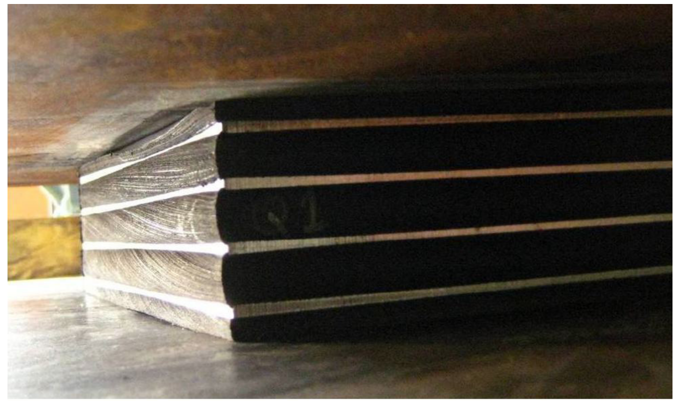
# Florida Department of Transportation Research

Experimental Validation of Bracing Recommendations for Long-Span Concrete Girders

BDK75 977-03

Neoprene bearing pads have long supported heavy structures, such as buildings, industrial machinery, and bridges, or structures that carry heavy loads, such as railroads. Bearing pads distribute weight, dampen vibration, and allow for thermal expansion of structural components.



*This neoprene bearing pad, in place for experimental testing, has been cut away to reveal its alternating layers of neoprene and steel.*

Steel-reinforced neoprene bearing pads often support the precast, pretensioned concrete girders used in bridge construction. As girders are lowered into place during assembly, the weight of the girder transfers to the pad. However, before girders are stabilized by the addition of cross-structures such as bridge decks, they can move out of vertical alignment, shifting weight to a smaller area of the bearing pad, compromising the pad's function and reducing the girder's buckling capacity, setting the stage for lateral or torsional buckling and, potentially, structural failure.

In previous work (Florida Department of Transportation Project BD545-36), University of Florida researchers examined the effect of skew and slope angles on the roll stiffness of bearing pads and the buckling capacity of girders supported on bearing pads. In this project, the researchers expanded the previous work through a series of in-depth studies of isolated roll stiffness using a specially designed test device and full-scale girder buckling tests, the first of its kind using these conditions. Finite element models were used to simulate, and were validated by, experimental buckling tests.

In the first phase of this study, a test device was developed to enable determination of bearing pad roll stiffness under typical loading conditions encountered during construction. The cruciform device reproduced forces acting on a bearing pad in the field, while permitting axial load, skew angle, and slope angle to be controlled independently, so that the effect of each on bearing pad roll stiffness could be quantified. More than 100 tests were performed on three different standard types of bearing pad, with varying severity of imposed skew and slope angle. These tests revealed substantial reduction in roll stiffness resulting from combined effects of skew and slope. Skew angle alone significantly reduced roll stiffness.

The second phase of the study included design and construction of a full-scale test girder, a vertical loading system, and end supports that enabled various combinations of slope and skew to be imposed on the supporting bearing pads. Tests showed clearly that imposition of either skew or slope angle reduced buckling capacity, and when the two were combined, the reduction was severe. In some extreme cases, the test girder buckled under its own weight with no superimposed loads.

Based on study results, the researchers offered valuable guidance for bridge building processes, which can lead to more efficient and cost-effective construction and safer, more durable structures. The study also opens the door to further refinement in understanding bearing and support structures through novel test devices and advanced analytical methods.

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For more information, visit http://www.dot.state.fl.us/research-center