3.8   **Master Files**

A.   <u>Overview</u>

Master files are used in the development and creation of Contract Plans for the purpose of bidding, constructing and inspecting a project. Master files are developed using the standard Caltrans Roadway Design Software (Civil 3D) and standard drafting software (MicroStation).

Master files should begin in the Surveys and Photogrammetry units. These units develop the mapping that depicts the existing conditions of the project in the Master Topographic file (referred to as the "**bb**" file). Design units then utilize this existing information to help develop the proposed permanent design information in the Master Design file (referred to as the "**aa**" file). These master files usually begin as files in the Roadway Design Software (Civil 3D) and then are converted to MicroStation design files when completed. Together they create what is referred to as the "<u>base map</u>" that serves as the basis for all the plan view sheets (i.e. Layouts, Drainage, Utilities, etc.) within a project. This base map can then be referenced to any other MicroStation design file (DGN).

The "**bb**" and "**aa**" files and all plan view sheets are to maintain the State Plane Coordinates that the project is based on in the MicroStation design file. California has 6 zones in the California Coordinate System 1983 (CCS83).

A base map reference is an effective and efficient way to develop plan view sheets. The base map remains unchanged as specific plan view sheets are developed using all or portions of the base map. By referencing, only one base map needs to be created, and should be utilized by the different functional design units. When any change is made to the base map (changes should only be made by the unit responsible for creating the base map), the change is automatically reflected in all the files that have the base map referenced to them when the base map remains referenced and is not copied into the active DGN file (individual Contract Plan Sheet).

The Master Clip Frame file, (which defines the appropriate area for each Contract Plan sheet), is generally referenced to the Contract Plan Sheet. The Master Plan Sheet file (which is the sheet border) is referenced to the appropriate Contract Plan Sheet file (which contains specific information only for that individual sheet). Once the design of the project is completed all sheet specific information, in any reference file, is merged into the final Contract Plan Sheet file. Each Contract Plan Sheet submitted for Plans, Specifications and Estimate (PS&E) is a standalone DGN file, with no reference files attached or any files linked, and should be thought of as a stand-alone legal document.

B.   Master Topographic Files

The "**bb**" file contains all data representing existing topographic features of the project. These features are located or positioned using State Plane Coordinates. Usually this file remains static after the existing roadway features have been placed (Photogrammetry or Surveys usually develops this file). The topographic file contains existing natural and man-made features such as:

Trees or natural vegetation, all public and private roads, curbs, edge of road, power and telephone poles, signs, sidewalks, underground and above ground utilities, manholes, fences, buildings, hydrographic features such as lakes, rivers, streams and natural channels, drainage and irrigation structures, and contours of the original terrain.

The "**bb**" file is developed using Roadway Design Software. Once completed, it is then converted to a MicroStation design file, which can then be referenced to the "**aa**" file to assist Caltrans staff working on the project. The Project Number is to be part of the file name plus the letters "**bb**" (i.e. 0600009999bb.dgn). The first 2 digits represent the district while the next 8 digits represent a sequential number that replaces the first 5 characters of the old Expenditure Authorization (EA).

C.   Master Design Files

   1. Overview

The "**aa**" file contains the design information that may be needed for the various plan view sheets (i.e. layouts, drainage, utilities, pavement delineation, stage construction, etc.). These features are to be placed in a design file created using proper State Plane Coordinates. The design file contains the proposed work such as:

Curbs, edge of road, relocated utilities, lights, signs, driveways, right of way lines, sidewalks, new utilities, drainage facilities, sound walls, retaining walls, guard railing, fences, top of cut or toe of slope, alignment lines, centerlines, station ticks and annotation. The "**aa**" file generally contains information that needs to be shown on each type of plan sheet (but not information specifically tied to one type of plan sheet).

Only the permanent physical design features (visible features that will become existing information for the next project or stage) should be added to the "**aa**" file. The project engineer/design unit staff develop and maintain this file. The Project Number is to be part of the file name plus the letters "**aa**" (i.e. 0600009999aa.dgn).

2. Utilizing the Master Design File in DGN Format

The "**bb**" file should always be referenced to the "**aa**" file while developing a project. If the Caltrans CADD standards (particularly level, color, style and weight) are adhered to from the inception of the project, it is easier for any individual or functional design unit to utilize the design information in either master file more effectively and efficiently. Master files may contain a lot of information, but only the necessary information needed for any specific Contract Plan Sheet (for the bidding or construction of the project), should be merged into that Contract Plan Sheet (active file). Too much information on a Contract Plan Sheet is just as bad as too little information.

Note: The "**bb**" and "**aa**" files should stay referenced to any DGN file as long as possible before having specific information merged into the active file. This allows any changes made to the "**bb**" and "**aa**" files to be automatically reflected in all DGN files referencing these master files.

After the "**aa**" file is completed using Roadway Design Software, the pertinent graphic elements are then converted to a MicroStation design file. **All** functional units involved in the project should be able to reference both the "**bb**" and "**aa**" files. Only surveys unit's staff should make changes to the "**bb**" file while only the design unit handling the project should make changes to the "**aa**" file. During the process of designing a project and when archiving the MicroStation design files, it is a best practice to maintain the "**bb**" and "**aa**" files as separate DGN files.

Usually one "**aa**" file is enough and is created by the responsible design unit and referenced by all functional units involved in the project. A second Master Design file named "**aa1**" may be necessary if a plotting scale other than the Caltrans base scale of 1" = 50' is used. This "**aa1**" file (or "**aa20**" file for a plotting scale of 1" = 20') would need to adjust the size of station annotation and the length of the station tick marks. Depending on the type of information in the file, the size of text, cells and line styles would also need to be adjusted. Another option for handling the alignment line information (at a different plotting scale) can be accomplished by placing the information on a level used for storing alignment annotation for that scale (e.g. align_20-SCALE-anno, align_100-SCALE-anno for projects using Named Levels or undefined level for projects that use the old V8 Standards level convention) in the Master Design file.

Depending on the size and complexity of a project, additional Master Design files for various functional units may be necessary. These additional Master Design files (now referred to as "**base**" files) start as copies of the "**aa**" file but are modified to meet a certain purpose.

For example: the "**base**" file for pavement delineation plan sheets is usually modified to show the proposed roadway design information (new ETW, curbs, gutters, sidewalks and the alignment line and annotation when it is in conflict with a stripe line) as existing (dropped out) since striping is the important information to show, not the completed road work. The "**base**" file name for pavement delineation sheets should be;

  For PD plan sheets   0600009999**PvmtDelin**.dgn

The naming of additional "**base**" files should contain the abbreviated name of the type of sheet it is for or the Functional Unit it is created for.

Note: Each MicroStation design file references Caltrans DGNLIB files with level information stored in them. These DGNLIB files include dropout levels (level names that end with "_drop") that can be utilized for various purposes. Thus, it may not be required to create a "**base**" file for pavement delineation sheets for showing proposed roadway design information as dropped out. Simply copying the proposed information to one of the dropout levels within the same DGN file will work.

  Other techniques such as level symbology or using color numbers in the color table that drop out elements on non-dropout levels may be used temporarily to produce the dropout effect instead of creating a "**base**" file. But the "final" Pavement Delineation contract plan is to have the proposed roadway design information placed on a dropout level (usually a dropout level).

  Level Symbology is not a substitute for adhering to the Caltrans standards. Level Symbology can be effectively utilized for preliminary design and during project development but is not recommended for use in the final PS&E submittal.

The staging of a project creates the need for showing the previous stage(s) as dropped out. Completed roadbed work from a previous stage **must** be shown as existing information (dropped out) for the next stage of work.

Using a MicroStation version 7 design files, a separate "**base**" file for each stage was the simplest and most efficient way to display the design information correctly for each stage. The "base" files used for any Stage Construction sheets during this process used the following naming convention:

  Stage 2 plan sheets   0600009999**stage2**.dgn
  Stage 3 plan sheets   0600009999**stage3**.dgn

*The "**stage2**" in the file name refers to the "**base**" file that has been modified (from the proposed Stage 1 work) for the Stage 2 construction sheets.*

*The "**stage3**" in the file name refers to the "**base**" file that has been modified (from the proposed Stage 2 work) for the Stage 3 construction sheets.*

The latest MicroStation format files have pre-defined levels for showing stage construction work. There are 20 levels for proposed stage construction and 10 levels for showing a previous stage as existing (dropped out). See Chapter 2, Section 4, and Appendix A10 of this manual for further details on Caltrans' named level convention. When utilizing the latest MicroStation format files, there is no need to create separate DGN files for each stage of work, either proposed or existing. One DGN file can contain all the stage construction information, instead of having separate "**base**" files.

At the completion of the design of the project, the **final** "**aa**" file (when using MicroStation version 7) may vary depending on the scope and specifics of each individual project. The "**aa**" file for the layout sheets usually serves as the final. When a project involves staging, the "**base**" file for the last stage may be the final one. Some consider the "**base**" file for the pavement delineation sheets to be the final one because the proposed roadway features are dropped out and ready to be utilized by a future project. But if an "**aa**" file or "**base**" file is used for a future project, the right of way lines and alignment lines are to be shown as solid lines (not dropped out).

Districts and structures should archive the "**aa**" and "**bb**" files locally on their servers (not on DRS). These files can be re-used on subsequent projects within the same work limits (i.e. landscape project or a local agency project) or for preliminary information in future planning documents. Archiving the "**aa**" and "**bb**" files allow another project to utilize the previous project's coordinate geometry and design information, thus saving time and effort. The information contained in these files must always be based on State Plane Coordinates.

Using the Contract Plans (layouts) to reconstruct the "**aa**" file with the correct coordinate geometry should only be considered when the "**aa**" file was not archived. Removing extraneous information from the individual layout sheets and making sure that the files are coordinately correct, is subject to more errors and will take more time than utilizing an archived "**aa**" file.

MicroStation design files developed for advance planning projects should be archived for all the alternatives that were considered. For various reasons some projects are shelved for years, but if the DGN files were archived, the project can quickly be restored to the point it was put on

hold. The naming convention for advance planning projects (including all alternatives) should be.

For Alternative 1	0600009999**alt1**.dgn
For Alternative 2	0600009999**alt2**.dgn

3. Functional Unit Master File

If a specific type of work (i.e. irrigation layout or planting plan) needs to be shown in one MicroStation design file because of a specific workflow associated with the process, then a Functional Unit Master File may be needed. The "**aa**" and "**bb**" files would be referenced to the Functional Unit Master File while the specific type of work would be added to the Functional Unit Master File. State Plane Coordinates are to be maintained in all Functional Unit Master Files. Legend, notes, abbreviations, callouts, plus stations and identified items of work should still be placed in the Contract Plan Sheet. The Project Number is to be included in the file name along with the name of the Functional Unit or type of work.

For planting work	0600009999planting.dgn
For Irrigation work	0600009999irrigation.dgn
For Drainage work	0600009999drainage.dgn
For Structures work	0600009999structures.dgn

Sharing of DGN files between any District and Structures (during preliminary design stage of the project) will be easier to achieve when proper naming convention and appropriate seed file tied to State Plane Coordinate System (CCS83) is used when creating/storing files. To easily share DGN files, the Structures Master File must use the same State Plane Coordinates (CCS83) that the District uses for the "**aa**" and "**bb**" files. Structures Preliminary Investigations team must also use the same State Plane Coordinates (CCS83) when surveying bridge site conditions. This also applies to local agencies or consultants who are an active participant in the Project Development Team (PDT).

The District is responsible for supplying Structures with a geo-referenced MicroStation design file based on the appropriate zone in the CCS83 (there are 6 zones in California). The District will use the Bridge Site Data Submittal (https://des.onramp.dot.ca.gov/des-structure-design/pi-forms) to convey all pertinent information for Structures to begin the design of the bridge or wall.

The Structures Master File should contain the footprint of the bridge, approach slabs, abutments, bents/piers and footings. The "begin and end" of bridge must be identified, the skew angle, the limits of any barrier, railing or sidewalk that will be designed. It is important that the above items be located at the identical coordinate values that are in the District

"**aa**" and "**bb**" files so any right of way or environmental issues can be accurately identified and addressed. The Structures Master File is to be shared with the District or any active member on the Project Development Team (PDT).

If the roadway project engineer makes any changes to the geometrics of the highway (alignment, profile, superelevation or width of roadbed), the Structures unit working on the project must receive the updated District "**aa**" file immediately or the Roadway unit could also provide the path to the location of the latest "aa" file on the District Project Directory to the Structures unit staff working on the project. The sharing of the updated District "**aa**" file and updated Structures Master File is imperative to assist any active PDT member in updating their files with any changes made that may affect them.

D.   Master Clip Frame Files

The Master Clip Frame file will contain both the maximum clip frames and the minimum clip frames. The maximum clip frames (shapes that fit within the sheet borders) are MicroStation cells that reside in the Caltrans named level cell library (CTCELLIB_NamedLevels.cel). They create the maximum limits, within the border, for the individual plan view sheets. When initially positioning the maximum clip frames, the "**aa**" file should be referenced to the Master Clip Frame file. Once completed, the Master Clip Frame file should then be referenced to the "**aa**" file or directly to the Contract Plan Sheet(s). Clip frames should not be added to the "**aa**" file since clip frames are not design information. The arrangement of the Master Clip Frame can be used to develop the Key Map and Line Designation sheet if the project needs to have a Key Map.

The minimum clip frame is constructed manually (for each plan view sheet) within the maximum clip frame. Between the two clip frames, the minimum clip frame is the most important. The minimum clip frame defines the appropriate amount of area to be displayed for each specific plan view sheet. The minimum clip frame should be used to define the match line between consecutive sheets. Match lines are to be placed perpendicular to the alignment line. The minimum clip frames are placed approximately 1 inch outside the right of way line (for a full-size, 22" x 34", printed plan sheet). This allows the placement of text, callouts and notes in a blank area created between the maximum and minimum clip frames.

Clip frames are used for all plan view sheets. The clip frames created for the Layout Sheets are generally used for Drainage, Contour Grading, Utilities, Pavement Delineation, Signing, Landscape and perhaps Stage Construction/Traffic Handling sheets. Stage Construction/Traffic Handling sheets may need their own clip frames because of the unique staging or phasing of a project. Signals, Lighting and Electrical Systems plan view

sheets usually develop their own clip frames because their work doesn't always coincide with the clip frames created for the Layout sheets.

Clip frames for most plan view sheets are usually created for the Caltrans base scale of 1" = 50'. If different plotting scales are needed for various plan sheets (i.e. 1" = 20' for Signals, Lighting and Electrical Systems), more than one Master Clip Frame file is to be created. A Master Clip Frame file is to contain only the clip frames for one plotting scale unless they cover different areas within the project limits.

Note: Station tick marks and annotation will need to be adjusted for each plotting scale (see Master Design Files section).

E.   Master Plan Sheet Files

The Master Plan Sheet file contains the appropriate sheet border (one sheet border per file) for each registered engineer that is responsible for signing one or more plan sheet(s). The Master Plan Sheet file (sheet border) is referenced to the appropriate Contract Plan Sheet file and is referenced to as many Contract Plan Sheets that each registered engineer is responsible for. The sheet border should never be placed in the Master Design file.

Note: The signature (which is placed in the Master Plan Sheet) for each responsible engineer is to be the final procedural step before finalizing the Contract Plan Sheets (see Section G).

There is no need to create different Master Plan Sheet file in the rare occurrence where the border may be used for more than just one plotting scale. Simply reference the Master Plan Sheet file at the appropriate scale ratio.

There should be one Master Plan Sheet file for each registered engineer, licensed landscape architect, land surveyor, certified engineering geologist or electrical engineer that is responsible for signing one or more plan sheet(s). The Master Plan Sheet File contains the following information:

The seal information, signature of the registered engineer, landscape architect or electrical engineer, approval date, the project number and phase, unit, name or initials of engineers involved in the project and the District/County/Route/Post Mile.

F.   Contract Plan Sheet Files

The Contract Plan Sheet file is composed of information that is specific and unique to that plan sheet. The Contract Plan Sheet file generally contains descriptions, labeling, notes or symbology that define or quantify the items of work for that plan sheet. Any description that assists in

bidding and construction of design features shown in the Master Design file should be placed in the Contract Plan Sheet file (plus stations, off-set distances, lane widths, etc.).

Each Contract Plan Sheet file is a separate MicroStation design file (DGN). Each MicroStation design file for PS&E submittal may also require an Iparm (see Chapter 5 of this manual) or a pdf file. The Caltrans naming convention applies to each Contract Plan Sheet file submitted for PS&E (see Section 2.2 of this manual).

The "**aa**" and "**bb**" files, Master Plan Sheet, Master Clip Frame and Functional Unit Master files are referenced to the Contract Plan Sheet files during the development of the project. This allows a project, with various types of plan sheets, to be worked on at the same time while referencing the same files.

Depending on the size, complexity and the functional units involved in the project, the merging of the various Master files (except for the Master Plan Sheet file) into the Contract Plan Sheet may be handled by either the design unit or the drafting unit. Because the incorporation of the signature into the Contract Plan sheet is the final procedural step, it is to be handled by the person(s) that have authority to access the signatures (this is usually a person in the drafting unit and may vary by District where the work is being done). The Master Plan Sheet file can be merged into the Contract Plan Sheet after the other Master files have been merged into the Contract Plan Sheet.

The delineation group in some districts (design squads in other districts) maintains the Contract Plan Sheet files. Contract Plans that depict the design information in "plan view" (Layouts, Drainage, Utilities, Landscape, etc.) are to maintain the State Plane Coordinates from the "**aa**" and "**bb**" files. Quantity sheets and detail sheets do not have to use State Plane Coordinates. Information generally found on a typical Contract Plan Sheet (layout, drainage, pavement delineation, etc.) may contain information such as:

> Notes to the engineer, dimensions, callouts, legends, notes, curve data information, plus stations, lane widths, abbreviations not found in the Standard Plans Manual, elevations, identifying items of work, limits of work or construction such as BEGIN or END REMOVE AC DIKE, and hatched regions outlining or designating work to be done such as COLD PLANE or REPLACE AC SURFACING.

Information that pertains to a specific sheet belongs in the Contract Plan Sheet file and not in the other Master Files.

G.   Final PS&E Submittal

The placement of the signature is the final procedural step before all appropriate and necessary information, in any attached reference file, is merged into the final Contract Plan Sheet for PS&E submittal. There must be a signature release form for each person responsible for signing any sheet in the project (this does not apply to NSPs or RSPs). This form allows the signature to be placed in the Master Plan Sheet file. Each signature release form is project specific and must not be used for any other project. If a person (responsible for signing a sheet) is working on more than one project, a second signature release form is required.

All signatures must be kept in a secured location that only authorized staff have access to. Only after a signature release form is submitted is the signature to be placed in the Master Plan Sheet file by authorized staff.

Contract Plan Sheet files, for PS&E submittal, shall not have any reference files attached. There is to be one DGN file for each Contract Plan Sheet. Each plan sheet is a snapshot of the information needed for review by the Office Engineer and then finalized as contract bid documents. Each Contract Plan Sheet is a "legal stand-alone document". There is to be no linkage to an external file (i.e. excel spreadsheet). In a MicroStation design file, only the default model is to be in the DGN file at the time of PS&E submittal.