Knox County knew about Full-Depth Reclamation using Cement (FDR) as they had recently attended an open house organized by the Southeast Cement Promotion Association and Road Worx during the FDR process on the Foot Hills Parkway. They were able to witness the process firsthand and learn the answers to all of their questions. Understanding the process and witnessing the results gave the County enough ammunition to get the ball rolling towards designing the new pavement with FDR.

They decided to cut their teeth on a short 12-year-old problematic road, Harvest Grove Lane, in Harvest Grove subdivision that was never completed. “The developer went bankrupt and never placed the surface course on the road. Between the lack of surface and heavy traffic from tandem dump trucks hauling soil, the road ultimately failed in multiple areas,” said Director of Construction Services Brad Warren with Knox County.

Needless to say, the residents were complaining constantly. “Extensive repairs were made prior to using FDR,” said Warren. “Many times, we had crews out there making repairs after hours and on the weekends.” As a result, the cost to make said repairs were adding up and becoming very costly to the county. They needed a better, more permanent solution.

They considered two options to address the issue. “We estimated it would take us 4-6 weeks to undercut and repair the 8 inches of base stone and 2 inches of asphalt surface, but with FDR, we were able to complete the work in 4 days,” said Warren.

Geotechnical firm S&ME took representative samples from the existing road which was riddled with alligator cracking, rutting, and sections of polished aggregate. Through mandatory lab testing, they determined that the FDR section needed to be 11 inches deep, and in order to achieve the TDOT FDR SP304’s requirement of 300-500 PSI in 7-day rule, the cement percentage would need to be 3.7%, which is 42 pounds per square yard. S&ME also stated that while TDOT SP304 recommends 95% compaction, they recommend that the FDR base be compacted to at least 98% of the standard Proctor maximum dry density. This was achieved by Road Worx with ease during construction.

Overall, Knox County was pleased with their first FDR project. “It allowed us to complete the work in a quarter of the time as traditional repairs and the residents of the subdivision were minimally disrupted,” said Warren. That being said, many counties and cities often have concerns about underlying utilities. Warren states that, “the depth of FDR should not interfere with existing utilities as long as they are installed to the proper
FDR is complete and ready for the surface layer.

Harvest Grove subdivision utilizes the FDR process.

Final pavement is complete on Harvest Grove Lane.

depth. The only utility we encountered was communications (i.e. cable TV) which wasn't buried deep enough as required and given that, it was the cable company's responsibility to fix the damage." It should also be mentioned that this subdivision also contained curb and gutter, mailboxes, and concrete driveways that were unharmed during construction. “This project wasn’t the easiest as we had to work around existing curbs as well as a multitude of drainage structures and concrete driveways but we were able to tie everything in with zero damage,” said President Barry Wilder of Road Worx. “We are looking forward to working with Knox County again.”

Knox County now has a brand-new road with a base now strong enough to provide many years of service. When asked if Knox County will use FDR again, Warren said, “Yes, we have several more roads and are pleased to have FDR in our tool bag.”

Typical Construction Sequence of Full-Depth Reclamation with Cement (FDR)

1. **Investigate existing pavement:** To ensure that the final results are optimized, always investigate the existing pavement structure and subgrade prior to reclamation. Typically, samples of the pavement and subgrade are collected to determine the appropriate rate of cement addition. Either too much or too little cement may reduce the quality of the final product.

2. **Plan operation to ensure a well-coordinated job:** Mixing, curing, and paving operations should be sequenced to minimize traffic disruptions and cover the FDR in a timely manner. Although FDR base can carry traffic for a week or more with only a chip-seal treatment, extended exposure without further paving is not recommended.

3. **Begin FDR by pulverizing existing pavement:** As a first step, it is recommended that the existing pavement be pulverized to the desired depth using the pavement reclaimer. The maximum particle size after pulverization varies with different specifications, but is generally required to be 2 inches or less. The contractor may elect to add some water at this stage to reduce dust and ease initial shaping, as was done on this project. Under limited circumstances, such as when the existing asphalt is less than an inch thick, this step may be omitted.

4. **Roughly reshape the pulverized pavement:** A motor grader and sheepsfoot roller are used to roughly regrade the base and prepare it to receive cement.

5. **Spread Cement:** Cement is spread with a spreader that is calibrated to deliver the specified amount of cement within tight tolerances. (Typically +/- 5 percent) Actual spread rate should be measured in the field by testing technicians periodically during construction.

6. **Mix cement, water, and pulverized pavement:** The reclaimer will make a second pass to mix the cement and pulverized pavement. If additional moisture is needed, the reclaimer may also use an attached water tanker to simultaneously bring the final mixture to the appropriate moisture content as determined in Step 1.

7. **Compaction and fine grading:** The sheepsfoot roller is used to compact the reclaimed mixture. The motor grader works in tandem to achieve deep compaction while maintaining the desired elevation. Once initial compaction is achieved, the motor grader and vibratory steel wheel roller will complete the fine grading operation and provide a smooth surface ready for overlay. This step is critical in achieving a smooth base that is ready to receive further overlay.

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