

TEXTURED CONCRETE PAVEMENT SURFACES



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MICHIGAN DEPARTMENT OF
STATE HIGHWAYS AND TRANSPORTATION

TEXTURED CONCRETE PAVEMENT SURFACES

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Michigan State Highway Commission
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Introduction

This project was initiated to investigate different methods of texturing concrete pavement surfaces and to evaluate the performance of these textures with respect to skid resistance and noise.

Eisenhour Construction Co. agreed to apply certain textured finishes to a concrete pavement surface while constructing Project I 13074-001, a three mile length of I 69 beginning just north of I 94 in Calhoun County.

Sufficient wire combs were available to texture transversely, but not longitudinally; and enough nylon brushes to texture both transversely and diagonally. Longitudinal texturing requires a sufficient length of brushes or combs to span the full width of a 24-ft pavement, while transverse texturing requires lengths of only a few feet.

Construction

Continuous lengths of I 69 were specially textured in three ways:

- 1) transverse texture using nylon brushes,
- 2) transverse grooves using metal combs,
- 3) longitudinal texture using nylon brushes.

Total length of these special textures was about 4,600 ft of roadway (24 ft wide); the remainder of the pavement was finished with a conventional burlap drag. Table 1 gives the location of the special textured surface sites.

TABLE 1

LOCATION OF TEXTURED PAVEMENT SURFACE AREAS

Texture type	Limits, by station
Nylon brush (longitudinal)	2241+50 to 2249+88
Wire comb (transverse)	2249+88 to 2269+82
Nylon brush (transverse)	2270+53 to 2289+50

Brush, comb, and burlap finishes were each applied by mounting the appropriate texturing tools on the membrane curing application equipment

at the project site. Figure 1 shows the nylon brushes mounted for longitudinal texturing.

Texturing presented no great problems during construction, and there was no trouble keeping pace with the CMI slip-form paver, used in casting the slab. The brushes, in common with a burlap drag, tended to collect a slurry as they textured. The wire combs always appeared clean with no indication of clogging or slurry retention.

Figures 2 through 4 show typical textures achieved on this project.

Performance

Skid resistance measurements were made about four months after the textured areas had been constructed. Initial skid test results, shown on Figure 5, give the ranges for three measurements made on each textured surface. All the surfaces exceed Michigan's minimum wet skid coefficient (measured at 40 mph) of 0.4. However, since stopping distance and traction on a wet pavement are directly related to skid coefficient, it is desirable that coefficients be as high as practicable. The transverse comb texture had the highest skid coefficient, the transverse nylon brush second highest, with the conventional burlap and longitudinal brush being lowest but still acceptable. It was noticed that the wheel tracks over part of the transverse comb textured pavement had been noticeably worn (Fig. 6).

A concrete batching plant was located adjacent to the test area and the textured surface roadway was used intensively by the contractor's trucks before the highway was opened for traffic. This traffic in combination with dirt on the pavement had caused the wear.

Wet skid coefficients measured in the worn wheel paths of the transverse comb texture are also shown in Figure 5. In such areas, skid coefficients had been reduced markedly to a level that was still acceptable, but still the lowest of the entire group. Because of the sharp shoulders on the grooves and the reduced mass available to resist wear, it seems likely that the transverse combed areas would always initially wear faster than brush or burlap treated areas. In transverse combed areas, initial skid resistance would probably decrease rapidly for a short time and then, after reaching a certain level, wear at the same rate as brush or burlap treated pavements.

It was also noted that vehicles traveling over wet transverse comb textured pavement did not generate the fog of water behind them that was apparent in other areas. This characteristic was especially apparent because of the large quantities of water thrown up behind trucks.

Noise level measurements were taken over the textured pavement by means of a microphone mounted near a tire on a trailer which was towed over the areas at three speeds: 15, 30, and 60 mph. There was a noticeable but not great difference in noise levels between the various textured

surfaces. The transverse brushed area had a noise level slightly higher than that of the combed area and the longitudinal brush and burlap drag areas had equal noise levels which were lowest of the group. Noise generated by any of the textures was not considered to be great enough to be a factor in rejecting any of the texture types.

Discussion

A conventional burlap drag texture, when properly applied, provides acceptable skid resistance. However, burlap is subject to wind flap, can tend to create a wavy texture, and--if the concrete has set too long--does not score the surface as deeply as desired. On this, as with many other projects, areas of insufficient texturing exist where the concrete had set too long before burlaping. Wet skid coefficient tests (40 mph) for all new concrete pavements during 1969 ranged from 0.39 to 0.67. This shows how variable burlap texturing has proven to be. Therefore, burlap does present some job control problems. Neither nylon brushes or wire combs would be vulnerable to wind flap and, because of their rigid mounting, surface waves should be minimal. Although the depth of texturing would still depend upon the timing of the operation during the period of concrete set, it should not be as critical as the burlap drag since the burlap does not cut like bristles or comb teeth.

During this study, there was no realistic means of comparing costs for the different types of textures. However, it appears that brushes for longitudinal texturing could easily be mounted to replace the burlap drag on existing equipment and should justify no increased cost. Transverse texturing might require that a contractor purchase additional equipment. However, Indiana has required transverse texturing for years and any contractor who does work for the State would already own the necessary equipment. Therefore, since no additional operator or equipment time was required for transverse finishing, very little, if any additional cost can be expected.

Conclusions

1. Any of the textures used during this study, including burlap drag when properly applied, provide an acceptable skid resistant surface.
2. Job control of the degree of texture appears more difficult with the burlap drag than the other texturing methods.
3. Because of the fragile groove shoulders and the lesser mass of concrete on the wearing surface, the wire comb areas will wear more rapidly than the other types tested, consequently its initial very high skid resistance would be rapidly reduced.

4. The longitudinal brush texture was about equal to the burlap drag in initial skid resistance but apparently provided easier job control of texture than the burlap.

5. The transverse brush texture provided a desirable combination of high initial skid resistance and wear resistance which should approach that of a burlap drag finish.

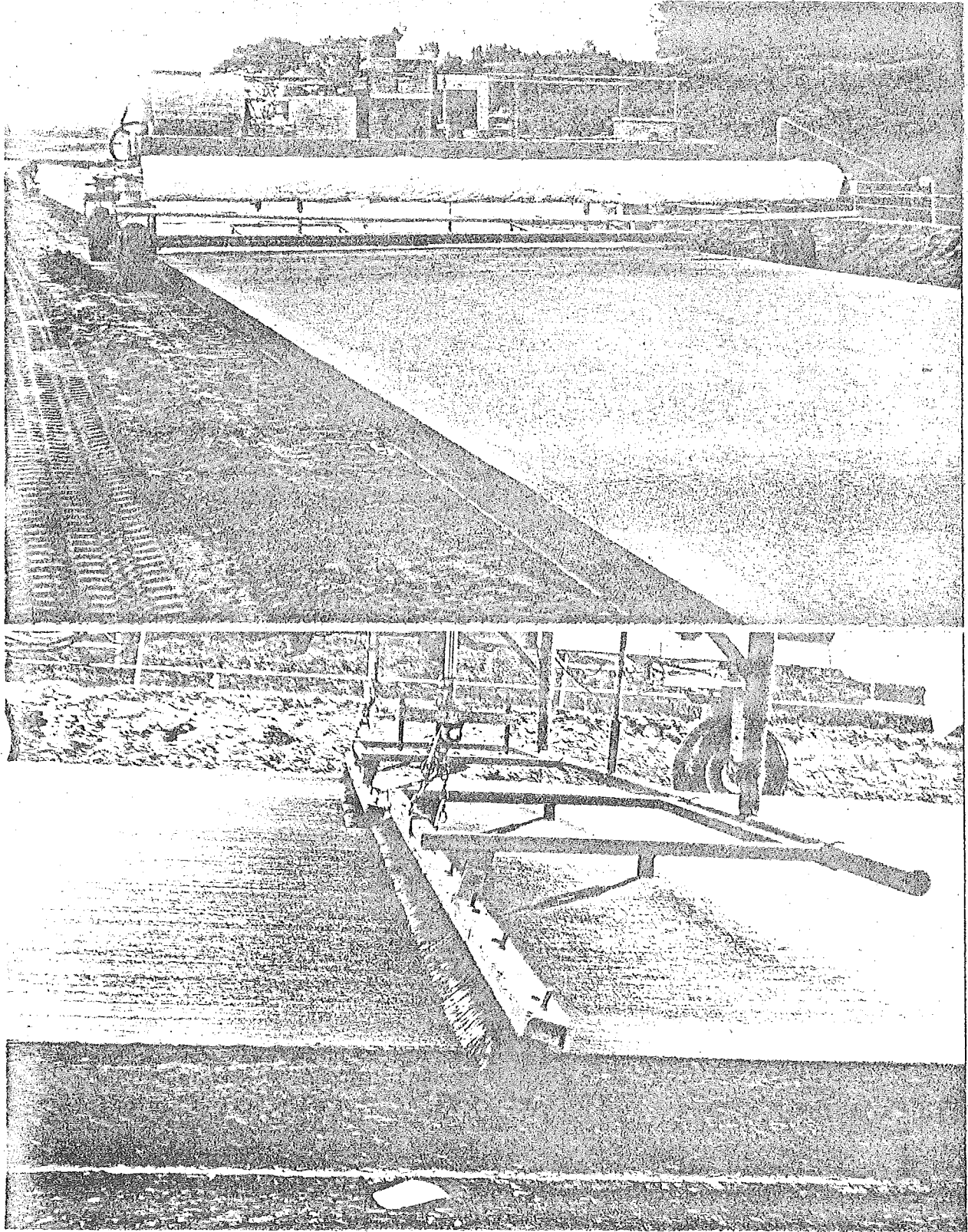


Figure 1. Longitudinal pavement texturing with nylon brushes.

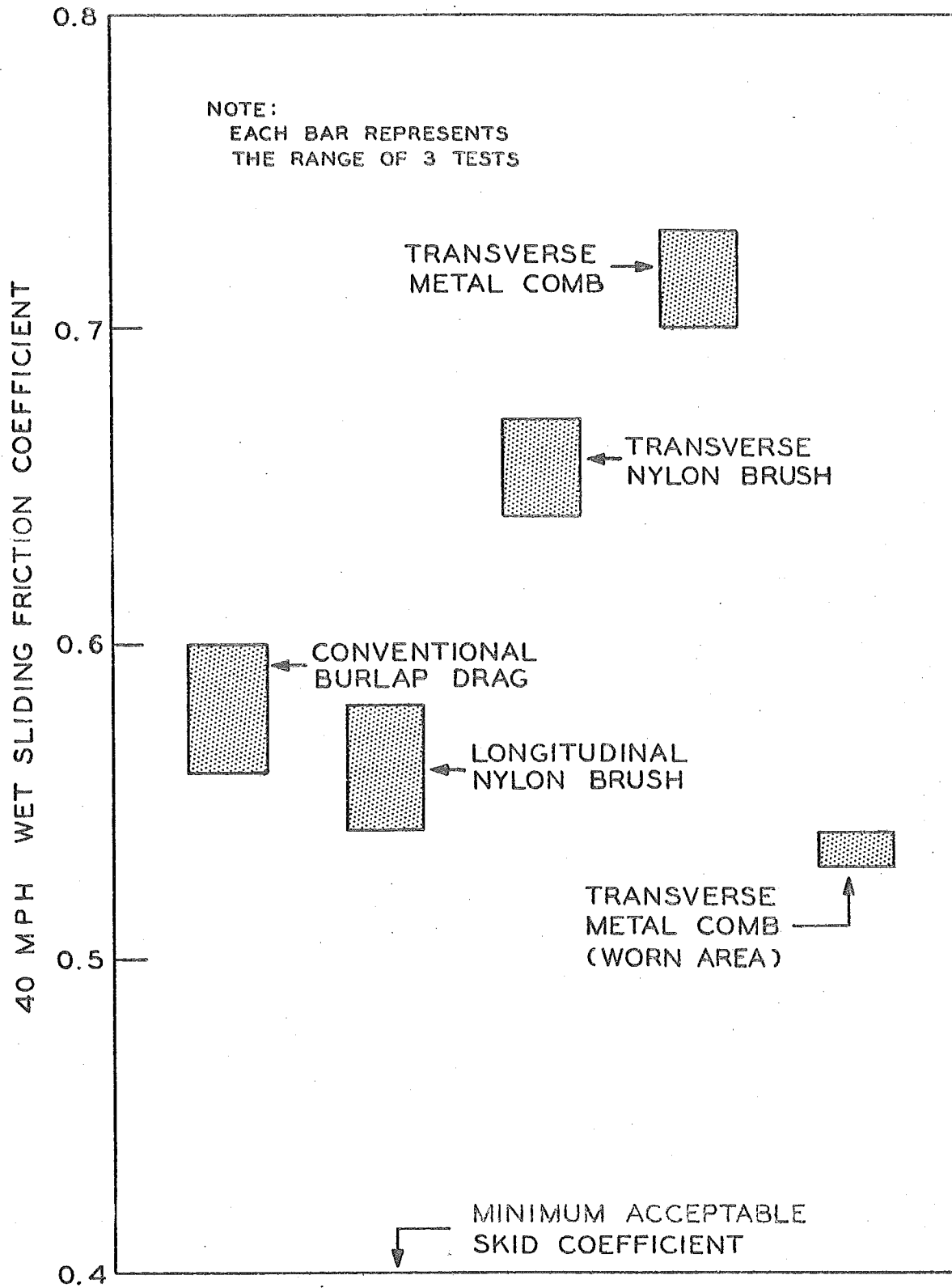


Figure 1. Initial skid coefficient for textured pavement surfaces. Construction Project I-13074-001.

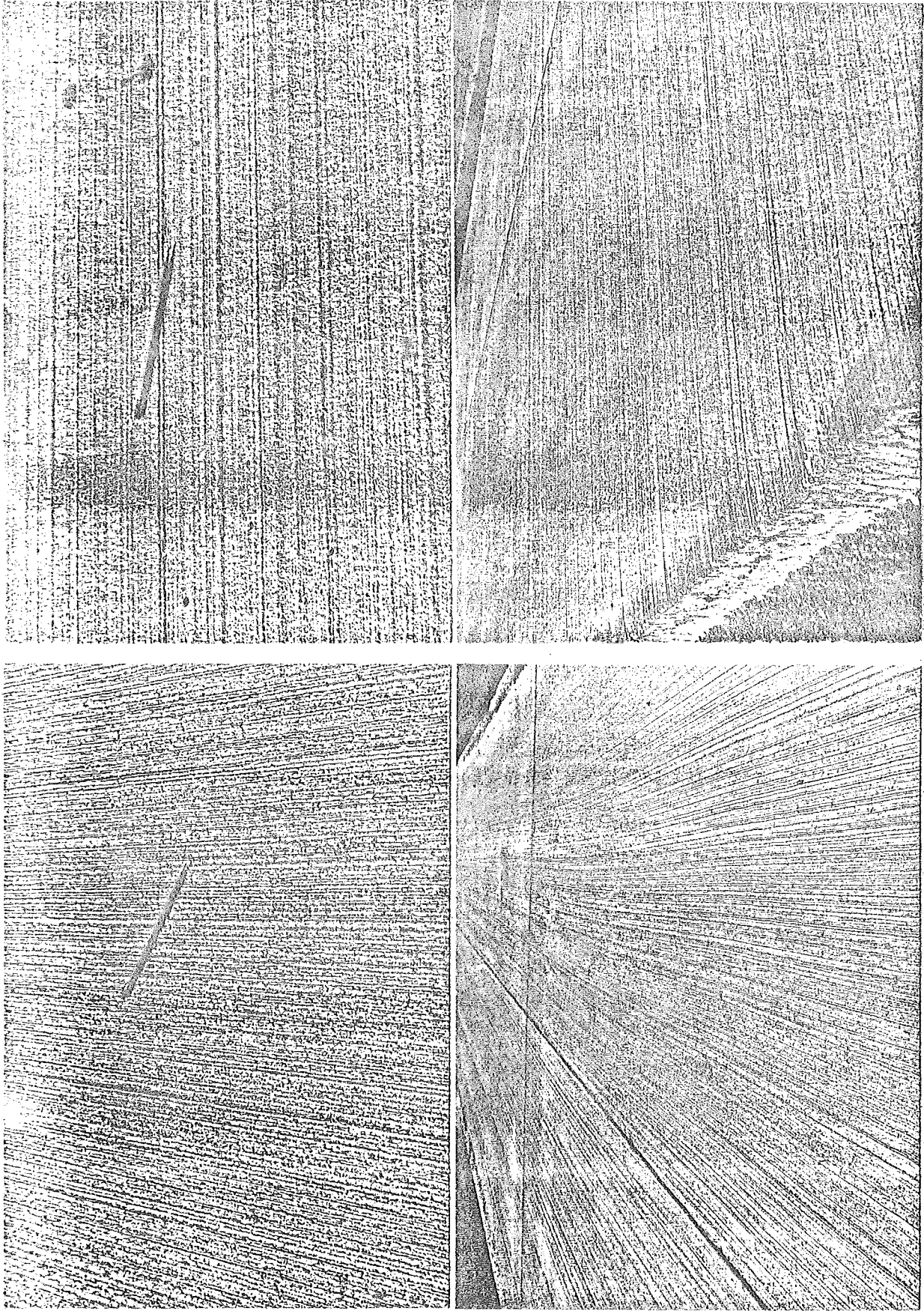


Figure 2. Pavement textured with nylon brushes. Longitudinal texturing at left; transverse texturing at right.

Figure 3. Transverse texturing with wire combs showing general view (lower left) and close-up.

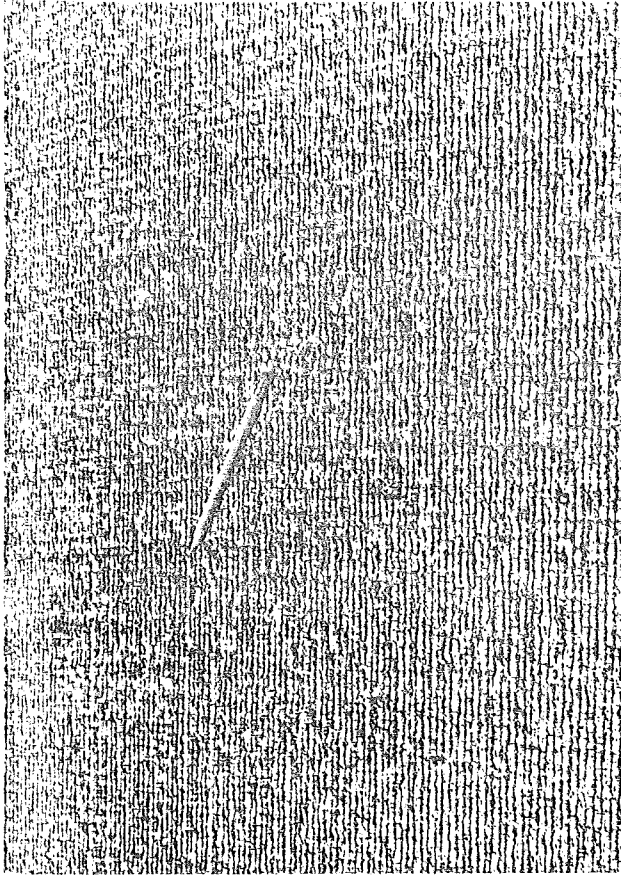


Figure 4. Longitudinal burlap drag finish.

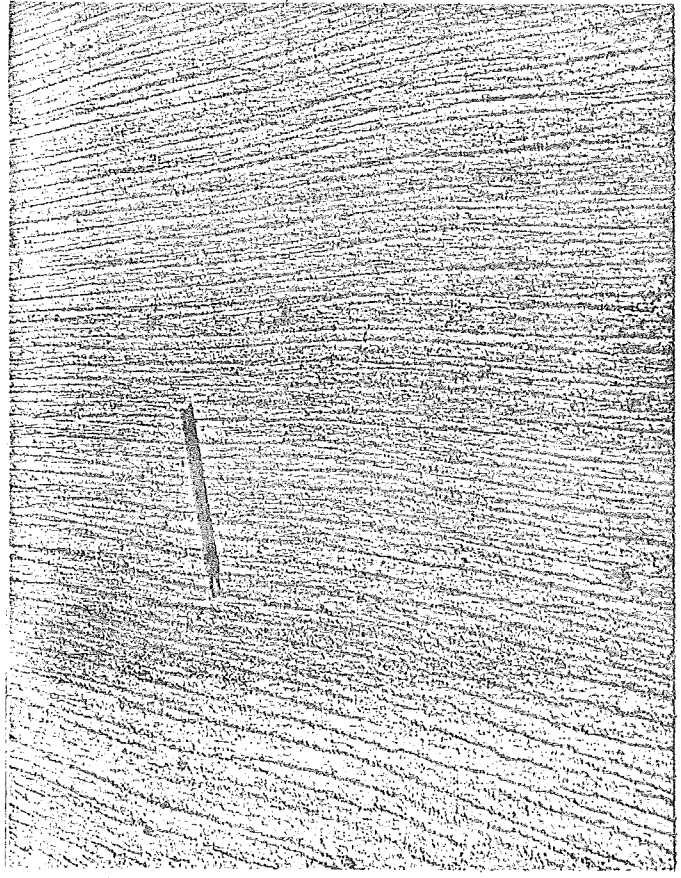


Figure 5. Initial skid coefficient for textured pavement surfaces. Construction Project I 13074-001.

Figure 6. Wheel path wear of wire comb texture (transverse).

