

EXTRUSION OF NEOPRENE SEALS
FROM EXPANSION JOINTS IN CONCRETE PAVEMENT



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MICHIGAN DEPARTMENT OF STATE HIGHWAYS

**EXTRUSION OF NEOPRENE SEALS
FROM EXPANSION JOINTS IN CONCRETE PAVEMENT**

F. J. Bashore

**Research Laboratory Division
Office of Testing and Research
Research Project 62 G-116
Research Report No. R-654**

**State of Michigan
Department of State Highways
Lansing, September 1967**

OFFICE MEMORANDUM



MICHIGAN
DEPARTMENT OF STATE HIGHWAYS

September 26, 1967

To: L. T. Oehler, Director
Research Laboratory Division

From: F. J. Bashore

Subject: Extrusion of Neoprene Seals from Expansion Joints in Concrete Pavement. (US 127, 196 to South of Holt Rd, F 33035B, C1 and I 94, Eight Mile Rd to Fourteen Mile Rd, BU 50051A, C30, Roseville). Research Project 62 G-116. Research Report No. R-654.

It was brought to our attention by Department personnel that a number of expansion seals on the subject projects were protruding above the pavement surface. In addition, G. E. Langen, District Maintenance Engineer at Jackson, asked for recommendations—through the Office of Maintenance—concerning the repair of the joints on US 127 from Holt Rd north to I 96, where the preformed sealer was extruding from the pavement joint grooves.

In Research Report R-530 (July 1965) we presented the first report of neoprene expansion joint seal extruding from the joint groove. Certain causes of this problem on the two projects on I 94 and on Columbia Ave were stated. Due to this problem, several changes in construction were made. Joint grooves were sawed, rather than formed, to insure vertical joint groove faces. Two means of reducing the amount of compression in the seal when the expansion joints were closed were attempted: 1) using the same joint groove width as the filler (1 in.) but using a thinner ("thin wall") neoprene cross-section, which would compress to a greater extent without extruding; and 2) using a wider (1-1/4-in.) groove and the conventional neoprene cross-section wall thickness. Three experimental projects were constructed where some, or all, of the expansion joints were constructed in accordance with the first process. These were evaluated in our annual performance report on neoprene joint seals (R-628, March 1967). The US 127 project was included. However, alternate two, which proposed widening the joint groove to 1-1/4 in. and using the regular weight seal, was adopted on all other projects.

Construction Project F 33035B, C1

The US 127 project was inspected in detail by Research Laboratory personnel on August 1, 1967. The expansion joint seals are 1-5/8-in. thin wall installed in 1- by 2-1/2-in. deep joint grooves. The condition and joint groove width of each expansion joint was determined at air temperatures ranging from 70 to 83 F. Joint groove widths ranged from 0.88 to 0.30 in., the average width being 0.51 in. Of the 90 joints inspected (the closely spaced joints at the structures were excluded), 44 had extruded to some extent. In the more severe cases,

the top portion of the seal had split away, leaving the lower portion in the joint groove.

This type of failure is similar to that found on earlier projects in the summer of 1965, where the regular weight 1-5/8-in. seal was installed in a 1-in. groove. The thin wall seal differed from the regular weight in wall thickness only and was capable of greater compression before extrusion should occur. This seal was authorized as an experiment to determine whether the extrusion problem could be eliminated without forming a joint groove wider than 1 in.

The primary reason for extrusion on this project was probably the low temperature at which many of the expansion grooves were sawed. Much of the paving was done during October and November of 1965 with temperatures as low as 22 F at the time of sawing. Joint grooves sawed to 1 in. at 22 F would be expected to close more during the summer than grooves sawed to 1 in. at 60 F, for example.

It is our opinion that these joints are not particularly unsightly and that any protruding material will be removed by traffic. The remaining seal left in the groove should seal against intrusion of foreign material. If it is later found necessary to replace seals on this project, we recommend that this be done during cool weather and that 1-1/4-in. contraction seals be installed.

Construction Project BU 50051A, C30

This project was inspected by D. L. Wickham and myself on July 31, 1967 and described in Mr. Wickham's memo to C. B. Laird dated August 2, 1967. The following is in concurrence with his comments and recommendations.

It was found that the neoprene seal in 13 expansion joints was extruded to some extent. Most of the extrusion had occurred in the outside lane which was reported to have been poured in cool weather in late fall. Measurements showed that joint grooves in the outside lane had closed more than those in the inside lane and were as little as 5/8-in. wide.

In most cases, the extruded portions will be worn off by traffic, leaving a substantial portion of the seal in the groove. It was difficult to determine the exact condition of the extruded areas since hot-poured rubber-asphalt had been applied to many of them. If it is felt necessary, extruded portions can be trimmed off for the sake of appearance. If it becomes necessary to replace seals on this project, we would recommend that 1-1/4-in. contraction seals be used.

Summary

Inspections of both projects showed that expansion grooves, sawed to specified widths at low temperatures, closed too much during the summer to accommodate their respective joint seals. It might be possible to prevent extrusion of the currently specified seal by sawing the joint groove wider as the temperature of the

slab decreases at the time of sawing. In addition to the adjustment of width with temperature change, we recommend that when a 1/8-in. relief cut is made to prevent random cracking, and the full-width groove sawed later, the final groove be sawed to the temperature-adjusted width plus any increase in width of the relief cut due to contraction. A decrease of groove width would be justified when a temperature increase after relief sawing has caused the relief cut to close. This is important if we are to eliminate the two extreme conditions of extrusion at summer temperatures and loss of sealer compression (and intrusion of foreign material) at sub-zero temperatures.

Research Laboratory data on movement of expansion joint grooves shows that the widest opening occurs during the first winter with a progressive closing from year to year, accompanied by a decreased seasonal movement. We do not feel that the problem of extrusion of preformed expansion joint seals is sufficiently extensive to warrant design changes at this time. However, if this does become a more general and severe problem, there are several possible ways that it could be eliminated or minimized. One possible solution is a 1-5/8-in. seal which will compress to approximately 1/2 in. before internal cells are collapsed. There should be no problem of extrusion since the minimum joint groove width at the extreme summer condition would be 1/4 in. plus the minimum thickness of the compressible filler which would be a total of 5/8 in. or more. When an initial 1/8-in. relief cut is made, it would be necessary to increase the final full-width cut to compensate for any width increase of the relief cut due to contraction. The minimum increment of change in width is 1/8 in. since 1/8-in. saw blades are used as spacers.

It was suggested by Stewart Watson, of Acme Highway Products, that a seal such as their 2-in. by 2-in. thin wall expansion seal be used in a 1-1/2-in. wide groove. This seal has the same wall and web thicknesses as the standard 1-5/8-in. and will compress to less than 3/4 in. Disadvantages would be increased cost of sawing a deeper and wider groove and an increase in the cost of the seal.

The simplest and least expensive solution would be to specify the use of hot-poured rubber-asphalt (1967 Standard Specifications) for sealing expansion joints. Recent inspections have shown hot-poured rubber-asphalt sealed expansion joints to be performing well (Research Reports R-563 and R-625). The currently specified hot-poured material has better low temperature properties than the material formerly specified. Research Laboratory experience on joint sealer performance does not show any serious problems with properly installed hot-poured expansion joints. Extensive failure, however, of hot-poured contraction joints has been experienced.

L. T. Oehler

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September 26, 1967

The material cost for the current neoprene expansion seal is approximately \$2.75 per foot, compared to \$0.28 per foot for hot-poured rubber-asphalt in 1-1/4- by 2-1/2-in. joint grooves.

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