

APPENDIX A

PAVEMENT PRESERVATION DEFINITIONS

(FHWA, SEPTEMBER 12, 2005)



U.S. Department
of Transportation
**Federal Highway
Administration**

Memorandum

Subject: **ACTION**: Pavement Preservation Definitions

Date: September 12, 2005

(Original Signed by David R. Geiger, P.E.)

From: David R. Geiger, P.E.
Director, Office of Asset Management

Reply to
Attn. of: HIAM-20

To: Associate Administrators
Directors of Field Services
Resource Center Director and Operations Manager
Division Administrators
Federal Lands Highway Division Engineers

As a follow-up to our Preventive Maintenance memorandum of October 8, 2004, it has come to our attention that there are differences about how pavement preservation terminology is being interpreted among local and State transportation agencies (STAs). This can cause inconsistency relating to how the preservation programs are applied and their effectiveness measured. Based on those questions and a review of literature, we are issuing this guidance to provide clarification to pavement preservation definitions.

Pavement preservation represents a proactive approach in maintaining our existing highways. It enables STAs to reduce costly, time consuming rehabilitation and reconstruction projects and the associated traffic disruptions. With timely preservation we can provide the traveling public with improved safety and mobility, reduced congestion, and smoother, longer lasting pavements. This is the true goal of pavement preservation, a goal in which the FHWA, through its partnership with States, local agencies, industry organizations, and other interested stakeholders, is committed to achieve.

A Pavement Preservation program consists primarily of three components: preventive maintenance, minor rehabilitation (non structural), and some routine maintenance activities as seen in figure 1.

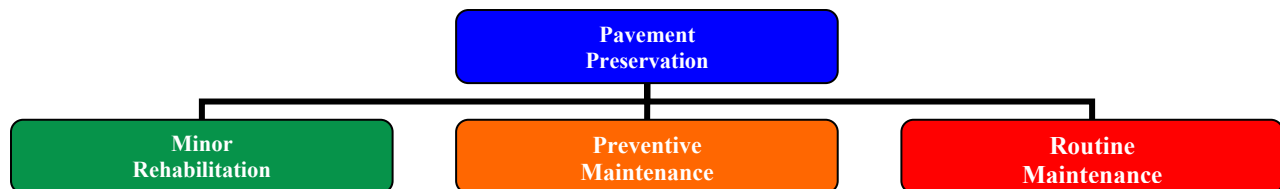


Figure 1: Components of Pavement Preservation



An effective pavement preservation program can benefit STAs by preserving investment on the NHS and other Federal-aid roadways, enhancing pavement performance, ensuring cost-effectiveness, extending pavement life, reducing user delays, and providing improved safety and mobility.

It is FHWA's goal to support the development and conduct of effective pavement preservation programs. As indicated above, pavement preservation is a combination of different strategies which, when taken together, achieve a single goal. It is useful to clarify the distinctions between the various types of maintenance activities, especially in the sense of why they would or would not be considered preservation.

For a treatment to be considered pavement preservation, one must consider its intended purpose. As shown in Table 1 below, the distinctive characteristics of pavement preservation activities are that they restore the function of the existing system and extend its service life, not increase its capacity or strength.

Pavement Preservation Guidelines					
	Type of Activity	Increase Capacity	Increase Strength	Reduce Aging	Restore Serviceability
	New Construction	X	X	X	X
	Reconstruction	X	X	X	X
	Major (Heavy) Rehabilitation		X	X	X
	Structural Overlay		X	X	X
	Minor (Light) Rehabilitation			X	X
Pavement Preservation	Preventive Maintenance			X	X
	Routine Maintenance				X
	Corrective (Reactive) Maintenance				X
	Catastrophic Maintenance				X

Table 1- Pavement Preservation Guidelines

Definitions for Pavement Maintenance Terminology

Pavement Preservation 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.”

Source: FHWA Pavement Preservation Expert Task Group

An effective pavement preservation program will address 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 is restored almost to its original condition. The cumulative effect of systematic, successive preservation treatments is to postpone costly rehabilitation and reconstruction. During the life of a pavement, the cumulative discount value of the series of pavement preservation treatments is substantially less than the discounted value of the more extensive, higher cost of reconstruction and generally more economical than the cost of major rehabilitation. Additionally, performing a series of successive pavement preservation treatments during the life of a pavement is less disruptive to uniform traffic flow than the long closures normally associated with reconstruction projects.

Preventive Maintenance is “a planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system (without significantly increasing the structural capacity).” *Source: AASHTO Standing Committee on Highways, 1997*

Preventive maintenance is typically applied to pavements in good condition having significant remaining service life. As a major component of pavement preservation, preventive maintenance is a strategy of extending the service life by applying cost-effective treatments to the surface or near-surface of structurally sound pavements. Examples of preventive treatments include asphalt crack sealing, chip sealing, slurry or micro-surfacing, thin and ultra-thin hot-mix asphalt overlay, concrete joint sealing, diamond grinding, dowel-bar retrofit, and isolated, partial and/or full-depth concrete repairs to restore functionality of the slab; e.g., edge spalls, or corner breaks.

Pavement Rehabilitation consists of “structural enhancements that extend the service life of an existing pavement and/or improve its load carrying capacity. Rehabilitation techniques include restoration treatments and structural overlays.” *Source: AASHTO Highway Subcommittee on Maintenance*

Rehabilitation projects extend the life of existing pavement structures either by restoring existing structural capacity through the elimination of age-related, environmental cracking of embrittled pavement surface or by increasing pavement thickness to strengthen existing pavement sections to accommodate existing or projected traffic loading conditions. Two sub-categories result from these distinctions, which are directly related to the restoration or increase of structural capacity.

Minor rehabilitation consists of non-structural enhancements made to the existing pavement sections to eliminate age-related, top-down surface cracking that develop in flexible pavements due to environmental exposure. Because of the non-structural nature of minor rehabilitation techniques, these types of rehabilitation techniques are placed in the category of pavement preservation.

Major rehabilitation “consists of structural enhancements that both extend the service life of an existing pavement and/or improve its load-carrying capability.” *Source: AASHTO Highway Subcommittee on Maintenance Definition*

Routine Maintenance “consists of work that is planned and performed on a routine basis to maintain and preserve the condition of the highway system or to respond to specific conditions and events that restore the highway system to an adequate level of service.” *Source: AASHTO Highway Subcommittee on Maintenance*

Routine maintenance consists of day-to-day activities that are scheduled by maintenance personnel to maintain and preserve the condition of the highway system at a satisfactory level of service. Examples of pavement-related routine maintenance activities include cleaning of roadside ditches and structures, maintenance of pavement markings and crack filling, pothole patching and isolated overlays. Crack filling is another routine maintenance activity which consists of placing a generally, bituminous material into “non-working” cracks to substantially reduce water infiltration and reinforce adjacent top-down cracks. Depending on the timing of application, the nature of the distress, and the type of activity, certain routine maintenance activities may be classified as preservation. Routine Maintenance activities are often “in-house” or agency-performed and are not normally eligible for Federal-aid funding.

Other activities in pavement repair are an important aspect of a STA’s construction and maintenance program, although they are outside the realm of pavement preservation:

Corrective Maintenance activities are performed in response to the development of a deficiency or deficiencies that negatively impact the safe, efficient operations of the facility and future integrity of the pavement section. Corrective maintenance activities are generally reactive, not proactive, and performed to restore a pavement to an acceptable level of service due to unforeseen conditions. Activities such as pothole repair, patching of localized pavement deterioration, e.g. edge failures and/or grade separations along the shoulders, are considered examples of corrective maintenance of flexible pavements. Examples for rigid pavements might consist of joint replacement or full width and depth slab replacement at isolated locations.

Catastrophic Maintenance describes work activities generally necessary to return a roadway facility back to a minimum level of service while a permanent restoration is being designed and scheduled. Examples of situations requiring catastrophic pavement maintenance activities include concrete pavement blow-ups, road washouts, avalanches, or rockslides.

Pavement Reconstruction is the replacement of the entire existing pavement structure by the placement of the equivalent or increased pavement structure. Reconstruction usually requires the complete removal and replacement of the existing pavement structure. Reconstruction may utilize either new or recycled materials incorporated into the materials used for the reconstruction of the complete pavement section. Reconstruction is required when a pavement has either failed or has become functionally obsolete.

If you need technical support or further guidance in the pavement preservation area, please contact Christopher Newman in the FHWA Office of Asset Management at (202) 366-2023 or via e-mail at Christopher.Newman@fhwa.dot.gov.

FHWA:HIAM-20:LLAWNDY:63975:11:08/22/05

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Preservation Definitions Memo 081605.doc

APPENDIX B

GLOSSARY OF TERMS (Adopted from AASHTO)

Adhesion – Bond between a sealant material and the crack or joint sidewall or the bond between asphalt cement and aggregate.

Agency Costs – See Annual Costs.

Aggregate Interlock – The projection of aggregate particles or portions of aggregate particles from one side of a joint or crack in concrete into recesses in the other side of the joint or crack so as to affect load transfer in compression and shear and maintain mutual alignment.

Analysis Period – The period of time used in making economic comparisons between rehabilitation alternatives. The analysis period should not be confused with the pavement's design life (performance period).

Annual Costs – Any costs associated with the annual maintenance and repair of the facility.

Application Temperature – The manufacturer's recommended temperature to be used when installing sealant. For hot-applied sealants, the application temperature is any temperature between the minimum application temperature and safe heating temperature.

Asset Management – A systematic process of maintaining, upgrading, and operating physical assets cost-effectively. It combines engineering principles with sound business practices and economic theory, and it provides tools to facilitate a more organized, logical approach to decision-making. Thus, asset management provides a frame work for handling both short and long-range planning.

Backer Material – A compressible material that is placed in joints or cracks before applying sealant to prevent bonding of the sealant on the bottom of the joint, control sealant depth, and prevent sagging of the sealant.

Bituminous Pavement – A pavement comprising an upper layer or layers of aggregate mixed with a bituminous binder, such as asphalt, coal tars, and natural tars for purposes of this terminology; surface treatments such as chip seals, slurry seals, sand seals, and cape seals are also included.

Blow-up – Buckling and shattering of PCC pavement resulting from thermal expansion and the resultant compressive forces exceeding the strength of the material.

Bond Breaker – Any material used to prevent bonding or to separate adjacent pavement layers. Thin bituminous layers are often used as bond breaker layers between a concrete pavement and an unbonded concrete overlay.

Bonded Concrete Overlay – Increase in the pavement structure of a concrete pavement by addition of

concrete thickness in direct contact with and adhering to the existing concrete surface. May be used to correct either functional or structural deficiencies.

California Profilograph – Rolling straight edge tool used for evaluating pavement profile (smoothness) consisting of a 7.5m (25-ft) frame with a sensing wheel located at the center of the frame that senses and records bumps and dips on graph paper or in a computer.

Carbide Milling – Surface removal or sawing done with a carbide milling machine. Machine uses a blade or arbor equipped with carbide-tipped teeth that impact and chip concrete or asphalt.

Chemically Curing Sealant – A material that reaches its final properties through the reaction of the component materials when mixed.

Cohesion – The internal bond within a joint sealant material. Cohesion loss is seen as a noticeable tear along the surface and through the depth of the sealant.

Cold Applied Sealant – A crack-sealing compound that is applied in an unheated state (generally at ambient temperature) and then reaches final properties through a curing process.

Compressible Insert – Material used to separate freshly placed concrete (such as from a partial-depth or full-depth repair) from existing hardened concrete. This usually consists of a 12-mm (0.5 in) thick Styrofoam or compressed fiber material that is impregnated with asphalt.

Concrete – See Portland Cement Concrete

Construction Joint – A joint constructed in a transverse direction in PCC pavements to control cracking of the slab as it cures. Highway construction joints are created by sawing the concrete.

Continuously Reinforced Concrete Pavement (CRCP) – PCC pavement constructed with sufficient longitudinal steel reinforcement to control transverse crack spacings and openings in lieu of transverse contraction joints for accommodating concrete volume changes and load transfer.

Corner Break – A portion of a concrete slab separated by a crack that intersects the adjacent transverse or longitudinal joints at about a 45° angle with the direction of traffic. The length of the sides is usually from 0.3 meters (1 ft) to one-half of the slab width on each side of the crack.

Corrective Maintenance – Maintenance performed once a deficiency occurs in the pavement; e.g., pothole filling, or spall repair.

CPR (Concrete Pavement Restoration) – A series of repair techniques used to preserve or improve the structural capacity or functional characteristics of a PCC pavement. CPR techniques each have a unique purpose to repair or replace a particular distress (kind of deterioration) found in PCC pavement and to manage the rate of deterioration. CPR

techniques include:

- Full-depth repair
- Partial-depth repair
- Diamond grinding
- Joint and crack resealing
- Slab stabilization
- Dowel Bar Retrofit
- Cross-stitching cracks or longitudinal joints
- Retrofitting concrete shoulders
- Retrofitting edge drains

Crack – Fissure or discontinuity of the pavement surface not necessarily extending through the entire thickness of the pavement. Cracks generally develop after initial construction of the pavement and may be caused by thermal effects, excess loadings, or excess deflections.

Crack Filling – The placement of materials into non-working cracks to substantially reduce the intrusion of incompressibles and infiltration of water, while also reinforcing the adjacent pavement. Crack filling should be distinguished from crack sealing (see below).

Crack Sealing – A maintenance procedure that involves placement of specialized materials into working cracks using unique configurations to reduce the intrusion of incompressibles into the crack and to prevent infiltration of water into the underlying pavement layers. (See Working Crack.)

Cross Stitching – A repair method that involves the drilling of holes diagonally across a crack in PCC pavement into which steel reinforcement bars are inserted and epoxied in place. The holes are alternated from side to side of the crack on a pre-determined spacing. This technique is generally used for longitudinal cracks that are still in no worse than fair condition. Cross-stitching increases slab integrity by adding steel reinforcement to hold the crack together.

Cure – A period of time following placement and finishing of a material such as concrete during which desirable engineering properties (such as strength) develop. Improved properties may be achieved by controlling temperature or humidity during curing.

Curing – The maintenance of a satisfactory moisture content and temperature in concrete during its early stages so that desired properties may develop.

Curing Blanket – A built-up covering of burlap sacks, matting, straw, waterproof paper, or other suitable material placed over freshly finished concrete.

Curing Compound – A liquid that can be applied as a coating to the surface of newly placed concrete to retard the loss of water, or in the case of pigmented compounds, also to reflect heat so as to provide an opportunity for the concrete to develop its properties in a favorable temperature and moisture environment. See also Curing.

Depression – Localized pavement surface areas at a lower elevation than the adjacent paved

areas.

Design Life – The expected life of a pavement from its opening to traffic until structural rehabilitation is needed. The typical reporting of pavement design life does not include the life of the pavement with the application of preventive maintenance. (See also Analysis Period and Performance Period.)

Diamond Grinding – A process that uses a series of diamond-tipped saw blades mounted on a shaft or arbor to shave the upper surface of a pavement to remove bumps, restore pavement rideability, and improve surface friction. (See also CPR)

Discount Rate – The rate of interest reflecting the investor's time value of money used to determine discount factors for converting benefits and costs occurring at different times to a baseline date. Discount rates can incorporate an inflation rate depending on whether real discount rates or nominal discount rates are used. The discount rate is often approximated as the difference between the interest rate and the inflation rate.

Dowel – Most commonly a plain round steel bar (usually coated, such as with paint or epoxy), which extends into two adjoining slabs of a PCC pavement at a transverse joint placed parallel to the center line so as to transfer shear loads.

Dowel Bar Retrofit – A rehabilitation technique that is used to increase the load transfer capability of existing jointed PCC pavements by placement of dowel bars across joints and/or cracks that exhibit poor load transfer. (See also CPR)

Equivalent Uniform Annual Cost (EUAC) – The net present value of all discounted cost and benefits of an alternative as if they were to occur uniformly throughout the analysis period. Net Present Value (NPV) is the discounted monetary value of expected benefits (i.e., benefits minus costs).

Faulting – Differential vertical displacement of a slab or other member adjacent to a joint or crack. Faulting commonly occurs at transverse joints of PCC pavements that do not have adequate load transfer.

Free Edge – An unrestrained pavement boundary.

Fuel Resistant Sealant – A joint or crack sealant compound that is resistant to and maintains serviceability after being exposed to fuel or other petroleum products.

Full-Depth Patching – Removal and replacement of a segment of pavement to the level of the subgrade in order to restore areas of deterioration. May be either flexible or rigid pavement.

Functional Performance – A pavement's ability to provide a safe, smooth riding surface. These attributes are typically measured in terms of ride quality (see International Roughness Index) or skid resistance (see International Friction Index).

Grinding Head – Arbor or shaft containing numerous diamond blades or carbide teeth on diamond grinding or cold milling equipment.

Grooving – The process used to cut slots into a pavement surface (usually, although not always, PCC) to provide channels for water to escape beneath tires, improving skid resistance and reducing the potential for hydroplaning.

Hot Applied Sealant – A crack or joint sealing compound that is applied in a molten state and cures primarily by cooling to ambient temperature.

Hot Mix Asphalt Concrete (HMAC or HMA) – A thoroughly controlled mixture of asphalt binder and well-graded, high quality aggregate thoroughly compacted into a uniform dense mass. HMAC pavements may also contain additives such as anti-stripping agents and polymers.

Hydroplaning – Loss of contact between vehicle tires and roadway surface that occurs when vehicles travel at high speeds on pavement surfaces with standing water.

Initial Costs – All costs associated with the initial design and construction of a facility, placement of a treatment, or any other activity with a cost component.

International Friction Index (IFI) – A measure of pavement macrotexture and wet pavement friction at 60 miles per hour determined using measured friction at some test speed and macrotexture determined using ASTM E-965 or ASTM E-1845.

International Roughness Index (IRI) – A measure of a pavement's longitudinal surface profile as measured in the wheelpath by a vehicle traveling at typical operating speeds. It is calculated as the ratio of the accumulated suspension motion to the distance traveled obtained from a mathematical model of a standard quarter car traversing a measured profile at a speed of 80 km/h (50 mph). The IRI is expressed in units of meters per kilometer (inches per mile) and is a representation of pavement roughness.

Joint – A pavement discontinuity made necessary by design or by interruption of a paving operation.

Joint Depth – The measurement of a saw cut from the top of the pavement surface to the bottom of the cut.

Joint Deterioration – See Spalling.

Joint Filler – Compressible material used to fill a joint to prevent the infiltration of debris.

Joint Sealant – Compressible material used to minimize water and solid debris infiltration into the sealant reservoir and joint.

Joint Seal Deterioration - Break down of a joint or crack sealant, such as by adhesion or cohesion loss, which contributes to the failure of the sealant system. Joint seal

deterioration permits incompressible materials or water to infiltrate into the pavement system.

Joint Shape Factor – Ratio of the vertical to horizontal dimension of the joint sealant. Factor can vary depending on type of sealant specified.

Jointed Plain Concrete Pavement (JPCP) – PCC pavement constructed with regularly spaced transverse joints to control all natural cracks expected in the concrete. Dowel bars may be used to enhance load transfer at transverse contraction joints (depending upon the expected traffic); however, there is no mid-slab temperature reinforcement.

Jointed Reinforced Concrete Pavement (JRCP) – Portland cement concrete pavement containing regularly spaced transverse joints and embedded steel mesh reinforcement (sometimes called distributed steel) to control expected cracks. Steel mesh is discontinued at transverse joint locations. Dowel bars are normally used to enhance load transfer at transverse joints. The transverse joint spacing of JRCP is typically longer than the joint spacing of JPCP.

Lane-to-Shoulder Dropoff – (highways, roads and streets only) Difference in elevation between the traveled surface and the shoulder surface.

Life Cycle Costing – An economic assessment of an item, system, or facility and competing design alternatives considering all significant costs of ownership over the economic life, expressed in terms of equivalent dollars.

Life Extension – The extension of the performance period of the pavement through the application of pavement treatments.

Load-Transfer Assembly – Most commonly, the basket or carriage designed to support or link dowel bars in the desired alignment during jointed PCC pavement construction.

Load Transfer Efficiency – A measure of the ability of a joint or crack to transfer a portion of a load applied on one side of a joint or crack to the other side of the joint or crack.

Longitudinal Crack – A crack or discontinuity in a pavement that runs generally parallel to the pavement centerline. Longitudinal cracks may occur as a result of poorly constructed paving lane joints, thermal shrinkage, inadequate support, reflection from underlying layers, or as a precursor to fatigue cracking.

Longitudinal Joint – A constructed joint in a pavement layer that is oriented parallel to the pavement centerline.

Low Modulus Sealant – A joint or crack sealing material, which is less stiff at low temperatures than standard grade sealants.

Maximum Heating Temperature – The maximum temperature, as recommended by the manufacturer, to which a hot-applied joint or crack sealant can be heated while

conforming to all specification requirements and result in appropriate application characteristics.

Melter – A piece of equipment designed specifically to heat hot applied joint or crack sealant accurately and controllably to a temperature where it will flow.

Melter Applicator – A piece of equipment designed specifically to melt, heat accurately and controllably, and apply hot-applied sealants to pavement cracks or joints.

Mineral Filler – A finely divided mineral product with at least 70% passing the No. 200 sieve. Commonly used mineral fillers include, limestone dust, hydrated lime, portland cement, and fly ash.

Minimum Application Temperature – The minimum temperature, as recommended by the manufacturer, to which a hot-applied sealant for pavement cracks or joints must be heated while conforming to all specification requirements and result in appropriate application characteristics.

Net Present Value – The value of future expenditures or costs discounted to today's dollars using an appropriate discount rate.

Overbanding – Overfilling of a joint or crack reservoir so that a thin layer of crack or joint sealant is spread onto the pavement surface center over the joint or crack.

Partial-Depth Patching – Repairs of localized areas of surface deterioration of PCC pavements, usually for compression spalling problems, severe scaling, or other surface problems that are within the upper one-third of the slab depth.

Patch – Placement of a repair material to replace a localized defect in the pavement surface.

Pavement Distress – External (visible) indications of pavement defects or deterioration.

Pavement Preservation – The sum of all activities undertaken to provide and maintain serviceable roadways. This includes corrective maintenance and preventive maintenance, as well as minor rehabilitation projects.

Pavement Preventive Maintenance – Planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system (without increasing the structural capacity).

Pavement Reconstruction – Replacement of an existing pavement structure by the placement of the equivalent of a new pavement structure. Reconstruction usually involves complete removal and replacement of the existing pavement structure and may include new and/or recycled materials.

Pavement Rehabilitation – Structural enhancements that extend the service life of an existing pavement and/or improve its load carrying capability. Rehabilitation techniques include restoration treatments and structural overlays.

Performance Period – The period of time that an initially constructed or rehabilitated pavement structure will perform before reaching its terminal serviceability.

Point Bearing – Concentration of compressive stressed between small areas. May occur when a partial-depth patch in portland cement concrete pavement is made without the compressible insert. Also, slab expansion in hot weather forces an adjacent slab to bear directly against a small partial-dept patch and causes the patch to fail by delaminating and popping out of place.

Polishing – Wearing away of the surface binder, causing exposure of the coarse aggregate particles. A polished pavement surface is smooth and has reduced skid resistance.

Portland Cement Concrete Pavement (PCC) – A pavement constructed of portland cement concrete with or without reinforcement. Conventional PCC pavements include JPCP, JRCP, and CRCP.

Preformed Compression Sealant – An extruded joint sealing material for PCC pavement that is manufactured ready for installation and is supplied in rolls. Preformed sealants incorporate an internal web design so that the material, when compressed and inserted into the sealant reservoir, remains in compression against the sides of the joint.

Present Serviceability Index (PSI) – A subjective rating of the pavement condition made by a group of individuals riding over the pavement. May also be determined based on condition survey information.

Present Worth – See Net Present Value.

Pumping – Ejection of fine-grained material and water from beneath the pavement through joints, cracks, or the pavement edge, caused by the deflection of the pavement under traffic loadings.

Reactive Maintenance – Maintenance applied to restore a pavement to an acceptable level of service due to unforeseen conditions. Activities, such as pothole repairs, performed to correct random or isolated localized pavement distresses or failures, are considered reactive. Similar to Corrective Maintenance.

Reflection Cracking – Cracking that appears on the surface of a pavement above joints and cracks in the underlying pavement layer due to horizontal and vertical movement of these joints and cracks.

Reservoir – The part of a portland cement concrete pavement joint that normally holds a sealant material, usually formed by a widening saw cut above the initial saw cut. Reservoirs may also be found in HMA pavements where joints are sawed and sealed above existing PCC pavements.

- Retrofit Dowel Bars** – Dowels that are installed into slots cut into the surface of an existing concrete pavement to restore load transfer.
- Rideability** – A measure of the ride quality of a pavement as perceived by its users or roughness measuring equipment.
- Router** – A mechanical device, with a rotary cutting system, that is used to widen, cut, and clean cracks in pavements prior to sealing.
- Routine Maintenance** – Maintenance work that is planned and performed on a routine basis to maintain and preserve the condition of the highway system or to respond to specific conditions and events that restore the highway system to an adequate level of service. Examples include crack sealing, fog sealing, and repair of localized failed areas of pavement.
- Rubberized Asphalt Sealant** – A sealant, generally hot applied, that is composed of asphalt cement, various types of rubber or polymer modifiers, and other compounding ingredients used for pavement crack and joint sealing. Many grades and ranges of properties are available.
- Sandblasting** – A procedure in which sand particles are blown with compressed air at a pavement surface to abrade and clean the surface. Sandblasting is a construction step in partial-depth patching and joint resealing.
- Sealant** – A material that has adhesive and cohesive properties to seal joints, cracks, or other various openings against the entrance or passage of water or other debris in pavements (generally less than 76 mm (3 in) in width).
- Sealant Reservoir** – See Reservoir.
- Sealing** – The process of placing sealant material in prepared joints or cracks to minimize intrusion of water and incompressible materials. This term is also used to describe the application of pavement surface treatments.
- Sealing Compound** – See Joint Sealant.
- Segregation** – Separation of aggregate component of asphaltic or portland cement by particle size during placement.
- Serviceability** – Ability of a pavement to provide a safe and comfortable ride to its users. As such, it is primarily a measure of the functional capacity of the pavement.
- Settlement** – A depression at the pavement surface that is caused by the settling or erosion of one or more underlying layers.

Silicone Sealant – A type of joint or crack sealant compound either self leveling or non-sag in application characteristics that is based on polymers of polysiloxane structures and cures through a chemical reaction when exposed to air.

Skid Resistance – A measure of the frictional characteristics of a surface.

Slab Stabilization – Process of injecting grout or bituminous materials beneath PCC pavements in order to fill voids without raising the pavement.

Spalling, Compression – Cracking, breaking, chipping, or fraying of slab edges within 0.6 meters (2-ft) of a transverse crack.

Spalling, Sliver – Chipping of concrete edge along a joint sealant usually within 12 mm (0.5in) of the joint edge.

Spalling, Surface – Cracking, breaking, chipping, or fraying of slab surface, usually within a confined area less than 0.5 square meters (0.6 sy).

Structural Condition – The condition of a pavement as it pertains to its ability to support repeated traffic loadings.

Structural Overlay – An increase in the pavement load carrying capacity by adding additional pavement layers.

Surface Texture – The microscopic and macroscopic characteristics of the pavement surface that contribute to surface friction and noise.

Swell - A hump in the pavement surface that may occur over a small area or as a longer, gradual wave; either type of swell can be accompanied by surface cracking.

Terminal Serviceability – The lowest acceptable serviceability rating before resurfacing or reconstruction becomes necessary for the particular class of highway.

Transverse Crack – A discontinuity in a pavement surface that runs generally perpendicular to the pavement centerline. In HMA pavements, transverse cracks often form as a result of thermal movements of the pavement or reflection from underlying layers. In PCC pavements, transverse cracks may be caused by fatigue, loss of support, or thermal movements.

Treatment Life – The period of time during which a treatment application remains effective. Treatment life is contrasted with Life Extension.

Two Component Sealant – A sealant supplied in two components which must be mixed at a specified ratio prior to application in order to cure to final properties.

Unbonded Overlay – Increase in the pavement structure of an existing concrete or composite pavement by addition of jointed plain, jointed reinforced or continuously reinforced

concrete pavement placed on a separator layer (usually an asphalt layer) designed to prevent bonding to the existing pavement.

User Costs – Costs incurred by highway users traveling on the facility, and the excess costs incurred by those who cannot use the facility because of either agency or self-imposed detour requirements. User costs typically are comprised of vehicle operating costs (VOC), crash costs, and user delay costs. To be differentiated from agency costs.

Warranty – Contractual agreement between an approved contractor/vendor and the agency soliciting bids, that uses specific performance measures to protect the agency from responsibility of repair due to premature defects in material and/or workmanship.

Waterblasting – The use of a high-pressure water stream (8500 to 10,000 psi) to clean PCC. It may be used in PCC joint resealing to remove sawing laitance or in patching to produce a clean surface prior to placement of the sealer or patch material. Also referred to as hydroblasting.

Working Crack – A crack in a pavement that undergoes significant deflection and thermal opening and closing movements greater than 2 mm (1/16 in), typically oriented transverse to the pavement centerline.

APPENDIX C

LIST OF ACRONYMS

Acronyms	Description
AASHTO	American Association of Highway and Transportation Officials
ACPA	American Concrete Pavement Association
ACR	Alkali-carbonate reaction
ADT	Average daily traffic
ASR	Alkali-silica reaction
ASTM	American Standards for Testing and Materials
Caltrans	California Department of Transportation
CPR	Concrete pavement restoration
CPX	Close-Proximity method
CRCP	Continuously reinforced concrete pavement
CTM	California Test Methods
CTMeter	Circular Texture Meter
DBR	Dowel bar retrofit
DOT	Department of Transportation
ESAL	Equivalent single axle loads
EUAC	Equivalent uniform annual cost
FHWA	Federal Highway Administration
FP2	Foundation for Pavement Preservation
FWD	Falling weight deflectometer
HMA	Hot-mix asphalt
HMWM	High-molecular-weight methacrylate
IGGA	International Grooving and Grinding Association
IRI	International Roughness Index
ISO	International Standards Organization
JPCP	Jointed plan concrete pavements
JRCP	Jointed Reinforced Concrete Pavement
LCCA	Life cycle cost analysis
LISA	Lightweight Inertial Surface Analyzer
LTE	Load Transfer Efficiency
MLP	Multi-Laser Profiler
MnDOT	Minnesota Department of Transportation
MPD	Mean Profile Depth
MSDS	Material safety data sheets
MTAG	Maintenance Technical Advisory Guide
MTD	Mean Texture Depth
NCHRP	National Cooperative Highway Research Program
NCPP	National Center for Pavement Preservation
NDT	Non destructive testing
NHI	National Highway Institute
OFT	Outflow time
PCA	Portland Cement Association
PCC	Portland cement concrete

Acronyms	Description
PM	Preventive Maintenance
PSR	Pavement Serviceability Rating
PV	Present value
PVC	Poly-vinyl chloride
ROSAN	Road Surface Analyzer
RTRRMS	Response-type road roughness measuring systems
SHRP	Strategic Highway Research Program
SI	International System of units or Metric System
SI	Sound intensity method
SPB	Statistical Pass-By method
SSD	Saturated surface dry
SSPs	Standard Special Provisions
STAs	State transportation agencies
TI	Traffic index
TRB	Transportation Research Board

APPENDIX D

USEFUL WEBSITES

Source	Web Link
AASHTO Lead States Program	http://leadstates.transportation.org/pp/research_protocols.stm
ACPA	http://www.pavement.com/
Caltrans	http://www.dot.ca.gov/hq/esc/oe/specifications/std_specs/2006_StdSpecs/ http://www.dot.ca.gov/hq/maint/PavePres/ppindex.htm http://www.dot.ca.gov/hq/oppd/pavement/guidance.htm http://www.dot.ca.gov/hq/esc/approved_products_list/
FHWA	http://www.fhwa.dot.gov/pavement/pub_listing.cfm?areas=Concrete http://www.fhwa.dot.gov/pavement/pres.cfm http://www.fhwa.dot.gov/pavement/preservation/ppcl00.cfm
Foundation for Pavement Preservation	http://www.fp2.org/
NCPP	http://www.pavementpreservation.org/library/libraryindex.php
PCA	http://www.cement.org/
UC Berkeley, Institute of Transportation Studies	http://www.techtransfer.berkeley.edu/pavementpres/#prelim

APPENDIX E*

**CALIFORNIA DEPARTMENT OF TRANSPORTATION
Surface Treatment
Review Checklist and Evaluation**

District ____ Project EA _____ Work Type Code ____

Program HA HM Warranty

Type of Review: General Review Test Site Review District Request

Other _____

Review Requested By District: _____

Review Requested By Person: _____

Surface Treatment Type: _____

Project Location: County _____ Rte _____ PM From _____ PM TO _____

Description: Route Class # ADT % Truck IRI

Reason for Use of Surface Treatment: PM CM CAPM REHAB

Pre-Construction Review Follow Up 1 Follow Up 2 Follow Up 3

Date of Review: _____

Reviewers: _____

* Example only. This is for asphalt concrete pavements

Drive through Checklist

Note specific areas to review : **By GPS OR Post Mile**

Sample Site #1 _____ Sample Site #2 _____

Sample Site #3 _____ Over View _____

Scoring System:	Very Poor 1-3	Poor 4-6	Acceptable 7	Good 8-9	Excellent 10
------------------------	-------------------------	--------------------	------------------------	--------------------	------------------------

1. OVERVIEW AND RIDE QUALITY

Overview of Project: 1 2 3 4 5 6 7 8 9 10
 (Overall impression of project based on drive-through, windshield inspection)

Rideability: 1 2 3 4 5 6 7 8 9 10
 (Smoothness)

Appearance: 1 2 3 4 5 6 7 8 9 10
 (Consistent surface texture and/or color, blemishes, fattiness/flushing, raveling)

Laydown: 1 2 3 4 5 6 7 8 9 10
 (Joints, Edges, overlaps, starts and finishes, corrugations)

Misc. Surface Conditions: 1 2 3 4 5 6 7 8 9 10
 (Spillage, consistency, loose aggregate, discarded materials, pickup and carry over)

Method of Review: Review outside lane – Make a note of any problems in the inside lanes if different from condition of outside lane.

EVALUATION

Scoring System:	Very Poor 1-3	Poor 4-6	Acceptable 7	Good 8-9	Excellent 10
------------------------	-------------------------	--------------------	------------------------	--------------------	------------------------

Cracking:

Rt Lane Up Station

Rt Lane Down Station

	<u>Rt Lane Up Station</u>							<u>Rt Lane Down Station</u>							
	Type	Size	LT	RT	Pumping	L ong or Trans	Size	Type	Size	Lt Wheel Tract	RT Wheel Tract	Pumping	Long or Trans	Size	
	A or B	Hairline <1/4, > 1/4, < 1/2, > 1/2,						A or B	Hairline <1/4,>1/4 <1/2,>1/2						
SS #1	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
SS #2	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
SS #3	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
OV	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Total Score:

SS#1 Comments

SS#2 Comments

SS#3 Comments

Over View Comments

EVALUATION

Scoring System:	Very Poor 1-3	Poor 4-6	Acceptable 7	Good 8-9	Excellent 10
------------------------	-------------------------	--------------------	------------------------	--------------------	------------------------

Rutting

Rt Lane Up Station

Rt Lane Down Station

Lt Whl Depth Length Rt Whl Depth Length

Lt Whl Depth Length Rt Whl Depth Length

SS#1

SS#3

Over View

Rutting Score:

SS#1 Comments

SS#2 Comments

SS#3 Comments

Over View Comments

EVALUATION

Scoring System:	Very Poor 1-3	Poor 4-6	Acceptable 7	Good 8-9	Excellent 10
------------------------	--------------------------	---------------------	-------------------------	---------------------	-------------------------

Surface Texture:

Delamination / Potholes:

	<u>Rt Lane Up Station</u>				<u>Rt Lane Down Station</u>			
	Delam	% Of	Potholes	Number Of	Delam	% Of	Potholes	Number Of
Sample Site #1	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Sample Site #2	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Sample Site #3	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Over View	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Total Score:

SS#1 Comments

SS#2 Comments

SS#3 Comments

Over View Comments

EVALUATION

Scoring System:	Very Poor 1-3	Poor 4-6	Acceptable 7	Good 8-9	Excellent 10
------------------------	-------------------------	--------------------	------------------------	--------------------	------------------------

Flushing / Bleeding:

Rt Lane Up Station

LT Whl Length RT Whl Length
 F/B F/B

Rt Lane Down Station

LT Whl Length RT Whl Length
 F/B F/B

Sample Site #1	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Sample Site #2	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Sample Site #3	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Over View	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Total Score:

Comments:

Rich Area

Rt Lane Up Station

Severity Number Length
 L,M,H Of

Rt Lane Down Station

Severity Number Length
 L M H Of

Sample Site #1	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Sample Site #2	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Sample Site #3	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Over View	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Rich Area Score

Comments:

EVALUATION

Scoring System:	Very Poor 1-3	Poor 4-6	Acceptable 7	Good 8-9	Excellent 10
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Raveling (surface blemishes):

Rt Lane Up Station

Rt Lane Down Station

RT Lane **Severity** **Length**
 Yes / No L,M,H

RT Lane **Severity** **Length**
 Yes / No L,M,H

Sample Site #1

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

Sample Site #2

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

Sample Site #3

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

Over View

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

Raveling Score

Comments

Aggregate polishing or crushing:

Rt Lane down Station

Rt Lane Down Station

Type **Lt Whl** **Rt Whl** **Length**
 P/C Track Track

Type **LT Whl** **RT Whl** **Length**
 P/C Track Track

Sample Site #1

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------	--------------------------

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------	--------------------------

Sample Site #2

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------	--------------------------

Sample Site #3

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------	--------------------------

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------	--------------------------

Over View

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------	--------------------------

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------	--------------------------

AGG/ Polish Score

2. RAMPS, CONNECTORS & INTERSECTIONS

EVALUATION

Very Poor 1-3	Poor 4-6	Acceptable 7	Scoring System:	Good 8-9	Excellent 10
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Ramps:

1 2 3 4 5 6 7 8 9 10

Cracking Rutting Bleeding Raveling

Polishing Crushing Score

Connectors:

1 2 3 4 5 6 7 8 9 10

Cracking Rutting Bleeding Raveling

Polishing Crushing Score

Intersections:

1 2 3 4 5 6 7 8 9 10

Cracking Rutting Bleeding Raveling

Polishing Crushing Score

EVALUATION

Performance Exceeds Meets Fails Final Score

Final Comments:

Recommendations:

District Major Repairs

	Dig Outs			Overlays			Profile Grind			Seal Coats		
	# Of Lanes	Lene Rep'd	Area Sq Yd	# Of Lanes	Lene Rep'd	Area Sq Yd	# Of Lanes	Lene Rep'd	Area Sq Yd	# Of Lanes	Lene Rep'd	Area Sq Yd
SS#1	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
SS#2	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
SS#3	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Over View	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

SS#1 Comments

SS#2 Comments

SS#3 Comments

Over View Comments

District Minor Repairs

	<u>Crack Seal</u>			<u>Potholes</u>			<u>Skin patches</u>		
	Type Crack	Length L M	Type Material	Lane #	# Lanes	Potholes # of	Lane #	Type Of	Area Sq Yd
SS#1	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
SS#2	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
SS#3	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Over View	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

SS#1 Comments

SS#2 Comments

SS#3 Comments

Over View Comments
