NONDESTRUCTIVE EVALUATION FOR
HYBRID-COMPOSITE GIRDER BRIDGES

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ABSTRACT

This thesis will describe the efforts to develop quality control tools for the fabrication and construction of Hybrid Composite Beams (HCBs), a relatively new bridge technology currently being evaluated by the Missouri Department of Transportation (MoDOT). The HCBs are comprised of a rectangular fiber reinforced polymer (FRP) shell enclosing a concrete arch tied with steel prestressing strands.

The form for the concrete arch is shaped as a void within the composite shell. Concrete can be placed either before or after the beams have been erected, reducing crane requirements and providing a lightweight alternative to prestressed or reinforced concrete construction. Uniform placement of the concrete within the arch is critical to ensuring the quality of construction, durability, and capacity of the HCBs. Therefore self-consolidating concrete (SCC) is typically used to form the arch. However, because this arch is enclosed within an FRP shell, internal voids or honeycombs that may occur during concrete placement can go undetected.

The research to be presented is focused on the application of nondestructive evaluation (NDE) technologies of thermography, ultrasonic testing, and acoustic emission testing to assess the quality of placement within the arch section of the HCB. Tap testing, another NDE technique, was also used to test the quality of the FRP shell construction. The research shows that thermography is the only one that produced viable NDE data of the HCB arch. Infrared
thermography is used to assess the integrity of the concrete following placement based on the thermal signatures on the surface of the FRP shell.