

What Is Microcracking?

The “block cracks” common to cement-treated base (CTB) initially present a cosmetic problem and result in negative public perception; however, these cracks can allow water into the pavement structure which will accelerate the rate of pavement deterioration. Combined with good lab design, microcracking can help alleviate the severity of cracking in CTB and therefore help improve the perceived quality of TxDOT projects and extend the project life.

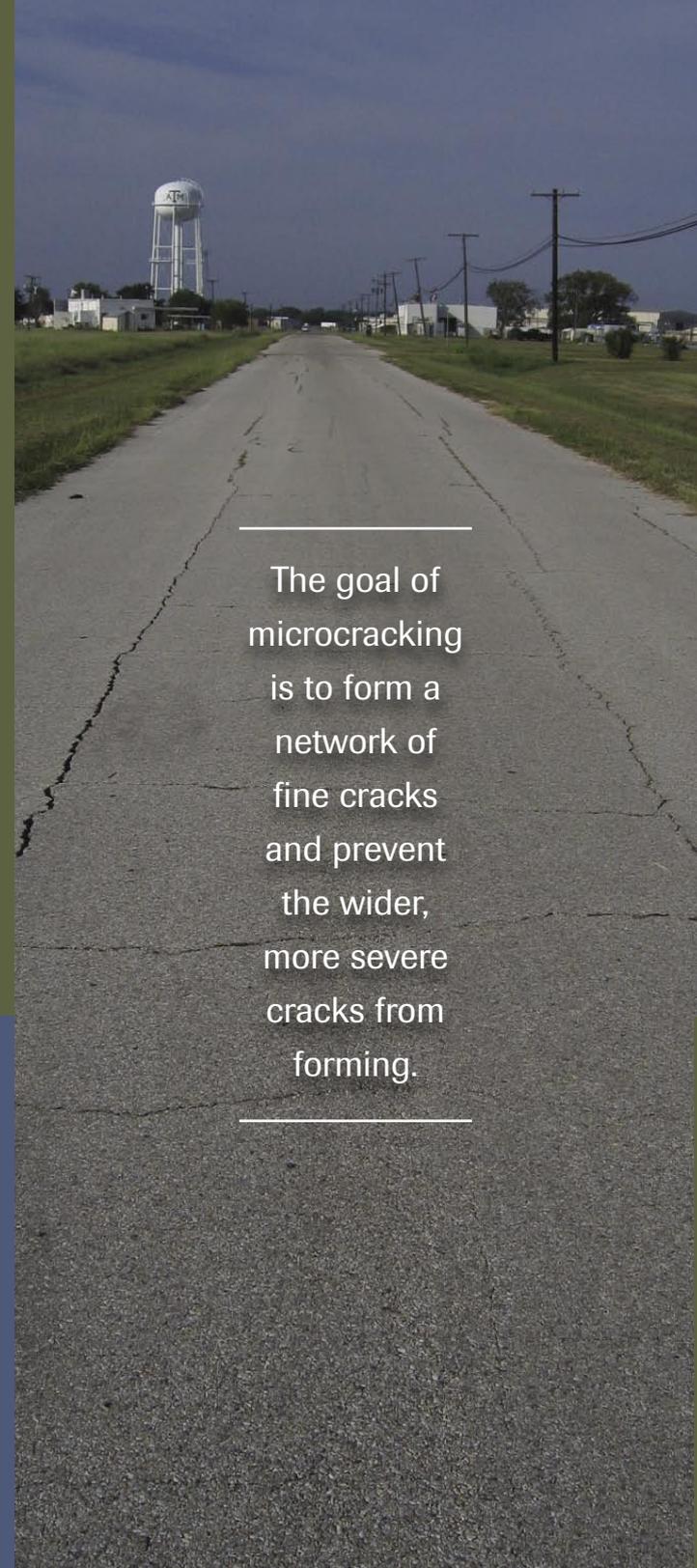
Microcracking is the application of several vibratory roller passes to a CTB after a short curing stage, typically after one to three days, to create a fine network of cracks. Microcracking is one

technique to help reduce the risk of cracks in the CTB reflecting through the pavement surfacing. The



Block cracking typical of CTB.

goal of microcracking is to form a network of fine cracks and prevent the wider, more severe cracks from forming.



The goal of microcracking is to form a network of fine cracks and prevent the wider, more severe cracks from forming.

NEED MORE INFORMATION?

The oldest TxDOT project incorporating microcracking involved SH 47 near Bryan, Texas. Complete details can be obtained from the lab engineer in charge:

Darlene Goehl, P.E.
Texas Department of Transportation
(979) 778-9650
dgoehl@dot.state.tx.us

Texas Transportation Institute researchers evaluating microcracking include:

Stephen Sebesta
(979) 458-0194
s-sebesta@tamu.edu

and

Tom Scullion, P.E.
(979) 845-9910
t-scullion@tamu.edu

Complete project details are available in Technical Report 0-4502-1, available by calling Nancy Pippin, Texas Transportation Institute, TTI Communications, at (979) 458-0481 or n-pippin@ttimail.tamu.edu.



microcracking



Product 0-4502-P4
TxDOT Project 0-4502:
Microcracking Stabilized Bases during
Construction to Minimize Shrinkage

March 2005
Resubmitted: May 2005

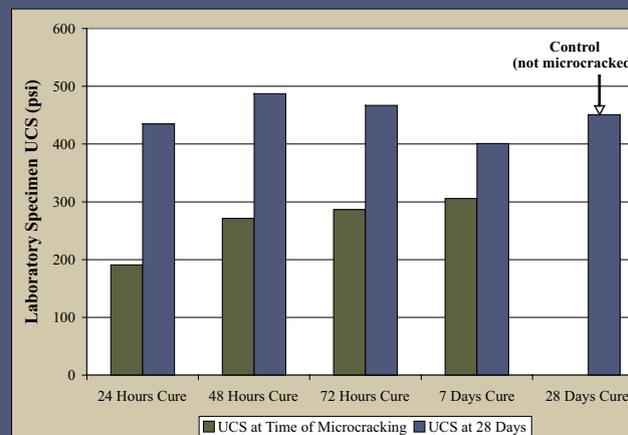




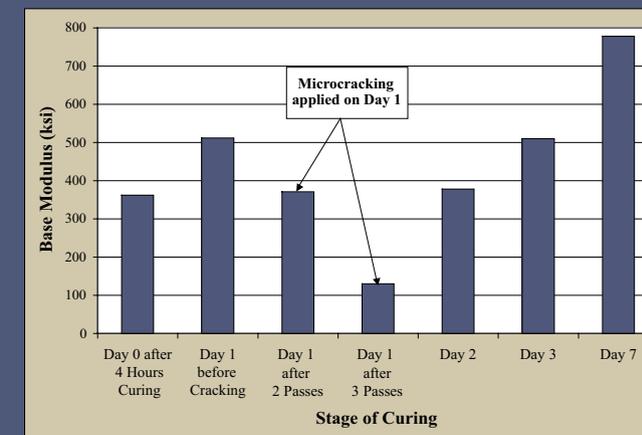
Microcracking in progress with the vibratory roller. TxDOT's FWD can serve as the control mechanism to determine when to stop rolling by measuring the reduction in average base modulus.

What Materials Should Be Microcracked?

Performance of microcracked field projects in Texas indicates no detrimental structural effects from microcracking. Even after failure at an early curing stage, the strength of the material recovers by continued cement hydration. At the end of the hydration stage, the strength of the previously failed material does not differ significantly from material simply cured to an age of 28 days. Additionally, the base modulus recovers after microcracking since the procedure takes place at an early curing stage. Microcracking imparts a temporary reduction in the base modulus. With additional curing time the base modulus rapidly recovers. Given the observed benefits and the lack of negative effects, microcracking can be considered for any properly designed CTB.



The 28-day unconfined compressive strength (UCS) of CTB is not harmed by microcracking at an early age.



Microcracking creates a temporary dip in the increase in modulus as curing progresses. (Modulus backcalculated from FWD with Modulus 6.0)

What Are the Benefits of Microcracking?

Microcracking reduces the severity of shrinkage cracking problems in CTB. Compared to moist curing alone, microcracking improves the performance of CTB by reducing the crack width, reducing the total crack length, or both. Through these mechanisms, microcracking reduces the risk of reflective cracking through the surface layer.



Crack in moist-cured section.



Crack in section microcracked.

What Does a Microcracked CTB Look Like?

Upon introduction to the microcracking concept, most pavements personnel fear microcracking will rubblize or powder the base. Contrary to this fear, a properly microcracked CTB looks no different than an ordinary CTB. Typically, no visual changes are detectable in the base immediately after microcracking. On rare occasions, some visible hairline cracks may appear. However, use of some type of stiffness testing device, such as the falling weight deflectometer (FWD), is typically the only method to definitively detect a change in the base after microcracking.



Visible cracks in CTB after microcracking are rarely observed.

How and When Should Microcracking Be Performed?

After placement and satisfactory compaction of the CTB according to the applicable bid item, the base should be moist cured by sprinkling for 48 to 72 hours before microcracking. If performing construction during winter months when average daily temperatures are 60° F or below, moist cure the base at least 96 hours before microcracking. Microcracking should be performed with the same (or equivalent tonnage) steel wheel vibratory roller used for compaction. A minimum 12-ton roller should be used. Typically three full passes (one pass is down and back) with the roller operating at maximum amplitude and traveling approximately 2 to 3 mph will satisfactorily microcrack the section. After satisfactory completion of microcracking, the base should be moist cured by sprinkling to a total cure time of at least 72 hours from the day of placement.



A portable FWD (PFWD) provides a compact alternative to the standard FWD for controlling microcracking. Other stiffness devices may also be able to control microcracking.

What to Look for During the Microcracking Process

Inspect the microcracking operation and look for:

1. Satisfactory completion of three full passes that achieve 100 percent coverage.
2. Signs of cracking in the CTB. Although new cracks are rarely observed (oftentimes some transverse cracking will have already taken place during the moist-curing stage), hairline cracks imparted by the roller occasionally may be visible. If available, the FWD can be used to ensure adequate completion of microcracking by testing every station immediately before microcracking, then retesting at each station immediately after completion of the three microcracking passes. The average base modulus should be reduced 50 to 70 percent by microcracking with three passes of the roller. If the actual reduction is greater than 50 percent but less than 60 percent, the engineer may choose to accept the section or direct the contractor to perform additional microcracking passes. If using a PFWD for controlling microcracking, target a 40 percent reduction in average base modulus.
3. Signs of detrimental damage to the CTB. If properly designed and cured, microcracking should not damage the CTB. However, if the base appears to start to break up excessively at the surface, stop microcracking and use a static roller until a satisfactory surface finish is obtained.
4. Satisfactory completion of continued moist curing to an age of at least 72 hours from the day of placement.