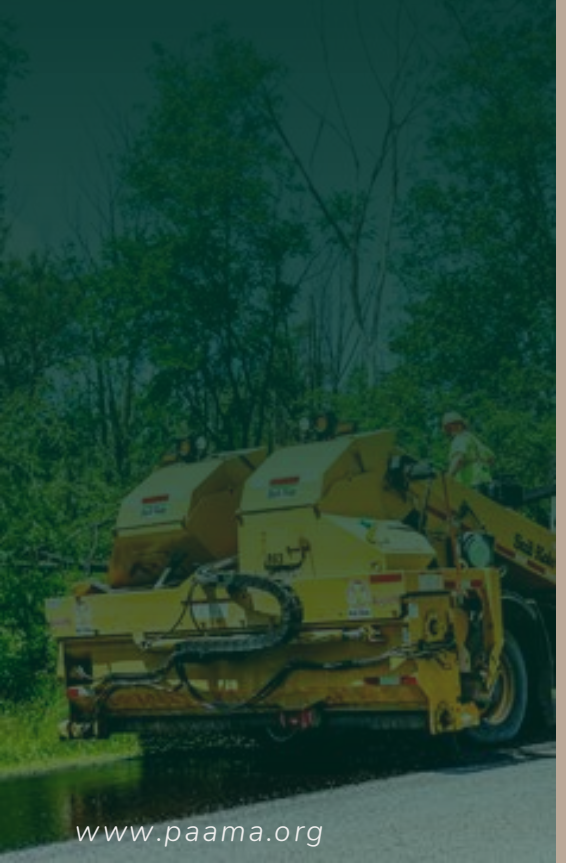
PAAMA
Pennsylvania Association of Asphalt Material Applicators



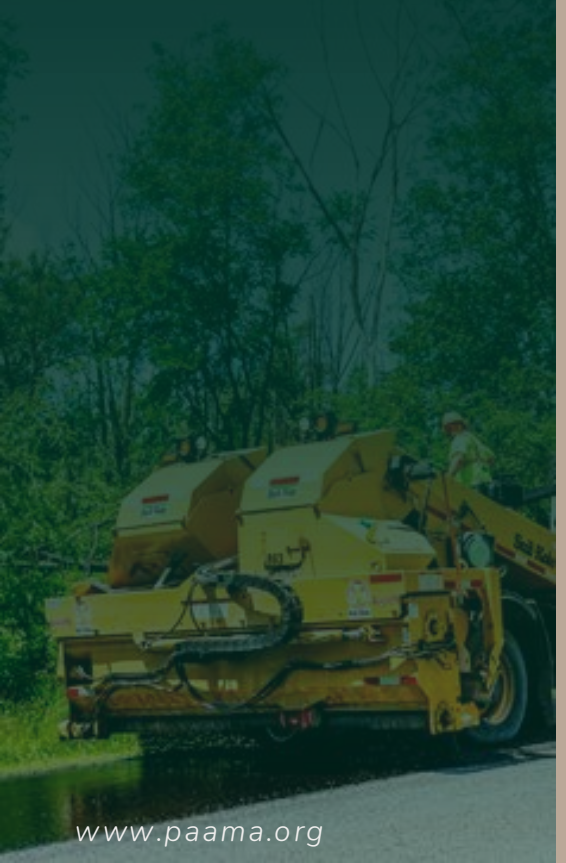
www.paama.org

pennsylvania
DEPARTMENT OF TRANSPORTATION

Innovations
Cold In-Place Asphalt Recycling

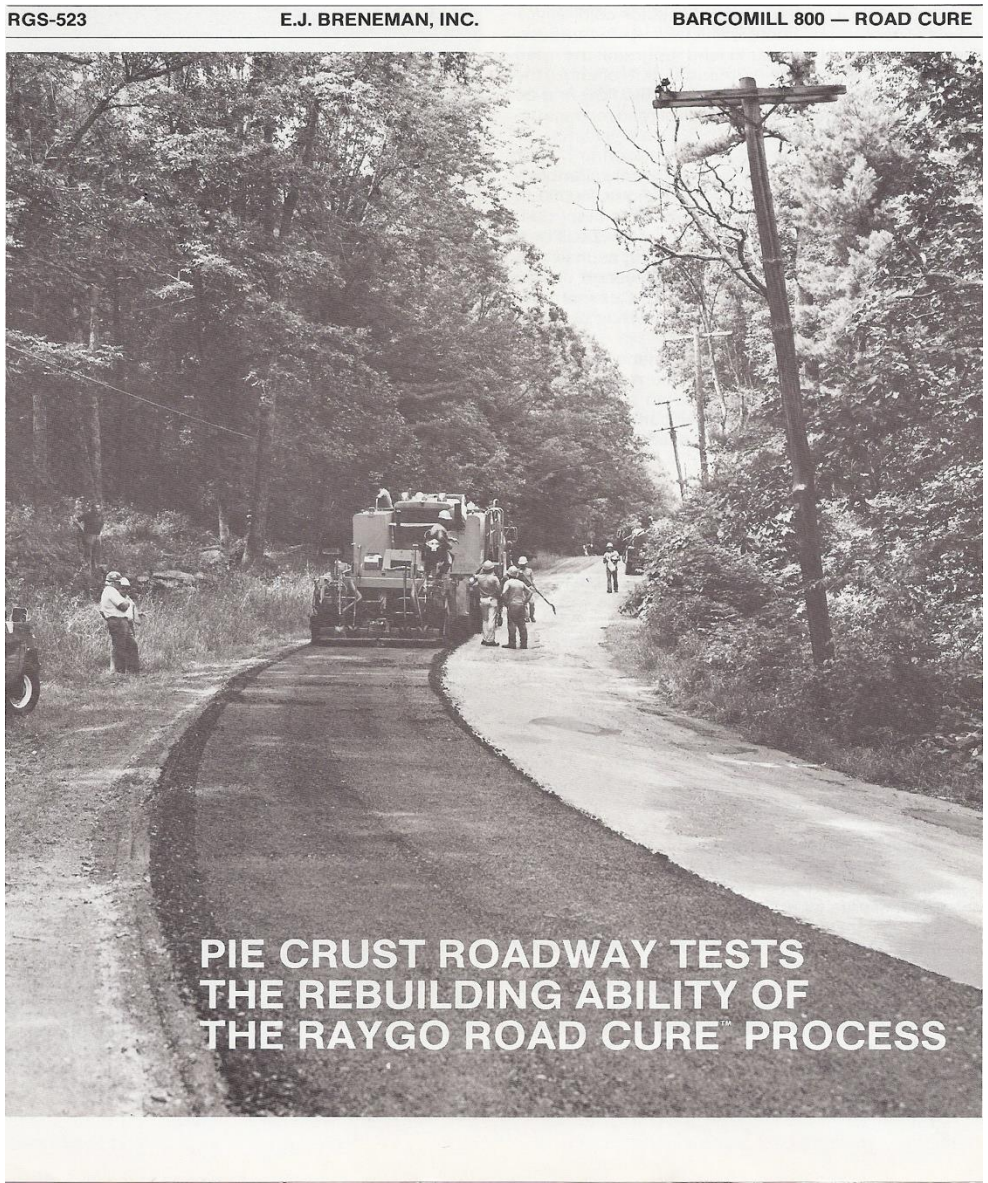
Presented By
Pennsylvania Association of Asphalt Materials & Applicators
PAAMA

PAAMA
Pennsylvania Association of Asphalt Material Applicators

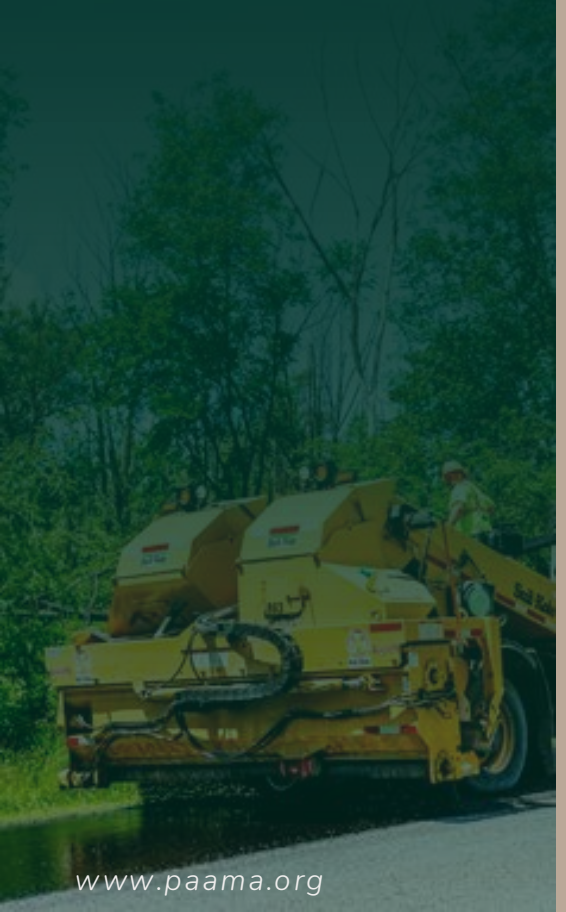


www.paama.org

Cold In-Place Recycling: History 1983



PAAMA
Pennsylvania Association of Asphalt Material Applicators



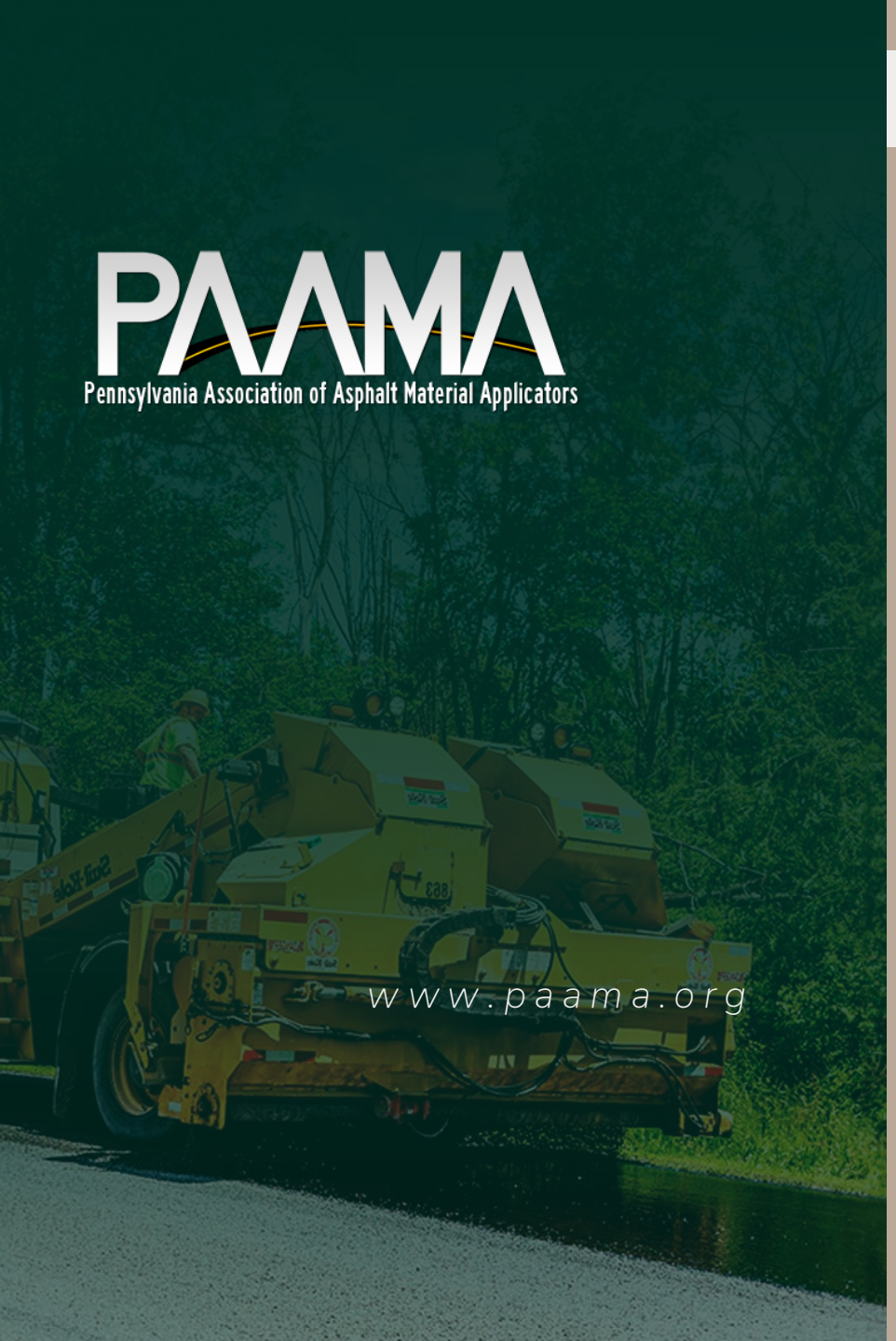
www.paama.org

Cold In-Place Recycling

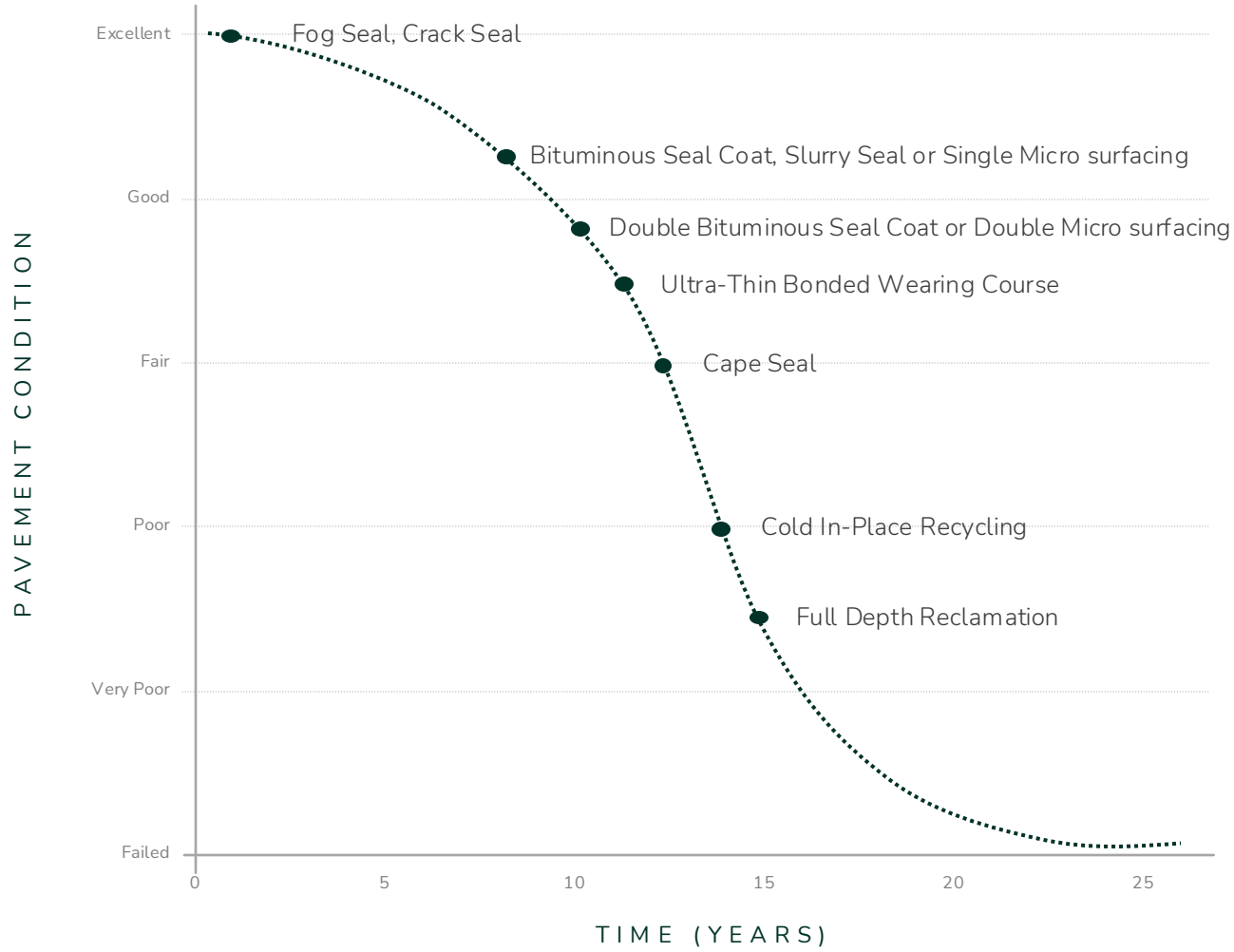
After the first Cold In-Place Asphalt Recycled projects 1983 – 1987 it was specified: CIPR may only be used on roadways with an ADT of less than 200 vehicles per day. State Rout 176 has an ADT of 18,000 vehicles

PAAMA

Pennsylvania Association of Asphalt Material Applicators



PAAMA Processes Keep Good Roads in Good Condition



PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

INTRODUCTION to Cold In-Place Asphalt Recycling

Cold In-Place Asphalt Recycling
CIPR

PAAMA
Pennsylvania Association of Asphalt Material Applicators

PROCESS

What is Cold In-Place Recycling?

- The recycling of a deteriorated asphalt pavement material that has reached the end of its serviceable life. This includes asphalt wearing and asphalt base course material.
- In some cases, the underlying aggregate may be incorporated into the new recycled pavement.
- Dual additives and imported Aggregate or RAP may be introduced into the mix.
- Typical depths are 3 to 5 inches.
- The milling machine down cuts and sizes the old asphalt pavement. The material is then mixed in-place with a new asphalt binder, paver-laid and compacted to the desired depth and scope of the project specifications, using steel drum vibratory rollers and pneumatic tire rollers for the compaction effort.

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

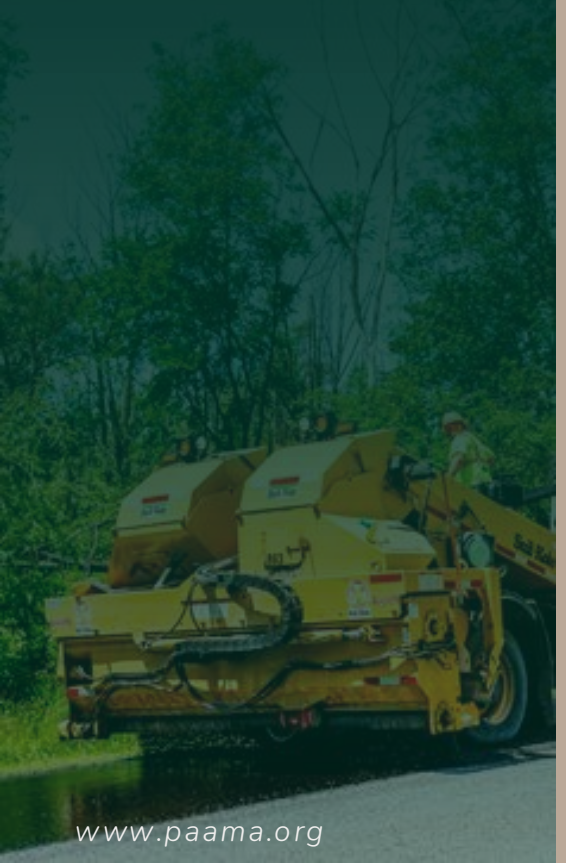
Cold In-Place Recycling

Asphalt pavements eventually will develop distress such as:

- Cracking
- Raveling
- Potholes
- Poor ride quality
- Cross section issues

Traffic, weather and hardening of the asphalt binder all contribute to these problems.

PAAMA
Pennsylvania Association of Asphalt Material Applicators



www.paama.org

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

MILL & FILL or CIPR

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

MILL & FILL or CIPR

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

How do we fix a deteriorated pavement?

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Asphalt Recycling can be the answer!

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Benefits

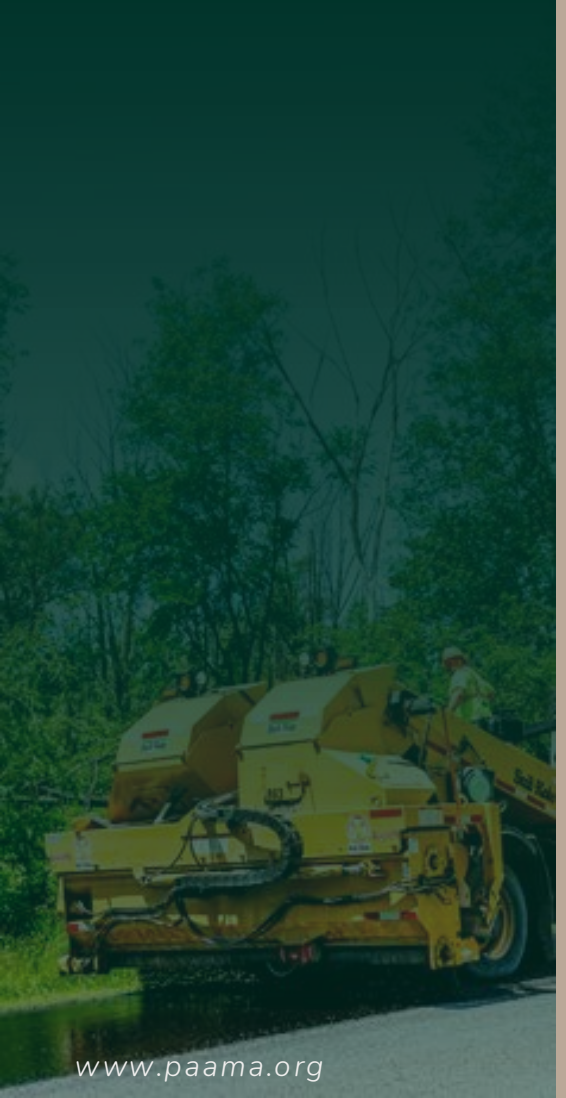
- Roadway remains open during construction
- Conserves energy and natural resources, green technology
- Reduced impact on adjacent roadways
- Reduced cost over reconstruction
- Little material exported from site
- Re-use existing material
- Re-profile roadway
- Restores curb reveal
- Environmentally friendly
- Construction time halved
- No drop offs or open cuts

PAAMA
Pennsylvania Association of Asphalt Material Applicators

PROBLEMS ENCOUNTERED
Road Preparation for CIPR

- Any damaged cross pipes should be replaced, well before CIPR
- Drainage and water problems should be addressed
- Any vegetation growing on the pavement or pavement edge should be removed
- Shoulder or pavement widening should take place prior to CIPR
- Any under ground utility should be addressed gas lines, water lines, sanitary sewer lines, cable lines.
- Any overhead obstructions, tree limbs, power lines

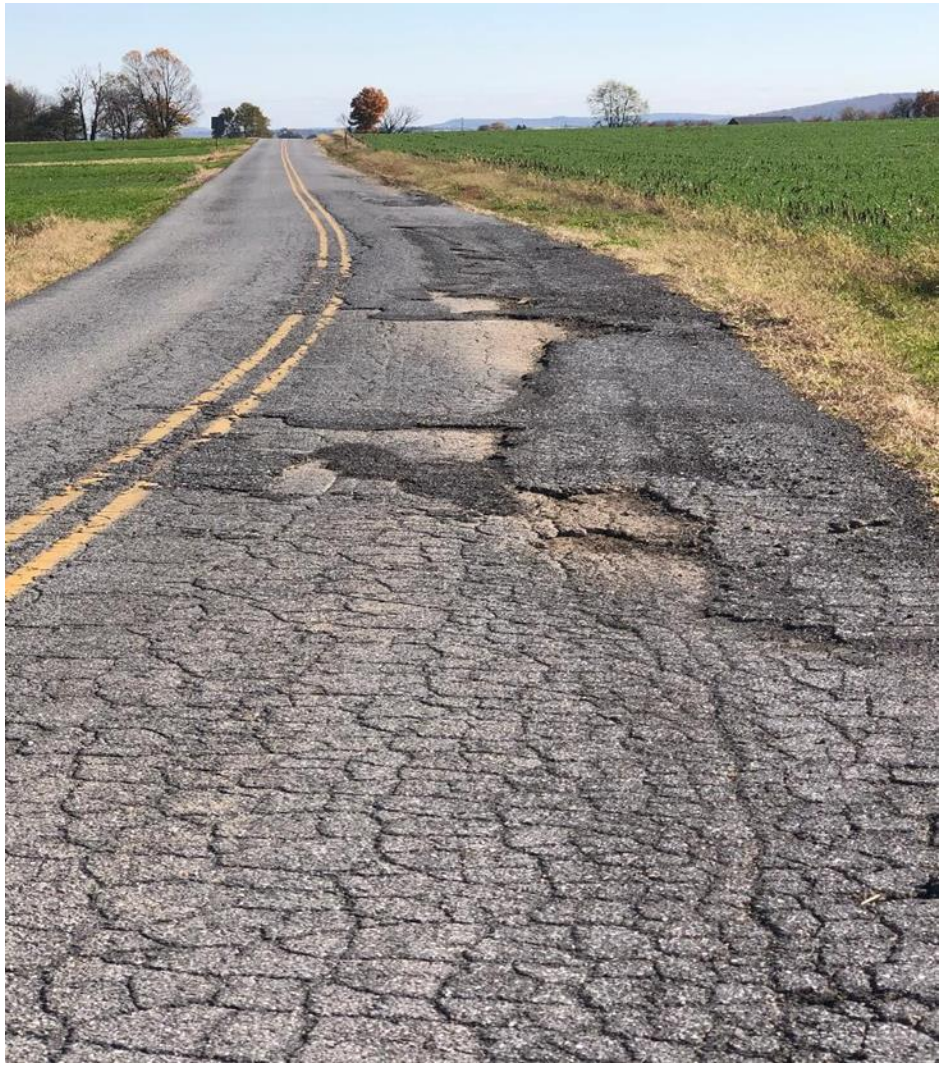
PAAMA
Pennsylvania Association of Asphalt Material Applicators



www.paama.org

Cold In-Place Recycling

What would prohibit a Cold In-Place Asphalt Recycled project?



PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

Left to late for CIPR

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

SPRINGS

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

Storm Water Correction

PAAMA
Pennsylvania Association of Asphalt Material Applicators

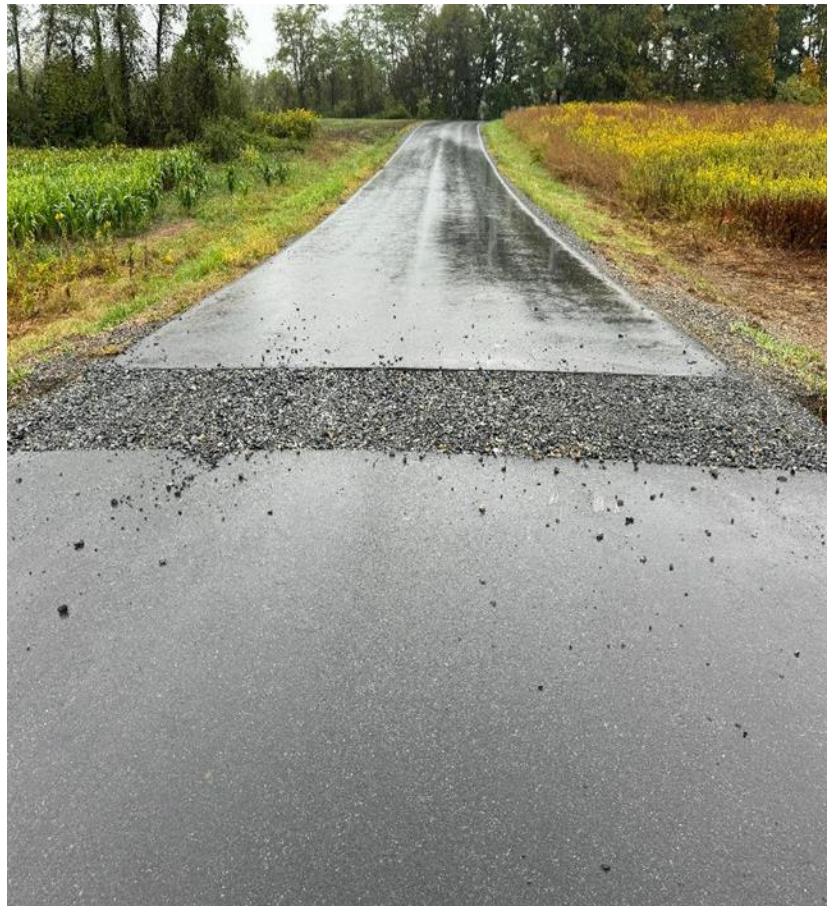
www.paama.org

Cold In-Place Recycling

Storm Water Correction

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling



PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

The CIPR Process

- Core the roadway. Take representative cores samples right shoulder, left shoulder and centerline of roadway.
- PennDOT approved mix design
- Any widening should take place prior to CIPR
- If the roadway is curbed, check height of curb, what curb reveal is required after the installation of the wearing surface.
- The CIR train resizes, mixes & places the material into a bituminous paver and spreads to the desired cross-slope
- Compact with a 12-ton steel wheel vibratory roller and a 22 - 25ton pneumatic tire roller or larger, under the guidance of a certified Nuclear Gage operator
- Placement of a suitable Wearing Surface

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

Core samples are <u>essential</u> in any Cold In-Place Asphalt Recycling project.

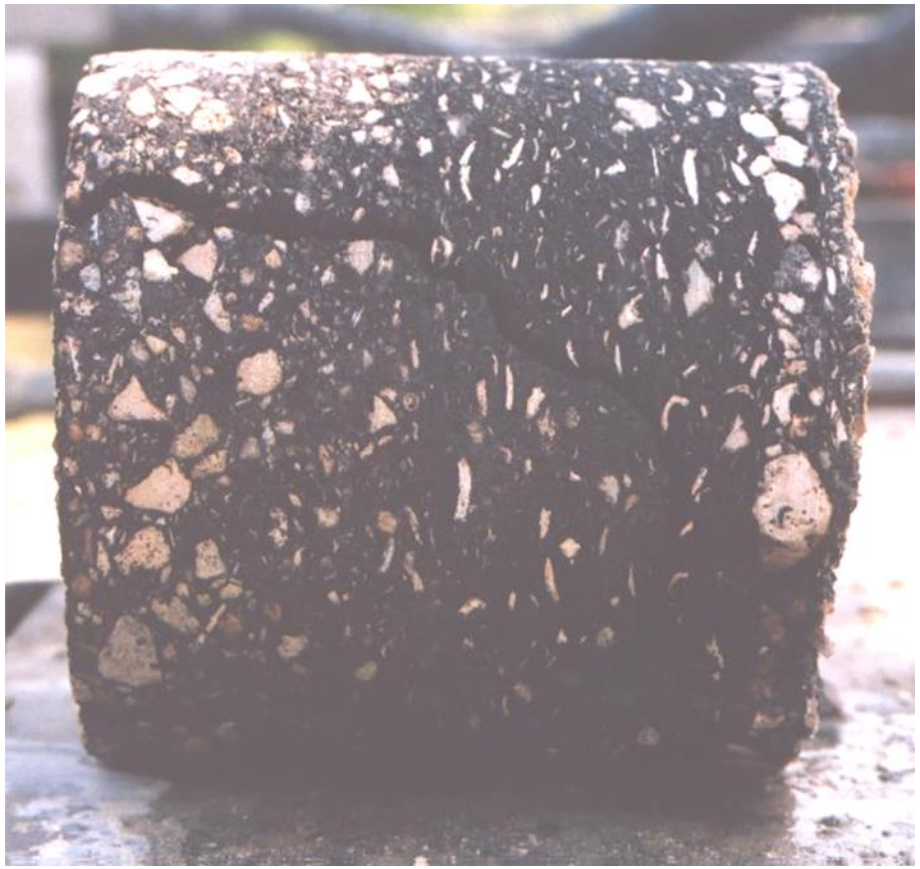
You <u>must</u> core sample all roadways.

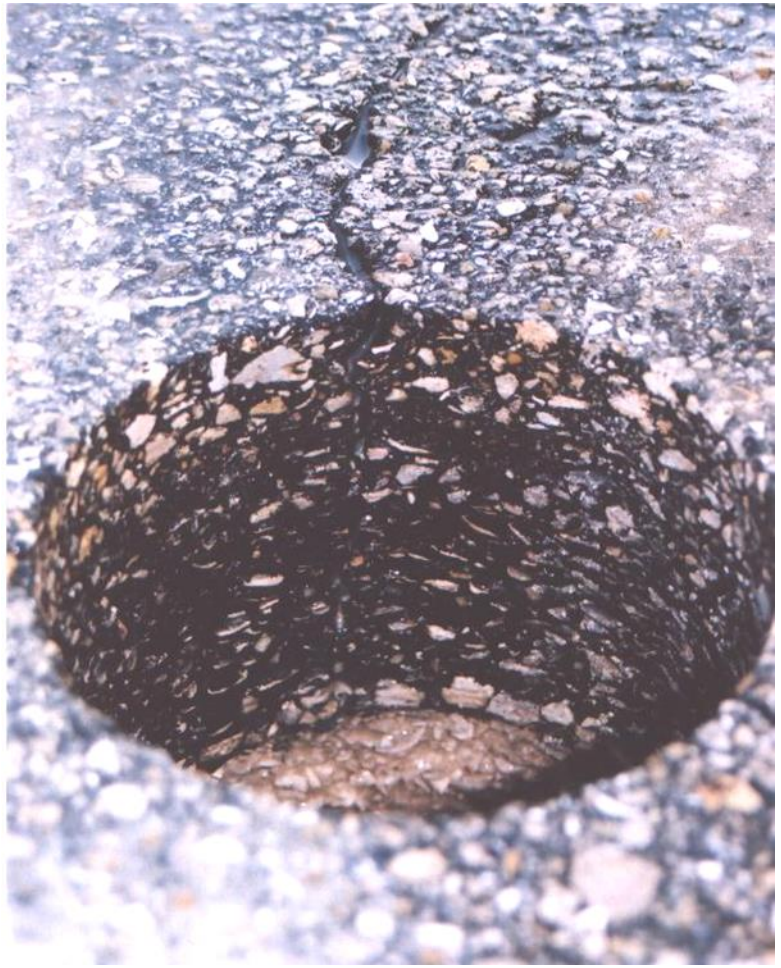
PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

Often, the crack network penetrates the full depth of the old hot mix



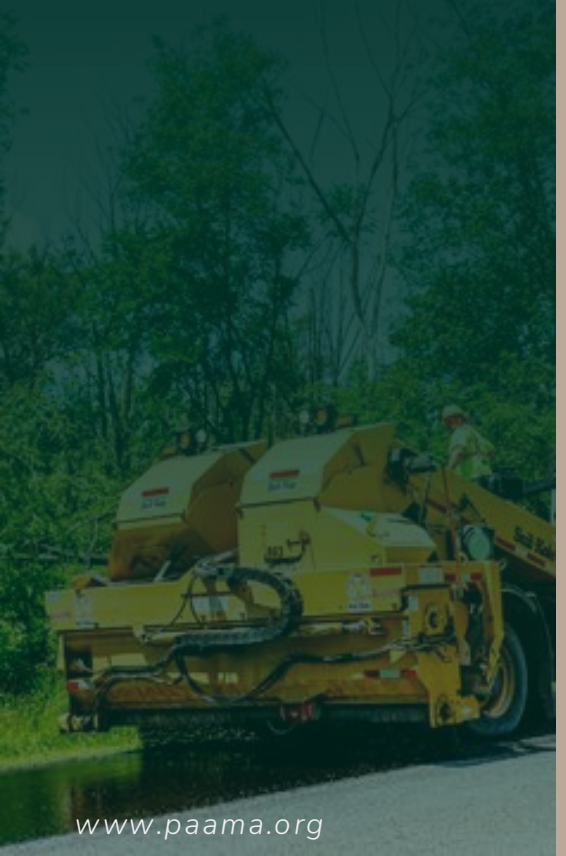


PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Multiple Overlays

PAAMA
Pennsylvania Association of Asphalt Material Applicators



www.paama.org

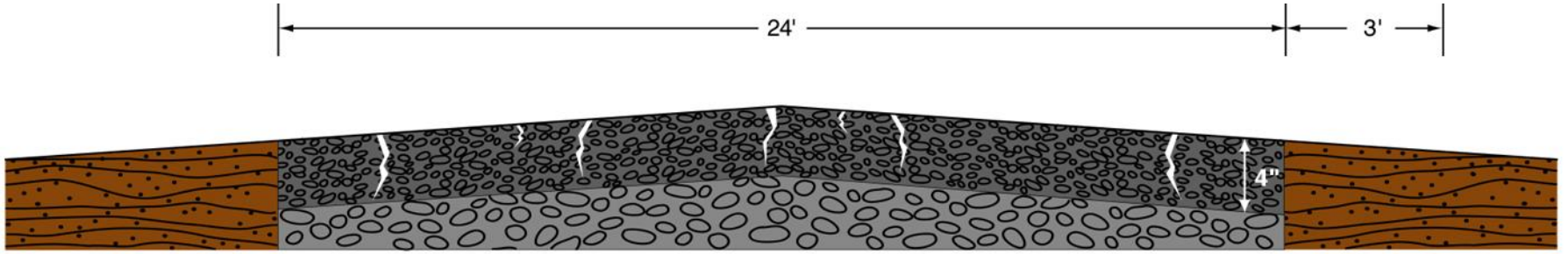
Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

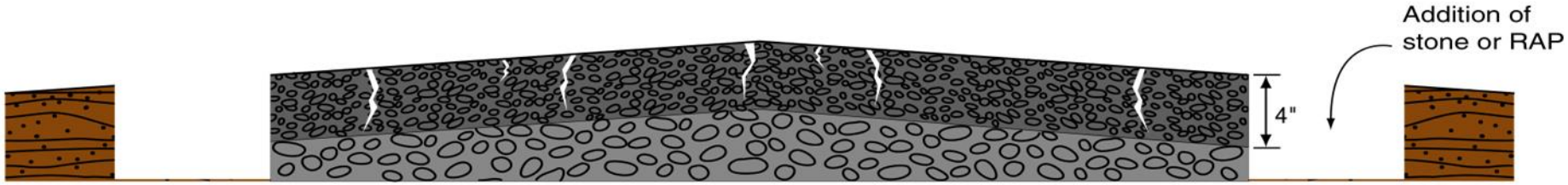
www.paama.org

Cold In-Place Recycling

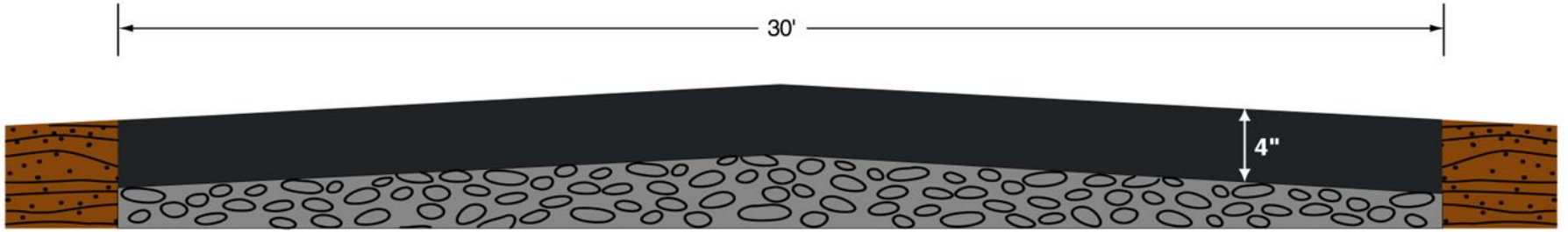
CIPR – Pavement Widening



Existing section before CIR



Proposed widening section (addition of stone or RAP)



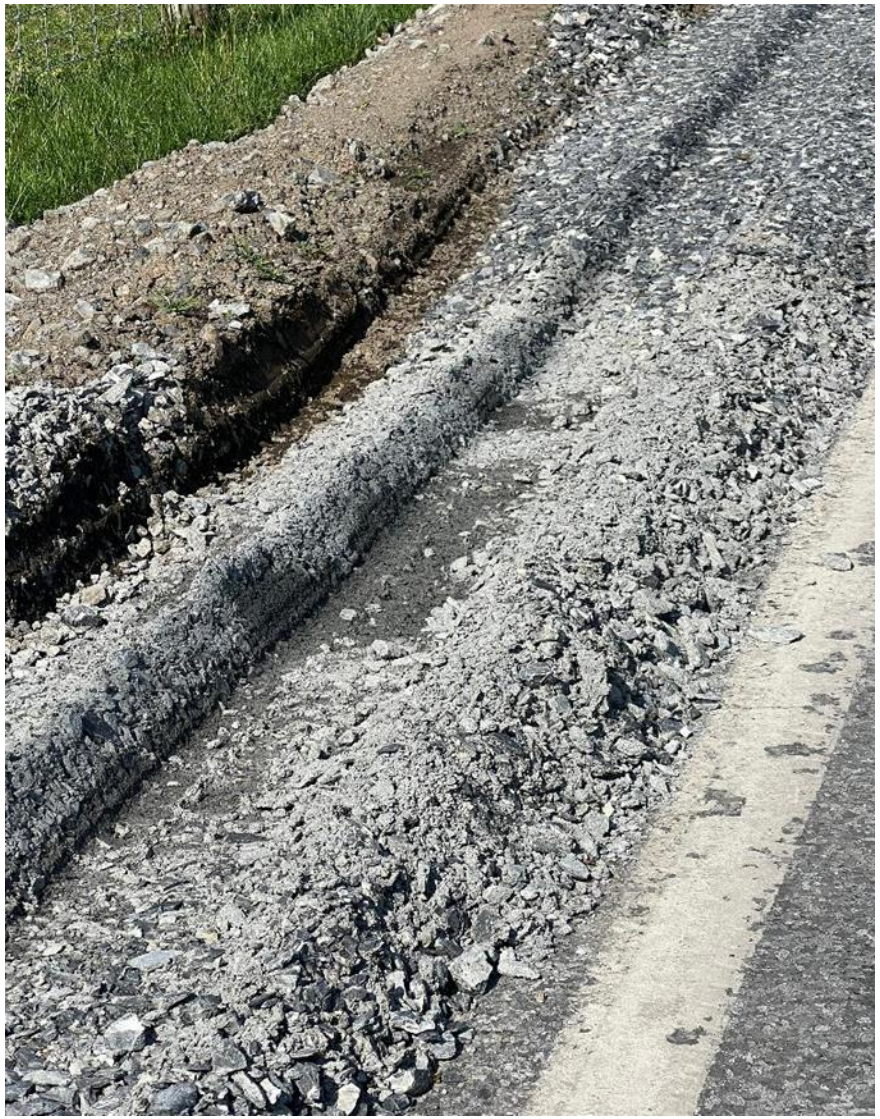
Completed widening section after CIR

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

Widening - Soft Shoulders



PAAMA
Pennsylvania Association of Asphalt Material Applicators

Curbline Milling

- Some Department of Transportation Roadways are within City, Town or Borough boundaries, curblines and utilities will be encountered
- Small Mills will be needed to excavate and export RAP material from curblines
- In some cases, the excess RAP may be used to fill low areas or create additional crown and cross section within the project area

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

Excavated manhole before CIPR.

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Compaction of CIPR around manhole

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

RAP or Aggregate can be added to create a thicker base material

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Things to consider in a CIPR – QC/QA Plan

- All meters and computers should be calibrated
- Recycling additive – check specifications and compliance.
- Recycled mat smoothness
- Density and Compaction
- CIPR gradation
- Moisture content before overlay
- Check depth of recycled material

PAAMA
Pennsylvania Association of Asphalt Material Applicators

CIPR – Mix Design

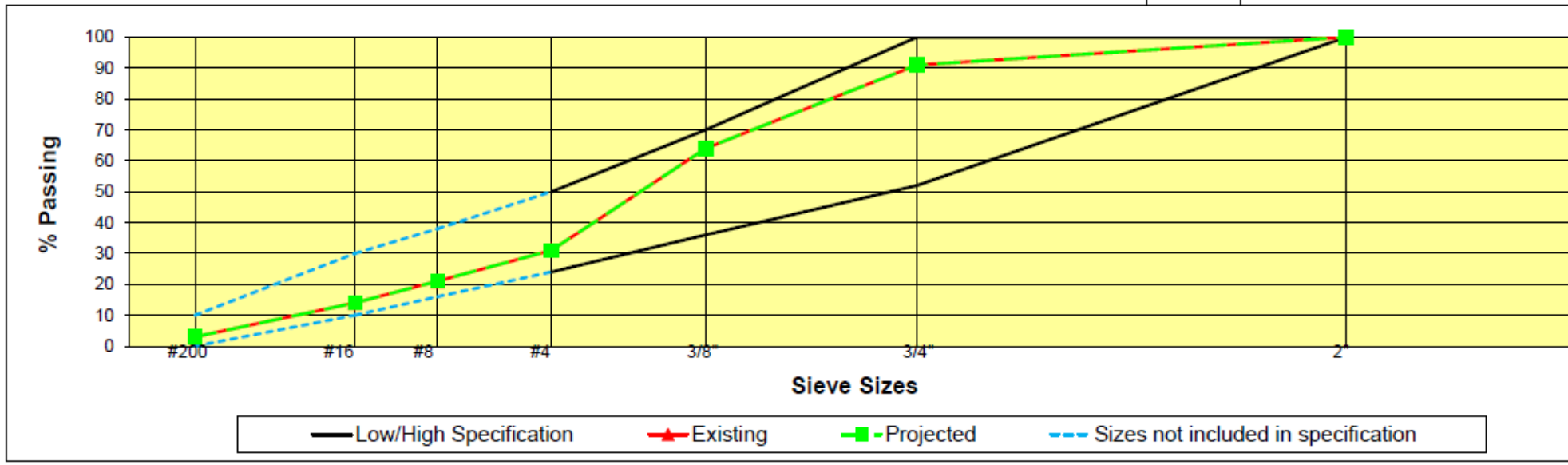
- Obtain Sample of RAP from Field
- Determine RAP Gradation, Binder Content, and Aged Binder Properties
- Select Amount and Gradation of Additional Aggregate or RAP, if required
- Select Type and Grade of Recycling Additive
- Test Trial Mixtures: Initial Cure Properties, Final Cure Properties, and Water Sensitivity
- Establish Job Mix Formula
- Follow PennDOT CIPR Mix Design

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

RECYCLE MIX DESIGN FORM

X	PRELIMINARY
CH	FINAL



DATE: 7/2/2024	SIEVE SIZE		#200	#16	#8	#4	3/8"	3/4"	2"
SAMPLE #: RD24-PB-446PA	% PASSING	EXISTING	3	14	21	31	64	91	100
PROJECT/CUSTOMER		LOW SPEC.	0	10	16	24	36	52	100
Penndot- CARBON COUNTY		HIGH SPEC.	10	30	38	50	70	100	100
		PROJECTED	3	14	21	31	64	91	100
STATE ROUTE #1001	ADD STONE GRADATION		0	0	0	0	0	0	0

MIX TYPE: In place train	EXISTING CORE SAMPLE THICKNESS :			5"+	in.
PROJECT LENGTH: 7.5 MI	DEPTH TO BE RECYCLED :	4 in.	LANE WIDTH(ft) :		10
FULL DEPTH AC X	EXISTING AVERAGE ASPHALT CONTENT %:				5.7
AC OVER CONCRETE	PROJECTED ASPHALT CONTENT %:				7.4
SAMPLED FOR:	MIX: 100 % RAP	0 %	7-8 GAL/TON	L/TONNE	
BRIAN HINKLEY	TYPE : SS-1		0.0 #/S.Y.	1.54 G/S.Y.	1.71 G/Lin.ft.
RECYCLE METHOD :			0.0 kg/m²	6.97 L/m²	21.23 L/lin. m
IN - PLACE	STONE SHALL BE SPREAD AT: 0	#/S.Y. AT: 9	FT. IN WIDTH TO GRIND AND PAVE :		10 FT.

Comments:

ADD STONE & LIQUID APPLICATION RATES MAY VARY BASED ON WEATHER & RAW STOCKPILE CONDITIONS.
BASE & DRAINAGE DEFICIENCIES IF PREVALENT,SHOULD BE ADDRESSED PRIOR TO CIPR PROCESS
Emulsion to be added at 3.0% based on weight of agg/rap material blend.
EXISTING GRADATION BASED ON DRY GRADATION FROM CRUSHED CORES (MECHANICAL CORE CRUSHER)
ASSUME EXISTING AND RAP GRADATIONS ARE THE SAME RAP WILL BE USED AS ADD AGGREGATE AT 58#S/Y
GRIND DEPTH AT 3" WITH 1 " OF ADD RAP TOTAL GRIND DEPTH OF 4"

CH **SR-1001 SEGMENTS 0010/2579 -0170/2579 CARBON COUNTY**

PAAMA
Pennsylvania Association of Asphalt Material Applicators

CIPR – Selection of Additive(s)

Bituminous Additives:

- Asphalt Emulsion

Anionic Emulsions	HFMS-2 HFMS-2s SS-1
Cationic Emulsions	CSS & CMS CSS-1h

- Rejuvenating Agents
- Foamed Asphalt

PAAMA
Pennsylvania Association of Asphalt Material Applicators

CIPR – Selection of Dual Additives Applications

- Portland Cement – (1%)

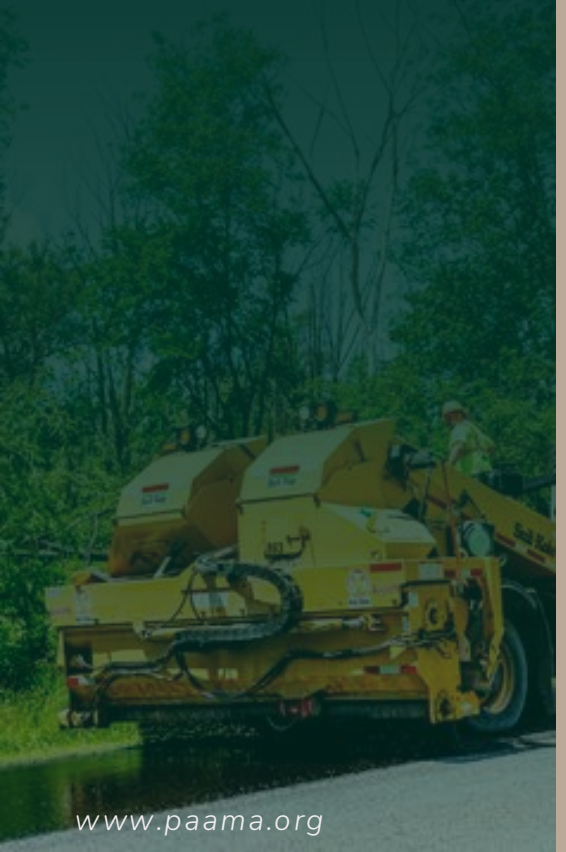
  Portland Cement & Hydrated Lime have been used in conjunction with asphalt emulsion to improve early strength, increase rut resistance and improve moisture resistance.

- Additional Aggregate. Correct gradation and build thickness and strength in mat.

- RAP (Reclaimed Asphalt Pavement) used to enhance thickness of pavement.

- Type “C” Fly Ash

PAAMA
Pennsylvania Association of Asphalt Material Applicators



www.paama.org

CIPR – Aggregate or RAP Application

- The existing asphalt pavement properties may be enhanced with the addition of Aggregate or RAP. Not only can the mix properties be improved, but additional structure may also be added to the asphalt pavement. Add #57 to the mix or other sized aggregate

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

RAP or Aggregate can be added to increase pavement thickness

- The Aggregate can be paver-laid or truck spread

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

The gradation will vary depending on the aggregate size in the old asphalt materials

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

Portland cement application

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

SINGLE UNIT TRAIN

- Proportioning of Recycled Agent is based on volumetric depth and width of cut, the amount of liquid asphalt dispersed into the mix, and is based off the PennDOT Mix Design.
- Down cutting milling head, sizes material, forward speed of mill will determine size of RAP, increase or decrease in speed will produce larger or smaller particles.
- Material is mixed in milling head chamber
- Mixed material is placed directly into paver via a conveyer system, or they can be picked up by a windrow elevator and placed into the paver hopper.

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Single Unit Train RX 800 Cold In-Place Asphalt Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Single Unit Cold In-Place Asphalt Recycling Train RX 700

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

Asphalt Additive CSS-1h

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Asphalt Additives Controls

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cross slope and elevation controls

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

No contact Sensor Controls

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

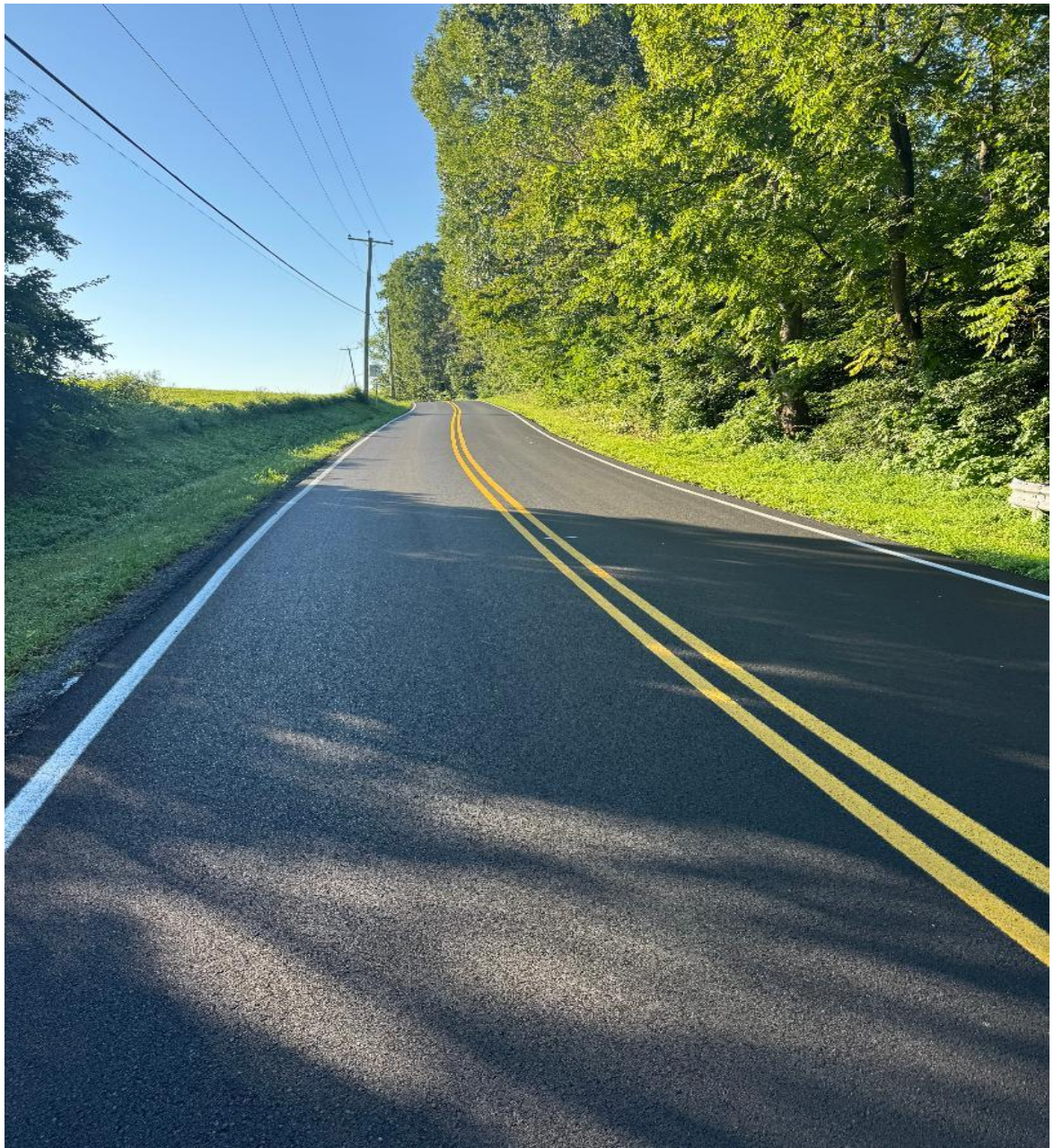
www.paama.org

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling



PAAMA
Pennsylvania Association of Asphalt Material Applicators

Excess Material Removal

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

Steel Vibratory Rollers of 12 + Tons

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Pneumatic Tire Roller of 23 – 30 tons

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Density & Compaction Testing

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

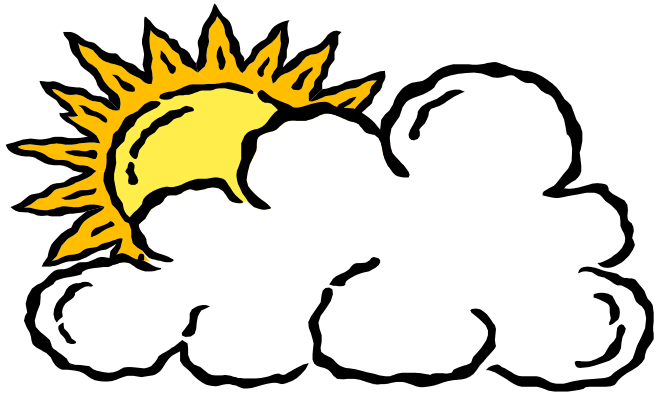
Cross Slope

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

Weather Limitations



- Air Temperature of 45 Degrees F. and Rising is preferred.
- Rain or Misting must not be occurring.

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Fog Seal Application on all projects using CIPR

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

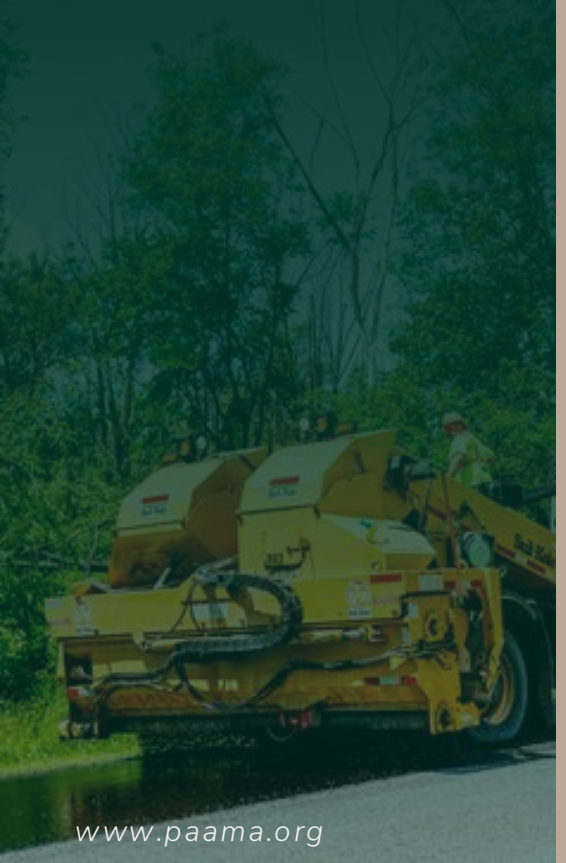
www.paama.org

176 Berks County Pennsylvania June/July 2025

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling SR 176 Berks County Pa

PAAMA
Pennsylvania Association of Asphalt Material Applicators



www.paama.org

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

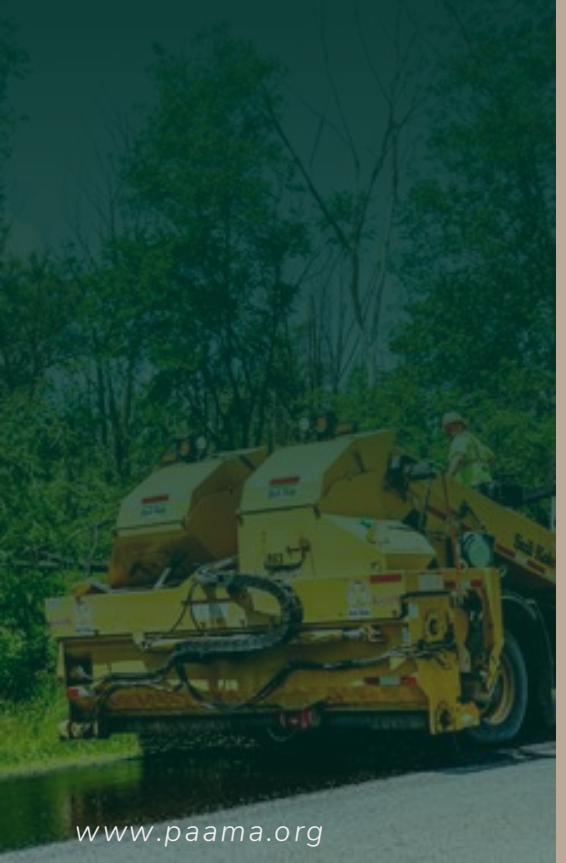
PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators



www.paama.org

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

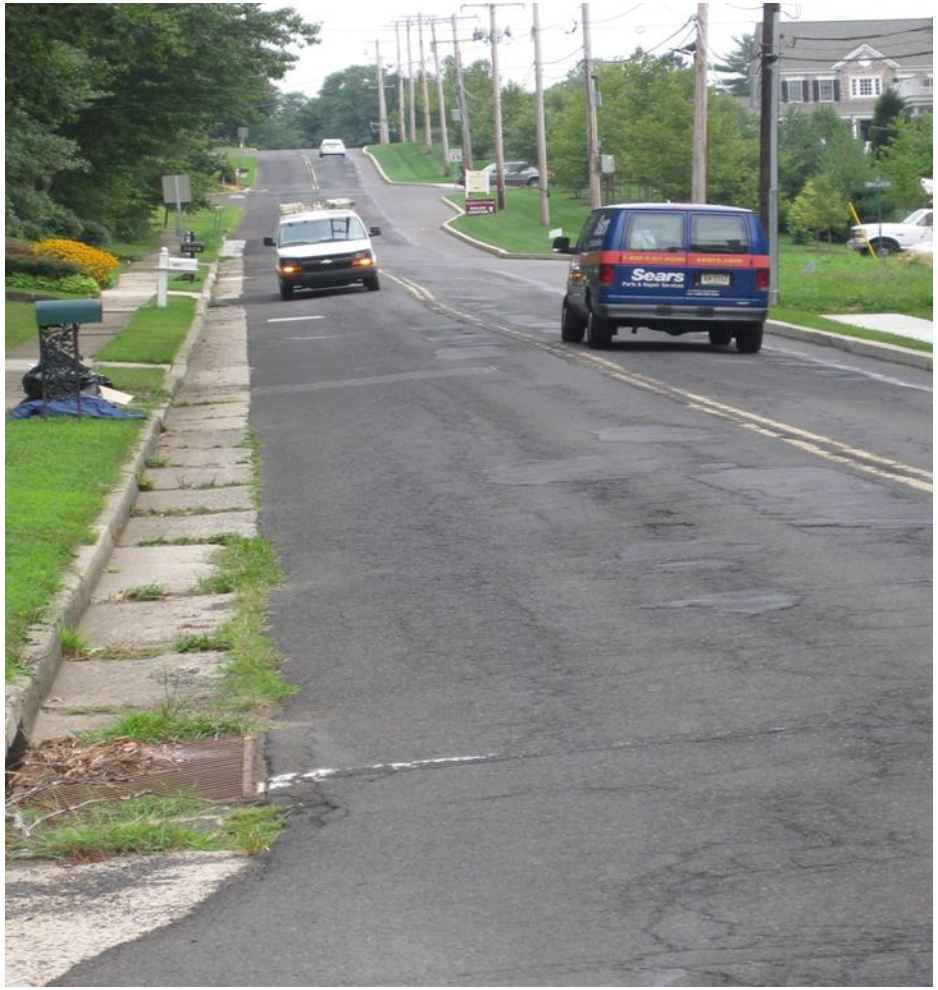
PAAMA
Pennsylvania Association of Asphalt Material Applicators

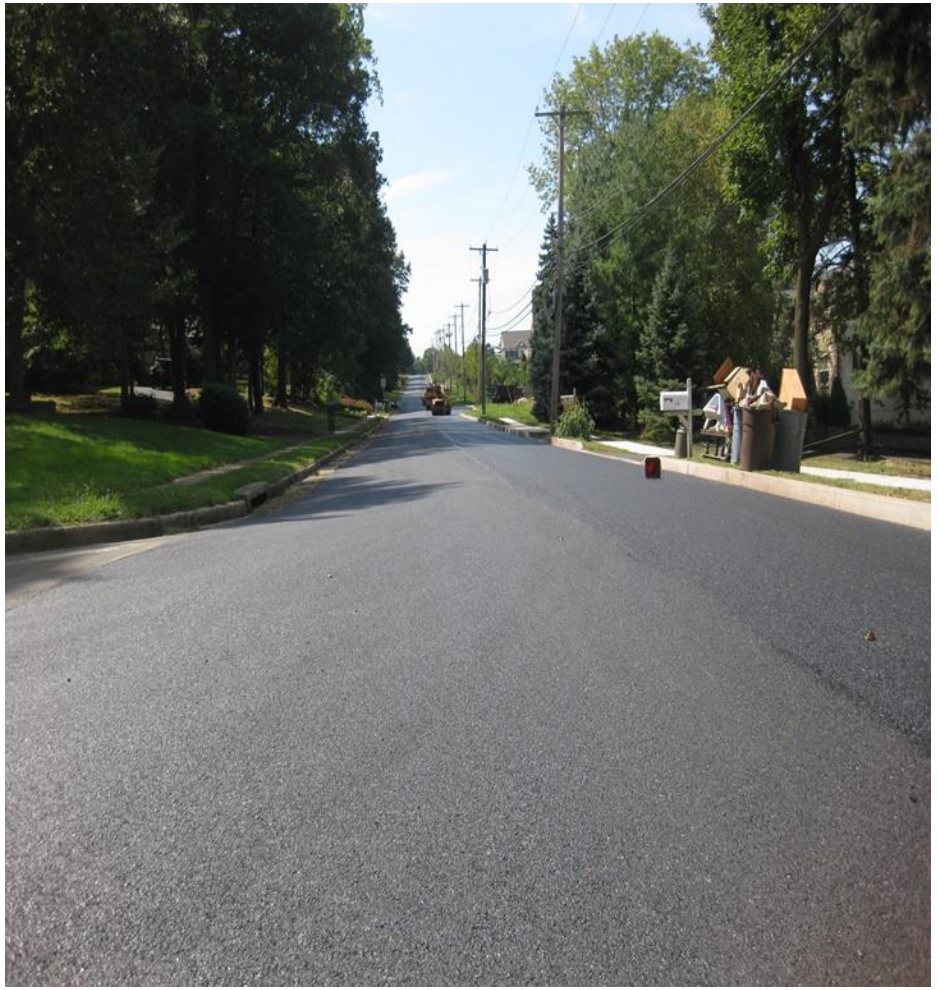
Cold In-Place Recycling

RURAL

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling





PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

Industrial

PAAMA
Pennsylvania Association of Asphalt Material Applicators

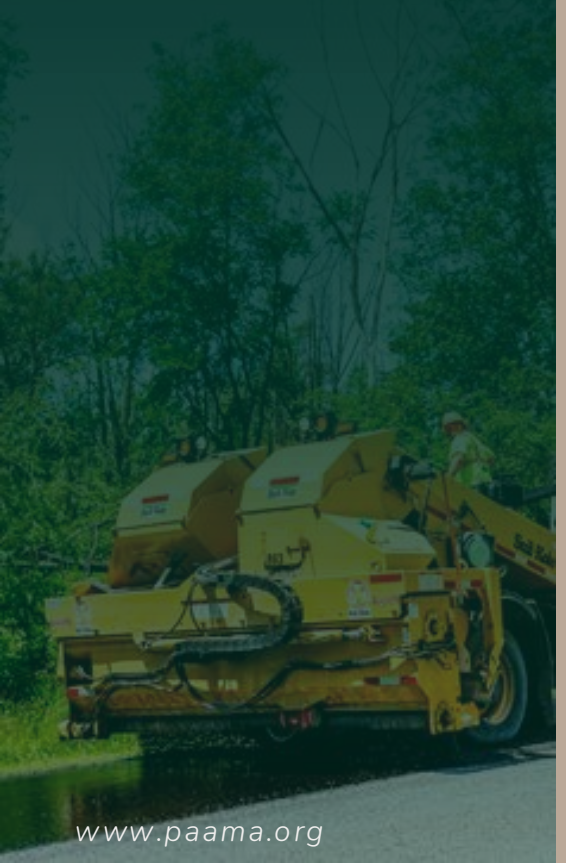
www.paama.org

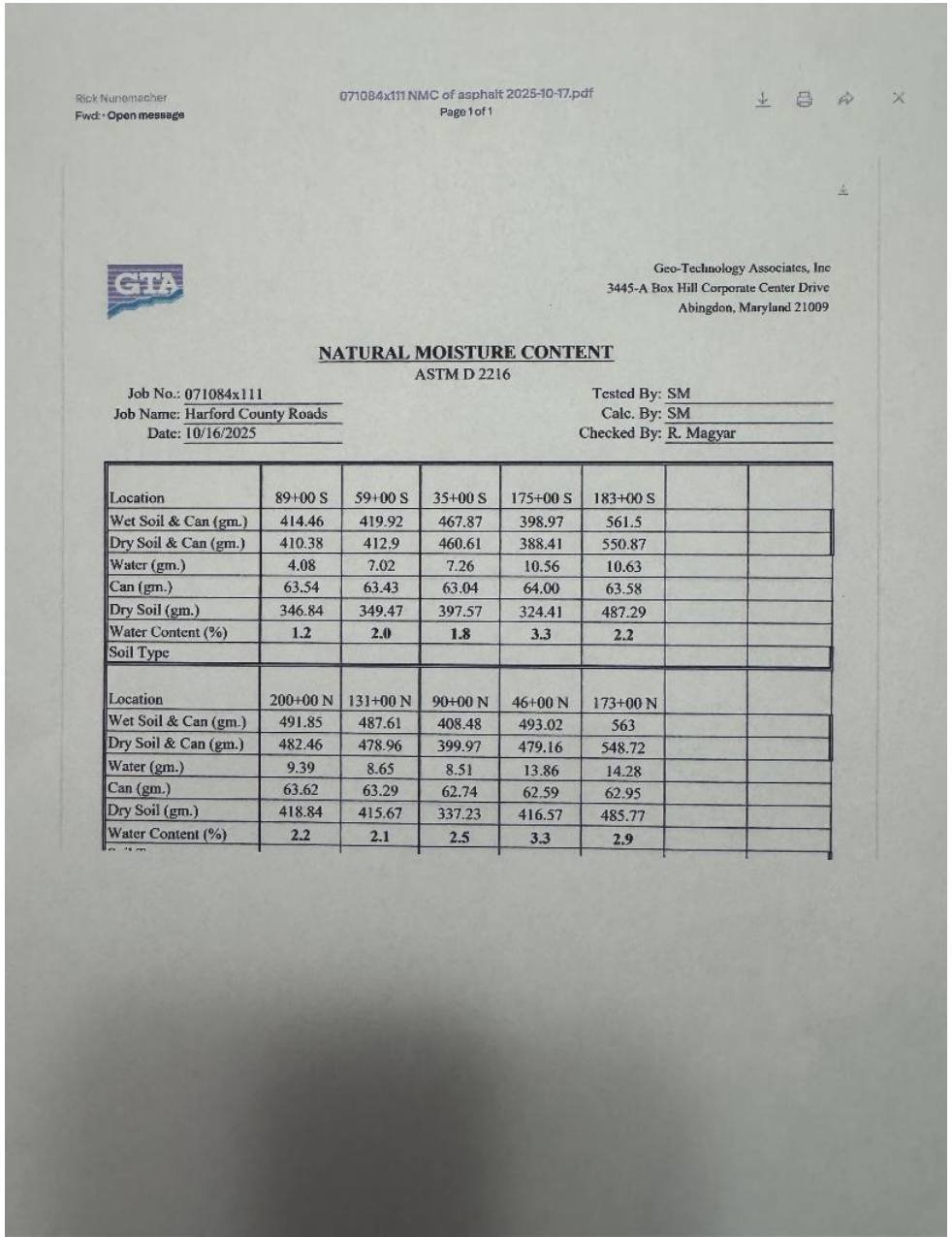
Cold In-Place Recycling

Heavy Highway Old US 22 SR 501 to SR 419

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling





Rick Nunemacher
Fwd: Open message

071084x111 NMC of asphalt 2025-10-17.pdf
Page 1 of 1

Geo-Technology Associates, Inc
3445-A Box Hill Corporate Center Drive
Abingdon, Maryland 21009

NATURAL MOISTURE CONTENT
ASTM D 2216

Job No.: 071084x111
Job Name: Harford County Roads
Date: 10/16/2025

Tested By: SM
Calc. By: SM
Checked By: R. Magyar

Location	89+00 S	59+00 S	35+00 S	175+00 S	183+00 S		
Wet Soil & Can (gm.)	414.46	419.92	467.87	398.97	561.5		
Dry Soil & Can (gm.)	410.38	412.9	460.61	388.41	550.87		
Water (gm.)	4.08	7.02	7.26	10.56	10.63		
Can (gm.)	63.54	63.43	63.04	64.00	63.58		
Dry Soil (gm.)	346.84	349.47	397.57	324.41	487.29		
Water Content (%)	**1.2**	**2.0**	**1.8**	**3.3**	**2.2**		
Soil Type							

Location	200+00 N	131+00 N	90+00 N	46+00 N	173+00 N		
Wet Soil & Can (gm.)	491.85	487.61	408.48	493.02	563		
Dry Soil & Can (gm.)	482.46	478.96	399.97	479.16	548.72		
Water (gm.)	9.39	8.65	8.51	13.86	14.28		
Can (gm.)	63.62	63.29	62.74	62.59	62.95		
Dry Soil (gm.)	418.84	415.67	337.23	416.57	485.77		
Water Content (%)	**2.2**	**2.1**	**2.5**	**3.3**	**2.9**		

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Wearing Surface Applications
Hot Mix Asphalt

PAAMA
Pennsylvania Association of Asphalt Material Applicators

Cold In-Place Recycling

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

Ultra-thin Hot Mix

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

Chip Seal

PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

Chip Seal

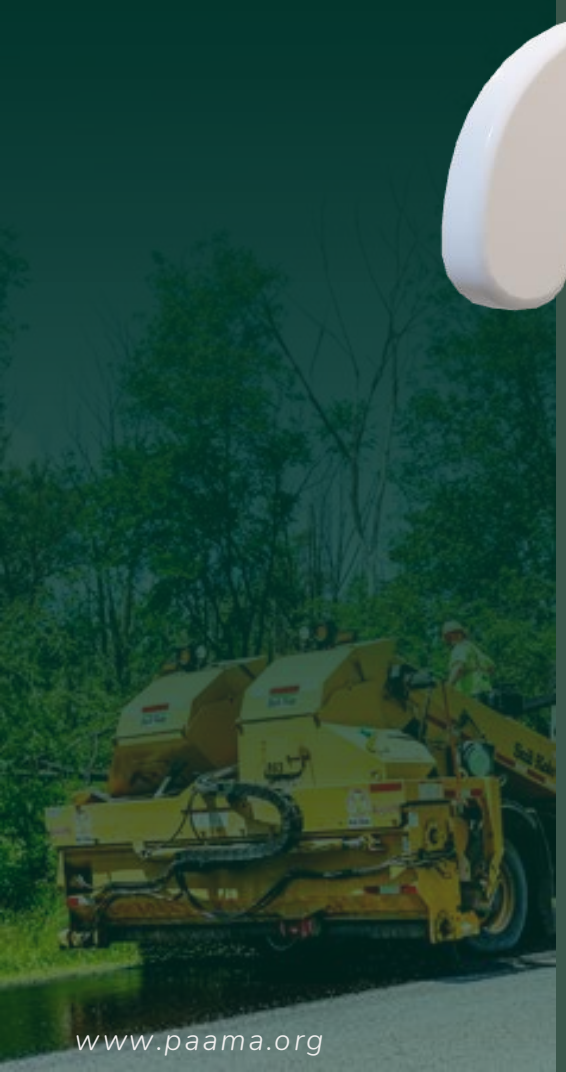
PAAMA
Pennsylvania Association of Asphalt Material Applicators

www.paama.org

Cold In-Place Recycling

Micro-Surfacing or Cape-Seal

PAAMA
Pennsylvania Association of Asphalt Material Applicators



www.paama.org

QUESTIONS