



## Florida Department of Transportation Research

### Alternative Materials for FDOT Sign Structures: Phase I

BDK82 977-06

Inspections of tubular sign structures by the Florida Department of Transportation (FDOT) have revealed premature corrosion inside galvanized steel tubes. Costs of installing and maintaining these structures, interference with traffic from these procedures, and delays for drivers have moved FDOT engineers to seek alternative materials, principally in the horizontal trusses. A possibility is fiber-reinforced polymer (FRP), which has been applied in other areas of transportation and could be useful in sign structures. To begin investigating this option, FDOT commissioned a literature review from University of North Florida researchers to address the uses of FRP, its material properties, and its economics.

The researchers documented many uses of FRP that suggested it could be applied in sign structures. Among FRP's benefits are resistance to environmental degradation, lower density, and extended service life. Because it is nonmetallic, FRP is not subject to some of the environmental factors that degrade metallic sign components, notably high humidity and rainfall. Lower density makes FRP components lighter, requiring less equipment to install and allowing quicker installation. The durability of FRP promises extended service life and lower lifetime costs.

The researchers also found technical issues with the use of FRP that must be resolved before it can be used in sign structures. Two important issues are the susceptibility of FRP to ultraviolet light, which can accelerate its degradation, and finding an appropriate means of connecting FRP parts to other parts, whether made of FRP or metals. Also, metals tend to fail through processes that take time and often become obvious to inspectors, but if FRP connections fail, it is often sudden and without warning. The researchers suggest that the best approach to a reliable FRP connection system is combining adhesives and metallic fasteners.

The researchers also investigated the economics of FRP structures. Currently, FRP structures do not



*Fiber-reinforced polymers offer advantages over steel in applications such as some components of this cantilever sign on I-95.*

have the extensive research literature and design standards that would lead to their more frequent use, and so there is not yet an economics of scale. A National Institute of Standards and Technology study found that the price of FRP components and installation is about twice that of conventional materials and means. The researchers refer to this price difference as the new technology implementation premium, and they concluded that this premium should not be a primary consideration in comparing conventional and FRP technologies because as the new technology is more widely used this premium will decrease.

The potential advantages of FRP in transportation structures were summarized by the findings of one particular report, which identified significant benefits for FRP structures, including improved service life, reduced maintenance costs, and reduced construction time. This same study found that, when comparing FRP and steel, initial costs were only 30% greater while service life was doubled. Considering the number of these signs, the savings could be quite significant.