



# IOWA SCENE

## Pavement Rehabilitation Uses In-Place Recycling Keokuk County

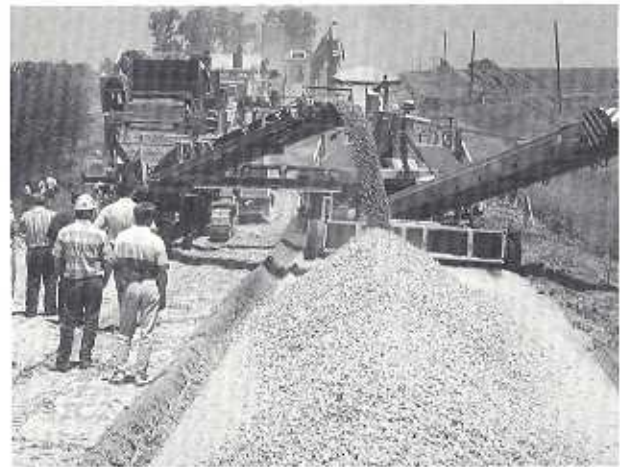
Project Report #21  
July, 1996

Are you looking for a concrete solution to worn out or old-deteriorating pavements? Iowa's **first in-place PCC recycling** project on the secondary road system was built in Keokuk County during July, 1996 on route V-44 from Keswick north 3.4 mi.

In keeping with conventional practices of a quarter century ago, V-44 had been concrete paved 7 in. thick by 22 ft. wide in 1970 using full-face quarry production from a local limestone source for the coarse aggregate. Although suitable for granular surfacing and meeting specification quality for secondary road pavement at that time, evidence of D-cracking, spalls, and early joint deterioration developed in a few years. As conditions worsened, Iowa DOT geologists examined this quarry face and identified certain ledges with high percentages of unsound chert that negatively affected concrete durability. Aggregate quality standards were revised in 1974 by prohibiting use of the chert-laden ledges, but early pavements have had to be extensively repaired and are now scheduled for replacement.

After considering alternatives that included 'crack and seat', 'remove and replace' or 'patch and AC overlay', a 30-year pavement design analysis showed equivalent life-cycle costs. Care was taken to evaluate all reasonable options because Keokuk County has 30 more miles of similar vintage pavement that must be rehabilitated in the future.

After observing state-of-the-art construction techniques used for industrial park service roads and interstate highway reconstruction projects in their area, County Engineer Christy Collicott and Assistant Russell Smeltzer developed a best-case design for replacing this badly damaged 26-year old pavement.



For example, the old slab, rather than being removed and crushed off-site, was required to be crushed and screened in-place, where it would be used as granular subbase. This recycling method was recently developed in Iowa by Manatts, Inc. and successfully used for similar work on two Interstate 80 projects east of Des Moines.

Other enhancements for long term durability included ① installation of longitudinal 4 in. subdrains surrounded by porous backfill to intercept and dispose of surface water and capillary moisture from the silt/clay embankment typical of Keokuk County soils, and ② construction of 6 in. deep by 4 ft. wide Type A crushed stone shoulders.

Highest quality concrete pavements throughout Iowa are built using Class 3i coarse aggregate and skewed load-transfer dowels at 20 ft. transverse joint spacing. While typical for state highways, this plan also has served well at an industrial site in Sigourney. An 8 in. thickness was selected to serve

design year 2014 traffic of 750 vpd having a high percentage of heavy trucks and large single axle farm wagons.

With approval of the plans and financial assistance from ISTEAF funds, a low-bid at the April 30, 1996 Iowa DOT letting from Manatts, Inc. of Brooklyn, Iowa was accepted for \$1,462,920. After establishing an off-site detour, work began May 30.

Final plans had called for replacement of 13 crossroad pipe drainage structures with new 2000 D RCP. This operation included open trench excavation followed by flowable mortar backfill in 4 ft. lifts at 24-hour intervals. When found to create serious delay and interference with farm access along V-44, a value engineering alternative to substitute placement by drilled jacking was approved at a project savings of \$5,000.



Prior to the start of pavement processing, the old concrete slab was shattered by a towed rotating breaker that weighed 26,550 lbs. and imparted 30,000 ft.-lbs. of dynamic force delivered with each blow of its four-sided drum. For crushing the fractured concrete into specification complying sizes, Manatts, Inc. used their "Paradigm" self-propelled equipment train consisting of a primary crusher fed by backhoe and a secondary crushing/screening plant to produce required gradations. Belt conveyors, trimmers and related machines insured correct placement of specified materials in a moving operation.

Concrete for paving was batched and mixed in a Heltzel 8 CY drum from Manatts Con-E-Co Lo Pro plant and transported by dump trucks. Class 3i coarse aggregate was delivered from Kaser's Sully mine, with fine aggregate from Marengo. Continental Cement Company supplied 80% of the

cementitious material from their Bettendorf terminal. The remaining 20% was Type C fly-ash from Midwest's Ottumwa power plant. Because of the limiting 30 ft. embankment width, paving was placed with Manatts GOMACO 3000 slipform machine preceded by a CMI 'Iowa Special' auto-grader with overhead conveyor. CD baskets were hand placed and nailed to the subbase behind the conveyor and just ahead of the paver. A Lewis 'vee float' behind the paver was followed by straight edging finishers, transverse texturing and white pigmented cure to produce a generally satisfactory ride quality. A metal blanking band removed timing edges ahead of skewed transverse joint saw cuts to minimize spalls. All joints were sealed with hot-poured material. Pavement crushing started June 20 and except for final erosion control seeding and clean-up, V-44 was restored to normal traffic service September 11, 1996.



This project demonstrated another effective way to utilize in-place recycling of old concrete to economically enhance the structural quality of new pavement. County Engineer Collicott and Assistant Smeltzer are pleased with the end result, but on future projects may require "special backfill" gradation for the subbase. Due to the narrow 30 ft. embankment top and absence of alternate routes, all concrete batches and return truck movements had to be hauled longitudinally on the grade. These movements disturbed the base stability and distorted its cross-section, while pumping moisture and silt from below. An improved gradation and thicker section would be beneficial.

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