



**Rehabilitation Solutions with Rubblized Slab  
and PCC Overlay  
Buchanan County**

**Project Report #23**

**October, 1997**

After having previously built 130 mi. of portland cement concrete (PCC) pavements, at an Open House on October 20, 1997 in Brandon, Iowa, Buchanan County demonstrated once again its willingness to utilize advances in rigid paving technology for rehabilitating an aging highway.

These 6 in. thick x 22 ft. wide 30-year old pavements had been built on embankments constructed of silty native soils obtained by excavating side ditches, without the benefit of classification, stabilization or subgrade drains. Following the July 15, 1997 letting, the Fred Carlson Co. Inc. of Decorah, Iowa was awarded a \$1,044,775 contract to replace all 5.1 mi.



In 1967 Quad City Construction Co. was low bidder on 3.5 mi. of Secondary Road D-48 from Black Hawk County to Brandon and 1.6 mi. on V-71 from Iowa 283 to Benton County. Coarse aggregate for the specified B-3 mix came from Coralville ledges in Pints Quarry near Raymond. Although meeting specification requirements at that time, concrete slabs which contained such joint material have been found to experience severe joint deterioration. This limestone deposit is no longer an approved source for PCC highways. Accelerated wear associated with Interstate 380 construction traffic in 1984 dictated that this 30-year old county road pavement should be replaced before maintenance costs escalated.



Using his broad-based experience, County Engineer Brian Keierleber prepared a design which included requirements to enhance the durability of concrete while minimizing inconvenience to local residents and the Brandon community. Several innovative concepts were incorporated.



- To eliminate open trench excavation needed to replace jointed concrete pipe culverts at 7 locations totaling 412 l.f. and ranging in size from 24 in. to 66 in. diameter, Polyethylene Liner pipes conforming to Iowa DOT SP-97028 were inserted inside existing structures and the void areas backfilled with flowable mortar. Interlocking liner sections of 22 in. to 63 in. diameter were easily slipped into place and had the advantage of furnishing increased hydraulic efficiency without impacting traffic service.



- Iowa DOT SP-97039 described the process of rubblizing and compacting old PCC pavement in preparation for placing new concrete. Resonant breakers furnished by RMI, Tulsa, Oklahoma were selected to meet the requirement for obtaining a nominal 4 in. surface dimension.

The broken concrete was then seated with 4 coverages by two 10-ton vibratory steel rollers over the entire 59,375 SY surface area. Unfortunately, the unstable quality of roadway fill lacked sufficient stiffness to achieve uniformly small fractured face dimensions. Initial full-width rubblizing and compactive efforts produced a distorted surface that was accentuated by the weight of dump trucks carrying 7 CY concrete batches.



A revised procedure was implemented whereby one-half of the existing slab was maintained in an unbroken state and used for mix hauling, except for a short section immediately adjacent to the paver. Because of such distortion, yield averaged 115% of design volume. No other transport alternative was possible due to the existing 32 ft. embankment top width, 2:1 foreslopes and ditch cuts. Nevertheless, in addition to creating a sound subbase for paving operations, its drainable characteristics will be enhanced by the future installation of perforated plastic longitudinal drains.

Within the 5.1 mi. project, 7,485 SY of old pavement was also removed to provide full-depth 300 ft. transitions at the end of each division and at the one bridge, plus replacing three paved intersections.

- The new 7 in. x 22 ft. PCC pavement was estimated to require 12, 898 CY of concrete, with a surface area of 66,860 SY "Furnish" and "Place" contract items provided an equitable basis for payment when authorized quantity

changes warranted compensation. The C-3WR-C/10 mix produced by Carlson's Rex Model S batch plant used the following proportions per cubic yard:

|  |            |
|--|------------|
| Holnam Type-1S Cement                            | 491 lbs.   |
| Midwest Fly Ash, Port Neal                       | 55 lbs.    |
| 3i coarse limestone aggregate,<br>Niemann/Miller | 1,389 lbs. |
| Fine (sand) aggregate,<br>Bruening/Mishler       | 1,701 lbs. |

By petition from contractor Fred Carlson Co., Inc. and with the approval of Buchanan County, Holnam Type-1S cement was authorized for use in the new paving. Ground granulated blast furnace slag is permitted under Articles 2201.04 and 4101.01, Iowa DOT Specifications, at a cement substitution rate not greater than 35% by weight. Type-1S cement not only adds to the supply side of such materials available for late season work but it also provides a surface condition which makes finish and texture easily obtained.



Conventional air entrainment procedures were used to assure quality compliance. Placement with a Rex Town & Country slipform paver produced excellent slab and surface conditions. Surface tines followed a burlap drag to impart texture. After marking the 2:12 skew for transverse contraction joints, a blanking band centered over the joint location eliminated a grooved characteristic that invites spalling at the saw cut edges. Finally, white pigmented curing compound was applied. Carborundum saw blades were used at proper age to cut skewed transverse joints at 12 ft. spacing 2¼ in. deep and 2½ in. longitudinally on centerline, both then requiring hot pour sealant.



The Maturity Test Method (Iowa DOT IM-383) was specified for non-destructive determination of pavement strength which allowed early opening to construction traffic and restricted use by abutting residents. The contractor was required to furnish certified plant inspection and do all testing.

Briefly stated, IM-383 recognizes that cement hydration and strength gain are dependent on both curing time and temperature. When the strength of concrete is expressed as a function of those factors and verified by comparison to conventional center point flexural tests, information secured from temperature monitoring probes in new concrete predict the rate of gain.

Profilograph readings ranged from 3½ in. to 5 in. per mi. and averaged well within specification requirements. With the final construction of new 7 in. thick by 5 ft. crushed limestone shoulders, and completion of traffic control features, County Engineer Keierleber is pleased to present his newest PC concrete paving project to Buchanan County motorists.

For more specific project details, contact:

Mr. Brian Keierleber, P.E.  
Buchanan County Engineer  
1511 First Street East  
Independence, Iowa 50644  
Phone: (319) 334-6031  
FAX: (319) 334-9951