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## 9.0 SURVEY

### 9.1 Administrative Requirements

#### 9.1.1 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 Work for the Project. The Contractor's 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 Contractor's Project Survey Coordinator.

All survey crew chiefs shall carry business cards that include their name, title, business address, and phone number while engaged in performing survey Work on the Project. These cards shall be offered to any public contacts made during the performance of survey Activities as a means of introduction and point of contact.

#### 9.1.2 Standards

The Contractor shall design and construct the Project in accordance with the requirements of the standards referenced in Book 3 and in this Section 9. The Contractor shall use the latest adopted edition at the time of the Proposal Due Date. The Contractor shall meet all applicable federal, state, and local requirements related to surveys, records, and monuments. It is the responsibility of the Project Survey Coordinator, in responsible charge, to perform all survey work in conformance with the specifications, methods, and tolerances as set forth in the current Colorado Department of Transportation (CDOT) *Survey Manual*, *CDOT Right of Way Manual*, and *CDOT CADD Manual*.

Prior to any field survey Activities, all conventional survey Equipment shall be checked in accordance with the CDOT *Survey Manual* on a National Geodetic Survey (NGS)/National Oceanic and Atmospheric Administration (NOAA) calibrated baseline. In lieu of NGS/NOAA baseline observations, conventional Equipment can be checked and certified by a survey equipment vendor. A certificate of calibration is required from the vendor. Calibration documentation for conventional Equipment shall be submitted to CDOT for Review prior to any field survey Activities.

#### 9.1.3 CDOT Supplied Survey Data

Ground Survey information to be supplied by CDOT is provided in Reference Documents.

The ground survey was performed according to the guidelines for preliminary surveys published in the CDOT *Survey Manual*. The Project Survey Coordinator is responsible for verifying vertical and horizontal tie-ins to existing features. If the Project Survey Coordinator identifies any inaccuracies in CDOT- provided survey information, it shall be the Contractor's responsibility to provide additional surveys, as necessary, to resolve the inaccuracies to complete the Work.

The Contractor shall verify the Vertical Surface (500 ft. minimum Cross sections). Verification shall be submitted to CDOT for review prior to NTP2.

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Changes in conditions at all project segments may occur after the Proposal Due Date that require additional surveys. Survey of said changes are the responsibility of the Contractor at no added cost to the Project.

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

#### **9.1.4 Preservation of Survey Monuments**

The preservation of survey markers and monuments is mandatory and affects all governmental agencies, including CDOT. The Contractor shall notify CDOT as soon as it becomes known that a marker/monument is in a position that will interfere with new construction or with Contractor operations. The marker/monument position shall be accurately preserved prior to disturbing any such marker in accordance with the current *CDOT Survey Manual*. The Contractor shall submit documentation for the preservation or re-monumentation of any survey monument for Acceptance by the agency affected.

#### **9.1.5 Survey Records**

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

Field books shall contain daily records of points set and/or measurements observed. The information recorded shall contain the date, crew members' names, point number, description, staking information, and sketches. If the survey information is collected electronically, information recorded shall be submitted to CDOT in a hard copy format that is intuitive, clear, and related to the supplemental information recorded in the field books. All linear surveys, such as slope stakes and blue tops, shall have the station and offset information related to the measured information. Non-linear surveys shall have sketches relating electronic information, such as point numbers, to the sketch.

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, Section 625 and Section 629 of the current *CDOT Standard Specifications* and the *CDOT Survey Manual*. All survey records, including documentation, shall be submitted to CDOT for Acceptance at the completion of the Work and prior to Final Acceptance.

### **9.2 Design Requirements**

#### **9.2.1 Submittals**

All submittals shall be prepared, reviewed, and submitted in accordance with the requirements set forth in Book 2, Section 3.

#### **9.2.2 Project Control Survey/Networks**

The Project Survey Coordinator shall plan, schedule, and perform all surveys and monumentation necessary to develop, maintain, and supplement the Project control network for the design and construction of the Project in accordance with the *CDOT Survey Manual*. All existing CDOT primary

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control shall be checked and verified prior to use for any survey Activities. If any substantial discrepancies are found, the Project Survey Coordinator shall develop a report showing the discrepancies and immediately submit to CDOT for Review.

If it is determined that any primary control monuments will be disturbed by construction Activities, the Project Survey Coordinator shall establish replacement monuments. Replacement monuments shall be established before the existing primary control monuments are disturbed. All monument material shall be furnished by the Contractor. Within 30 Days of the establishment of the revised Project control network, the Project Survey Coordinator shall submit to CDOT for Review, a Project Control Diagram showing the revised Project control network and shall contain information as required in the CDOT *Survey Manual*.

After Review, the Project Control Diagram shall be signed and sealed by the Project Survey Coordinator.

### **9.2.3 Design Surveys**

The Contractor shall arrange for all supplemental survey information (including Utility locations) necessary to complete the design. Surveying shall be performed in accordance with the CDOT *Survey Manual*. The Project Survey Coordinator shall collect survey data in Bentley OpenRoads formats utilizing CDOT's Terrain Modeling Survey System (TMOSS) coding and configuration. The Contractor shall submit the survey data to CDOT for Review within 30 Days upon completion of the survey. Errors and omissions found by CDOT shall be corrected by the Project Survey Coordinator and the data resubmitted. Traffic control and permits necessary to complete the survey shall be the responsibility of the Contractor.

### **9.2.4 Right-of-Way Survey and Monumentation**

If the Contractor determines that additional ROW or Easements are required, the Contractor shall follow the request for ROW process set forth in Book 2, Section 8. The Project Survey Coordinator shall locate ROW monuments, private land surveyor monuments, and Public Land Survey System monuments, as required, to develop an existing property, encumbrance, and ROW model. The Project Survey Coordinator is responsible for conducting all parcel and Easement (temporary and permanent) staking associated with Contractor Acquisitions.

If the Contractor prepares ROW plans for Contractor Acquisitions, ROW monuments shall be set at a time when they will not be impacted by construction Activities. All Material for ROW monumentation shall be provided by the Contractor. The Project Survey Coordinator shall submit ROW plans to CDOT for Review and Acceptance before parcel/Easement acquisition and before ROW monuments have been set. The Project Survey Coordinator shall sign and seal the ROW Plans and deposit with the appropriate county office. A copy of the signed and sealed ROW Plans shall be submitted to CDOT for inclusion into the survey records.

## **9.3 Construction Requirements**

### **9.3.1 Construction Control Surveys**

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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.

### 9.3.2 Construction Layout Surveys

The Contractor shall plan, schedule and perform all staking and construction layout required for the Work. All survey Work and staking intervals shall be done in accordance with the CDOT Survey Manual.

3D Engineered Construction Surveying (3DECS) is approved for the Project. The Contractor's use of 3DECS shall conform to the requirements set forth in CDOT *Standard Special Provision 625* included in Book 2, Section 20, and the Chapter 6, Section 6.5 (Construction Surveys) of the CDOT *Survey Manual*.

### 9.3.3 Pre-Survey Conference-Construction Survey

Prior to beginning any construction survey Activities, the Contractor shall hold a Pre-survey Conference - Construction Survey as required in the CDOT *Survey Manual* Section 6.1.6. Any known error or oversight on the plans or specifications shall be discussed at the pre-survey conference.

### 9.3.4 As-Constructed Surveys

The Contractor shall plan, schedule and perform all surveys required to document the location of constructed features on the Project as required in Section 6.13 of the CDOT *Survey Manual*. The Project Survey Coordinator shall collect as-constructed survey data in Bentley OpenRoads dgn format utilizing CDOT's TMOSS coding, configuration and workspace. The Project Survey Coordinator shall deliver the data and field notes to CDOT for Review and Acceptance upon completion of the survey. Errors and omissions found by CDOT shall be corrected by the Contractor and data resubmitted.

### 9.3.5 ROW Monumentation

The Contractor shall replace all ROW monumentation lost or destroyed during the progression of the Work. The Contractor shall perform all work as per the CDOT *Survey Manual*.

The Contractor shall submit to CDOT for Acceptance revised ROW monumentation sheets listing all ROW monumentation reset by the Contractor prior to Final Acceptance.

**9.4 Deliverables**

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

<b>Deliverable</b>	<b>Review, Acceptance or Approval</b>	<b>Schedule</b>
Equipment Calibrated baseline check or vendor Equipment certificate and Current calibration documents	Acceptance	Prior to any field survey activities as per CDOT <i>Survey Manual</i> , Section 2.2
Report of any discrepancies in primary control	Review	Discrepancies shall be reported immediately.
Land Survey Control Diagram	Review	Prior to the disturbance of any monument
Verification of the Vertical Surface (500 ft. minimum Cross sections)	Review	Before NTP2
All other surveys and documentation, Survey Records	Review/Acceptance	Survey records may be Reviewed by CDOT at any time during the course of the Work. Acceptance at completion of the Work and Prior to Final Acceptance
Revised Project Control Diagram	Review	Revised Project Control Diagram shall be submitted within 30 Days of the establishment of the revised Project Control Network
Supplemental survey information for design and utility locations	Review	Within 30 Days upon completion of the survey
Right-of-Way plans for Contractor Acquisitions	Review/Acceptance	Before proposed acquisition and Right-of-Way monumentation
Revised ROW monumentation sheets	Acceptance	Prior to Final Acceptance
Documentation/date of the location As-Constructed features on the Project (in OpenRoads TMOSS survey format) and field notes	Review/Acceptance	At completion of the Work and prior to Final Acceptance

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