



Use of Cold-Recycle RAP Base, Limestone County, Texas

Project Overview

This maintenance project was let in June of 1998 to install a 4-in. overlay of cold processed RAP base (CRRB) using two different emulsified recycling agents (ERA), referred to in this case study as “immediate use.” This case study also included preparation of three different blends of maintenance mix, referred to as “stockpiled mix.”

Immediate Use

The roadway selected for this project, FM 2838, runs from US 84 west of Mexia to SH 171 northwest of Mexia and had an estimated average daily traffic (ADT) of 710 vehicles.

The roadway had a moderate amount of 18-wheel truck traffic, predominately gravel trucks hauling material from quarries located south of US 84. Typical of the low- to medium-volume FMs in the area, this was a good roadway for testing the performance of cold-processed RAP.

This district re-let this project, originally let in spring 1997, with changes, summarized below to make using RAP more economical:

1. Test sections were approximately five miles from the RAP stockpile location.
2. The plans allowed the contractor to waste oversize stockpile material so the portable rock crusher was not required.
3. The project used and evaluated the performance of two different emulsified recycling agents (ERA) (Cyclogen-ME and Prime-ERA-25).
4. The plans separated out bid items for mobilization and traffic control so these costs would not affect the bid price of the mix.

Test Sections

- #1 – Approximately one-third of the plan quantity of Cyclogen-ME and RAP mix.
- #2 – Approximately one-third of the plan quantity of Prime-ERA-25 and RAP mix.
- #3 – Approximately one-third of the plan quantity of Prime-ERA-25 and “RAP blend” mix. The RAP blend consisted of the original RAP with 15 in. plus particles scalped off, with the balance of material separated into 1 in., 0.625 in. and minus 0.625 in. The mix did not use portion of the RAP between 1 in. and 1.5 in.

The initial rolling pattern was one pass with a 25-ton vibratory steel wheel, two passes with a 25-ton static steel wheel, and passes with a 30-ton pneumatic. Excessive shoving and cracking of the mix and an unanticipated, yet required, compactive effort required revising the rolling pattern to one pass with a 25-ton static steel wheel followed by eight to 10 passes of a 30-ton pneumatic.

Stockpiled Mix

This project used stockpiles of three types of “maintenance mix” shown in Table 1.

Table 1. Stockpiled Mix

MIX TYPE	QUANTITY (tons)
Cyclogen-ME	220
Prime-ERA-25	25
AES 300RP	160

Specifications

The project used a “Cold-Recycle RAP Base” Special Specification.

Test Data

- Moisture analysis of the RAP taken just prior to mixing showed total moisture content of 6.7 percent (average of multiple samples).
- The HVEEM stability of laboratory molded specimens of all three mixes ranged from 35 to 44.
- Table 2 shows the road density of the different types of mix, as determined by TxDOT nuclear density thin-lift gauge.

Approximately one month after construction, the roadway was cored with a 6 in. wet-core barrel. The cores crumbled before they could be removed from the hole. Approximately two months after construction, the roadway was successfully cored with a 12-in. dry core barrel.

Results

Immediate Use: The project, completed almost a year ago, is holding up very well. This confirms that the use of RAP as a rehabilitation technique has potentially good value to TxDOT for low- to-medium volume FM roadways as a strength course. (One of the ERAs also indicated potential as a surface course.)

A project can use CRRB if it has all the following:

- A source of fair to good quality RAP close to the job site
- A RAP stockpile location that is suitable for proper handling of the material
- A quantity of mix required for the project large enough to ensure adequate competition for the work and, more specifically, the ERA
- A low- to medium-volume roadway



Maintaining clean aggregate throughout the CRRB process is extremely important. Hot-mix and hot-recycle processes usually vaporize small quantities of contaminant and disperse them in the heater or drying drum. This is not the case in this cold-recycle process. Even a seemingly insignificant quantity of wet soil or grass will result in a defect on the roadway.

On this project, the RAP stockpile seemed to be in an ideal location. The material was stockpiled along the center of a 20-ft wide abandoned concrete roadway. The mixing plant was set up in the center of the abandoned roadway at the end of the stockpile. The processed material, both in front of and behind the mixer, was belt-fed directly onto the concrete pavement.

Even with these conditions, loading the material from the bottom of a pile at the edge of the roadway introduced contaminants into the mix. In addition, the loader tires tracked the contaminants onto the concrete pavement. This contaminated material in the mix led to problems on the roadway.

The significant differences between the two ERAs tested in this project were in appearance and texture only. When first delivered to the roadway, the mixes looked very much alike. Working one of the mixes, it became drier but maintained a somewhat “greasy” feel and a smooth texture, demonstrating potential for use as a possible surface course. The other mix became dry and crusty, appearing and feeling similar to untreated RAP. The texture was more open and appeared more likely to damage in rain prior to sealing.

Table 2. Road Density

MIX TYPE	DENSITY (lb/cf)	
	<i>Date Constructed</i>	<i>After approximately one month under traffic</i>
Cyclogen-ME/RAP	115 – 126	132 – 133
Prime-ERA-25/RAP	120 – 128	127 – 129
Prime-ERA-25/RAP Blend	125 - 126	129 – 131

Stockpiled Mix

The quantities of “maintenance mix” sat undisturbed in the stockpile for approximately 30 days before use by Limestone County and Falls County maintenance forces. Maintenance crews laid the material with a blade and used for FM base failure cutouts and FM level-up. The maintenance supervisors reported that the mixes handled like other TxDOT requisition “trap mix” and performed moderately well. Based on observations, laying or even mixing this material with a blade is feasible. This procedure, however, is probably more appropriate for low-volume roadways.

This project has increased interest in the potential for the use of RAP and an ERA in the production of a stockpile maintenance mix. It seems the maintenance mix products



performed as well as most “virgin” mixtures now used. This may very well be one of the more practical uses for the RAP produced by TxDOT construction projects. As a direct result of the CRRB project, the Waco District is going out for bids to have 10,000 tons of this RAP plant mixed with an ERA to produce stockpile maintenance mix.

Based on projected prices, estimated costs for future projects are as follows:

- Cold-recycle RAP Base (Plantmix/Laydown Machine) – \$20–32/ton
- Cold-recycle RAP Base (Roadmix/Blade Laid) – \$14-25/ton

Table 3. Project Contacts

Name	Organization	Phone
Jeff Kennedy, P.E.	TxDOT Waco District, Asst. Area Engineer	254-883-3302
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