MATERIALS DIVISION

MEMORANDUM

GENERAL SUBJECT: Notice of Revision to Materials Division's Manual of Instructions Chapter VI	**NUMBER: MD 386-15**
SPECIFIC SUBJECT: Incorporation of a new section titled as "Project Selection Guidelines for Cold Pavement Recycling" and update of section 604.02	**DATE: June 2, 2015**
DIRECTED TO: District Materials Engineers, District Maintenance Engineers	**SIGNATURE:** **Charles A. Babish, PE** *Signature on original copy of memorandum*

This Memorandum notifies the users of the Materials Division's Manual of Instructions that a new section has been included due to the Department's initiative to implement cold pavement recycling on applicable projects. This new section, referred to as Section 608, has been in practice as a stand-alone document titled as "Project Selection Guidelines for Cold Pavement Recycling". However, some changes have been made reflecting the experiences gathered from recent projects and discussion with various stakeholders. The most notable changes are as follows:

1. Relaxation of minimum HMA overlay thickness for primary routes.
2. Incorporation of guidance related to the use of Cold Central Plant Recycling (CCPR) materials
3. Incorporation of specific direction for considering cold pavement recycling in pavement rehabilitation
4. Relaxation of Central Office (CO) Materials approval requirement for project involving cold pavement recycling
5. Increase in Layer Coefficient for Full Depth Reclamation (FDR), Cold In-Place Recycling (CIR) and Cold Central Plant Recycling (CCPR)

The focus of the inclusion is to ensure cold pavement recycling is considered for pavement rehabilitation projects where cold pavement recycling is a viable option. The Department will continue evaluating various technical aspects of the cold pavement recycling techniques and may incorporate appropriate changes in future.

Due to the inclusion of this new section, section 604.02 of the Chapter VI was updated with applicable layer coefficients and allowable lift thicknesses for recycled materials when using the

1993 AASHTO Pavement Design Procedure to design projects incorporating Cold Recycling. Reference to BM37.5 mix (a mix that is no longer used) is also deleted from this section.

The entire new section 608 is shown below.

SECTION 608- PROJECT SELECTION GUIDELINES FOR COLD PAVEMENT RECYCLING

SECTION 608.01 PURPOSES AND GOAL

The guidelines provided herein are intended to aid the user in properly selecting candidate projects when rehabilitating flexible or composite pavements using Cold Pavement Recycling.
Cold Pavement Recycling consists of three processes -Cold In-Place Recycling (CIR), Cold Central Plant Recycling (CCPR), and Full-Depth Reclamation (FDR).

The goal of selecting the appropriate pavement recycling approach is to provide adequate pavement structural capacity to meet the projected traffic over the design life with consideration to the depth of the deteriorating layers, economics, and the time needed to complete the project.

SECTION 608.02 DEFINITIONS

The CIR, CCPR, and FDR processes are defined below (paraphrased from ARRA's Basic Asphalt Recycling Manual and Wirtgen's Cold Recycling Manual):

> *CIR is a process in which a portion of the asphalt pavement layers are pulverized, stabilized, and repaved in place. This is most commonly performed using emulsified asphalt or foamed asphalt as the stabilizing agents and is usually performed at a depth of 3 to 6 inches. The pavement may be milled, stabilized, and repaved using the same machine or machine train or paved from stabilized, windrowed material using traditional practices.*
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> *CCPR is similar to CIR but the stabilizing operation occurs at a mobile or central plant location. For rehabilitation projects, the asphalt materials are milled, processed at a mobile or central plant location and then repaved using traditional practices. CCPR is used as a base layer in pavement rehabilitation on the same project. Typical layer thicknesses range from 3 to 6 inches; however, multiple lifts may be placed.*
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> *FDR is a process in which the bound layers and a predetermined portion of the unbound aggregate materials are pulverized, stabilized, and compacted in place. Common stabilizing additives include: hydraulic cement, lime, fly ash, cement kiln dust, lime kiln dust, emulsified asphalt, foamed asphalt, or some combination of these materials. Treatment depths generally range between 6 to 12 inches but vary depending on the thickness of the existing pavement structure.*

SECTION 608.03 SELECTION OF REHABILITATION/RECONSTRUCTION PROJECTS

Cold pavement recycling applies to rehabilitating in service pavement. However, CCPR materials can be used on new construction projects as a bound flexible base material following the guidelines provided in this document. Also, CCPR materials shall not be used as the final riding surface.

(a) Initial Project Selection Criteria

For rehab projects, appropriate pavement recycling candidate projects should be identified by first obtaining the following information:

1. *Distress Rating Data - Projects identified as Restorative Maintenance (RM) or Reconstruction (RC) as defined in VDOT's Maintenance Division "Supporting Document for the Development and Enhancement of the Pavement Maintenance Decision Matrices" are typically suitable candidates. Furthermore, depending on circumstances, projects identified under other Maintenance Activity Categories may be suitable recycling candidates.*
2. *Project Length – The total project length should be greater than approximately 5 lane miles for CIR or greater than approximately 3 lane miles for FDR. The total project length can be any size for CCPR projects.*
3. *Maintenance History - A substantial rehabilitation effort may be needed if existing or projected patching exceeds approximately 15% of the pavement surface area or if applied overlays did not achieve their expected service life.*
4. *Pavement Management System (PMS) History - The PMS can be used to obtain the total bound and unbound layer thickness, the layers material composition, and the Critical Condition Index (CCI) values with respect to time.*

(b) Project-Level Pavement Forensic Investigation

It is essential to conduct a project level field forensic investigation to identify the failure mechanism on the project. The Materials Division Manual of Instructions, Section 600 discusses the required elements of a project-level pavement forensic investigation. Additionally, the use of ground-penetrating radar (GPR) is strongly recommended to determine layer thicknesses and identify changes in pavement structure.

If FDR is considered, soil borings are required unless waived by the Engineer to classify the aggregate base and subgrade materials (USCS Soil Classification). The results of the classification tests shall be used to determine the choice of stabilizing agent(s). Generally, cohesive materials should be stabilized using lime. Non-cohesive materials may be stabilized with cementitious or bituminous stabilizing agents (with cementitious stabilizing agents being preferred for silty materials).

(c) Project-Level Recycling Considerations

FDR is intended to correct pavement deterioration due to failures in the subgrade or unbound base /subbase layers for flexible pavement structures. A layer coefficient value for FDR of 0.25 shall be used for design purposes.

CIR is intended to correct pavement deterioration within the bound layers of a flexible pavement or the asphalt layers of a composite pavement. CIR is typically performed at 3 to 6 inch depth. A layer

coefficient value for CIR of 0.35 shall be used for design purposes. When the pavement deterioration is located within approximately 3 inches of the surface, CIR may not be as cost effective as a typical mill and overlay. When pavement deterioration is located within approximately the bottom two inches of thick bound layers, CIR is usually not a good candidate as the existing pavement structure may not be able to support the weight of the construction equipment. In these cases, FDR should be considered to stabilize this area in place. .

(d) Consideration for using CCPR materials
CCPR materials can be used on projects that include both new construction and rehabilitation. CCPR is intended to be used as a replacement of bound and unbound materials within a new or existing flexible or composite pavement system. CCPR is typically applied at a 3 to 6 inch lifts; multiple lifts can be placed for depths exceeding 6 inches. A layer coefficient value of 0.35 for CCPR shall be used for design purposes.

The use of CCPR materials can be assessed during the design phase or through the Value Engineering process outlined in the Road and Bridge Specifications Section 104.02 (b). For design purposes, the designer may choose to exclusively use CCPR materials or select a dual design option. In the latter case, the department will advertise the project with two different sets of pavement structure (conventional and with CCPR materials) and two different sets of pay items/estimated quantities.

The designer (or the contractor while submitting Value Engineering proposal) must ensure that the alternative pavement design Structural Number (SN) of the CCPR alternative used shall meet or exceed the total Structural Number of the original design.

In addition the CCPR materials can be used as 1:1 replacement for conventional asphalt materials for the following low risk situations.

- ***Shoulder Construction*** *– For shoulders that do not serve as a restricted travel lane, the ratio may be reduced to 1:1 and a single lift of asphalt material (i.e. asphalt concrete, slurry seal, surface treatment) will be placed over the finished CCPR.*
- ***Trench Widening*** *–CCPR materials can substitute IM-19.0T and BM-25.0T for Type I Trench Widening at a 1:1 ratio.*

(e) Surface Layer Options

Typically, cold pavement recycling projects are surfaced by one or more layers of asphalt concrete. The thickness is usually determined by structural capacity requirements (refer to Manual of Instructions, Section 600). However, cold pavement recycled materials can be surface treated on low volume routes.

However, for all Interstate routes, the cold pavement recycled materials shall be covered with a multi-layer asphalt concrete overlay having a minimum combined thickness of 3.5 inches. For routes other than Interstates where the design traffic loading exceeds 10 million ESALs, the cold pavement recycled materials shall be covered with a multi-layer asphalt concrete overlay having a minimum combined thickness of 3.5 inches. Asphalt concrete leveling courses are not to be considered as part of the multi-layer asphalt concrete overlay.

(f) Final Project Selection

After completion of the project level forensic investigation and identifying the failure mechanism, the final treatment selection shall be made by assessing all the competing options with estimated cost, time, and any other project specific constraints. Project specific constraints to consider include pavement grade. CIR and FDR material can increase 10 to 15% in volume compared to the original in-place materials. This additional volume of recycled layer should be accounted for in the final elevation. If the final depth of recycled layer and asphalt overlay is not acceptable, consideration of pre-milling the existing pavement or profile milling should be given. In cases where trench widening is part of the project, impacts to the grade may be minimized but should still be reviewed as previously stated. Depending on the project specific conditions, pavement recycling may or may not be selected. If applied appropriately, pavement recycling is expected to reduce project cost and/or completion time.

Projects where more than 4 inches of milling is deemed necessary to remove deteriorated materials, recycling shall be considered as a solution. If recycling is not the best solution for the project, justification must be included in the design recommendations. A pavement evaluation report for the recycling projects can be sent to Pavement Design and Evaluation section of CO Materials for review at the discretion of the District Materials Engineer; however, completed copies of all pavement evaluation reports for recycling projects are to be sent to CO Materials for information.

SECTION 608.04 EXCEPTIONS

Any exceptions to these Guidelines shall be submitted to the State Materials Engineer for review and approval.

The updated applicable portion of section 604.02 is shown below:

Structural Layer Coefficients (New Design, Rehabilitation and Overlay)

Material	Typical Value
SM-9.0	.44
SM-9.5	.44
SM-12.5	.44
IM-19.0	.44
BM-25.0	.44
SMA 9.5, SMA 12.5, SMA 19.0	.44
Cold Central Plant Recycling (CCPR) mat.	*.35*
Cold In-Place Recycling (CIR) materials	*.35*
Graded Aggregate Base – 21A or 21B	.12
Cement Treated Aggregate Base	.20
Cement Treated Soil (i.e.- soil cement)	.18
Lime Treated Soil	.18
Full Depth Reclamation (FDR) materials	*.25*
Rubblized Concrete	.18
Break and Seat/Crack and Seat Concrete	.25
Gravel	.10
Open Graded Drainage Layer – Bound	.10
Open Graded Drainage Layer – Unbound	0 – .10
All other soils and subgrade improvements	No Layer Coefficient

Material Layer Thickness

Material	Minimum Lift Thickness (in.)	Maximum Lift Thickness (in.)
SM-9.0	0.75	1.25
SM-9.5	1.25	1.5
SMA-9.5	1.25	1.5
SM-12.5	1.5	2
SMA-12.5	1.5	2
SMA-19.0	2	3
IM-19.0	2	3
BM-25.0	2.5	4
Asphalt OGDL	2	3
CCPRM	*3*	*6*
CIR	*3*	*6*
FDR	*6*	*12*

The updated document can be accessed by using the link below:

http://www.virginiadot.org/business/materials-download-docs.asp

cc: Deputy Chief Engineer
Division Administrators
District Administrators
District Location & Design Engineers
District Construction Engineers
District Maintenance Engineers
District Bridge Engineers
District Traffic Engineers
Virginia Asphalt Association
Virginia Center for Transportation Innovation and Research
Virginia Ready-Mixed Concrete Association
Precast Concrete Association of Virginia
Virginia Transportation Construction Alliance
Federal Highway Administration
American Concrete Paving Association
NE Chapter, Southern Region
Old Dominion Highway Contractors Association