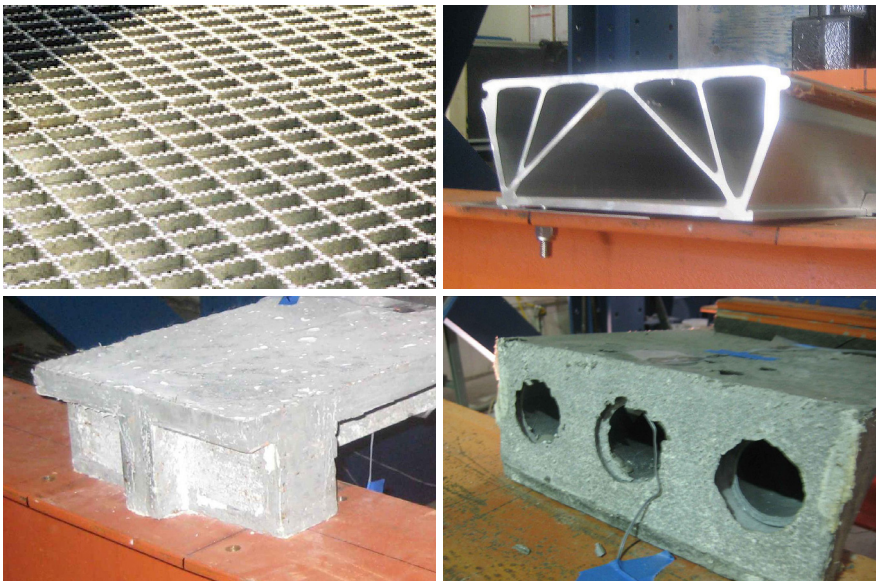
Florida Department of Transportation Research

Alternatives to Grid Steel Decks
BD015-22

Florida's 148 moveable bridges represent the largest stock in the nation. Most of these bridges use open grid steel decks, which are factory assembled, light-weight, and easy to install, but they have several disadvantages. Steel decks are not as skid resistant as solid decks, and become less so over time as they wear down. The potential for deck panels to separate from support structures, costly maintenance, high noise levels, poor riding comfort, and susceptibility to vibrations are among the other drawbacks of these decks.



Clockwise from upper left: Rectangular steel grid deck; SAPA aluminum span; Ductal MMFX steel-reinforced concrete span; Span made of Ductal with fiber reinforced polymer tubing.

Researchers at Florida International University and the University of Central Florida examined three solid deck alternatives to steel grid decks. Suitable substitutes must weigh no more than 25 lb/ft^2, have solid riding surface, be no more than 4-5 in. thick, and withstand AASHTO LRFD loading. Three deck systems were considered in this study: SAPA aluminum deck by SAPA Group of Sweden, Ductal®-MMFX steel deck and Ductal®-fiber reinforced polymer (FRP) tube deck.

SAPA aluminum deck panels have been used in Europe for the last 15 years. Detailed experimental and analytical evaluation of the system included static and dynamic testing on the deck panels, elastic and simple plastic analysis, and detailed finite element analysis. Based on the in-depth experimental and analytical evaluation, researchers concluded that SAPA aluminum deck is a feasible alternative to open grid steel deck and ready for implementation.

Ductal®-MMFX steel deck employs a type of ultra high performance concrete (UHPC), which, due to its ultra high strength, results in thinner sections, satisfying the strict self-weight limit. Comprehensive experimental and analytical evaluation of the system was carried out. Both single and multi-unit specimens with one or two spans were tested for static loading. Finite element models were developed to predict deck behavior. Ductal®-MMFX steel deck has great potential to serve as an alternative system. It requires development of a few additional components before it can be implemented.

For a third alternative, researchers combined ultra strong Ductal® concrete with fiber-reinforced polymer tubes for the first time to produce light and strong deck spans. Preliminary experimental and analytical evaluations of two simple-span specimens, one with uniform section and the other with tapered section, were carried out. The system showed good promise to replace the conventional open grid decks, however, detailed research is needed before the system can be recommended for field application.

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