

FEASIBILITY STUDIES FOR A PLASTICITY-BASED CONSTITUTIVE MODEL FOR ULTRA HIGH PERFORMANCE FIBER-REINFORCED CONCRETE

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A plasticity and damage-based constitutive model is calibrated to existing and newly acquired material characterization data pertaining to ultra-high performance fiber-reinforced concrete (UHPFRC). Estimates for constitutive model parameters were generated using a combination of nonlinear least square regression (NLSR) and the response surface method (RSM) approaches.

This constitutive model is then employed in Lagrangian finite element calculations that are compared against laboratory and field tests conducted under quasi-static and dynamic loads. Although the UHPFRC material response database is sparse and several key phenomenological aspects of UHPFRC remain unquantified, the constitutive model yields good qualitative comparisons with behaviors observed in UHPFRC structural panel tests.

Quantitative comparisons are presented that indicate the response of the UHPFRC panels is sensitive to model parameters related to the tension/extension behaviors of the material. These results are of interest in helping prioritize the UHPFRC materials testing that is needed to complete the initial characterization of a UHPFRC constitutive model.