C.1. SURFACE TREATMENT TECHNICAL PLAN

C.1.1. Introduction to Surface Treatment Program

The Surface Treatment Program (STP), or Pavement Asset Management, is tasked with maintaining the condition and drivability life of Colorado roadways at acceptable levels as established by policy. The STP uses pavement condition data (cracking, rutting, and International Roughness Index), along with parameters such as traffic, climate, and age of the existing pavement, to recommend the most cost-effective treatments at the appropriate time within the pavement’s lifecycle.

The Colorado Department of Transportation’s (CDOT) Staff Materials Pavement Management Section, in coordination with CDOT’s Asset Management Branch, uses pavement management analytical tools and—based on annual pavement condition data collection—makes recommendations as to which segments of the state highway system should be prioritized for surface treatment and rehabilitation.

Policy Directive (PD) 1400.00, “Surface Treatment Program,” establishes the STP and requires that a funding level be established that will maintain the condition and drivability of Colorado’s Interstate Highway System, its National Highway System (NHS), and the state highway system. The objective of CDOT’s STP is to maintain the quality of the pavement on state highways at the highest level possible by allocating limited resources through a performance-based approach.

As it is the STP’s purpose to maintain the existing network roadway surface, many items that do not affect surface condition of the existing network should not be funded with STP monies. Allowed items that can be funded with STP funds are detailed in the Division of Project Support Memorandum, 2017-02.

C.1.2. Regulatory Considerations

C.1.2.1. Regulations/Resolutions

The following list provides an overview of relevant federal and state regulations and requirements governing planning, policy, data, performance, funding, and project selection of surface treatment projects.

- Fixing America’s Surface Transportation (FAST) Act
- 23 CFR Part 667
- 23 CFR Part 490.319 Section (c)
- Transportation Commission (TC) Resolution TC-17-10-12 and TC-18-03-12
- PD 14, 703, 704, and 1400
- Procedural Directives 704.1 and 1608.2
- Division of Project Support Memos 2017-02 and 2018-01
C.1.2.2. Guidelines

STP funds focus on maintaining pavement surface rather than enhancements, capacity improvements, or other project costs. To accomplish this, STP funds are prioritized to fund efforts that do the most to improve the pavement condition performance, as discussed in Section C.1.4. To this end, guidelines are used to direct funds to appropriate activities as outlined below.

Essential Items

In an effort to maximize proper allocation and use of STP funds, the Pavement Management Technical Committee has developed an “essential items” memorandum. Essential items are project-related costs necessary to complete a typical surface treatment project. The essential items list includes bid items that, while not necessarily associated with the pavement surface, are considered ancillary, or “essential,” to the construction and delivery of a typical surface treatment program. The latest iteration of the “essential items” memorandum was ratified and published as Division of Project Support Memorandum 2017-02.

Non-Essential Items

STP funds will not be used for items that are not directly related to the roadway surface other than as listed in the above table. Bid items that will not be paid for with STP funds are listed in Memorandum 2017-02.

Safety Surface Treatment Funds

Safety Surface Treatment funds are administered from the same central funding pool as the STP. STP Safety Surface Treatment funds are exempt from the Essential Item restrictions. Region staff will estimate and track the total safety treatment project costs on each project and will be allowed up to 3.3 percent of their total assigned regional planning budget to be used for safety treatment work on surface treatment projects. See Division of Project Support Memo 2017-02 for guidance on appropriate use of Safety Surface Treatment funds for project-related safety work.

Regional Planning Budgets for STP

In support of PD 1400, Division of Project Support Memo 2018-01 instructs that a portion of annual STP funding be distributed for regional planning based on the total cost of the Pavement Management Program’s recommended treatments in each region from Material and Geotechnical Branch’s statewide network analysis. Memo 2018-01 provides fiscal year 2021 through 2024 planning and design pool budgets for regions.
FASTER Asset Management Funds

FASTER Asset Management funds can be spent on construction, reconstruction, or a maintenance project that enhances the safety of a state highway. Spending may include all aspects of delivering a safety mitigation project, including planning, financing, study analysis, design, engineering, mitigation, acquisition contracting, and installation.

C.1.3. Asset Inventory and Condition

C.1.3.1. Asset Inventory

Regularly updated surface treatment inventory summaries are provided by the Performance and Asset Management Branch and may be viewed here. Custom queries and reporting requests can be made through the branch.

C.1.3.2. Asset Conditions

Pavement condition data are collected and monitored to inform the CDOT performance determinations discussed in Section C.1.4. As detailed in the section, Drivability Life (DL) is an indication of how long a highway will have acceptable driving conditions. Acceptable driving condition is a function of smoothness and safety, as determined by the amount of pavement cracking and depth of rutting. Unacceptable pavement condition does not mean the roadway is impassable, but it does mean that drivers must reduce speeds to compensate for less-than-desirable driving conditions, navigate around potholes, or endure rough rides.

While condition is measured in DL to support performance-based decision-making, CDOT also measures condition in Federal Highway Administration (FHWA) defined “Good,” “Fair,” and “Poor” categories (based on the International Roughness Index), Present Serviceability Rating (PSR), rutting, faulting, and fatigue/alligator cracking percentage. These measurements are only used for FHWA performance reporting purposes, and do not factor into CDOT’s performance-based decision-making rooted in DL.

C.1.4. Performance

C.1.4.1. Metrics

CDOT uses both federal and state performance metrics. Currently, FHWA’s Final Rule on pavement and bridge performance measures (23 CFR Part 490) requires state DOTs to report four conditions for NHS and non-interstate NHS for the percent of pavement in good and poor condition. Based on PD 14, and as detailed in the Transportation Asset Management Plan (TAMP), CDOT’s primary metric for pavement condition is DL.

C.1.4.2. Targets

Performance targets are based on both aspirational funding levels and fiscally constrained levels. Aspirational funding reflects established goals that are set as part of the statewide planning process. These goals reflect an ideal level of desired performance that would require revenues beyond what is projected. Fiscally constrained targets represent a more realistic goal. Fiscally constrained targets consider revenue limitations and reduced buying
APPENDIX C. TECHNICAL PLANS

power. These constrained targets show an acceptable level of service within the context of a more likely budget and may increase or decrease slightly as a result of funding cycles.

Surface treatment performance targets align with federal requirements (e.g., FAST Act, Moving Ahead for Progress in the 21st Century Act (MAP-21)) and PD 14. The underpinning to the targets is “to preserve the transportation infrastructure condition to ensure safety and mobility at a least lifecycle cost.” The surface treatment performance targets are documented in the TAMP.

C.1.5. Funding
C.1.5.1. Funding Mechanisms
PD 1400. STP, establishes the STP and requires that a funding level be established that will maintain the condition and drivability of Colorado’s Interstate Highway System, its NHS, and the state highway system.

C.1.5.2. Region Pool Distributions (4-Year Forecast)
Region pool distributions are updated every 2 years. The most recent distribution is available here.

C.1.6. Investment Strategies

C.1.7. Lifecycle Management and Project Selection
C.1.7.1. Lifecycle Management
CDOT has a formal planning process with CDOT Engineering Regions to develop a 3- to 5-year STP. Staff Materials Pavement Management Section runs a statewide pavement analysis using the Deighton Total Infrastructure Management System (dTIMS) to determine the most cost-effective surface treatment methods and procedures for a range of budget scenarios. This statewide analysis generates a list of recommended statewide project segments. The process is documented here.

C.1.7.2. Treatment Lists
The number of potential treatments or strategies available for pavement can range from as few as 21 to as many as 200 treatments over the course of a 20-year analysis. So many options are available because of the length of the analysis period, the expected life of the asset, and the combination of treatment strategies available under different funding scenarios. Assuming the average highway asset has 100 potential treatments or strategies, when all 3,900 segments are iteratively analyzed, the program will have identified 390,000 potential treatments. Software is used to distribute dollars to treatments based on highest benefit/cost ratios and available budget. Categories of treatments are provided in Table C-1.
## Table C-1. Treatment Categories and Descriptions

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Treatment Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconstruction</td>
<td>Complete removal, redesign, and replacement of the pavement structure (asphalt or concrete) from subgrade to surface. A minimum design life of 20 years for asphalt pavements and 30 years for concrete pavements is used for these projects.</td>
</tr>
<tr>
<td>Major Rehabilitation</td>
<td>Heavy-duty pavement treatments that improve the structural life of the highway. These are asphalt treatments typically thicker than 4 inches, and may include, but are not limited to, full-depth reclamation, thin concrete overlays, deep cold-in-place recycles, and thick overlays. Concrete treatments in this category may include, but are not limited to, asphalt overlays (thicker than 4 inches), extensive slab replacements, and rubblization.</td>
</tr>
<tr>
<td>Minor Rehabilitation</td>
<td>Moderate pavement treatments that improve the structural life of the highway. These are asphalt treatments between 2- and 4-inches thick, and may include mill-and-fills, shallow cold-in-place recycles, overlays, and leveling courses with overlays. Concrete treatments in this category may include black toppings (thinner than 4 inches), dowel and tie bar repairs, and diamond grinding.</td>
</tr>
<tr>
<td>Pavement Maintenance</td>
<td>Thin functional treatments 1.5 inches in thickness or less, intended to extend the life of the highway by maintaining the driving surface.</td>
</tr>
<tr>
<td>Ultra-Thin Overlay</td>
<td>An asphalt overlay that does not exceed 1.5 inches in thickness; this type of overlay addresses rutting better than a chip seal treatment.</td>
</tr>
<tr>
<td>Chip Seal Treatment</td>
<td>A chip seal treatment is a layer of emulsion and fine-graded aggregate that seals the pavement surface from moisture penetration.</td>
</tr>
</tbody>
</table>

### C.1.7.3. Project Selection Process

Building on the processes described in Section C.1.7.2, Figure C-1 shows how surface treatment projects are developed from Asset Management, informed by Region Materials Engineering, deliberated upon by Region Transportation Directors (RTD) and Engineers, considered by the Chief Engineer, and finally elevated to the TC.
Figure C-1. Surface Treatment Asset Management
C.1.7.4. Regions

The interaction needed to develop treatments between CDOT’s Headquarters (HQ), Engineering Regions, and Transportation Planning Regions (TPR) developing treatment is summarized in Table C-2 below.

### Table C-2. Headquarters Roles vs. Region Roles

<table>
<thead>
<tr>
<th>Headquarters Roles</th>
<th>Region &amp; Local Partner Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>HQ collects pavement data and loads the software (dTIMS). HQ analyzes data inputs for completeness and quality. HQ runs pavement management software for strategic statewide analysis. HQ provides pavement software to regions for their project-level needs.</td>
<td>Regions assist with data input completeness and quality. Regions provide pavement project inventories to HQ. Regions modify their software to accurately reflect region-specific variables and needs. Regions run software to identify cost-effective pavement projects. Using the software, regions compile their list of treatment projects.</td>
</tr>
<tr>
<td>Through the Pavement Management Technical Committee, HQ facilitates the policy evolution and technical model improvement in partnership with the regions.</td>
<td>Regions are voting members of the Pavement Management Technical Committee that oversees pavement management model improvements and STP procedures.</td>
</tr>
</tbody>
</table>

C.1.8. Reporting, Management, and Documentation

C.1.8.1. Reporting to Internal and External Stakeholders

Table C-3 below describes the positions and their responsibilities with regard to the STP.

### Table C-3. Roles and Responsibilities of Internal CDOT Offices

<table>
<thead>
<tr>
<th>Position Responsible</th>
<th>Description of Responsibility</th>
</tr>
</thead>
</table>
| Chief Engineer                           | • Review and approve justifications for projects beyond specific category treatments  
• Review and approve statewide project list                                                                                                                                  |
| Pavement Management Program              | • Collect annual statewide pavement data  
• Develop surface treatment condition maps  
• Perform statewide predictive condition analysis  
• Determine the surface treatment planning budget for each region from the dTIMS-CT  
• Determine if project list meets match criteria                                                                                                                             |
| Regional Materials Engineering           | • Review surface treatment condition maps  
• Determine surface treatment projects to recommend based on region-specific dTIMS-CT data  
• Confirm that project list meets dTIMS-CT match criteria                                                                                                                      |
| Regional Transportation Director         | • Establish region-specific surface treatment design pool funds  
• Evaluate project list based on Regional Planning and pre-construction factors  
• Determine if any projects can be combined with other asset management projects                                                                                           |
**C.1.8.2. Management/Advisory Committees**

Table C-4 below presents information about how assets or funds are governed by policy bodies.

<table>
<thead>
<tr>
<th>Position Responsible</th>
<th>Description of Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavement Management Program Technical Committee</td>
<td>Guides the growth of pavement management. Identifies subject areas for investigation and assigns task forces. Reviews the Quality Assurance Protocol for verifying Pavement Management condition data (completed 3 weeks after final condition data are received) and ensures the processes outlined in the document are fulfilled.</td>
</tr>
<tr>
<td>Condition Data Task Force</td>
<td>Validates the index equation and reviews the myriad of performance curves (completed mid-July). This task force also reviews the Quality Assurance Protocol for verifying Pavement Management Remaining Service Life (completed the first week of August).</td>
</tr>
<tr>
<td>Index Equation/Performance Curve Task Force</td>
<td>Reviews and updates the triggers and costs for each treatment. This task force also reviews the Quality Assurance Protocol for verifying Pavement Management Recommended Project Treatments (completed the last week of August).</td>
</tr>
<tr>
<td>System Task Force</td>
<td>Reviews the current Pavement Management performance measures, which includes investigating the project match definition and percentage (completed the first week of October).</td>
</tr>
<tr>
<td>Materials Advisory Committee Transportation Asset Management Oversight Committee (TAMOC)</td>
<td>Oversees the Pavement Design Manual. Provides oversight and strategic direction to CDOT’s Asset Management Program.</td>
</tr>
<tr>
<td>Transportation Asset Management Working Committee (TAMWC)</td>
<td>Performs tactical work on various CDOT Asset Management initiatives.</td>
</tr>
</tbody>
</table>