



**SCOPE OF WORK**

**FIELD SURVEY, RIGHT OF WAY PLANS, AND PAVEMENT DESIGN  
I-25; Monument to C-470**

**December 14, 2016**

PROJECT NUMBER: NHPP 0252-450

PROJECT LOCATION: I-25; Monument to C-470

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## SECTION 1 PROJECT SPECIFIC INFORMATION

**1.01 Project Background.** CDOT is currently conducting a Planning & Environmental Linkage (PEL) Study on I-25 from the Town of Monument in El Paso County to C-470 in northern Douglas County. The Planning and Environmental Linkages Study will examine operational, capacity, safety, transit, and maintenance needs in the I-25 Corridor between Monument and C-470. Currently, I-25 is 4 lanes from Monument to Castle Rock, 6 lanes through the Town of Castle Rock, and 8 lanes from the north end of Castle Rock to C-470. Concurrent with the PEL Study, CDOT Geotechnical will be completing geotechnical investigations (borings) and provide reports of their findings for pavement design purposes.

The roadway will be examined for increased capacity, interchange modifications, safety improvements, express lanes, climbing lanes, Intelligent Transportation Systems (ITS), frontage roads, shoulder widths, and other improvements that may provide safety and operational benefits. Land uses within the project limits vary from developed commercial, open space, agricultural, retail and residential uses.

The PEL study will recommend several alternatives for road improvements within the project limits. The surveys, Right-of-Way mapping, and pavement design completed as a result of this contract may ultimately be used to prepare final designs for a number of preferred alternatives or improvements to the corridor.

**1.02 Project Goal.** This project is intended to produce survey, right-of-way, and pavement design sufficient for a 30 percent design of preferred corridor improvement projects that may come out of the PEL Study.

**1.03 Project Location.** The project is located on I-25 between the Town of Monument in El Paso County and C-470 in northern Douglas County, approximate Mile Post 161.2 to 194.3

**1.04 Work Duration.** The time period for the work described in this scope is estimated to begin January 2017 and end approximately December 2020.

**1.05 Consultant Responsibility.** The Consultant is responsible for one or more of the following (defined by project Scope of Work):

### A. Surveys

1. Pre-survey Meeting
2. Progress Meetings
3. Secure Right of Entry
4. Traffic Control and Traffic Control Plan
5. Underground Utility Locates

6. Survey Data Research
7. Establish Ground Control
8. Property/Boundary Surveys as needed
9. TMOSS Survey
10. Project Control Diagram and/or Preliminary/Final Land Survey Control Diagram
11. Map Compilation
12. Right-of-Way Research including adjoining vesting deeds, title commitments, or memorandums of ownership
13. Right-of-Way Plan/Map Preparation
14. Right of Way Mapping (Mapping of existing right of way only)
15. Right-of-Way Staking (Existing ROW, new ROW, TE's, SE's, and PE's delineated for Appraisal)
16. Right-of-Way Monumentation (CDOT Monument)
17. Property Monumented Survey (As required per Colorado Revised Statutes)
18. Review By Licensed Professional Surveyor
19. Final TMOSS Survey

**B. Pavement Design**

1. Pre-Design, Materials, and Geotechnical Coordination Meetings
2. Progress Meetings
3. Evaluation of condition of existing pavement (Travel Lanes/Shoulder/Auxiliary Lanes/Ramps/Interchanges/etc)
4. Pavement design report for new pavement, including Life Cycle Cost Analysis.

**1.06 Work Product.** The Consultant work products are (defined by project Scope of Work):

1. Project Schedule
2. Man-hour Proposal
3. Cost Proposal
4. Project Progress Meeting Minutes
5. Traffic Control Plan(s)
6. Monument & Surveyed Ground Control
7. Signed and sealed Project Control Diagram and/or Preliminary and/or Final Land Survey Control Diagram/s (Control Map)
8. Digital TMOSS Data
9. Photography Products
10. All Documents Found In Research
11. Preliminary and Final Ownership Map
12. Original Field Notes
13. Survey Reports
14. Monuments on Right of Way Lines
15. Sealed ROW Plans and copies as filed in the County

16. Quality Control Reports
17. Electronic Data
18. Pavement Design Analysis and Technical Report
19. Life Cycle Cost Analysis Report

Detailed work product requirements are described in the following Sections.

**1.07** **Work Product Completion.** All submittals are subject to approval by the CDOT Contract Administrator or their designee.

**1.08** **Additional Project Information.** Additional information regarding this project is included in the following documents:

- A. CDOT Survey Manual (Current Ed.)
- B. CDOT Right-of-Way Manual (Current Ed.)
- C. CDOT Standard Specifications for Road and Bridge Construction (Current Ed.)
- D. CDOT CADD Manual (Current Ed.) (InRoads TMOSS, InRoads Geometry for ROW, etc.)
- E. CDOT M & S Standards (Current Ed.)
- F. FHWA Manual on Uniform Traffic Control Devices for streets and roads (MUTCD) (Current Ed.)
- G. CDOT InRoads TMOSS coding booklet (Current Ed.)
- H. I-25 PEL Study documents as they are finalized
- I. As-Constructed roadway, structure, and existing ROW plans
- J. CDOT Pavement Design Manual
- K. CDOT Field Materials Manual (Current Ed.)
- L. AASHTO Interim Mechanistic Empirical Pavement Design Guide (MEPDG) Manual of Practice.

Copies of these documents may be obtained from the internet, CDOT, or otherwise purchased.

A moderate fee, determined by document size, will be charged for CDOT provided copies.

An additional charge will be added for requests by mail or for billing. Please provide a notice of two working days prior to obtaining the document(s) in person. The most recent edition of any CDOT publication will apply to individual task orders issued under this contract and new editions will apply to new task orders issued after the release of a new manual or publication.

**1.09** **Scope of Work Organization.** This draft scope of work has been carefully reviewed by the Department and reflects a plan of approach based on the known goals. One factor determining the selection of a Consultant is the ability of that consultant to analyze the project goals, evaluate the work elements, and formulate a work plan. This process may produce new approaches or modification to the project work elements. Because of that, all consultants should

be aware that the Final Scope of Work for a project will be produced  
selected Consultant.

with the input of the

**SECTION 2**  
**PROJECT MANAGEMENT AND COORDINATION**

**2.01 CDOT Contacts**

The Contract Administrator for this project is:

Mr. Paul Jesaitis  
Region Transportation Director, Region 1

Active day-to-day administration of the contract will be done by:

Jerome Estes, Express Lanes Unit Resident Engineer  
7852 S. Elati St., Suite 200  
Littleton, CO 80120  
303-347-0504

The CDOT/PM will be:     Jody Allen  
7328 S. Revere Pkwy, Suite 204A  
Centennial, CO 80112  
303-365-7254



## SECTION 3 PROJECT DESCRIPTION

The consultant shall provide support in the following work disciplines:

### **3.01 Surveys**

#### **3.01.01 Surveying**

- A. Surveying general procedures
- B. Global Positioning System (GPS) surveys
- C. Aerial surveys
- D. Preliminary surveys
- E. Construction surveys
- F. Perform survey data research and preliminary field reconnaissance
- G. Secure right of entry using CDOT forms (Form 730)
- H. Geodetic surveys using FGCC Standards & Techniques including Blue Booking (Conventional & GPS)
- I. Project Control Networks tied to geodetic surveys based on NAD 83(2011) (Conventional or Fast Static GPS) or current datum used by CDOT.
- J. Vertical Control based on NAVD 88 datum
- K. Prepare Project Control Diagrams
- L. Prepare Preliminary and/or Final Land Survey Control Diagrams
- M. Blue Book Vertical control with the National Geodetic Survey
- N. Locate & Survey BLM & GLO Aliquot & Public Land Survey System Corners.
- O. TMOSS survey utilizing the CDOT Field Code Library (InRoads TMOSS Coding format) (Total Station, LIDAR, GPS RTK, etc.).
- P. Right of Way Surveys
- Q. Locate & Survey all private property monumentation required to resolve property ownerships and locations and their intersections with the existing and proposed CDOT Right of Way.
- R. Property Surveys
- S. Prepare preliminary ownership maps
- T. ALTA/ACSM Surveys (As required per ACSM.)
- U. Prepare monument recovery forms and records (CDOT, NGS, USGS, BLM or required by Colorado survey laws)
- V. Stake ROW Parcels, TE's, SE's, and PE's for appraisers
- W. Final Monumentation of ROW Line, SE's and PE's
- X. Comply with all applicable Colorado Revised Statutes
- Y. Prepare survey report using MicroStation V8 or newer, and InRoads. Using CDOT's latest configuration found at:  
<http://www.coloradodot.info/business/designsupport/cadd/microstation-inroads-config.html>
- Z. Prepare a quality control report

- AA. Slope and Structure Staking using design data. (Post-design/Pre-construction)

### **3.01.02 Right Of Way Plans Preparation**

- A. Perform research, calculations and drafting to determine existing CDOT Right-of-Way within project limits defined by metes and bounds on the project coordinate system. Deliver electronic data in InRoads and MicroStation.
- B. Resolve private property/boundary locations and the intersection of these boundary lines with the existing and proposed CDOT Right-of-Way.
- C. Research ownership deeds
- D. Prepare Right-of-Way Plans and Legal Descriptions. See Section 8.04 for more detail.

### **3.01.03 Terrain Modeling**

- A. Compile point #, Y, X, Z, code, and comment data using InRoads TMOSS codes (not a conversion to InRoads TMOSS codes). InRoads TMOSS format and methodology is described in the InRoads TMOSS booklet and InRoads Survey Data Reduction training manual.
- B. Through ground supplemental survey (1) find & locate any ROW Markers and property corners (2) define all features on the project - fences, signs, culverts, all underground features, utilities, pavement, bridge structures, and features with sensitive elevation requirements.
- C. Provide digital ortho-rectified photos in TIFF format with accompanying TFW file.
- D. Provide MicroStation drawings of InRoads TMOSS survey data

### **3.01.04 Administrative Support**

- A. Perform clerical or word processing duties
- B. Prepare billings and monthly progress reports

### **3.01.05 Traffic Control**

- A. Perform traffic control with planning, signing and properly trained personnel, using CDOT Plans and Specifications, and MUTCD manual as a guide
- B. Provide traffic control plans to be reviewed by the R-1 Traffic Engineer prior to implementation.

### **3.01.06 Quality Control**

Prepare a report that describes the procedures incorporated into the work to assure and control the quality

### **3.01.07 Title Work**

- A. Performs title research and prepares memorandum of ownerships with attached vesting deeds or the commitments for parcels to be acquired by CDOT.
- B. Arranges for title policies for and on behalf of the Colorado Department of Transportation.

## **3.02 Pavement Design**

### **3.02.01 Roadway Pavement Analysis and Design**

- A. The Consultant will perform the pavement design and Life Cycle Cost Analysis to determine the pavement type, minimum thickness, and minimum sub-grade stabilization requirements that shall be used throughout the project limits. The pavement design Consultant will be precluded from performing pavement design services on behalf of any innovative project delivery team should a project move forward within the aforementioned I-25 corridor limits.
- B. The pavement design shall be conducted using AASHTOWare Pavement Mechanistic-Empirical (M-E) design software (formerly DARWin-METM) using the CDOT calibration model and following the procedures and standards set forth in the most current CDOT Pavement Design Manual. CDOT strongly recommends using the AASHTO Interim Mechanistic Empirical Pavement Design Guide (MEPDG) Manual of Practice in conjunction with the latest CDOT Pavement Design Manual.
- C. All work related to completing the pavement design(s) must be conducted in accordance with the latest edition of the CDOT Pavement Design Guide, available online at:

<https://www.codot.gov/business/designsupport/materials-and-geotechnical/manuals/pdm/2017-m-e-pavement-design-manual>

- D. Elements of the pavement design such as reliability for which there are ranges and not specified inputs shall follow the recommendations of Region 1 Materials.
- E. The life cycle cost analysis (LCCA) shall be conducted using the FHWA's RealCost software. An analysis of the entire project length with user cost included is required. An LCCA of a representative segment of the project will not be accepted. The Consultant shall

arrange meetings with the Colorado Asphalt Pavement Association (CAPA) and the American Concrete Pavement Association (ACPA). The first meeting shall occur before the LCCA is run to garner industry feedback into inputs such as production rate, cost ranges, etc. Both industries shall also be given a chance to review and to respond to the LCCA before it is finalized.

- F. Pavement design analysis and recommendations will include the following activities:
- Feasible alternatives of new pavement structure will be designed utilizing procedures accepted by the CDOT PM.
  - Pavement designs will be based on the findings from the geotechnical investigation report supplied by CDOT. Soil samples tested for properties such as soil classification, R-value and corrosion potential will be used for analysis in the pavement design.
  - Final pavement design report including Pavement Justification Report (PJR) documenting all geotechnical findings as well as recommended pavement design thickness for various designs following the guidelines as described above.
  - Flexible pavement will include HMA mix and binder recommendations and shall be designed for a 20-year design life.
  - Rigid pavement designs consist of Portland Cement Concrete Pavement (PCCP), containing load transfer devices and tied shoulders and shall be designed for a 30-year design life.
  - Life cycle cost comparisons between properly designed structural sections that would be approved for construction.

### **3.02.02 Traffic Loading**

An estimate of annual growth rate over the design period will be needed to calculate the traffic load during the design period. CDOT Otis website can be used to access traffic load information. The link is <http://dtdapps.coloradodot.info/Otis/TrafficData>

### **3.02.03 Field Reconnaissance**

CDOT will coordinate with Consultant to conduct a field reconnaissance visit for planning the necessary field investigation work.

### **3.02.04 Subsurface Investigations**

The subsurface investigation will at the very minimum follow the sampling protocol delineated in the current version of the CDOT Field Materials Manual. CDOT Geotechnical branch will provide all necessary subsurface investigation collecting pavement cores and soil samples at predetermined frequencies approved by the Region Materials Engineer. If it is determined that supplemental investigations are required for the pavement design, structure design, culverts, etcetera, the Consultant may be required to provide all

equipment, labor, materials and traffic control required for the additional field investigation and data collection

### **3.02.05 Laboratory Testing**

CDOT Geotechnical branch will perform all necessary laboratory testing of all data collected by CDOT. If supplemental laboratory testing is needed, the Consultant may be required to provide and ensure all necessary laboratory testing is conducted as needed to comply with the requirements of the CDOT Field Materials Manual and Colorado Laboratory Procedures and to provide the basis for the necessary inputs required for the pavement design analysis.

## SECTION 4 GENERAL INFORMATION

**4.01 Contract Provisions.** The contract between CDOT and the Consultant shall be a cost plus fixed fee contract. This basic contract will set up the framework for project specific task orders. Funds for actual work will be committed only by task order and not by the contract. The task order shall be initiated by:

- A. Preparing a project specific Scope of Work.
- B. Negotiating the number of hours by classification for each work element with the CDOT Project Manager (CDOT PM).
- C. Identifying the other direct costs needed to accomplish the Scope of Work.
- D. Applying the pre-approved rates as established in the basic contract.
- E. Negotiating the product delivery dates.
- F. Identifying the total cost of work and resources needed to meet the project schedules.
- G. Submitting one copy of the Project Cost/Manhour Work Sheet with original signatures.

Each task order shall include a Scope of Work that describes the specific work to be done. This Scope of Work shall be in specific detail in order to provide a basis for the negotiation of the number of work hours. A meeting on the project site with the CDOT Project Manager (hereon referred to as CDOT PM) is required for each Scope of Work prepared. In the event the consultant experiences unexpected cost/rate changes, annual rate changes, changes in the project team and/or costs, delays during the term of the task order that require that the performance time of a task order be extended the consultant shall request an amended task order. The consultant shall submit one copy with original signatures to the CDOT PM of an amended task order request letter specifying the items to amend and the reasons for the amendment. Back up documentation supporting the request such as certified payroll reports detailing the salary or personnel change or documentation that substantiates any delays are required with the request. The CDOT PM then requests an amended task order from the CDOT Agreements and Consultant Management section. Approval of the amended task order is by the Chief Engineer or designee. All amendments to the task order require this formal process. Changes during the course of a task order are not permitted unless the consultant has requested an amendment. No payments will be made for work accomplished after the expiration date of the task order. Payments of rates differing from or not included in the original task order cannot be made without a formal amendment to the task order.

**4.02 Authorization to Proceed.** Work will not commence until the written notice-to-proceed is received by the Consultant and all work will be completed within the allotted time. No payments can be made for work accomplished outside the limits of the timelines set up by the task order.

Unanticipated changes that require that the performance time be extended must be documented.

These are unanticipated changes to the work schedule not caused by the consultant. The consultant shall request that the task order be formally amended to extend the time. The consultant shall submit a letter to the CDOT PM detailing the reasons for the request, documenting the time lost, and asking for the amendment for a time extension.

**4.03 Project Coordination.** The routine working contact will be between the CDOT PM and the Consultant Project Manager (C/PM). Each Project Manager will provide the other with:

- A. Synopses of their respective contacts (both by telephone and in person) with others
- B. Copies of pertinent written communications

Consultant is responsible for coordinating all sub-consultants and team members.

**4.04 Routine Reporting and Billing.** The Consultant will provide the following on a routine basis:

- A. Coordination of all contract activities by the C/PM
- B. The periodic reports and billings required by CDOT Procedural Directive 400.2
- C. Minutes of all Meetings. The minutes will be completed and will be provided to the CDOT PM within five (5) working days after the meeting. When a definable task is discussed during a meeting, the minutes will identify the "Action Item", the agency responsible for accomplishing it, and the proposed completion date.
- D. In general, all reports and submittals must be accepted by CDOT prior to their content being utilized in follow-up work efforts.
- E. The consultant shall submit a progress report with each billing.
- F. The progress report shall include a statement addressing the project schedule and any delays encountered.
- G. The primary consultant shall be responsible for checking and verifying all sub consultant and team member billings for compliance with the contract before submitting to CDOT for payment.
- H. The consultant must use the following personnel classifications for their firm's personnel when submitting task order proposals and billings to CDOT:
  - Right of Way Manager
  - Professional Land Surveyor II
  - Professional Land Surveyor I
  - Land Survey Intern II
  - Land Survey Intern I
  - Technician II
  - Technician I
  - Technician Assistant 1
  - Technician Assistant 2

Technician Assistant 3  
 Administrative Assistant  
 Project Manager  
 Professional Engineer  
 Field Technician  
 Lab Technician

For Survey personnel, the consultant shall assign each employee a title from the preceding list in lieu of Party Chief, Instrument operator, draftsman, CADD operator, etc. A detailed Minimum Qualifications (MQ's) description outlining minimum education and experience, special requirements, and substitutions and copies of the Descriptions (CD's) for each position are available upon request. Class

Monthly Status Reports. Each billing shall include a status report that includes the total man-hours bid compared to the total billed to date for each position, a percent complete for each work element.

**4.05 Personnel Qualifications.** The Consultant Project Manager (C/PM), must be approved by the CDOT Contract Administrator. Survey tasks must be supervised by Licensed Professional Surveyors who are registered with the Colorado State Board of Registration for Architects, Professional Engineers and Professional Land Surveyors. The Pavement Design tasks must be supervised by a Licensed Professional Engineer.

**4.06 CDOT Computer/Software Requirements.** The primary hardware used by CDOT is a Personal Computer - Windows based operating system, and the types of software are:

- Earthwork - InRoads
- Drafting - MicroStation
- Survey Control - Trimble Business Center (TBC)
- Survey - InRoads TMOSS coding (developed by CDOT to convert total station surveys, GPS and aerial surveys to MicroStation formats) and InRoads Survey.
- Geometry - InRoads
- Pavement Design - AASHTOWare Pavement M-E Design
- Life Cycle Cost - FHWA's RealCost software

Microsoft Word, Excel, Access, Outlook, Power Point and Project are used at CDOT.

**4.07 Computer Data Compatibility.** CDOT presently utilizes three data formats which consultants shall be required to use for submitting survey and design data: TMOSS (Topography Modeling Survey System using the InRoads coding), InRoads and MicroStation.

The data format used by the consultant to submit surveying data shall be as determined by the CDOT PM. The data format for submitting design computer files shall be compatible with the



InRoads. The data format shall be submitted in English Units in US Survey feet unless otherwise determined by the CDOT PM.

The consultant shall immediately notify the CDOT PM if the firm is unable to produce the desired format for any reason and cease work until the problem(s) is resolved.

Refer to Section 9.01 - SUBMITTALS, for additional information regarding InRoads TMOSS, InRoads, MicroStation and the acceptable transmittal media.

#### **4.08 Project Standards**

A. General. The following is a list of technical references applicable to CDOT work. The Consultant is responsible for ensuring compliance with the listed references. Conflicts in criteria shall be resolved by the CDOT PM.

*Colorado Revised Statutes, CDOT Survey Manual, Bureau of Land Management Instructions to Surveyors, State Board of Registration Rules, CDOT Right of Way Manual, NOAA National Geodetic Survey Specifications, Code of Federal Regulations, CDOT Road and Bridge Specifications, CDOT CADD Manual, Geometric Geodetic Accuracy Standards for Using GPS Equipment, Code of Ethics for Surveyors and Employees, ALTA/ACSM standards, CDOT Pavement Design Guide, AASHTO Interim Mechanistic Empirical Pavement Design Guide (MEPDG) Manual of Practice, CDOT Field Materials Manual*

B. Specific Criteria. The Consultant shall submit the pertinent criteria to the CDOT PM at one of the periodic progress meetings prior to initiating work.

**SECTION 5  
WORK ACTIVITY ASSIGNMENTS**

This list encompasses the consultant's individual task responsibility. The consultant shall perform all work tasks which are indicated below by an 'X' mark in the consultant column, in accordance with the forms and conditions of Sections 8-10, and the standards described in the manuals and documents associated with this contract in Section 1.07 and Section 4.08 after coordination and consultation with CDOT. The Consultant is also responsible for coordinating the required work schedule for those tasks accomplished by CDOT and other agencies.

**Preconstruction**- See Sections 8 and 9 for Work Tasks and Task Descriptions.

		<u>CDOT/OTHER</u>	<u>CONSULTANT</u> <u>&amp;/or SUBS</u>
<b><u>5.01</u></b>	<b><u>Project Initiation and Continuing Requirements</u></b>		
	A. Initial Project Meeting	<u>  X  </u>	<u>  X  </u>
	B. Project Schedule Reviews (Deliverables Deadlines)	<u>  X  </u>	<u>  X  </u>
	C. Initiate Survey	<u>  X  </u>	<u>  X  </u>
	D. Pavement Design Meeting	<u>  X  </u>	<u>  X  </u>
	E. Geotechnical Coordination Meetings	<u>  X  </u>	<u>  X  </u>
	F. Right of Entry & Permits	<u>      </u>	<u>  X  </u>
	G. Traffic Control	<u>      </u>	<u>  X  </u>
	H. Initial Submittals	<u>      </u>	<u>  X  </u>
	I. Progress Meetings	<u>      </u>	<u>  X  </u>
	J. Safety	<u>      </u>	<u>  X  </u>
	K. Project Management	<u>      </u>	<u>  X  </u>
<b><u>5.02</u></b>	<b><u>Project Development</u></b>		
	A. Communication and Consensus Building		
	B. Contact List	<u>      </u>	<u>  X  </u>
	C. General Meetings		
	1. Small Group	<u>      </u>	<u>  X  </u>
	2. Project Review	<u>      </u>	<u>  X  </u>
	D. Communication Aids	<u>      </u>	<u>  X  </u>
	1. Graphics Support	<u>      </u>	<u>  X  </u>
	E. Route Location Surveys		
	F. Survey Manual General Procedures		
	1. Equipment Checking	<u>      </u>	<u>  X  </u>
	2. Calibration	<u>      </u>	<u>  X  </u>
	3. Error reduction	<u>  X  </u>	
	4. Field notes	<u>      </u>	<u>  X  </u>
	5. Preliminary Survey scope	<u>      </u>	<u>  X  </u>
	6. Presurvey conference	<u>      </u>	<u>  X  </u>

7. Special use permit	_____	<u>  X  </u>
8. MUTCD Traffic Control	_____	<u>  X  </u>
9. Permission to Enter Property	_____	<u>  X  </u>
10. Underground utility locates	_____	<u>  X  </u>
	<u>CDOT/OTHER</u>	<u>CONSULTANT</u> <u>&amp;/or SUBS</u>
<b>G. GPS Surveys</b>		
1. GPS survey specifications	_____	<u>  X  </u>
2. Error reduction	<u>  X  </u>	_____
3. Equipment checking and calibration	_____	<u>  X  </u>
4. GPS survey methods	_____	<u>  X  </u>
5. Static & Fast Static Network design	_____	<u>  X  </u>
6. GPS planning	_____	<u>  X  </u>
7. GPS vertical survey	_____	<u>  X  </u>
8. GPS Horizontal survey	<u>  X  </u>	_____
9. Project and LS Control Diagrams	_____	<u>  X  </u>
10. CORS	_____	<u>  X  </u>
11. OPUS	_____	<u>  X  </u>
<b>H. Aerial Surveys</b>		
1. General	_____	<u>  X  </u>
2. Ground control	<u>  X  </u>	_____
3. Photo control Horizontal	_____	<u>  X  </u>
4. Photo control vertical	_____	<u>  X  </u>
5. Photo control survey report	_____	<u>  X  </u>
6. InRoads TMOSS Coding	_____	<u>  X  </u>
7. Tolerance verification	_____	<u>  X  </u>
8. Photogrammetry Specifications	_____	<u>  X  </u>
9. Deliverables	_____	<u>  X  </u>
<b>I. Right of Way</b>		
1. Early ROW	_____	<u>  X  </u>
2. ROW Review	_____	<u>  X  </u>

### **5.03 Preliminary Design**

<b>A. Preliminary Surveys</b>		
1. General	_____	<u>  X  </u>
2. Reconnaissance	_____	<u>  X  </u>
3. Research	_____	<u>  X  </u>
4. Railroad Research	_____	<u>  X  </u>
5. Horizontal Tolerance verification	_____	<u>  X  </u>
6. Control Survey	<u>  X  </u>	_____
7. Horizontal Control Survey	_____	<u>  X  </u>
8. Vertical Control Survey	_____	<u>  X  </u>

9. Differential Leveling		<u>          </u>	<u>      X</u>
10. Project Control Diagram		<u>          </u>	<u>      X</u>
11. Right of Way Survey		<u>          </u>	<u>      X</u>
12. Land Survey Control Diagram		<u>          </u>	<u>      X</u>
13. Boundary Analysis		<u>          </u>	<u>      X</u>
14. InRoads TMOSS Coding		<u>          </u>	<u>      X</u>
		<u>CDOT/OTHER</u>	<u>CONSULTANT</u>
			<u>&amp;/or SUBS</u>
15. Topographic Survey		<u>          </u>	<u>      X</u>
16. Drainage Survey		<u>          </u>	<u>      X</u>
17. Utility Survey		<u>          </u>	<u>      X</u>
18. Staking for Appraisal		<u>          </u>	<u>      X</u>
<b>B. Utility Coordination</b>			
1. Location Maps	<u>          </u>	<u>      X</u>	
2. Contact Locate Services		<u>          </u>	<u>      X</u>
3. Reviews and Investigations		<u>          </u>	<u>      X</u>
4. Underground Locates		<u>          </u>	<u>      X</u>
5. Ditch Co. Coordination	<u>          </u>	<u>      X</u>	
<b>C. Right of Way</b>			
1. Research		<u>          </u>	<u>      X</u>
2. Ownership Map		<u>          </u>	<u>      X</u>
<b>D. Pavement Design</b>			
1. Perform a Distress Survey		<u>          </u>	<u>      X</u>
2. Analyze Geotechnical Data		<u>          </u>	<u>      X</u>
3. Analyze Life Cycle Costs of Alternatives	<u>          </u>		<u>      X</u>
4. Pavement Design Report		<u>          </u>	<u>      X</u>

**SECTION 6  
SUBMITTALS**

		<u>CDOT/OTHER</u>	<u>CONSULTANT</u> <u>&amp;/or SUBS</u>
<b><u>Section 4 - Project Initiation and Continuing Requirements</u></b>			
4.04-B	Periodic Reports & Billings _____	<u>X</u>	
4.04-C	Meeting Minutes _____		<u>X</u>
<b><u>Section 8.01 – Project Initiation and Continuing Requirements</u></b>			
8.01-A	Man-hour Estimates _____		<u>X</u>
8.01-A	Project Cost Worksheet _____		<u>X</u>
8.01-B	Project Schedule _____		<u>X</u>
8.01-C	Survey Plan _____		<u>X</u>
8.01-D	Permission to Enter Forms _____	<u>X</u>	
8.01-E	Traffic Control Plan _____		<u>X</u>
8.01-F	Initial Submittal of InRoads TMOSS _____		<u>X</u>
8.01-F	Initial Submittal of an Original Plan Sheet _____		<u>X</u>
8.01-G	Meeting Minutes _____		<u>X</u>
<b><u>Section 8.02 - Project Development</u></b>			
8.02-A-1	Permission to Enter Contact List _____		<u>X</u>
8.02-B-1-b	Equipment Calibration _____		<u>X</u>
8.02-B-1-d	Field Notes _____		<u>X</u>
8.02-B-1-f	Preliminary Survey Conference Minutes _____		<u>X</u>
8.02-B-1-g	Special Use Permits _____	<u>X</u>	
8.02-B-1-h	Traffic Control Plan _____	<u>X</u>	
8.02-B-1-i	Executed Permission to Enter Forms _____	<u>X</u>	
8.02-B-1-j	Underground Utility Reports _____	<u>X</u>	
8.02-B-2-a to 8.02-B-2-h			
	GPS Quality Control Report _____	<u>X</u>	
8.02-C	Photo control survey report _____	<u>X</u>	
8.02-C	Planning maps, flight plan, camera calibration report, negatives, contact prints, photo index, photo enlargement prints, digital images, analytical aerial triangulation report, planimetric feature identification, InRoads TMOSS supplemental survey, mapping sheets, digital terrain models, digital elevation models, contours, ortho-photography data _____		<u>X</u>
8.02-D-a-(1)	ROW Preliminary Cost Estimate _____	<u>X</u>	<u>X</u>
8.02-D-a-(1)	Relocation Study _____	<u>X</u>	<u>X</u>
8.02-D-a-(6)	Plat of Existing Right of Way _____		<u>X</u>

	<u>CDOT/OTHER</u>	<u>CONSULTANT</u> <u>&amp;/or SUBS</u>
<b><u>Section 8.03 - Preliminary Design</u></b>		
8.03-A-3 Researched materials	_____	_____X
8.03-A-10 Project Control Survey Diagram	_____	_____X
8.03-A-12 Land Survey Control Diagram	_____	_____X
8.03-A-14 InRoads Files (.FWD, .ALG, .DTM)	_____	_____X
8.03-A-15 Digital Topographic Survey (.DGN)	_____	_____X
8.03-A-16 Drainage Survey	_____	_____X
8.03-A-17 Utility Survey	_____	_____X
8.03-A Survey Field Notes (Hardcopy and/or Electronic)	_____	_____X
8.03-B Utility Location Maps	_____	_____X
8.03-C-1 Right of Way Research	_____	_____X
8.03-C-1 Memoranda of Ownership	_____	_____X
8.03-C-2 Preliminary Ownership Map (for Field Inspection Review plan set)	_____X	
8.03-D Pavement Design Analysis and Technical Report	_____	_____X
<b><u>Section 8.04 - Final Design</u></b>	_____X	
<b><u>Section 8.05 - Data</u></b>		_____X
<b><u>Section 8.06 - Survey Plats</u></b>		_____X
<b><u>Section 8.06 - Right of Way COGO Data</u></b>		_____X
<b><u>Section 8.07 - Plans</u></b>		_____X
<b><u>Section 8.08 - Electronic Data Submittals</u></b>		_____X
<b><u>Section 10.01 - Post Design Plan Modifications</u></b>	_____X	
<b><u>Section 10.02 - Pre-Construction Services</u></b>		_____X

**SECTION 7**  
**CONTRACT CONCLUSIONS**

**7.01** **Supplemental Work.** This contract will be supplemented by task orders for specific tasks during a three-year period.

**7.02** **Contract Completion.** This Contract will be satisfied upon acceptance of the following items (if applicable) to supplement(s) by task order:

- Project Schedule
- Project Progress Meeting Minutes
- Traffic Control Plan(s)
- All Documents Found In Research
- All Permission to Enter Forms
- Monumented & Surveyed Ground Control
- Digital InRoads TMOSS Data
- All Electronic Data from InRoads and MicroStation packages
- Photography Products
- Project Control Diagram
- Final Land Survey Control Diagram deposited with appropriate county (counties)
- Preliminary Ownership Map
- Original Field Notes
- Survey Report (Including monument recovery forms)
- Quality Control Report
- Monumented and Sealed ROW Plans
- Legal Descriptions, Signed and Sealed
- NOAA - NGS Blue Book
- Memorandum of Ownerships
- Title Commitments and policies
- Deposited ROW Plans
- Pavement Design Analysis and Technical Report

And the completion of review of contract submittals.

## **SECTION 8 PRECONSTRUCTION WORK TASK DESCRIPTIONS**

The following includes work descriptions for all tasks normally accomplished during this phase of the work. Work items listed may need to be advanced in time period in order to meet compressed schedules.

The tasks that could be the responsibility of the consultant are identified in Section 5 of this scope. The Consultant should review this entire section to identify applicable material. Contact the CDOT PM if clarification is required.

The following activities of communication and consensus building, project team reviews, conceptual design, gather data, documentation, and formal public notice should be planned by the Consultant and coordinated with the CDOT PM to satisfy the requirements of the "Procedures for Public Involvement and Participation in the Project Development and Environmental Analysis Process". The time of their accomplishment will overlap and parallel paths of activity should be planned to finish the development phase in accordance with the shortest possible schedule. The type and number of meetings, documents, etc. will depend on the category and characteristics of the project work. A project plan will be developed by the Consultant that satisfies the requirements of the project. This plan must be approved by the project manager before starting the work.

### **8.01 Project Initiation and Continuing Requirements**

- A. Initial Project Meeting. An initial meeting will be held and an on-site inspection (when appropriate) will be made to ensure that the Consultant is familiar with the existing conditions as well as the project requirements. This meeting will be coordinated by the Consultant and conducted by the CDOT PM. Notices for the meeting are to be sent by the Consultant. A scope of work, man-hour estimate and the project cost work sheet designated by the contract will be developed from this meeting.
  - 1. If this contract is for the production of right of way plans, the consultant or sub-consultant actually designing the right of way plans shall attend a "pre-survey" conference with the CDOT PM.
  - 2. A "Pre-Survey" conference between the consultant and the CDOT PM will be held prior to any survey work performed. The CDOT Survey Manual provides several agendas for the Pre-Survey Conferences.
  - 3. A Pavement Design conference between the consultant and the CDOT PM will be held prior to any pavement design work performed.
- B. The consultant shall submit a proposed schedule to complete each survey and pavement



design task with each task order proposal. The schedule shall be negotiated with the CDOT PM before the task order proposal is accepted. A Gantt chart created in Microsoft Project showing all work tasks, the duration of each task, the resources assigned to each task, and the relationship of each dependent task shall be prepared and submitted to the CDOT PM. It is the consultant's responsibility to communicate and document any delays or setbacks in the schedule in the monthly status reports and submit a revised schedule Gantt chart.

- C. The survey and pavement design is initiated by the "Notice to Proceed" from the CDOT. The consultant is then responsible to begin the work. A CDOT Form 1217a Preliminary Survey Scope may be used as a guide for completing the survey scope. An example of the Form 1217a is included in the CDOT Survey Manual.
- D. Obtain necessary right of entry (Permission to Enter - Form 730a) and permits. It is useful to start the project contact list called for in Section 8.02 B. at this stage with the names of the adjoining to the project.
  - 1. Some activities may require work on land not controlled by the CDOT. In such cases the Consultant shall obtain the necessary written permission to enter the premises. Included in this written permission will be the names and telephone numbers of persons to contact should notification prior to entry be necessary. These written permissions will apply to CDOT personnel as well as Consultant personnel. CDOT Form 730a must be used for this purpose. Signed copies of the written permission will be submitted to the CDOT PM prior to entering private property for survey work. Include County Assessor number or state ID number on Form 730a when submitting to CDOT so completed Permission to Enter can be located on County Tax Plat.
  - 2. Some activities such as materials testing on existing pavement and structures may require a special use permit or temporary easement from the landowner. Permits and temporary easements will be obtained by the consultant and copies submitted to the CDOT PM.
- E. Traffic Control. Consultant field activities that interfere with traffic operation within existing roadways will require control of existing traffic. The Consultant will plan and provide any required traffic control for the survey, testing, or design process. Traffic control operations will be in accordance with the MUTCD. The Consultant will note that the proposed method for handling traffic must be acknowledged in writing by the CDOT PM. Also, certification of the Traffic Control Supervisor as a Worksite Traffic Supervisor by the American Traffic Safety Services Association (ATSSA) will be required. The consultant should schedule a two-week review period for the approval of the traffic control plan. Region One has in place an extensive lane closure strategy that provides authoritative guidance for scheduling lane closures in Region One. Copies of the technical report are

available from the R-1 Traffic unit.

- F. Initial Submittals. Submit the following samples to the CDOT PM for approval:
- An original plan sheet that complies with Section 8.02 of this scope.
  - Photogrammetric and/or survey data and a drawing or photograph in accordance with the requirements specified in Section 8.02.

NO ORIGINAL PLAN SHEETS OR PHOTOGRAMMETRIC SURVEY WORK WILL BE ACCOMPLISHED UNTIL SATISFACTORY SAMPLES HAVE BEEN RECEIVED AND APPROVED BY THE CDOT PM.

G. Progress Meetings

1. The CDOT and Consultant Project Managers will meet periodically as required (typically at one month intervals). These progress meetings will be used to coordinate the work effort and resolve problems. The meetings will review the following:
  - a. Activities completed since the last meeting.
  - b. Problems encountered.
  - c. Delayed and behind schedule activities.
  - d. Activities required by the next progress meeting.
  - e. Solutions for unresolved and anticipated problems.
  - f. Information or items required from other agencies.
2. Other required meetings are described in the following sections.

H. Safety

1. Consultants working within the CDOT Right of Way are subject to all safety requirements of the department and OSHA. See Chapter 7 of the CDOT Survey Manual for a list of the CDOT policy and procedural directives and other references to CDOT safety manuals and guides. The consultants engaged by this non-project specific contract shall assume the responsibilities listed in the CDOT Survey Manual for the region survey coordinator for all consultant employees and crew members.

- I. Project Management – The consultant will coordinate all the work tasks being accomplished by all parties to ensure project completion on schedule.

**8.02 Project Development**

- A. Communication and Consensus Building. Establish and maintain a computerized list or database of all appropriate receptors for the communication process. The data shall be in

Microsoft Excel format.

The contacts will be compiled from the general list below as supplemented by the Project Review Team and the attendees at public meetings.

The list will be used for notices regarding public meetings, mailing newsletters, or other communications as appropriate.

The information on the list shall include as a minimum:

Name  
Firm (if any)  
Mailing address  
Phone number

1. Contact List:

Property owners adjoining the project  
Public Agencies  
Neighborhood Groups  
Property Owners/Tenants  
Business Interests  
Special Interests  
Railroads

The contact list shall be delivered to CDOT in Microsoft Excel format.

2. General Meetings. The types and number of meetings shall be flexible and determined by an interactive process as approved by the CDOT PM.

- a. Small Group Meetings (one-on-one). Meet with property and business owners or others directly affected by the project work to identify likely impacts and discuss possible mitigation or resolutions. Minutes of these meetings will be provided to all participants by the consultant.
- b. Project Review Meetings. These meetings are intended to disseminate project progress information to the public and representatives of local entities. Notices will be mailed at least 14 days in advance of these meetings to those on the contact list. The Consultant will provide the presentation aids, conduct the meeting, and provide complete minutes of the meetings to CDOT.

3. Communication Aids

- a. Graphics Support. Provide the graphics for public presentations and environmental documents. This may include PDF's of photographs, maps and plan views of conceptual design, and other displays for visual presentations at meetings.
- B. Route Location Surveys. Surveys will be conducted in accordance with the CDOT Survey Manual and the latest addendum thereof.
- 1. See the CDOT Survey Manual General Procedures (CDOT Survey Manual Chapter 2) for a detailed description of the following work tasks and elements.
    - a. Equipment Checking and Calibration (CDOT Survey Manual Chapter 2.1)
    - b. Calibrations (CDOT Survey Manual Chapter 2.2)
    - c. Error Sources in Surveying (CDOT Survey Manual Chapter 2.3)
    - d. Field notes (CDOT Survey Manual Chapter 2.4)
    - e. Preliminary Survey Scope Form 1217a (CDOT Survey Manual Chapter 2.5)
    - f. Presurvey Conference (CDOT Survey Manual Chapter 2.6)
    - g. Special Use Permit Form 1283a (CDOT Survey Manual Chapter 2.7)
    - h. Manual of Uniform Traffic Control Devices (MUTCD) 6H-16 & 6H-10 (CDOT Survey Manual Chapter 2.8). Region One has a lane closure strategy technical report that is available from the Traffic engineer. The lane closure strategy is a guiding document on when lanes can be closed for work.
    - i. Permission to Enter Property Form 730a (CDOT Survey Manual Chapter 2.9)
    - j. Underground Utility Locates Prior to Installing Monumentation (CDOT Survey Manual Chapter 2.10)
  - 2. Global Positioning System Surveys (CDOT Survey Manual Chapter 3 and Appendices)
    - a. GPS Survey Specifications (CDOT Survey Manual Chapter 3.1 and Appendices). This includes GPS reports and a submittal for the CDOT GPS control monument database and specifications for blue book data for submittal to the NSRS. The appropriate GPS report is required for each survey performed.
    - b. Error Sources in GPS (CDOT Survey Manual Chapter 3.2). Procedures are required to reduce errors.
    - c. GPS Equipment Checking and Calibration (CDOT Survey Manual Chapter 3.3). A CDOT approved method is required for each project.
    - d. GPS Survey Methods (CDOT Survey Manual Chapter 3.4). The project survey scope will specify the survey required.
    - e. Static and Fast Static Network Design (CDOT Survey Manual Chapter 3.5). Consultant is responsible for network design.
    - f. GPS Planning (CDOT Survey Manual Chapter 3.6) procedures are to be adhered to.

- g. GPS Vertical Procedures (CDOT Survey Manual Chapter 3.7). GPS derived orthometric heights are used to check and trouble shoot differential leveling on CDOT control monuments. GPS vertical procedures may be used to establish elevations when existing bench marks are not within the project limits and prior approval by the CDOT PM is obtained.
- h. GPS Horizontal Procedures (CDOT Survey Manual Chapter 3.8) shall be followed for the survey type requested.
- i. Project Control Diagram and Land Survey Control Diagram (CDOT Survey Manual Chapter 3.9) shall be prepared for the survey performed. (See the General Cell Library in the CDOT configuration in MicroStation for the appropriate sheets to use.)
- j. Continually Operating Reference Stations (CORS) (CDOT Survey Manual Chapter 3.12) the consultant must supply the eight items listed to the survey coordinator for the prior approval of the use of CORS stations. The final constrained adjustment must also be provided.
- k. On-Line Positioning User Service (OPUS) (CDOT Survey Manual Chapter 3.13) is used to check prior processing.

C. Aerial Surveys (refer to CDOT Survey Manual Chapter 4 for specifications and deliverables)

D. Right of Way (ROW)

a. Early ROW

- (1) Perform a field inspection of each short-listed alignment. Ascertain number of parcels, types of improvements, and possible problem areas (i.e., mobile homes, functional replacements, historical sites, etc.). Identify parcels which could require relocation activities.
- (2) Identify potential problem areas.
- (3) Prepare a property ownership map based on tax assessors' records that identify owners for each alignment.
- (4) Prepare a land use map that identifies land usage along each alignment. The parcel use categories shall utilize appropriate categories including:
  - (a) Land in public ownership: specific use and responsible agency/jurisdiction
  - (b) Commercial: retail, wholesale, industrial, other commercial
  - (c) Residential: single or multi-family
  - (d) Vacant
  - (e) Mixed Uses
  - (f) Other (specific)
- (5) Ownership Maps
- (6) Right of Way Mapping - Set right of way monuments at all angle points, points

of curvature, end of curvature, and no more than 1400' apart on tangent sections of the right of way (per CDOT MOU). If no monuments are found then monuments must be set on all preliminary ROW surveys. Preliminary ROW mapping projects also require monuments if field investigations uncover a lack of monuments at each angle point or change in curvature on a curve, or on tangent sections of the right of way longer than 1400'. This preliminary ROW survey to establish, calculate, monument and plat the existing ROW line is called ROW mapping or a monumented land survey of the ROW in the project scope. A plat suitable for filing in the county records is required.

b. ROW Review

- (1) Review the impact of each proposed alignment on existing and known future land use.
- (2) Prepare a ROW report that summarizes the findings and includes:
  - (a) Identified problem areas
  - (b) Ownership map
  - (c) Land Use Map

**8.03 Preliminary Design**

A. Preliminary Surveys. This work shall be done in accordance with the CDOT Survey Manual, State Board of Registration rules and policies and applicable state statutes.

1. See General procedures in the CDOT Survey Manual Chapter 5.
2. In addition to the reconnaissance survey described in the CDOT Survey Manual reconnaissance is done on the project site to determine an effective survey plan. GPS satellite visibility, project accessibility, and the general lay of the land are determined.
3. Research is conducted for all applicable materials, recorded and field data, as described in the CDOT Survey Manual.
4. Railroad research and permission to enter the railroad is conducted as described in the CDOT Survey Manual. The survey consultant is responsible for training personnel in railroad safety procedures and guidelines.
5. Horizontal tolerance verification is documented as called for in the CDOT Survey Manual. The surveyor is responsible for choosing the proper method to meet the prescribed tolerances.
6. A control survey is established as described in the CDOT Survey Manual.
7. The horizontal control for the project is established by a method described in the CDOT Survey Manual. Primary and secondary control is described.
8. The vertical control survey is established according to the CDOT Survey Manual. Tolerances and documentation are described.
9. Differential leveling is required on the primary control points, CDOT class A.

Differential leveling may be required on asphalt and concrete surfaces under this contract.

10. A Project Control Diagram is prepared as described in the CDOT Survey Manual. The minimum standards and required notes and certifications are described.
11. A right of way survey is performed according to the CDOT Survey Manual. This is a monumented land survey according to Colorado Revised Statutes.
12. A Preliminary and/or Final Land Survey Control Diagram is prepared using the general format and minimum standards, notes, and certifications as described in the CDOT Survey Manual.
13. Boundary analysis and platting is performed according to the CDOT Survey Manual. The determination of the boundary must be made by or under the direct supervision of a PLS in the State of Colorado. The preponderance of evidence gathered including the recorded documents, field and topographic data, parole evidence, other found monuments, interviews of other surveyors among other things are all weighed and the decisions made presented in the project narrative.
14. TMOSS data is gathered and coded according to the CDOT Survey Manual. The coding method is based upon the file structure (.DC, .SDR, .FWD, .ALG, .DTM) described in the CDOT Survey Manual.
15. The topographic survey is performed according to the CDOT Survey Manual using the approved CDOT coding method. Coding is applied to every topographic field shot in order to produce an electronic scale model (.DGN) of the terrain, improvements, and all existing features desired for the design of the project.
16. The drainage survey is included in the topographic survey as directed by the CDOT Survey Manual.
17. The utility survey is to include all underground utilities from surface located stakes and markings. The utility survey is included in the topographic survey.
18. Staking for appraisal includes establishing temporary stakes for proposed parcels for the purpose of the appraisal and negotiations with the present owner.

#### B. Utility Coordination

1. Location maps are to be procured from the utility and included in the survey report.
2. Contact Utilities and Utility Notification Center of Colorado to field mark utilities for InRoads TMOSS surveying.
3. Reviews and investigations. When "pot-holing" is designated by task order, the Consultant shall be responsible for the excavation. If designated in Section 1.04, the Consultant shall be responsible for surveying utility locations.
4. Underground utility locates. The consultant is responsible for contracting with an underground utility locator for surface marking underground utilities when called for in the task order.
5. Ditch Companies. Contact information is to be compiled and delivered to CDOT. Research into the title, rights and interest of the ditch companies is to be provided.

C. Right of Way. The following work shall be done by or under the immediate supervision of a PLS in the State of Colorado. The following work may be included as part of a surveying task order. The following work may also be included as part of right of way plans preparation task order.

1. Research. See CDOT Right of Way Manual.

- a. Identify affected ownership from preliminary design plans and assessors maps.
- b. Obtain assessors map, locating project limits.
- c. Locate documents that transfer title.
- d. Prepare 60 year long chain of title as directed by the CDOT PM.
- e. Look for encumbrances, releases, etc.
- f. Make physical inspection of property. Note any physical evidence of easements, wells, ditches, ingress and egress.
- g. Check with County Road Department or County Engineer for location of existing roads.
- h. Check for latest sub-division plats and vacation of streets.
- i. Memoranda of ownership shall be as described in the Right of Manual Chapter 2.

2. Ownership Map. See CDOT Right of Way Manual. For additional detail on required drafting software, COGO, and project coordinate system see SECTION 9 - SUBMITTALS. Ownership map shall be submitted along with a "Project Narrative" see Section 8.02-D-a-(6)

- a. Review preliminary design and field survey notebooks.
- b. Review Basis of Bearing and Project Coordinate system from the Control Survey prior to calculations.
- c. Compute alignment of ROW and store coordinates of all found monuments within the first tier of properties within the project limits.
- d. Obtain and review ownership documents (Memorandums of Ownership and/or title commitment and supporting plats).
- e. Calculate coordinates of lost or obliterated corners using guidelines established by the Bureau of Land Management. (To be used by field surveyor in resetting the monuments.)
- f. Establish subdivisions of sections using Bureau of Land Management Guidelines.



- Show all Section Lines and ¼ section lines on the ownership map and ROW plans.
- g. Determine existing right of way limits from deeds of record, CDOT plans and found ROW markers. Previous right of way plans, if available, will be provided by CDOT as an aid.
  - h. Determine ownership and their property/boundary line locations. Locate the intersection of these property boundary lines with the existing CDOT Right of Way. Determine location and ownership of existing easements of record. Show as measured dimensions compared to record dimensions where they differ.
  - i. Secure additional property owner ties and additional topography where the highway improvement may affect improvements adjacent to the right of way. This additional topography should include:
    - (1) Underground cables and conduits and any overhead utilities.
    - (2) Wells
    - (3) Irrigation ditches and systems
    - (4) Septic tanks, cesspools, and leaching fields.
  - j. Reconcile overlaps and gaps in ownerships as required by CDOT, documenting method used (may require additional field work). Include reasons and supporting evidence in the project narrative.
  - k. Plot ownership map on 11 inch x 17 inch sheets in accordance with specifications. The Sheet cell (see the Sheet cells provided in the General Cell Library in the CDOT MicroStation configuration) will be provided by CDOT for this purpose. Normal scale, 1" = 400' in rural areas, 1" = 200' in urban areas. If entire ownership will not fit on the sheet at this scale, an additional abbreviated Ownership map may be used at a scale of 1" = 1 mile, or other suitable scale, to show the configuration of large ownerships.
  - l. Label all monuments found with description of monument, point number, and project coordinates.
  - m. Show improvements and topography within the ownerships as well as existing access to the street system.
  - n. Number ownerships alternately as they occur along the Centerline from south to north or west to east in the same direction as the stationing. Show current names of owners and lessees.
  - o. Calculate the total area of all ownerships affected, and establish bearings and distances on all ownership lines, including coordinate of all property corners.
  - p. Show areas of complex ownerships graphically by cross hatching different land uses.
  - q. Transmit finished reproducible ownership map, a PDF of the title work, and an electronic MicroStation drawing of the ownership map drawn to scale, all calculations, field notes, and supporting data. The ownership map will include a control and found monument sheet. Note that only the project control data needs to be completed at this time. The ROW Ownership Map shall be available for review at the time of the FIR.

- r. The ownership map in electronic format shall be delivered and be suitable as the base map or master drawing from which all right of way plans and exhibits are developed in the next phase of the project.
- s. Ownership map shall be as described in the Right of Manual Chapter 2 with the addition of the following 2 items:
  - (1) The map shall include a description of monuments found.
  - (2) All measured and record distances shall be shown.
- u. The ownership map shall be submitted electronically in MicroStation format with the understanding that this drawing will become the master drawing for any right of plans developed in the corridor.
- v. This ownership drawing is to be completed to the standards of a land survey plat.

Monumented Land Survey of right of way includes all requirements as called for in the Colorado Revised Statutes, including CRS 38-51, 38-52, 38-53. All Colorado State Board of Registration for Architects, Professional Engineers and Professional Land Surveyors By-laws and Rules including Chapter 6 – Rules of Professional Land Surveying Practice; Section 6.4 - Physical Standards for Public Land Survey System Monuments and Section 6.5 - Standards for Land Surveys. All Policies of the State Board of Registration are to be followed. Nothing in this scope relieves the consultant from complying with state statutes and Colorado State Board of Registration for Architects, Professional Engineers, Professional Land Surveyors rules and policies.

#### D. Pavement Design Analysis and Technical Report

The Consultant shall perform an engineering analysis of the data in accordance with the requirements of the CDOT Pavement Design Guide for the development of the pavement design(s) required under this SOW. Consultant shall prepare a technical report to document all phases of the pavement design process, provide the recommended design section(s), as well as the materials and specifications for construction.

The pavement design report shall be prepared addressing the geotechnical findings and presenting preliminary pavement design recommendations for both Hot Mix Asphalt (HMA) and Portland Cement Concrete Pavement (PCCP). The report shall also summarize the results of field investigation and laboratory testing. Specifically, the report will address the following items:

1. Descriptions of the existing subsurface conditions encountered.
2. Boring logs graphically depicting the subsurface data.
3. Recommend subgrade treatment to address swelling soils and/or soils with high plasticity indices.
4. Discussion concerning the ramifications of ground water conditions, as appropriate.

5. The results of the soil corrosivity testing (soluble sulfates, pH, soluble chlorides and electrical resistivity) and proposed construction recommendations to help mitigate corrosion concerns or sulfate related concrete problems.
6. Preliminary geotechnical pavement thicknesses based on the traffic loading provided by CDOT and the subsurface conditions encountered in the predetermined spaced borings.
7. Discussion concerning the Pavement Life-Cycle Cost Analysis, Pavement Selection Report, and Final Pavement Section Design.

Copies of the final report shall be submitted on flash. Six printed and bound copies of the final report will be delivered to CDOT project team, Region 1 Materials, and Staff Materials.

## **SECTION 9 SUBMITTALS**

### **9.01 Reports**

From Section 8.01-A – A completed Preliminary Survey Scope Form 1217a, a man hour estimate, and a project cost work sheet for a specific rate of pay contract shall be submitted.

From Section 8.01-A-1 & 8.01-A-2 – A Pre-Survey conference agenda form is to be filled out and provided to the CDOT PM after the pre-survey conference is held.

From Section 8.01-B – A project schedule is to be approved by the CDOT PM before any task order is approved. The consultant shall submit a written schedule with any task order proposal. The schedule shall include a Gantt chart as described.

From Section 8.01-C – Preliminary Survey Scope Form 1217a

From Section 8.01-D-1 & 8.01-D-2 – Original Permission to Enter forms, CDOT Form 730a, shall be submitted. A county assessors map or equivalent map of the project map is also to be submitted. This map is to be used as a base map for tracking the status of the completion of the permission to enter forms. Temporary easements or use permits Form 1283a may be required in lieu of or in addition to completed permission to enter forms. Electronic copies may be substituted in lieu of hard copies.

From Section 8.01-E – When the consultant is required for safety reasons to close a lane of traffic, a traffic control plan shall be submitted for CDOT review before the traffic lane is closed.

From Section 8.01-F – Initial submittal of InRoads TMOSS, InRoads, and MicroStation data refers to a small sample of electronic data in InRoads TMOSS format which is submitted early in the project to assure CDOT that the final data will be in the correct format. CDOT's survey processing software is InRoads and MicroStation. Submittals will be Inroads/MicroStation files.

From Section 8.01-G – Minutes of progress meetings are required.

From Section 8.01-H – Confined space entry permits may apply.

From Section 8.02-A and 8.02-B – The contact list developed shall be in a Microsoft Excel format. This same format is used to create the tabulation of property owners for the right of way sheets. This contact list will include the permission to enter contacts. Additional contacts must be delivered in a separate spreadsheet file. Mailing lists may be required.

From Section 8.02-A-3 - Communication aids include digital aerial photos merged with survey data for computer projection, court exhibits, posters for public meetings and presentations, Microsoft Power Point presentations, etc.

From Section 8.02-B-1 & 8.02-B-2 – Survey Report and GPS Bluebook. One copy of the survey report shall be delivered by the consultant with any final submittal for each task order. The report shall be bound in a ring binder. The report in addition to the NGS blue book requirements shall include the following sections:

- a project description and scope of work
- Quality Control Report. Submit a report that itemizes the procedures taken to assure that the survey data is of specified quality. The report shall address the steps taken to assure quality in the following work elements: The horizontal control survey, the vertical control survey, the TMOSS survey, the property tie survey, and the aliquot corner survey. The report shall include actual closures, ratios, tolerances, and differences detected while performing the work and evaluating quality. The report is to be sealed and signed by the PLS in responsible charge of the survey work. The office procedures used to produce record documents shall also be discussed in the quality control report.

From the CDOT Survey Manual products to be delivered to CDOT or deliverables in the project development stage may include:

- Equipment calibration reports including calibration baseline work sheets
- Field notes
- Preliminary survey scope form
- Pre-survey conference minutes
- Special use permits
- Traffic control plans
- GPS specifications
- GPS planning and network design reports
- GPS quality control reports
- Project control diagrams
- Preliminary and/or Final Land Survey control diagrams
- GPS control files

- InRoads .CTL file (text file of project control used to process conventional surveys)
- InRoads PPT.CTL file (text file of found monumentation used for property ties)
- SDR 20 format file (Unedited and edited - real time kinematic survey or conventional survey, free of errors)
- Trimble .DC file (Raw and edited)
- InRoads alignment file (.ALG)
- InRoads Digital Terrain Model file (.DTM)
- InRoads Field Book file (.FWD)
- CHARND request to Blue Book letter and Blue Book
- NGS adjust input and output files
- GPS station visibility diagrams
- GPS monument photograph log
- GPS observation logs
- GPS monument rubbing logs
- GPS fast static observation logs
- NGS station description / recovery forms
- Documentation showing that the horizontal control survey meets specifications
- Documentation showing that the vertical control meets specifications
- Documentation that the TMOSS survey meets specifications
- Monument records used in the survey along with photos of aliquot corners included in the survey. Monument records are as prescribed by Colorado Revised Statutes governing Land Surveying. See Colorado Standard Specifications for Road and Bridge Construction section 629 for CDOT monument record requirements.
- Copies of utility maps
- Copies of assessors maps
- Copies of deeds used in the survey
- Original copies of permission to enter forms
- Copies of maps or plats used in the survey
- Electronic data on a CD ROM
- Any photographs requested in the Preliminary Survey Scope
- All project related correspondence
- Adobe PDF's of any of the aforesaid documents where applicable

Survey Plats. The Professional Land Surveyor Consultant that sets or accepts a monument shall prepare and file a Land Survey Control Diagram in accordance with Colorado Revised Statutes. A copy of the diagram and filing shall also be submitted to the CDOT PM.

The surveyor in responsible charge of the work shall submit a Project Control Diagram for each task order that included a primary control survey and/or a Land Survey Control Diagram if the project makes ties to property corners or public land survey monuments. See CDOT Survey Manual for requirements for each type of control diagram. The control diagram shall be submitted before the FIR for the first project in the corridor. The control diagram shall

include a table of geodetic coordinate values as well as a table of project coordinate values. The diagram shall include descriptions of all monuments. A statement if monuments were found or set must be included. A basis of bearing statement as described in Board of Registration rules must be included. A basis of elevation statement detailing the origin of the project elevation and a detailed description of the project bench mark and the project vertical datum. A statement defining the horizontal coordinate datum. A statement and formula of how the project coordinates were derived. A statute of limitation statement as called for in state statutes for land survey plats. A surveyor's statement that certifies to the accuracy of the survey is needed. A scale drawing of the surveyed area which accurately locates all monuments found and set in relation to all improvements surveyed is required. The section township and range designation must be shown. The highway and milepost limits and the county must be included.

CDOT survey data processing will be accomplished with InRoads and MicroStation.

These submittals shall use the CDOT configuration found at:

<http://www.coloradodot.info/business/designsupport/cadd/microstation-inroads-config.html>

From Section 8.02-C - All aerial products listed in the CDOT Survey Manual as deliverables:

- Presurvey Conference
- Photo Control Survey Report
- Flight Plan
- Camera Calibration Report
- Original Negatives
- Photo Index
- Contact Prints
- Photo Enlargement Prints
- Analytical Aerial Triangulation Report
- Planimetric Feature Identifications
- InRoads TMOSS Supplemental Survey
- 2D Planimetric Features
- Mapping Sheets
- 3D Break Lines with Mass Elevation Points
- Triangulation Irregular Network
- Digital Terrain Model (DTM)
- Digital Elevation Model (DEM)
- Contours
- Orthophotography
- Electronic data is to be in InRoads TMOSS format. Sample aerial InRoads TMOSS data is to be submitted early in the project development. Base map sheets are to include planimetric sheets, contour map sheets, and index maps as called for in the CDOT Survey Manual.

- Rectified digital photos. When designated in the Scope of Work, the Consultant shall submit rectified photography (at the designated approximate scale) with Mylar original plan sheets.
- Any other mapping or Photogrammetric products required by the task order

From Section 8.02-D-a-(6) - Project narrative includes all decisions made on property boundary locations. It includes the evidence used and the evidence accepted and rejected.

From Section 8.02-D-a-(6) - Copies of researched data including assessors information, documents that transfer title in order from newest to oldest for each adjacent owner, County road records, subdivision plats, re-plats, exemption plats, vacation documents and Memorandum of Ownership.

From Section 8.02-D-a – Right of way report that includes identified problem areas, ownership maps, land use maps, and impacts on future uses for each proposed alignment. Right of way mapping and monumented land survey plat of existing right of way may be required at this phase of the project. The plat must be filed in the appropriate county records.

From Section 8.03-D Pavement Design Analysis, Life Cycle Cost Analysis, and Technical Report in a format acceptable to the CDOT PM.

## **9.02 Electronic Data Submittals**

**Photogrammetric data.** Prior to generating mapping data the Consultant shall submit a sample of data and receive approval to continue the work. A sealed and signed hard copy (map sheets when appropriate) shall be submitted with all electronic data.

**TMOSS data.** Submittal of TMOSS data shall be in an electronic form as acceptable to the CDOT PM. The final TMOSS data shall include the raw data collector files, the edited data collector files, the combined data collector segment files, a control file and any property pin files. The data shall run through InRoads with no errors or warnings when processed. The DTM shall produce no crossing break lines when processed through InRoads-Surface-View Surface-Crossing Segments. The data shall produce an accurate contour model of the actual ground with no elevation or rod height busts. The codes and notes shall be sufficient to allow a design engineer to accurately identify every feature surveyed without returning to the field. Each traffic sign shall be dimensioned and the text or symbol on the sign shall be included in a note immediately following the record for the sign location and include those items called for in the Preliminary Survey Scope. Each culvert and drainage structure shall be associated with a Drainage code 283 note described in the InRoads TMOSS Code Book. Each access opening, driveway, field access, and side road shall be associated with an Access code 277 note as



described in the InRoads TMOSS Code Book. The InRoads TMOSS data file naming conventions are explained in Chapter 9 of the CDOT Survey Manual. There shall not be any duplicate point numbers.

#### **Right of Way Data.**

- Right of Way plans shall be submitted as a \*.DGN electronic drawing, prepared using the current CDOT standard naming convention.
- A MicroStation drawing of the entire ROW plan from beginning to end shall be included as a referenced MicroStation drawing for each plan sheet.
- The Consultant will use the drawings folders in the MicroStation file structures setup by the CDOT PM.
- MicroStation drawing files with the required CDOT borders will be supplied.
- A PDF file will be supplied in 11"x17" format for plotting purposes using PDF "levels".
- All Electronic drawing files and plot files shall be submitted on a CD ROM or as approved by the CDOT PM.
- All files created by the COGO software package (input, output, archive, etc.) shall be submitted.
- The parcel descriptions shall be submitted in Microsoft Word format.
- All other electronic files (spreadsheets, databases, etc.) shall be submitted.

#### **Pavement Design Data**

- Pavement Design files: Shall include all AASHTOWare ME Design Project Files (in \*.dgp format).
- LCCA Files: Shall be generated using the Real Cost program, which are Microsoft Excel Macro Enabled Worksheet Files (in \*.xlm format).
- User Cost Files: User Cost files are generated for use in conjunction with the Real Cost Program by the CDOT User Cost program and shall be generated in the \*.wzm format.
- All other electronic files (spreadsheets, databases, etc.) shall be as determined acceptable by CDOT.

It is suggested that the CDOT PM be contacted prior to creation of magnetic media to verify the current submission requirements or to discuss any questions concerning the ability to satisfy the current submission requirements.

CDOT Computer/Software Information. The primary hardware used by CDOT is a PC-Windows system, and the types of software are:

Drafting - MicroStation (Compatible with current CDOT Edition)  
Survey - Trimble Business Center and InRoads Survey using the CDOT configuration  
Geometry - InRoads Geometry  
Pavement Design - AASHTOWare Pavement M-E Design

Life Cycle Cost - FHWA's RealCost software

Electronic media submittals. CDOT can accept media of the following types and format:  
CD ROM

Required documentation. CDOT requires that each unit of the electronic media submitted be identified with adhesive labels affixed to the media containing the following MINIMUM information as applicable, depending on the media, format, etc. used to create the magnetic media being submitted:

- CDOT Project Number, Project code, and CDOT PM's name
- Highway Number
- Begin Milepost # - End Milepost #
- Files name(s) and type(s) {ex. InRoads .FWD, MicroStation .DGN }
- Date created
- Contact Person and Telephone number(s)

A letter MUST accompany the electronic media which contains the same information as required on the media AND:

Either contains a description of the operating system commands used to create the electronic media or an attached computer generated listing of the actual process which created the electronic media (preferred). A task order may call for data to be submitted in fragments or partial submittals. If the submittal is a partial submittal, then it must be identified as a partial submittal on the transmittal letter and on the CD ROM. All information contained in any preliminary or incomplete submittals shall be resubmitted by the consultant with the final submittal.

A copy of the control diagram shall be submitted in electronic MicroStation format and an Adobe PDF format with the understanding that CDOT personnel for subsequent projects in the corridor may change the project numbers. The control survey diagram is included in the construction plans and therefore requires an original signature and seal from the surveyor in responsible charge on the record set of plans. The Adobe PDF submittal shall contain an electronic stamp and signature of the surveyor in responsible charge. The record set of plans is circulated for signatures after the project is advertised. This final review of the plans will not be paid for separately and shall be included in all task orders issued under this contract.

All material must be submitted to the CDOT PM.