This research addresses the experimental characterization of the mechanical and structural properties of a fiber reinforced polymeric (FRP) bridge deck composed of bonded triangular tubes with top and bottom face plates. The material consists of a vinylester matrix reinforced with E-glass fibers in the form of 2-D quadriaxial non-crimp stitched fabrics (NCF) in one case and 3-D triaxial braided preform (3-D braid) in another case. The mechanical and structural properties of the materials are characterized at the coupon, element, and full scale levels.

At the coupon level, tensile, compressive, and flexural tests are conducted on coupons of various widths to examine the inhomogeneity associated with the 3-D braided preform combined with roving. In addition, tensile and compressive tests are conducted on the composites reinforced with the 2-D stitched fabric. The results of these tests are then calibrated with those obtained using classical laminate theory to derive a reliability-based reduction factors that accounts for the uncertainties associated with the material property, manufacturing, and dimensional variabilities. At the structural element level, an acceptance three- and four-point bending test method that uses a gravity load simulator for applying the load is proposed to examine not only the material and dimensional non-uniformity but also the structural response of the element under transverse loading. At the full-scale level, experiments are carried out to characterize the flexural response of bridge deck panels consisting of triangular beams and flat plates. An engineering approach for predicting the deflection, strains, and stresses of FRP deck panels is also proposed.