OFFICE MEMORANDUM

DATE: May 11, 1976

TO: G. R. Cudney
Assistant Engineer of Research

FROM: F. Copple

SUBJECT: CMI Autograde Pavement Profiler.
Research Project 76 TI-341. Research Report No. R-999.

At your request, I accompanied Ralph Roller, Vice-President for Marketing of the CMI Corp., to observe a demonstration of a cold-planer in Oklahoma City on April 21. This new machine, the CMI Autograde Pavement Profiler, was used to remove the surface of a bridge deck on I 40 to a depth of about 1/2 in. in preparation for overlayment with low-slump concrete. The bridge deck being treated was about 2-1/2 miles long, three lanes wide, and included at least two exit ramps. After two weeks work, the surface had been almost entirely removed. Production rate on the I 40 bridge appeared to be about 1,000 to 1,200 sq yd/hr, when I observed the unit. Overall, 45,000 sq yd were planed in 60 operating hours. In comparison, a Tennant G-12 planer, used on some Michigan bridge decks, has a production rate of about 150 sq yd/hr.

Specifications for the CMI cold-planer are attached, in addition to the following remarks on the observed performance characteristics. Figure 1 shows the unit in operation. Cutting of the concrete was possible right up to the faces of low curbs; on higher curbs (about 8 in.) a protruding gearbox prevented planing of the pavement closer than about 3 in. (Fig. 2). Cross slopes can be adjusted, just as with CMI's fine-grading equipment. The manufacturer claims that their hydraulic system controls profile cuts to a tolerance of 1/8 in., and can be referenced to a stringline, curb, the old surface, or the freshly cut surface. Reinforcing steel, when within 1/2 in. of the surface was either trimmed flush with the adjacent deck (Fig. 3) or, in a few cases, the bars were cut through and bent upward. No apparent damage was caused to the cutters when they contacted the steel. There are 230 tungsten carbide teeth on the cutting drum, each tooth costing about $3. On the I 40 bridge deck, constructed of concrete containing a limestone coarse aggregate, teeth were worn out after cutting 8,000 to 10,000 sq yd. Tooth life would probably be longer for asphalt and less for concrete with natural aggregate. Fragments of concrete, removed from the bridge deck, were platelets with a maximum size of about 1-1/2 in.

CMI has built only one cold-planer, and this was the first project on which it has been used. Based upon its performance, the company plans to build more units. CMI hasn't decided how to market the unit; it may either sell or rent them. Purchase cost is estimated to be about $185,000 to $190,000 per unit. Ownership and operating costs, based upon a use of about 200,000 sq yd/year, would total about 30-cents/sq yd; this figure does not include contractor's profit. Also, estimated operating costs were taken from trimming concrete consisting of limestone aggregate; costs would be more when operating on concrete consisting of natural aggregates. Operating costs for bituminous work should be somewhat less regardless of the type of aggregate encountered.

Comparison of the CMI Cold-Planer with Other Types of Pavement Planers

During the past year, another type of cold-planer, the Galion RP30, was used on the I 75 Rouge River bridge deck. The Galion RP30 is a grader with a cutting drum mounted underneath. Because the CMI unit is mounted on crawler tracks, while the Galion unit is mounted on pneumatic rubber tires, it appears that grade can be controlled more closely with the CMI. Moreover, the production rate of the 110-in. wide CMI planer is much higher than that of the 31-in. wide Galion planer.

Another type of planer that has been used in Michigan is the heater-planer. Heater-planers are suitable only for treating asphalt pavements, while the CMI cold-planer can be used on either asphalt or concrete. Asphalt surfaces have been successfully treated in the past for surface distortion, and for improving skid-resistance with a heater-planer. In 1975, skid resistance was improved dramatically by heater-planing some Michigan bituminous pavements, but the durability of such treated surfaces has yet to be evaluated. Although the surface treated by the CMI cold-planer appeared to be well textured, no actual skid measurements have been made. Also, surfaces textured by the CMI cold-planer appeared to be very coarse (Fig. 4) and some problems with the handling of motorcycles might be encountered at high speeds; this is a situation that bears investigation. Because of high operating temperatures, the heater-planer is known to damage or destroy shrubs and other vegetation growing near the roadside. The scarified material from a cold-planer is friable (Fig. 5) and can be easily stockpiled for later use. In contrast, material removed by a heater-planer fuses together and should be used before it cools.

Conclusions

The CMI unit appears well suited for high production planing and texturing of both bituminous and concrete surfaces, and close grade tolerances can be achieved. I drove over the concrete texture at various speeds up to about 65 mph and detected no significant increase in noise nor any erratic

behavior in vehicle handling. Although no measurements had been made, texture appeared to be of the type which would show high skid resistance. Provided that the base is satisfactory, the CMI machine should be an excellent means for planing and texturing distorted bituminous surfaces or for texturing either polished concrete or bituminous surfaces. I suggest that trial projects be let both for correcting surface distortion and for improving skid resistance on polished pavements. There are many pavements throughout the system where rutting, shoving, or low skid resistance could be economically corrected by merely planing, and without overlaying.

TESTING AND RESEARCH DIVISION

Fred Coppola

Supervisor, Pavement Performance Group

by DM

FC:bf

Figure 1. CMI autograde pavement profiler.

Figure 2. Pavement textured by CMI. Note how close to curb texture extends.

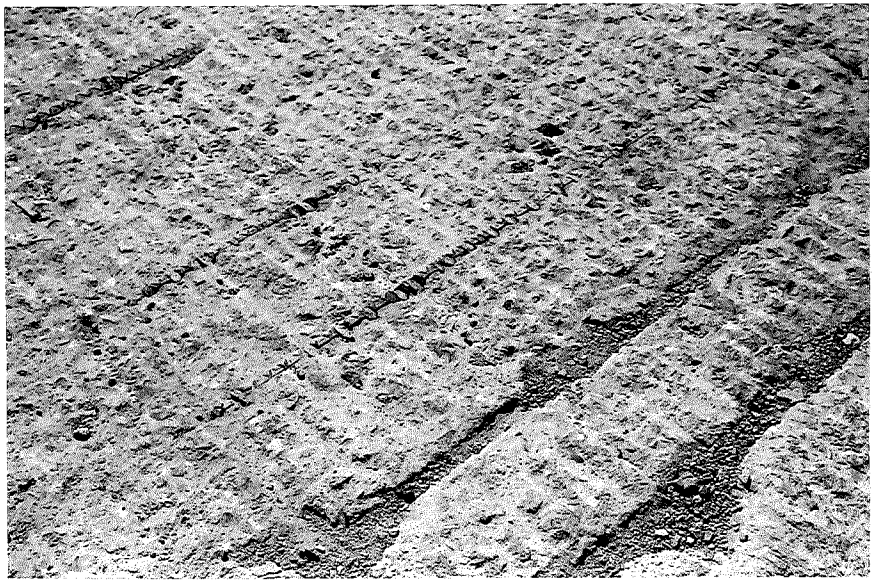

Figure 3. Reinforcing steel trimmed by CMI.

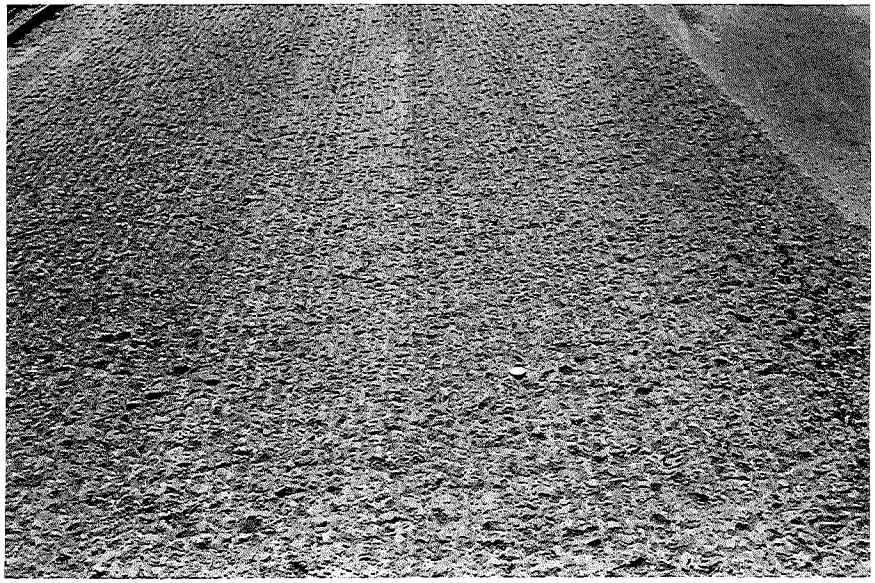

Figure 4. Close-up view of texture created by CMI.

Figure 5. Stockpiled material planed off concrete pavement by CMI.

CMI AUTOGRADE

PAVEMENT PROFILER SPECIFICATIONS

ENGINE

Caterpillar...3406TA
Horsepower...375 at 2100 RPM
High idle setting...2285 RPM
Maximum torque...1125 at 1400 RPM
Cycle...4
Number of cylinders...6
Bore and stroke...5.4" bore x 6.5" stroke
Piston displacement...893 cu. in.
Aspiration...turbocharged and after cooled
Electrical system...24 Volt
Starting method...electrical

AIR CLEANER

Dry type, two (2) stage with service indicator

WEIGHT

(Approximate)...55,000

OVERALL DIMENSIONS

Overall length...46'
Overall width...10'4"
Overall height...10'4"

HYDROSTATIC DRIVES

Axial piston variable speed drives for cutter tool, tracks, conveyors and control system driven by engine through a four output drive gear box.

GROUND SPEEDS

Working range...0-50 FPM
Traveling range...0-200 FPM

FI TRATION

CMI 3-micron absolute filtration system with auxillary reservoir and 3-micron absolute fill system for positive hydraulic system contamination control.

MOLDBOARD

Floating moldboard with hydraulic down pressure for material clean up.

RECLAIMER CONVEYORS

1-36" wide collecting conveyor
1-36" wide discharge conveyor with 180° swing
Both conveyors hydrostatically driven

SERVICE CAPACITIES

Fuel tank...100 U.S. Gallons
Hydraulic tank...36 U.S. Gallons
Cooling system...22 U.S. Gallons
Water tank...156 U.S. Gallons (Total) (Two tanks, for dust control)

CRAWLER TRACKS

Three (3) - hydrostatically powered
Width...16"
Length...8'8"

CONTROL SYSTEMS

1-CMI Hydra-Mation hydro-mechanical-servo steering control system.
2-CMI Hydra-Mation hydro-mechanical-servo elevation control systems.
1-CMI Hydra-Mation hydro-mechanical-servo slope control system

All systems have manual or automatic modes controlled by operator.

PARTICULATE EMISSION CONTROL

Enclosed and shrouded cutting tool area with pressure fog spray system operated from control station.

CMI AUTOGRADE

PAVEMENT PROFILER FEATURES

1. AUTOMATED PROFILE CONTROL

CMI's exclusive Hydra-Mation Control System allows machine to operate from a stringline reference or averaging ski to control the machine to a 1/8" tolerance.

2. 9' - 2" CUTTER WIDTH

This wide cut allows better profile control on multi-width passes, yet allows the machine to stay within one driving lane when working. The machine can be moved without disassembly.

3. CUTS CONCRETE OR ASPHALT

The 375 hp engine enables the machine to cut the toughest pavements at production rates never before achieved.

4. MATERIAL RECLAIMER

The combination of the cutter-loader, the conveyor system and a floating moldboard gives the machine the ability to pick up and load the cuttings which greatly reduces the overall cost in re-establishing the desired profile and grade on a pavement.

5. OPERATION NOT LIMITED BY WEATHER

The all hydraulic control that is unaffected by rain and the cutting power that doesn't require any heat, extends the use of the machine to a longer working season than heater planers.

6. CONTROLS DUST

The unique cutter action coupled with a water spray system in the enclosed cutter work area eliminates the dust problem associated with most pavement cutting methods.

Air pollution concerns associated with heater planers are also eliminated because no heaters are used in this method.

7. EASY TO OPERATE

Since the machine is automated and controls depth of cut and slope from a preset or traveling reference, very little operator skill is required. A reference line or curb face can also be used to automatically steer the machine.

8. IMPROVES RIDE

The ability of the machine to control the profile to a 1/8" tolerance, makes the finished cut a smooth uniform surface that doesn't have to be resurfaced in cases where the pavement that remains is structurally adequate. When this

8. IMPROVES RIDE, Cont.

smooth surface is overlaid, the resultant pavement is far superior to an overlay alone because the overlay thickness is uniform after planing and the problem of reflective roughness associated with overlaying and uneven surface is eliminated. Bonding the overlay to the pavement is also improved.

9. IMPROVES SAFETY

The elimination of wheel path ruts and washboarded areas, when establishing a smooth profile, greatly improves the rideability and safety of the pavement. The machine can also be used to improve the skid resistance on a worn and slick surface.

10. REDUCES COST

The elimination of wheel path ruts, low spots and uneven surfaces, prior to an overlay, greatly reduces the amount of material required in an overlay. The improved bonding surface also eliminates the need for thick overlays and the thickness and material use can in many cases be halved.

Additional savings come from using the cuttings as base material on other jobs or recycling the material for use in the overlay.