IOWA CONCRETE PAVING ASSOCIATION
IOWA SCENE

In-Place Recycling Offers Solution for 1969 "D" Cracker

Keokuk County, Iowa

Project Report #27

Paradigm Crusher

November, 2002

Keokuk County was looking for a solution to their "D" cracking aggregate problems and found that recycling with a special mobile crusher offered a very economical solution for reusing the old pavement aggregate to stiffen local soils which can be moist and unstable. Built over 30 years ago, V67 was unknowingly built with aggregate susceptible to what has now become known as "D" cracking. The "D" represents durability because the cracking is actually brought on by freeze-thaw durability problems within the aggregate.

Aggregate with the right combination of factors can allow water to saturate the particle and literally break it apart when water freezes. Critical factors in determining whether or not a particle could cause "D" cracking are size of the aggregate, pore size, permeability, porosity, and tensile strength. In addition, sufficient moisture must be present in order to saturate the particles before freezing. As individual particles continue to break, they can cause cracks to form along the joints in the pavement, which is where water infiltration would begin. The problem can be compounded by a poor draining subgrade.

Since V67 was built, engineers have identified the types of aggregates in Iowa that can cause a pavement to encounter "D" cracking. Plus, many of today's pavements are designed with an eye on limiting exposure to moisture. As such, very few pavements built today experience this particular type of deterioration. Pavements of the same vintage as V67, however, still require economical solutions to their deterioration problems.

Because "D" cracking takes place from within the pavement and the aggregate, the problem cannot simply be covered up. In fact, overlaying a "D" cracking pavement may hasten deterioration by preventing moisture from escaping through its surface. A real solution has to include removing the offensive particles from the pavement structure. This is exactly what in-place recycling provides.

The end result is a concrete pavement with more durable aggregate and a stronger subbase.

In-place recycling allows elimination of "D" cracking coarse aggregate particles from the pavement without all the cost of disposal and with the added benefit of providing a durable subbase. Thanks to the recent development of self-contained mobile processing trains, an old pavement is shattered, crushed, screened, and windrowed in place for reuse below a new concrete pavement. The end result is a concrete pavement with more durable aggregate and a stronger subbase.

In-place recycling was chosen by Keokuk County as the process they would use for V67. Built in 1969, V67 was

360 S.E. Delaware Avenue • Ankeny, Iowa 50021 • (515) 963-0606 • FAX (515) 963-4010

recycled in the summer of 2002 by Manatts, Inc. Manatts submitted the low bid of $2,616,275 for the 6.67 mile job let by the Iowa DOT on June 4. The existing 6" concrete pavement was 22' wide and ran north from Harper to Iowa Highway 22. Keokuk County Road V67 is now 8" with dowelled joints, longitudinal edge drains, and a soil aggregate subbase.

Project Summary

Work began shortly after the June 4 letting when Manatts, Inc., brought in their Paradigm recycling train. By July 30, the pavement had been removed, crushed to Gradation #14, and the material had been placed in a single windrow to the right side of the grade. Road design plans specified that all the crushed PCC be spread uniformly across the adjusted centerline profile and then mixed with existing soil in the embankment to a depth of 10" and width of 26'. Manatts brought in their Reclaimer machine for the mixing-blending process. Plans also specified that the processed subbase sit a minimum of 7 days, or a maximum of 14 days, before paving could begin. Any soft spots would then be repaired and 4" longitudinal subdrains would be placed under each pavement edge prior to paving.

Recycled pavement, crushed to Gradation #14, to be used as subbase for new pavement.

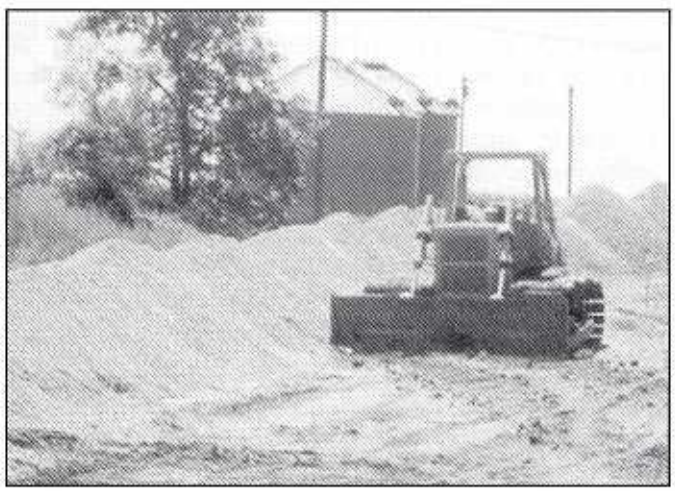
Concrete paving began August 19 and the project was opened to traffic on November 13, 2002. The new 86,040 SY slab required a DOT Class C mix with Class 3i (interstate) coarse aggregate for long term durability. Joints were dowelled with baskets placed at 20' on center (RH-22 Standard). Shoulders were finished with 4" granular surfacing to a width of 4'.

Economics

Certainly an improvement over the 33 year-old "D" cracker, the new V67 was built to provide decades of great service at a very economical price. Bid documents show that the cost for removing and crushing the old 6"x22' pavement was $2.45 per square yard. Add in the "place only" cost of $0.45 per square yard for the 10" subbase and the total cost for in-place recycling on this project came to $2.90. In other words, Keokuk County purchased a 10" granular subbase for less than $3.00 per square yard, and received removal of the old pavement, as well.

Keokuk County found a very economical means of turning a negative into a positive. Even though "D" cracking aggregate within the pavement can be detrimental, it can also serve a very valuable purpose in a pavement's subbase. And, with the advent of in-place recycling, this aggregate can be turned over in a very inexpensive fashion. For Keokuk County, in-place recycling has proven to be a great solution for their "D" cracking problems.

By John Cunningham, Director - Local Partnerships, and R. H. "Bob" Given, P.E., Associate Engineer



Following removal and crushing by the mobile crushing train, the material was placed in a single windrow on the right side of the grade.