide for noxious weeds prior to final seeding.

Seeding

Placement of soil conditioner, topsoil, seeding, mulching (weed free), and mulch tackifier (or soil retention blanket) shall not be done in a single operation, but shall be completed immediately following each area that is to final grade per Standard Specifications 101, 107, and 208.

Fertilizer shall not be used adjacent to wetlands and waterways.

Seeding shall be drilled .25-inch to .5-inch into the soil. In small areas not accessible to drill, the Contractor shall hand-broadcast the seed at double the rate and rake into the soil .25-inch to .5-inch per Section 212 of the Standard Specifications.

Hydro mulching is an acceptable method of stabilization. Hydro seeding shall only be allowed as Accepted by the CDOT landscape architect. Hydro seeding and hydro mulching shall not be done in the same operation

All native seeding areas shall be mulched and mechanically crimped with weed free hay per Section 213 of the Standard Specifications.

Soil retention blanket shall be used for slopes steeper than 4:1. If soil retention blanket is used, mulching (weed free) and mulch tackifier are not required. Turf reinforcement mats shall be used in swales steeper than 2%. Soil retention blankets shall be per Section 216 of the Standard Special Provisions.

Section 17 – Landscaping

The Contractor shall place native seed, mulch (weed free), and mulch tackifier after each construction phase and prior to any winter shutdown Work.

Native seed areas shall contain a minimum of 90 percent grass species and no noxious weeds. Native seed areas shall have 80 percent coverage prior to Project Final Acceptance. Any native seed areas having poor germination (less than 80 percent coverage) shall be reseeded until establishment is reached. No bare spots greater than 6 feet by 6 feet shall be accepted.

Landscaping Inspection, Establishment, Acceptance, and Warranty Period

Interim Landscape Inspections

The following inspection points shall be completed and the Work shall meet the requirements of the Contract Documents prior to proceeding:

1. Completion of the subgrade preparation
2. Completion of finished grade preparation
3. Layout of planting beds
4. Layout of all plant materials
5. Completion of irrigation systems
6. Completion of planting operations

Nonconforming Work shall be replaced or repaired promptly by the Contractor at its own expense. When damage endangers public safety, or traffic, remedial action shall be taken immediately to ensure safety and prevent further disruption of traffic.

Substantial Landscape Completion

Substantial Landscape Completion is defined as when all plant materials have been planted and all irrigation items are completed in compliance with the requirements of the Contract Documents. Plants shall be healthy and in flourishing condition and be free of dying branches and branch tips, and shall bear foliage of normal density, size, and color. All mulch beds shall be completely mulched.

Prior to Substantial Landscape Completion, a landscape inspection shall be held with CDOT to determine Acceptance of plant material, seeding areas, and irrigation systems. Upon Acceptance CDOT will issue a “Notice of Substantial Landscape Completion.”

Section 17 – Landscaping

Landscape Establishment

The Landscape Establishment Period will commence at Project Final Acceptance which will be contingent upon receipt of a written "Notice of Substantial Landscape Completion" from CDOT in accordance with the requirements of Section 214 of the Standard Specifications and herein. The Landscape Establishment Period will last for 12 months, and will begin the following spring if Project Final Acceptance is issued in the fall.

All landscape installations shall be completely maintained by the Contractor during the Landscape Establishment Period. The Contractor shall submit a detailed Landscape Maintenance Plan in accordance with the requirements of Section 214 of the Standard Specifications and prior to requesting Project Final Acceptance. CDOT will inspect the landscape installations on at least a monthly basis to determine the acceptability of the maintenance Work. Non-conforming maintenance will be brought up to acceptable levels within 5 Days of receipt of notice of maintenance deficiencies.

Landscape Acceptance

Upon completion of the Landscape Establishment Period, at the Contractor's request, CDOT will inspect the landscaping to determine compliance to the requirements of the Contract Documents. All landscape installations shall be fully established, weed-free, clean, smooth, properly graded, and without plant mortality to be Accepted. The Landscape Establishment Period and Contractor maintenance will terminate after Landscape Acceptance is reached. Should CDOT identify any areas of Nonconforming Work, the Contractor shall correct the deficiencies and extend the Landscape Establishment Period for a minimum of one additional growing season at no additional cost to the Project. If Landscape Acceptance occurs in the fall, the Contractor shall continue to maintain the landscaped area (including irrigation system) until the following spring. Any dead plant material or any damaged irrigation components shall be replaced or repaired at no additional cost to the Project. The Contractor shall perform a spring startup on the irrigation system, at no additional cost to the Project, ensuring all irrigation components are in working order.

Landscape Warranty Period

All trees, shrubs, and ground covers shall be completely warranted by the Contractor for one calendar year from the date of Landscape Acceptance. Any plant material deemed deficient following this one-year warranty period shall be replaced in-kind by the Contractor at no additional cost to the Project, and shall be warranted for one additional year by the Contractor. Any additional one-year warranty period beyond the initial one-year warranty period will be considered an extended warranty period. Another inspection will be conducted at the request of the Contractor at the end of the extended warranty period to determine Acceptance or rejection.

Section 17 – Landscaping

If access to a completed landscaped area is required by the Contractor after Landscape Acceptance, landscape materials will be considered existing and shall be protected in accordance with the requirements of the Contract Documents.

Trees or shrubs transplanted at CDOT's direction are not required to be warranted.

Project Special Provisions

The following specifications modify and take precedence over the CDOT *Standard Specifications*.

REVISION OF SECTION 107 - PROTECTION OF EXISTING VEGETATION

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

Subsection 107.12 shall include the following:

The Contractor shall save all existing vegetation (including trees, shrubs, ground covers, grasses, wetlands & riparian) in this area, except for that vegetation, which must be removed to accommodate construction of the Project, per the plans. Specific areas of vegetation to be protected shall be as directed by the Engineer and shall be protected by using orange construction fencing, wire fencing with metal posts or silt fence. Fencing for trees shall be installed at the drip line of the tree or as approved by the Engineer. Equipment shall not be installed or stockpile material placed within 15 feet of existing trees to remain.

The Contractor shall perform all the work in such a manner that the least environmental damage will result. All questionable areas or items shall be brought to the attention of the Engineer for approval prior to removal or any damaging activity.

The Contractor shall promptly report any vegetation damaged or scarred during construction to the Engineer for assessment of damages. Damaged or destroyed fenced vegetation, shall be replaced at the expense of the Contractor. Vegetation of replaceable size shall be replaced at the Contractor's expense. When trees, shrubs beyond replaceable size or wetlands have been damaged or destroyed, the Contractor shall be liable for the appraised value based upon the official current publications. For trees and shrubs use the International Society of Arboriculture, Guide for Plant Appraisals. The Contractor shall pay any fines or jail time should a wetland be damaged, at no cost to the Project. The value of disturbed vegetation shall be calculated according to the following formula:

(Vegetation size) x (Species) x (Location) x (Condition) x (Arborist or Wetland Specialist) = Vegetation value

Section 17 – Landscaping

A consulting Arborist retained by the Department will determine the value of the trees and shrubs. A consulting Wetland Specialist shall determine the value of the wetland or wetland species. This value will be deducted from any money due to the Contractor.

The determination as to whether a plant is of replacement size or beyond will be made by the CDOT Landscape Architect or Wetland Specialist.

If the fence is knocked down or destroyed by the Contractor, the Engineer will suspend the work, wholly or in part, until the fence is repaired to the Engineer's satisfaction at the Contractor's expense. Time lost due to such suspension will not be considered a basis for adjustment of time charges, but will be charged as contract time.

REVISION OF SECTION 202 - REMOVAL AND TRIMMING OF TREES

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

Subsection 202.02 shall include the following:

This work includes the removal and the trimming of trees as directed by the Engineer. This work includes the preservation from injury or defacement of all vegetation and objects designated to remain.

The Engineer will establish environmental limits. All trees, shrubs, plants, grasses, and other vegetative materials shall remain, except as designated by the Engineer.

Prior to beginning any Bridge construction, removal, trimming, and pruning of encroaching vegetation (as determined by the Engineer) shall be completed.

Once all directed clearing, trimming, and pruning is completed and accepted, no additional clearing, trimming, cutting, or pruning will be allowed unless approved, in writing, by the Engineer.

This work shall be done by a Contractor or subcontractor who is a qualified tree surgeon and a member of the National Arborist Association. The firm's or individual's name and qualifications shall be submitted at the preconstruction conference for the Engineer's approval. A list of references and other clients shall be included with the qualifications statement. A written description of work methods and time schedules shall be submitted and approved in writing by the Engineer prior to work commencing.

Access for the removal or pruning of trees will be extremely limited. Trees shall be felled at the risk of the Contractor. Strict limits of disturbance will be defined and shall be adhered to.

Section 17 – Landscaping

Branches on trees or shrubs shall be removed as directed by the Engineer. All trimming shall be done by skilled workmen. All work shall be done according to the following requirements:

1. Pruning shall be done with proper, sharp, clean tools in such a manner as to preserve the natural character of the tree.
2. All final cuts shall leave no projections on or off the branch and shall not be cut so close as to eliminate the branch collar.
3. To avoid bark stripping, all branches 50 mm (2 inches) in diameter and larger shall be cut using the 3-cut method. These branches shall be lowered to the ground by proper ropes.
4. Tools used on trees known or found to be diseased, shall be disinfected with alcohol before they are used on other trees.
5. Structural weaknesses, decayed trunk or branches, or split crotches shall be reported to the Engineer.
6. When cutting back or topping trees, the Contractor shall use the drop-crotch method and avoid cutting back to small suckers. Smaller limbs and twigs shall be removed in such a manner so as to leave the foliage pattern evenly distributed.
7. When reducing size (cut back or topping) not more than one-third of the total area shall be reduced at a single operation.
8. Climbing spikes shall not be used on trees not scheduled for removal.

All brush, branches, limbs, and foliage smaller than 75 mm (3 inches) in diameter shall be chipped into mulch and stockpiled at a designated site. The trunks and limbs 75 mm (3 inches) and larger shall be cut into less than 2 m (6 foot) lengths and hauled to a designated site. Stumps shall be left no higher than 0.5 m (2 feet) above the ground surface and shall not be removed when within the areas to be excavated. When trees being cut off are outside the excavation limits, the stumps shall be cut so that no more than 75 mm (3 inches) remains above the ground surface. Stump grinding is not required in any circumstances.

Subsection 202.12 shall include the following:

Chipping, stockpiling mulch, and hauling and stockpiling trunks and limbs will not be paid for separately but shall be included in the work. Removal of trees less than 75 mm (3 inches) in diameter will not be paid for separately but shall be included in the work.

All clearing and grubbing directed by the Engineer will be paid for as lump sum under the clearing and grubbing item.

Section 17 – Landscaping

REVISION OF SECTIONS 207 AND 212 - TOPSOIL

Sections 207 and 212 of the Standard Specification are hereby revised for this Project as follows:

Subsection 207.01 shall include the following:

This Work includes importing or salvaging on site topsoil that is to be placed on disturbed areas within the Project.

Subsection 207.02 shall include the following:

The source of topsoil for this Project is undesignated. This imported topsoil is subject to Acceptance by CDOT before use. The Contractor shall submit a 1 pound sample of the product four (4) weeks before its use on the Project Site for the Acceptance. The Contractor may salvage existing on site topsoil and/or import topsoil and/or prepare soil using soil preparation. If imported topsoil is used the Contractor shall submit a written notice to CDOT at least 30 days before hauling soil to the site. The Contractor shall supply a sample of the topsoil to Colorado State University Testing Laboratory for analysis. A Certificate of Compliance shall be submitted to the Engineer and to CDOT to verify the organic matter content, pH, sodium absorption ratio, electrical conductivity, and nutrient requirements.

Contractor supplied topsoil shall meet the following criteria:

Property	**Minimum Value**	**Maximum Value**
pH	6.5	7.8
Sodium Absorption Ratio	-	10.0
Salts (electrical conductivity)	-	4.0 mmhos/cm
Organic matter	3.0%	10%

The area where imported topsoil is excavated and/or stored shall be free of noxious weeds. Topsoil shall contain the following minimum ammonium DPTA (chelate) extractable nutrients (the extracting solution used by CSU Soil Testing Laboratory).

Section 17 – Landscaping

Nitrogen	5 ppm air dried basis
Phosphorus	5 ppm
Potassium	30 ppm
Iron (Fe)	5 ppm

Topsoil shall not include any minerals or elements detrimental to plant growth. All rocks and debris larger than 4 inches in diameter, that are visible after topsoil is spread, shall be removed and disposed of in an appropriate manner on the Project site.

At the Contractor's option soil preparation as described below may be used instead of topsoil.

REVISION OF SECTION 212 - ORGANIC AMMENDMENT

Subsection 212.01 shall include the following:

The Work shall consist of incorporation of an organic amendment into the top 6 inches of the soil to be seeded.

Subsection 212.03 shall include the following:

All seeded areas shall be amended with composted organic amendment as shown on the plans, which shall be tilled or ripped, to a depth of 6 inches into the soil. After ripping, remove all debris such as concrete, rocks (greater than 3 inches in diameter), and other deleterious or undesirable material from the area.

Section 17 – Landscaping

Deliverables

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

Deliverable	Review, Acceptance, or Approval	Schedule
Landscape Plan	Acceptance	Prior to construction
Landscape walkthrough and installation of temporary fencing for the protection of all existing vegetation that is designated to remain undisturbed	Acceptance	After tagging all existing plant material according to the Landscape Plan and prior to construction
Notification of use of imported topsoil	Approval	At least 30 Days prior to hauling topsoil to the site
A 1-pound sample and Certificate of Compliance for imported topsoil and 2-pound sample of organic soil amendments and Certification of Compliance	Acceptance	Four (4) weeks before its use on the Project Site
Hydro seeding	Acceptance	Four (4) weeks before its use on the Project Site
Noxious Weed Management Plan	Acceptance	As included in the Landscape Plan within 60 Days after NTP
Substantial Landscape Completion	Acceptance	Prior to Substantial Landscape Completion, a landscape inspection shall be held with CDOT to determine Acceptance of plant material, seeding areas, and irrigation systems. Upon Acceptance CDOT will issue a “Notice of Substantial Landscape Completion.”
Landscape Maintenance Plan	Acceptance	In accordance with the requirements of Section 214 of the Standard Specifications and prior to requesting Project Final Acceptance
Landscape Acceptance	Acceptance	According to requirements of Section 17

Section 18 - Maintenance During Construction

Responsibilities for Maintenance

The responsibility for performing maintenance on US 6 within the project limits shall be the Contractor's responsibility and shall conform to Sections 104.04, 105.19 and 107.17 of the 2011 Standard Specifications for Road and Bridge Construction, and as described herein.

Initiation of Contractor Maintenance Responsibilities

The Contractor will commence maintenance responsibilities beginning at the time of Notice to Proceed for Construction through Substantial Completion, including any and all project suspensions for weather and or seasonal shut downs.

Termination of Contractor Maintenance Responsibilities

All responsibilities assigned to the Contractor shall remain as such until Project Completion.

Maintenance Responsibilities of the Contractor

CDOT will provide snow plowing on paved lanes open to traffic. All other maintenance shall be the responsibility of the Contractor. The Contractor shall perform all required maintenance Activities including, but not limited to:

- Patching and repair of existing pavements.
- Patching and repair of all existing structures included as a part of the Work.
- Repair of shoulder drop-offs.
- Snow and ice removal for lanes closed to traffic, including areas needed for the placement of channelization devices in tapers and tangents sections.
- Maintenance and cleaning of reflective surfaces on delineators and sign panel faces, and refurbishing pavement markings.
- Repair and or replacement of damaged guardrail and barriers.
- Daily trash and debris removal within project limits.

Payment for Maintenance During Construction

Payments for maintenance during construction shall be included in the original Lump Sum Bid price.

Section 19 – ITS

Intelligent Transportation Systems (ITS) Infrastructure

The ITS system in the project area currently includes a CDOT fiber optic trunk line along the north side of US 6. The project requirements include protection of this fiber optic trunk line, and/or relocating the trunk line to fit the new project design needs. In addition, a Closed Circuit Television (CCTV) is required to be added along US 6 near the bridge structure, with a tie-in to the fiber optic trunk line.

The Contractor shall design and construct ITS equipment in accordance with, but not limited to, the requirements of the standards of CDOT based on the project specifications in Section 20 and 21 as appropriate for CDOT ownership, oversight and approval of the Work. The contractor shall be responsible for all costs associated with impacts or relocation to the fiber optic lines cause by the contractor's final roadway, bridge, wall, or drainage design or construction. The existing splice points for the fiber optic trunk line are outside of the anticipated project limits CDOT ITS will direct where the fiber optic trunk line is allowed to be cut.

Design Requirements

The Contractor shall prepare ITS designs and plans for all areas on the Project in accordance with the requirements of the following sections. These plans shall be a component of all Released for Construction Documents where any new ITS elements or modifications are required for the Work. No material, part, or attachment of any equipment shall be substituted or applied contrary to the manufacturer's recommendations and standard practices. The contractor shall submit, for approval to CDOT, all ITS devices and materials prior to installation by submitting product sheets. ITS Infrastructure locations need to meet the requirements of CDOT.

Electrical Power

A new alternating current (AC) metered power source is required for the new camera that will be located on US 6 at Garrison St. The Contractor shall prepare electrical designs and shall include electrical and power requirements for the Intelligent Transportation Systems (ITS). The contractor shall coordinate with the electrical utility company to determine electric power requirements for the Project. The Contractor shall obtain approval of the power service design from the power service provider for the complete and operational power service to all required locations. All power connections to devices shall include a quick-disconnect.

The Contractor shall be responsible for the coordination of power source work to be performed by Xcel Energy. The Contractor shall contact Xcel Energy to request and process to completion the required coordination to establish the power sources for ITS equipment.

Section 19 – ITS

All cost charges from the power service provider, and all necessary materials, including meter (if required), labor, and coordination required to maintain existing or establish new power sources shall be included in the Work.

Location and Protection of ITS Elements

The Contractor shall locate all ITS infrastructure elements within the public Right-of-Way (ROW) such that routine maintenance will not require a lane closure, affect mainline, ramp, or arterial roadway traffic operations, or require complex traffic control. ITS elements shall not be located in the highway median. All devices shall be placed outside of the clear zone, on approved breakaway devices, or placed behind guardrail for the protection of the travelling public and the infrastructure.

All existing underground utilities shall be identified, and all ITS infrastructure elements shall be designed to avoid outages. The Contractor shall be responsible for all repairs to facilities damaged during construction. The Contractor shall be responsible for maintaining and keeping operational all existing ITS devices during construction. All current live fibers shall be respliced in one work shift. Contractor shall notify CDOT ITS a minimum of two (2) weeks before any ITS device, fiber back-bone, or branch outages.

Pull Boxes and Manholes

The Contractor's design shall utilize fiberglass reinforced, polymer concrete pull boxes and pre-cast concrete manholes with a cast iron frame ring and cover. Pull boxes shall be 24 inches x 36 inches for intermediate locations and ITS Manholes shall be used for splice locations. 100 feet of fiber optic cable shall be coiled inside each manhole, and 50 feet of fiber optic cable shall be coiled inside each pull box. Pull box and manhole spacing shall not exceed 1,000 feet.

Material Requirements

If determined to be required, all CDOT pull boxes shall be constructed of fiberglass reinforced, polymer concrete and have a detachable cover with a skid-resistant surface and have the words "CDOT COMM", cast into the surface. Painting of words shall not be allowed. All pull boxes shall be verified by a third-party nationally recognized Independent Testing Laboratory as meeting all test provisions of

ANSI/SCTE 77 2007 Specification for Underground Enclosure Integrity, Tier 22 rating. Pull boxes shall be UL listed. Certification documents shall be submitted with material submittals.

Cabling and Conductors

The Contractor shall design conductors and cables utilizing a minimum of #12 AWG for all electrical conductors. All video-device control cables and connectors shall be designed in accordance with the manufacturer's recommendation and the CCTV manufacturer's signal attenuation requirements.

Section 19 – ITS

Conduit

Design Requirements

The Contractor shall design new and separate conduit systems (including all hardware, fasteners, and accessories) for communication and power control systems. Longitudinal conduits for the communications network shall be installed within the ROW and as close to the ROW line as practical. ITS conduit shall be a minimum of 4-foot deep. The mainline communications run shall contain:

1. One 2” conduit for the CDOT backbone

Material Requirements

All conduits shall meet CDOT specifications. The conduit shall be factory lubricated, low friction, high-density conduit constructed of virgin Schedule 80 high-density polyethylene resin. Conduit shall be capable of being coiled on reels in continuous lengths, transported, stored outdoors, and subsequently uncoiled for installation, without affecting its properties or performance.

Intelligent Transportation System (ITS) Construction Requirements

The Contractor is responsible for the design to maintain all ITS within the Project limits. Modification of ITS facilities shall be subject to the review and Approval of the CDOT ITS at 303-512-5805.

The ITS system is an existing 144-strand fiber optic cable (backbone) in a 2” conduit along the north side of US 6. If the project design requires relocation of the backbone, design details, splicing details and the schedule of downtime of camera and shall be subject to the Approval of CDOT ITS. The ITS design shall be submitted to CDOT at least 90 Days prior to Released for Construction Documents.

Final design shall include one new camera per the specifications in this Project that is on a 30’ pole (30’ above the US 6 roadway surface) near the east side of the new bridge structure on the north side. This position is flexible with pre-approval by Region 1 Traffic and CDOT ITS. This new camera will require a new power source and a 12-Strand Lateral in conduit to a new ITS manhole for splicing to the existing fiber line. The Contractor shall coordinate with CDOT ITS for fiber splicing diagram determination.

Outages

The Contractor shall maintain the operations of the US 6 fiber backbone at all times during the project. If the ITS line needs to be out of service for relocation purposes or splicing to the new ITS manhole, the line shall not be out of service for more than 48 hours.

Section 19 – ITS

The allowed outage timeframe starts at 9pm Friday evening through Sunday evening. Notify 303-512-5805 for coordination of the fiber optic outage two weeks prior to the planned outage.

Pull Boxes and Manholes

The Contractor shall install all pull boxes and manholes based on the latest CDOT *Standard Specifications*. Each location shall be easily accessible for maintenance purposes. Pull boxes and manholes shall not be placed in a known flood-prone area or drainage ditch. A fiber optic cable label shall be attached to each fiber optic cable located within a pull box or manhole. All fiber optic cable splices inside manholes shall be housed in a separate splice closure.

Refer to the Modified Standard Specification for additional requirements.

Cabling and Conductors

All cables shall be installed per the manufacturer requirements for each device or the requirements found in the Modified Standard Specifications in Section 19.4, below. The maximum conduit fill ratio for both new and existing conduits shall be in accordance with the NEC, latest version.

Conduit

For bores that contain more than one conduit, the conduit shall be bundled together and contained in a single bore.

Refer to the Modified Standard Specifications for detailed construction requirements for all conduit installations.

Integration and Testing

Integration and testing shall be conducted for all components that meet any of the following criteria:

1. A device and/or cabinet supporting the device has been installed or relocated.
2. The communications path between the devices and the local cabinet has been disturbed and/or relocated.
3. A new communication path to a device has been established

The Contractor shall be responsible for the installation and integration of all ITS devices within the project limits. This includes all CCTVs and Fiber Optic Cable that currently exist within the project limits. All modifications to the CTMS or Camera software on the CDOT end will be performed by CDOT ITS.

For all devices connected to the fiber optic communication network, integration shall include field site integration and subsystem integration.

Section 19 – ITS

Deliverables

The Contractor shall submit the following to the CDOT Project Engineer.

Deliverable	Review, Acceptance, or Approval	Schedule
ITS plan sheets and details	Acceptance	Prior to Released for Construction
Splicing details	Acceptance	4 weeks prior to splicing
Integration and testing plan	Approval	5 weeks prior to testing and integration
CDOT device data sheets	Acceptance	4 weeks prior to device integration

As-builts upon construction showing devices and fiber locations for integration into CDOT's fiber inventory system, for acceptance.

Section 19 – ITS – Appendix A – Special Provisions

SECTION 19, APPENDIX A

Project Special Provisions

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 604
MANHOLE (TRAFFIC MANAGEMENT SYSTEM)

Section 604 of the Standard Specifications is hereby revised for this project as follows:

DESCRIPTION

The Traffic Management System (TMS) manhole shall include the installation of manholes for the Traffic Management System for locations shown on the plan sheets, or as approved by the Engineer.

MATERIALS

Manhole (TMS) shall consist of a pre-cast concrete, 4-foot square vault with a base and cast iron frame ring and cover. The manhole shall be designed to provide a pre-cast conduit entrance depth of 3 foot. Each manhole, frame and cover shall conform to AASHTO HS20-44. Each Manhole shall be equipment with a removable ladder that is engineered to support 300 pounds. The ladder support shall be permanently fixed to the manhole.

CONSTRUCTION

Pre-cast manhole shall be provided with Corbels (knockouts) to accommodate six (6) 2-inch conduits which shall remain intact unless otherwise required for conduit installation. Contractor shall install conduit in order from bottom to top. Contractor shall seal all voids surrounding conduits in knockouts with epoxy. The manhole shall have a detachable cover that has a skid-resistant surface and have the words “CDOT COMM” physically impressed, (not painted) on its top. The cover shall be attached to the manhole body by screw-in bolts. Each Manhole shall include fiber management canister hangers and cable hooks for proposed fiber. Hangers and hooks for fiber coils and splice canisters shall be of sufficient quantity for each backbone and lateral cable. Fiber optic cable coils shall be tied to each cable hook with plastic cable ties. Caution shall be taken to coil the fiber cable per the manufacture’s recommendations. If hangers are not factory installed in the manhole, bolts for attaching hangers and hooks shall be installed in the manhole walls by means of either an epoxy compound or expansion type fitting. Conduit entering manhole shall have sweeps attached so conduit entrance is elevated.

METHOD OF MEASUREMENT

Manhole (TMS) will be measured by the complete unit in place and accepted by the Engineer. Manhole (TMS) shall include but not be limited to the manhole, excavation and backfill, hooks for coils, hangers for splice canister, knockout sealing, as well as all equipment and labor necessary for a complete manhole installation per project detail sheet.

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 604
MANHOLE (TRAFFIC MANAGEMENT SYSTEM)

PAYMENT

Payment will be made under:

Pay Item	**Pay Unit**
Manhole (Traffic Management System)	Each

Conduit plugs shall be included in the cost of the conduit.

END OF SECTION REVISION

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 612
LOCATION MARKERS

Section 612 of the Standard Specifications is hereby revised for this project as follows:

Description

Contractor shall furnish and install location markers for identifying fiber optic cable and other utilities at locations shown on the plans.

Material

Location Marker (Fiber Optic) (Dome) shall be made of non-conductive high-density polymer, and shall be integrally white in color with an orange cap. All colors shall be stabilized against ultraviolet light such that they will not fade under continuous exposure to direct sunlight. The marker shall retain dimensional stability in temperatures ranging between -40º F and 175º F. In some instances when markers are installed on National Forest Service Lands the fiber optic marker shall be brown in color.

Location Marker (Utility) (Flat Slat) shall be made of fiberglass reinforced composite, and shall orange in color. The marker shall retain dimensional stability in temperatures ranging between -40º F and 175º F. In some instances when markers are installed on National Forest Service Lands the fiber optic marker shall be brown in color.

Concrete footing for dome marker shall be 18 x 18 x 12 inches per project detail. Concrete footing shall be Concrete Class B and shall be in accordance with Section 601.

Location Marker Electronic (Ball) shall be a Full Range Electronic Marker Ball operating at the frequency of 101.4 kHz for communication line locating. The electronic marker ball shall be compatible with a Dynatel cable locator. These electronic markers shall be installed within 12 inches of the lid of said pull box, manhole or open trench. Electronic Markers may be fabricated into the pull box or manhole.

Construction

Location Marker (Fiber Optic) (Dome) shall be installed at appropriate Pull Box and Manhole (TMS) locations as shown on the plans to identify both the backbone fiber cable and lateral fiber cable. To additionally designate the fiber cable, intermediate markers shall be installed at 1000-foot spacing along the running line.

The marker shall include a label with CDOT contact information and the designation of "FIBER OPTIC CABLE". The label shall have black lettering on an orange background. The label shall include the highway milepost of the Pull Box or Manhole (TMS).

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 612
LOCATION MARKERS

The mile post shall be to the nearest hundredth. This label shall be placed below the "FIBER OPTIC CABLE" warning label. In some instances when markers are installed on Forest Service Lands the dome marker label shall have black letting on a brown background. The Contractor shall provide the label submittal to the Project Engineer.

Location Marker (Utility) (Flat Slat) shall be installed at utility pull box/manhole locations and utility point of service to identify both electric and telephone communication lines. Contractor shall designate the utility line with a marker installed mid-point between the utility point of service and the device.

The markers shall include a label with CDOT contact information and the designation of "ELECTRICAL CABLE" or "TELEPHONE CABLE". The label shall have black lettering on an orange background. In some instances when markers are installed on Forest Service Lands the flat marker label shall have black letting on a brown background. The Contractor shall provide the label submittal to the Project Engineer.

Location Marker Electronic (Ball) shall be installed inside each pull box, manhole or open trench at locations shown on the plan sheets. The Marker Ball shall be securely positioned for optimal output and prevent accidental removal.

The Contractor shall provide the Engineer with three copies of detailed As-Built drawings showing the installed locations of all markers and the associated utilities. These drawings shall include but not be limited to the following:

(1) Type of location marker installed
(2) Distances between location markers
(3) Distances between pull boxes and manholes to ITS devices
(4) The distance and location to each CDOT utility point of service connection source point which the local utility companies have provided, including electrical power, transformer source, and telephone pedestals.

Method of Measurement

Location markers, labels and footing will be measured by the actual number of markers that are placed and accepted.

Section 19 – ITS – Appendix A – Special Provisions

-3-

REVISION OF SECTION 612
LOCATION MARKERS

Method of Payment

Pay Item	**Pay Unit**
Location Marker (Fiber Optic) (Dome)	Each
Location Marker (Utility) (Flat Slat)	Each

Payment will be full compensation for all work, materials and equipment required to place the markers at the locations shown on the plans, including excavation, backfill, and patching.

Concrete for footing will not be measured and paid for separately but shall be included in the Marker.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 613
ELECTRICAL CONDUCTOR IDENTIFICATION

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

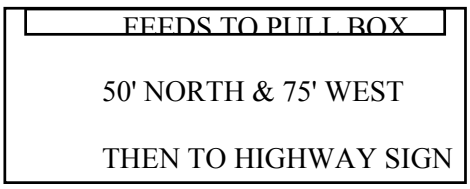
Section 613.08 shall include the following:

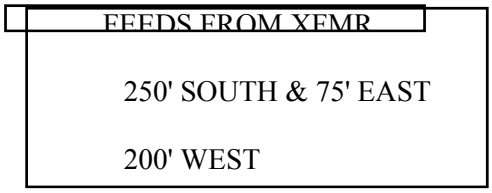
All electrical conductors shall be tagged as follows:

Electrical conductor cable tags shall be located below the termination in the base of the street light, in the pull box, in the pedestal and at the point of termination to existing facilities of the Local Utility Company supplying electrical service. The tags shall be attached with a cable tie. The information written on the tag shall include the direction and approximate length of cable feeds running from where to, etc.

Each incoming conductor shall be individually color coded with 1 tape mark, while outgoing conductors shall have 2 tape marks.

Example:





Uniform tags are available in a Tag Kit. The
Tag Kit consists of: 100 tags, 3 part yellow with 1 hole, 100 black nylon ties and 1 black sharpie pen.

Size	2-1/2" X 5"
Standard Package	Kit
Weight, Kit, Approx.	1.5 Pounds
Color	Yellow

Electrical conductor tagging will not be paid for separately, but shall be included in the cost of the Electrical Conduit and all associated equipment installation.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 613
PULL BOXES

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

DESCRIPTION

Contractor shall furnish and install fiberglass reinforced, polymer concrete pull boxes.

MATERIALS

Pull boxes installed in dirt or landscaped areas shall have a concrete apron with 3 sides, 12 inches wide by 6 inches deep and a top side of 18 inches wide by six inches deep for marker installation. Pull boxes shall not be installed above the grade of the apron. Concrete apron shall have a 1% slope away from the top of pull box. All concrete aprons shall be Class B and shall be in accordance with Section 601.

Pull boxes shall have a detachable cover with a skid-resistant surface and have the words "CDOT COMM" cast into the surface. Painting of words shall not be accepted. The cover shall be attached to the pull box body by means of 3/8 x 7 inch lag head stainless steel hex head bolts and shall have two (2) lift slots to aid in the removal of the lid.

Wire mesh shall be installed in a manor to completely surround the box. The wire mesh shall meet the material standard ANSI/ASTM A555-79 and made of T-304 stainless steel, 0.025 inch wire diameter minimum and shall have a spacing of 12 mesh per inch.

Pull boxes shall be verified by a 3rd Party Nationally Recognized Independent Testing Laboratory as meeting all test provisions of ANSI/SCTE 77 2007 Specification for Underground Enclosure Integrity, Tier 22 rating. Pull boxes shall be UL listed. Certification documents shall be submitted with material submittals.

CONSTRUCTION

A minimum of 12 inches of ¾ inch granite-gravel shall be installed as a base for the pull box to aide in drainage. The ¾ inch granite-gravel shall be free of dirt and debris and spread evenly to facilitate a level base for the pull box. The Contractor shall ensure that sufficient compacting is made prior to the installation of ¾ inch granite-gravel to help alleviate future settling.

Wire mesh shall be installed in a manor to completely surround the box. The wire mesh shall be installed prior to the installation of the pull box above the bed of 3/4" granite-gravel and extending one foot past the outer edges of the concrete apron.

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 613
PULL BOXES

The wire mesh shall be gently cut to allow only the entrance of the conduit at the bottom of the box. Any openings cut in the wire mesh larger than the diameter of the conduit shall be remedied by the installation of additional wire mesh to obtain a completely sealed pull box enclosure.

Pull Box (Surface Mounted) shall be aluminum type with a hinged front door and have at least a NEMA 3R rating. The hinged door shall be provided with both a weather tight seal and an aluminum hasp. Surface mounted pull boxes shall be of the dimensions shown in the plans, and shall be mounted on or embedded into hard surfaces

such as bridge decks, concrete barriers, retaining walls, or buildings, as shown on the plans. Surface mounted pull boxes shall be attached using 3/8-inch epoxy anchors or other methods, as approved by the Engineer. Surface mounted pull boxes shall not be used for ground installations.

METHOD OF MEASUREMENT

Pull Boxes will be measured by the actual number that are installed and accepted, and will include base, lid, excavation, backfill, concrete apron, -wire mesh and 3/4" granite-gravel. Pull Boxes shall also include the removal and patching of pavement, sidewalks, curb and gutters and their replacement in kind to match existing grade.

BASIS OF PAYMENT

Pay Item	**Pay Unit**
Pull Box (24x36x24)	Each

Concrete will not be measured and paid for separately, but shall be included in the cost of the pull box.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 613

ELECTRICAL CONDUIT

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

DESCRIPTION

This work includes furnishing and installing either (HDPE) High Density Polyurethane or PVC electrical conduit. All materials furnished, assembled, fabricated and installed under this item shall be new, corrosion resistant and in strict accordance with the plan sheets and these Special Provisions.

MATERIALS

All conduits shall be Schedule 80 in the diameters, quantities and colors as shown on the project detail sheet and shall be compliant with all ASTM and Bellcore TW-NWT-000356 requirements.

All HDPE conduit shall be factory lubricated, low friction, high-density conduit constructed of virgin high-density polyethylene resin. Conduit shall be capable of being coiled on reels in continuous lengths, transported, stored outdoors, and subsequently uncoiled for installation, without affecting its properties or performance.

PVC conduit shall be certified by the manufacturer as meeting ANSI/UL 6 and 651. The manufacturer shall be ISO 9000 compliant.

CONSTRUCTION

Electrical Conduit (Bored) shall be HDPE and installed using a trenchless technology of either jacked conduit or directional boring.

Electrical Conduit (Plastic) shall be PVC or HDPE and installed by direct burial methods such as plowing, open trenching, or other excavation methods. When PVC is used, expansion fittings shall be installed at 100’ intervals.

One conduit per bundle shall have a copper tracer wire of at least 12-gauge in a single conduit. In trenches containing multiple conduits, the tracer wire shall not be installed in the same conduit as the fiber.

Each individual conduit shall be equipped with a pull tape of 1250 pounds tensile strength and be of a design to prevent cutting or burning of conduit walls during cable installation.

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 613
ELECTRICAL CONDUIT

CONSTRUCTION REQUIREMENTS

The installation of conduit shall be performed in such a manner as to avoid unnecessary damage to streets, sidewalks, utilities, landscaping, and sprinkler systems. Excavations and conduit installation shall be performed in a continuous operation. All trenches shall be backfilled by the end work day. The material from trenching operations shall be placed in a location that will not cause damage or obstruction to vehicular or pedestrian traffic or interfere with surface drainage.

The Contractor shall take all necessary precautions to avoid heaving any existing asphalt/concrete mat or over-excavating a trench, whether caused by equipment directly or by dislodging rocks and boulders. Any such heaving or over-excavation shall be repaired or replaced at the Contractor's expense. The Contractor shall bear the cost of backfilling all over-excavated areas with the appropriate backfill material as approved by the project engineer.

The Contractor shall restore all surface materials to their preconstruction condition, including but not limited to pavement, sidewalks, sprinkler systems, landscaping, shrubs, sod, or native vegetation that is disturbed by the conduit installation operation. All repairs shall be included in the cost of the conduit.

If the Contractor is unable to bore the conduit at the lengths shown on the plans from access point to access point, all splice couplings and associated work to splice conduit shall be included in the cost of this item. The coupling technology shall allow the conduit to be connected without the need for special tools, and shall form a watertight, airtight seal. Breaking force between segments shall exceed 250 pounds of force. No metal fittings shall be allowed. No elevation difference between the conduit run and the splice location will be allowed. Conduit splices shall be kept to a minimum and all locations shall be approved by the project engineer. Additional pull boxes shall not be substituted for splices.

Conduit plugs shall be supplied and installed in all conduit ends as soon as the conduit is installed. Conduit shall be plugged at all termination points such as pull boxes, manholes, controller cabinets, and node buildings. Conduits containing cable shall be plugged with durable and reusable split type plugs, fabricated without metallic parts, and allow easy removal and reinstallation around in-place cables. Split type plugs shall provide a water and air-tight seal of at least 50 psi and shall be installable by hand without using special tools and without damaging the cable. All plugs shall be correctly sized to fit the conduit being plugged. Empty conduits shall be sealed with removable type duct plugs that provide a watertight barrier.

Section 19 – ITS – Appendix A – Special Provisions

-3-

REVISION OF SECTION 613
ELECTRICAL CONDUIT

All conduits shall use sweeps to elevate the buried conduits to within 4 inches of the bottom of the pull box or manhole, as shown in project details. The sweeps shall be terminated within the pull boxes and manholes to allow for easy installation and removal of the conduit plugs. The sweeps shall be set above the ground surface within the pull box at a height that does not interfere with the coiling of the fiber optic cable.

All conduit runs containing fiber optic cable shall have a limited number of bends. The sum of the individual conduit bends on a single conduit run between two pull boxes shall not exceed 360□□□□The preferred limit is 270□□ No individual bend shall be greater than 90□□□□ All conduit bends shall have a minimum acceptable radius. □□he minimum radius for 90□□bends is 48 inches, and the minimum radius for all other bends is 24 inches.

If new conduits are installed in existing pull boxes, manholes or cabinet bases the Contractor shall carefully excavate around the pull box or manhole and install the new conduit as shown in the plans. The Contractor shall not damage the existing pull box, manhole or their contents. If the existing pull box, lid, or the concrete collars are cracked or damaged during conduit installation, the Contractor shall restore the damaged section to preconstruction condition at no additional cost.

METHOD OF MEASUREMENT

Electrical Conduit shall include all electrical wire and/or telephone wire per end equipment requirements. Conduit shall also include anchors, bands, skids, sweeps, pull tape, copper tracer wire, adapters, expansion couplings, conduit plugs, installation equipment, adhesives, labor, and all other items necessary to complete the work.

BASIS OF PAYMENT

Electrical Conduit contract unit price shall be full compensation for work described above, specified in the plans, and complete and in place.

Payment will be made under:

Pay Item	**Pay Unit**
2-Inch Electrical Conduit (Bored)	Linear Foot
2-Inch Electrical Conduit (Plastic)	Linear Foot

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
ETHERNET SWITCH 3930

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

Ethernet Switch shall be a Ciena 3930 Carrier Ethernet Service Delivery Switch (SDS) to be installed at each individual Intelligent Transportation Systems (ITS) device communication cabinet and Variable Message Sign (VMS) cabinet on this project. These Ethernet switches shall be used to transport Ethernet data to and from roadway ITS devices to adjacent regeneration node buildings. All Ethernet switches shall be manufactured by Ciena.

Optical Transceivers or Ethernet extension equipment shall not be used in lieu of an Ethernet switch to transport ITS device communications back to a common Ethernet switch location. If the communications distance between the ITS device and Ethernet switch is greater than can be sent on a standard Cat-5e / Cat 6 Ethernet cable, an Ethernet switch shall be installed at that location.

The Ethernet switch shall utilize Coarse Wavelength Division Multiplexing (CWDM), Small Form-Factor Pluggable (SFP) optic modules. Each switch shall be provided with both a Coarse Wavelength Division Multiplexing SFP optic module and a 1310nm optic module. Optic modules shall be provided as described in the Project Specifications, 614 - Coarse Wave Division Multiplexing SFP and 614 – Small Form-Factor Pluggable – 1310nm SFP as part of the ITS specification package section.

A single mode, 9/125um CWDM wavelength independent attenuator to match the wavelength of the SFP optic modules shall be provided and installed in the communications cabinet or VMS cabinet termination patch panel. Optical attenuators shall be provided as described in the Project Specification, 614 - Coarse Wavelength Division Multiplexing Attenuator as part of the ITS specification package section.

MATERIALS

The Ethernet switch shall be configured with two (2) 1GIG/10GIG SFP+ Small Form-Factor Pluggable ports, four (4) 100M/1000M Small Form-Factor Pluggable ports and four (4) 10/100/1000M RJ-45 Ethernet ports.

The Contractor shall furnish and install the Ethernet switch and associated items shown in Item Table A below. The Contractor shall also furnish the Ethernet switch software and maintenance licenses show in Item Tables B and C. Tables A, B and C describe items for a single Ciena 3930 SDS Ethernet switch.

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 614
ETHERNET SWITCH 3930

Item Table A – Ciena 3930 SDS Ethernet Switch, Hardware Description

ITEM DESCRIPTION	ITEM NUMBER	QUANTITY
3930,(4)100M/1000M SFP,(4)100/1000M SFP/RJ-45,(2)1G/10G SFP+,EXT.TEMP,(2)SLOTS AC/DC PWR SUP	170-3930-900	1
3930/3932/5142,AC PLUGGABLE POWER SUPPLY,WIDE RANGE 120/240V	170-0014-900	2
AC POWER CORD, IEC C13, NORTH AMERICA	CABL-PW01NA	2
100M/1GIG, SM SFP OPTIC, LC CONNECTOR, 10 KM, 1310 NM,EXTENDED TEMPERATURE	XCVR-A10Y31	1
100M/1 GIG, SM SFP OPTIC, LC CONNECTOR, 80 KM, (XXXX) NM, EXT. TEMP	XCVR-A80D(XX)	1
10/100/1000M,SFP TRANSCEIVER,RJ45 CONNECTOR,SGMII,100 METERS, RX LOS,EXTENDED TEMPERATURE	XCVR-B00CRJ	4

Matching coarse wavelength division multiplexing, small form-factor pluggable optic modules shall also be provided for the existing Ciena Ethernet aggregation switches in each of the regeneration node buildings to which the sub ring switches communicate.

Item Table B – Ciena 3930 SDS Ethernet Switch, Software Description

ITEM DESCRIPTION	ITEM NUMBER	QUANTITY
SAOS ADVANCED ETHERNET PERPETUAL SOFTWARE LICENSE FOR 3930	S70-0001-900	1
SAOS ADVANCED OAM PERPETUAL SOFTWARE LICENSE FOR 3930	S70-0001-901	1
SAOS ADVANCED SECURITY PERPETUAL SOFTWARE LICENSE FOR USE WITH SAOS 6.X	170-0204-900	1
ESM CARRIER ED RIGHT TO MANAGE PERPETUAL SOFTWARE LICENSE FOR 3930	S70-0005-900	1

Item Table C – Ciena 3930 SDS Ethernet Switch, Maintenance License

Section 19 – ITS – Appendix A – Special Provisions

-3-

REVISION OF SECTION 614
ETHERNET SWITCH 3930

ITEM DESCRIPTION	ITEM NUMBER	QUANTITY
GLOBAL 3930 SMARTSUPPORT - 3 YEARS	80M-3930-SSP	1
GLOBAL 3930 STANDARD HARDWARE REPAIR 10-DAY - 3 YEARS	80M-3930-HWM	1
GLOBAL 3930 NEXT BUSINESS DAY SHIP MANAGED SPARES - 3 YEARS	80M-3930-NBS	1

All associated hardware and materials not listed in the item tables are considered subsidiary and are required for a complete installation and shall be included as part of the work.

Each Ethernet Switch shall be furnished and installed with a G.8032 ring protection configuration in conformance with Ciena's Ethernet Design and Configuration Services per the Colorado Department of Transportation requirements either prior to installation or at the individual installation sites.

Final configuration including all IP schema design for data transport will be conducted by CDOT personnel after installation and G.8032 configuration.

If field changes are made which affect the original Contractor's material order for the Ethernet switches and require any reconfiguration of the original Ethernet switch order, the Contractor shall ensure that the Ciena representative is contacted and made aware of such changes to alleviate any possible delays in delivery and installation. If for any reason the switch or associated materials are defective or are damaged at the time of installation by either the Contractor or by Ciena, the item shall be removed and replaced at no additional cost to the project. Items shall also be replaced if any failures occur do to manufacture's defects, at no additional cost to the project prior to the final acceptance.

CenturyLink is the direct contracted equipment supplier of Ciena Corporation for the State of Colorado, Colorado Department of Transportation for networking equipment and associated network materials. For project equipment estimate quotations and purchasing, Contractors shall contact the following distributer representative:

Section 19 – ITS – Appendix A – Special Provisions

-4-

REVISION OF SECTION 614
ETHERNET SWITCH 3930

State of Colorado, Colorado Department of Transportation project equipment estimate quotations and purchasing distributer representative.

Keith A. Glose
Premier Account Manager
CenturyLink Government
930 15th Street, 4th Floor, Denver, Colorado 80202
Telephone: 303-992-5567 Fax: 720-578-2694
E-Mail: keith.glose@centurylink.com

CONSTRUCTION REQUIRMENTS

The 3930 SDS Ethernet switch will be installed in an ITS device communications cabinet or variable message sign and connected via the fiber optic backbone to a communications node building in a protected ring design. The switch shall have both a Coarse Wavelength Division Multiplexing (SFP) optic module and a 1310nm SFP optic module. In the final design and implementation, this switch shall share a single wavelength with one (1) other Ciena 3930 Carrier Ethernet Service Delivery Switches making a two (2) Ethernet switch configuration and part of creating a single Carrier Ethernet diverse path sub-ring.

For connection of the switch to the optical fiber network, one (1) lateral fiber optic cable shall be terminated and patch cables shall be installed and connected to the optical ports of the Ethernet switch. A total of four (4) lateral fiber strands shall be used for data communications to the Ethernet switch. Two (2) lateral fiber strands shall be used for communications connecting the SFP optics carrying CWDM traffic, and two (2) lateral fiber strands shall be used for communications connecting the 1310nm SFP optics. Each pair of fiber strands shall be designed for transmitting data on one backbone fiber optic strand and receiving data on a second backbone strand.

Additional splicing is required for the coarse wavelength division multiplexing (CWDM) optical filters at each Ethernet switch location.

The Contractor shall provide single mode, bend insensitive, pre-connectorized duplex patch cables with a polyurethane jacket for connection from the coarse wavelength division multiplexing SFP optic module and the 1310nm SFP optic module. Connectors for the patch cable shall be LC on the Ethernet switch end and ST on the termination end.

Section 19 – ITS – Appendix A – Special Provisions

-5-

REVISION OF SECTION 614
ETHERNET SWITCH 3930

The patch cable shall be of sufficient length to span from the existing termination patch panel to the Ethernet switch SFP ports with a maximum of two (2) feet of slack. They shall be installed in a manner which will not interfere with internal device equipment in the switch enclosure and will include cable management so as not to interfere with future maintenance within the enclosure.

If a protected area inside of the variable message sign cabinet cannot be found for the Ethernet switch installation, the contractor shall install an aluminum backplane on the internal structural supports of the sign housing. It shall be mounted in a location which will not interfere with internal equipment and future maintenance of the variable message sign electronics and cabling.

A field site survey for final placement of the Ethernet switch in the variable message sign cabinet shall be conducted prior to installation.

The Contractor shall arrange to provide for a certified Ciena representative either on site or via remote access through the Colorado Transportation Management Center network to aid in the configuration and installation of the Ethernet switch.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
CLOSED CIRCUIT TELEVISION

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

This work consists of furnishing and installing an Internet Protocol (IP) Closed Circuit Television (CCTV) camera at the locations shown on the Plans.

MATERIALS

The CCTV camera shall include: camera with weatherproof dome housing, pole mount adapter, Power over Ethernet (PoE) midspan module, manufacturer supplied management software, Cat-6 Ethernet cables, and all attachment hardware to complete installation.

Camera Specifications –

The pan-tilt-zoom camera shall be of dome type construction and shall be enclosed in a sealed, heated environmental video dome housing to operate in 100% humidity at a minimum operating temperature of -40° to 122°F carrying both IP66 and NEMA 4x ratings. The camera shall utilize Ethernet protocol for native communications and be capable of sending multiple individually configurable video streams in H.264 and MJPEG format up to 30fps and capable of gathering a minimum of 50 preset color video still frame images with a minimum 176x120 resolution and maximum 704x480. The camera shall have an internal web interface for configuration with security functionality allowing multiple user access levels with password protection. The camera shall support Ipv4/v6, HTTP, HTTPS, SSL/TSL, QOS Layer 3 DiffServ, FTP, SMTP, SNMP v1/2/3, UpnP, DNS, DynDNS, NTP, RTSP, TCP, UDP, IGMP, RTCP, ARP, SOCKS.

Technical specifications for the camera shall be as follows:

- The lens shall be f=3.4 to 119mm, F1.4 to 4.2, autofocus; focus range of 35 mm (wide) to 800 mm (telephoto) to infinity. The angle of view shall be 2.8°- 48° horizontal with minimum zoom capability of 35x optical and 12x digital

- Minimum illumination color 0.5 lux at 30 IRE and B/W 0.005 lux at 30 IRE

- The camera shall provide dual mode, day (color) and night (monochrome) video down to 0.008 lux

- Shutter speed shall be variable from 1/30000 to 0.5 seconds at 60Hz.

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 614
CLOSED CIRCUIT TELEVISION

- The pan function shall provide 360° of continuous rotation at 0.05 – 450°/s and a 220° tilt range allowing for 20° view above the horizon at 0.05 – 450°/s

Pole mount adapter arm and bracket -

The adapter shall have a minimum 33 lb load rating and have provisions that allow mounting directly to the weatherproof dome housing without modification to the housing. The adapter bracket shall have slots for a minimum of 2 straps or banding material for mounting to the poles from 3 inches to 6 inches in diameter. The bracket shall have cable strain relief in at least two locations on the reverse side, (between the bracket and the pole).

PoE midspan module-

Power for the camera shall be by means of a high power over Ethernet midspan module with a pass through port for all Ethernet communications. The module shall meet IEEE 802.3at and 802.3af standards and operate at temperatures from -40°F to +122°F. The PoE module shall allow 100-240 VAC input and 55 VDC output at 60W and operate at temperatures from -40°F to +122°F.

Manufacturer's supplied management software-

Management software shall give the user access to discover and configure the camera using standard network protocols. Software shall allow for network setup and firmware updates.

Cat6 Ethernet cable-

Cable shall be a UTP cable, Category 6 rated and constructed of 24 AWG stranded copper wires. The outer jacket shall be UV resistant PVC insulation. The Ethernet cable shall be terminated with male 8P8C connectors as a 'straight through' cable using the Telecommunications Industry Association / Electronic Industries Alliance (TIA/EIA) T- 568B pin/pair assignments.

CONSTRUCTION REQUIREMENTS

The CCTV camera shall be installed in accordance with these specifications, the details shown in the Plans, and in accordance with manufacturer's recommendations. The Contractor shall make all arrangements for a qualified manufacturer's representative to be on-site to ensure proper installation of the CCTV camera.

Section 19 – ITS – Appendix A – Special Provisions

-3-

REVISION OF SECTION 614
CLOSED CIRCUIT TELEVISION

The weatherproof dome housing shall be attached to the pole mount adapter using the materials supplied from the manufacturer.

For the attachment of the adapter bracket to the pole, a ¾ inch type 201 stainless steel strap used in conjunction with type 201 stainless steel buckles at a mounting height shown on the Plans. The attachment shall be banded to the pole at an orientation to achieve the optimal view of both the main roadway and crossroad or as directed by the Engineer.

A maximum 1 inch hole shall be drilled in the mounting pole to allow passage of the Ethernet cable. The hole shall be free of burs and sharp edges prior to the installation of the Ethernet cable. The Ethernet cable shall be attached to the reverse side of the mounting bracket to ensure proper strain relief or damage caused to the camera or housing. The Ethernet cable shall run down the interior of the pole and exit through non-metallic flexible conduit to the communication cabinet. The non-metallic flexible conduit shall be weather sealed on each end to eliminate exterior liquid entry. The Contractor shall also provide a weather seal for the adapter bracket at the 1 inch hole at the top of the pole per the manufacturer's recommendations.

The PoE midspan module shall be securely mounted in the communication cabinet and plugged into the communications power outlet. The Ethernet cable attached to the camera shall be connected to the PoE midspan output jack. A separate Cat 6 Ethernet cable shall be provided for connection to the field communication device.

METHOD OF MEASUREMENT

Closed Circuit Television will be measured by the actual number of Closed Circuit Televisions installed and accepted for a complete installation. Also included shall be all configuration, cabling, dome housing, adaptor arm, adaptor bracket, and PoE midspan module. All costs associated with arranging for the manufacturer's representative to be on-site will not be measured and paid for separately, but shall be included with the cost of the CCTV.

BASIS OF PAYMENT

Payment will be made under:

PayItem	**PayUnit**
Closed Circuit Television	Each

Payment will be full compensation for all labor, materials and equipment required to complete the work.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
COMMUNICATION CABINET

Section 614 of the Standard specifications is hereby revised for this project to include the following:

DESCRIPTION

This work consists of furnishing and installing communications cabinets at designated Intelligent Transportation System (ITS) field device locations to house and protect electrical power components as shown on the Plans.

MATERIALS

Communications Cabinets. Communications cabinets shall be UL 508A Industrial Control Panels listed and conform to a NEMA Type 4X rating. Communications cabinets shall be constructed of 0.125 inch Type 5052 H-32 aluminum conforming to the requirements of ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate. The dimensions shall be as shown in Table 1 below.

Table 1

COMMUNICATIONS CABINET TYPES

Communications Cabinet	Dimensions	Maximum Weight (w/o back panel)
Type 1	30 inches (H) × 24 inches (W) × 8 inches (D)	30 lb
Type 2	36 inches (H) × 24 inches (W) × 12 inches (D)	40 lb

All bolts, clamps, fasteners, hinges, latches, nuts and screws shall be stainless steel, unless an alternative corrosion proof material is approved in writing by the Department.

A cabinet grounding stud shall be provided in the vicinity of the ground bus mounted on the back panel as shown on the Plans.

Each communications cabinet, designated for mounting on a pole, shall include a pole mounting kit suitable for pole diameters ranging from seven to 12 inches. Each pole mounting kit shall include channel bars (for attachment to factory mounting holes on the back of the communications cabinet), pole shims (to prevent cabinet movement against pole), stainless steel straps and all other associated mounting and sealing hardware. The stainless steel straps and buckles shall be constructed of Type 201 stainless steel and have a width of ¾ inch. The channel bars, pole shims and associated mounting hardware shall be manufactured from either galvanized steel or stainless steel.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
COMMUNICATION CABINET

Each communications cabinet shall include the following:

(a) *Back Panel.* Each back panel shall be constructed of either 12 gauge steel with a conductive, corrosion-resistant coating or ≥ 0.19 inch Type 5052-H32 aluminum alloy. One back panel and associated mounting hardware shall be included with each communications cabinet and be rated for use in NEMA 4X cabinets. The back panel shall be not less than 27 inches (h) × 21 inches (h). The back panel shall be mounted within the communications cabinet with a minimum of four screws that are provided with each communications cabinet. A ground bus shall also be provided with each back panel for mounting at the location shown on the plans.

(b) *Device Box with GFCI Receptacles.* Each communications cabinet shall contain a single gang device box attached to the back panel as shown in the Plans. Each device box shall be constructed of metal in conformance with Articles 314.40 and 314.44 of the NEC. The depth of each device box shall be sufficient to accommodate the depth of the GFCI receptacle and provide adequate free space for all enclosed conductors as specified in Article 314.16 of the NEC. Each junction box shall include knockouts and clamps for conduit and cables. Covers shall be provided for each device box as appropriate for the duplex GFCI receptacles and shall be consistent with the requirements of Article 314.41 of the NEC.

Duplex NEMA 5-15R GFCI receptacles shall be provided within the device box as specified in the Plans. NEMA 5-15R GFCI receptacles shall be rated for 125 VAC, 0.5 HP and 15 A. It shall be of commercial grade quality and manufactured from high strength nylon. NEMA 5-15R GFCI receptacles shall have two poles, three wires, a manual reset button and a self-test button.

Duplex NEMA 5-15R GFCI receptacles shall conform to Article 210.8 of the NEC and be UL listed.

(c) *Power Conditioner with Power Strip.* The power conditioner shall be a Clary SP400U Universal Power Conditioner. The power conditioner has a unit weight of 5 pounds and its dimensions are 1.7 inches (H) × 11 inches (W) × 8.5 inches (D).

An integral component of the power conditioner shall be a factory-installed power strip. The power strip shall have six front facing NEMA Type 5-15R outlets. The power strip shall be rated for 15 A at 120 VAC. It shall have an energy rating of 630 Joules, clamping voltage of 500 V and EMI/RFI noise filter of 150 KHz to 100 MHz at up to 43 dB. The power strip shall have a recessed power switch and a power cord of not less than 2.5 feet. The dimensions of the power strip shall be 10 inches (L) × 1.63 inches (W).

One power conditioner with power strip shall be provided with each communications cabinet.

Section 19 – ITS – Appendix A – Special Provisions

-3-

REVISION OF SECTION 614
COMMUNICATION CABINET

(d) *Deutsche Institut fur Normung (DIN) Rails.* Each communications cabinet shall utilize standard 1.38 inch DIN rails. The DIN rails shall be of steel construction with a coating for corrosion resistance. The DIN rails shall utilize 0.25 inch × 0.71 inch slots for fastening to the back panel located in each communications cabinet. The spacing of the DIN rail slots shall be 0.98 inch center-to-center. DIN rails and associated mounting hardware for attachment to the back panel shall be provided with each communications cabinet in the lengths and quantities specified in the Plans.

(e) *12 VDC Power Supply.* The 12 VDC power supply shall support an input voltage range of 85-264 VAC and frequency range of 47-63 Hz. It shall have a typical efficiency of at least 76% and typical AC current of 1.6 A at 115 VAC. The 12 VDC power supply shall provide an output voltage of 12 VDC and have a minimum current rating of 6.3 A. It shall support an output current range of 0 to 6.3 A (minimum) and have a rated power of 75 W (minimum). The 12 VDC power supply shall have overload protection of 105-150% for its rated output power and overvoltage protection for voltages of 15-16.5 VDC. It shall be designed for an operating temperature of +14°F to +140°F and humidity levels of 20% to 90% (non-condensing). The 12 VDC power supply shall conform to the following standards: IEC 60068-2-6 Environmental Testing (Vibration) and UL 508 Industrial Control Equipment. It shall be DIN rail mountable, have dimensions not exceeding 5 inches (H) × 2.25 inches (W) × 4 inches (D) and a weight of not more than 1.5 pounds. One 12 VDC power supply shall be provided with each communications cabinet.

(f) *Fiber Optic Patch Panel.* Where communications cabinets are shown on the Plans to be connected with fiber optic cables, the Contractor shall provide one 6-port fiber optic patch panel mounted to the back panel as shown on the Plans. The panels shall have hinged doors to provide future access to both the fiber fan out and the termination bulkheads. The panel shall be sized to accommodate the entry of the lateral fiber optic cable, fiber fan out, bulkheads, and the fiber patch cable with access doors closed. The fiber optic patch panel shall be suitable for wall mounting and have dimensions not exceeding 5 inches (W) × 6 inches (L) × 2 inch (D). Each fiber optic patch panel shall include a flat polypropylene cassette, adapters, 6-fiber buffer tube fan-out kit (with 25 inch furcation tubing), strain relief boot, grommet tape, zip ties and wall mounting bracket. Terminations within the patch panel shall be for ST-UPC connectors and must be compliant with the Telcordia GR-326 Generic Requirements for Single Mode Optical Connectors and Jumper Assemblies. The manufacturer shall perform acceptance testing for insertion loss and return loss with the test certification provided with each patch panel.

Section 19 – ITS – Appendix A – Special Provisions

-4-

REVISION OF SECTION 614
COMMUNICATION CABINET

Each communications cabinet shall come with a warranty. The warranty shall cover all communication cabinet materials and workmanship, including pole mounting kits, for two years after delivery of each communication cabinet.

Service Disconnect. The service disconnect shall have factory installed main lugs. It shall have an ampere rating of 70 A , a voltage rating of 120/240 VAC (3-wire, single phase) and a short circuit current rating of 10 kA. The service disconnect shall accommodate up to four single pole circuits or two tandem circuit breakers. It shall accept aluminum wire sizes of #12 AWG to #3 AWG and copper wire sizes of #14 AWG to #4 AWG. The service disconnect shall utilize a tin plated aluminum bus and include a grounding bar. It shall have been specifically designed for industrial requirements to protect electrical systems, equipment and people and must be UL listed.

The service disconnect shall be NEMA 3R rated with the following maximum dimensions: 5 inches (W) × 9.5 inches (H) × 4 inches (D). It shall be constructed of galvanized steel with knockouts on the sides, bottom and back and a rainproof closing cap for any hub opening on the top of the enclosure. The service disconnect shall have a gray baked enamel finish electrodeposited over cleaned, phosphatized, galvanized steel. The complete service disconnect shall include the interior trim and door. The door shall open upward and be equipped with a hasp and staple for padlocking.

The Contractor shall be responsible for sizing the circuit breakers in the service disconnect in accordance with Article 240 of the NEC and circuit breakers must conform to UL 489 Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures. The Contractor shall consider all loads within the communications cabinet to be continuous except for the duplex GFCI receptacles which shall be non-continuous.

One service disconnect and corresponding circuit breakers shall be provided with each communications cabinet.

CONSTRUCTION REQUIREMENTS

Communications Cabinet. All fabricated materials and added components must be free from burrs and sharp edges. Exterior seams of the cabinet shall be continuously welded with edges ground smooth to a 0.03 inch radius. All welding shall be done with gas tungsten arc welds that comply with AWS B2.1-22-015 Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Aluminum and C5.6 Recommended Practices for Gas Metal Arc Welding. All welds shall be neatly formed and free of blisters, blowholes, cracks and other irregularities.

Section 19 – ITS – Appendix A – Special Provisions

-5-

REVISION OF SECTION 614
COMMUNICATION CABINET

The cabinet door opening shall be designed to prevent dust and moisture intrusion. All flange joints shall be welded or continuously formed. The door shall have an adequately sized, oil-resistant gasket that provides a uniform seal with the door frame surface and shall be permanently bonded to the door. The door shall utilize a continuous stainless steel hinge that allow for door removal from the hinge side. Hinges shall be mounted such that the cabinet door opens out to the left, unless otherwise specified on the Plans or as mandated by the Department. Hinges shall be mounted with appropriately sized stainless steel hardware. The door shall be equipped with a hasp and staple for padlocking. The Department prefers that a Corbin #2 key lock be utilized in place of the hasp and staple if the NEMA 4X rating can be maintained. A document holder constructed of high-impact thermoplastic shall be provided for each communications cabinet and permanently mounted to the lower portion of the inside door. The Contractor shall insert a copy of the communications cabinet bill of materials, individual communications cabinet component specification sheets and an asbuilt electrical/fiber optic/low-voltage wiring and cabling diagram of the communications cabinet in the document holder.

Mounting holes on the back of the communications cabinet shall be installed at the factory (communications cabinet Manufacturer) to assure NEMA 4X integrity along with all factory-recommended mounting and sealing hardware for use with the pole mounting kit. Field installation or modification of mounting holes shall be prohibited.

Two tapped conduit access holes shall be made on the bottom of the communications cabinet to provide access for electrical wiring, specific field device low-voltage control cabling, waveguides and fiber optic cabling, as applicable for each communications cabinet application. The conduit access holes shall be sized and positioned at locations shown in the Plans to ensure the proper, safe routing of cabling entering the cabinet. The holes shall be free of burrs and sharp edges prior to the installation of LFMC, fittings and nipples. Drilled and tapped conduit access holes and appropriate sealing strategies to maintain a NEMA 4X integrity shall be performed at the factory and no field installation or modification of the conduit access holes shall be permitted.

Each communications cabinet shall have tapped pads to provide for the mounting of a back panel as specified herein.

Both the power conditioner and power strip shall be mounted on the back panel. Mounting locations shall be as shown in the Plans.

Section 19 – ITS – Appendix A – Special Provisions

-6-

REVISION OF SECTION 614
COMMUNICATION CABINET

Mounting of equipment and hardware onto the back panel shall be through the use of self-tapping screws or Velcro as required per the Plans. Self-tapping screws shall be of appropriate size for the equipment or hardware being installed onto the back panel. The length of the self-tapping screw shall not exceed a ½ inch and the bit recess in the screw head shall be hexagonal.

Where fiber optic communications is utilized, the Contractor shall install the lateral fiber optic cable into the communications cabinet. The buffer tube fan-out kit supplied with the fiber optic patch panel will be installed so that the six fibers in the buffer tube are inserted into the 900 µm diameter furcation tubes that are color-coded to match the fiber color scheme. ST-UPC connectors shall be installed per the requirements of the Fiber Optic Cable specifications. The connectors shall be terminated within the fiber optic patch panel with the upper connector position being #1 (blue) and the lower connector position being #6 (white). Fiber optic jumpers shall be installed between the patch panel and fiber optic communication equipment as shown in the Plans.

Cable management and strain relief shall be employed within the communications cabinet. Cables shall be labeled and neatly organized using cable ties and/or Velcro. Velcro shall be used on fiber optic jumper cables or bundles of cables containing fiber optic jumper cables. Unused spaces within the back panel and interior wall of the communications cabinet may be used to facilitate cable management, but installation of cable management hardware that penetrate the interior walls of the communications cabinet shall not be permitted in order to maintain NEMA 4X integrity.

The communications cabinet manufacturer shall affix a permanent label on the inside of the door that identifies the cabinet type, date of manufacture, warranty expiration date and manufacturer's name. The warranty expiration date shall be expressed in the (mm/dd/yyyy) format.

(a) *Grounding.* Connection to the grounding electrode system shall be provided to place the equipment, hardware, back panel and communications cabinet at earth ground potential. The Contractor shall bolt mount a ground bus to the back panel of the communications cabinet at the location shown in the Plans and depicted in Figure 1.

Section 19 – ITS – Appendix A – Special Provisions

-7-

REVISION OF SECTION 614
COMMUNICATION CABINET

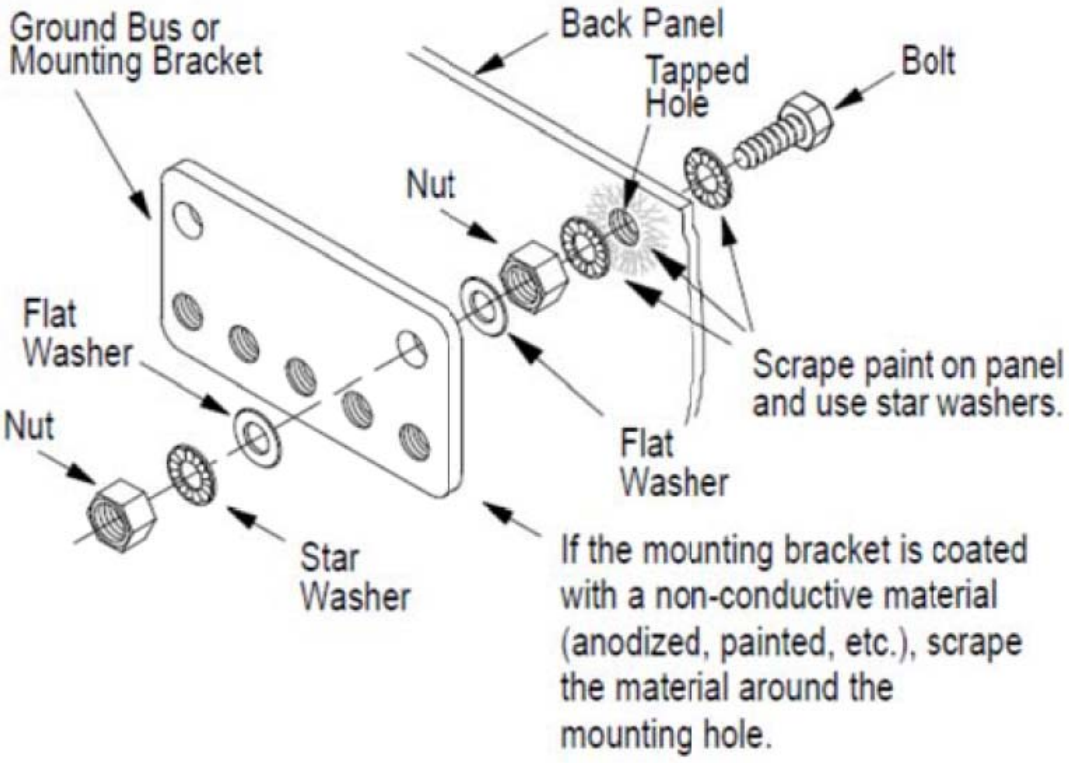


Figure 1

BOLT MOUNTING OF A GROUND BUS TO BACK PANEL

The Contractor shall make good electrical connections between the back panel and communications cabinet through the back panel mounting screws and the cabinet's grounding stud. Wherever contact is made, remove paint or other non-conductive finish from around tapped holes. The ground bus and number of tapped hole positions within the ground bus shall be sized by the Contractor as needed for each communications cabinet. Equipment grounding conductors shall be run from each powered device to the grounding bus using stranded copper wire as required per Article 250 of the NEC. DIN rails shall be connected to the ground bus using a minimum #8 AWG stranded copper wire. Figure 2 shows the ground bus connection details.

Section 19 – ITS – Appendix A – Special Provisions

-8-

REVISION OF SECTION 614
COMMUNICATION CABINET

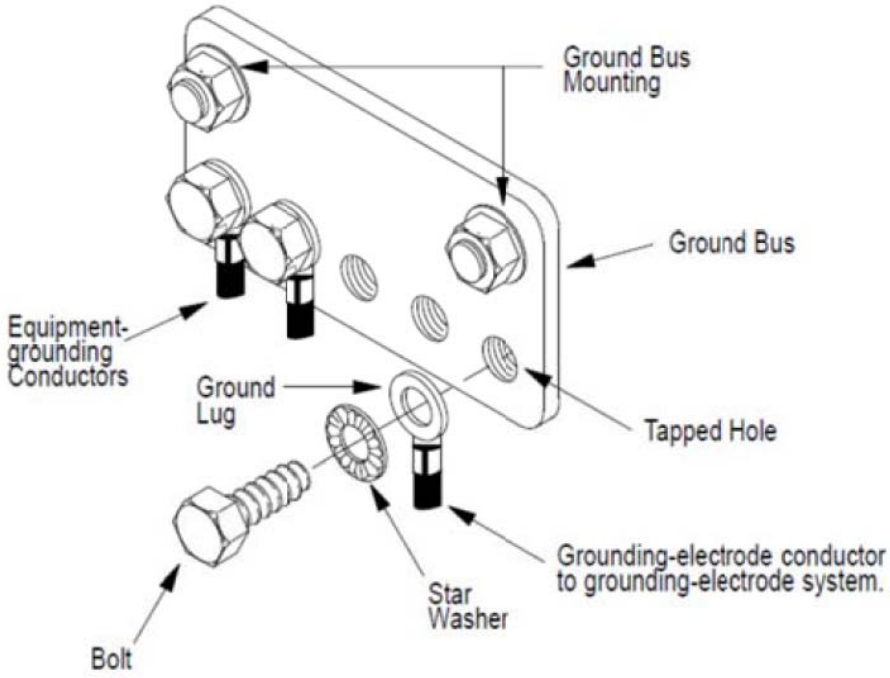


Figure 2

GROUND BUS CONNECTION DETAILS

Service Disconnect. Each service disconnect shall be readily accessible and installed on the pole as shown in the Plans so that the center of the grip of the operating handle of the circuit breaker, when in its highest position, is not more than 6 feet 7 inches above the ground or as required per Article 240.24 of the NEC.

The neutral from the power source or service enclosure shall be connected to the ground bar in the service disconnect. The ground bar shall be connected to the service disconnect using a bonding strap. The ground bar shall be connected to a grounding electrode using grounding conductors conforming to the requirements of Article 250.122 of the NEC. The grounding electrode shall conform to the requirements of Articles 250.52 through 250.70 of the NEC.

Section 19 – ITS – Appendix A – Special Provisions

-9-

REVISION OF SECTION 614
COMMUNICATION CABINET

METHOD OF MEASUREMENT

Communications cabinets shall be measured by the actual number of units installed and accepted, and full compensation shall include all document holders, pole mounting kits, back panels, factory installed mounting and conduit access holes, LFMC conduit, conduit fittings, outlet boxes, receptacles, power conditioners with power strips, DIN rails, 12 VDC power supplies, fiber optic patch panels, mounting and sealing hardware, grounding system, service disconnect and warranties as described herein, including all labor, low voltage cabling, fiber optic cable jumpers, electrical wiring, materials, tools, equipment and incidentals required to perform the work. Number of each type of communications cabinet shall be as listed in the project tabulations.

BASIS OF PAYMENT

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

Payment will be made under:

Pay Item	**Pay Unit**
Communications Cabinet – Type 2	Each

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
FIBER OPTIC CABLE (Single Mode)

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

This work consists of furnishing and installing single mode fiber optic cable.

Fiber optic cable shall be used for either main backbone cable or lateral cables that connect to equipment field cabinets. The main backbone cable shall be terminated in a Communications Node or Regeneration Building. Lateral fiber cables shall be terminated using fan-out kits in a termination patch panel in the field equipment cabinet.

All fiber optic cables shall be suitable for outdoor conduit installation.

MATERIALS

All fiber optic cable shall have compatible chrematistics with proposed and existing cables. All optical cables furnished on this project shall meet the following fiber optic industry standards:

a) International Telecommunications Union Recommendation G.652 Table D
b) Electronic Industries Alliance (EIA) Telecommunications Industry Association (TIA)
c) International Organization for Standardization (ISO)
d) Telecommunication industry Association (TIA)
e) International Telecommunications Union (ITU)
f) Insulated Cable Engineers Association (ICEA)

All cables shall be new and unused non-armored outdoor cable consisting of dispersion-unshifted, low water peak single-mode fiber strands free of surface imperfections and inclusions. Each single mode fiber shall consist of a doped silica core surrounded by a concentric silica cladding. The fiber shall be of matched clad design.

(a) Fiber Strands

a) Typical core diameter of 8.3µm
b) Cladding Diameter of 125.0 ± 1µm

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 614
FIBER OPTIC CABLE (Single Mode)

c) Core-to-Cladding Offset: □ 0.5 µm

d) Cladding Non-Circularity: □ 1 %

e) Coating Diameter (Colored): 245 ± 10 µm.

f) Maximum Attenuation (Loose Tube): 0.35 dB//km at 1310 nm wavelength and 0.22 dB/km at 1550 nm wavelength

g) Mode-Field Diameter: 9.20 ± 0.30 µm at 1310 nm wavelength and 10.40 ± 0.50 µm at 1550 nm
wavelength

h) Attenuation at the Water Peak: 0.32 to 0.34 dB/km at 1383 ± 3 nm wavelength

i) Cutoff Wavelength: 1260 nm.

j) Zero Dispersion Wavelength: 1300nm to 1322 nm

k) Zero Dispersion Slope: 0.090 ps / (nm^2□□□km)

l) Polarization Mode Dispersion: 0.06 ps/ □$_{km}$

m) Maximum Polarization Mode Dispersion at 0.01% distribution (PMDq): 0.20 ps/□$_{km}$

n) Maximum Fiber Dispersion: 3.5 ps/(nm□□□km) for 1285 nm through 1330 nm and shall be □ 18 ps/(nm □ km) at 1550 nm.

o) Fiber Curl: □ 4.0 m

All optical fibers shall be proof tested by the manufacturer to a minimum load of 0.7 GN/m^2 (100 ksi).

The fibers shall not adhere to the inside of the buffer tube.

The coating shall be a dual layered, UV cured acrylate applied by the fiber manufacturer. The coating shall be capable of being mechanically stripped with a force of 0.3 – 2.0 lbf (1.3 – 8.0 N).

Each single mode fiber strand shall be color coded with distinct and recognizable colors in accordance with the most recent version of EIA/TIA-598, Optical Fiber Cable Color, as shown in the plans.

Section 19 – ITS – Appendix A – Special Provisions

-3-

REVISION OF SECTION 614
FIBER OPTIC CABLE (Single Mode)

(b) Buffer Tubes

Each buffer tube shall contain 6 or 12 fibers as appropriate for the respective size cable.

Optical fibers shall be placed inside a loose buffer tube. The nominal outer diameter of the buffer tube shall be 3.0 mm

Each buffer tube shall be color coded with distinct and recognizable colors in accordance with the most recent version of EIA/TIA-598, Optical Fiber Cable Color, as shown in the plans.

In buffer tubes containing multiple fibers, the coloring shall be stable during temperature cycling as stated under "Fiber Specification Parameters" and shall not be subjected to fading or smearing onto each other or into the buffer tube gel filling material. Colorings shall not cause fibers to stick together.

Buffer tubes shall be of a dual-layer construction with the inner layer made of polycarbonate and the outer layer made of polyester.

Each buffer tube shall be filled with a non-hygroscopic, non-nutritive to fungus, electrically non-conductive, homogenous gel. The gel shall be free from dirt and foreign matter. The gel shall be readily removable with conventional nontoxic solvents.

Buffer tubes shall be stranded around a central member of the cable using a reverse oscillation stranding process.

The buffer tubes shall be resistant to external forces and shall meet the buffer tube cold bend and shrink requirements of EIA/TIA standards.

(c) Fiber Cable

Fillers may be included in the cable core to lend symmetry to the cable cross-section where needed.

The central anti-buckling member of the cable shall consist of a glass reinforced plastic rod. The purpose of the central member shall be to prevent buckling.

Section 19 – ITS – Appendix A – Special Provisions

-4-

REVISION OF SECTION 614
FIBER OPTIC CABLE (Single Mode)

For single layer cables, a water blocking tape shall be applied longitudinally around the outside of the strand tubes/fillers. The tape shall be held in place by a single polyester binder yarn. The water blocking tape shall be non-nutritive to fungus, electrically non-conductive homogenous. It shall also be free from dirt and foreign matter. Gel filled water-blocking compound shall not be allowed in the cable core interstices in either the backbone cable or the lateral cables.

Binders shall be applied with sufficient tension to secure the buffer tubes to the central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking (or rendered so by the flooding compound), and dielectric with low shrinkage.

The cable shall contain at least one ripcord under the sheath for easy sheath removal.

Tensile strength shall be provided by high tensile strength dielectric yarns and shall be helically stranded evenly around the cable core.

Outer cable jacket shall have a consistent thickness throughout the entire cable length and shall be sheathed with medium density polyethylene, (MDPE). The minimum nominal jacket thickness shall be 1.4 mm. Jacketing material shall be applied directly over the tensile strength members and water blocking tape. The MDPE shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

The cable jacket shall be free of holes, splits and blisters.

Cable jackets shall be marked with sequential foot markings, year of manufacture and a telecommunication handset symbol, as required by Section 350G of the National Electrical Safety Code (NESC). The actual length of

the cable shall be within 0 to 1% of the length markings. The marking shall be in contrasting color to the cable jacket. The height of the marking shall be easily readable.

(d) Environmental Parameters

a) Shipping, storage and operating temperature range of the cable as defined by Bellcore GR-12 shall be;
   -40°C to +75°C (-40°F to +167°F)
b) Operating temperature range of the cable as defined by Bellcore GR-12 shall be; -40°C to +70°C (-40°F to 158°F)

Section 19 – ITS – Appendix A – Special Provisions

-5-

REVISION OF SECTION 614
FIBER OPTIC CABLE (Single Mode)

c) Installation temperature range of the cable as defined by Bellcore GR-12 shall be; -30°C to +60°C (-22°F to +140°F)

(e) Quality Assurance

a) All optical fibers shall be 100% attenuation tested. The attenuation of each fiber shall be provided with each cable reel.

b) The cable manufacturer shall be ISO 9001 registered.

(f) Packaging

a) The complete cable shall be packaged for shipment on non-returnable wooden reels.

b) Top and bottom ends of the cable shall be available for testing.

c) Both ends of the cable shall be sealed to prevent the ingress of moisture.

d) Each reel shall have a weatherproof reel tag attached identifying the reel and cable.

e) Each cable shall be accompanied by a cable data sheet that contains significant information on the cable.

CONSTRUCTION REQUIREMENTS

The Contractor shall provide the Engineer with two copies of the cable manufacturer's installation instructions for all fiber optic cable. All installations shall be in accordance with the manufacturer's recommendations except as otherwise directed by the Engineer. All additional costs including fiber optic cable associated to damages caused by the Contractor's neglect of recommended procedures shall be the Contractor's responsibility.

The Contractor shall submit a Method Statement to the Engineer indicating cable routing, splice points and cable end splicing locations. Installation of the cable will not be permitted until the schematic diagram has been approved by the Engineer.

Fiber optic cable including both backbone cables and lateral cables shall be installed in continuous runs. Under no conditions shall fiber optic cable be cut or spliced at intermediate points without express written direction from the Engineer.

Section 19 – ITS – Appendix A – Special Provisions

-6-

REVISION OF SECTION 614
FIBER OPTIC CABLE (Single Mode)

Blowing cable is an acceptable alternative to pulling cable. If the Contractor chooses to use this method, submittals for cable installation shall be submitted along with complete information on fiber installation equipment.

The maximum pulling tension shall be 2700 N (600 lbs) during installation (short term) and 890 N (200 lbs) long term installed.

All cables shall have a minimum bending radius based on the diameter of the cable and shall meet the following;

a) Pulled under tension, (Short Term) – 20 (Twenty times the cable diameter)
b) Pulled not under tension, (Long Term) – 10 (Ten times the cable diameter)

The fiber optic cable shall be installed in the conduit with a split-mesh cable grip to provide a firm hold on the exterior covering of the cable.

The manufacturer's recommended limits for cable pull lengths shall not be exceeded. The Contractor shall use a pulley system with a numerical readout indicating the cable tension. The pulley system shall be capable of alerting the installer when the cable pulling tension approaches the manufacturer's maximum allowable tension. The Contractor may supplement this procedure with a breakaway tension limiter set below the lowest recommended tensile limit of the cables being pulled. Intermediate pulleys shall be used at all pull boxes or manholes along the installation run to prevent cable damage.

If cable installation limits are met and the entire length cannot be installed completely from the shipping reel, installation shall be continued from the mid-point of the run. The Contractor shall first pull one-half of the cable from the reel at the mid-point through the conduit to one end of the run. The other half of the cable shall be removed from the reel and carefully placed on the ground in a figure eight pattern with a minimum loop diameter of 10 feet. While installing the remaining cable, care shall be taken to avoid any dragging against the ground resulting in damage or excess bending of the cable. The Contractor shall not kink, twist or bend the cable during installation coiling or uncoiling.

The cable shall be continuously lubricated as it enters the conduit. The Contractor shall only use pulling lubricants recommended by the cable manufacturer. Liquid detergent shall not be used.

Section 19 – ITS – Appendix A – Special Provisions

-7-

REVISION OF SECTION 614
FIBER OPTIC CABLE (Single Mode)

If the Contractor must install new cable in conduits which contain existing fiber or electrical wiring, the Contractor shall be responsible for any damage to the existing cables or wires. After this installation the Contractor shall perform a functional test of all the equipment connected by the existing fiber cables or electrical wiring to ensure proper working conditions.

If an existing fiber optic cable is damaged during construction, it shall be removed from both points of termination and replaced, at no cost to the project. In no case shall the fill of any new conduit exceed the requirements of the National Electrical Code. The Contractor shall provide documentation to the Engineer

supporting the conduit fill. All costs associated with equipment testing and repairs shall be included in the cost of the Fiber Optic Cable.

Lateral cables shall be installed in continuous runs from the backbone splice location to the field equipment cabinet. Odd length cables and reel ends are acceptable for lateral cables provided they are pre-tested and free of defects and are of sufficient lengths to archive continuous runs.

Lateral cables shall have slack and include a maximum of three locations of appropriate strain relief within all field equipment cabinets.

All fiber optic cables shall include identification labels attached to the cable in each pull box, manhole or field equipment cabinet. The label shall be provided with information as shown on the Project Detail Sheet.

The Contractor shall splice fiber cables at locations shown on the plans. All splices shall be enclosed within a splice closure as approved by the Engineer. Following successful splicing, the splice closure shall be placed inside the pull box or manhole. The Contractor shall use tools and hardware recommended by the cable manufacturer.

Only proposed active (lit) fibers shall be spliced in the closure and terminated in the field communications cabinet. All unused (dark) fibers of both the backbone and lateral cables shall remain uncut and be neatly coiled in the splice tray within the closure. All unused buffer tubes shall remain uncut and neatly coiled along with the buffer tubes used for splicing in appropriate location in the splice closure.

Section 19 – ITS – Appendix A – Special Provisions

-8-

REVISION OF SECTION 614
FIBER OPTIC CABLE (Single Mode)

Backbone and lateral buffer tubes and fiber strands shall be labeled on the splice tray prior to sealing of the closure as shown on the Project Detail Sheet.

The Contractor shall coil 100 feet of backbone cable in the manholes. The Contractor shall coil 50 feet of backbone cable in pull boxes.

The Contractor shall coil 50 feet of lateral cable in the manholes. The Contractor shall coil 25 feet of Lateral cable in pull boxes.

The Contractor shall ensure that all cable coils and splice canisters are attached to the cable management hardware in all pull boxes and manholes.

The Contractor shall terminate the lateral cable at the field equipment cabinet using a buffer tube fan-out kit. Fanned-out fiber strands shall be terminated in a termination block with ST connectors.

The Contractor shall submit a final documentation package. The final documentation package shall include the cable manufacturer's installation procedures, technical support documentation and material documentation. These documents shall match the original submittals provided to the Engineer.

METHOD OF MEASUREMENT

Fiber Optic Cable shall be measured by the Linear Foot for both backbone and lateral cable and shall include all labor and materials required to install, splice and terminate the cable to make a complete and operational system and shall include the following items:

1. All required splicing, splice closures, splice kits, hardware, splicing tools and labor to accomplish the splices.
2. All required termination panels in field equipment cabinets.
3. All required fan-out kits, hardware and labor to accomplish fan-out.
4. All required termination connectors, adapters, jumpers, pigtails, hardware and labor required to accomplish lateral cable terminations.
5. Identification labels for both backbone and lateral fiber cables in each pull box, manhole and field equipment cabinet.
6. As Built Documentation

Section 19 – ITS – Appendix A – Special Provisions

-9-

REVISION OF SECTION 614
FIBER OPTIC CABLE (Single Mode)

METHOD OF PAYMENT

Payment for Fiber Optic Cable will be made according to the following schedule:

50% upon completion of cable installation

50% upon the review and acceptance of all fiber test results showing the conformance to this specification and the Revision of Section 614 Test Fiber Optic Cable Specification included in this plan package.

Payment will be made under:

Pay Item	**Pay Unit**
Fiber Optic Cable (Single-Mode) (12 Strands)	Linear Foot
Fiber Optic Cable (Single-Mode) (96 Strands)	Linear Foot

Testing Fiber Optic Cable will not be measured or paid for separately. See Revision of Section 614 Test Fiber Optic Cable specification included in this plan package.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
COARSE WAVELENGTH DIVISION MULTIPLEXING ATTENUATOR

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

Coarse Wavelength Division Multiplexing Attenuator shall be installed in all Ciena 3930 Carrier Ethernet Service Delivery Switches (SDS) and the Ciena aggregation switches in regeneration node buildings to reduce optical signal power to a level specified by the coarse wavelength division multiplexing (CWDM) small form factor pluggable (SFP) optic modules. The attenuator shall be installed in the receive port of the CWDM SPF. All coarse wavelength division multiplexing attenuators shall be compatible with the CIENA CWDM SFP optic modules.

MATERIALS

The Contractor shall furnish and install single mode, 9/125um CWDM wavelength independent attenuators to match the wavelength of the SFP optic modules installed in the Ethernet switch in wavelengths of:

1430nm, 1450nm, 1470nm, 1490nm, 1510nm, 1530nm, 1570nm, 1590nm and 1610nm. In the design of the network, the 1550nm wavelength will not be used.

Attenuators for 1310nm wavelength SFP optic modules will not be required.

The Contractor shall furnish and install a female to male plug type fiber optic attenuator. The types of fiber optic attenuators to be supplied shall match both the CWDM SFP port and the fiber optic pre-connectorized patch cable connectors.

The attenuators shall meet the following minimum specifications:

- Return Loss: Less than 65dB (APC)
- Attenuation Accuracy: +/-0.5 (1~10) +/-1.0(11~30)
- Polarization Dependent Loss: Less than 0.2dB
- Maximum Optical Input Power: 200mW
- Operating Temp Range: -40~80°C
- Low Polarization Dependent Loss **(**PDL**)**
- Tolerate high power UPC polished
- Minimum 500 connect/disconnecting tested

The CWDM attenuators to be provided shall be Bellcore Compliant.

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 614
COARSE WAVELENGTH DIVISION MULTIPLEXING ATTENUATOR

CONSTRUCTION REQUIREMENTS

After all splicing and testing is completed the Contractor shall test the optical power of the incoming, (Receive) signal at each field Ethernet switch location. To obtain the most accurate values of optical power, the testing equipment shall be attached to the SFP optic end of the pre-connectorized patch cable to be installed at that location.

Once the optical power has been tested, the Contractor shall install the appropriate CWDM attenuator in the receive port of the CWDM SFP to meet the receive values of the CWDM SFP optic module.

Prior to installation, all attenuators shall be cleaned with lint-free fiber wipes moistened with Isopropyl Alcohol 99% U.S.P. After cleaning with alcohol, the bulkhead shall be cleaned with an optical connector cleaner to ensure that all residue is removed.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
COARSE WAVELENGTH DIVISION MULTIPLEXING SFP

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

For this project the Coarse Wavelength Division Multiplexing SFP shall be a single wavelength Coarse Wavelength Division Multiplexing (CWDM) Small Form-Factor Pluggable (SFP) optic module for installation in a Ciena 3930 Carrier Ethernet Service Delivery Switch (SDS). There shall also be matching coarse wavelength division multiplexing, small form-factor pluggable optic modules provided for the existing Ciena Ethernet aggregation switches in each of the regeneration node buildings to which the sub ring switches communicate. All coarse wavelength division multiplexing SFP shall be provided from a manufacturer recommended by Ciena.

MATERIALS

The Contractor shall furnish and install the CWDM SFP optic modules in the wavelengths as shown in the item table below. This table describes optic modules for installation in Ciena 3930 Carrier Ethernet SDS Ethernet switches and Ciena 5150 Carrier Ethernet SAS switches.

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 614
COARSE WAVELENGTH DIVISION MULTIPLEXING SFP

Item Table – CWDM SFP Optic Modules for Ciena 3930 Carrier Ethernet SDS switches, Ciena 5150 Carrier Ethernet SAS switches and a 5142 Carrier Ethernet SAS switch.

ITEM DESCRIPTION	**ITEM NUMBER**
100M/1 GIG, SM SFP OPTIC, LC CONNECTOR, 80 KM, 1430 NM, EXT. TEMP	XCVR-A80D43
100M/1 GIG, SM SFP OPTIC, LC CONNECTOR, 80 KM, 1450 NM, EXT. TEMP	XCVR-A80D45
100M/1 GIG, SM SFP OPTIC, LC CONNECTOR, 80 KM, 1470 NM, EXT. TEMP	XCVR-A80D47
100M/1 GIG, SM SFP OPTIC, LC CONNECTOR, 80 KM, 1490 NM, EXT. TEMP	XCVR-A80D49
100M/1 GIG, SM SFP OPTIC, LC CONNECTOR, 80 KM, 1510 NM, EXT. TEMP	XCVR-A80D51
100M/1 GIG, SM SFP OPTIC, LC CONNECTOR, 80 KM, 1530 NM, EXT. TEMP	XCVR-A80D53
100M/1 GIG, SM SFP OPTIC, LC CONNECTOR, 80 KM, 1570 NM, EXT. TEMP	XCVR-A80D57
100M/1 GIG, SM SFP OPTIC, LC CONNECTOR, 80 KM, 1590 NM, EXT. TEMP	XCVR-A80D59
100M/1 GIG, SM SFP OPTIC, LC CONNECTOR, 80 KM, 1610 NM, EXT. TEMP	XCVR-A80D61

In the design of the network, the 1550nm wavelength will not be used.

If for any reason the CWDM SFP optic modules are defective or are damaged at the time of installation by either the Contractor or by Ciena, the optic module shall be removed and replaced at no additional cost to the project. CWDM SFP optic modules shall also be replaced if any failures occur do to manufacture's defect, at no additional cost to the project prior to the final network acceptance.

Section 19 – ITS – Appendix A – Special Provisions

-3-

REVISION OF SECTION 614
COARSE WAVELENGTH DIVISION MULTIPLEXING SFP

CenturyLink is the direct contracted equipment supplier of Ciena Corporation for the State of Colorado, Colorado Department of Transportation for networking equipment and associated network materials. For project equipment estimate quotations and purchasing, Contractors shall contact the following distributer representative:

State of Colorado, Colorado Department of Transportation project equipment estimate quotations and purchasing supplier representative.

Keith A. Glose
Premier Account Manager
CenturyLink Government
930 15th Street, 4th Floor, Denver, Colorado 80202
Telephone: 303-992-5567 Fax: 720-578-2694
E-Mail: keith.glose@centurylink.com

CONSTRUCTION REQUIREMENTS

For Ciena 3930 Carrier Ethernet SDS switch installations, a single CWDM SFP optic module shall be installed in each switch for CWDM data communications.

The Contractor shall ensure that the wavelengths of the CWDM SFP optic modules installed in the Ciena 3930 Carrier Ethernet SDS Ethernet switches match those installed in the corresponding Ciena 5150 Carrier Ethernet SAS Ethernet switch to ensure proper data communications.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
EQUIPMENT PROCUREMENT AND CONFIGURATION

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

To ensure that the Colorado Transportation Management Center (CTMC) Network personnel have sufficient time for configuration of the Ethernet switches for this project, the Contractor shall submit all network equipment cut sheets in a timeframe that will ensure timely configuration. This submittal shall include but not be limited to the follow project network equipment items;

- Ethernet Switches; Ciena 3930
- Coarse Wavelength Division Multiplexing Small Form-Factor Pluggable Optic Modules
- 1310nm Wavelength Small Form-Factor Pluggable Optic Modules
- Fiber Optic Attenuators
- All Network Licensing And Warranty Documentation
- All Telemetry (Field) Items - Coarse Wavelength Division Multiplexing Single Wavelength Filters
- All Telemetry (Master) Items – Coarse Wavelength Division Multiplexing Multiplexors
- Fiber Optic Splice Closures
- All Associated Materials Associated With Above Items For The Installation Of The Ethernet
  Optical Network

CDOT will review and comment of after receiving the submittals.

After the review and approval of the networking equipment cut sheets by CDOT, the Contractor shall place the order for the approved equipment to the CenturyLink representative listed in the project specifications to ensure the timely delivery of the above listed items.

The network equipment as part of this project requires both CTMC personnel and Ciena technical network representatives to jointly configure each individual Ethernet switch in addition to the configuration of this project network into the CTMC statewide intelligent transportation optical network.

The Contractor shall coordinate with the Project Engineer to schedule the Ciena technical representative and the CTMC personnel for a window of time that the configuration may occur, dependent on anticipated equipment delivery. All costs associated with the Ciena technical representative assistance shall not be paid for separately but will be included in the Ethernet Switch item.

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 614
EQUIPMENT PROCUREMENT AND CONFIGURATION

The Contractor shall provide all required information to the CTMC for the Ethernet switches. This includes but not limited to the Highway Mile Point of the Ethernet switch, the Project stationing of the Ethernet switch along with the devices to which they are connected. This information shall be submitted on a spreadsheet at the time that the Contractor delivers the Ethernet switches to the CTMC for configuration.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
FIBER OPTIC PRE-CONNECTORIZED CABLE

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

This work consists of the installation of fiber optic pre-connectorized patch cables in communication cabinets, variable message signs and communications node buildings from the termination patch panel to the optical communication device optics.

At Ethernet switch locations, coarse wavelength division multiplexing (CWDM) is to be utilized and shall require bend insensitive fiber optic pre-connectorized patch cables. Bend insensitive pre-connectorized patch cables shall also be required for CWDM optical connections in communications node buildings.

The bend insensitive cable shall be used to enable a tight bend radius and routing to help alleviate data loss.

MATERIALS

The measured attenuation of the connector (inclusive of coupler and mated test connector) shall not exceed an average of 0.3 dB for all connectors provided. Any connector found in excess of 0.5 dB shall be rejected. Reflectance shall be less than -40 dB from 14º F to 140º F (-10ºC to +60ºC). The manufacturer shall have a program that periodically tests connectors to ensure than after 1000 re-matings, the attenuation will not change more than 0.2 dB.

The measured insertion loss shall be a maximum of 0.25 dB with a typical loss of 0.15dB. Return loss shall be a maximum of -65 dB (APC) and -55 dB (UPC) with a typical loss of -68 dB (APC) and -58 dB (UPC). The minimum cable bend radius shall be less the 15 mm.

The connector shall be able to withstand an axial pull of 25 lbs. with no physical damage to the connector and no permanent optical degradation more than 0.3 dB.

The CWDM pre-connectorized cables shall be jacketed for extra protection and shall be provided with pre-connectorized connectors on both ends to match the termination patch panel bulkheads and coarse wavelength division multiplexing, small form-factor pluggable optic modules of the Ethernet switch. Connectors shall be terminated by the manufacturer.

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 614
FIBER OPTIC PRE-CONNECTORIZED CABLE

The connectors shall be nickel-plated with a ceramic ferrule and shall be polished with a physical contact (PC) finish end to reduce reflection.

The bend insensitive pre-connectorized patch cable shall meet the following specifications:

Patch Cable Connectors

- EIA, TIA-55 (FOCIS)
- UL94 V-O
- GR-326, Issue 3 Specifications

Fiber Cable

- Telcordia GR-409

CWDM patch cable bend insensitive fiber shall satisfy International Telecommunication Union (ITU) -T G.657 category A1 standards. The cable shall have a 'tactical' polyurethane jacket to resist bending and shall be blue in color.

The cables shall contain the exact number of loose tube fibers and bulkhead connectors to connect from the termination patch panel to the optical modules. If the optical equipment transmits and receives data with a single optic, the pre-connectorized cable shall contain a single optical fiber, (simplex). When the optical device transmits and received data with two or four optics, or a network Ethernet switch small form factor pluggable optic module, a pre-connectorized cable shall be provided with 2 (two) optical fibers, (duplex) per pair of transmit and receive optics.

CONSTRUCTION REQUIREMENTS

Pre-connectorized cables shall be installed from the termination panel bulkheads to the optical modules of the communication devices.

At the communications node building, the pre-connectorized cables shall be installed in the cable management hardware attached to equipment racks. The Contractor shall provide patch cables of sufficient length to span from the fiber termination patch panel bulkheads to the communications device or network device optical port. This length shall include a maximum of four (4) feet of slack cable. Appropriate cable management shall be used.

Section 19 – ITS – Appendix A – Special Provisions

-3-

REVISION OF SECTION 614
FIBER OPTIC PRE-CONNECTORIZED CABLE

At communication cabinets, the Contractor shall provide pre-connectorized cables of sufficient length to span from the fiber termination patch panel bulkheads to the equipment device or network device optical port. This length shall include a maximum of two (2) feet of slack cable. Appropriate cable management shall be used.

Prior to installation, all pre-connectorized cable bulkhead connectors shall be cleaned with lint-free fiber wipes moistened with Isopropyl Alcohol 99% U.S.P. After cleaning with alcohol, the bulkhead shall be cleaned with an optical connector cleaner to ensure that all residue is removed.

Manufacturer testing reports for pre-connectorized cables shall be submitted as part of the as-built documentation. The installation location shall be noted on the test report for future reference.

At communication node buildings, pre-connectorized patch cables shall have identification labels applied on each end. Information indicating the patch panel number, device being connected, CWDM wavelength and Ethernet switch port number. CDOT personnel will aid in the labeling as it pertains to the proper nomenclature to be provided and/or Ethernet port connectons.

At all field device locations, each cable shall have individual labels indicating the CWDM wavelength, termination panel port and the data transmitting description, (example: Tx or Rx).

Patch cable labeling shall be as shown on the Project Detail Sheet.

The pre-connectorized cables shall be provided in the following lengths.

Field Device Cabinets…….	4 Feet – 0 Inch maximum
Node Buildings ……	Cable shall be of sufficient length to accommodate connection of termination patch panel bulkhead to each individual optical device while allowing for 4 feet of slack.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
SMALL FORM-FACTOR PLUGGABLE – 1310NM SFP

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

For this project the Small Form-Factor Pluggable – 1310NM SFP shall be a single wavelength Small Form-Factor Pluggable (SFP) optic module for installation in a Ciena 3930 Carrier Ethernet Service Delivery Switch (SDS). All Small Form Factor-Pluggable – 1310NM SFP optic modules shall be provided from a manufacturer recommended by Ciena.

MATERIALS

The Contractor shall furnish and install the 1310nm SFP optic module shown in the item table below. This table describes the optic module for installation in the Ciena 3930 Carrier Ethernet SDS switch.

Item Table – 1310nm SFP Optic Modules for a Ciena 3930 Carrier Ethernet SDS Switch.

ITEM DESCRIPTION	ITEM NUMBER
100M/1 GIG, SM SFP OPTIC, LC CONNECTOR, 10 KM, 1310 NM, EXTENDED TEMPERTURE	XCVR-A10Y31

If for any reason the 1310nm SFP optic modules are defective or are damaged at the time of installation by either the Contractor or by Ciena, the optic module shall be removed and replaced at no additional cost to the project. 1310nm SFP optic modules shall also be replaced if any failures occur do to manufacture's defects, at no additional cost to the project prior to the final network acceptance.

CenturyLink is the direct contracted equipment supplier of Ciena Corporation for the State of Colorado, Colorado Department of Transportation for networking equipment and associated network materials. For project equipment estimate quotations and purchasing, Contractors shall contact the following representative:

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 614
SMALL FORM-FACTOR PLUGGABLE – 1310NM SFP

State of Colorado, Colorado Department of Transportation project equipment estimate quotations and purchasing supplier representative.

Keith A. Glose
Premier Account Manager
CenturyLink Government
930 15th Street, 4th Floor, Denver, Colorado 80202
Telephone: 303-992-5567 Fax: 720-578-2694
E-Mail: keith.glose@centurylink.com

CONSTRUCTION REQUIREMENTS

For Ciena 3930 Carrier Ethernet SDS switch installations, a single 1310nm SFP optic module shall be installed in each switch for data communications between 2 adjoining Ethernet switches.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
FIBER OPTIC SPLICE CLOSURE

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

Fiber optic splice closure shall be used to enclose fiber splices of both fiber optic backbone and fiber optic lateral cables at locations shown in the plans. The splice closures shall be provided for underground installations.

At field Ethernet switch locations two splice closures shall be required. Both closures shall be of the same size with the capacity for the proposed or existing fiber optic backbone cable and the associated fiber optic lateral cable.

One splice closure will be used for splicing the backbone fiber optic cable to a single lateral fiber optic cable. The second splice closure will be used for splicing two (2) separate lateral fiber cables to the coarse wavelength division multiplexing single wavelength filters.

MATERIALS

The fiber optic splice closures shall be furnished by the Contractor.

The splice closures shall be stand-alone, dome type and shall meet the following minimum requirements:

(a) The closures shall seal, anchor and protect fiber optic cable splices, coarse wavelength division multiplexing single wavelength filters.
(b) The closures shall have a maximum of six (6) total cable entries.
(c) The closures shall be suitable for underground applications and shall be watertight and airtight.
(d) The closures splice trays shall have a hinged design with an upright locking mechanism for all splice trays to provide ease of access for future maintenance to lower trays.
(e) The closures shall have a gel compression ring type sealing design. A gluing or sealant design for sealing of the closure shall not be accepted.

The closures shall be sized to provide the capacity equal to the total number of strands for all cables entering the closure. All fiber optic cables shall be secured to prevent the ingress of water per the manufacture's recommendations. All remaining access holes not utilized shall be plugged to prevent water from entering the closure.

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 614
FIBER OPTIC SPLICE CLOSURE

CONSTUCTION REQUIEMENTS

All splices shall be performed using the fusion splicing method. The fusion splicer shall be calibrated and certified at least once within the previous year from this project. All certification documentation shall be presented to the Project Engineer prior to start of splicing.

The Contractor shall cut and splice only those fiber strands shown to be spliced on the fiber splice plan sheets. All unused buffer tubes and fiber strands shall remain uncut. After the fiber cable and proposed buffer tube is prepped for splicing, all fiber strands in the buffer tube shall be cleaned of all homogeneous
gel. All uncut fiber strands shall be coiled in the tray. Remaining buffer tubes shall be neatly coiled, secured and stored in the storage area within the closure under the splice trays per the manufacturer's recommendations. Buffer tubes proposed for splicing shall be wrapped and secured to the splice tray with ties per the manufacturer's recommendations.

The completed splices and coarse wavelength division multiplexing single wavelength filters shall be secured in the splice tray foam splice chips per manufacturer's recommendations.

Bare fiber strands shall not be taped to the splice tray.

At field Ethernet switch splice locations; two (2) closures shall be required. One closure shall be used for spicing of the backbone fiber optic cable to one end of a lateral cable. A second closure shall be required for splicing two (2) lateral fiber optic cables to the coarse wavelength division multiplexing single wavelength filters.

If the closure requires re-entry, it shall be conducted per the manufacturer's recommendation for re-entry and resealing. The Contractor shall use caution not to damage the fiber strands, splices, coarse wavelength division multiplexing filters or buffer tubes existing inside. When sealing the closure for a second time, the Contractor shall follow all re-entry requirements of the manufacturer.

The Contractor shall ensure that the fiber optic splice enclosures and associated fiber cable coils fit adequately within the manhole or pull box splice locations specified on the plans.

Section 19 – ITS – Appendix A – Special Provisions

-3-

REVISION OF SECTION 614
FIBER OPTIC SPLICE CLOSURE

The optical fibers shall be fusion spliced and shall meet the following minimum requirements:

(a) Splice loss <0.15 dB
(b) Reflection <50 dB
(c) Completed splice shall be stable from -40º F to +185º F (-40ºC to +85ºC)

The Contractor shall label each individual splice and buffer tube in all splice trays per the Project Detail Sheet included in the project plans. The coarse wavelength division multiplexing single wavelength filter position and its working wavelength shall also be labeled.

The Contractor shall inform the Project Engineer two days before and the morning of proposed splicing locations for that day. While the splicing procedures are occurring and within four (4) hours prior to sealing the closure and installation in the pull box, the Contractor shall again contact the Project Engineer for inspection. In the event that the Project Engineer cannot be on site, a minimum of eight (8) digital pictures shall be taken at varying angles of the interior of the splice closure showing all completed work as stated in this specification and shown on the Project Detail Sheet. These pictures shall include exposed fiber stands, (both spliced and uncut) in all splice trays, coarse wavelength division multiplexing filter storage, fiber tray labeling and remaining buffer tubes showing appropriate coiling. One picture shall also include the complete re-assembly of all interior parts prior to final sealing. Once the closure and fiber coils are installed in the pull box or manhole, two (2) pictures shall be taken showing the final installation of both the closure and the coiled fiber cable attached to the fiber management hardware.

All pictures shall be organized per location and shall be submitted to the Project Engineer along with all final testing result documentation.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
TELEMETRY (MASTER)

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

For this project Telemetry (Master) shall be a rack mounted 10-Channel Coarse Wavelength Division Multiplexing Module for wavelengths of 1430nm to 1610nm with LC/APC Port Bulkheads, Extension Ports and outgoing / incoming Mux and DeMux ports to be installed in communication node building equipment racks. The unit shall have the capabilities of passively multiplexing and de-multiplexing multiple wavelengths to and from field Ciena 3930 Ethernet switches and communications node building Ciena Ethernet Switch small form-factor pluggable optic modules. All 10-channel Coarse Wavelength Division Multiplexing Modules shall be provided from a manufacturer recommended by Ciena. In the design of the network, the 1550nm wavelength will not be used.

MATERIALS

The 10-channel Coarse Wavelength Division Multiplexing (CWDM) module shall have twelve (12) transmit / receive ports. 10 of the 12 ports shall be for individual wavelength matching the Ethernet switch coarse wavelength division multiplexing, small form-factor pluggable optic modules.

The 10-channel CWDM module shall have the ability of multiplexing and de-multiplexing the following wavelengths;

1430nm, 1450nm, 1470nm, 1490nm, 1510nm, 1530nm, 1550nm, 1570nm, 1590nm and 1610nm. In the design of the network, the 1550nm wavelength will not be used. The dust covers for the 1550nm port shall remain installed to prevent dirt and dust from entering the CWDM multiplexing module.

The 10-channel CWDM modules shall also include a chassis capable of mounting in a 19 inch communications equipment rack. The chassis shall have an integrated cable management tray on the front side to house the optical patch cables installed from the CWDM multiplexing module ports to the Ethernet switch optic modules.

CenturyLink is the direct contracted equipment supplier of Ciena Corporation for the State of Colorado, Colorado Department of Transportation for networking equipment and associated network materials. For project equipment estimate quotations and purchasing, Contractors shall contact the following representative:

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 614
TELEMETRY (MASTER)

State of Colorado, Colorado Department of Transportation
equipment estimate quotations and purchasing supplier representative.

Keith A. Glose
Premier Account Manager
CenturyLink Government
930 15th Street, 4th Floor, Denver, Colorado 80202
Telephone: 303-992-5567 Fax: 720-578-2694
E-Mail: keith.glose@centurylink.com

CONSTRUCTION REQUIREMENTS

The 10-channel CWDM multiplexing modules and chassis shall be installed in 19 inch equipment racks in communication node buildings and in a communications cabinet on Interstate 25.

Single mode, bend insensitive, pre-connectorized duplex patch cable with a polyurethane jacket shall be installed from the 10-channel CWDM module to the backbone termination patch panel for communications to the field Ciena 3930 SDS Ethernet switches. Connectors for the patch cable shall be LC on the 10-channel CWDM module end and ST on the termination patch panel end.

Single mode, bend insensitive, pre-connectorized duplex patch cables with a polyurethane jacket shall be installed from each 10-channel CWDM module wavelength Tx/Rx port to the matching CWDM small form-factor pluggable optic module on the Ciena 5150 Carrier Ethernet SAS Ethernet switch. A duplex patch cable shall be installed for each wavelength. Connectors for the patch cables shall be LC on the10-channel CWDM module end and LC on the Ethernet switch SFP optic module end.

In communication node buildings, the patch cables shall be of sufficient length to span from the termination patch panel to the 10-channel CWDM module and from the 10-channel CWDM module to the Ciena 5150 Ethernet switch with a maximum of four (4) feet of slack for each cable. They shall be installed in a manner which will not interfere with equipment in the equipment racks and will include cable management so as not to interfere with future maintenance within the rack.

Section 19 – ITS – Appendix A – Special Provisions

-3-

REVISION OF SECTION 614
TELEMETRY (MASTER)

If for any reason the 10-channel CWDM module is defective or is damaged at the time of installation by the Contractor, the item shall be removed and replaced at no additional cost to the project. Modules shall also be replaced if any failures occur do to manufacture's defect at no additional cost to the project prior to the final network acceptance.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
TELEMETRY (FIELD)

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

For this project Telemetry (Field) shall be a Single Wavelength Coarse Wavelength Division Multiplexing (CWDM) optical filter manufactured for use in coarse wavelength division multiplexing at all Ciena 3930 Carrier Ethernet Service Delivery (SDS) Ethernet Switch device location. All coarse wavelength division multiplexing single channel filters shall be provided from a manufacturer recommended by Ciena.

MATERIALS

The CWDM optical filter shall have the capability of splitting a single CWDM wavelength from the multiple wavelengths being transmitted along the fiber strands including passing a 1310nm wavelength between Ethernet switch pairs. All remaining wavelengths other than those being added or dropped at the designated location shall be allowed to travel from Ethernet switch to Ethernet switch or communications node building to Ethernet switch.

The CWDM optical filters shall be provided with industry standard operating ranges of 1430nm to 1610nm to match wavelengths of the Coarse Wavelength Division Multiplexing Small Form-Factor Pluggable optic modules of the Ethernet switches. The individual filters shall have the following channel center wavelengths;

1430nm, 1450nm, 1470nm, 1490nm, 1510nm, 1530nm, 1570nm, 1590nm and 1610nm. In the design of the network, the 1550nm wavelength will not be used.

1310nm wavelength filters shall also be provided.

If for any reason the single wavelength filter is defective or is damaged at the time of installation by the Contractor, the filter shall be removed and replaced at no additional cost to the project. Filters shall also be replaced if failures occur do to manufacture's defect, at no additional cost to the project prior to the final network acceptance.

CenturyLink is the direct contracted equipment supplier of Ciena Corporation for the State of Colorado, Colorado Department of Transportation for networking equipment and associated network materials. For project equipment estimate quotations and purchasing, Contractors shall contact the following representative:

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 614
TELEMETRY (FIELD)

State of Colorado, Colorado Department of Transportation
equipment estimate quotations and purchasing supplier representative.

Keith A. Glose
Premier Account Manager
CenturyLink Government
930 15th Street, 4th Floor, Denver, Colorado 80202
Telephone: 303-992-5567 Fax: 720-578-2694
E-Mail: keith.glose@centurylink.com

At each Ethernet switch location a total of four (4) single wavelength filters will be required. The Contractor shall splice two (2) matching single wavelength CWDM optical filters and two (2) 1310nm optical filters. The filters shall match the industry standard wavelength of the Ethernet switch's Coarse Wavelength Division Multiplexing Small Form-Factor Pluggable (SFP) optic module and the 1310nm SFP optic module.

The CWDM optical filters shall have three (3) fiber pigtails to be fusion spliced to lateral fiber optic cable strands and secured in the foam splice chips on splice tray in the splice closure. The pigtails shall be provided with distinctive buffer tube colors designating "Pass", Reflect" and "Common". If the filter pigtail buffer tubes are all of the similar color, The Contractor shall color code each individual tube for future maintenance.

The filters shall be provided with the optical wavelength printed on the filter body.

Bare fiber strands shall not be taped to the splice tray.

All splices and optical filter wavelengths shall be labeled on the splice tray.

If for any reason the Contractor installs or splices any single wavelength optical filter in a location which does not match the Ethernet switch coarse wavelength division multiplexing SFP optic modules, the Contractor shall replace the filter and re-splice all fibers at no additional cost to the project.

Section 19 – ITS – Appendix A – Special Provisions

-3-

REVISION OF SECTION 614
TELEMETRY (FIELD)

Prior to splicing of the filters, the Contractor shall submit to the Project Engineer a Microsoft Excel spreadsheet containing the following information:

a) Splice Location for the CWDM and 1310nm filters (manhole milepost as shown on the fiber splice project plan sheets).
b) Serial Number of the CWDM and 1310nm filters.
c) Wavelength of the filter.
d) Usage and color of filter pigtails.

Once the spreadsheet has been submitted and approved by the Project Engineer the splicing may begin.

The pigtails of the filters shall be labeled inside the splice closure per the Project Detail sheet included in the project plan set.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
BUFFER TUBE FAN OUT KIT

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

For this project, the Buffer Tube Fan Out Kit shall be furnished and installed on fiber lateral cable ends in field termination panels mounted within communication cabinets.

MATERIALS

The Contractor shall use fiber optic fan out kits on the fiber lateral cable in the communication cabinet termination panels. Fan out buffer tubes for the lateral fiber strands shall be 9mm minimum and shall be neatly coiled after installation and secured within the field termination panels. Fan out kits shall be supplied with buffer tubes matching the lateral fiber strand colors. ST type bulkhead connectors shall be terminated on the ends of the lateral cable fiber strands and installed on the back side of the termination panel bulkheads. The connectors shall have a ceramic ferrule with a nickel-plated nut and body. The connector shall be polished with a physical contact (PC) finish.

METHOD OF MEASUREMENT

Buffer Tube Fan Out Kit will not be measured or paid for separately, but will be considered subsidiary to the Fiber Optic Cable (Single Mode) pay item. This item shall include all labor, materials and equipment required to complete the work.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
FIBER OPTIC CABLE INSTALLATION

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

Fiber optic cable installed on this project will be installed in electrical conduits, pull boxes and equipment communication cabinets which contain existing electrical cable or electronic equipment currently carrying communications data from existing intersection traffic signals and roadway devices. The new fiber cable shall be installed in a manner which will not interfere with the integrity of the existing cable and or equipment. Slack fiber cable shall be coiled in pull boxes, manholes and communications cabinets using proper fiber management as noted on the plans. Fiber optic cable installed in traffic controller cabinets shall be placed in a manner which will not interfere with the maintenance or the traffic signal cable, wiring or equipment. All OTDR testing shall be conducted as stated in this specification and in accordance with the Project Special Provision, Test Fiber Optic Cable, included in this plan set.

The Contractor shall install all fiber optic cables in accordance with the splicing diagrams as shown in the plans. The Contractor shall conduct an on-reel test prior to installing any fiber cables. After the on-reel test the Contractor shall provide the Project Engineer with all resultant documentation prior to actual cable installation. No installation shall commence until the Project Engineer reviews and accepts all test results showing all fibers in the cables are undamaged, containing no breaks or micro bends. Once the results are accepted, the fiber cable may be installed. If the test results show damage to any strand or strands within a reel, that reel shall be rejected, replaced and retested at no additional cost to the project.

Once the fiber cable is accepted by the Project Engineer, the cable may be installed. The fiber cable is to be installed in reel lengths that minimize cable end splices, in turn minimizing fiber cable loss. Once the entire cable is installed and all cable end splices are complete, bi-directional testing shall be conducted to assure that no damage occurred in the installation process.

For backbone fiber cable, if any strand(s) of the fiber cables show damage from the Contractor's installation, that entire section of fiber cable shall be removed, re-installed and re-spliced from the cable end splice point at no additional cost to the project.

For lateral fiber cable, if any strand (s) of the fiber cables show damage from the Contractor's installation, the entire length of fiber cable shall be removed, re-installed and re-splices form the splice point to the device communication cabinet at no additional cost to the project.

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 614
FIBER OPTIC CABLE INSTALLATION

Prior to any fiber optic work, the Contractor shall give the Project Engineer a detailed installation and splicing schedule a minimum of one week, prior to commencing work. All installation, splicing, termination, and testing shall be listed on the schedule and any revisions to this schedule shall be re-submitted to the Project Engineer as soon as the changes are made.

After completing all splicing and termination work, a final inspection of the fiber network will be conducted. If damage exists to the fiber optic cable system due to Contractor negligence, all costs associated with the cable, pulling of the cable, splicing, splice canisters and testing of the network shall be at the Contractor's expense

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

This work consists of furnishing and installing fiber optic termination panels in Intelligent Transportation System (ITS) device communication cabinets, traffic signal controller cabinets, ramp metering controller cabinets and/or automated traffic recorder station cabinets for single mode fiber.

MATERIALS

The units shall meet the design requirements of ANSI/TIA/EIA-568 and the plastics flammability requirements of UL 94 V-0.

Termination panels shall be manufactured using 16-gauge aluminum or equivalent and shall be finished with powder coat for durability. The termination panel shall have a slide out interior for future access of the remaining lateral fibers and the back side of the bulkheads while minimizing disturbance to existing fiber and terminations.

Termination panels for ITS communication cabinets shall be a single six (6) port panel with ST type bulkheads. The panels shall have hinged doors to provide future access to both the fiber fan out and the termination bulkheads. The panel shall be sized to accommodate the entry of the lateral fiber optic cable, fiber fan out, bulkheads, and the fiber patch cable with access doors closed. The fiber optic patch panel shall be suitable for wall mounting and have dimensions not exceeding 5 inches (W) × 6 inches (L) × 2 inch (D). Each fiber optic patch panel shall include a flat polypropylene cassette, adapters, 6-fiber buffer tube fan-out kit (with 25 inch furcation tubing), strain relief boot, grommet tape, zip ties and wall mounting bracket.

Section 19 – ITS – Appendix A – Special Provisions

-3-

REVISION OF SECTION 614
FIBER OPTIC CABLE INSTALLATION

Terminations within the patch panel shall be for ST-UPC connectors and must be compliant with the Telcordia GR-326 Generic Requirements for Single Mode Optical Connectors and Jumper Assemblies. The manufacturer shall perform acceptance testing for insertion loss and return loss with the test certification provided with each patch panel.

Termination panels for traffic signal controller cabinets, ramp metering controller cabinets and automated traffic recorder station cabinets shall be sized to accommodate twenty four (24) ports and mounted in the cabinets' 19-inch rack rails. The panels shall be provided with two (2) ST termination bulkhead 6 pack modules for fiber terminations as shown in the plans. The panel shall be provided with covers for the remaining spaces for future bulkhead installations. All bulkheads shall be metal. Plastic bulkheads will not be accepted.

CONSTRUCTION REQUIREMENTS

Termination panels within cabinets shall be mounted in locations which will allow for ease of access and shall not interfere with maintenance of the internal equipment.

The Contractor shall use proper strain relief inside the termination panel for the fiber cable and fiber fan out strands per the manufacturer's recommendations. The use of tape to secure the individual fanned out strands to the bottom of the termination panel shall not be allowed.

All hardware shall be installed in accordance with manufacturer's recommendations. All termination panels shall have a labeling scheme that complies with ANSI/TIA/EIA-606 and the details as shown on the Project Details Sheet.

METHOD OF MEASUREMENT

Fiber Optic Termination Panels will not be measured or paid for separately but will be considered subsidiary to the Fiber Optic Cable (Single Mode) pay item.

Fiber Optic Termination Panels shall include all bulkheads, covers for empty spaces, labeling panels and all materials, hardware, labor and equipment necessary to complete the work.

Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
FIBER OPTIC CABLE AS-BUILT DOCUMENTATION

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

The Contractor shall complete and forward to the Project Engineer the Fiber Cable As-Built Documentation Sheet as part of their final submittals on the project. This form is an aide to document information as it pertains to the installation of fiber optic cable along the project corridors as part of this project.

At each pull box and manhole location, fiber optic cable information to be provided shall include the following:

2) Cable sequential foot marking measurements stamped on the cable jacket as the cable enters and exits the pull box
3) Type of splices, lateral cables or cable end splices
4) Number of lateral cables at the pull box location
5) Fiber cable ID serial number
6) Identification or location of pull boxes or manholes as they are shown on the final as-built documentation

As part of the as-built documentation, any revised fiber optic splices shall also be provided as marked up copies of the original splice diagrams. If changes are made during the splicing procedures, those changes shall be documented by the Contractor and submitted to the Project Engineer as final as-built drawings.

BASIS OF PAYMENT

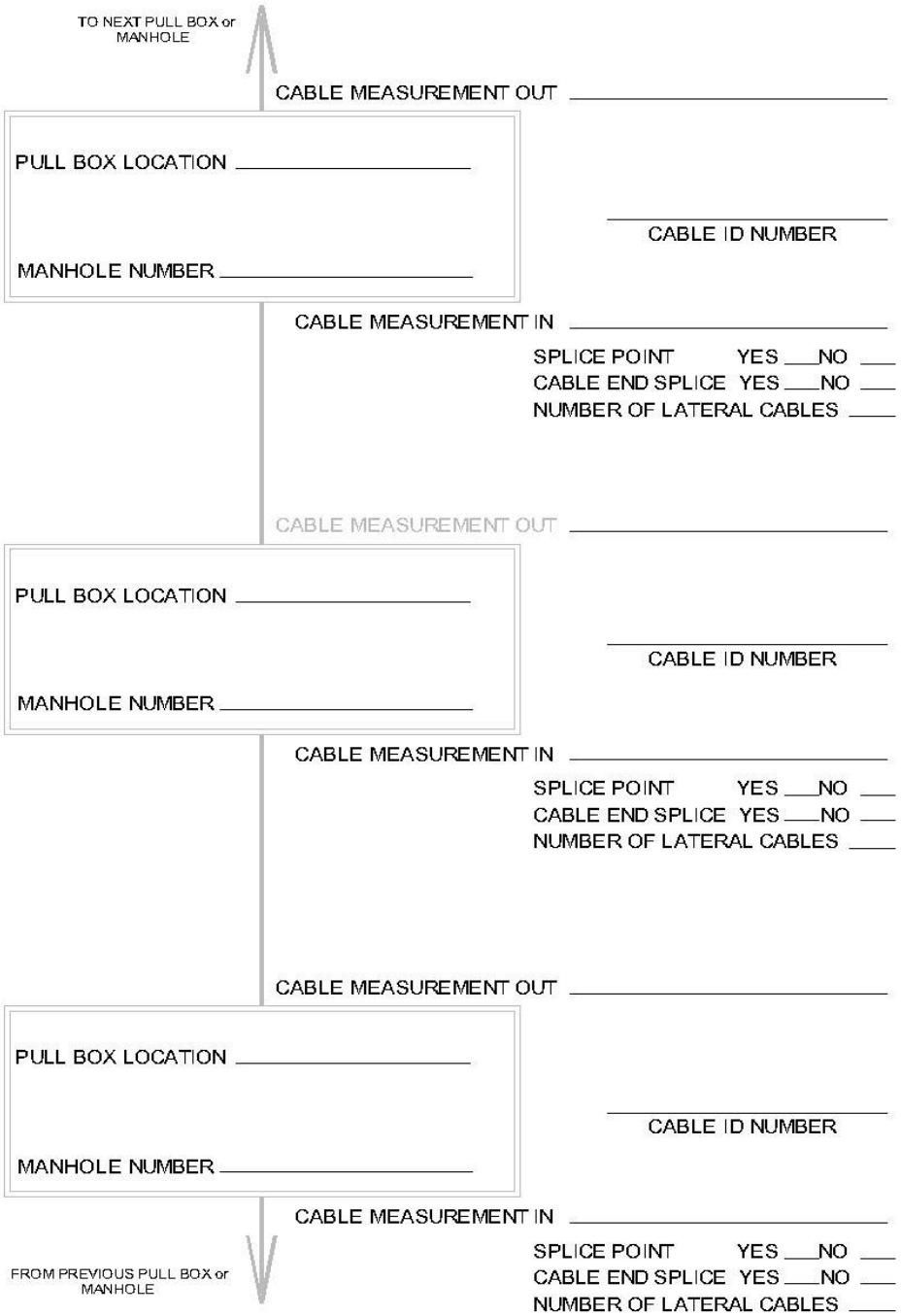
Fiber Optic Cable As-Built Documentation will not be measured or paid for separately but will be considered subsidiary to the Fiber Optic Cable (Single Mode) pay item.

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 614
FIBER OPTIC CABLE AS-BUILT DOCUMENTATION

FIBER OPTIC CABLE AS-INSTALLED DOCUMENTATION SHEET



Section 19 – ITS – Appendix A – Special Provisions

REVISION OF SECTION 614
TEST FIBER OPTIC CABLE

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

DESCRIPTION

This project includes the installation of a Dense Wavelength Division Multiplexing (DWDM) and Coarse Wavelength Division Multiplexing (CWDM) optical fiber network for the transport of Intelligent Transportation System highway device data communications. A combination of edge, distribution and high sped backbone Ethernet switches will be used for the network transport of this data.

For this project all fiber optic cable shall be tested with the following testing equipment;

Optical Time Domain Reflectometer
Power Meter Set
Coarse Wavelength Division Multiplexor - Optical Time Domain Reflectometer
Spectrum Analyzer

CWDM wavelengths used on this project range from 1430nm to 1610nm as follows:

1430nm, 1450nm, 1470nm, 1490nm, 1510nm, 1530nm, 1570nm, 1590nm and 1610nm. The 1550nm wavelength is not in use. This wavelength is reserved for any possible testing by using a non CWDM optical time domain reflectometer.

Industry stand nomenclature for the identifying of individual wavelength (ex 1490nm = 1491nm) shall be observed on the project.

Due to the nature of DWDM and CWDM optical networks, strict adherence to industry standards and this specification will be required for all CWDM testing. All testing results shall be submitted to the Project Engineer as details in the Project Plans and Project Specifications.

Prior to any splicing and testing on the project the Contractor shall submit a detailed Method Statement to the Project Engineer explaining their planned splicing plan and testing schedule and methods. No fiber optic splicing shall begin until the Method Statement is submitted and approved. Once the splicing and testing begins, the Method Statement shall be updated if necessary to address any required changes in the original planned and approved procedures.

Section 19 – ITS – Appendix A – Special Provisions

-2-

REVISION OF SECTION 614
TEST FIBER OPTIC CABLE

MATERIALS

Test fiber optic cable shall include an OTDR on reel test on all fiber optic cable strands installed on the project by the Contractor. In addition, an optical power meter test shall be conducted on fiber strands from all device locations to the communications node buildings. These tests shall be for all "dark" fiber optic strands not being used for the coarse wavelength division multiplexing optical network as part of the final network acceptance.

The Contractor shall use a Coarse Wavelength Division Multiplexor – Optical Time Domain Reflectometer (CWDM-OTDR) purchased as part of this project to test all fiber optic cable for use in the course wavelength division multiplexing (CWDM) optical network. Testing shall be conducted for all CWDM wavelengths applicable to the individual fiber stands used for data communications. This testing shall commence after all fiber splicing has been completed as part of the final network acceptance. If

required, testing shall also be conducted at Colorado Transportation Management Center (CTMC) for troubleshooting purposes.

The Contractor shall use an Optical Spectrum Analyzer to test all CWDM. Testing shall be conducted for all CWDM optics at the communications node buildings to individual field Ethernet field switches and from the field switches to the node buildings. This testing shall commence after all fiber splicing has been completed as part of the final network acceptance. If required, testing shall also be conducted at the Colorado Transportation Management Center (CTMC) for troubleshooting purposes.

Bidirectional wavelengths shall be tested for optics to ensure the proper wavelength is being dropped at the Ethernet switches and in turn sent to the communications node buildings.

As part of the CWDM design all wavelengths will travel on single fibers, and dropped to individual Ethernet switches in the field. Tests shall be required at all switch locations to ensure the proper wavelength is delivered and transmitted.

CONSTRUCTION

For fiber optic cables and/or cable strands not utilized for coarse wavelength division multiplexing the following requirements shall be followed.

Section 19 – ITS – Appendix A – Special Provisions

-3-

REVISION OF SECTION 614
TEST FIBER OPTIC CABLE

Test Fiber Optic Cable. For this project this work shall consist of the testing of either multimode or Single Mode fiber optic cable as shown and tabulated in the plans. The testing procedures involve an OTDR test and an Optical Power Meter Test.

Guidelines for fiber optic cable testing include:

(1) Test jumpers and patch cords must be of the same fiber core size and connector type as the cable system:
Multimode fiber 62.5/125 μm
Single Mode fiber 8.3/125 μm

(2) The light source and OTDR must operate within the range of 850±30 nm or 1300±20 nm for multimode testing in accordance with ANSI/EIA/TIA-526-14.

(3) The light source and OTDR must operate with the range of 1310±10 nm or 1550±20 nm for Single Mode testing in accordance with ANSI/EIA/TIA-526-7.

(4) The power meter and the light source must be set to the same wavelength during testing.

(5) The power meter must be calibrated and traceable to the National Institute of Standards and Technology (NIST).

(6) All system connectors, adapters and jumpers must be cleaned as per manufacturer's instructions before measurements are taken.

A) Fiber Optic Cable Testing Equipment. The following is required to perform fiber optic cable tests:

(1) An OTDR
(2) A test reel, if necessary
(3) A light source at the appropriate wavelength
(4) Optical Power Measurement Equipment
(5) Test Jumpers as specified below

Section 19 – ITS – Appendix A – Special Provisions

-4-

REVISION OF SECTION 614
TEST FIBER OPTIC CABLE

Multimode Fiber Testing

CPR Test Jumper-1 shall be 1-5 meters long with connectors compatible with the light source and power meter and have the same fiber construction as the link segment being tested.

CPR Test Jumper-2 shall be 1-5 meters long with connectors compatible with the light source and power meter. Test Jumper-2 shall contain Class IV a single-mode fiber for tests on 1300 nm light sources and from which is single-moded at 850 μm for tests on 850 nm light sources.

Single Mode Fiber Testing

CPR Test Jumper-1 and Test Jumper-2 shall be 1-5 meters long with connectors compatible with the light source and power meter and have the same fiber construction as the link segment being tested.

B) Optical Fiber Cable Testing with OTDR. The Contractor shall perform an OTDR test of all fibers in all tubes on the reel prior to installation of the fiber. The test results shall be supplied to the Project Engineer prior to installation of the cable. Once the test results have been reviewed and approved, the final fiber optic cable installation may commence.

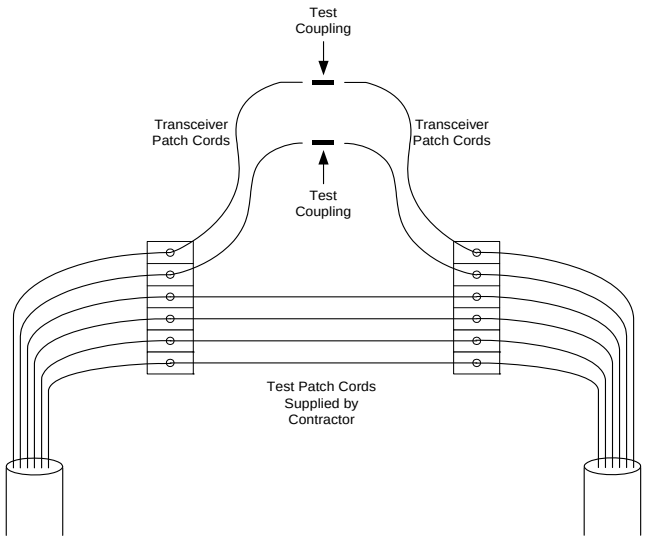
If the fiber is specified as "Install Only", the Contractor shall test the fiber on the reel and provide the test results to the Project Engineer prior to accepting the cable. After installation, if there are unused portions of cable remaining on the reel, the Project Engineer may request the Contractor or other qualified technician to perform a reel test. The Contractor shall provide the Project Engineer the test results prior to delivering the cable to the Project Engineer. Any cable damaged while in the Contractor's possession shall be replaced at the Contractor's expense.

All fiber testing shall be performed on all fibers in the completed end-to-end system. Testing shall consist of a bi-directional end-to-end OTDR trace performed per TIA/EIA-455-61. The system margin loss measurements shall be provided at 850 and 1300 nm for multimode fibers and 1310 and 1550 for Single Mode fibers. If the Plans require installation of a fiber optic patch panel, the Contractor shall supply patch cords to patch all terminated fibers through the panel for all fiber testing. If patch cords are specified in the Plans for final equipment installation, these patch cords shall be connected using a test coupling for the end-to-end test.

Section 19 – ITS – Appendix A – Special Provisions

-5-

REVISION OF SECTION 614
TEST FIBER OPTIC CABLE



OTDR readings will be used to ensure proper installation and to troubleshoot faults. OTDR signature traces will be used for documentation and maintenance. An OTDR provides an indirect estimate of the loss of the cable plant, generally, more accurate or reliable values will be obtained by using an Optical Power Meter. For fibers that are identified in the Plans to be left unterminated, an OTDR shall be used to test end-to-end attenuation.

Loss numbers for the installed link shall be calculated by taking the sum of the bi-directional measurements and dividing that sum by two.

The Contractor shall use an OTDR that is capable of storing traces electronically and shall save each final trace.

To ensure the traces identify the end points of the fiber under test and the fiber designation, the Contractor shall use a test reel, if required, to eliminate the "dead zone" at the start of the trace so that the start of the fiber under test can be identified on the trace. Indicate the length of the test reel for all test results.

If the fiber designation is not indicated on the trace itself, the Contractor shall provide a cross-reference table between the stored trace file name and the fiber designation.

In compliance with EIA/TIA-455-61 "Measurement of Fiber or Cable Attenuation Using an OTDR" the Contractor shall record the following information during the test procedure:

Section 19 – ITS – Appendix A – Special Provisions

-6-

REVISION OF SECTION 614
TEST FIBER OPTIC CABLE

(1) Names of personnel conducting the test.
(2) Type of test equipment used (manufacturer, model, serial number, calibration date).
(3) Date test is being performed.
(4) Optical source wavelength and spectral width.
(5) Fiber identification.
(6) End point locations.
(7) Launch conditions
(8) Method of calculation for the attenuation or attenuation coefficient.
(9) Acceptable link attenuation.

C) Optic Fiber Cable Testing with Optical Power Meter. The Contractor shall conduct an Optical Power Meter Test for each fiber installed.

Multimode segments shall be tested in one direction at both the 850 nm and the 1300 nm wavelength.

Single Mode segments shall be tested in one direction at both the 1310 nm and 1550 nm wavelength.

In compliance with TIA/EIA-526-14A "Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant" and TIA/EIA-526-7 "Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant," the following information shall be recorded during the test procedure:

(1) Names of personnel conducting the test.
(2) Type of test equipment used (manufacturer, model, serial number, calibration date).
(3) Date test is being performed.
(4) Optical source wavelength, spectral width, and for multimode, the coupled power ratio (CPR).
(5) Fiber identification.
(6) End point locations.
(7) Test direction.
(8) Reference power measurement (when not using a power meter with a Relative Power Measurement Mode).
(9) Measured attenuation of the link segment.
(19) Acceptable link attenuation.

Section 19 – ITS – Appendix A – Special Provisions

-7-

REVISION OF SECTION 614
TEST FIBER OPTIC CABLE

The minor attenuation differences due to test direction are on par with the accuracy and repeatability of the test method. Lateral segments within a building are limited to 90 meters. Therefore, attenuation differences caused by wavelength are insignificant, and as a result, single wavelength testing is sufficient.

D) Acceptable Attenuation Values. Acceptable attenuation values shall be calculated for each fiber tested. These values represent the maximum acceptable test values.

1) Multimode Fiber. The general attenuation equation for any multimode link segment is as follows:

Acceptable Link Attn.=Cable Attn.+Connection Attn.+Splice Attn.+CPR Adj.

62.5 μm Multi-mode Attenuation Coefficients:

Cable Attn.=Cable Length (km) x (3.40 dB/km@850 nm or 1.00 dB/km@1300 nm)
Connection Attn. (ST or SC connectors)=(No. of Connections x 0.39 dB)+0.42 dB.
Connection Attn. (LC connectors)=(No. of Connections x 0.14 dB)+0.24 dB.

Splice Attn. (Mechanical or Fusion)=Splices x 0.30 dB.
CPR Adj.=See table below.

A connection is defined as the joint made by mating two fibers terminated with re-mateable connectors (e.g. ST, SC, LC).

Multi-mode Light Source CPR Adjustment

	Cat. 1 Overfilled	Cat. 2	Cat. 3	Cat. 4	Cat. 5 Underfilled
Links with ST or SC Connections	+0.50	0.00	-0.25	-0.50	-0.75
Links with LC Connections	+0.25	0.00	-0.10	-0.20	-0.30

The Coupled Power Ratio of a light source is a measure of the modal power distribution launched into a multimode fiber. A light source that launches a higher percentage of its power into the higher order modes of a multimode fiber produces a more over-filled condition and is classified as a lower category than a light source that launches more of its power into just the lower order modes producing an under-filled

condition. Under-filled conditions result in lower link attenuation, while over-filled conditions produce higher attenuation. Therefore, adjusting the acceptable link attenuation equation to compensate for a light source's launch characteristics increases the accuracy of the test procedure.

7) Singlemode Fiber. The general attenuation equation for any Single Mode link segment is as follows:

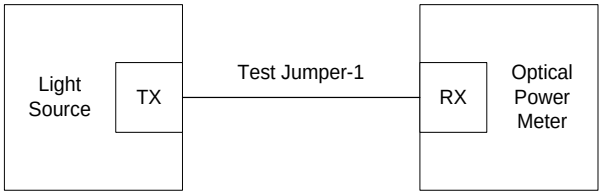
Acceptable Link Attn. = Cable Attn. + Connector Attn. + Splice Attn.

8.3 μm Single-mode Attenuation Coefficients:

Cable Attn.=Cable Length (km) x (0.34 dB/km@1310 nm or 0.25 dB/km@1550 nm)
Connection Attn. (ST or SC connectors)=(No. of Connections x 0.39 dB)+0.42 dB.
Connection Attn. (LC connectors)=(No. of Connections x 0.14 dB)+0.24 dB.
Splice Attn. (Mechanical or Fusion)=Splices x 0.30 dB.

E) Test Procedures. All fiber testing shall be performed on all fibers in the completed end-to-end system.

(1) Multimode Fiber. The multimode fiber cable test shall be conducted as follows:
Clean the test jumper connectors and the test coupling per manufacturer's instructions.
Follow the test equipment manufacturer's initial adjustment instructions.
Connect Test Jumper-1 between the light source and the power meter. Avoid placing bends in the jumper that are less than 100 mm (4 inches) in diameter.



If the power meter has a Relative Power Measurement Mode, select it. If it does not, reduce the Reference Power Measurement (P_{ref}). If the meter can display power levels in dBm, select this unit of measurement to simplify subsequent calculations.

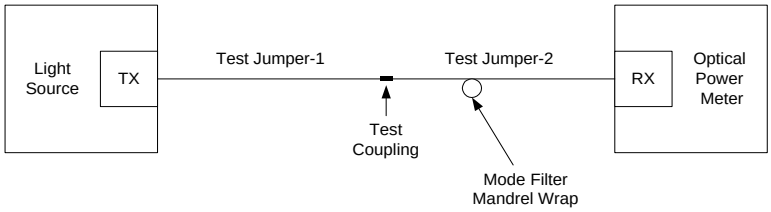
Disconnect Test Jumper-1 from the power meter. Do NOT disconnect the test jumper from the light source.

Section 19 – ITS – Appendix A – Special Provisions

-9-

REVISION OF SECTION 614
TEST FIBER OPTIC CABLE

Connect Test Jumper-2 between the power meter and Test Jumper-1 using the test coupling. Test Jumper-2 should include a high order mode filter. This can be accomplished by wrapping the jumper three times around a 30 mm (1.2 inches) diameter mandrel.

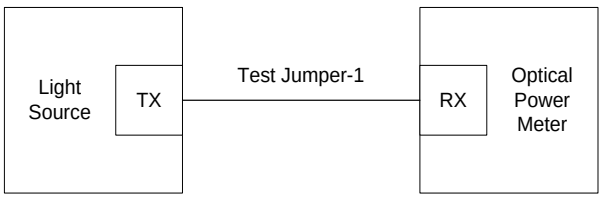


Record the Power Measurement (P_{sum}). If the power meter is in Relative Power Measurement Mode, the meter reading represents the CPR value. If the meter does not have a Relative Power Measurement Mode, perform the following calculation:

If P_{sum} and P_{ref} are in the same logarithmic units (dBm, dBu, etc.):
CPR (dB) = P_{sum} - P_{ref}
If P_{sum} and P_{ref} are in watts:
CPR (dB)= 10 x $\log_{10}$ [O_{sum}/P_{ref}]

(2) Single Mode Fiber. The Single Mode Optical Power Meter fiber test shall be conducted as follows:

Clean the test jumper connectors and the test coupling per manufacturer's instructions.
Follow the test equipment manufacturer's initial adjustment instructions.
Connect Test Jumper-1 between the light source and the power meter. Avoid placing bends in the jumper that are less than 100 mm (4 inches) in diameter.



If the power meter has a Relative Power Measurement Mode, select it. If it does not, reduce the Reference Power Measurement (P_{ref}). If the meter can display power levels in dBm, select this unit of measurement to simplify subsequent calculations.

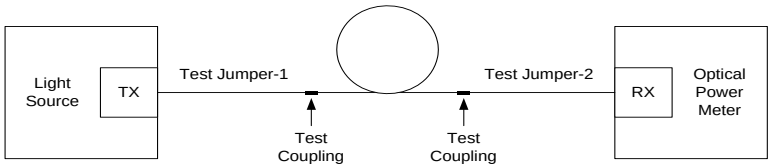
Section 19 – ITS – Appendix A – Special Provisions

-10-

REVISION OF SECTION 614
TEST FIBER OPTIC CABLE

Disconnect Test Jumper-1 from the power meter. Do NOT disconnect the test jumper from the light source.

Attach Test Jumper-1 to one end of the cable plant to be measured and Test Jumper-2 to the other end.



Record the Power Measurement (P_{sum}). If the power meter is in Relative Power Measurement Mode, the meter reading represents the true value. If the meter does not have a Relative Power Measurement Mode, perform the following calculation:

If P_{sum} and P_{ref} are in the same logarithmic units (dBm, dBu, etc.):
CPR (dB) = P_{sum} - P_{ref}
If P_{sum} and P_{ref} are in watts:
CPR (dB)= 10 x $\log_{10}$ [O_{sum}/P_{ref}]

F) Test Acceptance. The Contractor shall demonstrate that each Optical Power Test results in acceptable attenuation values.

The Contractor, solely at the Contractor's cost, shall remake any fusion splices that have test results exceeding acceptable attenuation values.

The Contractor, solely at the Contractor's cost, shall retest any fiber links that have been re-spliced.

The Contractor, solely at the Contractor's cost, shall bring any link not meeting the requirements of this specification into compliance.

G) Testing for CWDM single wavelength filters (CWDM filter) shall be conducted in the following manner to ensure that the filter Pass, Reflect and Common pigtails are spliced to proper lateral fiber
strands. Testing procedures and CWDM data flow information is included in the project plan set.

Section 19 – ITS – Appendix A – Special Provisions

-11-

REVISION OF SECTION 614
TEST FIBER OPTIC CABLE

a) After completion of fiber optic cable installation and prior to the CWDM filter splicing, all backbone cable to lateral cable splices shall be completed in the individual Ethernet switch sub-rings. Required steps shall include:
   (a) Splicing of backbone end of lateral cable number 1 shall be spliced to the fiber optic backbone cable in splice canister number 1. Once this splice is complete no future access to the closure shall be made unless a re-splice is required.
   (b) The opposite end of lateral cable number 1 shall be splice in a manner to achieve continuity in the backbone strands form the beginning of the sub-ring, (first communication node building) to the far end of the sub-ring, (next adjacent communications node building).
   (c) An OTDR test shall be conducted on the sub-ring to ensure proper splicing of the lateral cable (cable number 1) to the individual backbone fiber strands.

Once the OTDR test is complete the results shall be submitted to the Project Engineer for approval. After review to ensure continuity, the splicing of the CWDM filters may begin.

The Contractor shall be required to break the lateral fiber optic strands used in the continuity test and conduct the actual CWDM filter splice per the project fiber splice plans. This will include splicing of both lateral fiber cable number 1 and number 2 along with the termination of lateral cable number 2 in the communications cabinet.

During the splicing at the individual CWDM Ethernet switch sites, the Contractor may use one of the following methods to ensure the proper CWDM filter splicing.

1) By using a fiber identifier, testing of the incoming signal from either the upstream or downstream CWDM location, the Contractor shall show the Project Engineer that proper CWDM filter pigtail splicing is being achieved.
2) By using a spectrum analyzer to test the incoming wavelength to ensure proper splicing and wavelength of the CWDM signal.

Once all splicing of the individual sub-ring is complete the Contractor shall conduct the CWDM-OTDR and spectrum analyzer testing and submit the results to the Project Engineer. At the acceptance of these tests, the Contractor shall determine the proper optical attenuator to install at both the communications cabinet termination panel and the communications node building termination panel. After installation one final test of optical power shall be conducted to determine if the proper signal strength is being acheived by the Ethernet switch CWDM optic.

Section 19 – ITS – Appendix A – Special Provisions

-12-

REVISION OF SECTION 614
TEST FIBER OPTIC CABLE

At this point the Colorado Department of Transportation, Colorado Transportation Management Center personnel along with Ciena network engineers will configure the sub-ring into the overall CDOT ITS network. If for any reason network communications cannot be achieved, a review of the CWDM materials will be begin.

G) Submittals. The Contractor shall submit test results documentation as both a hard copy and electronic copy.

After each reel test, the Contractor shall submit one (1) hard copy of the OTDR trace for every fiber on the reel.

After installation, the Contractor shall submit two (2) hard copies and one (1) electronic copy of the following tests;

1) Continuity OTDR trace for every spliced fiber which the CWDM optical network will utilize.
2) OTDR trace for every fiber the high speed DWDM optical network will utilize.
3) CWDM-OTDR trace for every fiber which the CWDM optical network will utilize.
4) Spectrum analyzer test results for every fiber which the CWDM optical network will utilize.
5) OTDR traces and power meter results for all "dark" unused fiber strands in the backbone fiber optic cable from communications node buildings.

Hard copy traces shall be organized and bound in logical order in an 8 ½" x 11" 3 ring hard cover binder in addition to other documentation listed in this Special Provision and other splicing documentation listed in the project Special Provision package.

The Contractor shall submit, after approval of the hard copy traces, electronic copies of all traces and appropriate software to allow reading the traces.

The Contractor shall submit one (1) copy of the complete contract plan set, including additional drawings issued as part of any change orders, revisions to the project plans during fiber optic work with any deviations clearly marked in color. Deviations to be noted and shall include but not be limited to the following:

(1) Fiber Splice location
(2) Fiber Splice configuration
(3) Termination layout

Section 20 – Standard Special Provisions

COLORADO
DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISIONS
STANDARD SPECIAL PROVISIONS

Name	Date	No. of Pages
Revision of Section 103 – Colorado Resident Bid Preference	(February 3, 2011)	1
Revision of Section 103 – Escrow of Proposal Documentation	(May 5, 2011)	2
Revision of Section 105 – Contractor Submittals Traffic Signal Pedestal Pole	(February 3, 2011)	1
Revision of Section 105 – Disputes and Claims for Contract Adjustments	(January 30, 2014)	31
Revision of Section 105 – Hot Mix Asphalt Pavement Smoothness	(May 8, 2014)	7
Revision of Sections 105 and 106 – Conformity to the Contract of Hot Mix Asphalt (Voids Acceptance)	(January 30, 2014)	10
Revision of Section 106 – Certificates of Compliance and Certified Test Reports	(February 3, 2011)	1
Revision of Section 106 – Hot Mix Asphalt – Verification Testing	(July 29, 2011)	2
Revision of Section 106 – Material Sources	(October 31, 2013)	1
Revision of Section 106 – Supplier List	(January 30, 2014)	1
Revision of Section 107 – Project Payrolls	(May 2, 2013)	1
Revision of Section 107 - Responsibility for Damage Claims, Insurance Types, and Coverage Limits	(February 3, 2011)	1
Revision of Section 107 – Transfer of Stormwater Permit to the Contractor	(April 26, 2012)	1
Revision of Section 107 – Warning Lights for Work Vehicles and Equipment	(January 30, 2014)	1
Revision of Section 108 - Critical Path Method	(August 19, 2011)	1
Revision of Section 108 – Liquidated Damages	(May 2, 2013)	1
Revision of Section 108 – Subletting of Contract	(January 31, 2013)	1
Revision of Section 108 - Payment Schedule (Single Construction Year)	(October 31, 2013)	1
Revision of Sections 108 and 109 - Payment Schedule (Multiple Construction Years)	(Nov. 15, 2013)	1
Revision of Section 109 – Asphalt Cement Cost Adjustment	(April 5, 2013)	2
Revision of Section 109 - Compensation for Compensable Delays	(May 5, 2011)	1
Revision of Section 109 – Fuel Cost Adjustment	(February 3, 2011)	2
Revision of Section 109 – Measurement of Quantities	(February 3, 2011)	1
Revision of Section 109 – Measurement of Water	(January 06, 2012)	1
Revision of Section 109 – Prompt Payment	(January 31, 2013)	1
Revision of Section 203 – Imported Material for Embankment	(February 3, 2011)	2
Revision of Sections 203, 206, 304 and 613 - Compaction	(July 19, 2012)	2
Revision of Section 206 – Imported Material for Structure Backfill	(July 19, 2012)	2
Revision of Section 206 – Structure Backfill (Flow-Fill)	(April 26, 2012)	2
Revision of Section 206 – Structure Backfill at Bridge Abutments	(January 30, 2014)	1
Revision of Sections 206 and 601 – Backfilling Structures that Support *Lateral Earth Pressures*	(July 29, 2011)	1
Revision of Section 208 – Aggregate Bag	(January 31, 2013)	1
Revision of Section 208 – Erosion Log	(January 31, 2013)	1
Revision of Section 212 – Seed	(April 26, 2012)	1
Revision of Section 213 – Mulching	(January 31, 2013)	4
Revision of Section 216 – Soil Retention Covering	(January 30, 2014)	6
Revision of Section 250 – Environmental, Health and Safety Management	(July 19, 2012)	1

Section 20 – Standard Special Provisions

Revision of Section 401 – Compaction of Hot Mix Asphalt	(April 26, 2012)	1
Revision of Section 401 – Compaction Pavement Test Section (CTS)	(July 19, 2012)	1
Revision of Section 401 – Composition of Mixtures – Voids Acceptance	(February 3, 2011)	1
Revision of Section 401 – Plant Mix Pavements	(February 3, 2011)	1
Revision of Section 401 – Reclaimed Asphalt Pavement	(May 2, 2013)	2
Revision of Section 401 – Temperature Segregation	(February 3, 2011)	1
Revision of Section 401 – Tolerances for Hot Mix Asphalt (Voids Acceptance)	(January 6, 2012)	1
Revision of Section 401 and 412 – Safety Edge	(May 2, 2013)	2
Revision of Sections 412, 601, and 711 - Liquid Membrane-Forming Compounds for Curing Concrete	(May 5, 2011)	1
Revision of Section 504 – Concrete Panel Facing MSE Wall	(February 3, 2011)	12
Revision of Sections 507, 601 and 606 – Macro Fiber-Reinforced Concrete	(May 2, 2013)	1
Revision of Section 518 - Bridge Expansion Device	(October 31, 2013)	1
Revision of Section 601 – Concrete Batching	(February 3, 2011)	1
Revision of Section 601 – Concrete Finishing	(February 3, 2011)	1
Revision of Section 601 – Concrete Form and Falsework Removal	(July 28, 2011)	2
Revision of Section 601 – Concrete Slump Acceptance	(July 29, 2011)	1
Revision of Section 601 – Depositing Concrete Under Water	(May 2, 2013)	1
Revision of Section 601 – Fiber-Reinforced Concrete	(May 2, 2013)	1
Revision of Section 601 – QC Testing Requirements for Structural Concrete	(May 8, 2014)	1
Revision of Section 612 – Delineators	(February 3, 2011)	1
Revision of Section 612 – Flexible Delineators	(July 19, 2012)	1
Revision of Sections 613 and 715 – LED Roadway Luminaire	(January 30, 2014)	5
Revision of Section 614 – Accessible Pedestrian Signal	(November 1, 2012)	3
Revision of Section 614 – Pedestrian Push Button Assembly	(July 19, 2012)	1
Revision of Section 618 – Prestressed Concrete	(April 26, 2012)	24
Revision of Section 620 – Field Laboratories with Ignition Furnace	(February 3, 2011)	1
Revision of Section 627 and 708 – Pavement Marking Paint	(January 31, 2013)	2
Revision of Section 630 – Construction Zone Traffic Control	(February 17, 2012)	1
Revision of Section 630 – Retroreflective Sign Sheeting	(May 8, 2014)	1
Revision of Section 630 – Signs and Barricades	(January 31, 2013)	1
Revision of Section 703 - Aggregate for Bases (Without RAP)	(October 31, 2013)	1
Revision of Section 703 – Aggregate for Hot Mix Asphalt	(November 1, 2012)	2
Revision of Section 703 – Aggregate for Stone Matrix Asphalt	(April 26, 2012)	1
Revision of Section 703 – Concrete Aggregate	(July 28, 2011)	1
Revision of Section 703 – Mineral Filler	(May 8, 2014)	1
Revision of Section 712 – Geotextiles	(November 1, 2012)	2
Revision of Section 712 – Water for Mixing or Curing Concrete	(February 3, 2011)	1
Revision of Section 713 - Epoxy Pavement Marking	(October 31, 2013)	2
Revision of Section 713 – Reflectors for Delineators and Median Barrier	(May 2, 2013)	1
Affirmative Action Requirements – Equal Employment Opportunity	(February 3, 2011)	10
Minimum Wages, Colorado, U.S. Department of Labor General Decision Number CO140016, MOD 1, Highway Construction for Adams, Arapahoe, Broomfield, Clear Creek, Elbert, Gilpin, Jefferson, and Park counties.	(January 24, 2014)	10
On the Job Training	(July 29, 2011)	3
Partnering Program	(February 3, 2011)	1

Section 20 – Standard Special Provisions