

OFFICE MEMORANDUM

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MICHIGAN
STATE HIGHWAY DEPARTMENT

JOHN C. MACKIE, COMMISSIONER

December 3, 1962

To: L. T. Oehler, Supervisor
Physical Research Section

From: C. J. Arnold

Subject: Placement of Steel: I 75 North of St. Ignace (Project No. BI 49025E, C18). Research Project 39 F-7. Report No. R-405.

At the request of W. W. McLaughlin the writer accompanied C. S. Lundberg and W. MacCreery of the Road Construction Division, on an inspection trip near St. Ignace on October 18, 1962. The purpose of the trip was to observe a new method of placing reinforcing steel in concrete pavement, on Construction Project No. BI 49025E, C18, Stations 415 to 623+25 southbound and 415 to 517+48 northbound.

The contractor was using three mixers to place the full 9 in. of concrete in the forms. Reinforcing steel was then placed on top of the concrete (Fig. 1) and vibrated to depth with a Heltzel Flex-plane machine as shown in Figs. 2 through 5. The vibrating parts of the machine consist of eight gangs of six plates each. The plates are roughly 6 ft long, 4 in. deep, 1/2 in. thick, and are about 12 in. apart. The machine has four gangs in front and four behind. The rear gangs are shown in Figs. 2 and 4.

The machine is driven over a section of the mesh and the gangs lowered onto the steel as shown in Fig. 6. The plates are then started vibrating and force downward to the required depth. Concrete is displaced by steel and plates as shown in Fig. 7. The plates continue to vibrate for a short time at the bottom of the stoke, Fig. 8, and while being withdrawn. Fig. 9 was taken shortly after the plates were withdrawn, showing apparent flow of fines to the vibrator and the void left by the plates.

A dozen random measurements taken of the final depth of reinforcement found it to be within $\pm 1/4$ in. of the required 3 in. Fig. 10 shows a narrow scale on the steel and a wider scale in the vibrator groove.

Fig. 11 shows the overall appearance of the surface before the first finisher passes, and Fig. 12 shows the concrete carried along in front of the first finisher.

The finisher apparently does little to remove the segregation of aggregate, since the wooden ruler could still be pushed easily into the area where the plates had

been, after the finisher had passed. This would seem to indicate absence of coarse aggregate. The paving inspector has taken measurements of the locations of some of these longitudinal lines of possible segregation formed by the vibrating plates, and cores will be taken at these critical points to establish whether segregation has occurred.

Placement of steel near joints was the main problem with the machine, since the vibrators must be at least a foot away to prevent pushing the basket assembly into the subgrade. When the vibrator is a foot from the ends of the steel bars, however, the ends tend to bow upward, leaving the steel too close to the surface at the joint. Workmen were using bolt nippers to cut off some ends and pushing the steel downward as the joints were being finished.

Impressions of the machine, gained from observation and talking with the operator, are as follows: (1) the machine is quite fast, when working properly, readily keeping up with the three mixers, and (2) it seems to have been badly underdesigned for the severe vibration that it produces, requiring numerous repairs, and some alteration on the job. The machine broke down and was taken out of service at Station 517+48 North Bound.

It would be very interesting to inspect the crack patterns in the roadway after the first cold weather this fall and after some heavy traffic, to see whether any longitudinal cracks develop along the lines where the vibrator was used, and if, perhaps, the transverse cracks follow the planes where the steel was forced down through the concrete.

A published article titled, "Indiana Contractor Uses Mesh Placer" which discusses the use of a similar machine on I 65 in Jackson County, Indiana is contained in the Portland Cement Association magazine Concrete Paving, issue No. 256.

OFFICE OF TESTING AND RESEARCH

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CJA:nl

Attachment

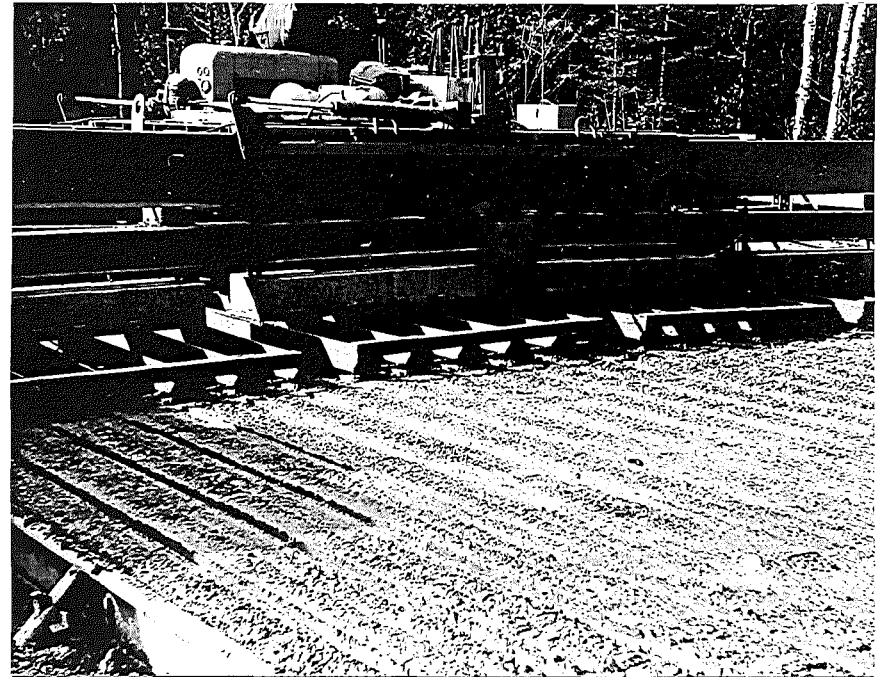


Figure 1. (upper left) Steel being placed on top of 9 inches of concrete.

Figure 2. (above) Machine with vibrating gangs raised.

Figure 3. (left) Machine with vibrators at lowest point of stroke.

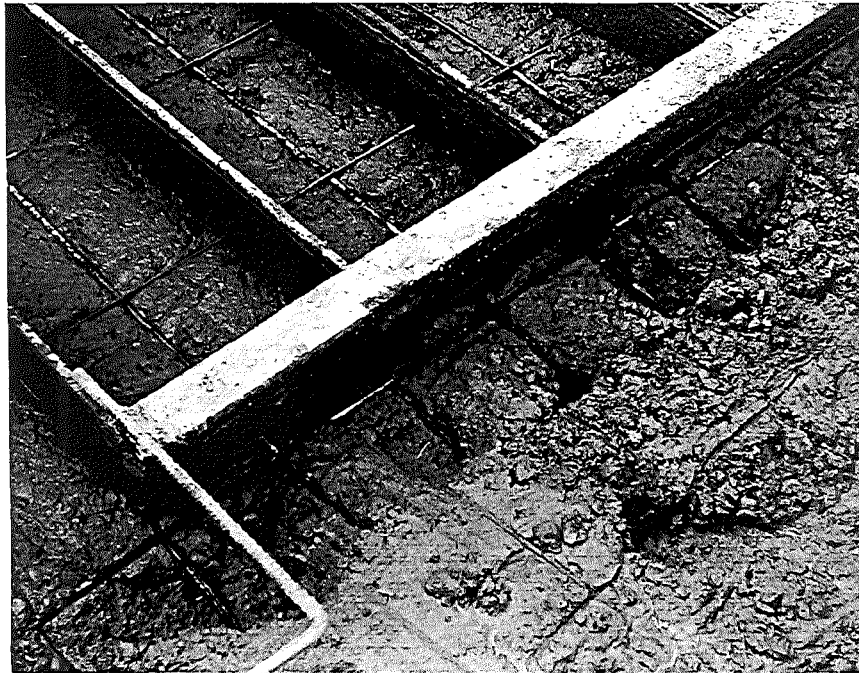
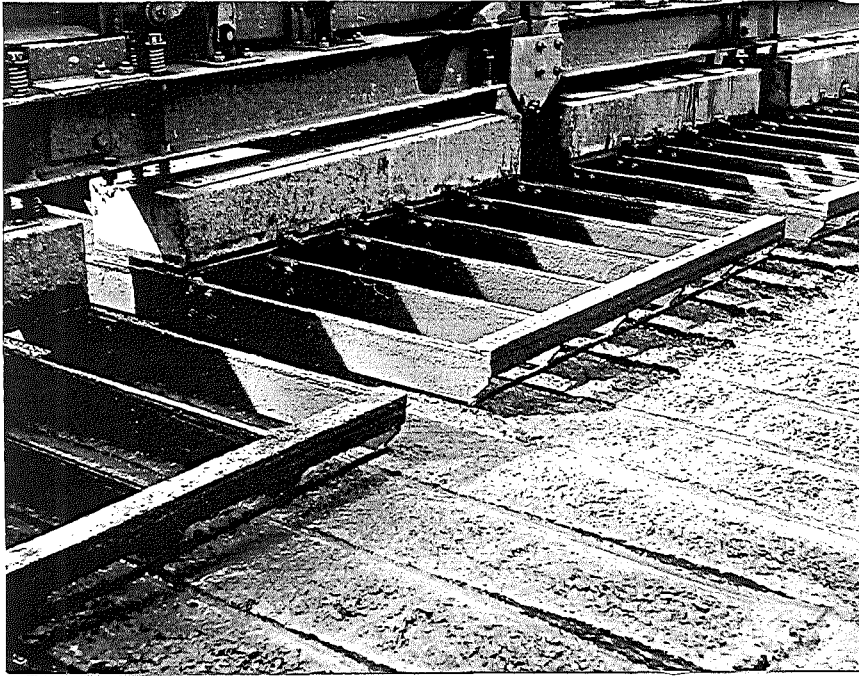


Figure 4. (upper left) Vibrator plates and framework.

Figure 5. (above) Front gangs at lowered position, showing next mat in place.

Figure 6. (left) Placement of vibrator plates over steel mesh.

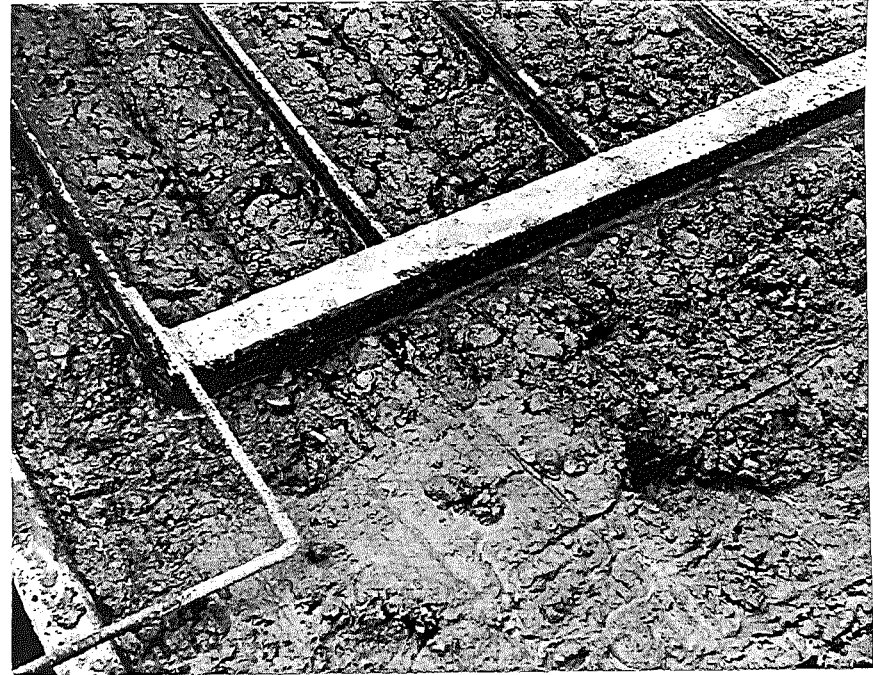
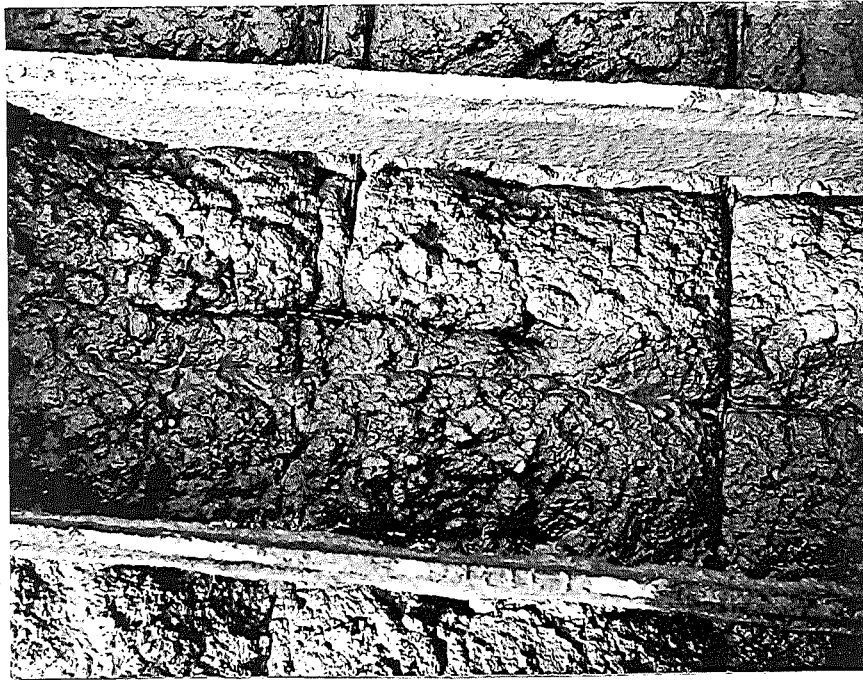


Figure 7. (upper left) Concrete being displaced as steel starts downward.

Figure 8. (above) Close-up of Vibrator at bottom of stroke.

Figure 9. (left) Void left by vibrator when it is withdrawn.

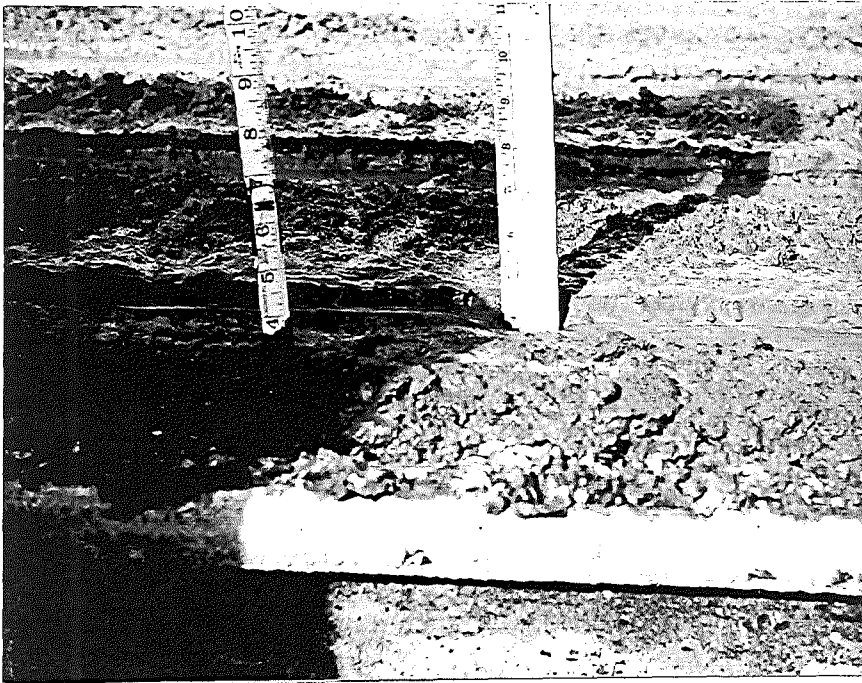


Figure 10. (upper left) Narrow ruler on steel, wider ruler in vibrator groove.

Figure 11. (above) Surface of slab between vibrator and first finisher.

Figure 12. (left) First finisher approaching.