

SECTION 01 71 23
FIELD ENGINEERING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Qualified services.
- B. Lines and grades.
- C. Survey of layout and performance.
- D. Surveying accuracy and tolerances in setting survey stakes.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 REFERENCES

- A. Caltrans Division of Right-of-Way and Land Surveys, Office of Land Surveying, "Surveys Manual".
- B. Profession Land Surveyors Act, Business and Professions Code Sections 8762, 8771.
- C. California Public Resources Code 8801-8819 and 8890-8902.

1.04 SUBMITTALS

- A. Refer to Contract Specifications Section 01 33 00, Submittal Procedures, for submittal requirements and procedures.
- B. Survey notes, drawings, and calculations shall be completed as the work progresses and one copy of each survey document shall be submitted to the District for record purposes.
- C. Construction survey notes shall be provided to the Engineer within 48 hours after completion of the Contractor's survey.
- D. Submit maps showing all final centerline, station, and other Contractor-installed monumentation, properly prepared and submitted to the Engineer for approval.
- E. The Contractor prior to construction shall comply with Business and Professions Code 8771 "Monuments".

- F. Results of surveys performed as specified herein.
 - 1. List of spatial coordinates, both horizontal and vertical, of the measurements taken.
 - 2. A Survey Control plan, at a scale no greater than one inch = 100 feet, depicting the results of the survey conducted.
- G. Contractor shall incorporate the results of surveys conducted with the documents to be prepared, maintained, and submitted pursuant to Contract Specifications Section 01 78 39, Project Record Documents.

1.05 QUALIFIED SERVICES

- A. Surveying services and field engineering services shall be performed under the direct supervision of a professional land surveyor or civil engineer currently licensed or registered in the State of California. A civil engineer providing field surveying shall have been registered prior to 1982 or have a current professional land surveyors license in the State of California.

1.06 LINES AND GRADES

- A. Only such primary control lines, monuments, and bench marks will be set by the District as the District determines to be necessary to control establishment of the lines and grades required for completion of the Work. In general, these will consist of the primary horizontal and vertical control points indicated on the Contract Drawings. Work points shall be established by the Contractor for all major structures, all track alignments, and all roadway alignments. Survey monuments shall be set at each end of station platforms by the Contractor to establish platform finish elevations.
- B. Primary control monuments set by the District shall be carefully preserved by the Contractor. In case such monuments are destroyed or damaged, they will be replaced at the District's earliest convenience. The Contractor will be charged for the cost of replacing or restoring monuments destroyed or damaged by the Contractor's operations. This charge will be deducted from any monies due or to become due the Contractor.
- C. The Contractor shall temporarily suspend work at such points and for such reasonable times as the District may require for resetting monuments, and the Contractor will not be entitled to any additional compensation or extension of time therefore.
- D. All other stakes or markers required to establish the lines and grades required for the completion of the Work shall be the responsibility of the Contractor.

1.07 SURVEYS FOR LAYOUT AND PERFORMANCE

- A. Surveying Requirements: Perform all surveys for layout and performance of the Work, reduce the field notes, and make all calculations and drawings necessary to carry out such work. The Contractor shall check the relative positions of all

monuments and benchmarks to be used and shall report any damaged or out-of-position monuments to the Engineer at once. The Contractor shall check such relative positions each time the Contractor uses such monument or benchmark.

- B. Datum: The Contractor shall be responsible for correctly locating all lines and grades and for performing all measuring as required for the construction and completion of the Work from established reference points and information is shown on the Contract Drawings.
- C. Equipment and Personnel: The Contractor's instruments and other survey equipment shall be accurate, suitable for the surveys required in accordance with recognized professional standards, and in proper condition and adjustment at all times. Perform all surveys under the direct supervision of a professional land surveyor or civil engineer currently licensed or registered in the State of California.
- D. Field Notes and Records: Furnish the original pages of all survey records to the District at intervals required by the District. Furnish each field notebook to the Engineer when filled or completed.
- E. Use by the District: The District may at any time use line and grade points and markers established by the Contractor. The Contractor's surveys are a part of the work and may be checked by the Engineer at any time. The Contractor shall be responsible for any lines, grades, or measurements which do not comply with specified or proper tolerances, or which are otherwise defective, and for any resultant defects in the work. The Contractor shall conduct resurveys or check surveys to correct errors indicated by review of the field notebooks or by check surveys performed by the District.

1.08 SURVEYING ACCURACY AND TOLERANCES IN SETTING SURVEY STAKES

- A. Contract Control Surveys
 - 1. Contract survey control shall be verified, densified, and maintained as necessary for the duration of the Contract. Surveys performed to verify and establish Contract survey control shall meet Caltrans standards specified herein. Contract control surveys shall reliably establish the Contract datum locally by direct ties to a minimum of three horizontal and vertical monuments. Existing Contract control values and descriptions will be provided by the District.
 - 2. Contract control surveys shall be performed using appropriate equipment and techniques. Measured values shall be of sufficient redundancy to establish realistic measurement error estimation at the 95 percent confidence level. Contract control surveys shall be adjusted using least squares adjustment software. Final adjustment listing shall incorporate differences from control "provisional" values, and a summary listing of any residuals. Any measured Contract control value discrepancies, which fall significantly outside these accuracy guidelines, shall be reported immediately to the Engineer.

B. Contract Survey Control Nominal Accuracy Requirements:

1. Use horizontal control, vertical control, and units in accordance with Caltrans Survey Manual Chapter 5 "Classifications of Accuracy and Standards" Figure 2-1B Proportional Accuracy.
2. Horizontal datum shall be in accordance with California Coordinate System per Public Resources Code Section 8801-8819.
3. Vertical datum shall be in accordance with California Orthometric Heights of 1988 per Public Resources Code Section 8890-8902.

C. Construction Staking Requirements:

1. Construction staking shall be performed in accordance with the specifications contained in the Caltrans Surveys Manual, Chapter 12, sections 12.3 through 12.5, regarding the staking tolerances and the placement and marking of construction stakes.
2. Construction survey accuracies shall be in accordance with the specifications of the Caltrans Surveys Manual, Chapter 5 and Figure 5-1A, therein.
3. Surveying activities shall comply with Construction Safety Section 01 35 24, to include "Roadway Worker Protection Safety" requirements, Caltrans Surveys Manual Chapter 2 "Safety", and Caltrans Code of Safe Surveying Practices figure 2-1.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 71 23