

EPOXY-COATED DOWELS FOR CONCRETE PAVEMENT

A vast majority of the nation's highways and roads are made of jointed concrete pavement. These joints allow for deformation and movement due to thermal and environmental conditions. These joints are assumed to be approximately 1/8" gaps between two adjacent slabs. Dowel bars are located at these joints and used to transfer load from one slab to an adjacent slab. The 1993 AASHTO pavement design guide indicates that dowel bars "should be resistant to corrosion when used in those geographic locations where corrosive elements are a problem and epoxy-coated bars have been used to provide this corrosion resistance. In a survey conducted by the Kentucky Department of Highways in 2005, the following comment was received from New York DOT: "I was involved in two CPR projects where transverse joints were removed and replaced. In both cases the epoxy coated dowels were in excellent condition. Both repair projects were on PCC pavements that had been in service in excess of 20 years."

Dowel bars are typically 32 to 38 mm (1.25 to 1.5 inches) in diameter, 460 mm (18 inches) long and spaced 305 mm (12 inches) apart. They are generally inserted into the middle of the slab and coated with a bond-breaker, which reduces bond of the bars to the concrete slab. Dowels prevent the slabs from moving in a vertical direction relative to each other, but allow them to move with changes in temperature and concrete shrinkage. Dowels may be used in both new and repaired concrete slabs.

A recent survey of 36 DOT agencies found that 26 of them were currently using epoxy-coated dowelsⁱ and a study by Iowa State University found that there were approximately 18 million dowel bars used in the US per year. Almost all epoxy-coated dowels are manufactured to meet AASHTO M 254 Standard Specification for Corrosion-Resistant Coated Dowel Bars.

In order to be accepted, coatings for dowel bars undergo stringent tests according to AASHTO T253 Standard Method of Test for Coated Dowel Bars. This test standard requires coated bars to pass load-deflection, pull-out, corrosion-abrasion, chemical resistance, cathodic disbanding, coating hardness, and coating impact tests. These tests are briefly described below.

The load-deflection test evaluates dowels in concrete and places limits on the concrete deflection under load, while the pull-out procedure evaluates the ability of the dowels to move within the concrete. Failure of the dowels to move would result in pavement cracking or buckling.

The corrosion abrasion test first subjects the dowel to 10,000 cycles of concrete abrasion followed by freezing and thawing exposure in a salt solution. After this test the bars are examined for corrosion.

The chemical resistance tests evaluate the performance of the coated dowels in four different solutions including distilled water, calcium chloride, sodium and calcium hydroxide. Cathodic disbondment tests are conducted using a salt solution and a potential of 2V over a period of 30 days.

Coating hardness is evaluated using a dropped tup, with an impact force of 80 in-lb and hardness is determined using the Knoop hardness test.

Most dowels are manufactured in plants that conform to the Concrete Reinforcing Steel Institute Fusion-Bonded Epoxy Coating Applicator Plant Certification, initiated in 1991.

ⁱ "Epoxy Coated Dowel Bars Used in Portland Cement Concrete Pavements," Results of Survey by Kentucky Department Of Highways, Division of Materials, December 27, 2005