# On-Site Reclaimed Material as Subbase Layer

**RESEARCH PROJECT TITLE**
Central Iowa Expo Pavement Test Sections: Phase I – Foundation Construction (InTrans Project 12-433)

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The Iowa Department of Transportation (DOT) worked with its research partners to design comparative pavement foundation test sections at the Central Iowa Expo Site in Boone, Iowa. The project was constructed from May through July 2012. Sixteen 700 ft long test sections were constructed on 4.8 miles of roadway with the following goals:

- Construct a test area that will allow long-term performance monitoring
- Develop local experience with new stiffness measurement technologies to assist with near-term implementation
- Increase the range of stabilization technologies to be considered for future pavement foundation design to optimize the pavement system

This tech brief provides an overview of in situ test results and key findings from test sections constructed using the on-site granular material that was reclaimed and used as the subbase layer with and without stabilization. Stabilization of reclaimed subbase was performed by: (1) blending the subbase layer with the underlying subgrade (referred to as mechanical stabilization), (2) mixing portland cement (PC), and (3) mixing PC along with two different types of polypropylene fibers (identified as PP and MF-PP).

## Description of Test Sections and In Situ Testing

The original project conditions consisted of a thin chip seal coat and 6 in. granular subbase at the surface. The granular subbase material was excavated down to the subgrade. The subgrade material was classified as CL or A-6(5). The subbase material was classified as SM or A-1-a (with 14% fines content).

The test sections with untreated reclaimed subbase material were constructed on 9th St. North and South by placing the loose material (Figure 1) and compacting the layer with a smooth drum vibratory roller. Test sections with mechanically stabilized subbase/subgrade were on 2nd St. North and South, PC-stabilized subbase on 7th St. North and South, and PC with reinforcing fiber-stabilized subbase on 6th St. North and South. 6th St. North consisted of black PP fibers while 6th St. South consisted of white MF-PP fibers.

Additional details for the different stabilization methods/processes, materials, and test results are provided in the individual tech briefs. A 6 in. thick crushed limestone-modified subbase layer was placed at the surface of all test sections. The crushed limestone subbase layer was classified as GP-GM or A-1-a (with 7% fines content).

In situ testing involved testing the foundation layers prior to construction (May 2012), shortly after construction (July 2012), about three months after construction (October 2012) and during the spring thaw period (April and May 2013). In situ testing methods used included light weight deflectometer (LWD), dynamic cone penetrometer (DCP), falling weight deflectometer (FWD), and roller-integrated compaction monitoring (RICM). Results from only the DCP and FWD tests are presented here. RICM data is presented in a separate tech brief. All test results are presented in the Phase I final report.

*Figure 1. Reclaimed subbase material placed on 9th St. North*

## In Situ Test Results and Key Findings

DCP-California Bearing Ratio (CBR) profiles and cumulative blows with depth from before re-construction (May 2012) and several times after construction on reclaimed subbase, mechanically stabilized subbase, PC-stabilized subbase, and PC + PP fiber-stabilized subbase, and PC + MF-PP fiber-stabilized subbase sections are provided in Figures 2 through 6, respectively. Average CBR values in the crushed limestone subbase and the reclaimed subbase layers are shown in Figure 7. Average FWD modulus from each test section are shown in Figure 8.

Results indicated that DCP-CBR values of the crushed limestone and reclaimed subbase layers, and the surface FWD modulus values were lower during the spring thaw period. Test sections with mechanically stabilized subbase showed the lowest average CBR and FWD modulus while the PC + fiber-stabilized sections showed the highest average CBR and FWD modulus at all testing times.

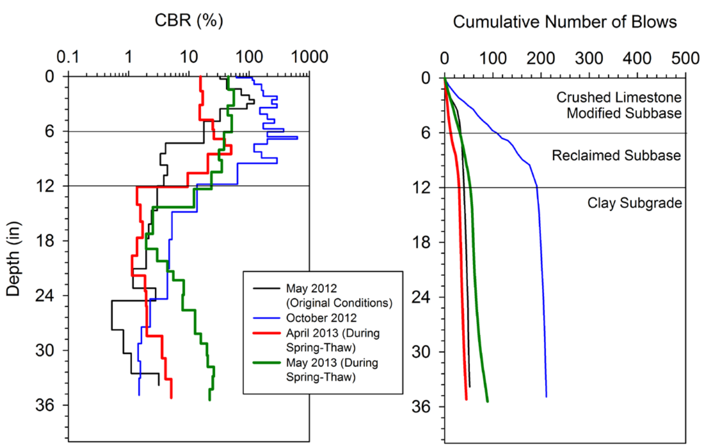


*Figure 2. DCP-CBR and cumulative DCP blows with depth profiles for 9th St. South with reclaimed subbase*

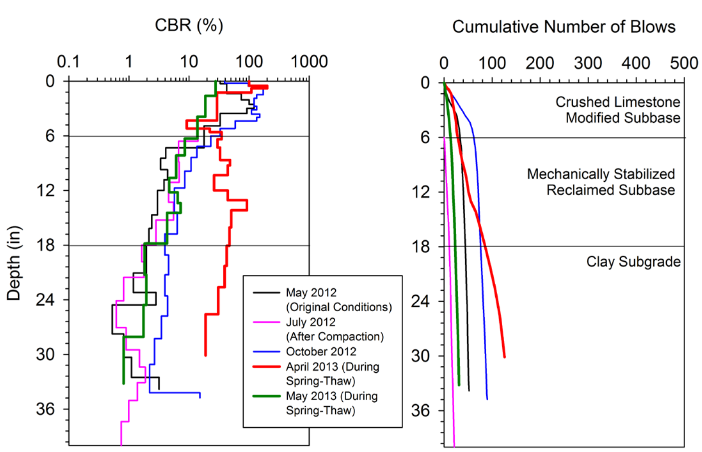


*Figure 3. DCP-CBR and cumulative DCP blows with depth profiles for 2nd St. South with mechanically stabilized reclaimed subbase section*

Average FWD modulus on test sections with PC-stabilized and PC with reinforcing fiber-stabilized reclaimed subbase layers were similar (15,570 to 17,520 during the thawing period). The ratio of FWD moduli from October 2012 and April 2013 (during spring-thaw) testing was about 4 to 5 in the unstabilized and mechanically stabilized sections, while the ratio was about 2 in the PC and PC with reinforcing fiber-stabilized sections.

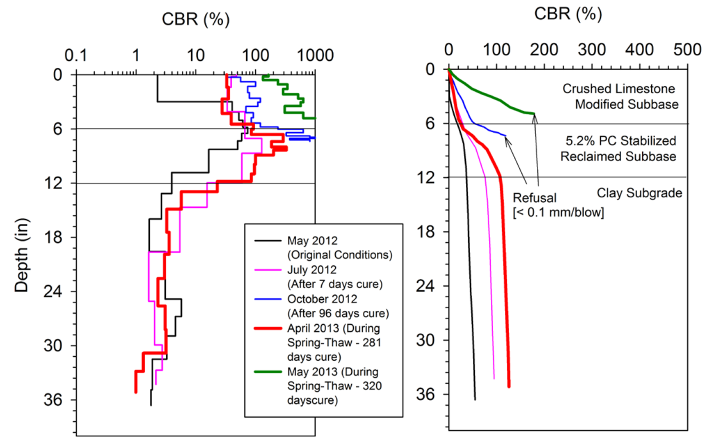


*Figure 4. DCP-CBR and cumulative DCP blows with depth profiles for 7th St. South with PC-stabilized reclaimed subbase*

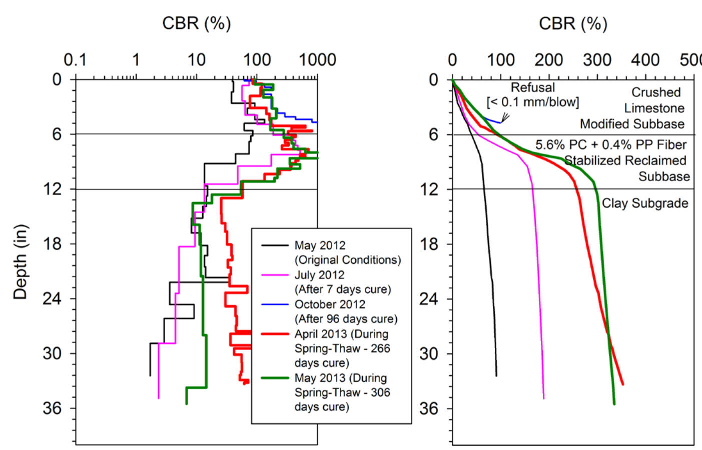


*Figure 5. DCP-CBR and cumulative DCP blows with depth profiles for 6th St. North with PC + PP fiber-stabilized reclaimed subbase*

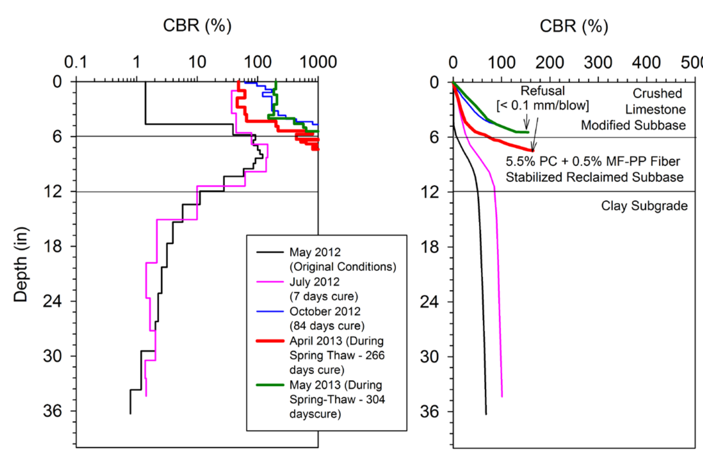


*Figure 6. DCP-CBR and cumulative DCP blows with depth profiles for 6th St. South with PC + MF-PP fiber-stabilized reclaimed subbase*

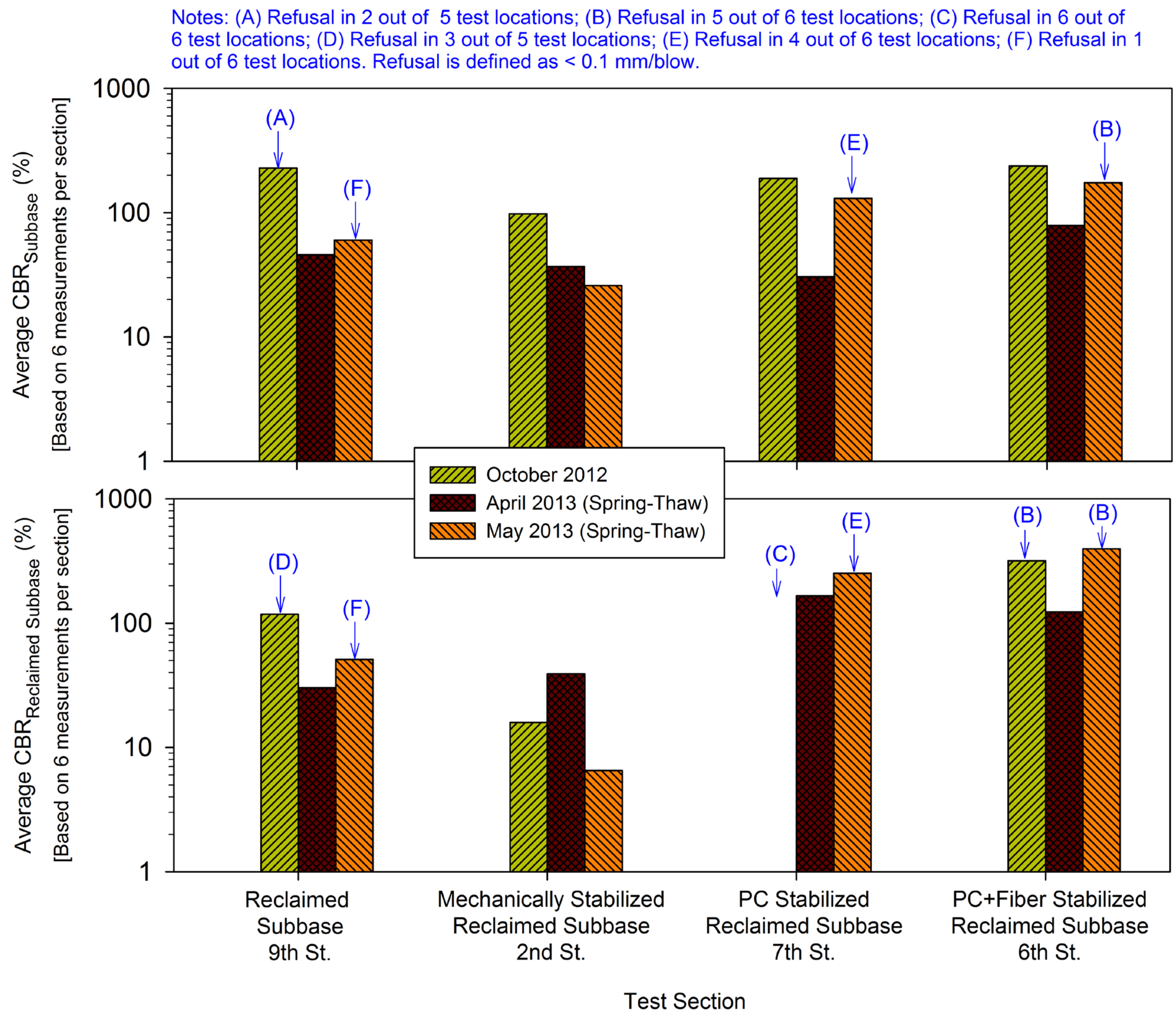


*Figure 7. Average CBR of subbase and reclaimed subbase layers for different test sections*

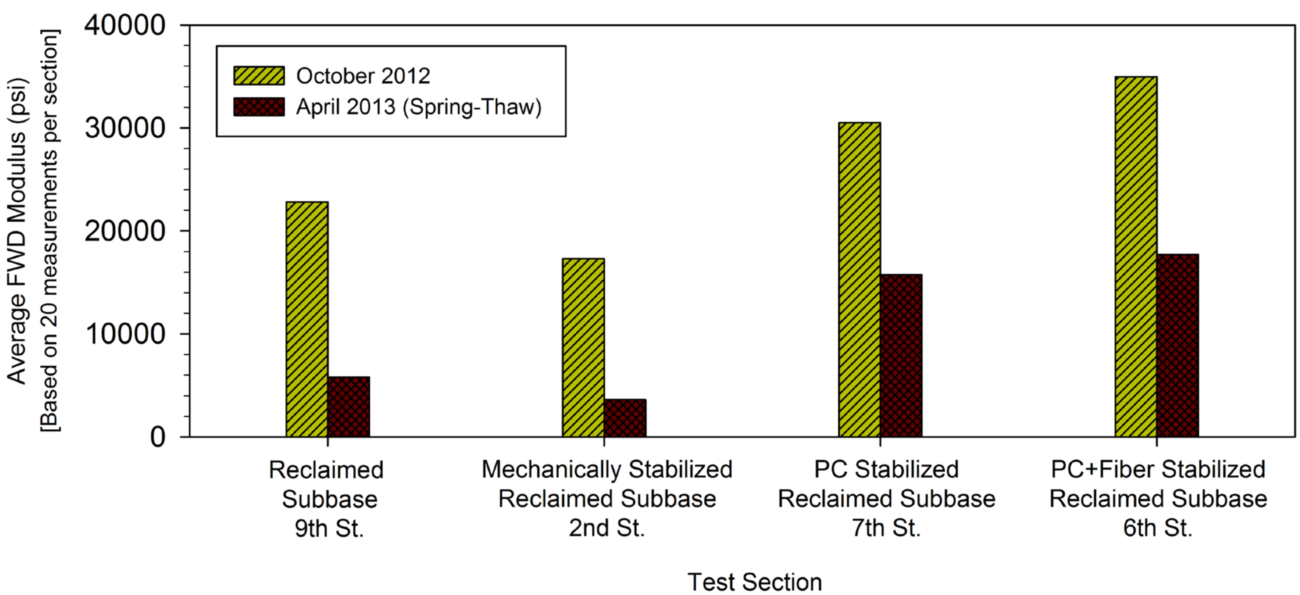


*Figure 8. Average FWD modulus of different test sections*