

## CHAPTERS 600 – 670 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.
- Observation 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 that will have 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 and should not preclude engineering judgment based on experience, and knowledge of the local conditions 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 discussed below.

- (1) *Subgrade*. It is the portion of the roadbed consisting of native or treated soil on which surface course, base, subbase, or a layer of any other material is placed. Subgrade may be composed of either in-place material that is exposed from excavation, or embankment borrow material that is 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 that is 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, 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. It provides additional load distribution and contributes to drainage and frost resistance. 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 base is typically a higher quality material than that used in 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 disintegrating 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 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. This type of pavements is engineered to bend or flex when loaded. Flexible pavements transmit and distribute traffic loads to the underlying layers. 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 types of pavements are called "flexible" because the total pavement structure bends (or flexes) to accommodate deflection bending under traffic loads. 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. These types of pavements rely on the substantially higher stiffness of the concrete slab to distribute the traffic loads over a relatively wide area of underlying layers and the subgrade. Some rigid concrete slabs have reinforcing steel to help

resist cracking due to temperature changes and repeated loading. 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 condition. Although non-structural wearing courses are not given a structural value in the procedures and tables found in this manual, they will improve the service life of the pavement by protecting it from traffic and environmental effects.
- (6) *Others.* Depending on the type of pavement built and the subgrade or existing soil conditions encountered, additional layers may be included in the pavement. Some of these layers include:
- (a) Interlayers can be used between pavement layers or within pavement layers to reinforce pavement and/or improve resistance of HMA layers to reflective cracking. Interlayers can be 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 can be used on aggregate base prior to paving for better bonding and to act as water proofing of the aggregate base.
- (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 the building of a new facility. This includes new roadways, interchanges or grade separation crossings, and new parking lots or safety roadside rest areas.

### 603.2 Widening

Widening projects involve the construction of additional width to improve traffic flow and increase capacity on an existing highway facility. Widening may involve adding lanes (including transit or bicycle lanes), shoulders, 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 provide preventive treatments to preserve pavements in good condition. These projects are typically done by Department Maintenance forces or through the Major Maintenance Program. The District Maintenance Engineer determines which preventive treatment to apply and when.

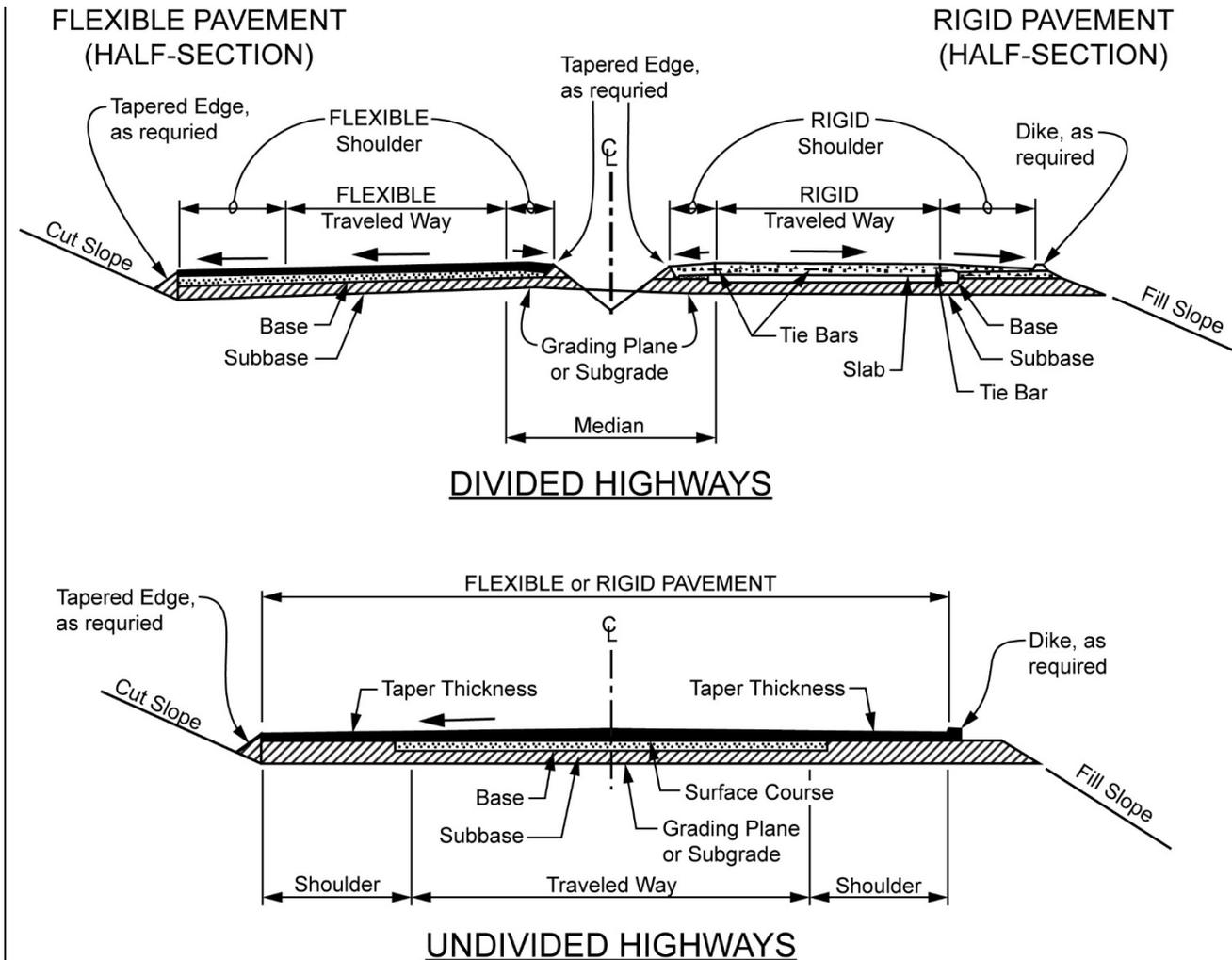
Traffic safety and other operational improvements, geometric upgrades, or widening are not included in preventative maintenance projects. Strategies and guidelines on preventive maintenance treatments currently used by the Department are discussed further in Indexes 624.1, 634.1, and 644.1.

- (2) *Capital Preventive Maintenance (CAPM).* Capital Preventive Maintenance (CAPM) is a program of short-term (5 to less than 20 years) repair projects agreed to between the Department and FHWA beginning in 1994. Since the CAPM program is part of pavement preservation, CAPM projects are more closely related to preventive maintenance (Major Maintenance) projects than to roadway rehabilitation projects.

The primary purpose of the CAPM program is to repair pavement exhibiting minor distress as identified in Design Information Bulletin (DIB) 81 under the Flexible and Rigid Selection Criteria, Sections 2.1.1 and 2.1.2, determined by the Pavement Condition Survey (PCS) and the Pavement Management System (PMS). Ride improvement and preservation of serviceability are key elements of this program. Timely application of CAPM treatments will postpone the need for major roadway rehabilitation and is generally more cost effective than having to rehabilitate pavements exhibiting major distress. CAPM provides flexibility to make the most effective use of all funds available in the biennial State Highway Operation and Protection Plan (SHOPP).

Figure 602.1

## Basic Pavement Layers of the Roadway



## 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, are illustrated and discussed under Chapter 650.
- (3) Only flexible and rigid pavements shown. Composite pavements are 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.

CAPM projects involve non-structural overlays and repairs, which do not require Traffic Index calculations or deflection studies. CAPM projects include all appropriate items or work necessary to preserve the pavement in good condition for a minimum of 5 years (10 years preferred). The District Maintenance Engineer is responsible for making strategy selections and recommendations for CAPM projects. Information on CAPM strategies is found in Indexes 624.2, 634.2, and 644.2. For further information and other guidance for CAPM projects, see DIB 81 and PDPM Appendix H. See DIB 82 for required work regarding accessibility for persons with disabilities.

### 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 maintenance work engineered to restore the service life as well as provide upgrades to enhance safety where needed. As described in Design Information Bulletin 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 - "Design Guidance and Standards for Roadway Rehabilitation Projects" and in the PDPM Chapter 9, Article 5.

### 603.5 Reconstruction

Pavement reconstruction is the replacement of the entire existing pavement structure by an equivalent or increased new pavement structure, and rebuilding of adjacent operational and roadside features. Reconstruction is typically justified 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:

- Is in a substantially distressed condition and rehabilitation strategies will not restore the pavement to a good condition; or
- Existing alignments and clearances are functionally obsolete and need to be upgraded to improve safety and mobility; or
- 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 in order to conform to bridges, existing pavement, or meet vertical clearance standards are considered rehabilitation and not reconstruction. Storm or earthquake damage repair (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 temporarily carry traffic anticipated during

construction. 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:

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

Life-cycle cost should be considered before using a staging option.

## 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 in responsible charge of

appropriate project development documents (i.e., project initiation document, project report, and PS&E) and coordinates all aspects of project development. The PE is responsible for project technical decisions including pavement engineering, quality (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 Pavements (OAP) are responsible for maintaining pavement engineering standards, specifications, standard plans, design methodologies, design software, and practices that are used state wide. OCP and OAP also provide technical expertise on material properties and products for pavements. 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 for the implementation of pavement policies, standards, and specifications.
- (7) *Materials and Geotechnical Services*. The Materials and Geotechnical Services subdivision of the Division of Engineering Services (DES) consists of the Materials unit (formerly Materials Engineering and Testing Services (METS)) and the Geotechnical Services (GS) unit. The Materials unit is responsible for conducting laboratory testing, field testing, specialized field inspections, and maintaining the test method procedures for the Department. The GS unit provides the Districts, Structures, and Headquarters with expertise and guidance in soil related investigations and groundwater issues, GS prepares or reviews Geotechnical Design Reports based upon studies and information supplied by the District.

## 604.2 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 that will accomplish the purpose and need of the project and minimum design/performance standards found in this manual, including life cycle cost analysis.
- Compliance with Section 42703 of the Public Resources Code on use of 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 report.
- Preparer's name. Include engineering stamp for pavement structure recommendations.

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

## 604.3 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 the prior written approval of the Chief, Office of Concrete Pavement and Pavement Foundations. Standard plans for pavements can be found on the Department Pavement website.
- (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 modify the Standard Specifications including descriptions, quality requirements, and measurement and payment for the project work and materials. When no Standard Specification or Standard Special Provision exists for new or proprietary items, the Pavement Program must review and concur with the special provision. For further information, see the Specifications section on the Department Pavement website.
- (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 maintainability 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, 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 may be accessed on the Department Pavement website.
- (4) *Supplemental District Standards and Guidance.* Some Districts have developed additional written pavement standards and guidance to address local issues. Such guidance adds to or 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 Deputy or Office Chief. Supplemental District Guidance can be obtained by contacting the District Maintenance Engineer and/or the District Materials Engineer.
- (5) *Department Pavement website.* The Department Pavement website provides a one-stop resource for those seeking to find standards, guidance, reports, approved software, and other resource tools related to pavements. The Department Pavement website can be accessed at [http://www.dot.ca.gov/hq/maint/Pavement/Pavement\\_Program/index.html](http://www.dot.ca.gov/hq/maint/Pavement/Pavement_Program/index.html).
- (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 to terms and practices used in pavement engineering that are intended 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, or internal, website.
- (7) *The AASHTO "Guide for Design of Pavement Structures."* Although not adopted by the Department, the AASHTO "Guide for Design of Pavement Structures" is a comprehensive reference guide that provides background that is helpful to those involved in engineering of pavement structures. This reference is on file

in the Pavement Program and a copy should be available in each District.

## Topic 605 – Record Keeping

### 605.1 Documentation

One complete copy of the documentation for the type of pavement selected should be retained in permanent District Project History files as well as subsequent updates of construction changes to the pavement structure. The documentation must contain the following:

- Pavement design life (including both the construction year and design year),
- The Unified Soil Classification of the subgrade soil, and where used, the California R-value,
- The strength properties for the materials selected for the subbase and/or base layers (provide California R-value when used for the design),
- Ride quality data as measured by International Roughness Index (IRI),
- The Traffic Index (TI) and equivalent single axle loads (ESALs) or spectra used to engineer each pavement structure, and
- 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 performance of the pavement, is encouraged. Research proposals should be sent to the Division of Research, Innovation and System Information (DRISI) in Headquarters for review and consideration. Suggestions for research studies and changes in pavement standards may also be submitted to the State Pavement Engineer. The Pavement Program must approve pilot projects and experimental construction features before undertaking such projects. District Maintenance 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.

### 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 either or both of 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, or
- 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).
- The Unified Soil Classification of the subgrade soil(s) and, if used for the design, the California R-value (See Indexes 614.2 and 614.3).

- The strength properties for the materials selected for the subbase and/or base layers (See Tables 663.1A and 663.1B). Provide the California R-value if used for the design.
- The Traffic Index (TI) and ESALs or spectra for each pavement structure (See Indexes 613.3 & 613.4).
- The name of the engineering analysis and methods used in developing the “special” design(s).
- Justification for the “special” design(s).

The relevant Office at the Pavement Program (Office of Concrete Pavement and Pavement Foundation or Office of Asphalt Pavements) will act as the Headquarters’ focal point to obtain concurrence of Pavement Program and other Headquarters functional units as needed prior to granting approval of the “special” designs.

### 606.3 Mechanistic-Empirical Design

The Mechanistic-Empirical (ME) design method offers a unique special design system that utilizes solid mechanics to mechanistically model the primary responses of the pavement materials in terms of stresses, strains, and deflections in response to detailed traffic loading and climatic conditions. The ME design process accumulates pavement damage over time and empirically relates accumulated damage over time to pavement surface distresses and ride quality. The primary responses are determined using advanced mechanistic models such as the multilayer elastic theory (MLET) or finite element method (FEM) and these are in turn used in distress prediction models (relationships) to determine pavement performances and related service life. Distress prediction models are calibrated using field data for the same type of pavement structure in similar traffic loading and climatic conditions.

(1) *Application.* The ME design methods are being considered by all State Departments of Transportation as alternative tools to existing empirical methods. On March 10, 2005, the Department committed to developing ME Design to replace the old existing empirical methods. The Department has completed the development of the procedures and criteria for performing ME Design. The following are

current applications of ME design for rigid and flexible pavements on the State highway system or other roads maintained by the State.

- (a) Rigid Pavements - The current design catalogs for rigid pavements (see Index 623.1) are based on AASHTOware™ ME software. The design catalogs are to be used for rigid pavement design on State owned and operated highways. Using AASHTOware™ to independently design or refine data from these catalogs is not permissible because the design catalogs take into consideration other factors not currently addressed in the AASHTOware™ ME software.
- (b) Flexible Pavements - The Caltrans ME design procedure for flexible pavement is being implemented on select projects (mostly long life project with 40-year design life) as determined by Districts and HQ Pavement Program. Districts are encouraged to identify candidate projects for ME design and work with the HQ Pavement Program (Office of Asphalt Pavements) to perform the required design and conduct the additional testing needed to develop material specifications. The ME method for flexible pavement design (both new construction and rehabilitation) has been encoded into two programs: CalME and CalBack. Additional information on these two programs is given in Chapter 630. To date, the ME method has been used in the design and construction of four projects: one in southern California, one in Central California, and two in Northern California. The Department is currently fine tuning the ME process particularly with regard to materials testing and selection in preparation for future statewide implementation. Future use of the ME method will not be limited to long-life projects but to all flexible pavement projects on the State highway system or other roads maintained by the State; 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.

Indexes 633.2 and 633.3 provides detailed information on ME design procedures as related to new construction, widening, reconstruction, and rehabilitation of flexible pavements. Additional information on flexible pavement ME design procedures can be found on the “ME Designer’s Corner” on the Pavement Program’s intranet site.

#### **606.4 Proprietary Items**

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