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## **CHAPTER 1 INTRODUCTION**

### **1.1 OVERVIEW**

This chapter presents an overview of pavement preservation purpose, concept, benefits, and pavement preservation treatment selection and the optimal timing for a treatment. This chapter also provides the fundamentals of flexible pavements, which provides a basic understanding of the factors affecting flexible pavement performance. A brief description of various distresses and distress mechanism associated with flexible pavements is also provided.

### **1.2 PURPOSE OF PAVEMENT PRESERVATION**

The purpose of pavement preservation is to keep good pavements in good or near new conditions by applying the right maintenance strategies at the right time to extend pavement life and preserve investments. This section briefly describes the definition, concept, benefits of pavement preservation and importance of treatment selection and the optimal timing for the treatments used.

#### *1.2.1 Definition*

Pavement preservation, as defined by FHWA, is a program employing a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety and meet motorist expectations (FHWA, 2016). A pavement preservation program consists primarily of three components: preventive maintenance, minor rehabilitation (restoration), and some routine maintenance (FHWA, 2016). A pavement preservation program does not include pavements that require major rehabilitation or reconstruction.

#### *1.2.2 Pavement Preservation Concept*

Pavement preservation is a proactive approach in maintaining the existing highways. An effective pavement preservation program addresses pavements while they are still in good condition and before the onset of serious damage. By applying a cost-effective treatment

at the right time, the pavement can be restored almost to its original condition. The cumulative effect of systematic, successive preservation treatments is to postpone or delay costly rehabilitation and reconstruction (FHWA, 2016). The pavement preservation treatments restore the function of the existing system and extend its life by reducing aging and restoring its serviceability, not increase its capacity or strength. Performing a series of successive pavement preservation treatments during the life of a pavement is less disruptive to uniform traffic flow than long closures normally associated with reconstruction projects (FHWA, 2016).

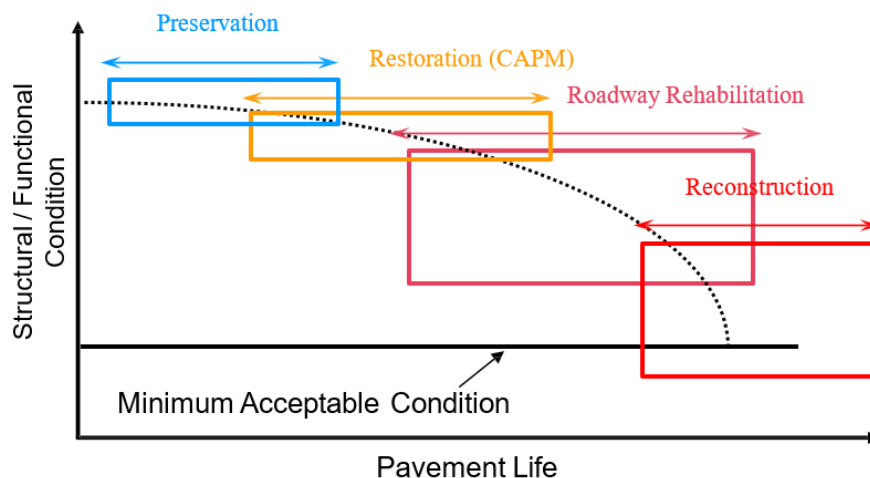
Pavement preservation is not simply a maintenance program, but an agency program. Essentials for an effective pavement preservation program include agency leadership, a dedicated annual budget, and support and input from staff in planning, finance, design, construction, materials, and maintenance.

### 1.2.3 Benefits of Pavement Preservation

An effective pavement preservation program can benefit Caltrans by preserving the roadway network, enhancing pavement performance, ensuring cost-effectiveness by extending pavement life, and reducing user delays by delaying major rehabilitation or reconstruction projects. Some of these benefits may be noticed immediately and some may be realized over time (Galehouse, Moulthrop, and Hicks, 2003).

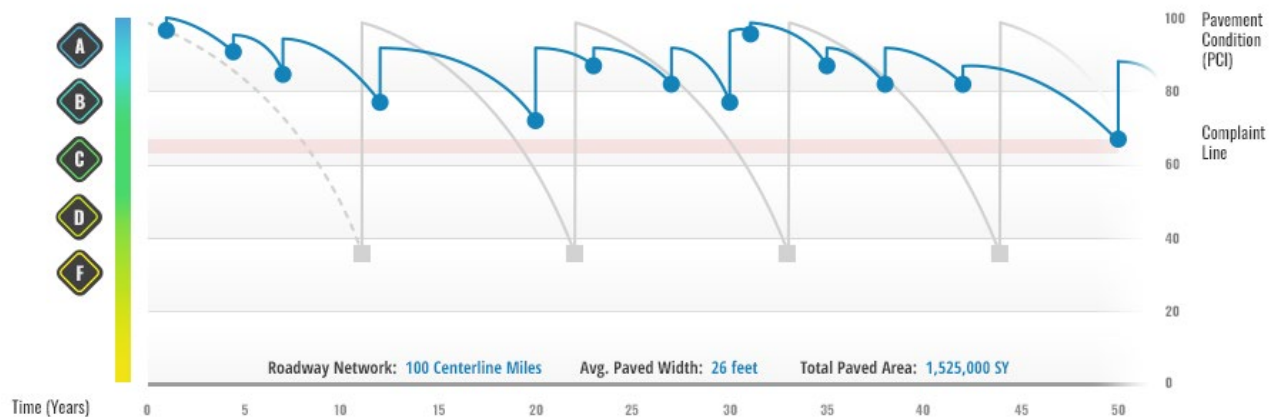
### 1.2.4 Treatment Selection and the Optimum Timing for the Treatment

Figure 1-1 shows how a flexible pavement would typically perform under traffic and with time (dotted line). Various types of treatment stages are also shown in the figure. It clearly indicates that the pavement preservation should be carried out at early stage of the pavement life while it is still in good condition both structurally and functionally. If the pavement is not maintained effectively, it will eventually deteriorate to where the only choice is reconstruction, which is the costliest option.



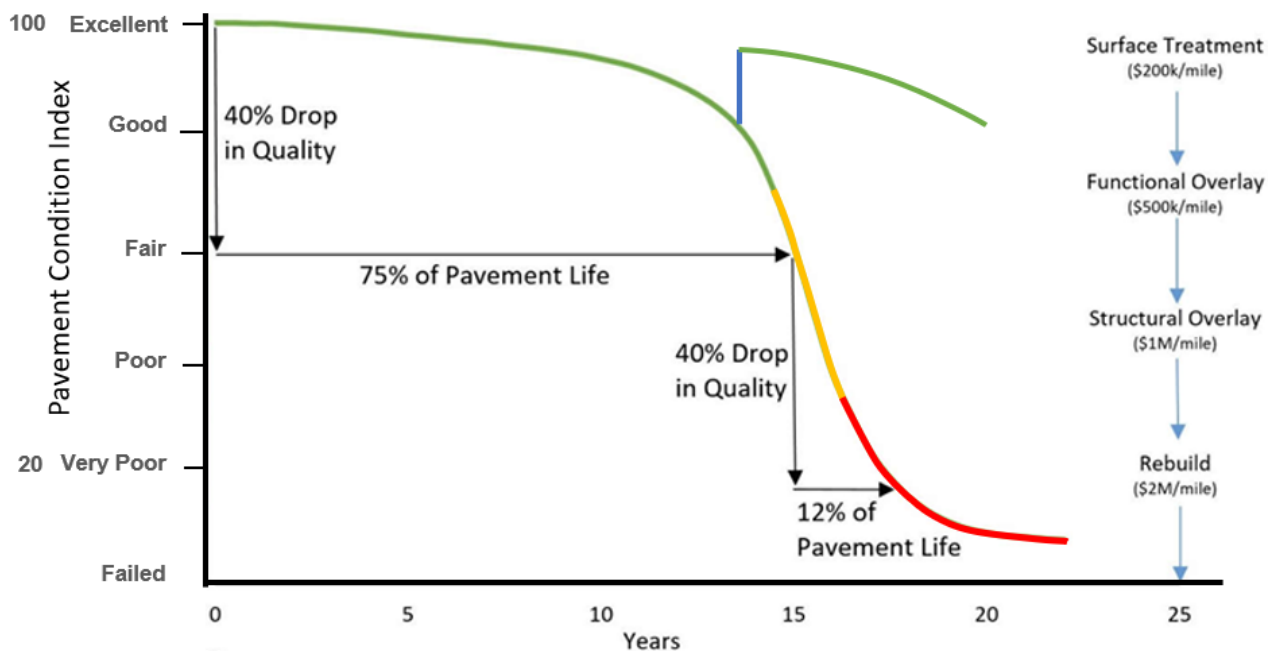
**Figure 1-1 Typical Pavement Performance Curve and Maintenance/Rehabilitation Time**

The timing of the application of the treatment has a significant influence on the effectiveness of the treatment in prolonging the performance of the pavement; therefore, applying the right treatment to the right pavement at the right time is the core of pavement preservation. Timely application of a successive treatment can maintain the pavement in good condition and prolong the need for more expensive roadway rehabilitation and reconstruction strategies, as shown in Figure 1-2. This figure illustrates the concept of timely application of a treatment is important to maintain the existing pavement condition. The frequency of applying treatment will depend on the type of treatment that has been used and their life expectancy.



**Figure 1-2 Concept of Optimal Timing for Pavement Preservation (PPRA 2025)**

The timely application of preservation treatments is important as they not only improve pavement condition but also save money over the life of a pavement. Reconstruction or extensive dig-out and replacement strategies are far more costly than applying pavement preservation treatments. Figure 1-3 shows an example of the relative costs of preventive maintenance treatments in 2021 versus major rehabilitation treatments or reconstruction. When treatments are properly timed, preventive maintenance can produce savings over the life of the pavement (Gorrill Palmer 2022). In addition, subsequent maintenance treatments can be applied in a relatively quick manner resulting in fewer disruptions to the traveling public and less exposure to traffic for maintenance employees as compared with major rehabilitation or reconstruction activities.



**Figure 1-3 Pavement Deterioration Curve and Associated Costs**

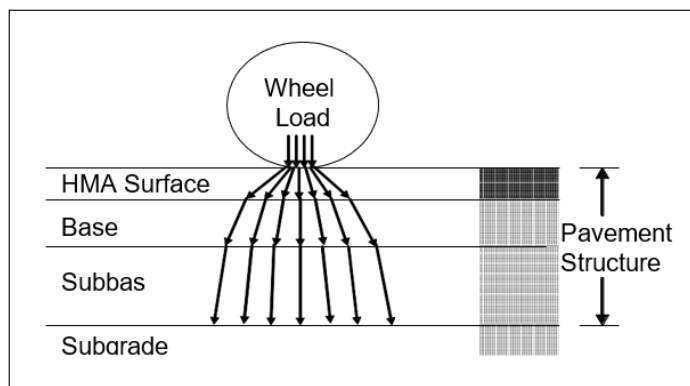
### 1.3 FUNDAMENTALS OF FLEXIBLE PAVEMENTS

#### 1.3.1 Function of Pavements

Pavements are constructed to serve two primary functions. First, they serve the traveling public by providing a smooth and skid-resistant surface upon which vehicles may safely travel. Second, they must be structurally capable of withstanding the traffic and environmental loads that are imposed upon them. A pavement may be considered failed if it does not adequately serve either one of these two functions.

Flexible pavements are one of several pavement types. They are the most common pavement types and are typically built with a Hot-Mix Asphalt (HMA) surface or an asphalt surface treatment. Flexible pavements are very effective in providing load-carrying capacity, resisting distortion, providing a smooth riding surface, minimizing the intrusion of moisture from the surface, resisting traffic wear, and retaining anti-skid properties.

Flexible pavements typically consist of several layers of paving materials, as illustrated in Figure 1-4, which are built on natural soil, normally referred to as the subgrade soil. The top portion of the subgrade soil is compacted prior to placing the subbase or base. The subgrade soil ultimately carries all traffic loads. Thus, the function of a flexible pavement structure is to support a wheel load on the pavement surface and to spread or distribute the applied loads to the subgrade soil without exceeding its strength or that of various overlying pavement layers. Therefore, layers near the surface are generally constructed with paving materials of increasing quality and load-carrying capability.



**Figure 1-4 Typical Flexible Pavement Structure and Stress Distribution (NHI, 2001)**

### 1.3.2 Factors Affecting Pavement Performance

There are a number of factors that contribute to pavement distress and loss in performance. The key factors that can affect pavement performance and/or impact pavement preservation treatment selection include:

- Subgrade Soil
- Pavement Materials Characteristics
- Traffic Loading
- Environment

#### **Subgrade Soil**

Pavement structures must rely upon the strength and stiffness of the underlying subgrade soil for support. As shown in Figure 1-4, one of the functions of a pavement structure is to distribute stress from applied wheel loads so that the subgrade soil is protected from overstress. Because of this load distribution, weak soils require thicker pavements than strong soils to provide the same protection against overstress due to traffic loadings.

In pavement engineering, there are two general characteristics of the soil, its classification and either its strength or stiffness. Soil classification provides the engineer with the gradation and constituents of the subgrade soil. The strength of a material refers to the amount of load or stress it can withstand before failing (either through fracture or high deformation). The stiffness of a material refers to its capacity to resist deformation under applied loading. The two properties are distinctly different; however, they are highly correlated and often used as surrogates for one and other. The primary measures of soil strength include the California Bearing Ratio (CBR) and the unconfined compressive strength. The primary measures of stiffness are Hveem stabilometer (R-value) and elastic (or resilient) modulus. Although many of these measures have been adequate in the past for strength and stiffness characterization, the current trend is to consider more fundamental engineering properties, such as the elastic (or resilient) modulus. The resilient modulus is a measure of the pavement's response under load and is better suited for long-term pavement performance prediction.

## **Pavement Materials Characteristics**

There are many materials that are used in the construction of a pavement. Typically, the individual ingredients or constituents fall under one of four different categories:

- Asphalt Cement
- Aggregate
- Modifiers for Asphalt Cement (e.g., Rubber and Polymers)
- Additives or Stabilizing Agents for Aggregates (e.g., Lime and Cement)

When the various ingredients are combined in proper proportions, they produce mixes (e.g., HMA, stabilized bases/subbases) that ultimately make up the structural components of the pavement. High quality materials, good mixing and construction practices, and good quality control/quality assurance will help maximize the ultimate load-carrying capacity of the pavement.

Adding polymer to asphalt binders provides several benefits. First, the addition of polymer improves the overall performance and durability of the asphalt pavement. The polymer enhances the binder's resistance to aging and weathering, increasing its lifespan and reducing maintenance needs. This is particularly important in areas with extreme temperature variations or heavy traffic loads. Second, polymer-modified asphalt binders exhibit improved flexibility and elasticity compared to traditional non modified asphalt binders. This enhanced elasticity helps the pavement withstand deformation and cracking caused by traffic loads or thermal expansion and contraction. Consequently, polymer-modified asphalt pavements are less prone to rutting, fatigue cracking, and other forms of distress, leading to improved pavement quality and longevity. Moreover, the addition of polymer also improves the adhesion properties of the asphalt binder. This enhanced adhesive characteristic results in better bonding between the asphalt binder and aggregate particles, leading to a stronger and more durable pavement structure. Additionally, polymer modification improves the resistance of asphalt binders to moisture damage. The polymer forms a coating around the aggregate particles, protecting them from moisture intrusion and reducing the potential for stripping and raveling of the pavement. Overall, the addition of polymer to asphalt binders enhances the material's performance, durability, flexibility, adhesion, and resistance to moisture. This results in improved pavement quality, reduced maintenance costs, and extended service life of asphalt pavement.

Structural (or physical) characteristics of the pavement system have a significant impact on pavement performance. Structural characteristics for HMA pavements primarily include the layer types and their thicknesses. These characteristics can be controlled during the design and construction process. Another factor that influences pavement material properties and consequently affects pavement performance is the variation in material properties that occurs in construction and rehabilitation operations. For example, failure to achieve proper compaction, variable moisture conditions during construction uniformity and quality of paving materials, and as-built layer thickness all directly affect performance.

## **Traffic Loading**

Pavements are designed and constructed to withstand the stresses and strains caused by repeated wheel loadings that are sustained over the course of their life. Therefore, it is

important to have a good knowledge of the amount of traffic loading expected on a pavement. The proper structure design of a pavement relies upon developing an accurate forecast of future loadings, which should include the following:

- Average Daily Traffic, ADT (initial number of vehicles per day)
- Future Projections (annual growth rate by vehicle type)
- Truck Factors or Load Equivalency Factors (to convert the distribution of vehicle loads into an equivalent number of load applications that can be used for design)
- Lane Distribution (percent of trucks in design lane)
- Directional Distribution (percent of trucks in design direction)

These factors are combined with the design period (up to 40 years for long-life pavements) to derive the 18,000 lb. Equivalent Single Axle Load (ESAL) applications that must be sustained by the “design lane” (i.e., the pavement lane that carries the most ESAL applications and for which the pavement structure or overlay will be designed). Caltrans Mechanistic-Empirical Structural Analysis Program for Flexible Pavements (CalME) uses weigh-in-motion data. For preservation treatments, the traffic factors are not as important as for the design of new pavements.

## Environment

Moisture and temperature are two key environmental factors that have a significant impact on pavement performance:

- **Moisture:** Moisture enters a pavement structure through cracks in the surface, laterally from poor draining ditches, and from the underlying water table through capillary action. The presence of moisture in the soil and underlying layers of the pavement structure, weakens those materials and thereby reduces their load-carrying capacity. The presence of moisture in an HMA layer can lead to a phenomenon known as stripping, which is the separation of asphalt cement from aggregate particles in the mix. Moisture in the soil in regions where freezing occurs can result in differential frost heave and thaw weakening. In addition, moisture changes in some clay soils can cause volume changes and pavement distortion and roughness. Because of the effects of moisture on pavement performance, significant attention should be given to drainage during pavement design and construction.
- **Temperature:** At high temperatures, HMA softens and therefore, pavement is more likely to experience permanent deformation (rutting) under wheel loading. At low temperatures, HMA will shrink (due to thermal contraction) and contribute to transverse (thermal) cracking. Also, at low to intermediate temperatures, HMA can become brittle and susceptible to fatigue cracking.

## 1.4 FLEXIBLE PAVEMENT DISTRESSES

Typical pavement structures include asphalt mix layer(s), with or without any untreated or treated aggregate base layers, over the subgrade soil. Flexible pavement preservation

typically includes thin overlays or bituminous seals (as described in Caltrans Standard Specification, Section 37).

In general, thin overlay, as defined in this Guide, is a non-structural layer and is applied as a maintenance treatment, either corrective or preventive. Bituminous seals are intended to improve functional performance. The pavement distresses and distress mechanisms for flexible pavements can generally be classified into the following categories:

- Cracking
- Deformation
- Deterioration
- Mat problems

The type of treatment will depend on the types of distress, extent and severity of the distresses. In general, pavement preservation treatments should be applied to pavements with little or minor distresses to preserve the pavements while they are still in a good condition.

Distress photos shown in this chapter are from “*Guide to the Investigation and Remediation of Distress in Flexible Pavements*” (Caltrans, 2003) and “*Distress Identification Manual for the Long- Term Pavement Performance Program*” (FHWA, 2014). RoadResource.com also has a number of distress photos.

#### 1.4.2 Cracking

**Longitudinal** – Cracks that are approximately parallel to pavement centerline and are not in the wheel path. Longitudinal cracks are non-load associated cracks. Location within the lane (wheel path versus non-wheel path) is significant. Longitudinal cracks in the wheel path are normally rated as Alligator ‘A’ cracking.



**Figure 1-5 Longitudinal Cracks**

**Fatigue** – Cracks in asphalt layers that are caused by repeated traffic loadings. The cracks indicate fatigue failure of the asphalt layer. Hence, the term fatigue cracking is used. When cracking is characterized by interconnected cracks, the cracking pattern resembles that of an alligator’s skin or chicken wire. Therefore, it is also referred to as alligator cracking.



**Figure 1-6 Fatigue Cracks**

**Transverse** – Cracks that are predominately perpendicular to pavement centerline and are not located over Portland cement concrete joints.



**Figure 1-7 Transverse Cracks**

**Reflective** – Cracks in HMA overlay surfaces that occur over joints in concrete or over cracks in HMA pavements.



**Figure 1-8 Reflective Cracks**

**Block** – A pattern of cracks that divides the pavement into approximately rectangular pieces. Rectangular blocks range in size from approximately 0.1 square yard to 12 square yards.



**Figure 1-9 Block Cracks**

**Edge** – Crescent-shaped cracks or fairly continuous cracks that intersect the pavement edge and are located within 2 feet of the pavement edge, adjacent to the unpaved shoulder. Includes longitudinal cracks outside of the wheel path and within 2 feet of the pavement edge.



**Figure 1-10 Edge Cracks**

### 1.4.3 Deformation

**Rutting** – Longitudinal surface depression that develops in the wheel paths of flexible pavement under traffic. It may have been associated with transverse displacement.



**Figure 1-11 Rutting**

**Corrugations** – Transverse undulations appear at regular intervals due to the unstable surface course caused by stop-and-go traffic.



**Figure 1-12 Corrugations**

**Shoving** – A longitudinal displacement of a localized area of the pavement surface. It is generally caused by braking or accelerating vehicles, and is usually located on hills or curves, or at intersections. It also may have vertical displacement.



**Figure 1-13 Shoving**

**Depression** – Small, localized surface settlement that can cause a rough, even hazardous ride to motorists.



**Figure 1-14 Depression**

**Overlay Bumps** – In newly overlaid pavements, bumps occur where cracks in old pavements were recently filled. This problem is most prevalent with thin overlays.



**Figure 1-15 Overlay Bumps**

#### 1.4.4 Deterioration

**Delamination** – Loss of a large area of pavement surface. Usually there is a clear separation of the pavement surface from the layer below.



**Figure 1-16 Delamination**

**Slippage** - Cracking may often occur as a result of poor bonding or adhesion between layers due to paving over a dirty surface.



**Figure 1-17 Slippage**

**Potholes** – Bowl-shaped holes of various sizes in the pavement surface. The minimum plan dimension is 6 inches.



**Figure 1-18 Potholes**

**Patching** – Portion of pavement surface, greater than 0.1 sq. yard, that has been removed and replaced or with additional material applied to the pavement after original construction.



**Figure 1-19 Patching**

**Raveling** – Wearing away of the pavement surface in high-quality hot mix asphalt concrete that may be caused by the dislodging of aggregate particles and loss of asphalt binder.



**Figure 1-20 Raveling**

**Stripping** – The loss of the adhesive bond between asphalt cement and aggregate, most often caused by the presence of water in asphalt concrete, which may result in raveling, loss of stability, and load carrying capacity of the HMA pavement or asphalt treated base.



**Figure 1-21 Stripping**

**Polished Aggregate** – Polishing of stone due to traffic and weather.



**Figure 1-22 Non-polished (Lt.) Versus Polished Aggregate (Rt.)**

**Pumping** – Seeping or ejection of water and fines from beneath the pavement through cracks.



**Figure 1-23 Pumping**

### 1.4.5 Construction Related Issues

**Segregation** – Separation of coarse aggregate from fine aggregate as a result of mishandling of the mix at several points during mix production, hauling, and placing operations. Segregation leads to non-uniform surface texture and non-uniform density.



**Figure 1-24 Segregation (HMA)**

**Checking** – Short transverse cracks, usually 1 inch to 3 inches in length and 1 inch to 3 inches apart, which occur in the surface of the HMA mat at some time during the compaction process. The cracks do not extend completely through the depth of the course but are only 3/8 to 1/2-inch deep.



**Figure 1-25 Checking**

**Bleeding** – Excess bituminous binder occurring on the pavement surface. May create a shiny, glass-like, reflective surface that may be tacky to the touch. Usually found in the wheel paths.



**Figure 1-26 Bleeding (HMA)**

**Rock Loss** – Wearing away of the pavement surface in seal coats.



**Figure 1-27 Rock Loss**

**Bleeding/Fat Spot** – Excess binder occurring on the surface treated pavements. May create a shiny, glass-like, reflective appearance. Fat spots are localized bleeding.



**Figure 1-28 Bleeding/Fat Spot (Seal Coats)**

Distress types under each category along with primary mechanisms for each distress are summarized in Table 1-1 to Table 1-4. Note that many of these types of distress also occur on HMA patched or recycled surfaces and mechanisms for causing these distresses are similar to those of HMA.

**Table 1-1 Distress Types and Mechanisms - Cracking**

Type	Mechanism
<p><b>Longitudinal (Alligator A)</b></p>	<p>Poorly constructed paving joint, shrinkage of surface layer due to temperature cycling or hardening of the asphalt. Longitudinal cracking can be load or non-load related depending on the location of the crack within the travel lane.</p> <p>Longitudinal crack in the wheel path also refers to the initial stage of fatigue (alligator) cracking. Note: longitudinal cracking due to thermal and/or shrinkage will be considered under the transverse and block-cracking categories.</p>
<p><b>Fatigue (Alligator B)</b></p>	<p>Repeated applications of tensile strain due to wheel loading cause the initiation (and propagation) of a crack at the bottom of the HMA layer. A secondary type of fatigue cracking that occurs in thick HMA layers from the top-down. This surface-initiated fatigue cracking is associated with the state of stress directly below a tire and usually takes much longer to appear than bottom-up cracking in thinner HMA layers.</p>

**Table 1-1 Distress Types and Mechanisms - Cracking (Continued)**

Type	Mechanism
<b>Transverse</b>	Inadequate bonding between paving lanes due to poor construction techniques (improper joint compaction), shrinkage of asphalt surface due to low temperatures or hardening of asphalt cement, or reflective cracks caused by cracks below the surface. Transverse cracks caused by low temperature are thermal cracks due to contractive forces and restraint, supplied by 1) friction on the bottom of the HMA surface and 2) the continuity of the HMA layer itself, that causes the tensile stress to build up, which can exceed the tensile strength of the HMA layer thus initiating cracking.
<b>Reflective</b>	Typically appears in an overlay due to movements in a crack or joint in the underlying pavement. Development is especially likely when the pavement below is a PCCP with long joint/crack spacings and poor load transfer.
<b>Block</b>	Shrinking and hardening of the asphalt due to age and/or environment (temperature).
<b>Edge</b>	Excessive vehicle loading (stress) at pavement edge. The problem is usually related to poor geometry, inadequate shoulders, and/or poor drainage near the pavement edge.

**Table 1-2 Distress Types and Mechanisms - Deformation**

Type	Mechanism
<b>Rutting</b>	Excessive vertical compressive stresses on the HMA surface, base and subgrade soil causing non-recoverable permanent deformation in one or all layers in the pavement structure.
<b>Corrugations</b>	Plastic movement in the HMA surface layer caused by traffic action on HMA with too much asphalt, too much fine aggregate, or smoothed coarse aggregate. Appearance is that of a washboard and it has a definite influence on ride quality.
<b>Shoving</b>	Plastic movement in the HMA surface layer caused by traffic action on HMA with too much asphalt, too much fine aggregate, or smoothed coarse aggregate. The distress usually appears in localized areas and the deformation can be longitudinal as well as vertical.
<b>Depression</b>	Localized consolidation or movement of the supporting layers beneath the surface course due to weak or instable material.
<b>Overlay Bumps</b>	Excessive uneven stress concentration at the crack caused by unstable crack filler, unstable HMA with low shear strength, and excessive moisture in the crack.

**Table 1-3 Distress Types and Mechanisms - Deterioration**

Type	Mechanism
<b>Delamination</b>	Loss of bond between the surface and the layer below causing surface layer to be easily peeled off.
<b>Potholes</b>	Traffic loads causing pavement to disintegrate because of inadequate strength in one or more layers of the pavement, usually accompanied by the presence of water.
<b>Patching</b>	Crack, settlement, or distortion in patched areas when the underlying cause of the original pavement defect is not corrected or that the utility trench was not properly backfilled forming a weak support underneath.
<b>Raveling</b>	The result of a loss of adhesion between the asphalt binder and the aggregate causing the loss of material from pavement surface.
<b>Stripping</b>	The presence of a prolonged high-moisture condition (together with an aggregate with a high-stripping potential) in asphalt bound layers leads to the debonding of the asphalt binder from the aggregate particles.
<b>Polished Aggregate</b>	Surface binder worn away to expose aggregate due to traffic action and/or mix properties. Polished aggregate can occur quickly if the aggregate is susceptible to abrasion.
<b>Pumping</b>	Seeping or ejection of water and fines from beneath the pavement through cracks or joints under the applications of heavy vehicle loadings.

**Table 1-4 Distress Types and Mechanisms - Construction Related Issues**

Type	Mechanism
<b>Segregation</b>	Improper mix handling during laydown of HMA causing coarse aggregate to separate from fine aggregate and the compacted mix does not have desired density and uniformity.
<b>Checking</b>	Primarily caused by two factors: excessive deflection of the pavement structure under compaction equipment and one or more deficiencies in the asphalt mix design. Incorrect mix design could result in a tender mix that has very low resistance to deformation under horizontally applied shearing loads after compaction has been completed. The tender mixes normally resulted from a lack of inter-particle friction or shear strength and were generally material properties and/or construction related.
<b>Bleeding</b>	During hot weather, the asphalt binder fills the aggregate voids. When the mix has too few air voids or an excessive amount of binder, the excess binder is forced to the pavement surface, resulting in bleeding.

**Table 1-4 Distress Types and Mechanisms - Construction Related Issues  
 (Continued)**

Type	Mechanism
<b>Rock Loss</b>	Lack of bonding between aggregate and binder, plus traffic action causing rock breaking away from the compacted mixture. This problem occurs in chip sealed pavements.
<b>Segregation</b>	Materials not properly mixed and placed during construction therefore not having a desired uniformity, strength and ability to sustain traffic action.
<b>Bleeding / Fat Spots</b>	Due to excess binder.
<b>Delamination</b>	Loss of bond between the surface treatment and the existing surface causing surface treatment material to separate from the existing pavement surface.

## 1.5 DISTRESS TREATMENTS

One purpose of this guide is to provide guidance on selecting the most appropriate strategies to address various pavement distresses described earlier by applying pavement preservation treatments. Chapter 2 provides information on material usage for pavement preservation while Chapter 3 presents a framework for treatment selection. The various treatment strategies are described in detail in Chapters 4 through 14.

For distresses that are related to the existing pavement structure, pavement preservation treatments will not be appropriate; separate rehabilitation design(s) will need to be developed on a project basis. Nevertheless, the distress mechanisms described in the guide will still be useful for the development of the rehabilitation design. Table 1-5 provides general guidelines for appropriate pavement preservation treatments of various types of distresses. As can be seen, preservation treatments are primarily useful for low distress levels. This suggests, as the distress levels increase, preservation treatments become less effective.

**Table 1-5 General Treatment Guidelines for HMA Distress**

Category	Type	Low Severity Level	Medium Severity Level	High Severity Level
<b>Bituminous Seals</b>	Rock Loss	Yes	Yes	Yes
	Segregation	Yes	Yes	Yes
	Bleeding / Fat Spots	Yes	Yes	No
	Delamination	Yes	No	No
<b>Cracking</b>	Longitudinal	Yes	No	No
	Fatigue	Yes	No	No
	Transverse	Yes	No	No
	Reflective	Yes	No	No
	Block	Yes	No	No
	Edge	Yes	No	No
<b>Deformation</b>	Rutting	Yes	No	No
	Corrugations	Yes	No	No
	Shoving	Yes	No	No
	Depression	Yes	No	No
	Overlay Bumps	Yes	No	No
<b>Deterioration</b>	Delamination	Yes	No	No
	Potholes	Yes	No	No
	Patching	Yes	No	No
	Raveling	Yes	No	No
	Stripping	No	No	No
	Polished Aggregate	Yes	No	No
	Pumping	No	No	No
<b>Mat Problems</b>	Segregation	Yes	No	No
	Checking	Yes	Yes	No
	Bleeding	Yes	No	No
	Segregation	Yes	Yes	Yes
	Bleeding / Fat Spots	Yes	Yes	No
	Delamination	Yes	No	No

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*Note: Caltrans manuals referenced above may have later editions than those cited. Refer to the latest editions of these references for the most current information.*