TRC2402

Field Evaluation of High-Performance Cold Mix (HPCM) Products

Materials Division
and
Planning & Research Division

Arkansas Department of Transportation

Final Report

June 2026

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16. Abstract

This research project evaluated the field performance of nine High-Performance Cold Mix (HPCM) products from various producers to determine suitability for inclusion on ARDOT's Qualified Products List (QPL). The test section was constructed in September 2024 on Hwy 338 (Sweet Home Cutoff/Dixon Road) in south Little Rock. Nine unique HPCM products, both bagged and plant-produced, were installed in simulated potholes and monitored over 12 months. Monthly inspections assessed durability, compaction retention, rutting, and adhesion performance. All nine products demonstrated satisfactory performance with minimal degradation through one full freeze-thaw cycle and a summer season. Based on the results, all tested products were approved for inclusion on the Department's QPL for HPCM. The research also established evaluation criteria for future product submissions, enabling ARDOT to adopt HPCM materials into maintenance and construction projects without requiring individual project-based approvals.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		NOTE: volumes greater than 1000 L shall be shown in m^3		
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
^oF	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	^oC
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
^oC	Celsius	1.8C+32	Fahrenheit	^oF
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003)

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

High-Performance Cold Mix (HPCM) products have been widely used for pothole repair and pavement maintenance as they perform well across a range of weather conditions. HPCM offers better workability, adhesion, moisture resistance, and durability under traffic as compared to traditional cold mixes allowed by the Arkansas Department of Transportation (ARDOT). Currently, ARDOT does not have a set process to accept HPCM on construction projects without completing the change order process. The primary objectives of this research project were to complete performance testing of HPCM products, establish a HPCM Qualified Products List (QPL), and determine test parameters for future products to be evaluated and added to the QPL.

This research has evaluated the field performance of HPCM products through a head-to-head comparison by observing a test section developed with available HPCM products over a winter (freeze/thaw) cycle. Ideally, the section has included potholes created and filled with different products to assess their durability during winter stress, helping determine their suitability for Department use. The detailed objectives are listed below.

- Determine the performance of different HPCM products over an estimated 12-month period; this period may vary depending on the result.
- Develop a QPL entry process for approved HPCM products.
- Determine the future test/data parameters to evaluate/approve future submitted products.

This study involved a direct comparison of HPCM products by observing and assessing the performance from the developed test section or strip. The project was organized in phases: a literature review, securing permissions and sourcing HPCM materials, and culminating in the development of the test sections. The team evaluated HPCM performance against key criteria, including rutting, cracking, popouts, depressions, and others. After conducting the performance assessments, all findings were thoroughly documented.

In this research, products were submitted and tested in a real-world environment to determine the performance over a 12-month period. Companies were solicited to gauge interest in this performance test; nine responded and provided HPCM materials for evaluation. A test site location was determined in south Little Rock on a portion of Hwy 338 known as Sweet Home Cutoff/Dixon Road. To simulate potholes, ARDOT maintenance forces cut out nine sets of 16-inch squares in both wheel paths of the eastbound lanes and placed and compacted the HPCM materials. The patches were monitored over 12 months from September 2024 to September 2025 that includes a freeze-thaw cycle and summer. All nine participants' materials showed very little degradation over the 12 months, and all performed at a high level and were selected to be included in the Department's newly established QPL for HPCM. At the end of the test period, ARDOT maintenance forces returned to the site, milled out the test strip area, and placed new ACHM surface course.

CHAPTER 1. INTRODUCTION

1.1 Background

HPCM products have become widely accepted for pothole repair and routine pavement maintenance because of their ability to perform under a broad range of environmental and weather conditions while enabling rapid and efficient repairs. Compared to conventional cold mix materials currently permitted under the ARDOT Standard Specifications, HPCM products are generally recognized for providing improved workability, better adhesion to existing pavement surfaces, enhanced resistance to moisture damage, and longer-lasting repairs under traffic loading. Their ability to remain stable during placement and maintain structural integrity under varying temperature conditions has contributed to their increased use in maintenance operations across many transportation agencies.

Field performance is the main measure of a pothole repair material's effectiveness. The most important evaluation criteria remain the long-term durability and serviceability of repairs under real traffic and environmental conditions, even though laboratory testing may provide useful information about material properties. The performance of HPCM materials has been thoroughly studied in previous research, with emphasis on aspects such as rutting resistance, moisture susceptibility, bonding qualities, application convenience, and overall repair lifetime. According to the previous research [1], it was indicated that HPCM products perform better than traditional cold patch combinations by lowering the number of repair failures, requiring less maintenance, and enhancing ride quality and traffic safety.

Even though there are lots of national-level research projects available, there is a need to evaluate the effectiveness of the HPCM products that are now authorized and utilized in Arkansas. Field performance can be significantly affected by differences in temperature, traffic, aggregate sources, and maintenance techniques, so it is not advisable to rely only on results from other areas. Additionally, producers of HPCM products use specialized additives and proprietary formulae that vary significantly from product to product. The composition of the binder, polymer modifiers, aggregate gradation, anti-stripping agents, and chemical additives intended to increase adhesion and durability are some examples of these variances. Therefore, it is difficult to create a single performance specification that covers all commercially available HPCM products.

1.2 Objectives and Scope

The primary objective of this research was to evaluate the performance of HPCM products. In particular, the research was conducted as a head-to-head comparison of HPCM products through the test section developed, observed, and evaluated. It was anticipated that a field test section/strip would be created for available HPCM products and the sites would be evaluated over a winter (freeze/thaw) cycle when potholes tend to experience the most stress. Ideally, this research would include a test section/strip with potholes created and filled with the different products that would allow us to determine how successful each product is and which ones should be allowed for Department use. The detailed objectives are listed below:

- Determine the performance of different HPCM products over an estimated 12-month period; this period may vary depending on the result.
- Develop a QPL entry process for approved HPCM products.
- Determine the test/data parameters to evaluate/approve submitted products in the future.

1.3 Benefits

The output of this research would be useful to ARDOT, as it could provide significant benefits by evaluating the performance of HPCM materials for field applications, which could lead to these products being added to the Department's QPL for construction and maintenance use.

1.4 Implementation

The implementation efforts will include prioritizing or ranking the HPCM products that should be allowed for Department use based on their field performance. A specification will be developed to encompass all high-performing products for the Department.

1.5 Work Plan

The primary objective of this research was to evaluate the performance of HPCM products. This research was conducted as a head-to-head comparison of HPCM products by observing and evaluating the test section/strip developed. This project, TRC2402, carried out the following tasks to accomplish these objectives.

Task 1: Literature Review

The goal of this task was to understand how other states are implementing HPCM products and to synthesize findings. The review summarizes and categorizes the various HPCM products and specifications being used by other state agencies.

Task 2: Obtain Permissions and Procure HPCM Materials

- Test site permission was obtained at the potential location.
- Bagged mix was tested due to the uniformity of its storage conditions. However, bulk mix was also considered and tested.
- HPCM manufacturers were encouraged to participate in this test section/strip by supplying a cold mix that was evaluated by the Principal Investigator.
- ARDOT Districts were surveyed to determine the cold mixes currently being used.

Task 3: Develop the Test Site

- Determine the test site location
    - ARDOT selected a test area with high traffic and heavy loads that is reasonably close to an ARDOT maintenance or district crew. Asphalt plant exits were discussed as possible locations for testing, pending ARDOT permission for ARDOT crews to work off the State right-of-way.
- Create potholes
    - Determine the pothole dimensions to be constructed
    - Determine the number of potholes to be constructed depending on material availability
    - Potholes shall be square holes saw-cut into asphalt
- Place HPCM materials
    - ARDOT maintenance crews placed the HPCM materials in the test section/strip per the manufacturer's recommendations using State labor and equipment. Each material was placed and compacted using the same guidelines.

Task 4: Evaluate the Performance of HPCM

- Performance monitoring plan – each site was monitored regularly.

- Any field tests or measurements of performance for HPCM materials included the following key performance criteria:
  - Rutting
  - Shoving
  - Popouts
  - Deformation
  - Raveling
  - Cracking
  - Bleeding

Task 5: Documentation

The final report was produced at the conclusion of the evaluation period. The final report includes recommendations for prioritizing or ranking the HPCM products to be allowed for Department use based on field performance, along with the methods used to rank the products. A specification was developed to encompass all high-performing products for Department use and to deploy future technologies and innovations that will be included in project documentation. This specification provides a method for evaluating future requests to add new HPCM products to the ARDOT QPL.

CHAPTER 2. LITERATURE REVIEW

2.1 Other State DOTs Practices and Trends

Cold mix asphalt technologies have become increasingly important for pavement maintenance and rehabilitation, particularly in environments and operational contexts where hot-mix asphalt is impractical or unavailable. This literature review synthesizes findings from several key studies and experiences from different state DOTs to provide an overview of recent advances, challenges, and best practices in the design and use of cold mix asphalt materials, with an emphasis on performance, sustainability, and cost-effectiveness.

Proprietary Cold-Mix Materials for Winter Repairs - Virginia DOT

A study by the Virginia Transportation Research Council (VTRC) evaluated thirteen proprietary cold-mix asphalt materials for winter pothole repair, integrating both laboratory and field analyses to assess workability, durability, and resistance to pavement distress [2]. The research demonstrated that high-quality proprietary cold-mix products can match, and in some cases exceed, the performance of traditional hot-mix asphalt in terms of structural stability and service life, especially under challenging weather conditions. To methodically assess each repair's performance, an inspection form was created. Bleeding, dishing, debonding (including edge disintegration and loss of patch material), raveling, and pushing or shoving were the five main distress categories evaluated by the form. Based on frequently reported failure scenarios for cold-mix patching materials found in earlier research, these categories were chosen.

Each repair area was split into four equal pieces (quadrants) to guarantee evaluation uniformity. Using a scale from 1 to 4, each quadrant was individually scored for each of the five distress categories in accordance with the standards outlined in the inspection form. This method enabled deeper, local-level evaluation of performance within each patch. A quadrant with roughly 9.5 mm (3/8 inch) of dishing, for example, would be rated a 3. This methodical approach offered a consistent foundation for assessing performance across all assessed fixes. However, the researchers emphasized that laboratory results alone cannot predict field performance, advocating for performance-based specifications and a combined laboratory and field validation approach to ensure durable, cost-effective repair strategies.

Lightweight Hot-Mix, Cold-Laid Mixtures - Texas DOT

The research focused on the development and evaluation of lightweight hot-mix and cold-laid asphalt mixtures for pavement maintenance and rehabilitation in Texas [3]. Cold-laid mixtures are frequently used for surface maintenance and pothole repairs because they are easily stored, transported, and applied in a variety of weather conditions. However, workability, durability, stripping, and stability throughout service are common problems with traditional cold mixes. The study examined previous studies on lightweight aggregates and synthetic materials used in asphalt mixtures and concluded that, when properly constructed, lightweight aggregates can enhance handling, reduce mixture weight, and provide satisfactory field performance. Aggregate gradation, asphalt content, and environmental factors have a major impact on pavement performance and maintenance quality, according to earlier research by the Texas Highway Department and the Texas Transportation Institute (TTI). The study's primary goal was to assess how lightweight hot-mix and cold-laid mixes performed in both field and lab settings and to determine whether these materials could perform on par with, or better than, traditional maintenance mixtures. Using various aggregate mixes and asphalt binders, the study also sought to investigate stockpile properties, workability, stability, skid resistance, and mixed durability. Evaluating combinations of lightweight synthetic aggregates, limestone screening, field sand, asphalt cement, water, and priming ingredients across several Texas districts was part of the scope.

Both field assessments and laboratory testing were part of the process. Lightweight aggregates with different gradations and binder concentrations were used to design and produce various combinations. Sieve analysis, specific gravity calculation, extraction testing, Hveem stability testing, density assessment, and cohesion meter testing to gauge mixture strength and performance attributes were all part of the laboratory mixture design processes. To track storage qualities, handling traits, placement workability, and skid resistance after service, field sections were built in various districts. The researchers also assessed the impact of water addition, primer content, and asphalt content on mixture behavior. The specifications, which included standards for aggregate quality, gradation limits, asphalt content, stability, density, and mixing techniques, were developed based on laboratory and field performance data.

The results demonstrated that lightweight hot-mix/cold-laid combinations typically provided adequate handling, storage, and field performance. The final pavement portions had good surface quality, and maintenance staff stated that the mixtures were simple to blade, compact, and put down during field operations. According to the study, using lightweight aggregates increased workability while preserving sufficient density and stability. During laboratory testing, certain mixes showed satisfactory cohesive qualities and Hveem stability values above allowable limits. After several months of service, field observations also showed that skid resistance values stayed within acceptable ranges. Rubber-particle combinations, however, did not significantly outperform standard mixtures in terms of field performance or stockpiling. Additional priming ingredients and softer asphalt binders could enhance winter workability in colder climates, according to the paper. Long-term pavement performance and mixture durability were found to be significantly influenced by proper control of aggregate gradation and asphalt content.

The study concluded that, with the right materials, mix designs, and construction techniques, lightweight hot-mix, cold-laid combinations can be effectively used for pavement repair. To enhance workability and field performance, the research suggested using high-quality lightweight aggregates, regulated asphalt contents, and appropriate stockpile management techniques. To ensure uniformity and durability prior to field application, it also emphasized the importance of laboratory testing, including stability, density, and extraction studies. To ensure consistent mixture quality, the criteria established guidelines for equipment requirements, paving conditions, mixing temperatures, and aggregate selection. Overall, the study showed that lightweight cold-laid mixtures might offer practical benefits for transportation companies engaged in pavement repair operations, including dependable maintenance performance and a satisfactory service life.

Evaluation of Hot-Mix, Cold-Laid Asphalt Concrete Paving Mixtures - Texas DOT

The study evaluated Texas DOT Item 334 HMCL asphalt mixtures, commonly used for pothole repairs. Research by the VTRC, Strategic Highway Research Program (SHRP), Pennsylvania DOT, and Ohio DOT showed that well-designed cold-mix materials with proper binders, crushed aggregates, and anti-stripping additives outperform conventional mixes in durability, workability, and cost [4]. Although high-quality cold patch materials may cost more initially, they reduce repair failures and maintenance needs. Cold-laid patching is easy to store and use. Material quality greatly affects pavement repair performance and long-term costs, emphasizing the benefits of properly designed cold-mix solutions.

The study reviewed past research, surveyed maintenance districts about patching materials, evaluated lab-made mixtures, and examined field-aged, stockpiled materials. It was focused mainly on Item 334 mixtures due to inconsistent performance reports, aiming to understand factors affecting workability, cohesion, stripping resistance, and stability of HMCL patching mixtures. The goal was to analyze variables influencing these qualities under different environmental conditions. The scope included reviewing literature, conducting district surveys, laboratory testing of crushed gravel and limestone aggregates with binders AES-300S and MC-800 with diesel, and field evaluations. Lab tests included Marshall, Hveem, unconfined compressive strength, cohesion, stripping, and workability. Field-stacked materials of various ages were examined to study aging effects. The study also compared lab results with field performance to evaluate testing methods.

The results demonstrated that binder type, aggregate characteristics, and stockpile conditions have a significant impact on mixture performance; laboratory results showed that mixtures compacted at 92 percent density frequently achieved stability and strength values comparable to or better than mixtures compacted at 95 percent density; the study also found that crushed aggregates and carefully chosen binders improved mixture cohesion and reduced stripping problems; workability and cohesion tests, such as the SHRP rolling sieve cohesion test and penetrometer-based workability tests helped distinguish between good-performing mixtures and some proprietary cold mixes performed more consistently. According to laboratory results, mixes compacted at 92 percent density frequently produced strength and stability values that were on par with or superior to those of combinations compacted at 95 percent density. Based on the results from the study, it was found that carefully selected binders and crushed aggregates improved mixture cohesiveness and reduced stripping. The study also showed that workability and cohesion tests, like the penetrometer-based workability test and the SHRP rolling sieve cohesion test, helped distinguish high-performing mixtures from low-performing ones.

To improve the performance of cold-laid asphalt patching materials, the study found that appropriate mixture design, aggregate selection, binder modification, and quality control testing are crucial. Before authorizing combinations for field use, it was advised to assess workability, cohesion, stability, and stripping resistance using straightforward laboratory procedures. Additionally, the report recommended that maintenance agencies prioritize selecting high-quality materials, even if the initial cost is higher, because greater durability reduces the need for frequent repairs and long-term maintenance.

Performance-Based Specifications for Cold Patching Mixtures – Texas DOT

Research at the University of Texas at Austin and by the Texas Department of Transportation has driven a shift toward performance-based specifications for cold patching mixtures [5]. Instead of relying solely on empirical mix designs, these specifications focus on measurable engineering properties such as cohesion, moisture susceptibility, and deformation resistance. The use of polymers, anti-stripping agents, and well-graded aggregates has improved cold patch longevity, while field evaluations confirm the importance of placement techniques and compaction for short-term effectiveness.

The study aimed to develop a cold-weather patching mixture design and performance standards for homemade and containerized blends. It sought to identify failure modes, evaluate lab and field performance, and create testing methods for workability, cohesiveness, stability, and durability. The research compared the cost-effectiveness and field adaptability of different containerized and handmade options, including commercial products such as Asphalt Patch, Perma Patch, Proline, QPR, Stayput, and UPM, tested in cold-dry and warm-wet climates. It involved lab tests, accelerated pavement tests, field evaluations, winter performance, and cost studies.

A comprehensive evaluation of the literature was conducted, including an accelerated pavement testing program, a laboratory testing program, mixture design creation, and field assessments. Existing failure mechanisms and desired mixture characteristics, including workability, stability, durability, stripping resistance, stickiness, storage ability, and freeze-thaw resistance, were examined by researchers. Then, utilizing various aggregate gradations, aggregate shapes, binder viscosities, binder contents, curing times, compaction temperatures, and anti-stripping additives, experimental combination designs were created. The study assessed hydrated lime, cutback binders, diesel additives, rounded and angular aggregates, and liquid anti-strip agents. Grading analysis, Superpave gyratory compaction, Texas Stability Test (TST), Hamburg Wheel Tracking Test, Cold Patch Slump Test (CPST), and drop testing were among the laboratory tests. The Model Mobile Load Simulator (MMLS3) was used to conduct accelerated pavement testing, while field evaluations monitored patch condition and long-term performance under traffic and varying weather conditions.

The results demonstrated that aggregate gradation, binder properties, curing conditions, and anti-stripping additives all significantly affected combination performance. According to the study, angular aggregates boosted stability, whereas rounded aggregates generally improved workability. Compared to extremely fine or open mixtures, dense and medium gradations offered a better compromise between workability and stability. While excessive softness decreased mixture stability, lower viscosity binders made the mixture easier to work with in the cold. Mixtures with appropriate gradation, a moderate binder level, and lime additions performed better under traffic loading and environmental exposure, according to accelerated pavement testing and field studies. The optimum overall balance of stability, workability, and field performance was demonstrated by the modified mixture design that included hydrated lime, rounded aggregate, medium gradation, and around 3.5 percent residual binder. Inadequate installation techniques, such as poor compaction and the popular "throw-and-roll" repair approach, were also found to cause numerous field failures.

According to the study's findings, it was identified that well-designed cold patching mixtures can greatly enhance pavement maintenance effectiveness and pothole repair performance. To minimize inconsistent field performance, the paper suggested using performance-based requirements and uniform mixture design techniques. It stressed the importance of choosing the right aggregate grade, regulating viscosity and binder content, using anti-stripping additives, and ensuring proper compaction during installation. Additionally, the study suggested that before authorizing combinations for field use, laboratory tests such as the CPST and TST should be used to assess workability and stability. The study also emphasized the importance of effective repair methods, curing control, and stockpile management in prolonging patch service life and lowering maintenance costs. All things considered, the study provided a useful framework for developing long-lasting, effective cold patching combinations suitable for various traffic and environmental conditions.

Use of Recycled Asphalt Pavement (RAP) in Cold Mixes – Oklahoma DOT

The University of Oklahoma examined the effects of various emulsions, moisture contents, curing times, compaction levels, and Portland cement additives on pavement performance and investigated the usage of reclaimed asphalt pavement (RAP) materials for cold-mixed, cold-laid pavement rehabilitation [6]. According to the research conducted, recycling asphalt millings has reduced demand for virgin materials and construction costs, making it a cost-effective and environmentally friendly way to maintain pavement. The study's analysis of prior studies demonstrated that RAP combinations can perform satisfactorily when the appropriate rejuvenating agents, curing techniques, and compaction procedures are used. However, when field conditions are poorly controlled, many recycled cold mixes exhibit low stability, moisture damage, poor compaction, and early pavement distress. Researchers also noted that additives such as polymer-modified emulsions and Portland cement could improve mixture strength and durability.

The study's primary goals were to identify the best mix design process for cold-processed RAP mixes and assess how well various emulsion types and cement-emulsion composite mixtures performed in both lab and field settings. Preparing RAP specimens using cationic, anionic, polymer-modified cationic (PMC), and polymer-modified anionic (PMA) emulsions, researching the impact of moisture and curing time on Hveem stability, and assessing the use of Portland cement as an extra stabilizing agent were all included in the scope. Finding appropriate moisture, emulsion, and cement contents that might increase stability and tensile strength without producing excessive brittleness or workability issues was another goal of the study. Both laboratory and field-testing procedures were part of the process. A Texas Gyratory Compactor was used to compact RAP millings collected from processing facilities after they were combined with water and emulsions. Different emulsion concentrations, moisture levels, curing times, and cement percentages were used to make laboratory specimens. To assess mixture performance, Hveem stability tests and indirect tensile strength tests were carried out in accordance with American Society for Testing and Materials (ASTM) guidelines. Samples were cured under both dry and wet conditions to assess their durability and moisture susceptibility. To evaluate laboratory and field performance, field cores were also taken from pavement sections built with various emulsion types. To increase stability and strength, cement-emulsion composite compositions made with powdered Portland cement were subjected to further testing.

The results demonstrated that moisture level, emulsion type, curing duration, compaction quality, and cement addition all significantly affected mixture performance. Longer curing times improved stability because greater water evaporation allowed the emulsion to properly set, although stability values often decreased as moisture and emulsion concentration increased. With fewer potholes and improved edge compaction, the PMA mix had the greatest overall field performance among the field sections. According to laboratory results, PMC combinations demonstrated superior stability under soaking conditions, but PMA mixtures offered high dry stability values. Tensile strength and dry and soaking stability were also greatly enhanced using Portland cement. Because water promotes cement hydration, the soaking stability improved more quickly. However, adding too much cement made the mixture less workable and more brittle and stiffer, which could cause pavement to split. Moreover, 2% cement caused mixtures to become dry and challenging to compact. Inadequate field compaction was identified as a primary contributor to lower field stability values compared with laboratory results, and curing time and compaction were found to be important factors in achieving satisfactory field performance.

According to the study's findings, cold-mixed, cold-laid RAP combinations can perform well when the appropriate mix design, curing, and compaction techniques are used. To improve mixture stability and moisture resistance, the research suggested using polymer-modified emulsions and adding small amounts of Portland cement. The ideal cement percentage was suggested to be between 1% and 2% based on the laboratory results, since it increased strength and maintained stability without significantly impairing workability or brittleness. Before opening pavements to traffic, the study also highlighted the significance of appropriate field compaction, regulated moisture content, and sufficient curing. It was suggested that further research be conducted to assess various RAP sources, optimize water and cement amounts, and examine other mechanical characteristics, such as resilient modulus and rutting resistance. Overall, the study showed that, compared with traditional recycled cold mixes, well-designed RAP mixtures containing cement-emulsion composites can offer superior pavement rehabilitation performance and a longer service life.

Cold In-Place Recycling (CIPR) – New York State DOT

The report examined the use of Cold In-Place Recycling (CIPR) as a pavement rehabilitation method for improving roadway performance, extending pavement service life, and reducing maintenance costs [7]. CIPR is a technique that involves crushing and milling existing asphalt pavement, mixing it with recycling agents such as foamed asphalt or asphalt emulsions, and reusing it on-site without heat. According to the study, this approach has become increasingly significant because it minimizes material transportation, conserves natural resources, reduces environmental impacts, and offers an affordable alternative to conventional rehabilitation techniques such as mill-and-fill and two-course overlays. Many states have effectively implemented CIPR for pavements experiencing functional distress such as longitudinal cracking, transverse cracking, raveling, potholes, and surface defects, according to earlier research and transportation agency practices examined in the report.

According to the literature, appropriate pavement selection, mix design, structural support, sufficient drainage, and high-quality construction techniques are all necessary for optimal CIPR performance. The study's goals were to develop best-practice guidelines for project selection, mix design, and construction processes, and to assess the performance, service life, cost-effectiveness, and environmental benefits of CIPR pavements in New York State. The study also sought to evaluate the effectiveness of CIPR with traditional rehabilitation techniques, including two-course overlays and mill-and-fill. Transportation agency surveys, field performance evaluations, pavement distress analysis, life-cycle cost analysis, service-life predictions, environmental impact assessments, and the creation of updated specifications and mix design processes for NYSDOT applications were all included in the scope. In addition to examining pavement conditions, traffic volumes, structural capacity, drainage conditions, and construction issues related to successful CIPR implementation, the study assessed CIPR techniques employed by several state transportation agencies. Transportation agency surveys, database creation, laboratory mix design analysis, field distress surveys, life cycle modeling, and comparative pavement assessments were all part of the process. To investigate current standards, recycling additives, traffic limits, mix design techniques, and building practices, a survey of 13 transportation agencies was conducted.

Additionally, researchers created a database containing traffic, pavement structure, distress conditions, and repair details from 169 CIPR projects in New York State. Using condition surveys and pavement rating systems, field investigations contrasted CIPR pavements with mill-and-fill and two-course overlay pavements. Grading analysis, Marshall stability testing, retained stability evaluation, moisture susceptibility assessment, density measurements, and optional raveling tests were all part of the laboratory mix design process. To enhance mixture performance and moisture resistance, the study also assessed the use of additives, including lime, Portland cement, polymers, and add-stone. The study also looked at construction methods, compaction techniques, curing specifications, and traffic control strategies. The results demonstrated that when applied to carefully selected pavements with adequate structural support and drainage, CIPR can greatly enhance pavement performance and prolong pavement service life. According to the service-life analysis, pavement life might be extended by an average of 11 years through CIPR repair.

Long-term performance was typically demonstrated by pavements with thicker base and subbase layers, whereas pavements with insufficient structural support had shorter service lives. Based on field distress assessments, the study also discovered that CIPR pavements performed comparably to mill-and-fill and two-course overlay pavements. Environmental assessments demonstrated that CIPR used less energy and generated fewer greenhouse gas emissions, while life-cycle cost analysis showed that CIPR without add-stone delivered lower initial and life-cycle costs than other typical rehabilitation methods. Additives, including lime, Portland cement, and polymer-modified emulsions, enhanced cohesiveness, moisture resistance, curing, and stability, according to laboratory and field tests. Additionally, the research noted that serious structural failures, poor subgrade conditions, and drainage issues restricted the efficacy of CIPR and necessitated corrective action before restoration.

The study found that when proper project selection, mix design, and construction processes are followed, CIPR is an efficient, cost-effective, and sustainable pavement rehabilitation approach. In addition to emphasizing the importance of assessing pavement distress type, drainage conditions, structural capacity, traffic loading, and curing requirements before choosing CIPR as a rehabilitation strategy, the report also suggested developing formal screening criteria to identify appropriate pavements for CIPR applications. To increase long-term pavement durability, it is also suggested to use formal mix design techniques, quality control testing, appropriate compaction, and performance monitoring. The report proposed that CIPR project performance be continuously monitored using pavement management systems and that current standards be updated to include standardized design requirements. Overall, the study showed that, when used in accordance with appropriate engineering and construction procedures, CIPR offers significant economic and environmental benefits while producing pavement performance comparable to traditional restoration techniques.

Pothole Prevention and Innovative Repair - Minnesota DOT

The Minnesota Department of Transportation has conducted research on pothole prevention and innovative repair [8], where potholes continue to be one of the biggest maintenance challenges for highway agencies because repairs are frequently temporary and necessitate repeated maintenance. According to the report, potholes primarily form when pavement cracks are not repaired in time, allowing water to penetrate the pavement structure; freeze-thaw cycles, traffic loading, and weak pavement foundations further accelerate pavement damage. Proactive pavement preservation activities, such as crack sealing and timely maintenance, are important in reducing pothole occurrence and extending pavement life. Because fixes are often temporary and require ongoing maintenance, potholes remain one of the biggest maintenance issues facing transportation agencies. According to the paper, potholes primarily form when water seeps through the pavement structure through unrepaired cracks. Pavement damage is accelerated by traffic loads, freeze-thaw cycles, and poor pavement foundations. The study highlighted the significance of proactive pavement preservation measures, such as regular maintenance and crack sealing, in reducing the frequency of potholes and prolonging pavement life.

Laboratory testing, numerical stress analysis, a literature review, and an assessment of maintenance practices across regions and countries were all part of the study's scope. The primary goal was to investigate the critical factors associated with pothole formation and repair and to recommend long-lasting and cost-effective solutions. The study also sought to evaluate various repair methods, analyze the effect of pothole geometry on stress distribution, examine the performance of traditional and innovative patching materials, and assess pavement preservation strategies that could delay pothole formation. The study's objectives were to evaluate various repair techniques, investigate how pothole geometry affects stress distribution, assess the performance of conventional and novel patching materials, and evaluate pavement preservation techniques that might prevent potholes from forming. Laboratory testing, numerical stress analysis, a review of the literature, and an assessment of maintenance procedures employed in various nations and areas were all included in the work's scope.

A variety of pothole repair techniques, including throw-and-go, throw-and-roll, semi-permanent, spray injection, and edge-seal techniques, were reviewed and compared; numerical simulations were performed using finite element modeling to study stress concentrations around circular, square, and diamond-shaped potholes; laboratory experiments were carried out on conventional cold mix materials, hot mix asphalt, and innovative materials, such as graphite nano-platelet modified mixtures; mechanical properties, bonding performance, creep stiffness, fracture resistance, and water penetration. The study also included surveys of Minnesota maintenance agencies to gain insight into current pothole repair practices and challenges. Throw-and-go, throw-and-roll, semi-permanent, spray injection, and edge-seal procedures were among the several pothole repair methods that were examined and contrasted. Stress concentrations around circular, square, and diamond-shaped potholes were investigated using numerical simulations based on finite element modeling. Traditional cold-mix materials, hot-mix asphalt, and novel materials, such as graphite nanoplatelet-modified mixes, were also tested in the lab. Under various temperature conditions, mechanical characteristics, bonding performance, creep stiffness, fracture resistance, and water penetration resistance were assessed. To understand current pothole repair procedures and challenges, the study also included questionnaires from Minnesota maintenance organizations.

The findings showed that delayed maintenance of pavement cracks is a major factor in the development of potholes. Pavement deterioration is further accelerated by freeze-thaw action and water infiltration. Compared to square- or diamond-shaped repairs, circular potholes produced the least stress concentration and were found to be more durable. The study also found that winter cold-mix materials typically perform poorly mechanically and require frequent repairs, particularly in extreme temperatures. Repairs made with hot mix asphalt in the spring or summer demonstrated significantly greater longevity and durability. Although they required more equipment and were more expensive, innovative technologies such as microwave and infrared heating, and taconite-based materials, showed promise. Low-cost temporary repairs may seem cost-effective at first, but durable repair techniques offer superior long-term performance and lower overall maintenance costs, according to life-cycle cost analysis.

The study recommended using high-quality patching materials, ensuring proper bonding between the repair material and the existing pavement, and adopting more durable repair methods rather than relying solely on temporary repairs. Circular pothole repair geometry and repair materials with stiffness similar to that of the original pavement were recommended to improve performance. The researchers also suggested implementing a systematic tracking program to monitor pothole repairs, maintenance costs, and long-term field performance, enabling agencies to make more effective maintenance decisions in the future. Pavement deterioration can be significantly delayed with regular maintenance, proper drainage, and prompt crack sealing. Instead of relying solely on temporary repairs, the study suggested using high-quality patching materials, ensuring the repair material and the existing pavement are properly-bonded, and implementing more durable repair techniques. For better results, circular pothole shape and materials with rigidity comparable to the original pavement were suggested. To help agencies make better maintenance decisions going forward, the researchers also recommended implementing a systematic tracking system to monitor pothole repairs, maintenance expenses, and long-term field performance.

2.2 ARDOT Practices

Research conducted by the Arkansas Highway and Transportation Department (AHTD), in 1984, explored the use of pavement millings' applicability in cold mix recycling for low-volume road applications in Arkansas [9]. According to the study, cold-mix recycling can save on building expenses, preserve natural resources, and serve as a substitute pavement material for maintenance tasks. The success of recycled mixtures depends on the condition of the salvaged material, the type of recycling agent used, and the final engineering properties of the mix, according to earlier research reviewed in the report. Cold recycling is the reuse of existing pavement materials without the addition of heat. The literature also indicated that a proper cold recycling mix design should include evaluating salvaged materials, selecting suitable modifiers, preparing and testing mixtures, determining the optimum modifier content, and final testing of the recycled mix. Previous studies emphasized that modifiers should improve workability, stability, and durability of the recycled material while maintaining acceptable moisture resistance.

The study aimed to develop a cold-mix recycling process for low-volume road maintenance, using pavement millings and various recycling agents. Ten Arkansas stockpiles of limestone and sandstone were tested for gradation, asphalt content, and physical properties, including ductility, viscosity, and penetration. Mixtures with 2-4% emulsions, rejuvenators, and cutbacks were evaluated for cohesiveness, appearance, and uniformity. The Marshall method and immersion tests assessed stability, flow, air voids, and moisture susceptibility, considering performance at different temperatures. The focus was solely on recycling existing pavement materials without adding new aggregate or binder.

The results demonstrated that pavement millings differed significantly among stockpiles. The asphalt content varied from roughly 4.4 percent to 6.3 percent, suggesting that different stocks would require different amounts of modifier and asphalt. Due to increased aggregate breakdown during milling, the aggregate gradations were often finer than conventional surface mix criteria require. Additionally, the study found that even when penetration and viscosity values were identical, the ductility of recovered asphalt binders varied dramatically, indicating that aged asphalt properties were unpredictable and inconsistent. While rejuvenators often required higher concentrations to improve workability and cohesion, visual evaluations showed that some emulsion-based modifiers produced acceptable mixtures at lower percentages. Nevertheless, in mixture evaluations, the MC-250 cutback was frequently considered undesirable. According to Marshall stability testing, the recycled mixtures exhibited weak structural behavior, with very high flow values and low stability at high temperatures. Due to the mix's high air voids and extreme moisture sensitivity, the maintained stability tests revealed that several samples failed during moisture conditioning. Overall, the laboratory results indicated that the recycled cold mixes did not function as well as durable asphalt surface mixtures but resembled untreated base materials.

According to the study's findings, pavement millings can be repurposed in cold mixes, but their engineering performance is constrained in the absence of appreciable advancements in material characteristics and mixture design. Since these elements were not thoroughly examined in the study, the report suggested that future research assess the impact of moisture during compaction and the effect of response time between modifiers and old asphalt components. Additionally, it indicated that to enhance the stability, durability, and moisture resistance of recycled cold mixes, new aggregates or other materials might be needed. The results showed that the laboratory-tested recycled combinations were highly susceptible to moisture and should not be used on medium- or heavy-traffic roads without further treatment. To reduce moisture infiltration and enhance pavement performance, the research also recommended applying seal coatings or protective surface treatments when using these materials in the field. Overall, the study demonstrated the importance of appropriate material evaluation, modifier selection, and moisture management for effective recycled pavement applications, and offered insights into the behavior of pavement millings in cold-mix recycling.

CHAPTER 3. TEST SITE DEVELOPMENT

3.1 HPCM Materials

In this study, nine different HPCM materials were selected to evaluate their performance under similar traffic and environmental conditions. Transportation agencies and contractors often use bagged or bulk, plant-produced cold mix solutions for pothole repairs. To maintain consistency, these products are referred to as Products 1 through 9 instead of their commercial names. Products 6 to 9 are plant-produced materials obtained from various vendors and manufacturing sites, while Products 1 to 5 are bagged commodities. The identities of the products were only revealed to the project team after the results were evaluated, ensuring an unbiased assessment. The Materials Division kept the list shown in Table 1, along with the suppliers.

Table 1: Product Numbers with Supplier Details

Product Number	Supplier	Supply Type
1	QPR	Bagged
2	Perma Patch	Bagged
3	EZ Street	Bagged
4	Rock Asphalt	Bagged
5	Proline	Bagged
6	QPR – Cranford North Little Rock Plant	Bulk
7	Proline – APAC Central Plant	Bulk
8	QPR – Jet Asphalt Plant	Bulk
9	Ergon – Blackstone Plant	Bulk

All products submitted for evaluation were monitored for variabilities in: workability, compaction, durability, moisture resistance, and long-term field performance of cold-mix products. While some products are meant to serve as long-term maintenance solutions, others are designed for rapid, temporary repairs. To better understand how various HPCM materials behave in real-world conditions, it was crucial to compare them side by side, as ARDOT maintenance staff frequently encounter potholes under a variety of weather and traffic conditions.

The selected HPCM materials also represented a variety of aggregate types, asphalt binders, additives, and production techniques. Plant-produced materials are usually supplied in bulk for larger maintenance activities, whereas bagged items are typically manufactured in controlled environments and packaged for convenient shipment and emergency repairs. The study provided a more accurate comparison of the products now available for pavement repair tasks by incorporating both material types. The assessment concentrated on tracking material handling, placement convenience, compaction properties, resistance to traffic loading, and overall patch performance over time.

3.2 Test Site Location

Figure 1 shows the test site on Highway 338, also known as Sweet Home Cutoff/Dixon Road in Little Rock, Arkansas, which reflects the traffic and road conditions that ARDOT maintenance staff frequently see during routine pothole repair operations; it was chosen as the test location for this evaluation. The roadway is a good place to assess the field performance of HPCM materials under practical service conditions, as it experiences frequent daily traffic, including medium to heavy-duty trucks and passenger cars. Pothole development is usually linked to surface aging, cracking, and localized deterioration, all of which were evident in the pavement portion chosen for the study. These current pavement conditions offered a useful setting for evaluating the long-term performance and durability of the repair materials under real-world traffic and environmental exposure.

Figure 1. Highway 338, Dixon Road, Little Rock, Arkansas

3.3 Test Site Preparation

Site Layout

The westbound lane was chosen for the investigation because it provided sufficient space to construct multiple test sections while maintaining similar pavement and road conditions across all repair materials. Proper traffic control measures, including cones, traffic lights, and signs, were implemented during fieldwork. The sites for the HPCM placements were marked with measuring tape and paint, as illustrated in **Figure 2**.

Figure 2: Test Site Layout

Creating Potholes

To assess the field performance of HPCM materials under controlled conditions, artificial potholes were created on the existing pavement surface. To ensure that variations in performance primarily indicate the properties of the HPCM materials rather than differences in repair dimensions, the potholes were created with consistent depth and geometry. The correct spacing between potholes was maintained at approximately 15 feet between each different HPCM set in the direction of traffic to avoid overlapping stress zones and allowing for independent monitoring of each repair section. To ensure consistent testing conditions, 16-inch by 16-inch potholes were created in the two-wheel paths of the roadway. Initially, the designated spots were milled using a skid steer with single-drum mill fitted with cutting teeth, as illustrated in **Figure 3**, to form rectangular grooves. These grooves were then cleaned using pneumatic tools and manual methods. **Figure 4** displays the final cleaned groove after milling.

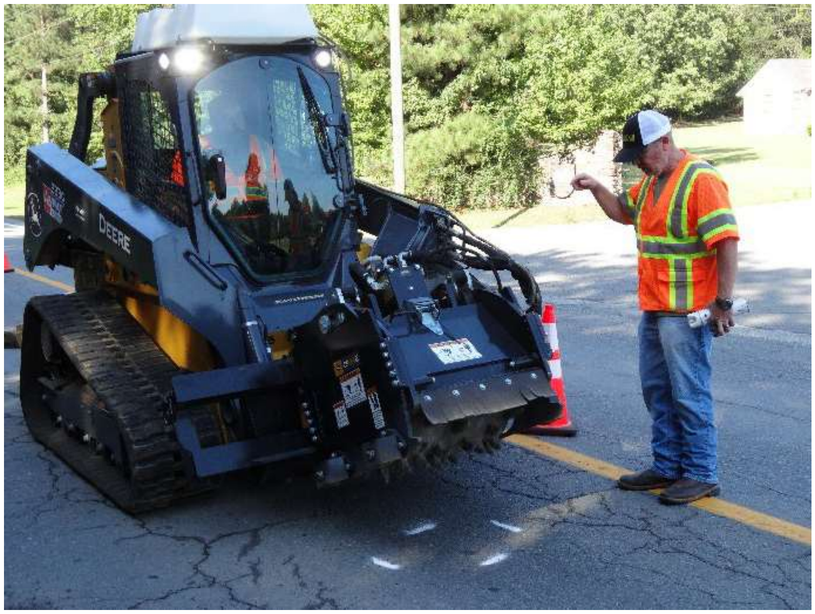


Figure 3. Pothole Creation by Milling

Figure 4. Clean Rectangular Groove After Milling

This study involved creating two types of potholes to assess HPCM's performance under various conditions. One type was formed by simply milling and cleaning the grooves, as shown in **Figure 4**. The other was made by milling then cutting the edges with a chop saw and breaking them with a jackhammer to form a proper rectangular shape with a relatively uniform bottom, as shown in **Figures 5 and 6**. The grooved patterns are positioned along the center line on the left wheel path, while the rectangular saw-cut pattern runs along the right edge of the road on the right wheel path. The simple milling pattern takes less time to prepare than the rectangular saw-cut pattern, allowing for quicker traffic opening. Both patterns were subsequently tested for performance.

Figure 5: Cutting Edges with a Saw and Breaking with a Jackhammer

Figure 6. Rectangular Pothole After Cleaning

Figure 7 displays the final prepared site after creating the necessary potholes and cleaning.

Figure 7. Prepared Site with Potholes

3.4 HPCM Materials Placement

Application of Tack Coat

After excavating the potholes, a standard asphalt tack coat (CSS-1 at 100 degrees F) was applied to the interior surfaces of the prepared grooves and sawed holes - making sure to tack the sides of the holes. This step helps ensure a strong adhesive bond with the existing pavement, preparing the patches for the new cold-mix asphalt. The tack coat was evenly sprayed over the rough, fractured aggregate floor and along the vertical saw-cut perimeter walls, as shown in **Figure 8**. Extra effort was made to coat the irregular depressions left by the jackhammer to prevent water infiltration. The same technique was used on the grooved surface. A field operator used a pressurized wand sprayer attached to an asphalt emulsion tank to apply the liquid tack coat evenly. This application fully covered two types of excavated test patches. The vertical edges and corners received complete coverage to reduce the risk of joint separation or raveling.

(a) Spraying Tack Coat on a Rectangular Cut **(b) Tack Coat Applied on a Rectangular Pothole Surface**

(c) Spraying Tack Coat on a Grooved Milled Patch **(d) Tack Coat Applied on a Grooved Pothole Surface**

Figure 8. Applying a Uniform Tack Coat Layer to all the Surfaces of the Prepared Pothole

Placement of HPCM Materials

The HPCM materials were applied in the repair zones following each manufacturer's or supplier's instructions, after the potholes were prepped and cleaned. These materials were carefully handled and transported to maintain their consistency and workability. Plant-produced materials were delivered in 5-gallon buckets and installed using standard maintenance procedures, while bagged items were opened and directly placed into the potholes. To ensure even distribution throughout each repair area, the potholes were gradually filled and bonded with the existing pavement making sure to completely fill the corners and edges as shown in **Figure 9**. The repair materials were placed and slightly overfilled above the pavement surface to allow for proper densification during rolling and traffic loads as depicted in **Figure 10**.

Figure 9. Placing HPCM Material in Potholes

Figure 10. Overfilled Repair Materials Before Compaction

Subsequently, compaction was performed in accordance with field maintenance protocols and manufacturer instructions, using suitable tools and techniques. Each hole was hand tamped and rolled with a roller to densify the material, creating a stable, dense patch, as shown in **Figure 11**. Achieving proper compaction was essential to improve patch stability and increase resistance to moisture penetration and traffic wear.

Figure 11. Compacting Placed HPCM Material

Material handling, workability, stickiness, ease of compaction, and overall constructability were observed during placement. Some materials required more effort to assemble, while others were easier to spread and compress. After compaction, the repaired areas were inspected to ensure the patches were well seated and roughly level with the surrounding pavement. The route was reopened to traffic once placement and compaction were complete. **Figure 12** shows the test section after placement and curing.

Figure 12. HPCM Material After Placement and Compaction

CHAPTER 4. PERFORMANCE EVALUATION FOR HPCM PRODUCTS

4.1 Performance Monitoring Plan

To ensure the long-term durability of the HPCM patches, a rigorous field observation schedule was carried out from September 2024 to September 2025. The project team has conducted weekly routine visual inspections. The data collected from these inspections were systematically compiled into quarterly progress reports, which detailed each site's appearance of structural integrity and tracked how the HPCM materials stabilized over the 12 months under actual traffic and weather conditions.

Field Performance Evaluation Criteria

During each field inspection, the HPCM patches were evaluated and rated for specific field distress criteria to document: material cohesion, load-bearing capacity, structural stability, and bond strength to the existing pavement. The main criteria examined during the inspections are as follows.

- **Rutting/Deformation:** Inspection personnel observed the depth of any permanent vertical displacement or wheel-path depressions within the patch area to evaluate the material's structural stability under heavy vehicle loads.
- **Shoving/Pushing:** The site was inspected for longitudinal displacement or bulging of the asphalt mix, which typically occurs at the edges of a patch due to severe traffic braking, acceleration, or a weak bond with the underlying road base.
- **Popouts/Raveling:** The patch surface was examined for progressive material disintegration, including the loss of aggregate particles (raveling) or the breaking away of larger chunks of the mix (popouts), to assess the cohesion of the binder.
- **Cracking:** Inspection personnel documented any signs of surface cracking, including reflective, edge, or fatigue cracking, to determine the patch's flexibility and its ability to withstand environmental thermal cycles without brittle failure.
- **Bleeding:** The surface was checked for the upward migration of liquid asphalt binder. Excessive binder pooling on the surface indicates a rich mix or high temperatures, which can severely compromise skid resistance.

4.2 Results

Since no rutting, shoving, raveling, cracking, or bleeding were recorded during the 12-month inspections, the discussion should focus on deformation (settlement) and pop-outs of the existing pavement while noting the absence of the other distresses. The summary evaluation results are presented in **Table 2** below, with the detailed inspection reports included as an **Appendix**.

Table 2: Summary Evaluation Results

Product Number	Patch	Rutting	Shoving	Popouts	Deformation (Settlement)	Raveling	Cracking	Bleeding
1	A*	No	No	Small Pop-out of existing pavement	Minor	No	No	No
1	B*	No	No	No	Minor	No	No	No
2	A	No	No	No	Minor	No	No	No
2	B	No	No	No	Minor	No	No	No
3	A	No	No	No	Minor	No	No	No
3	B	No	No	Small Pop-out of existing pavement	Minor	No	No	No
4	A	No	No	Small Pop-out of existing pavement	Minor	No	No	No
4	B	No	No	Small Pop-out of existing pavement	Minor	No	No	No
5	A	No	No	Small Pop-out of existing pavement	Minor	No	No	No
5	B	No	No	Small Pop-out of existing pavement	Minor	No	No	No
6	A	No	No	Small Pop-out of existing pavement	Minor	No	No	No
6	B	No	No	No	Minor	No	No	No

Product Number	Patch	Rutting	Shoving	Popouts	Deformation (Settlement)	Raveling	Cracking	Bleeding
7	A	No	No	Small Pop-out of existing pavement	Minor	No	No	No
7	B	No	No	No	Minor	No	No	No
8	A	No	No	No	No	No	No	No
8	B	No	No	No	No	No	No	No
9	A	No	No	Small Pop-out of existing pavement	Minor	No	No	No
9	B	No	No	No	Minor	No	No	No

** Note:*
A = Patches along the outside edge of the road near the white edge line
B = Patches along the center line of the road

Product 1

Product 1 demonstrates good overall field performance throughout the evaluation period. The patches remained largely stable with only minor settlement observed in later inspections. Small pop-outs of existing pavement developed on the test strip during the monitoring period, indicating localized material loss of the existing pavement at the patch edge. No rutting, shoving, raveling, cracking, or bleeding was observed. Overall, Product 1 exhibited moderate resistance to traffic loading and maintained satisfactory patch integrity. **Figure 13** shows the patches after installation and after 12 months at the time of the final inspection.

(a) Initial Placement **(b) Final Inspection**

Figure 13. Product 1: Newly Laid and After 12 Months

Product 2

Product 2 maintained its structural integrity during the evaluation period but experienced ongoing settlement below the surrounding pavement surface. The deformation indicates a gradual densification of the material under traffic loads. No signs of rutting, shoving, pop-outs, raveling, cracking, or bleeding were observed. While the material remained intact, the persistent settlement decreased its overall performance. **Figure 14** displays the patches after installation and after 12 months, as seen during the final inspection.

(a) Initial Placement **(b) Final Inspection**

Figure 14. Product 2: Newly Laid and After 12 months

Product 3

Product 3 performed moderately during field testing. Continuous settlement beneath the surrounding pavement surface indicated ongoing deformation. Slight pop-outs of existing pavement appeared in one test strip evaluation during later inspections. No signs of rutting, shoving, raveling, cracking, or bleeding were detected. The observed settlement indicates moderate resistance to traffic-related distress. **Figure 15** displays the patches after installation and after 12 months, as seen during the final inspection.

(a) Initial Placement **(b) Final Inspection**

Figure 15. Product 3: Newly Laid and After 12 Months

Product 4

Product 4 showed early signs of deterioration in the existing pavement compared to other products. Pop-outs in the existing pavement developed shortly after placement and were observed during subsequent inspections. The patches also experienced settlement below flush conditions, indicating deformation under repeated traffic loading. No rutting, shoving, raveling, cracking, or bleeding was observed. **Figure 16** displays the patches after installation and after 12 months, as seen during the final inspection.

(a) Initial Placement **(b) Final Inspection**

Figure 16. Product 4: Newly Laid and After 12 Months

Product 5

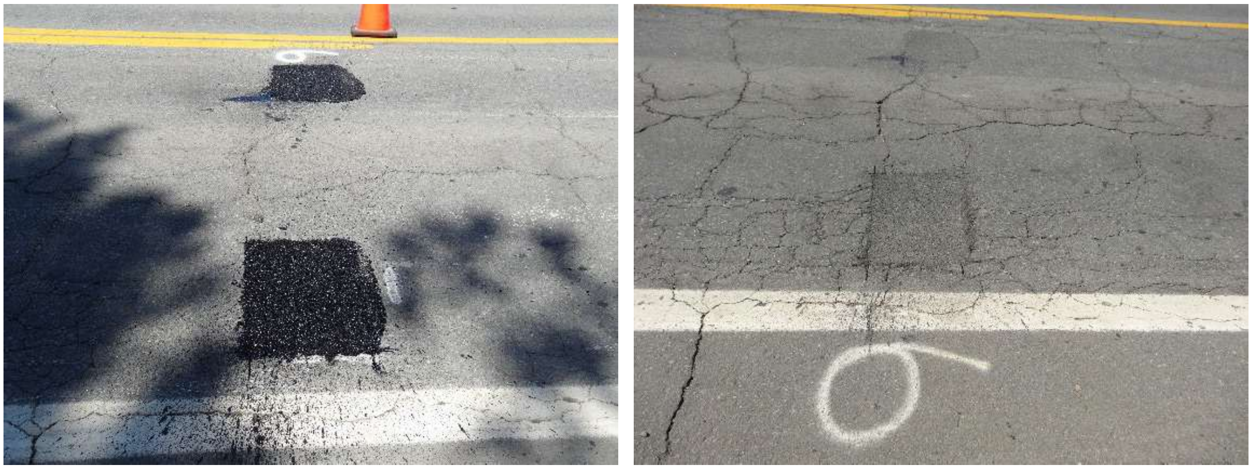
Early pop-outs of existing pavement were observed for Product 5, followed by increasing settlement throughout the monitoring period. The continued deformation indicates a lower ability to maintain patch elevation under traffic. No rutting, shoving, raveling, cracking, or bleeding was recorded. Overall, Product 5 demonstrated moderate resistance to deformation. **Figure 17** displays the patches after installation and after 12 months, as seen during the final inspection.

(a) Initial Placement **(b) Final Inspection**

Figure 17. Product 5: Newly Laid and After 12 Months

Product 6

Product 6 experienced consistent settlement throughout the evaluation period, with occasional deterioration observed in the adjacent existing pavement surrounding the patch. No rutting, shoving, raveling, cracking, or bleeding was observed. The material provided acceptable performance but was affected by surrounding pavement conditions and held up well and intact. **Figure 18** displays the patches after installation and after 12 months, as seen during the final inspection.



(a) Initial Placement **(b) Final Inspection**

Figure 18. Product 6: Newly Laid and After 12 Months

Product 7

Product 7 showed moderate performance characterized primarily by settlement below the surrounding pavement surface. Small pop-outs of existing pavement and localized pavement distress were observed during the monitoring period. No rutting, shoving, raveling, cracking, or bleeding was identified. **Figure 19** displays the patches after installation and after 12 months, as seen during the final inspection.

(a) Initial Placement **(b) Final Inspection**

Figure 19. Product 7: Newly Laid and After 12 Months

Product 8

Product 8 demonstrated the best overall field performance among all evaluated materials. Both patches remained in good condition throughout the monitoring period and stayed nearly flush with the surrounding pavement surface. No significant settlement, pop-outs, rutting, shoving, raveling, cracking, or bleeding were observed. The material maintained excellent patch integrity and exhibited superior resistance to traffic-related distress in the surrounding pavement. **Figure 20** displays the patches after installation and after 12 months, as seen during the final inspection.

(a) Initial Placement **(b) Final Inspection**

Figure 20. Product 8: Newly Laid and After 12 Months

Product 9

It should be noted that Product 9 material had not been received from the manufacturer at the time the test strip was installed. Temporary material was used for the first six days. Upon receipt, the temporary material was removed, and the specified Product 9 material was installed in its designated location. Although the patches remained intact, the observed deformation indicated reduced resistance to traffic loading. No rutting, shoving, pop-outs, raveling, cracking, or bleeding were observed. Overall, Product 9 performed like all other products, except product 8.

(a) Initial Placement **(b) Final Inspection**

Figure 21. Product 9: Newly Laid and After 12 Months

Overall Performance Assessment

During the 12-month evaluation, each product experienced similar traffic loads, environmental conditions, and drainage. Overall, there was no significant deformation or debonding, and all materials remained largely stable despite the localized distresses from the surrounding pavement. However, minor differences in performance were noted among the products evaluated. Some slight settlement appeared in certain areas, indicating localized compaction or consolidation under traffic. Very minor raveling was observed in the first few weeks after placement in which small aggregate particles began to detach from the surface. The most common damage across all products was settlement of the patch surface. Existing pavement pop-outs mainly occurred in products 1, 3, 4, 5, and 7, with products 4 and 5 showing relatively greater material loss. No significant rutting, shoving, cracking, or bleeding was observed. Product 8 performed the best overall, remaining flush with the pavement and maintaining structural integrity throughout the study.

4.3 ARDOT QPL Specification

ARDOT uses a systematic process to incorporate new technology and materials into its projects by assessing innovative products. These products include new innovations, materials, or equipment that are not yet in the Standard Specifications or listed on the QPL. Submissions for these new items are sent to the relevant ARDOT Divisions for review. The evaluation proceeds only if an ARDOT employee agrees to support the product and collaborates with the New Products Committee Secretary to create a custom review process, track performance, and develop an effective implementation plan.

Method of Documentation of Acceptance:

- Available by brand and supplier
- Bag mix can be bought at any retail store or directly from the approved supplier, in any quantity (such as bags, totes, or truckloads).

Method of Approval:

The following procedure shall be followed to obtain HPCM approval:

1. Submittal Requirements

The manufacturer/supplier shall submit the following to the ARDOT Materials Division:

- A 100-lb sample (or 2 bags) of the HPCM
- Safety Data Sheets (SDS) for all components
- Product literature, including recommended uses, mixing instructions, storage requirements, and placement/compaction guidelines
- Test data from a recognized independent laboratory showing performance tests for cold-mix asphalt, if available

2. Field Performance Requirement

Because High-Performance Cold Mix is intended for maintenance and construction applications under varying conditions, a field performance evaluation is required before QPL listing.

- The samples shall be sent to the Materials Division, which will then select a suitable site for the field performance evaluation.

- Performance will be monitored for at least six (6) months or as decided by the Materials Division. The materials will be evaluated for their resistance to degradation, including but not limited to raveling, stripping, potholing, and cohesion loss.

3. Approval of Asphalt Plants for Bulk Production of HPCM

HPCM shall be supplied either as a packaged product or as bulk-produced at an asphalt plant approved by the Department. Approval of HPCM will be specific to the manufacturer, product formulation, and approved production source, and will not be transferable without prior approval from the Department. When HPCM is produced in bulk, the following requirements apply.

- Manufacturer Authorization

  The HPCM manufacturer will authorize the asphalt plant in writing to produce the approved formulation. The manufacturer shall certify that all materials, proportions, additives, and production methods used at the plant are identical to the formulation submitted for QPL listing.

- Changes in Production

  Any change in plant location, equipment, aggregate source, binder source, additives, or formulation requires resubmittal to the Department and may require additional evaluation as determined by the Materials Engineer.

- Sampling and Inspection

  Destination or field samples of bulk-produced HPCM will be taken as deemed necessary by the Materials Engineer to verify continued compliance with approved requirements. Bulk-produced HPCM will be identified by manufacturer, product name, and approved production source on delivery documentation provided with each load of material.

4. QPL Listing

If the information submitted and field performance indicate compliance with all applicable requirements, a letter and an unsigned certification agreement will be sent to the manufacturer. The product will be placed on the QPL on receipt of the signed certification agreement. HPCM will be listed on the QPL by brand and source. When applicable, the listing shall identify approved asphalt plant(s) authorized to produce the material in bulk.

5. Ongoing Compliance

- Destination samples will be taken as deemed necessary by the Materials Engineer to ensure compliance with specifications.
- Any change in formulation, composition, or physical properties of the approved HPCM requires resubmission to the Department, including updated test data.
- The manufacturer of privately labeled products must be disclosed.
- Failure to maintain compliance with approved requirements may result in the removal of the product from the QPL as determined by the Materials Engineer.
- No information contained in these lists is to be used for promotional purposes.

CHAPTER 5. CLOSURE

5.1 Summary and Findings

All nine HPCM products performed well during the study, meeting performance expectations under traffic and environmental conditions. None required maintenance or replacement, indicating stability over twelve (12) months and resilience to weather. Minor deviations, such as slight settling or surface issues, were negligible and did not affect overall performance, with no major failures, such as rutting or cracking. Results showed similar performance across all products, demonstrating their durability for various road repair applications. This evaluation identified reliable products for pothole repair, leading to the creation of a QPL for HPCM materials. This list ensures that future submissions meet standards before approval, maintaining quality for HPCM repairs.

5.2 Conclusions

- Over the course of the study, all nine HPCM products assessed performed satisfactorily.
- Despite minor behavioral deviations like minimal settling or isolated surface issues, these negligible changes did not impact overall performance or cause major failures like rutting, cracking, or bleeding.
- All nine HPCM materials were selected to be added to the ARDOT QPL listing.
- The study compared two patterns: one with only milled grooves and the other combining milled grooves and saw cuts for a rectangular shape with vertical sides. Both performed well without distress. The milled pattern requires less preparation, reduces traffic control efforts, and allows faster reopening than the saw cut pattern.
- A QPL specification includes top-performing products for Department use. It provides a process for evaluating future requests to add new HPCM products to the ARDOT QPL, ensuring those meet the standards for repairs with HPCM.

5.3 Recommendation and Future Works

Based on the field performance findings and QPL specification guidelines, the following actions are suggested for future work:

- Establish Plant-Produced Bulk Production Protocols: Approved formulations produced in bulk require manufacturers to provide written authorization and to certify that all aggregates, binder properties, chemical additives, and blending ratios match the initial laboratory-submitted formulation.
- Ensure Consistent Field Preparation Procedures: Maintenance crews should strictly follow the procedure outlined in this study. This includes cutting clean rectangular boundaries, thoroughly removing dust and loose debris, and applying a pressurized wand-sprayed asphalt emulsion tack coat to all internal cavity surfaces before installing the cold mix or use the milled groove with tack coat. Where a milling head is not available, the hole preparation, cleaning, and tack application is critical to achieve results similar to this study.
- Geographic and Climatic Constraints: This assessment focused on a specific pavement segment in Central Arkansas, with environmental factors limited to the weather conditions from late 2024 to late 2025.
- Long-Term Monitoring: The 12-month tracking reveals initial consolidation and seasonal stability but does not reflect patches' fatigue limits over a multi-year pavement lifecycle. It is important to assess

how the chemical binder properties of top-performing HPCM products evolve over 3 to 5 years with exposure to localized UV light and freeze-thaw cycles.

- Laboratory-to-Field Correlation: Perform comparative lab testing like Hamburg Wheel-Track or IDEAL-CT cracking tests on the same verification samples sent to the Materials Division. This helps set performance benchmarks for future QPL candidates.

REFERENCES

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[9] Arkansas Highway and Transportation Department, Materials and Research Division, Use of Pavement Millings in Cold Mixes, Little Rock: Arkansas Highway and Transportation Department, Materials and Research Division, 1984.

APPENDIX: DETAILED INSPECTION REPORTS

Table A 1: Detailed Inspection Reports

Product Number	**Supplier**	**Supply Type**	**Date**	9/19/2024	12/3/2024	3/19/2025	3/27/2025	4/2/2025
^	^	^	**Avg Temp (°F)**	73	78	75	78	82
^	^	^	**Weather**	Sunny	Sunny	Sunny	Partly Cloudy	Partly Cloudy
1	QPR	Bagged	Strip-A*	Good	Good	Good	Good	Good
1	QPR	Bagged	Strip-B*	Good	Good	Good	Good	Good
2	Perma Patch	Bagged	Strip-A	Good	Good	Good	Good	Good
2	Perma Patch	Bagged	Strip-B	Good	Good	Good	Good	Good
3	EZ Street	Bagged	Strip-A	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
3	EZ Street	Bagged	Strip-B	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
4	Rock Asphalt	Bagged	Strip-A	Settling below flush	Settling below flush	Pop-out of existing pavement	Pop-out of existing pavement	Pop-out of existing pavement
4	Rock Asphalt	Bagged	Strip-B	Slight Settling	Slight Settling	Slight Settling	Slight Settling	Slight Settling
5	Proline	Bagged	Strip-A	Settling below flush	Settling below flush	Pop-out of existing pavement	Pop-out of existing pavement	Pop-out of existing pavement
5	Proline	Bagged	Strip-B	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
6	QPR – Cranford North Little Rock Plant	Bulk	Strip-A	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
6	QPR – Cranford North Little Rock Plant	Bulk	Strip-B	Slight Settling	Slight Settling	Slight Settling	Slight Settling	Slight Settling
7	Proline – APAC Central Plant	Bulk	Strip-A	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
7	Proline – APAC Central Plant	Bulk	Strip-B	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
8	QPR – Jet Asphalt Plant	Bulk	Strip-A	Good	Good	Good	Good	Good
8	QPR – Jet Asphalt Plant	Bulk	Strip-B	Good	Good	Good	Good	Good
9	Ergon – Blackstone Plant	Bulk	Strip-A	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
9	Ergon – Blackstone Plant	Bulk	Strip-B	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
Remarks/ Comments				Material 9 is temporary until the correct one comes in.	Looks similar to the previous inspection.	4A & 5A pop-out of existing pavement started.	4A & 5A pop-out of existing pavement existing pavement, little change.	Looks similar to the previous inspection.

Product Number	**Supplier**	**Supply Type**	**Date**	4/8/2025	4/23/2025	4/30/2025	5/8/2025	5/19/2025
^	^	^	**Avg Temp (°F)**	63	78	83	78	84
^	^	^	**Weather**	Sunny	Cloudy	Partly Cloudy	Partly Cloudy	Cloudy
1	QPR	Bagged	Strip-A*	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
1	QPR	Bagged	Strip-B*	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
2	Perma Patch	Bagged	Strip-A	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
2	Perma Patch	Bagged	Strip-B	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
3	EZ Street	Bagged	Strip-A	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
3	EZ Street	Bagged	Strip-B	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
4	Rock Asphalt	Bagged	Strip-A	New existing pavement pop-out	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
4	Rock Asphalt	Bagged	Strip-B	Slight Settling	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
5	Proline	Bagged	Strip-A	More Settling	More Settling	More Settling	More Settling	More Settling
5	Proline	Bagged	Strip-B	Settling below flush	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
6	QPR – Cranford North Little Rock Plant	Bulk	Strip-A	New existing pavement pop-out	Existing pavement pop-out	Existing pavement pop-out	Existing pavement pop-out	Existing pavement pop-out
6	QPR – Cranford North Little Rock Plant	Bulk	Strip-B	Slight Settling	Slight Settling	Slight Settling	Slight Settling	Slight Settling
7	Proline – APAC Central Plant	Bulk	Strip-A	New existing pavement pop-out	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
7	Proline – APAC Central Plant	Bulk	Strip-B	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
8	QPR – Jet Asphalt Plant	Bulk	Strip-A	Good	Good	Good	Good	Good
8	QPR – Jet Asphalt Plant	Bulk	Strip-B	Good	Good	Good	Good	Good
9	Ergon – Blackstone Plant	Bulk	Strip-A	New existing pavement pop-out	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
9	Ergon – Blackstone Plant	Bulk	Strip-B	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
Remarks/ Comments				Only 8 A&B have no settlement so far.	Existing pavement worsens, potholes between 6 & 7 grow, but aren't part of this project.	Small pop-outs of existing pavement were observed, cold mix potholes are settling, except 8A & 8B	All patches show moisture on the lower side, except 9B.	Looks like the previous inspection.

Product Number	Supplier	Supply Type	Date	5/29/2025	6/10/2025	6/26/2025	7/10/2025	7/22/2025
^	^	^	**Avg Temp (°F)**	82	90	92	92	99
^	^	^	**Weather**	Partly Cloudy	Partly Cloudy	Partly Cloudy	Partly Cloudy	Partly Cloudy
1	QPR	Bagged	Strip-A*	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
1	QPR	Bagged	Strip-B*	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
2	Perma Patch	Bagged	Strip-A	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
2	Perma Patch	Bagged	Strip-B	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
3	EZ Street	Bagged	Strip-A	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
3	EZ Street	Bagged	Strip-B	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
4	Rock Asphalt	Bagged	Strip-A	Adjacent Pop-out at the bottom of the existing pavement	Adjacent Pop-out at the bottom of the existing pavement	Same as above. No change.	Same as above. No change.	Same as above. No change.
4	Rock Asphalt	Bagged	Strip-B	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
5	Proline	Bagged	Strip-A	More Settling	Adjacent Pop-out at bottom of the existing pavement	Same as above. No change.	Same as above. No change.	Same as above. No change.
5	Proline	Bagged	Strip-B	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
6	QPR – Cranford North Little Rock Plant	Bulk	Strip-A	Existing pavement pop-out	Existing pavement pop-out	Existing pavement pop-out	Existing pavement pop-out	Existing pavement pop-out
6	QPR – Cranford North Little Rock Plant	Bulk	Strip-B	Slight Settling	Slight Settling	Slight Settling	Slight Settling	Slight Settling
7	Proline – APAC Central Plant	Bulk	Strip-A	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
7	Proline – APAC Central Plant	Bulk	Strip-B	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
8	QPR – Jet Asphalt Plant	Bulk	Strip-A	Good	Good	Good	Good	Good
8	QPR – Jet Asphalt Plant	Bulk	Strip-B	Good	Good	Good	Good	Good
9	Ergon – Blackstone Plant	Bulk	Strip-A	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
9	Ergon – Blackstone Plant	Bulk	Strip-B	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
Remarks/ Comments				Looks similar to the previous inspection.	Looks similar to the previous inspection.	Looks similar to the previous inspection.	Looks similar to the previous inspection.	Settlement noticed at all patches except 8A & 8B

Product Number	**Supplier**	**Supply Type**	**Date**	7/31/2025	8/14/2025	9/4/2025	9/25/2025	10/2/2025
^	^	^	**Avg Temp (°F)**	89	93	90	76	87
^	^	^	**Weather**	Partly Cloudy	Partly Cloudy	Partly Cloudy	Partly Cloudy	Clear
1	QPR	Bagged	Strip-A*	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
1	QPR	Bagged	Strip-B*	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
2	Perma Patch	Bagged	Strip-A	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
2	Perma Patch	Bagged	Strip-B	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
3	EZ Street	Bagged	Strip-A	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
3	EZ Street	Bagged	Strip-B	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
4	Rock Asphalt	Bagged	Strip-A	Same as above. No change.	Same as above. No change.	Same as above. No change.	Same as above. No change.	Same as above. No change.
4	Rock Asphalt	Bagged	Strip-B	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
5	Proline	Bagged	Strip-A	Same as above. No change.	Same as above. No change.	Same as above. No change.	Same as above. No change.	Same as above. No change.
5	Proline	Bagged	Strip-B	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
6	QPR – Cranford North Little Rock Plant	Bulk	Strip-A	Existing pavement pop-out	Existing pavement pop-out	Existing pavement pop-out	Existing pavement pop-out	Existing pavement pop-out
6	QPR – Cranford North Little Rock Plant	Bulk	Strip-B	Slight Settling	Slight Settling	Slight Settling	Slight Settling	Slight Settling
7	Proline – APAC Central Plant	Bulk	Strip-A	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
7	Proline – APAC Central Plant	Bulk	Strip-B	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
8	QPR – Jet Asphalt Plant	Bulk	Strip-A	Good	Good	Good	Good	Good
8	QPR – Jet Asphalt Plant	Bulk	Strip-B	Good	Good	Good	Good	Good
9	Ergon – Blackstone Plant	Bulk	Strip-A	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement	Small pop-out of existing pavement
9	QPR – Jet Asphalt Plant	Bulk	Strip-B	Settling below flush	Settling below flush	Settling below flush	Settling below flush	Settling below flush
Remarks/ Comments				Looks similar to the previous inspection.	Looks similar to the previous inspection.	Looks similar to the previous inspection.	Looks similar to the previous inspection.	Settlement noticed at all patches except 8A & 8B

**Note: A = Patches along the outside edge of the road near the white edge line; B = Patches along the center line of the road*

^Note: Empty Cells