Chapter 1: Introduction – Building & Project Types

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1-1 Types of Projects

Typical building projects encountered along the State Highway system include: District maintenance stations and equipment repair shops; sand and salt storage facilities; Safety Roadside Rest Areas (SRRA); Commercial Vehicle Enforcement Facilities (CVEF); agricultural inspection stations; light rail and transit stations; drainage pump plants; moveable bridge control houses; Caltrans housing for maintenance crews; training centers; testing and inspection laboratories; and toll plazas.

1-1.01 Maintenance Stations and Equipment Repair Shops

Maintenance stations support the crew and the equipment within the facilities' area of responsibility. These buildings will typically include bays for storage and maintenance of equipment, a crew meeting room, locker rooms, restrooms, shower, offices for a supervisor and possibly a superintendent, and rooms for electrical, mechanical, and communications equipment. This mechanical room will typically include electrical, lighting, heating/cooling, compressed air, and lubrication systems. Maintenance stations will likely have overhead doors and may include vehicle lift systems. Other structures, such as vehicle rinse facilities (wash racks), canopies, material storage bins, and well or pump houses, may also be included. Standby power is also sometimes required.

Equipment repair shops may be stand-alone District shops, sub-shops, or in maintenance stations as resident mechanic shops (see Figures 1-1 to 1-5). These shops will have similar components to maintenance stations but will utilize vehicle lifts and may include overhead cranes, welding and fabrication areas, and parts storage. They will usually include two or more repair bays that may be either drive-through or drive-in/drive-out style.



Figure 1-1. Repair Shop



Figure 1-2. Hat Creek Maintenance Station



Figure 1-3. Hat Creek Maintenance Station Interiors



Figure 1-4. Redding Equipment Shop



Figure 1-5. Redding Equipment Shop Interior

1-1.02 Sand and Salt Storage Facilities

Sand and salt storage facilities are located in areas with snow or ice and can be located at maintenance stations or as stand-alone sites along the highway at locations needed by maintenance to reload trucks during winter operations. These will be completely self-contained buildings with reinforced concrete or solid-grouted reinforced masonry walls as high as 12 feet above finished floor. A roof and wall structure above the concrete or masonry walls will be made of wood or steel. Salt storage facilities will typically be smaller than sand storage facilities. See Figures 1-6 and 1-7 for illustrations of sand and salt storage facilities.



Figure 1-6. Salt and Sand Storage Buildings at a Maintenance Station



Figure 1-7. Salt and Sand Buildings, Burney Maintenance Station

1-1.03 Safety Roadside Rest Areas (SRRA)

Safety Roadside Rest Areas are provided by Caltrans as an integral part of the State Highway System. Rest areas provide opportunities for motorists to safely stop, stretch, take a nap, use the restroom, get water, check maps, place telephone calls, switch drivers, check vehicles and loads, and exercise pets. See Figures 1-8 and 1-9 for illustrations of roadside rest areas.

Current work on safety roadside rest areas typically consists of rehabilitation, expansion, or modifications to comply with the Americans with Disabilities Act (ADA), as well as water and/or sewage treatment upgrades. These facilities will include restrooms

for men and women, employee services, a break room, and storage. Some of these facilities will also include a secure office designed specifically for the California Highway Patrol (CHP). The areas designated for CHP use will include specialty items such as bulletproof glass and doors. Additional items at roadside rest areas will often include picnic tables, both open and covered, freestanding kiosks for vending machines, display directories, visitor information, and communication facilities.

With the advancement of technology and sustainability awareness, electric vehicle charging stations are now being required in the building code. Information display panels for communication are still currently more common than digital displays for communication, although this may change in the future.

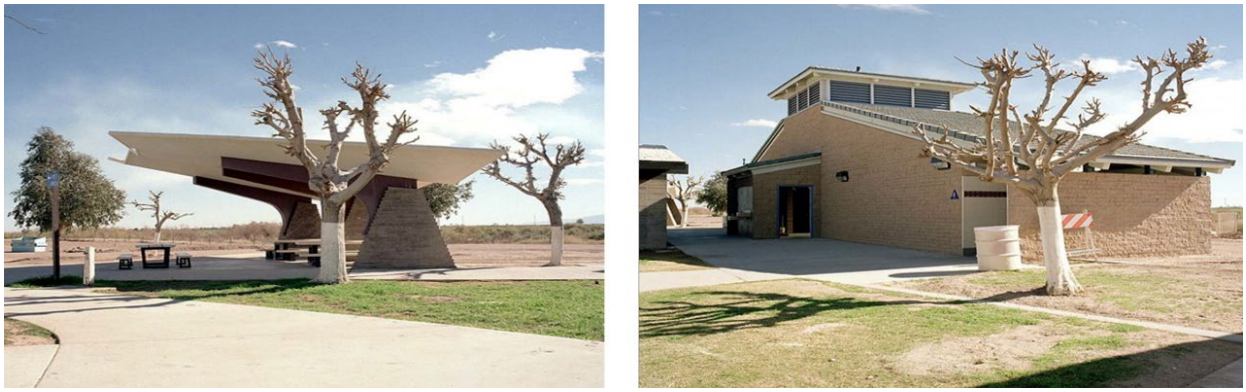


Figure 1-8. Safety Roadside Rest Areas (SRRA)



Figure 1-9. Honey Lake SRRA

1-1.04 Weigh Stations, Truck Inspection Facilities and Agricultural Inspection Stations

Commercial Vehicle Enforcement Facilities (CVEF) is the current term given for truck inspection facilities such as weigh stations and agricultural inspection stations. These inspection facilities include one or more bays for complete drive-through of the trucks being inspected. Inspection access pits will be constructed longitudinally along the center of the truck bays so that inspectors can make a complete inspection of the underside of the truck. Special lighting is also constructed into the floor to illuminate the underside of the truck. Weigh stations may be part of an inspection facility or stand-alone, and will include a scale system for weighing the trucks (see Figures 1-10 & 1-11). The newer systems at weigh stations will also have a weigh-in-motion scale. Agricultural inspection stations are normally located near the state line for inspection of passenger and commercial vehicles.



Figure 1-10. Fairfield-Cordelia CHP Truck Inspection Facility



Figure 1-11. Exterior and Interior of Inspection Bays

1-1.05 Toll Plazas

Toll plazas facilitate the collection of tolls for the toll roads and bridges (see Figure 1-12) Toll plazas may include underground tunnel(s) for toll collectors to access the individual toll booths. The primary facilities for a toll plaza will also include areas such as storage and service areas for emergency vehicles, offices, lunch and break rooms, showers, and locker rooms.

Since the COVID-19 pandemic, traditional toll collection methods utilizing toll booths are obsolete (e.g., manual toll collection, toll-payment machines) and have been replaced by all-electronic tolling (AET). At the time of this writing, a few projects are being programmed to upgrade traditional toll plazas with open-road tolling (ORT); i.e., remove toll booths and convert the current AET systems to ORT systems. Both AET and ORT systems are cashless and use either transponders or license-plate image billing.



Figure 1-12. Aerial and Traffic Lanes View of Benicia-Martinez Toll Plaza

1-1.06 Light Rail

Light rail stations are located along a light rail line where commuter lines stop to allow passengers to get on and off. Stations consist of a large platform. These platforms typically contain ticket vending machines, information on arrivals and departures, benches, shelters, lighting, and other amenities. Stations are designed to reflect the character of the community, and many stations incorporate artwork as an important design element. See Figure 1-13 for an example of a light rail station.



Figure 1-13. Light Rail Stations

1-1.07 Pump Houses and Bridge Control Houses

Pump houses are installed at depressed freeway sections where there is a need to pump storm water out to a higher elevation, as illustrated in Figure 1-14.



Figure 1-14. Pumping Facility

Bridge control houses are located at bridges with moveable spans that can be opened to allow passage of ships on the major waterway systems in California; see Figure 1-15 for an example.



Figure 1-15. Potato Slough Swing Span Bridge

1-1.08 Other Facilities

Other facilities may include training centers, testing and inspection laboratories, and modifications of district offices and/or facilities, as well as Caltrans housing for maintenance crews. These will be unique depending on the function of the facility. See Figures 1-16 and 1-17 for an illustration of a District 4 Training Facility.



Figure 1-16. District 4 Training Facility on Burma Road



Figure 1-17. District 4 Fort Ross Maintenance Station Housing

1-2 Notes to Structure Representatives and Assistant Structure Representatives

Building work presents its own set of unique challenges. As the contract administrator, you will be tasked with ensuring all parts of the puzzle fit together in a complete package. Managing the contract entails fielding hundreds of submittals, numerous requests for information (RFI), and the many changes necessary to complete the project. This is in addition to our ordinary procedures of developing a schedule of values and making progress payments, composing daily reports, and other paperwork common to bridge projects. You must familiarize yourself with and inspect many different types of work and various trades not normally encountered in bridge work. You will have to get familiar with ADA accessibility standards and fire-life-safety requirements, including fire suppression systems. Timely interaction with the project's state fire marshal field inspector during construction is crucial to a project's success. You will become knowledgeable by handling and working with hazardous materials, such as lead paint and asbestos, and the accompanying Cal/OSHA and Environmental Protection Agency (EPA) requirements on retrofitted structures. Collaboration with design engineers and architects is strongly encouraged to prevent potential delays in approval of submittals routed to their offices for review.

In addition to unique challenges, there are benefits to working on a building project. Assigned SC staff will get to know subcontractors from many different building trades, such as electrical, plumbing, HVAC, roofing, doors, and windows, and will gain experience and knowledge on how a building is constructed, along with the logistical challenges of coordinating the trades. You will have the opportunity to gain knowledge about some of these trades that will be useful not only in future projects, but also to develop a general understanding of building construction.

1-3 Notes to Bridge Construction Engineers and Area Construction Managers

Resourcing needs for building projects differ significantly from bridge projects, even when the construction cost is similar. Building work involves a larger number of dense, high-value elements and multiple interconnected systems, which make staffing decisions more complex. If staffing is based solely on capital cost, building projects may appear overstaffed because the nature and density of the work are not fully reflected in the dollar value. For Capital Outlay Support (COS) on building projects, it's important to consider the full construction timeline and scope, and it may be appropriate to reduce or exclude high-cost electrical and mechanical components when estimating required inspection staff relative to capital cost. While building work may be less technical than bridge work, it is often more complex due to the many different systems involved, and

for a building project, it is ideal to include specialized staff with building-construction experience.

A bridge has three basic elements: formwork/falsework, reinforcing steel (rebar and possibly prestressing), and concrete. In addition to those three elements, building work also includes:

1. HVAC systems
2. Plumbing systems
3. Sewer systems
4. Compressed air and/or lube systems
5. Fire sprinkler systems
6. Electrical systems
7. Lighting systems
8. Communications systems
9. Fire alarm systems, doors, and windows
10. Structural systems
11. Roof systems
12. Photovoltaic panels on canopies
13. Standby power
14. Electric vehicle charging systems, and
15. Other facility-specific systems.

It is imperative to coordinate benchmark inspections needed from the Office of Electrical, Mechanical, Water and Wastewater (OEMWW) and the Office of Transportation Architecture (OTA), which will be charging to the construction support phase of the contract. These systems must all be coordinated together and are often fitted into limited spaces.

Materials for building work are all approved by the submittal process. The Contractor submits on their proposed products to be incorporated into the building work. These submittals must be reviewed by both the Structure Representative (SR) and the DES design staff prior to being authorized. The material being installed then must be checked against the authorized submittals. Depending on the size of the project, there can be hundreds of submittals for materials; see section on submittals in Chapter 3-12, *Contract Administration – Building Submittals,* for more information.

As with all construction projects plans and specifications, there are omitted details and errors, which call for remedies during construction. These omissions can result in numerous changes and RFIs to research and respond to. There are often multiple plan sheets that locate equipment and furnishings in the same space, which requires field coordination to rearrange and accommodate all items in a given space so that functionally they all work together. The precise location and type of existing utilities are often unknown or may not be accurately depicted on project plans. As a result, contract changes may be required when unforeseen conditions are encountered during construction. Early preliminary site investigations—such as potholing and utility verification—can significantly reduce these uncertainties and improve project outcomes. When such investigations are not performed, or when unknown conditions remain, the use of a contingency fund may be the most appropriate method to address utility-related conflicts at the project level. In essence, the choice is between investing in early investigation or addressing the issues later during construction.

1-4 Organization of the Building Plans

The project plans for a building project are the graphic representation of the building design. The project plans will visually convey the design intent and the instructions necessary for the construction of the designed building.

The contract plans for building work are organized similarly to our standard bridge contracts, with the District or civil site sheets at the front of the plan set, followed by the structure plans. The civil drawings will be provided by the District and will show the site grading, paving, site concrete, storm water, landscape, and landscape irrigation. They will also include fencing, gates, driveway entrances, etc. Quantities of materials to be incorporated into the civil work on a unit cost basis will be included in the quantity sheets for civil work. The civil plans should also show the elevation of the finished floor of the building(s), as the structural plans typically reference finished floor as datum 0'-0" and reference vertical dimensions as +/– from finished floor.

1-4.01 Architectural Drawings

The following include many of the various types of drawings found within the architectural section of the project plans for a Caltrans building project:

1-4.01A General Plan/ Site Plan

These are views looking straight down at the building. The “General Plan” will include a north arrow and illustrate where the building is in relation to the nearest State highway and right-of-way. The site plans illustrate the building’s location and orientation on a plot of land and may also include information on the site’s topography, landscaping, utilities, site work, and configuration of parking lot.

1-4.01B Sheet Index

This is a table of contents of the structure plan sheets prepared by the Division of Engineering Services (DES); this includes the Architectural, Structural, Mechanical, Electrical, and Sanitary Sewer portions of the plans.

1-4.01C Building Abbreviations and Building Symbols

These are standard sheets that show abbreviations and symbols used in the building plans.

1-4.01D Code Analysis Sheet(s)

These list the building code requirements that the building is designed to comply with. This will include the occupancy classification, the building area in square feet, and the State Fire Marshal permit application number.

1-4.01E Accessibility Standard Detail Sheets

These sheets will include the standard details including those details required for ADA compliance.

1-4.01F Finish and Color Schedules

The room finish schedule provides information concerning the types of finish for floors, base, wainscots, walls, and ceilings. This sheet or sheets will normally carry a separate listing for interior and exterior colors and a color key schedule.

1-4.01G Door and Window Schedules

A door schedule will include the size and type of the door, the thickness, the type of material, a listing of the hardware group which will provide all the hardware to be included on that door and frame, the fire rating (if rated) and specific details concerning how it is attached to the structure and relation to the finish elements of the walls for both the jambs and the head. The sill condition will only be listed if there is a threshold or other sill condition. The window schedule will provide details concerning the size of the opening, operable sections, and reference details concerning the head, sill, and jamb conditions, as well as the glazing types and other window elements. Window frame materials are also indicated.

1-4.01H Floor Plan

This is a view looking straight down at the building if the roof and ceiling were removed. It illustrates the size, form, and relationship between the spaces of a building measured horizontally. It also shows the thickness and construction of the vertical space-defining elements (walls, columns, doors, and window openings). This will include the horizontal dimensions of the building and interior walls, columns, door and window openings. The floor plan will indicate room names and room numbers, door numbers, and window types. It will also show lines where sections are cut through various wall systems and where the details for those sections and wall construction can be located. A separate

floor plan may be shown indicating removal or demolition of existing facilities in the event such conditions are part of the scope of the project's work. Refer to floor plan drawings to verify required clearances for accessibility (ADA).

1-4.01I Roof Plan

This is a view looking straight down on the roof from above. It will normally indicate the location of all roof-mounted equipment, roof slopes, gutters, skylights, and other accessories. It will provide details indicating where information concerning the eaves, rake, ridge, and any specific detail concerning openings in the roof can be found. Depending on the project, there may be a separate sheet of roof details following the roof plan.

1-4.01J Reflected Ceiling Plan

This is a plan view looking up at the underside of the ceiling. It will show elements of the ceiling such as the location of light fixtures, heating, ventilating and air conditioning (HVAC) supply and return vents, and exhaust fans. It should also show the type of ceiling (for example, T-bar ceiling or gypsum board ceiling) and soffits. It may also have details indicating the location where construction of the ceiling member to ceiling member, ceiling member to walls, and ceilings to openings can be found.

1-4.01K Exterior Building Elevations

These are horizontal (side) views looking at the building's exterior from each side, from a perpendicular vantage point. The north elevation will be viewed as if looking at the building's north wall, with the other elevations viewed looking at the other walls respectively. The elevations will describe the materials used, the location and size of openings, canopies, parapets, eve conditions, and roof slope(s). They will also dimension the height above finished floor of openings and other items on the building's exterior. It will have detail callouts or notes indicating where the information can be found for constructing the walls, the elements on or within the walls, the openings, corners, eves, parapets, and terminations.

1-4.01L Building Sections

These are horizontal views of a building after a vertical plane is cut through significant spaces or a portion of the building and the front half is removed. Details are also provided to show the location of the information necessary for the construction of the elements that occur in the building section.

1-4.01M Interior Elevations

These are horizontal views providing separate elevations of walls in rooms within the building. These elevations provide additional information as to the finishes on the walls, the location of equipment and fixtures adjacent or attached to the walls, openings, etc.

1-4.01N Detail Sheets

Numerous detail sheets are provided in the project plans in all the sections. In the architectural section, some of the details will cover the head, jamb, and sill connections for doors, windows, louvers, and other items penetrating the walls, wall construction, roof construction, cabinet details, and finish details.

The architectural and structural plans will usually note or dimension items vertically from the finished floor, which will be at datum 0'-0". The civil or District plans will need to be referenced to get the elevation for datum 0'-0".

If the project contains multiple buildings, the architectural plans for all the buildings will be grouped together, followed by all the structural plans and all the mechanical plans, and so on. For example, multiple buildings within a project may be assigned multiple plan series such as A1-1, A2-1, and so on. For construction inspection and administration, it is sometimes helpful to have a set of plans that is printed or taken apart and all the various plan sheets for each individual building grouped together.

1-4.02 Structural Plans

The structural plans will include a “Structural Plan”, similar to a “General Plan”, a “Legend”, additional general sheets such as “Wood Framing Standard – Notes” and standard construction details. The structural plans will also include a foundation plan, floor plan (if applicable), wall framing plans, roof framing plans, and structural details. Architectural elements will usually not be included in the structural details, or if included, the information provided will be minimal. Coordinate and review the information between the architectural and structural sheets of the project plans.

1-4.03 Mechanical Plans

In addition to a “Mechanical Legend” and “Site Plan”, the mechanical plans will include a floor plan to show the location of most of the mechanical elements. Separate plan sheets will be provided for plumbing and mechanical work and may include a “Mechanical Plan”, “Domestic Water”, and “Sanitary Sewer”. They will provide plans for hot and cold-water piping, waste and vent piping, compressed air, lubrication, and any other special process piping. Details for equipment and the installation of the equipment will be included to provide the required information. Roof references will typically be made to the roof plan of the architectural section of the project plans and/or reflective ceiling plan to confirm the location of equipment and devices. They will provide any special details with information required for unique or specific equipment and devices (e.g., riser diagrams for plumbing work).

1-4.04 Electrical Plans

In addition to a “Legend” and an “Electrical Site Plan”, the electrical plans will include a floor plan. Architectural plans will typically be referenced for the location of equipment relating to the roof or reflected ceiling. Separate floor plans are typically provided for power, lighting, and communication. Conduit runs provided are diagrammatic only to coordinate the location of those runs; electrical plans also provide single-line diagrams to describe the power and panel schedules to show the circuiting and wiring along with the load calculations for the circuit systems.

1-4.05 Water and Wastewater Plans

In addition to a “Legend”, the water and wastewater plans will include site plans of all water and sewer piping outside of the buildings. They will include details of site piping and any water wells and sewage disposal systems. Depending on involvement, the mechanical or water and wastewater designer will show any fire hydrants or fire water tanks on site plans.

1-5 Organization of Building Specifications

For Structure Construction, as of this writing, building specifications are included in the project-specific *Special Provisions*, Section 99, *Building Construction*. These specifications may be organized using the Caltrans 16-division Specifications format. The Department is not transitioning to the 50-division CSI (MasterSpec format); however, the Department does allow the use of MasterSpec when its materials, products, or construction methods specifications benefit the project. In such cases, MasterSpec must be edited for the specific project, and the resulting modified specifications are inserted into the standard special provisions Section 99.

The organization of Section 99 in the *Special Provisions* will not be discussed since it is beyond the scope of this manual. However, information for it can be found in the DES Building and LEED Specifications[1] (including the generic Standard Special Provisions (SSPs)), as well as on the Office of Transportation Architect[1] webpages. However, SC staff should ultimately reference their project *Special Provisions.*

Building contracts typically will include Sections 1 through 14 of the *Standard Specifications*, and Sections 15 through 98 will not apply unless a specific reference is made to one of these sections in Section 99, *Building Construction*.

[1] Caltrans internal use only