

Introducing Slip-Form Concrete Paving

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As an introduction to the 1965 Highway Research Board Symposium on Slip-Form Paving, the general historical development and spread of this method of constructing concrete pavements in the United States from 1947 to the present time is briefly described.

•IN 1947, J.W. Johnson, Materials and Testing Engineer of the Iowa State Highway Commission, speculated that if the side forms of a paver are taken away before the concrete sets, good-quality concrete when properly consolidated would stay in place and retain its shape without running down the grade.

To try out the idea, the first pilot model of a slip-form paver was built (Fig. 1). It placed a concrete ribbon 3 in. thick and 18 in. wide sufficiently well that in 1948 another pilot model, large enough to lay a 6-in thick, 3-ft. wide strip, was built and tested. The real promise of the idea appeared to be as an economical method of providing low-cost pavements for secondary roads. The next version was full-size, with 11-ft long trailing side forms, as shown in Figure 2, which could lay a 6-in. thick, 10-ft. wide, slab. Field experiments on two small sections of pavement in O'Brian and Cerro Counties proved that it worked. This first practical slip-form paver was later modified in many ways; for example, it was made self-propelling. However, it was soon realized that further development was necessary, for example, to lay 24-ft wide pavement in one pass, and that such development was more properly the job of those engaged in building and using concrete paving equipment than of a state highway department.

Therefore, the Quad City Construction Company took over further development work. Crawler tracks, tamping bars, tube vibrators, oscillating finishing belts, etc., were added. Also, since proper preparation of the grade appeared to be a key prerequisite to smooth pavements, suitable form graders for the track paths and subgrade finishing machines were developed. The first commercial paver was used in 1955. Gradually, use spread from secondary to primary routes as the equipment and techniques were improved, so that by the end of 1964, as Figure 3 shows, more than 1,200 mi of slip-form paving had been laid in Iowa alone.

State highway officials, contractors, and equipment manufacturers gradually became interested in the potential ability of slip-form pavers to lay smooth concrete pavement at lower cost. Slowly at first, but later with ever-increasing speed, slip-form paving spread from Iowa to other states. It has thrived in California on unreinforced pavements with stabilized bases laid to a width of 36 ft or more in one pass. Much early work was also done in Colorado, including experimental work to incorporate reinforcing mesh. During the past decade several new machines have been developed, and construction techniques, particularly those for attaining smoothness or building complicated layouts, have been refined. As shown in Figure 4, by 1964 slip-form paving had attained considerable proportions in Iowa, California, Colorado, and Oklahoma, and had at least been tried in 20 other states. The mileage of concrete pavement constructed by the slip-form technique has risen to 4,000 mi in the United States in the last 15 years. This has included work on all classes of highways, rural or urban, from farm-to-market roads to Interstate routes. Furthermore, slip-form paving has already been used in France, and will soon be tried in England and other countries.

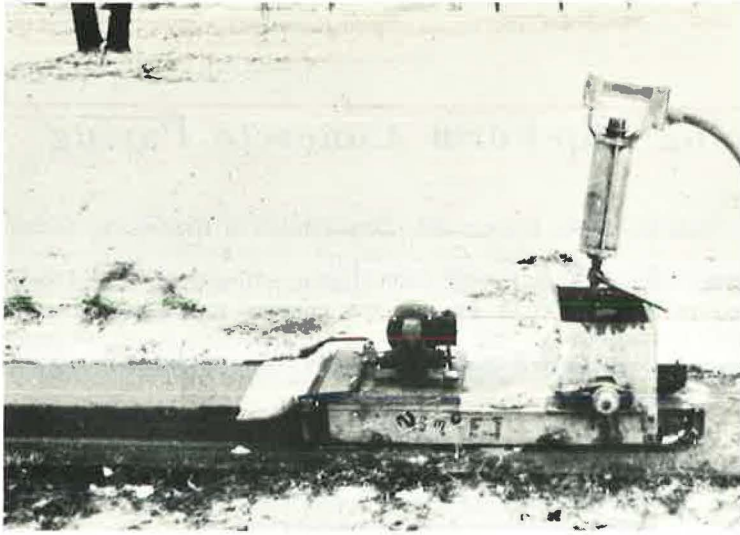


Figure 1. First pilot model slip-form paver; built in Iowa, 1947.

Recent rapid growth coincides with the big breakthrough in the development of an economical and practical method of incorporating mesh and dowels in a slip-form pavement. This milestone in slip-form paving occurred on the Oklahoma Turnpike in the fall of 1963, and means that slip-form paving techniques although of course still capable of refinement and improvement, can now lay any design of concrete pavement on any class of highway.

Our committee met in Iowa and inspected the first use of slip-form pavers to build a reinforced concrete pavement as part of their Interstate mileage. The method used

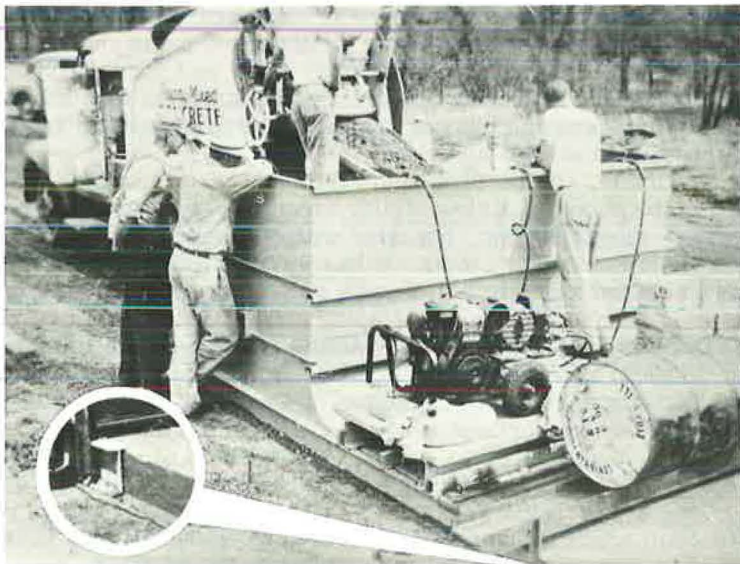


Figure 2. First practical slip-form paver laying an experimental concrete pavement; Iowa, 1949.

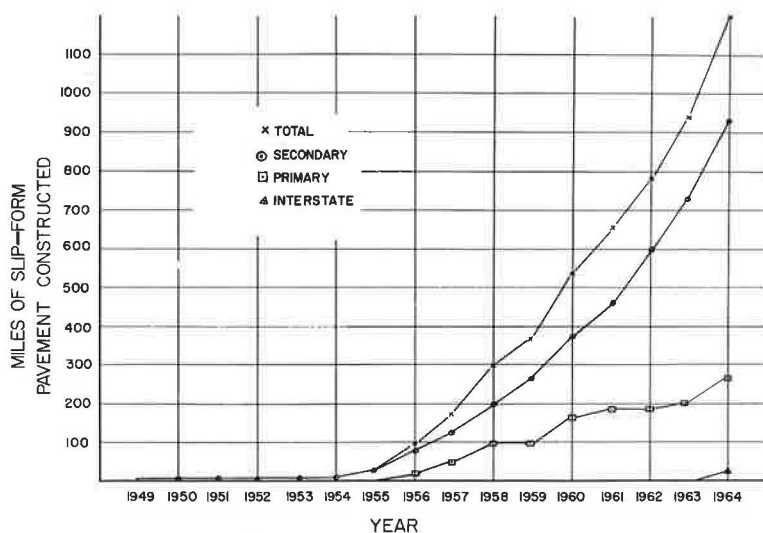


Figure 3. Fifteen-year progress of slip-form concrete pavement in Iowa, showing total miles constructed.

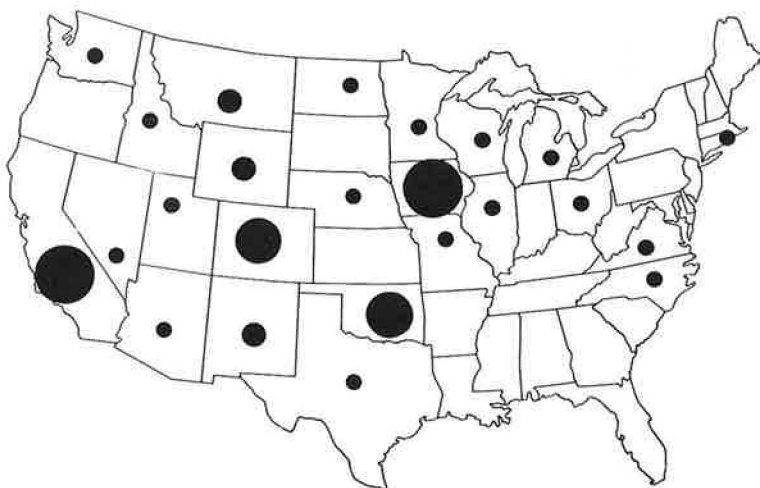


Figure 4. States where slip-form concrete paving has been used up to Dec. 1964.

was simple and worked just as well as it had the fall before in Oklahoma; two-course construction with two slip-form pavers was used, the first striking off the bottom lift to allow the steel to be placed and the second straddling this to lay and finish the top. As we drove back to our motel that evening, Phil Fordyce of the Portland Cement Association Paving Bureau said, "You know, Pete, after what we've seen today, it's goodbye forms within five years!"