

CHAPTER 1 INTRODUCTION TO THE PLANS PREPARATION MANUAL

SECTION 1-1 GENERAL

1-1.1 Purpose

This manual establishes uniform standards and procedures to be used when preparing right of way maps, project plans, route adoption maps, freeway agreement exhibits, PUC exhibits, and other maps and exhibits.

1-1.2 Application of Plan Preparation Standards

Plan preparation must follow the standards in this manual.

The categories of plan preparation standards, as used in this manual, are defined as:

- *Mandatory Standards* - Standards that are essential to produce a complete, concise and legal set of project plans. Mandatory standards use the words “shall” or “must.” The words "shall" or "must" are used interchangeably due to sentence structure. Additional word phrases such as "do not use," "are to be," and "is to be" are also mandatory directives.
- *Advisory Standards* - Standards that are also important, but allow some flexibility to be compatible with the procedures and practices for the preparation of project plans. Advisory standards use the word "should."
- *Permissive Standards* - All standards other than mandatory or advisory. Permissive standards use the word "may." Additional words such as "option" and "can" also denote permissive standards.

1-1.3 General Drawing Criteria

Line Work

Line quality is extremely important to the readability of CADD drawings. Line widths are varied to distinguish certain classes of features from others. The more basic outlining features are emphasized with heavier (wider) lines. Examples are station lines, base lines, construction layout lines, borders and the basic outline of objects. Medium weight lines are used for proposed construction, text and right of way. Light lines are used for existing topography, dimensioning, leader lines and other less important details. Dashed or dotted lines are used to distinguish existing from proposed work. For additional drafting conventions and standards regarding line weights, line styles and graphical representation of features refer to the CADD Users Manual, the Standard Plans, and Section 2-1.2 of this manual.

Text

Refer to Section 2.6 of the CADD Users Manual for text sizes and fonts. Caltrans uses uppercase text for projects. Use of uppercase text makes it easier to distinguish characters within the callouts, dimensioning, and labeling in the contract plans. See Section 2-1.2 of this manual regarding placement of text.

Scales

Recommended scales for project plans and other drawings are discussed in Section 2-1.3 of this manual. Caltrans does not draw to a scale, it only plots to a given scale.

1-1.4 Preparing Drawings

Generally, there is no prescribed sequence in which to prepare drawings. Each type of drawing involves different preparation procedures.

When preparing geographically oriented drawings, it is important that the physical features be drawn in exact position using state plane coordinate values. Labels, dimensions, notes, and other data is to be positioned to present the most understandable picture. For example, the area within the right of way may be used for data pertinent to construction. Notes and other data are usually placed outside the right of way.

To be effective, an engineering drawing must be clear, concise, complete, accurate, and functional. It is a graphic set of instructions.

1-1.5 Types of Engineering Drawings

Engineering drawings are generally categorized into two types, geographically oriented and nongeographically oriented. Geographically oriented drawings have graphic elements (lines, symbols) located on the drawing by their on-ground horizontal (N, E) locations. For example, a layout sheet is geographically oriented. Combining levels of data from a master drawing create geographic drawings. Refer to Section 2.4 of the CADD Users Manual. Nongeographically oriented drawings generally have graphic elements that describe the dimensional relationship of an object or planned construction without a direct relationship to specific on-ground horizontal locations. An example is a detail drawing for a drainage feature.

1-1.6 Use of Computer Aided Drafting and Design

Computer Aided Drafting and Design (CADD) has been used by Caltrans for more than 20 years. CADD is an integral part of the project delivery process, from project initiation through completion of the As-Built plans.

Civil 3D is the standard roadway design software. Civil3D was chosen to replace CAiCE, it does not replace MicroStation. Standalone AutoCad is not used by Caltrans and AutoCad files are not accepted for any designed and advertised projects on the state highway system. Civil 3D files are needed by surveys and construction to efficiently stake the project for the contractor to build (not all projects will need survey involvement). The Survey File Checklist, located in Appendix QQ of the Project Development Procedures Manual (PDPM), details the information the design engineer needs to provide surveys. Delivering all the files that surveys needs is now a performance indicator for final Ready-to-List (RTL) Certification.

MicroStation is the Caltrans standard drafting software. It is used primarily for the preparation of final contract plans for all PS&E submittals but can also be used for 3D modeling and visualization. A fully supported V8i version of MicroStation has been deployed by Caltrans. Caltrans will accept either MicroStation V8 or V7 file format for PS&E submittals, but each format must adhere to the current Caltrans CADD standards as defined in Section 4.1 of the CADD User's Manual. Even though MicroStation V8i has been deployed for use at Caltrans, some of the limitations or restrictions of the V8 file format are:

- Use only one model per DGN file, (the “Default” model)
- Use the appropriate State Plane Coordinates for all plan view sheets
- Use only Caltrans V8 zone seed files
- For every MicroStation highway design file a resolution of 10,000 for the "Working Units" is still required
- U.S. Survey foot must be defined as the default for the "foot unit"
- Use the level DGNLIB supplied by Caltrans
- Use only the standard Caltrans fonts and line styles

The current Caltrans official plotting solution is Interplot. Interplot shall be utilized for all Authority to Advertise Office Engineer (AAOE) and Authority to Advertise District Delegation (AADD) projects. Project plans (for any project on the state highway system (SHS)) submitted to any District or the Division of Engineering Services - Office Engineer (DES-OE) as part of the plans, specifications and estimate (PS&E) submittal package, must have an individual Interplot parameters file called an iparm (.i) for each MicroStation design file (DGN). Each DGN file contains just one individual plan sheet, with no reference files attached. Each project plan sheet is a stand-alone legal document when it is part of the awarded contract documents. The submittal of models representing the entire limits of a project and containing individual sheet files are not accepted for PS&E submittals.

1-1.7 Electronic Data and Project Delivery Process

Electronic data is used throughout the project delivery process from the inception of a Project Initiation Document (PID) such

as a Project Study Report (PSR) or Project Report (PR) to the completion of the As-Built plans. Information used for an advance planning study, environmental document or corridor study may not be appropriate or accurate enough for the final design of a project. For guidance on reports, requests and submittals needed for developing and completing a project, see Chapter 14 of the Project Development Procedures Manual.

Before requesting surveys and mapping or acquiring existing data (vector or raster), decide who will need to use or receive the information and what really needs to be included in the final product.

When developing a project for PS&E, keep in mind what electronic files will be required by construction, surveys or contractors to build the project, including the completion of the As-Built plans. Project Delivery Directive (PD-06) details how the sharing of electronic files is to occur on a Caltrans project.

An informal project assessment meeting (sometimes called a scoping meeting) early in the project delivery process will assist in identifying the functional units needed to help deliver the final project.

A project development team (PDT) meeting will also assist the designer in determining the extent of electronic data (i.e. mapping or surveys) needed and the accuracy required for their project. Early identification of each functional unit's electronic data needs and what they will be required to deliver will allow for more effective and efficient sharing of the project electronic files.

One important item commonly overlooked on many projects is the early face-to-face field meeting onsite at the project location between the Project Engineer and the functional units such as Construction, Maintenance, Right of Way, Surveys, Hydraulics and Environmental. A face-to-face meeting prior to any constructibility review will promote teamwork, the sharing of critical project decisions, and will minimize last minute changes and surprises. Knowing what the final products are and who will receive them early in the design process, will minimize duplication of work and contribute to the on-time delivery of a quality project.

Another key factor in project development is the early coordination between the designer, the drafting unit, and the DOE unit specifications engineer. Many disagreements can be avoided during final project review if the designer, the drafting unit, and the DOE unit work together early in the design of the project.

The designer should confer with their district delineation unit regarding drafting standards early in the design of the project or have delineation do the drafting work.

As a project is being designed, the designer should get a copy and read the special provisions that apply to the bid items in their project. By doing this, the designer will have a better understanding of how the bid items will need to be shown and accounted for on the plans.

1-1.8 Content and Development of Electronic Files

Electronic files for project plans should generally contain the following information and are developed in this order:

Master Topographic File

This file (sometimes referred to as the "bb" file) contains mapping that depicts existing conditions of a project. Existing topography may be provided by scanned maps, digitized maps or maps from ground surveys (digital terrain models).

This file will contain natural and man-made features such as:

- Roads and streets
- Driveways, sidewalks and curbs
- Streams, ditches and drains
- Bridges and culverts
- Utilities (railroads, poles, and pipelines)
- Fences and gates
- Buildings
- Trees and shrubs
- Contours of the original terrain

Topographic symbols are shown on Standard Plan A10E.

Master Design File

This file contains all proposed permanent design information for a project.

This file (sometimes referred to as the "aa" file) will contain features such as:

- Station lines
- Station tick marks and annotations
- Alignment line and route identification
- Layout lines
- Right of way lines
- North arrow
- Driveways, sidewalks and curbs
- Edge of roads
- Toe of slope and top of cut
- Construction features (guard railing, fences, sound walls, barrier, etc.)

Additional Master Design Files

For certain functional units it may be advantageous to create a separate Master File in addition to the Master Design ("aa") File. This allows all the elements from one bid item, system or owner to be in one DGN file.

- Drainage features
- Utilities
- Pavement Delineation
- Landscape

Symbology for Design Features is shown on Standard Plan A10C and A10D.

Contract Plan Files

The contract plan sheet file contains information that is necessary to the bidder and contractor and that is unique for that particular plan sheet. Plan view sheets (such as Layouts, Drainage, Utility sheets, etc.) are to be geo-referenced based on the California state plan coordinates. It generally includes labeling, descriptions, notes or symbology that defines or quantifies the bid items shown on that plan sheet. Specific plan sheet content, checklists and example plan sheets are contained in Section 2-2 of this manual.

Caution should be exercised when using completed projects as criteria in preparing new projects. Drafting standards and design standards may have changed and would not be reflected in completed projects. Due to a variety of reasons, a completed project may not have been prepared in an adequate manner.

Do not perpetuate mistakes when developing new projects. The instructions in this manual take precedence over the use of any completed project or past practices.

This manual not only states drafting standards for the presentation of the design of a project but also reflects policy and procedures related to the design and construction of a project. This includes such subjects as:

- Design designation criteria included on typical cross sections
- Determination of how and when project right of way is to be shown
- Determining if a project has railroad involvement
- Information regarding the inclusion of water pollution control best management practices (BMPs) in a project
- How staging and traffic handling information is to be shown for a project
- Necessary information to be provided to the contractor and sign manufacturer to furnish and install project sign panels

- Utilities and sub-surface features:
 1. Necessity of showing high-priority facilities and sub-surface features, including Caltrans-owned facilities
 2. Not providing full disclosure of utility locations can impact project construction
 3. Significant work stoppages have occurred in the past when an underground utility, not shown on the plans, was encountered during construction
- Project Control Data - Necessity of including horizontal and vertical control data and basis of datum control that is to be used to construct the project
- Drainage:
 1. Why existing ground lines and proposed grade lines are to be shown on drainage profiles for the installation or construction of a drainage facility
 2. Why existing ground line or average depth of excavation is required to be shown for removal of existing underground drainage facilities
 3. Why drainage system numbers and unit designations are required to identify the locations of drainage work
 4. What data is required to be included for drainage work such as, type of feature, type of material to be used, size, length of culverts, slope of culverts, and flowline elevations
- Walls designed to facilitate oversight by Office of Structure Design
- Why electrical systems work is to be segregated and clearly identified on plan sheets
- Construction Quantities:
 1. Why and how construction quantities are to be summarized in tabular format
 2. Why similar or related items of work are grouped together
 3. Why individual quantity summaries are to be provided for the various types of work involved (roadway, drainage, traffic handling items, signs, pavement delineation, etc.)
 4. Why lump sum items are to be clearly identified and shown only once as a bid item