



Kansas LTAP Fact Sheet

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Experiences with Roller Compacted Concrete in Kansas

By Lisa Harris

When paving a road or street, two common choices for the material are asphalt and poured concrete. Each material has its pros and cons in terms of cost, maintenance, and longevity. Now, in some parts of Kansas, there is a third option: roller compacted concrete (RCC). This article will describe a few roller compacted concrete projects in Kansas, and introduce you to a few resources for further information.

The roller compacted concrete process

The name of the product provides a good description of its characteristics. It starts with a very stiff **concrete** mix. The mix is trucked to the job site in dump trucks rather than drum mixers. The mix is then loaded into a paving machine, laid like asphalt, and then is **compacted** with vibratory **rollers** immediately after it is laid.

A typical asphalt paving machine can lay RCC at 85 percent density, but a high-density paver produces a better result at 95-98 percent density. The machine's rollers further compact the pavement to about 98 percent. Water content in the mix is a key to successful placement and rolling. It has to be right for the conditions. (See sidebar on next page on Keys to a Successful RCC Project.) After rolling, the pavement needs to be sealed for proper curing, and scored to prevent cracking.

Concrete forms are not necessary because the material does not slump. Edges can be angled or straight. The material does not contain reinforced steel, except at cold joints. It can be placed on streets with curbs and gutters, or without.

The end-result is a durable pavement with a rougher texture than poured concrete. It looks more like asphalt.

RCC in the Wichita area

Andale Paving, Inc., purchased a high-density paver a few years ago, and they have been marketing the technology to communities in their area for use on roads and streets. A few cities have jumped on board, with excellent results:

City of Maize. Maize has contracted with Andale to place RCC at three locations over the past few years:

1) A project at an intersection where heavy trucks were shoving the asphalt. Bill McKinley, city engineer, said they



Mystic Lakes project, Maize, KS, Courtesy of Andale Paving, Inc.

Roller compacted concrete can be placed on roads and streets with or without curbs and gutters.



replaced an 80 ft section of asphalt with RCC and they have not had any problems since.

2) A one-mile stretch of road at the Mystic Lakes subdivision in October 2011. The road has 20 houses on it, built around a lake. The surface was compacted sand/gravel.

3) A one-mile sand residential street in Belle Park.

Maize uses 5 inches of RCC for residential streets over a base compacted to 95 percent. The base has several inches of AB3 rock/gravel and/or crushed concrete. The concrete pavement is sawn. McKinley recommends sawing at 20 to 30 ft spacing across the pavement and at the center-line if there is a crown.

McKinley is very pleased with the performance of their RCC roads. Advantages of RCC, per McKinley, are:

- Relatively little down time for residents. "It lays down fast, and you can get traffic on it pretty quick. We did one mile in three days," he said. The city keeps traffic off the RCC roads 1-3 days, just to be on the safe side, especially at the ends of the project where the pavement can be more fragile. "However," McKinley said, "one time a project just had a few hours of drying time before a vehicle was on it—by mistake. The driver did not know the barricade was for him. The pavement was fine."

- Priced about the same as asphalt.



- Durability.
- Very little steel is needed; only at cold joints.
- The pavement is relatively cool and generates less heat and fumes than hot mix.

McKinley said RCC is impressive to see while it is being laid down. “It’s the most amazing thing I’ve seen with concrete,” he said. “Right after you lay it down, you can walk on it.”

Maize has added RCC as an option to its paving bids and will be bidding a pavement project on an arterial street this year. If RCC wins that bid, the city will have the pavement depth at six inches instead of five.

McKinley said he did his homework before trying RCC. He said the product has been used for 40-50 years in Canada on logging roads. Alliance, Nebraska did an RCC project 20 years ago on a collector street and it has not needed any maintenance in those 20 years. He talked with the public works director in Alliance for advice. Other road departments have used RCC for shoulders (see the KDOT project later in this article) or as a base with asphalt over the top (e.g., Columbus, Ohio) and for runways and parking lots.

Bill McKinley can be reached at bmckinley@cityofmaize.org and at (316) 722-7561.

The **City of Haysville** with about 10,000 residents near Wichita, contracted with Andale Paving for an RCC project on a curb-and-gutter residential street that carries a couple of hundred vehicles per day. They placed a 700 ft section of RCC. The project has been in place for about eight months, without cracking or settling.

Randy Dorner, public works director, said there is a slight curve in the road, and you can see faint roller marks in the curve, but nowhere else. The road was laid last summer, at night, to avoid the daytime heat. Temperatures in Haysville have ranged from 10 degrees to 110 degrees since the pavement was laid. “No spalling, no nothing,” said Dorner. “It’s excellent.”

Dorner said their decision to try RCC fit with his department’s overall approach for trying new things to improve their operations. “But before we [tried RCC] we did lot of research,” he said. Dorner visited one of the Maize projects as part of his research, and he took with him his mayor, engineering firm representatives and the director of governmental services (city manager). That made a difference in convincing them to try the technology.

Like Maize, Haysville now has RCC as a bid option. Dorner prefers using a concrete product when he can; he thinks concrete is a better investment for the community. “We see [RCC] as a cost effective alternative to asphalt, and a more durable product,” he said.

Dorner noted that it’s important to saw joints in RCC every 20 ft, which is closer than what is recommended by the national standards book (40-50 ft). He also said using a high density paver is the key to a good result when using RCC.

To sum up his thoughts about using RCC on the above project, he said “I’m proud of this street.”

Randy Dorner can be reached at rdorner@haysville-ks.com and at (316) 529-5940.



Andale Paving, Inc.

Close-up, the texture of RCC is similar to asphalt.

Keys to a Successful RCC Project

Richard Mfuko, quality assurance manager for Andale Paving, shared advice for local road managers on keys to a successful RCC project:

- 1. A suitable project.** It must be big enough to make using a paver cost-effective, and the site has to be able to accommodate the paving machine. The paver does best on relatively straight sections without sharp turns.
- 2. Appropriate mix design.** Water content in the mix design should be 6-7 percent but will vary depending on the weather conditions (more water when it’s hot outside) and the length of time the mix will be in a dump truck (more water for longer distances). The mix needs to be consistent from load to load.
- 3. Good quality materials, including the base.**
- 4. Applicable specs to allow the use of the technology.**
- 5. Quality control throughout the job, especially the moisture content of the mix.** Dump trucks must be covered to minimize moisture loss.
- 6. A competent contractor that understands RCC characteristics and performance—and has skilled operators.** “You’ve got to have a good roller man,” Mfuko said.
- 7. Realistic expectations about pavement smoothness.** The texture will look more like asphalt than poured concrete.
- 8. A good working relationship with the RCC contractor.**

KDOT’s experience with RCC

KDOT has used RCC on one project to date—as a base for an asphalt shoulder on a highway between Dodge City and Garden City. Thirty miles of RCC were laid in Summer 2011, 12 feet wide, topped with a 2 inch asphalt overlay, 10 ft wide. Koss Construction was the contractor.

The project manager was Ted Orrison, engineering technician senior, at KDOT’s Dodge City construction office. He said the idea for using RCC came from KDOT’s Bureau of Design. “They heard about it and wanted to try it,” he said.

Orrison had no prior experience with RCC, but did attend a tutorial to become more familiar with the technology. The



contractor, Koss Construction, also did not have experience with the product, but laid a nearby temporary detour on/off ramp with RCC to try the product before the KDOT project. In both projects, Koss used a typical asphalt paving machine to lay 7 inches of RCC over 6 inches of fly ash treated base, topped with 2 inches of asphalt.

Orrison said KDOT's experience with using RCC was mostly good, but they did have a few problems. "It's pretty easy to work with," he said. However, the pavement was not scored after being laid and it ended up cracking on its own every 15-20 ft or so. This caused reflective cracking in the asphalt overlay.

Another problem they encountered was having the steel rollers stick to the pavement after the contractor sprayed water on the pavement after it was laid. Water was added to keep the pavement from drying out before it was sufficiently rolled. (They did three passes.) Orrison said this was a "lesson learned"—and they do not recommend spraying the pavement when the rolling is in process.

You can reach Ted Orrison at TOrrison@ksdot.org or (620) 227-6122.

Getting it right

Andale's Paving's quality assurance manager, Richard Mfuko, stresses the importance of carefully controlling the mix for moisture content given the conditions of the particular job. The contractor needs to consider environmental conditions such as heat and wind and transportation distance in determining the percentage of water in the mix.

Mfuko also said that proper mixing equipment and transporting equipment are important to a good quality result. He recommends a twin shaft mixer (with paddles) or pug mill for mixing. Mixer trucks are a last resort, he said, because the mix can stick to the sides of the drum.

It's important to have enough dump trucks to keep a steady supply of mix going into the paver, Mfuko said. And dump truck beds used to carry the mix need to be clean. Truck bed covers are very important. Mfuko related one instance where a driver forgot to cover his load. When the driver arrived at the project site, the mix had two inches of white concrete on top, and the load had to be scrapped.

Rolling can be done with steel or rubber rollers, but Mfuko prefers steel because they leave fewer roller marks.

Because water content needs to be carefully controlled, Mfuko said the mix should not be transported more than 30 minutes to an hour from the plant. He said for distances longer than that, it could be feasible to bring in a high-density paver and have the local concrete plant prepare the mix.

You can reach Richard Mfuko or general manager Peter Molitor at Andale Paving at (316) 303-2624.

When to use which pavement?

There are no clear-cut guidelines for when to use asphalt, RCC or poured concrete for a pavement. It often comes down to the price of materials in your area, or a judgement call. But, in general:

Poured concrete is the most expensive option and is usually used in Kansas on higher-volume roads or those routinely carrying heavy loads. It provides high durability and smoothness.

Roller-compacted concrete is considerably less expensive than poured concrete. It is more commonly used on lower-volume roads and streets, or on shoulders, because of its rougher surface texture. But using a high density paver and/or diamond-grinding the surface can improve the smoothness to rival poured concrete. Its durability can match or even exceed poured concrete. A successful project requires tight quality control.

Asphalt is generally a little less expensive than RCC, but the price tends to fluctuate with the price of the petroleum products used in the mixes. Asphalt pavement is not designed to last as long as poured concrete or RCC, and it needs regular maintenance to maintain longevity.

Conclusion

Experience in Kansas is showing that roller compacted concrete can be a cost effective and durable option for pavement projects—if the mix design and placement is carefully controlled by the contractor, if the concrete is sawn, and if the equipment used is appropriate for the desired pavement density and smoothness.

For more information, consult the Guide for Roller Compacted Concrete, August 2010, \$12, by the Concrete Pavement Technology Center at Iowa State University (<http://www.cptechcenter.org>). McKinley said it's the best comprehensive guide he's seen on RCC.

For a quick read, the Portland Cement Association has a 4-page publication called Roller Compacted Concrete Pavements for Highways and Streets. See page 14 for more information.

Andale Paving, Inc.'s website has photographs of its RCC projects at <http://www.andalereadymix.com/products-roller-compacted-concrete.php>.

Cemex has a good five-minute video on RCC at <http://www.youtube.com/watch?v=CP8zjaT35X8>. It includes footage and testimonials from projects in South Carolina. ■

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Sources:

- Interviews with Bill McKinley 2-12-12, Pete Molitor 3-15-12, Richard Mfuko, 3-15-12, Randy Dorner, 3-19-12, Ted Orrison, 3-20-12.
- Asphalt versus concrete: Which material is better for your project? Public Works. March 1, 2006. <http://www.pwmag.com/industry-news.asp?sectionID=770&articleID=273635>