IOWA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
OFFICE OF MATERIALS

SPECIAL REPORT

AN EVALUATION OF THE ROTO-MILL PROFILER ON CONCRETE PAVEMENTS IN IOWA

NOVEMBER 1976

IOWA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
OFFICE OF MATERIALS

SPECIAL REPORT

AN EVALUATION OF THE ROTO-MILL PROFILER ON CONCRETE PAVEMENTS IN IOWA

NOVEMBER 1976

BY

CLARE J. SCHROEDER
SOILS ENGINEER

AND

JERRY V. BERGREN
P.C. CONCRETE ENGINEER

ACKNOWLEDGEMENTS

The authors wish to thank the members of the Special Investigations Section in the Office of Materials for their cooperation in expediting the testing and data acquisition for this report.

Abstract

A new machine, the ROTO-MILL Profiler, became available in early 1976. This machine, manufactured by CMI Corporation of Oklahoma City, Oklahoma provides pavement surface scarification at a much higher production rate than was previously possible.

Iowa had the opportunity to observe and evaluate this machine on two separate sections of primary portland cement concrete pavement in October, 1976.

The marked improvement in the profile index and the skid resistance indicates this machine may be considered a viable method for improving rideability and skid resistance of a roadway that is otherwise reasonably sound.

Introduction

Plain portland cement concrete pavements, depending on traffic volumes, base and subgrade conditions, etc., sometimes become faulted. If more than approximately 1/4 inch, such faulting becomes objectionable to the traveling public.

Also, again depending on traffic volumes, studded tires, etc., both asphalt and portland cement concrete pavements sometimes exhibit wear or deformation in the wheel tracks. In addition, skid resistance values sometimes reach dangerously low levels on otherwise sound pavements.

Highway engineers have long desired a machine which can economically remedy the above mentioned pavement defects with a high production rate. The ROTO-MILL Profiler may be such a machine.

PURPOSE

This report provides the results of profile index and skid resistance testing on concrete pavement, both before and after the passage of the ROTO-MILL Profiler.

SCOPE

The areas investigated and evaluated in this report are:

1) approximately 1500 lineal feet on the west bound lanes only; of U.S. 20, in Black Hawk County, at the east edge of Waterloo, Iowa, and
2) approximately 500 lineal feet of U.S. 30, located approximately 3-1/2 miles east of Clarence, Iowa, in Cedar County.

RESULTS

U.S. 20 - Black Hawk County

A. Skid Resistance:

	Inside Lane	Outside Lane
Before Grinding SN_{40}	36	31
Before Grinding SN_{50}	31	25
After Single Pass of Grinder, *SN_{40}	58	57

B. Profile Index Using 25 Ft. California Profilometer:

Before Grinding	25.0 in/mi	25.5 in/mi
After Single Pass of Grinder	7.4 in/mi	4.6 in/mi
After Second Pass of Grinder	3.1 in/mi	3.0 in/mi

* No skid resistance measurements were secured after second pass of the grinding machine.

U.S. 30 - Cedar County

A. Skid Resistance:

	East Bound Lane	West Bound Lane
Before Grinding SN_{30}	44	47
Before Grinding SN_{40}	38	40
Before Grinding SN_{50}	29	32
After Grinding SN_{30}	69	69
After Grinding SN_{40}	60	59
After Grinding SN_{50}	52	54

B. Profile Index Using 25 Ft. California Profilometer:

	East Bound Lane	West Bound Lane
Before Grinding	68.1 in/mi	66.5 in/mi
After Grinding	12.1 in/mi	10.0 in/mi

DISCUSSION AND CONCLUSIONS

Both sections of pavement were straight and on a nearly flat grade. The section of U.S. 20 exhibited some minor faulting (1/4 inch maximum) while the U.S. 30 section was severely faulted in both lanes - 1/2 inch to 3/4 inch faulting was common with some locations in excess of 1 inch.

The ROTO-MILL Profiler, (Figure 1) manufactured by C.M.I. Corp. of Oklahoma City, Oklahoma, can make a pass 9 feet 3 inches wide and remove approximately 1/4 inch from the entire surface, in addition to the faulted joints. This machine used a ski that provided a leveling action in the surface cutting operation. Approximately as long as the wheel base of the machine, the ski activated an automatic vertical control sensing device. Removal of material from the entire surface rather than just the faulted joints prevented leaving a surface with differential skid resistance.

On U.S. 30, a 2-lane pavement, the grinding was done all in the same direction. On the west-bound lanes of U.S. 20, a 4-lane divided pavement, grinding was performed in both directions. The direction of grinding had no noticeable effect on the machine operation or results.

The material resulting from the grinding was picked up by the machine and, by means of an attached conveyor, was deposited either onto the shoulder or into a truck. The material is in a size range of approximately 3/4 inch down to dust. This material is very useful for repairing aggregate shoulders.

Re-profiling or improving skid resistance, can be done under traffic with a flagman. After the ground surface is swept with a rotary broom it is ready for traffic. (Figure 2)

One detrimental feature of the ROTO-MILL Profiler is that some spalling results at transverse joints and along the outer edge of a concrete pavement. The spalls at the joints varied in width up to approximately one inch. The degree of detriment was difficult to determine. It is reasonable to expect some tire noise at these joints, but not to a degree that would be considered objectionable. The manufacturer of the machine is still experimenting with techniques that will hopefully lessen, if not entirely eliminate, the above mentioned spalling condition.

Although there were no wheel ruts caused by tire wear on either of the pavements evaluated in this report, they could easily be removed by a machine of this type. The possibility of hydroplaning due to trapped water in the wheel tracks can be eliminated by this operation.

An improvement in future machine development would be a cutting head at least 12 feet wide. Assuming that gross weight and power limitations would allow such a modification, the wider machine could "process" a full 12-foot travel lane during each pass. This should be more efficient when considering the crown in normal two-lane pavements.

The profile index test results demonstrate that grinding with a ROTO-MILL Profiler has great promise for improving pavement rideability by correcting faulted joints. It should be possible to obtain additional service of 8 to 10 years, or more, from a concrete pavement before resurfacing is necessary.

The outstanding improvement in skid resistance that resulted from the surface grinding provides the engineer with a rapid way to correct either an isolated condition of poor skid resistance or to restore a high skid resistant surface to an otherwise acceptable section of pavement.

This machine has been used in several states in the preparation of bridge decks for concrete overlays. The cleaning, scarifying, and profile-improving action of the machine also has the potential of making resurfacing with portland cement concrete an economical reality.

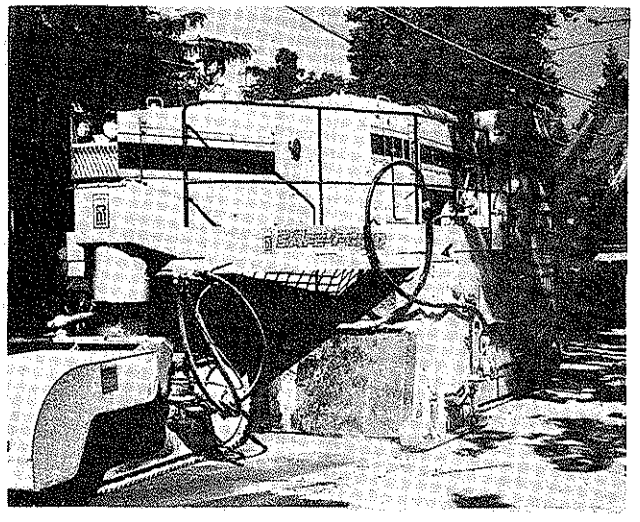

Figure 1
ROTO-MILL Profiler

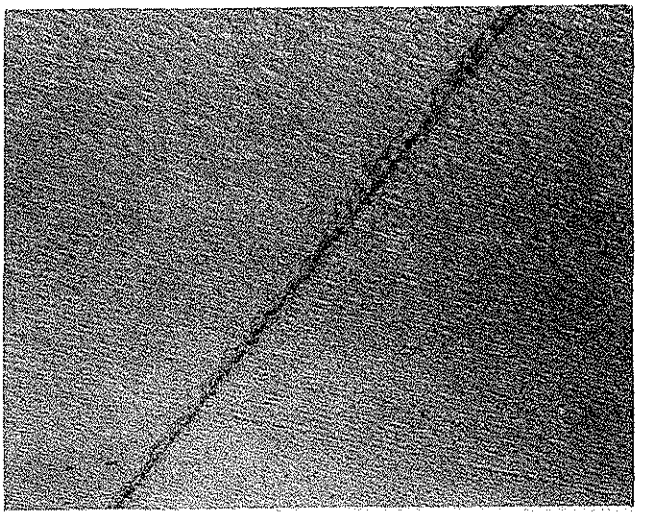

Figure 2
Pavement Surface after Grinding