Kansas
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Cracking Down on Crumbling Concrete

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Some cities, especially in Northeast Kansas, have found their concrete pavements and curbs are not all they are cracked up to be. They are not lasting as long as they should. The culprit is D-cracking, caused when the aggregate breaks down under repeated freeze-thaw cycles. Many of the limestone aggregates available in the Kansas City metropolitan region are susceptible to this distress.

Another cause of deterioration in concrete is alkali silica reactivity (ASR) that causes the aggregate (limestone or not) to react with the cement paste, creating a gel-like substance. This substance causes weakness in the concrete and the concrete deteriorates faster than expected. A concrete road designed to last 50 years may only last 20.

This article will describe how some communities are spec'ing their concrete to head off these problems.

Lawrence. The City of Lawrence has recently joined a group of communities in the Kansas City area that together form the Kansas City Metro Materials Board (KCMMB). The Board helps communities spec and obtain durable aggregates. Member-communities write into their concrete specs that their mixes must be approved by the KCMMB. These specs do not allow the use of limestone and instead specify more durable options such as quartzite, granite and trap rock. KCMMB mixtures also include either slag cement or type F fly ash to prevent ASR.

Currently, there are 19 members of the KCMMB: 16 cities in the Kansas City Metro area, plus Lawrence, St. Joseph, MO, and the Unified Government of Kansas City, Kansas/Wyandotte County.

Assistant public works director Mark Thiel said Lawrence has been using KCMMB specs since 2004, but recently joined the Board for an extra measure of assurance that the aggregate actually meets their specs. Every mix for a KCMMB member is tested by an engineering firm retained by the Board.

Overland Park. Overland Park initiated the research that led to the development of the KCMMB spec. They used data from their pavement management system, PAVER, that also tracks curb condition. The City determined that their curbs showing early failure were built with limestone aggregate. This was in spite of the fact that in 1984 the City switched to limestone aggregate that met KDOT's durability class 1 or 6.

Overland Park's research led to formation of the City/Concrete Industry Work Group of Johnson County—later called the Johnson County Concrete Board—an informal organization that brought together public works professionals, concrete suppliers, and representatives of related associations to share information and develop solutions to premature deterioration of curb and gutter applications and pavement, bridges, sidewalks, and storm drainage inlets. After studying various concrete mixes over three years, members of the Work Group agreed to develop a standard concrete specification. The new specification became effective for municipal and county projects constructed after April 1, 2001. The Group later expanded to add cities from Missouri and changed its name to the Kansas City Metro Materials Board.

Mike Ross, manager of technical and administrative support for Overland Park, said having a spec is just the first step in obtaining more durable concrete. "You also have to test the mix and pay attention to the process," he said.

Topeka. Shawn Bruns, city engineer, said that Topeka changed its own concrete specs in 2010 and now specifies durable aggregates such as granite, quartzite or trap rock in pavement-class concrete except that concrete in sidewalks, trails and

sidewalk ramps can still use Class I limestone. The City also modified its concrete specs to require the use of fly ash or slag in concrete mixes using more durable aggregates and to require that the pavement reach 75 percent of compressive strength before it is opened to traffic. Bruns explained that concrete mixes using durable aggregates take a longer time to reach that strength.

KDOT. The Kansas Department of Transportation allows limestone in its concrete mixes out of pre-approved seams in quarries. However, KDOT does have a special provision to allow the use of durable aggregates by their contractors on local projects.

Durable aggregates. Unfortunately, most sources of durable aggregate are outside the state. Common sources are in Minnesota, Arkansas and Oklahoma. The KCMMB affords large-scale purchasing, and this is bringing the cost down. Rail service expansion in the Kansas City area is also helping lower the cost. Thiel said it costs $10-15 more per cubic yard for durable aggregate compared with limestone, and that is well worth the cost if the pavement's life can be extended several decades.

Want more information? The KCMMB website has helpful articles, forms, and their concrete specs for download. Go to http://www.kcmmb.org. The site also contains an excellent comprehensive report by the City of Overland Park on the City's research on concrete durability. Download ir for free at the link below. ■

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Sources:

- Interviews with Mark Thiel, 3-26-12, Shawn Brunz, 3-27-12, Mike Ross, 3-30-12, Rick Kreider, 4-5-12.
- City of Overland Park, KS. Durable Concrete. (Report). http://www.kcmmb.org/images/stories/pdfs/Report.pdf