Missouri Department of Transportation (MoDOT) and Federal Highway Administration (FHWA) Missouri Division

Preventive Maintenance Agreement

September, 2020

I. Introduction

Preventive Maintenance (PM) 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: American Association of State Highway and Transportation Officials (AASHTO) Standing Committee on Highways, 1997

PM 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.

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.

Corrective maintenance encompasses work that is performed in reaction to an event, season, or over-all deterioration of the transportation asset. Corrective maintenance work may be re- occurring as necessary until such time as the asset can be otherwise preserved, rehabilitated or reconstructed.

Federal Aid funds may not be used on Routine or Corrective Maintenance.

In accordance with FHWA memorandum, Guidance on Highway Preservation and Maintenance (Appendix B), dated February 25, 2016 *"The State Transportation Department must demonstrate to the satisfaction of their respective FHWA Division Administrator that the activity is a cost-effective means of extending the useful life of a Federal Aid highway."*

The purpose of this document is to identify the activities that FHWA Missouri Division and MoDOT agree to be classified as PM, thus eligible for federal-aid. This document outlines MoDOT's PM plan which uses a systematic process to identify PM activities. The plan will not modify FHWA's program oversight and project approval responsibilities for activities such as those required under the Clean Air Act, the National Environmental Policy Act of 1969, and other related environmental laws and statutes. It

will be MoDOT's responsibility to conduct any necessary environmental reviews to ensure all environmental requirements are met and documented prior to any ground disturbing activities taking place. In addition, as reflected in 23 CFR 625 deviations from design standards for the defined PM activities will not require design exceptions. Standards for the design and construction of all projects on the NHS, including the Interstate system, are applicable to any proposed improvement regardless of the funding source (Federal, State, local or private); therefore deviations from standards for activities classified to exceed PM must have approved design exceptions.

FHWA guidance related to Civil Rights/ADA is included as Appendix C. Alterations, as noted in this guidance includes; a change to a facility in the public right-of-way that affects or could affect access, circulation, or use. Projects altering the use of the public right-of-way must incorporate pedestrian access improvements within the scope of the project to meet the requirements of the ADA. These projects have the potential to affect the structure, grade, or use of the roadway.

Examples of alterations that trigger the requirement of upgrading curb ramps to meet Public Right of Way Accessibility Guidelines (PROWAG) include:

- Open-graded surface course
- Microsurfacing
- Thin lift overlays
- Mill/fill projects
- In-place asphalt recycling

ADA features need not be addressed on corrective maintenance or pavement preservation treatments such as:

- Crack filling and sealing
- Surface sealing
- Chip seals
- Slurry seals
- Fog seals
- Scrub sealing
- Joint crack seals
- Joint repairs

- Dowel retrofit
- Spot high-friction treatments
- Diamond grinding
- Pavement Patching

II. Preventive Maintenance Plan

MoDOT's plan is intended to be used as a guide and process tool for planning and executing PM, by both contract and in-house (force account) methods. Use of force account methods for performing work must receive FHWA approval prior to use or implementation. The plan will also provide assurance to FHWA that we are conducting this effort in accordance with the following Federal Guidance:

Provide a systematic process for planning and executing PM.

Define all PM activities, which extend the service life of the bridge or pavement that federal aid reimbursement are being requested

Demonstrate each activity is cost effective, and for in-house (or force account) work, to demonstrate the activity is in the public's best interest and there is a significant advantage over contracted work.

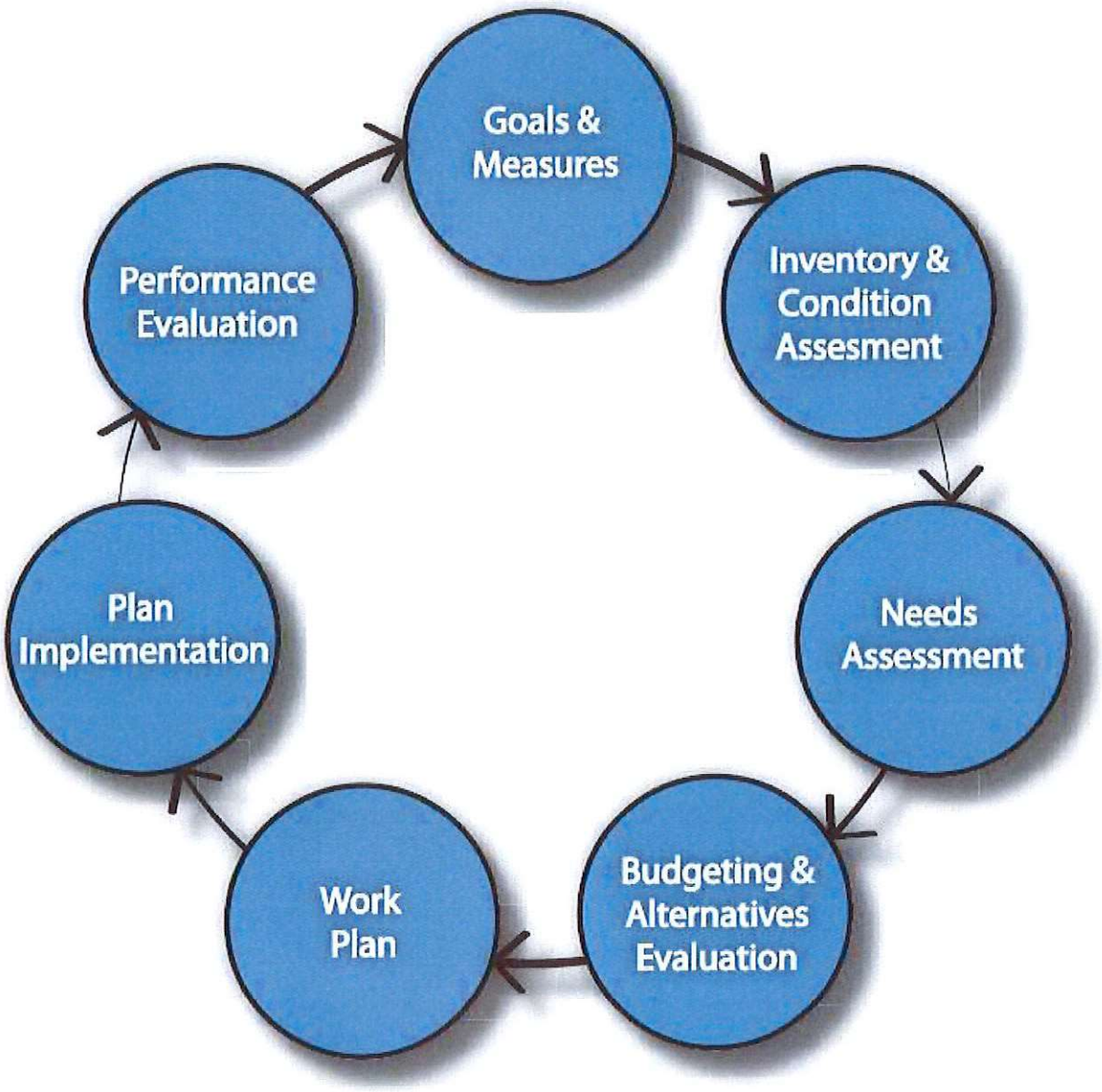
The steps in this process follow the Systematic Preventive Maintenance (SPM) guidance from FHWA, as follows:

1. Goals and Objectives: Clearly defined goals and objectives for the SPM program
2. Define Specific PM Activities: Including existing preservation condition criteria for each activity
3. Inventory and Condition Assessment: Conduct bridge and roadway inspections and evaluation for each project/location
4. Needs Assessment: Documented needs assessment process that outlines how PM needs are identified, prioritized, and programmed.
5. Cost-Effective PM Activities: Ability to demonstrate the PM activities are a cost-effective means of extending the life of a bridge or roadway.
6. Project Identification: Projects with general activity will be identified in the STIP. Detailed annual work plans will be provided with specific identification and tracking (Note: Work planning will be expanded within the Maintenance Management System (MMS) during subsequent work tasks – forecast for 2021).
7. Accomplishing the Work: Availability of tools and resources to accomplish the PM work.
8. Reporting and Evaluation: Ability to track, evaluate, and report on the planned and accomplished PM work on an annual or as-needed basis.

This plan outlines the systematic process for integrating PM into multiple aspects of MoDOT's organization. The goals for extending the life and function of our road and bridge assets provides direction and vision. The process starts with an inventory of assets, which is maintained primarily on our

Transportation Management System (TMS) database. Condition data is collected on a periodic frequency, and stored in the TMS or other databases for use in identifying needs. PM activities are then identified, through collaboration between both District and Headquarters staff, which are both cost effective and appropriate for the condition they are addressing. Specific activities are scoped and scheduled, and may be accomplished through a combination of both contract and in-house efforts. Budgeting for this overall effort is accomplished during the annual budget planning and approval cycle, although specific tasks and priorities may change during the course of each year due to varying priorities and budget constraints or opportunities. The cycle is complete, once results are tracked and reported, and the asset condition is then updated to start this cycle once more. This process is systematic, as this represents a planned strategy of cost-effective treatments to existing assets, with the overall goal of extending the functional life of these assets. This process is also iterative, and different treatments or actions are evaluated on a recurring cycle, such that they may be altered and improved over time to increase effectiveness. This is graphically illustrated, as follows:

Preventive Maintenance Process



III. Goals and Objectives

Bridge goals and objectives - Extend the life of decks and other bridge elements through timely PM activities, including mitigation/removal of corrosion sources and sealing critical or exposed surfaces to prevent further corrosion. Mitigate corrosion through removal of de-icing or corrosive material as well as debris which may hold water/moisture and contribute to oxidation or corrosion. This includes localized repair and sealing of exposed surfaces including decks and critical superstructure and substructure elements.

Pavement goals and objectives – Extend the life of pavements by appropriately timed application of overlays or sealants to reduce weathering/oxidation/corrosion of pavement structure, correct pavement surface geometry, friction restoration and corrections, smoothness correction, promote drainage, and prevent/reduce water intrusion into pavement sections.

Other Roadway Goals and Objectives – Extend the service life of various safety features through application of timely, cyclic and performance-based measures to ensure such items as pavement markings are maintained in visible conditions at all hours throughout the year.

Specific activities which are being requested for consideration of Federal Aid, include:

Bridge:

Bridge Deck Repair

Bridge Deck Sealing

Bridge Flushing

Pavement:

Asphalt Pavement Repair

Concrete Pavement Repair

Chip Seals

Crack Sealing

Pipe Culvert Repair

Other Roadway:

Striping

IV. Inventory and Condition Assessment

Bridge: MoDOT utilizes National Bridge Inventory (NBI) condition ratings and performs PM, including cyclic maintenance on select groups of bridges. MoDOT maintains a number of staff who are trained and qualified to perform these inspections, including a District Bridge Engineer in each of our seven Districts. Inspection information is stored and managed in our Bridge Division, and data is available for use in planning, programming, and design within the Transportation Management System (TMS). District Bridge Engineers work with planners to identify both project needs (STIP) and work plans for PM on an annual basis, utilizing the condition information from TMS, NBI inspection data, as well as good engineering judgment, while balancing the needs and priorities within our financial constraints. Bridge flushing is planned for all bridges on an annual basis to remove debris and chlorides. Bridge deck sealing is identified by District Bridge Engineers as a work item, and subsequently included in the annual work

plan to prevent the intrusion of water and chlorides into decks. Bridge deck repair is evaluated each spring, following annual freeze-thaw cycles. Preventive maintenance for bridge deck repair will consider fair or better ratings on bridge decks, as documented in TMS data, with partial depth repairs applicable when there is competent substrate and full-depth repairs planned where the deck has become saturated and/or cracked/weakened for the full depth.

Pavement: MoDOT obtains various measurements of road surface condition through use of the Automatic Road Analyzer (ARAN) van, including such items as rut depth and IRI (International Roughness Index). This data is evaluated using a Pavement Surface and Evaluation Rating (PASER) system to produce condition ratings for road segments. This system, managed through MoDOT's Transportation Management System (TMS), provides current condition information, as well as theoretical future conditions, packaged within the Pavement Management Tool in the TMS system. The District Pavement Specialists use this condition tool as a guide when planning STIP projects and annual maintenance work plans, where professional judgment and input from Maintenance Superintendents augment the Pavement Management Tool for decision-making. Routes in good condition will be proposed for preventive maintenance treatment, and subsequent Federal reimbursement, and will be confirmed through TMS data for both condition and Federal Aid status. Condition measurements which correspond to "Good" condition rating are noted in Appendix A-2, Pavement PM Activities. The goal is that asphalt pavement repairs are performed in a timeframe such that they are followed by other surface treatments (chip seal, cinder seal, etc.) or overlays within 2 years of the pavement repairs. Typically Major routes have activities planned and programmed in the STIP, while minor routes have activities planned such as contract overlays or other maintenance treatments which may be achieved through contracts or by in-house forces. Additional guidance on pavement maintenance is available in the Engineering Policy Guide, Section 144.5.

Other Roadway: MoDOT uses both performance-based indicators and cyclic scheduling to plan and prioritize such items as pavement marking. Visual night inspections are conducted every other year and random retro-reflectivity readings are taken to add some objective measure of condition. These random retro-reflectivity readings are presented in the MoDOT Tracker assessment. Pavement marking (types and dimension), rumble stripes, centerline stripe, etc., are inventoried on the Striping Application within TMS. Following are the EPG guidelines for acceptable retro-reflectivity readings for various conditions (units in millicandela per meter squared per lux or mcd/m^2/lux).

Pavement Marking Acceptance Table, mcd/m^2/lux		
	White	**Yellow**
New Pavement Markings	300	225
Existing Pavement Markings Expected to Last Through Winter (measured in the fall)	200	175
Pavement Marking Failure Point	150	125

Structural condition of overhead signs and high-mast lighting are in the development stage at this time, however this information will be used for both condition tracking and needs assessment as this effort is implemented.

V. Needs Assessment

Needs and priorities are developed on an ongoing basis in coordination with the Regional Planning Commissions (RPC's) and Metropolitan Planning Organizations (MPO's). All contracts involving federal cost participation are presented in the STIP, while in-house (or force account) efforts are summarized in Section 6 of the STIP. Ongoing coordination with MoDOT Environmental also takes place to ensure all environmental requirements are completed and documented.

Bridge: Bridge inspectors identify and record needs during each bridge inspection. District Bridge Engineers work with NBI inspection data and findings to communicate priorities for rehabilitation and replacement structures for STIP programming. District Bridge Engineers also prepare PM work plans or work item lists, on an annual basis, which are used to schedule contract and in-house efforts. These lists are subject to change with changing priorities and funding opportunities. Central Office staff from Bridge and Maintenance Divisions provides technical assistance and guidelines for timing of PM as well as management of condition and NBI rating data. Preventive maintenance for bridge deck repair will consider fair or better ratings on bridge decks, as documented in TMS data, with partial depth repairs applicable when there is competent substrate (delamination only above the top mat of reinforcing steel) and full-depth repairs planned where the deck has become saturated and cracked/weakened for the full depth. MoDOT Environmental Section will need to be coordinated with on these activities to ensure they are scheduled appropriately so that any necessary consultations with the State Historic Preservation Office occurs prior to the activity taking place.

Pavement: Central Office staff from Maintenance and Planning Divisions provide annual data to districts noting IRI and condition (as presented in TMS), and the District Maintenance Staff prepare annual work plans with input of the District Pavement Specialist and Maintenance Superintendents. This pavement data is often supplemented with field observations, as-built information, and core data. Major routes are primarily addressed in STIP projects, however some major and the majority of minor routes are addressed by the condition and traffic volume to prioritize the PM treatments and the associated cycle of these treatments, which may be accomplished by either in-house forces or contract.

Other Roadway features: MoDOT evaluates a variety of other roadway features to create work plans for maintenance. Pavement marking is evaluated on a similar night time visual review with pass/fail results. Pavement marking is currently scheduled as a cyclic maintenance task, with major routes re-striped every year, and minor routes re-striped every other year. Random retro-reflectivity measurements are conducted for an overall tracker measure, and to provide a qualitative measure of the overall condition of pavement marking. Note: wet retro-reflectivity is currently evaluated subjectively through visual observations, although quantitative test methods are being evaluated on a pilot scale for limited use in product evaluation. Signs and pavement marking are evaluated by Traffic and Maintenance staff. Structural signs, high mast lighting, retaining walls, and sound walls are also candidates for evaluation of

structural condition, and this data will be integrated into this plan, when condition data and reporting are implemented. Due to resource and funding constraints, there is no current schedule forecast for this effort.

VI. Cost Effective Preventive Maintenance Activities

Overall descriptions and strategies for all activities are included in MoDOT's Engineering Policy Guide (EPG), available at the following link: http://epg.modot.org/index.php?title=Main_Page

Specific sections of the EPG are also provided for reference within the Appendices.

Bridge: Strategies for PM activities are listed in Appendix A-1, Bridge PM Strategies. These strategies include guidance on the recommended treatment options, based on the condition and age of an asset, in order to emphasize the right treatment at the right time.

Pavement: Strategies for PM activities are listed in Appendix A-2, Pavement PM Strategies. These strategies include guidance on the recommended treatment options, based on the condition and age of an asset, in order to emphasize the right treatment at the right time.

Other Roadway Features: Strategies for PM activities are listed in Appendix A-3, Other Roadway PM Strategies. These strategies include guidance on the recommended treatment options, based on the condition and age of an asset, in order to emphasize the right treatment at the right time. This category also includes work which is required due to other causes, such as damage due to accidents, where work activity takes place to bring a safety feature back to functional condition quickly to maintain overall highway safety. Note: Federal participation is not allowed on work costs which are recovered through insurance or third parties.

General: PM activities will be executed by combination of in-house resources (force account) and contract efforts. The majority of contract efforts will be awarded based on competitive bid, with limited number including Design Build or other contract methods. Competitively bid contract formats include Job-Order Contracts, General Services Contracts/Proposals, maintenance contracts, and Performance-based maintenance contracts. In-house efforts are typically smaller in scale and geographically spread, which reduce the efficiency for contract efforts, however cost tracking is performed to demonstrate this work is advantageous to the State through lower cost and quicker response due to length of time to bid a project. Specific examples of in-house results/costs compared to competitively bid contract pricing will be submitted separately, for each major category of work. See Appendix D for FHWA memorandum, FHWA Policy on Agency Force Account Use, dated March 12, 2012 for force account eligibility.

VII. Accomplishing the Work

Bridge: Each District is staffed with a District Bridge Engineer, who manages condition rating and work plans/STIP planning efforts related to project work and PM. Bridge inspection results, including condition assessments are documented and recorded within the National Bridge Inventory inspection process, and are stored within the Transportation Management System (TMS) database. In-house efforts are accomplished with crews composed of maintenance staff throughout the District, with some Districts maintaining a limited number of dedicated staff and equipment. Supplies are provided through general

services contracts, and are delivered as needed. Each district also has access to contractor resources, currently through job-order contracts, maintenance contracts, general services contracts, and STIP projects. Additional work is anticipated through the use of performance-based maintenance contracts, as this contract model is developed.

Pavement: Each District is staffed with a District Pavement Specialist, who manages condition assessment of roadways with input from Maintenance Superintendents, Pavement Management System data, and other field observation. Pavement condition is determined through a combination of Automatic Road Analyzer (ARAN) van measurements and associated Pavement Surface Evaluation and Rating (PASER) ratings of the video collected by the ARAN van. This condition assessment data is stored within the TMS database. In-house efforts are accomplished with crews composed of maintenance staff throughout each District. Equipment is maintained for limited number of tasks (surface patching and seal coats) but may also be leased for short-term applications. Supplies are available through general services contracts. Each district also has access to contractor resources, currently through job-order contracts, maintenance contracts, and STIP projects. Additional work is anticipated through the use of performance-based maintenance contracts, as these are developed.

Other Roadway Features: District Maintenance and Traffic staff work with maintenance crews from within their Districts to perform pavement marking, sign replacement, and a limited amount of structural sign repair (note: St. Louis District is the only District with significant crew and equipment for structural sign work by in-house crews while Kansas City District has developed maintenance contracts for shoulder-mounted sign maintenance, but not overhead sign maintenance). Equipment is maintained in each District for pavement marking, while supplies are all provided through general services contract.

Note: Buy America requirements apply to all iron and steel materials permanently incorporated into federal-aid work. General Services contract guidelines for Federal Reimbursement items are provided in Appendix E. Quality Assurance/Quality Control guidelines and documentation are provided in Appendix F.

VIII. Reporting and Evaluation

Bridge: The District Bridge Engineers report on the progress of PM work plans on an annual basis and the District and Bridge Division report on STIP project and overall system condition progress (Tracker). This reporting will include a summary of results achieved and effort expended. Contract efforts will note contract costs, and quantity of road/bridge/other roadway condition improved, while in-house force work will be tracked through the SAM-II system, including the use of performance actual result tracking, where maintenance crews report the quantity of work completed, with their crew reports (listing labor, material, and equipment costs). The in-house system provides summary data for crew/equipment/materials used and associated results achieved. Examples of in-house reporting are provided in specific cost comparisons, submitted individually to FHWA for approval to demonstrate cost effectiveness of select in-house (or force account) efforts as compared to similar contract work.

Pavement: The District Pavement Specialists report on the progress and results of work plans and the District reports on STIP project progress. This tracking is reported in similar fashion as noted for the

Bridge category noted above. The annual updates to the Pavement Management Tool provide quality assurance of the results reporting, as this information is in turn utilized to plan future work.

Other Roadway Features: District Maintenance and Traffic staff track sign and striping overall condition, including retro-reflectivity. This data is compiled in TMS, with condition reporting in Tracker. Any additional condition data which may be obtained in the future will be coordinated with FHWA, as this condition data collection is developed and implemented. Work activities are reported in similar fashion as noted above.

MoDOT Assistant Chief Engineer	**Date** 10/26/20
JEFFREY S BLANTON Digitally signed by JEFFREY S BLANTON Date: 2020.11.04 16:19:58 -06'00'	
FHWA Missouri Division Administrator	**Date**

Appendix A-1

Bridge PM Activities

Bridge PM Activities

Bridge PM activities and descriptions are noted in the Engineering Policy Guide (EPG), Section 771. The following is a summary of recommended activities, including reference information on condition based treatments and recommended frequency of actions.

Bridge Washing: Cyclic activity, with nearly all bridges targeted for flushing in the early spring, in order to remove salts and debris, and again in the fall to remove any accumulated debris. Flushing is also performed in advance of sealing or crack sealing operations. Bridge washing also includes a 1-2 year interval for cleaning substructure elements, including cleaning and lubrication of bearings as applicable. Bridge drains are typically cleaned during deck flushing.

Sealing: Cyclic and condition-based activity. Primary candidates for deck sealing are condition 7 or higher, and the cycle is determined based on the type of sealer applied. Specific examples include: Silane (5-7 year interval), acrylic sealers (annual), asphalt chip seal (5-10 year interval), 3-layer epoxy (12 - 25 years, depending on age of structure at time of application), methacrylate (3-4 year interval), and high molecular weight methacrylate (7 – 15 year interval, under evaluation). Other materials are under evaluation, and may be added to this list as approved. Additionally, some lower condition decks may benefit from deck sealing, and this work may be performed as recommended by District Bridge Engineers.

Crack Sealing: This activity is primarily applied to bridge decks with easily visible cracking (typically NBI deck condition 5 or higher), and is applied on a 3-15 year interval, depending on the treatment. Chip seals and asphalt emulsion crack sealer are applied on bridge decks with more extensive cracking (typically condition 4 and 5 NBI deck condition), on a 3-5 year interval. All treatments noted are planned for a minimum of 3 year service life between treatments, with some approaching 15 year life. Crack sealing need is typically identified by the bridge inspector during National Bridge Inventory inspections (recorded in the TMS database). Typically this is applied to bridge decks where cracking is evident such that sealing alone is not effective. A variety of products are available, with varying treatment intervals (reference approved materials list). Product list/frequency info includes: asphalt emulsion sealers (3-5 year interval), low viscosity epoxy in a single layer application (5-7 year interval anticipated depending on AADT, currently under review), high molecular weight methyl methacrylate (7-15 year interval, currently under review), polymer emulsions (3-5 year interval, under evaluation), polyurea (test sites under evaluation). Crack sealing is dependent on age, location (amount of salt application), AADT, and thermal movement/deflection. Effective life is still undergoing evaluation for a variety of products, and this listing will be updated as data is obtained for various products.

Joint Repairs/Replacement: This is currently an emphasis area, to replace joints identified on work plans during NBI inspections. Various joint types may require a mixture of both in-house forces (when approved by FHWA) and contracts to accomplish. Some example joint materials in use include: pre-compressed joint material system, preformed silicone or polyurea joint strips , but may also include finger plate, flat plate, or other more complex joint systems. Note: Field measurement and evaluation of expansion movement should be checked prior to joint repair selection.

Steel Member overcoat: Typically includes calcium sulfonate overcoat application or cleaning and repainting of structural members. If the rust code is 7 or better and pull-off tests (ASTM D3359) are acceptable for overcoat, then overcoat application is feasible.

Wearing Surface: Includes wearing surface repair or replacement performed by in-house forces (when approved by FHWA) or contract.

Bridge Approach Slab Lifting: Settlement of approach slabs is typically corrected when differential at bridge end is equal to or greater than ½ inch vertical difference. Example methods to correct approach slab settlement include mud-jacking or use of expansive urethane Scour/Channel Mitigation/Repair: Scour mitigation is provided on an as-needed basis, and is typically identified during routine maintenance staff observations or during bridge inspections. Active scour or bank erosion areas are repaired on an as-needed basis with such measures as formed pier repair, gabion installation, or rock blanket.

Deck Repairs: Includes half-sole and full depth repairs: Preventive maintenance for bridge deck repair will be considered for bridge decks which may expect extended life from the patching effort. Guidelines of <20% of total deck surface area for half-sole patching and <10% for full depth patching serve as general guidelines for effective preventive maintenance deck repairs, with rehabilitation efforts recommended above these limits. Partial depth repairs are applicable when there is competent substrate (delamination only above the top mat of reinforcing steel) and full-depth repairs planned where the deck has become saturated and/or cracked/weakened for the full depth.

Replacement or upgrade of bridge railings, transition railings, and rail end treatments.

Appendix A-2

Pavement PM Activities

Pavement PM Activities

Pavement PM activities are noted in EPG Section 413, Surface Treatments and PM and EPG Section 507 – Portland Cement Concrete Pavement Maintenance. Overall pavement maintenance direction is provided in EPG 144.5 Pavement Maintenance, which also includes ranges of condition-based treatment and life expectancy of each treatment. Following is a list of recommended activities, with associated condition basis and frequency.

Pavement condition levels are monitored by data collection within Transportation Planning, with the following criteria defining Good condition. This data is presented within the MoDOT Tracker, and is documented within the TMS database.

Major Road – Good Condition:

IRI < 100, or Speed limit < 55 AND condition_index ≥6

Minor Road – Good Condition:

IRI < 140, or IRI between 140 and 170 AND condition_index ≥6

Low Volume – Good Condition:

IRI < 170, or IRI between 170 and 220 and condition_index ≥6

Full lane width overlays: Condition basis where these treatments are applicable is provided in EPG 144.5, and the projected life of this treatment ranges from 8 – 15 years. Pavement selection guidance in EPG 144.5.6 provides condition based criteria for overlays and surface treatments. Since the condition of a route segment is based on a weighted average of 0.1 mile condition rating increments, we consider greater than or equal to 50% meeting the criteria set for good condition pavement to be a good condition route segment. If asphalt pavement repair alone is capable of improving poor segments of a route, such that a majority of the route is good, then a weighted average of 40% or better meeting good condition criteria will be considered for follow-on surface treatment or overlay, provided no more than 15% of the route segment is rated as poor. This condition tracking will continue for the following year, and any route or route segment which maintains equal or better condition will remain approved, while any route or route segment which exhibits lower condition will be reduced from the following year submittal for reimbursement. Specific condition data will be shared with FHWA in making this determination, prior to any adjustment to the following year reimbursement. This work is accomplished through paving contract (hot or cold mix), pavement maintenance contracts, and in-house forces. Overlays typically include hot-mix asphalt on regionally significant minor routes, major routes and interstates, while minor routes and low volume roads will be evaluated for either hot or cold-mix for the most cost-effective application. Overlay thickness is greater than or equal to 1" and less than or equal to 1-3/4", and is applicable to good condition routes.

Asphalt pavement repair: May include full or partial lane-width patches, which are applied to address significant rutting or surface raveling on existing asphalt surfaced roadways. Patch material may be hot or cold mix asphalt. Asphalt pavement repair shall be considered for good condition routes only, as defined earlier, with a goal of subsequent overlay or surface treatment such as fly coat, fog seal, or chip seal performed within 2 years of completion of pavement repairs. Work plan preparation and tracking will be expanded as MMS capabilities are added to this system, and this agreement modified as needed at that time.

Concrete Pavement Repair: These repairs are performed on good condition routes, when joint repairs are less than 10 per lane-mile or if the proposed pavement repair quantities in any lane are less than 2% of the total lane area for that work activity. Full depth repairs are utilized when repairing faulted joints or edge cracks which extend through the majority of the pavement thickness. Partial depth repairs are utilized when partial depth distress is evident such as scaling or high steel delamination. Concrete crack repairs also include placement of polymer repair materials with high bond strength and reinforcement cross-stitching cracked areas.

Seal Coats: This is performed on a condition basis to good condition pavements with no significant rutting. Additional details are provided in EPG 144.5.6.1 Pavement Direction. Example seal coats include: Fog Seal/Scrub Seal (1-2 year life), Chip seal (many variations with 3-7 year life), microsurfacing (6-8 year life), slurry seal (4-6 year life), and rejuvenators (3-5 year life)

Other Surface Treatments: UBAWS (Ultrathin bonded asphalt wearing surface) is utilized where drainage and spray are a concern (with 5-9 year interval), and is performed on a contract basis. Note: Do not mill pavement edge for placement of UBAWS, as deterioration may accelerate at undrained pavement edge. Crack Sealing is used on both concrete and asphalt pavements where joints are open, reflective cracks or distress cracking are present - but not excessive. Crack sealing is applied to prevent incompressible material from entering cracks and prevent water intrusion, in order to extend pavement life until another treatment is applied (2-4 year expected life).

Pipe Culvert repair: Pipe culvert repair activities include total pipe replacement, installation of pipe liners to extend life, and extension of piping due to shoulder stabilization/widening.

Appendix A-3

Other Roadway Features

Pavement Marking: Includes placement of pavement markings, as required to maintain minimum retro-reflectivity standards. This work includes consideration of day/night, wet/dry, recessed pavement marking, and/or snow-plow able marking applications. Retro-reflectivity thresholds are noted in the table below. MoDOT crews utilize water-borne marking paint (2nd generation water-borne resin) and type L beads on major routes (ASTM type 3) and type PM beads on minor routes (combination of majority ASTM type 1, with lesser quantities of ASTM type 2 and 3 beads to produce a gradation).

Pavement Marking Acceptance Table, mcd/m²/lux		
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New Pavement Markings	300	225
Existing Pavement Markings Expected to Last Through Winter (measured in the fall)	200	175
Pavement Marking Failure Point	150	125