Chapters 600 – 680 Pavement Engineering

Chapter 600 – General Aspects

Topic 601 – Introduction

Pavement engineering involves the determination of the type and thickness of pavement surface course, base, and subbase layers that in combination are cost effective and structurally adequate for the projected traffic loading, service life, and specific project conditions including climate. This combination of roadbed materials placed in layers above the subgrade (also known as basement soil) is referred to as the "pavement" or the "pavement structure."

The Department guidelines and standards for pavements described in this manual are based on extensive engineering research and field experience, including the following:

- Theoretical concepts in pavement engineering and analysis
- Data obtained from test track studies and experimental sections
- Research on materials characteristics, testing methods, and equipment
- Results of research and observations of performance throughout the state and the Nation.

The pavement should be engineered using the standards and guidance described in this manual to ensure consistency throughout the State and provide a pavement structure with adequate strength, ride quality, and durability to carry the projected traffic loads for the design life of each project. The final pavement structure for each project should be based on a thorough investigation of specific project conditions including subgrade soils and structural materials, environmental conditions, projected traffic, cost effectiveness, and the performance of other pavements in the same area or similar climatic and traffic conditions. These factors are discussed in Chapter 610 of this manual.

The standards, procedures, and requirements found in this manual are best practices. They should not preclude engineering judgment based on experience, and knowledge of the local conditions, including drainage and continuity with existing pavement structures, when developing pavement structures for individual projects.

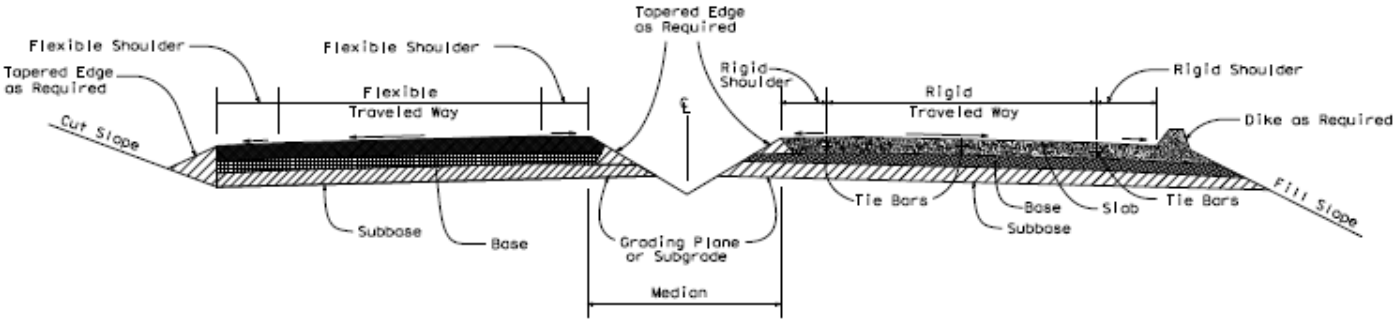
Topic 602 – Pavement Structure Layers

Index 602.1 – Description

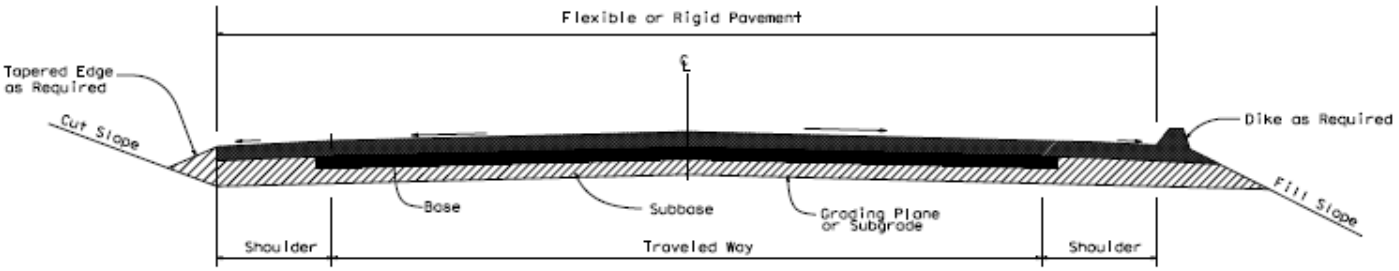
Pavement structures are comprised of one or more layers of select materials placed above the subgrade. The basic pavement layers of the roadway are shown in Figure 602.1 and discussed below.

Figure 602.1

Basic Pavement Layers of the Roadway



DIVIDED HIGHWAYS



UNDIVIDED HIGHWAYS

NOTES:
(1) These illustrations are only to show nomenclature and are not to be used for geometric cross section details. For these, see Chapter 300.
(2) Pavement drainage design, both on divided and undivided highways, is illustrated and discussed in Chapter 650.
(3) Only flexible and rigid pavements shown. Composite pavements are typically the same as rigid pavements with a flexible layer overlay.
(4) See Index 626.2 for criteria for when and how to use flexible or rigid shoulders.

(1) Subgrade. It is the portion of the roadbed consisting of native soil or embankment borrow material, that may be treated, on which the subbase, base, surface course or a layer of any other material is placed. Subgrade may be composed of either in-place material exposed from excavation, or embankment borrow material placed to elevate the roadway above the surrounding natural ground. Subgrade soil characteristics are discussed in Topic 614.

(2) Subbase. It is the unbound or treated aggregate or granular material placed on the subgrade as a foundation or working platform for the base. It functions primarily as structural support but it can also minimize the intrusion of fines from the subgrade into the pavement structure, provide mass to reduce subgrade expansion, improve drainage, and minimize frost action damage. The subbase generally consists of lower quality materials than the base but better than the subgrade soils. Subbase may not be needed in areas with high quality subgrade or where it is more cost effective to build a thicker base layer. Further discussion on subbase materials and concepts can be found in Chapter 660.

(3) Base. It is the select, processed, and/or treated aggregate material that is placed immediately below the surface course. The base may be composed of existing pavement layers that have been recycled in place. It provides additional load distribution and contributes to drainage and frost resistance. The base may be one or multiple layers treated with cement, asphalt, or other binder material, or may consist of untreated aggregate. In some cases, the base may include a drainage layer to drain water that seeps into the base. The aggregate in the base is typically a higher quality material than that used in the subbase. Further discussion on base materials and concepts can be found in Chapter 660.

(4) Surface Course. It represents one or more layers of the pavement structure engineered to accommodate and distribute traffic loads, provide skid resistance, minimize damaging effects of climate, reduce tire/pavement noise, improve surface drainage, and minimize infiltration of surface water into the underlying base, subbase and subgrade. Sometimes referred to as the surface layer, the surface course may be composed of a single layer, constructed in one or more lifts of the same material, or be composed of multiple layers of different materials. Pavements are generally classified based on the type of surface course, as follows:

(a) Flexible Pavements. These are pavements in which the surface course, is an asphalt-bound structural layer underlain with a non-rigid base. Each layer in a flexible pavement is designed to transmit and distribute traffic loads to a level at which the next layer below can carry them adequately over the design life. The highest quality layer is the surface course, which typically consists of one or more layers of asphalt concrete and may or may not incorporate underlying layers of base and/or subbase. These pavements are called "flexible" because each layer controls flexure from traffic loads to protect the layers beneath it. Flexible pavements with cement stabilized base layers are called “semi-rigid” pavements because the cemented base controls a large part of resistance to flexure from traffic loads, in addition to the surface course. Procedures for flexible pavements can be found in Chapter 630.

(b) Rigid Pavements. These are pavements with a rigid surface course, typically a slab of Portland cement concrete (or a variety of specialty hydraulic cement concrete mixes used for rapid strength concrete) over underlying layers of stabilized or unstabilized base or subbase materials. The concrete surface can be composed of slabs with joints cut in them and no reinforcing steel, in which case it is referred to as jointed plain concrete pavement (JPCP), or a continuous layer of concrete with reinforcing steel is referred to as continuously reinforced concrete pavement (CRCP). These pavements rely on the substantially higher stiffness of the concrete slab alone to distribute the traffic loads over a relatively wide area of underlying layers and the subgrade. The base layer helps the concrete distribute loads, although most flexural resistance is in the concrete. The base and subbase courses are primarily used to support to the concrete slab, improve drainage, and minimize pumping of fine materials to the surface. Procedures for rigid pavements can be found in Chapter 620.

(c) Composite Pavements. These are pavements comprised of both flexible (asphalt concrete) and rigid (cement concrete) layers over underlying layers of stabilized or unstabilized base or subbase materials. In California, composite pavements consist mostly of existing rigid pavements that have been overlaid with hot mix asphalt (HMA), open graded friction course (OGFC), or rubberized hot mix asphalt (RHMA). Refer to Chapter 640 for additional information on composite pavements.

(5) Non-Structural Wearing Course. On some pavements, a non-structural wearing course is placed to protect the surface course from wear and tear from tire/pavement interaction, the weather, and other environmental factors. Examples of non-structural wearing courses include OGFC, various types of surface seals, and added surface course thickness to allow for chain wear or grinding. Non-structural wearing courses are also placed over pavements to reduce noise and improve wet weather skid resistance condition. Although non-structural wearing courses are not given a structural value in the pavement structural design procedures found in this manual, they will improve the service life of the pavement by protecting it from the effects of traffic and the environment.

(6) Others. Additional layers may be included in the pavement depending on the type of pavement built and the subgrade or existing soil conditions encountered. Some of these layers include:

(a) Interlayers can be used between pavement layers or within pavement layers to reinforce pavement and/or improve the resistance of HMA layers to reflective cracking. Interlayers can be a geosynthetic type or asphaltic chip seals. Refer to Chapter 630 and Chapter 660 for additional information.

(b) Bond Breakers are used to prevent bonding between two pavement layers such as rigid pavement surface course to a cement-stabilized base.

(c) Tack Coats are used to bond a layer of asphalt binder mix to underlying existing pavement layers or between layers of asphalt concrete where multiple lifts are required.

(d) Prime Coats are used on aggregate base prior to paving of the surface course to provide a wearing surface for construction traffic (may require reapplication before placement of the surfacing), for better bonding with the layer to be placed above it, and to act as water proofing of the aggregate base during construction.

(e) Leveling Courses are used to fill and level surface irregularities and ruts before placing overlays. Hot mix asphalt is commonly used for constructing leveling courses.

(f) Working Platform is a layer of granular base, asphalt, or concrete used to support construction equipment. A working platform permits the efficient construction of the treated base and asphalt or concrete structural course.

Topic 603 – Types of Pavement Projects

603.1 New Construction

New construction is building a new facility, including new roadways, new alignments, interchanges or grade separation crossings, and new parking lots or safety roadside rest areas.

603.2 Widening

Widening projects involve constructing of additional pavement width to improve traffic flow and increase capacity on an existing highway facility. Widening may involve adding lanes (including transit or bicycle lanes), shoulders, turnouts, pullouts for maintenance/transit traffic; or widening existing lane, shoulder or pullouts.

Additional guidance and requirements on widening existing facilities, including possible options as well as certain circumstances that may justify adding rehabilitation or pavement preservation work to widening, or deferring it, are discussed in Index 612.3.

603.3 Pavement Preservation

Pavement Preservation has two main categories or programs:

(1) Preventive Maintenance. Preventive maintenance projects are used to construct preventive treatments to preserve pavements in good condition. Pavement preservation consists of nonstructural preventive and corrective strategies to maintain existing pavement in generally good condition. These projects are typically done through the Highway Maintenance Program or by Department Maintenance forces. The District Maintenance Engineer determines which preventive treatment to apply and when in consultation with the District Pavement Engineer.

Traffic safety and other operational improvements, geometric upgrades, or widening are not included in preventative maintenance projects. Strategies and guidelines on preventive maintenance treatments currently used by the Department are discussed further in Indexes 624.1, 634.1, and 644.1.

(2) Capital Preventive Maintenance (CAPM). Capital Preventive Maintenance (CAPM), also called Minor Pavement Rehabilitation is a program of short-term (5 to 10 year years) repair projects on existing roadways in generally fair condition with considerable remaining service life (15 to 30 years) agreed to between the Department and the FHWA beginning in 1994. CAPM projects are more closely related to preventive maintenance projects than roadway rehabilitation projects because they are not intended to significantly increase or restore the pavement's structural capacity.

The primary purpose of the CAPM program is to repair pavement exhibiting minor distress as identified in Design Information Bulletin (DIB) 81 or under the current Flexible and Rigid Selection Criteria, sections 2.1.1 and 2.1.2, using condition survey data from the Automated Pavement Condition Survey (APCS) and decision trees in the Pavement Management System (PMS). Ride improvement and preservation of serviceability are key elements of this program. The timely application of CAPM treatments delays the need for major roadway rehabilitation, improving the cost-effectiveness of the pavement life cycle. CAPM provides flexibility to make the most effective use of all funds available in the biennial State Highway Operation and Protection Plan (SHOPP).

CAPM projects involve non-structural overlays and repairs, which do not require pavement structural design. CAPM projects include all appropriate items or work necessary to keep the pavement in good condition for a minimum of 5 years and up to 10 years. The District Maintenance Engineer is responsible for making strategy selections and design recommendations for CAPM projects. Information on CAPM strategies is found in Indices 624.2, 634.2, and 644.2. For further information and other guidance for CAPM projects, see DIB 81 or current DIB and Caltrans Project Development Procedures Manual (PDPM).

See DIB 81 or current for required work regarding accessibility for persons with disabilities as part of CAPM projects.

603.4 Roadway Rehabilitation

The primary purpose of roadway rehabilitation projects is to return roadways that exhibit major structural distress to good condition. Many of these structural distresses indicate failure of the surface course and underlying base layers. Roadway rehabilitation work is generally regarded as major, non-routine work engineered to restore service life by restoring damaged structural capacity and providing upgrades to enhance safety.. As described in the current Design Information Bulletin or DIB 79, Section 1.2, rehabilitation criteria also apply to minor projects and certain other projects in addition to roadway rehabilitation projects. Roadway rehabilitation is different from pavement preservation that simply preserves or repairs the facility to a good condition.

Roadway rehabilitation projects are divided into 2R (Resurfacing and Restoration) and 3R (Resurfacing, Restoration and Rehabilitation). Roadway rehabilitation projects should address other highway appurtenances such as pedestrian and bicyclist facilities, drainage facilities, lighting, signal controllers, and fencing that are failing, worn out or functionally obsolete. Also, unlike pavement preservation projects, geometric enhancements and operational improvements may be added to roadway rehabilitation work if such work is critical or required by FHWA standards.

Roadway rehabilitation strategies for rigid, flexible, and composite pavements are discussed in Topics 625, 635 and 645. Additional information and guidance on roadway rehabilitation, including determining whether the project fits 2R or 3R screening criteria, and other rehabilitation projects may also be found in the Design Information Bulletin, Number 79-04 or current - "Design Guidance and Standards for Roadway Rehabilitation Projects" and in the PDPM Chapter 9, Article 5 (https://design.onramp.dot.ca.gov/downloads/design/files/lap/PDPM_LAP_Manuals.pdf).

603.5 Reconstruction

Pavement reconstruction replaces the entire existing pavement structure with an equivalent or increased new pavement structure, and rebuilding of adjacent operational and roadside features. Reconstruction is typically warranted when the roadway has become functionally and structurally obsolete.

Reconstruction features typically include significant change to the horizontal or vertical alignment of the highway, and may include the addition of lanes. Although reconstruction is often done for reasons other than pavement repair, it can be done as an option to rehabilitation when the existing pavement meets the following conditions:

- It is in a substantially distressed condition with extensive damage or other problems in many or all of the pavement layers and rehabilitation strategies will not restore the pavement to a good condition;
- Existing alignments and clearances are functionally obsolete and need to be upgraded to improve safety and mobility;
- Life-cycle costs for rehabilitation are greater than those for reconstruction.

Reconstruction differs from lane/shoulder replacement roadway rehabilitation options in that lane/shoulder replacements typically involve replacing portions of the roadway width whereas reconstruction is the removal and replacement of the entire roadway width. Incidental rebuilding of existing pavements for rehabilitation to conform to bridges, existing pavement, or to meet vertical clearance standards is considered rehabilitation and not reconstruction. Storm and earthquake damage repairs (i.e., catastrophic) also are not considered reconstruction projects.

Pavement reconstruction projects are to follow the same standards as “new construction” found in this manual unless noted otherwise.

603.6 Temporary Pavements and Detours

Temporary pavements and detours are constructed to carry traffic anticipated during construction temporarily . These types of pavements should be engineered using the pavement standards and procedures for new construction except where noted otherwise.

603.7 Stage Construction

In some cases, a pavement structure may need to be staged (constructed at different times or over multiple projects.) Stage construction for flexible pavement structures could be done by reducing the surface course thickness with provision for a future overlay to bring the

pavement to full design depth. For rigid pavement stage construction, the base and subbase layers could initially be built (if the base is built with asphalt) and then overlaid later with concrete pavement.

Where staging of the pavement structure is needed, the initial stage:

- Needs to be built to meet or exceed the expected time of the initial stage before placing the final stage.
- Needs to meet or exceed what would be required for ultimate pavement structure when final layers are placed.
- Should show the future placement of the pavement on the typical sections.

Topic 604 – Roles, Resources, and Proprietary Items

604.1 Roles and Responsibilities for Pavement Engineering

The roles and responsibilities listed below apply only to pavement engineering.

(1) Pavement Engineer. The pavement engineer is the engineer who performs pavement calculations, develops pavement structure recommendations, details, or plans. The pavement engineer can be the Project Engineer, District Materials Engineer, District Maintenance Engineer, consultant, or other staff engineer responsible for this task.

(2) Project Engineer (PE). The PE is the registered civil engineer responsible for appropriate project development documents (i.e., Project Study Report, Project Report, and PS&E) and coordinates all aspects of project development. The PE is responsible for project technical decisions including pavement engineering, quality control, and estimates. This includes collaborating with the District Materials Engineer, District Maintenance Engineer and other subject matter experts regarding pavement details and selecting pavement strategy for new and rehabilitation projects. The PE clearly conveys pavement related decisions and information on the project plans and specifications for a Contractor to bid and build the project.

(3) District Materials Engineer (DME). The DME is responsible for determining materials information used to develop pavement engineering strategies. The District Materials Unit is responsible for conducting or reviewing the findings of a preliminary soils and other materials investigation to evaluate the quality of the materials available for constructing the project. The DME prepares or reviews the Materials Report when needed for new construction, widening and rehabilitation projects; provides materials recommendations to and in continuous consultation with the PE throughout planning and design, as well as with the PE and Resident Engineer during construction. The DME also coordinates materials information with the Department functional units: Material Engineering and Testing Services (METS), Headquarters functional units, local agencies, industry, and consultants.

(4) *District Maintenance Engineer.* The District Maintenance Engineer manages and coordinates overall pavement strategies for the District. They are primarily involved in pavement management such as identifying future pavement preservation, rehabilitation and reconstruction needs, prioritizing pavement projects to meet those needs, and recommends pavement preservation strategies. The District Maintenance Engineer establishes pavement projects and reviews planning documents prepared by the PE for consistency with overall District and statewide goals for pavements.

(5) *Pavement Program (PP)*. The PP, within the Division of Maintenance (DOM) is responsible for statewide standards and guidelines for the pavement engineering process. The DOM Assistant Division Chief for Pavement Program serves as the State Pavement Engineer for the Department.

The PP Office of Concrete Pavement (OCP) and Asphalt Pavement (OAP) are responsible for maintaining pavement engineering standards, specifications, standard plans, design methodologies, design software, and practices that are used statewide. The OCP and OAP also provide technical expertise on material properties and products for pavements. The OCP and OAP work closely with the District Materials Engineers, Maintenance Engineers, and Resident Engineers to investigate ongoing field and pavement related issues.

(6) *State Pavement Engineer.* The State Pavement Engineer provides leadership and commitment to ensure safe, effective, and environmentally sensitive highway pavements that improve mobility across California. The State Pavement Engineer is responsible for conveying clear direction and priorities on pavement initiatives, policies, and standards that reflect departmental goals; and implementing pavement policies, standards, and specifications.

604.2 Mechanistic-Empirical Design

On March 10, 2005, the Department committed to developing Mechanistic-Empirical (ME) design methods to replace the previously used empirical methods. The Department uses ME design methods for the structural design of new construction, widening, and rehabilitation of flexible, rigid, and composite pavement. ME methods use models based on solid mechanics principles to model the primary responses of the pavement materials in terms of stresses and strains in response to traffic loading and climatic conditions, and empirical calibrations from field and test section observations to calculate the damage and distresses that result from the primary responses. The primary responses are determined using mechanistic models such as the multilayer elastic theory (MLET) or the finite element method (FEM). The empirical calibrations are also used to determine variabilities of pavement performance which are incorporated into design reliability calculations. Reliability calculations account for the probability that a pavement will not fail before its intended design life, and the percentage of pavement in a project that will fail at the design life.

Compared to previously used empirical methods, the main advantage of the ME design methods is that it makes updating of the design method to capture innovations in materials, construction, climate, and traffic and other changes in practice much faster and more accurate.

The Department has completed the calibration of the flexible and rigid pavement ME design methods using state-wide PMS performance data and historical materials data. The ME design methods are to be used for all new construction, widening, and rehabilitation projects. The ME design methods undergo periodic updating as new materials, structures, and construction practices are introduced, and new performance data becomes available. Updates are managed by the Headquarters Pavement Program and are communicated to all practitioners by the Pavement Program through change management documents that outline the changes, the reasons for the changes, and the expected effects on designs. The following are current applications of ME design for rigid and flexible pavements:

(a) Rigid Pavements - The design catalogs for rigid pavements (see Index 623.1) are based on AASHTOware™ Pavement ME software. The design catalogs are to be used for rigid pavement design on State owned and operated highways. Using AASHTOware™ Pavement ME software cannot independently design or refine data from these because the design catalogs consider other factors not currently addressed in the AASHTOware™ PavementME software. Contact the Office of Concrete Pavement for special designs requiring use of the Pavement ME software.

Additional information on concrete pavement design is given in Index 623.

(b) Flexible Pavements - The Caltrans ME (CalME) design program should be used for flexible pavement design on all flexible pavement projects on State owned or operated highways; except for the following types of projects which use predetermined strategies and/or designs:

- Pavement preservation,
- Roadside paving (including bikeways and pedestrian pathways), and
- Parking lots.

The HQ Pavement Program (Office of Asphalt Pavements) has adopted two design approaches for ME design of flexible pavements: projects using Performance Related Specifications (PRS) and non-PRS projects. PRS projects use performance related specifications for their asphalt concrete mixes. PRS projects require asphalt mixes to satisfy limits on performance test results such as fatigue life and rutting resistance as part of the job mix formula approval process. Non-PRS project refers to all other projects and asphalt materials are specified using standard specifications or QC/QA specifications. A PRS project uses project specific mixes as inputs in CalME and the reliability calculation only needs to account for project specific uncertainties. A Non-PRS project uses state-wide median materials values as inputs in CalME and the reliability calculation accounts for state-wide variability of the properties of materials delivered to the project. PRS projects may require additional testing to develop performance specifications appropriate for the specific project.

AC Long Life designs use specific types of materials for full depth asphalt reconstruction and crack, seat, and overlay concrete pavement, including a polymer modified surface course, a stiff intermediate layer, and a full depth reconstruction structures a “rich bottom” bottom course. They are used on very high traffic routes. AC Long Life projects can be designed and built using either PRS or non-PRS specifications.

Additional information on CalME is given in Chapter 630. Index 633 provides detailed information on flexible ME design procedures. Additional information on flexible pavement ME design procedures can be found on the "ME Designer's Corner" on the Pavement Program's intranet site (*https://maintenance.onramp.dot.ca.gov/paveprogram/caltrans-me-designers-corner*).

604.3 Pavement Recommendations

Recommendations for pavement strategies or structures for individual projects should be documented in writing. The project engineer uses the recommendations to determine the best pavement strategy for the project.

Recommendations should include the following information:

- Pavement climate zone or climate data used to prepare the recommendations.
- Design designation.
  - Not needed for non-structural recommendations such as pavement preservation or roadside paving work.
- Multiple alternatives to accomplish the purpose and need of the project and minimum design/performance standards are found in this manual, including life cycle cost analysis.
- Compliance with Section 42703 of the Public Resources Code on the use of Rubberized Hot Mix Asphalt (RHMA) alternatives. Asphalt rubber or crumb rubber modified binders should be included for asphalt pavements in accordance with Index 631.3.
- Summary of assumptions such as pavement design life.
- Reference to Materials Report used to prepare the report.
- Preparer's name. Include engineering stamp for pavement structure recommendations.

Pavement structure recommendations for new construction, widening, rehabilitation, and other situations where pavement structural requirements need to be met should be made by the Pavement Engineer and/or reviewed by the District Materials Engineer with input from the District Maintenance Engineer. The District Maintenance Engineer typically prepares recommendations for pavement preservation projects.

604.4 Other Resources

The following resources provide additional standards and guidance related to pavement engineering. Much of this information can be found on the Department Pavement website, see category (5) below.

(1) *Standard Plans*. These are collections of commonly used engineering details intended to provide consistency for contractors, resident engineers, and maintenance engineers in defining the scope of work for projects, assist in the bid ability of the project contract plans, and assist maintenance in maintaining the facility. The standard plans were developed based on research and field experience and in consultation with industry. Standard plans for pavement should not be altered or modified without prior written approval from the Headquarters Pavement Program.

(2) *Standard Specifications and Standard Special Provisions.* The Standard Specifications provide material descriptions, properties and work quality requirements, contract administration requirements, and measurement and payment clauses for items used in the project. The Standard Special Provisions are additional specification standards used to complement and/or modify the Standard Specifications including descriptions, quality requirements, and measurement and payment for the project work and materials. When no Standard Specifications or Standard Special Provisions exist for new or proprietary items, the Pavement Program must review and concur with the special provisions. For further information, see the Specifications section on the Department Pavement website (*https://dot.ca.gov/programs/design/ccs-standard-plans-and-standard-specifications*).

(3) *Pavement Technical Guidance.* Pavement Technical Guidance is a collection of supplemental guidance and manuals regarding pavement engineering which is intended to assist project engineers, pavement engineers, materials engineers, consultants, construction oversight personnel, and maintenance workers in making informed decisions on pavement structural engineering, constructability and maintenance issues. Information in the Technical Guidance includes, but is not limited to, resources for assistance in decision making, rigid, flexible and composite pavement rehabilitation strategies, pavement preservation strategies, guidance for site investigations, guidance on in-place recycling, and guidelines for the use of various products and materials. Technical assistance is also available from the Pavement Program to assist with pavements that utilize new materials, methods, and products. These Technical Guidance documents are on the Department Pavement website (*https://maintenance.onramp.dot.ca.gov/paveprogram/pavement-program*).

(4) *Supplemental District Standards and Guidance.* Some Districts have developed additional written pavement standards and guidance to address local issues. Such guidance supplements the standards found in this manual, the Standard Plans, the Standard Specifications, and Standard Special Provisions. District guidance does not replace statewide standards unless the State Pavement Engineer has approved an exception. Supplemental District Guidance should be approved by the District Director or as delegated to the Deputy, Division Chief, or Office Chief. Supplemental District Guidance can be obtained by contacting the District Maintenance Engineer.

(5) *Department Pavement Website.* The Department Pavement website provides a one-stop resource for standards, guidance, reports, approved software, and other resource tools related to pavements. The Department Pavement website is https://dot.ca.gov/programs/maintenance/pavement .

(6) Pavement Interactive Guide. The Pavement Interactive Guide is a reference tool developed by the Department in partnership with other states. It includes discussion and definitions of terms and practices used in pavement engineering to aid design engineers in obtaining a better understanding of pavements. This document is not a standards manual or guideline. Because of copyright issues, the Pavement Interactive Guide is only available to Department employees on the Pavement intranet.

(7) The AASHTO 1993 "Guide for Design of Pavement Structures" and the AASHTO 2020 "Mechanistic-Empirical Pavement Design Guide - A Manual of Practice." Although not adopted by the Department, the AASHTO guides are comprehensive references that provide background that are helpful to those involved in engineering of pavement structures.

Topic 605 – Record Keeping

605.1 Documentation

One complete set of electronic documents, and a hard copy set of the pavement selection and design report, should be retained in District Project History files at the end of the design stage as well as subsequent construction changes to the pavement structure at the end of construction. The documentation must contain the following:

- Pavement design life (including both the construction year and design year)
- Ride quality data as measured by International Roughness Index (IRI)
- The Traffic Index (TI) and equivalent single axle loads (ESALs) or spectra and AADTT used to engineer each pavement structure
- All inputs used to run the pavement design software, which can be produced in the standard report from the software
- All reports generated by pavement design program
- All documents used to determine pavement design inputs
- Life-cycle cost analysis (including the data required for the life-cycle cost analysis) and other factors mentioned in Topic 619

605.2 Subsequent Revisions

Any subsequent changes in pavement structures must be documented and processed in accordance with the appropriate instructions stated above and with proper reference to the original design.

Topic 606 – Research and Special Designs

606.1 Research and Experimentation

Research and experimentation are undertaken on an ongoing basis to provide improved methods and standards, which take advantage of new technology, materials, and practices. They may involve investigations of new materials, construction methods, and/or new engineering procedures. Submittal of new ideas by Headquarters and District staff, especially those involved in the engineering, construction, maintenance, paving materials, and pavement performance, is encouraged. Research proposals should be sent to the Division of Research, Innovation and System Information (DRISI) and the Pavement Program in Headquarters for review and consideration. Suggestions for changes in pavement standards may also be submitted to the State Pavement Engineer. The Pavement Program must approve research proposals, pilot projects, and experimental construction features before undertaking such projects. District Maintenance Engineers, Pavement Engineers, and Material Engineers should also be engaged in the discussion involving pilot projects and experimental construction features. Experimental sections must be clearly marked so that District Maintenance can easily locate and maintain such sites for pavement performance. A comprehensive pavement performance monitoring plan should also be developed during the project planning stage under the lead of the HQ Pavement Program.

606.2 Special Designs

"Special" designs must be fully justified and submitted to the Headquarters Pavement Program. Special designs are defined as those designs that meet the following criteria:

- Involve products, methods, or strategies which either reduce the structural thickness to less than what is determined by the standards and procedures of this manual and accompanying technical guidance
- Utilize experimental products or procedures not covered in the engineering tables or methods found in this manual or accompanying technical guidance

Special designs must be submitted to the Headquarters Pavement Program either electronically or as hard copies. Hard copy submittals must be in duplicate. All submittals must include the proposed pavement structure(s) and a location strip map (project title sheet is acceptable). The letter of transmittal should include the following:

- Pavement design life, including both the construction year and design year (See Topic 612)
- All inputs used to run the pavement design software, which can be produced in the standard report from the software
- All reports generated by the pavement design program
- All documents used to determine pavement design inputs
- Life-cycle cost analysis (including the data required for the life-cycle cost analysis) and other factors mentioned in Topic 619

- The name of the engineering analysis and methods used in developing the “special” design(s)
- Justification for the “special” design(s)

The Pavement Program (either the Office of Concrete Pavement or Office of Asphalt Pavement) acts as the Headquarter’s focal point to obtain concurrence from the Pavement Program and other Headquarter’s functional units as needed before approving the special designs.

606.3 Proprietary Items

The use of proprietary materials and methods on State highway projects is discussed in Topic 110.10.