California High-Speed Train Project

TECHNICAL MEMORANDUM

Engineering Survey and Mapping
TM 1.1.4

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ABSTRACT

The California High-Speed Train Project (CHSTP) is proposed to provide a high-speed intercity rail service state-wide and will demand accurate and consistent geospatial information along the entire high-speed rail network.

This technical memorandum outlines the requirements for horizontal and vertical datum and control, photogrammetric mapping accuracy, depiction of man-made features and existing property information, digital terrain modelling (DTM), and engineering survey procedures aimed to support design development through the 30% Design level. This technical memorandum includes review of current standards and polices already in place governing compilation of aerial mapping and land surveying procedures with an objective to establish guidance applicable to the CHSTP.

The approach presented in this technical memorandum for assessing applicable mapping and survey requirements is generally based on National Geodetic Survey (NGS), United States Geologic Survey (USGS) standards, and current Caltrans policies and practices developed by Caltrans Office of Land Surveys. Where appropriate, project-specific guidance is provided to supplement or clarify mapping and survey needs of the CHSTP.

This technical memorandum does not address requirements for right-of-way and construction surveys nor include procedures for preparation of survey plats, legal descriptions, or construction staking notes. These topics will be addressed in separate technical memoranda during subsequent design phases of the program.

6.0 DESIGN MANUAL CRITERIA

6.1 ENGINEERING SURVEY AND MAPPING

6.1.1 Horizontal and Vertical Datum

The survey datum used for the CHSTP shall be based on Chapter 4 of the Caltrans Survey Manual and shall include:

1. The California Coordinate System of 1983 is the coordinate system used for all mapping, planning, design, right-of-way engineering, and construction.
2. The North American Datum of 1983 (NAD 83) as defined by the National Geodetic Survey shall be used for horizontal datum for all mapping, planning, design, right-of-way engineering, and construction.
3. The North American Vertical Datum of 1988 (NAVD 88) as defined by the National Geodetic Survey shall be used for vertical datum for all mapping, planning, design, right-of-way engineering, and construction.
4. The physical ground survey reference network for NAD 83 datum shall use the California High Precision Geodetic Network (CA-HPGN) and its densification stations (CA-HPGN-D).

6.1.2 Accuracy and Standards

Surveys performed for the CHSTP shall be developed with the accuracy and standards as defined in the Caltrans Surveys Manual, 2006 or current edition. In addition to conforming to the applicable standards, surveys must be performed using field procedures that meet the specifications for the specified order of survey.

US Survey Foot to international meter conversions may be necessary in order to apply standards listed above. This conversion can be represented as following:

- 1 US Survey Foot = 1200/3937 meters

6.1.3 Errors and Adjustments

Errors and adjustments to field surveys shall be in accordance with Chapter 5 of the Caltrans Survey Manual.

6.1.4 Photogrammetric and Mapping Surveys

Photogrammetric and mapping surveys shall be prepared in accordance with Chapter 13 of the Caltrans Survey Manual, 2006 and the Caltrans User's Guide to Photogrammetric Products and Services, 1996.

The intent of the photogrammetric and mapping surveys is to supplement aerial topographic mapping and digital terrain models used in design and preliminary cost estimates.

In addition, controlled aerial photography in both electronic and print form shall be prepared for the CHSTP and used, as necessary, for exhibits, background, and other items required for the successful design of the CHSTP.

6.1.5 Topographic Mapping

General

Topographic mapping shall be developed based on project specific photogrammetric compilation and be supplemented by field survey as necessary to depict existing features and to confirm accuracy. Topographic mapping shall be compiled in an electronic format compatible with design and drafting software adopted by the CHSTP and confirming to the CHSTP's CADD procedures.

- Topographic mapping shall be developed in U.S. Customary Units.

- Mapping scales shall be per Caltrans Plans Preparation Manual, 2008 or current edition.
- Contour spacing shall be per Caltrans Plans Preparation Manual, 2008 or current edition.

Planning Level

Planning level (15% Design) topographic mapping shall consist of high-resolution ortho-corrected aerial photo images supplemented by 3-D topographic contours with vertical accuracy of +/- 3 feet.

Design Level

Topographic Mapping prepared for the CHSTP shall be compiled utilizing project specific aerial photography, resulting in electronic topographic mapping generated to clearly define existing ground surface conditions and all man-made features. The topographic mapping shall be prepared as 3-D Direct Digital mapping following procedures and guidelines outlined in Caltrans User's Guide for Photogrammetric Products and Services.

The topographic mapping shall be checked for accuracy and adjusted in accordance with Caltrans Photogrammetry requirements and USGS National Mapping Accuracy Standards. The topographic mapping shall be prepared in accordance with the CHSTP CADD Standards.

The accuracy of survey and mapping at interfacing and overlapping project segments shall be coordinated between regional design teams and adjusted accordingly.

6.1.6 Digital Terrain Model

Topographic aerial mapping supplemented as necessary by the field surveys is used to develop a Digital Terrain Model (DTM) that mathematically defines the existing ground surface conditions. The CHSTP will utilize development of DTM surfaces as a basis for defining vertical alignments, preparation of cross-sections, and the generation of earthwork quantities.

The Digital Terrain Model shall be checked for accuracy and adjusted in accordance with Caltrans Photogrammetry requirements. The DTM shall be prepared in accordance with the CHSTP CADD Standards and provided in a format compatible with the CHSTP design software requirements.