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Full-depth reclamation is tested at U.C. Pavement Research Center

Story and Photos by: Russell W. Snyder

On an unseasonably hot September day on the campus of the University of California, Davis, a road crew scurried about a section of asphalt pavement as heavy equipment rumbled nearby. From a distance it looked like just another road improvement operation on the sprawling campus west of Sacramento. But a closer inspection revealed a perfectly good section of roadway being sacrificed for science.

A Caltrans-funded study on Full-depth Reclamation recently moved to the field stage, with a pavement operation reclaiming and reusing asphalt test sections while comparing various FDR strategies.

"Caltrans conducts pavement research to ensure we are pursuing the latest innovations to help us preserve and maintain one of California's greatest assets," said Coco Briseno, Acting Chief, Division of Research and Innovation. "Our portfolio of pavement research covers a broad range of research topics directed at improving pavement performance."

Full-depth Reclamation, also known as Full-depth Recycling, is a process that rebuilds worn out pavements by recycling the existing roadway in place. Old asphalt base materials are pulverized using a specialized "reclaimer" machine. Water is added to the mixture along with various materials to achieve the optimum consistency for compaction.

Since material is reused in place, the technique shows promise for reducing truck trips and preserving material on the existing roadway. The field construction portion of the study got underway Sept. 27 at the UCPRC facility on the campus of U.C. Davis.

(Above) A Western Oil & Spreading tanker truck at the head of a pavement operation underway Sept. 27, 2012 during the Full-depth Recycling Accelerated Pavement Testing Experiment at the University of California Pavement Research Center in Davis, Calif. Test sections of pavement are marked out in the foreground.

It should be noted that "worn out" asphalt in this case was a relative term. Unlike conventional asphalt that labors dutifully and without complaint under years of vehicle traffic, the test sections placed at the UCPRC never get anywhere near a Toyota Prius or a Ford Explorer. Rather, they undergo rigorous pounding by the UCPRC's hulking "Heavy Vehicle Simulator," which looks like something created for a "Star Wars" movie. The HVS machine, in a matter of weeks, simulates the same kind of rough treatment a roadway could expect to receive from tens of thousands of vehicle trips over 20 years.

The HVS test beam hydraulically loads either a single or dual test wheel, which is driven backward and forward over a 24-foot length of pavement (the track width is up to 5 feet wide), depending on the type of wheels used. The text section can be trafficked either uni-directionally (rutting tests) or bi-directionally to maximize the productivity of the fatigue tests. The HVS can apply wheel loads between 30kN and 200 kN (7 to 45 kips) at speeds of up to about 8 m.p.h., allowing the HVS to accelerate load-associated distress and simulate overloading effectively.

Performance data is collected with a series of instruments, both on the surface and embedded in the pavement. Environmental influences, such as temperature and moisture variation in the pavement structure, can be simulated through a set of special add-on facilities including a temperature control chamber, and surface and subgrade water injection systems, which allow for interpretation of the HVS data relative to the performance of pavement under actual traffic and controlled environmental conditions.

Researchers take periodic measurements and perform tests on pavement samples to calculate how different pavement types, placed side-by-side, hold up to the torture. Cores and beams will be sawed from the test track sections and subjected to various laboratory tests, including strength, repeated loading, moisture sensitivity, and cracking behavior. In many cases the pavements come out looking no worse for the wear, even though their job for science is done.

But what do you do with the pavement when all the testing is complete? Enter the FDR study, which can recycle and reuse the pavements, much like what might be done on a roadway that meets the criteria for such a design strategy. Dr. David Jones of the UCPRC, who is leading the study, said the goal of the study is to generate field test data to help Caltrans understand how its FDR guidelines perform on actual projects.

"We want to see how it behaves in the long-run," Jones said. "And we want to see how the empirical concepts compare to the mechanistic ones."

FDR with foamed asphalt has been used on a limited basis in California since 2001, according to the UCPRC. Only limited research into long-term performance has been done in California on other stabilization strategies. The FDR experiment will include laboratory testing, accelerated loading and long-term field performance evaluation. The results of the study will be used to develop mechanistic-empirical design performance models for the various strategies.

Four different strategies are being evaluated, including pulverization only (no stabilizer), foamed asphalt and cement, engineered emulsion and cement-only. The study is recycling part of a Warm Mix Asphalt study test track that was constructed with a gap-graded rubberized asphalt concrete. The study is being carried out in conjunction with a study to assess high recycled asphalt concrete pavement content in new asphalt concrete mixes. Jones said the high RAP mixes will compare a 15 percent control section with sections up to 50 percent RAP. Caltrans standard specifications allow for the use of 15 percent RAP, but the department earlier this year announced that it is moving to 25 percent and has already used 25 percent RAP on some pilot projects.

Dr. Dave Jones with the HVS in the background during an HVS operation in 2011.

Back out on the UCPRC test track, as the sun climbed higher in the sky, the asphalt reclaimer gave way to a grader and a roller as they took turns preparing the site for the next paving operation. And another sacrifice for science. **CAM**