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Structural Performance Evaluation of Electronic Road Sign Panels Reflecting Damage Scenarios

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Abstract : This paper is intended to evaluate the structural performance of welded electronic road signs under various damage scenarios (DSs) using a finite element (FE) model calibrated with full-scale ultimate load testing results. The tested electronic road sign specimen was built with a back skin made of 5052 aluminum and two channels and a frame made of 6061 aluminum, where the back skin was connected to the frame by welding. The size of the tested specimen was 1.52 m long, 1.43 m wide, and 0.28 m deep. An actuator applied vertical loads at the center of the back skin of the specimen, resulting in a displacement of 158.7 mm and an ultimate load of 153.46 kN. Using these testing data, generation and calibration of a FE model of the tested specimen were executed in ABAQUS, indicating that the difference in the ultimate load between the calibrated model simulation and full-scale testing was only 3.32%. Then, six different DSs were simulated where the areas of the welded connection in the calibrated model were diminished for the DSs. It was found that the corners at the back skin-frame joint were prone to connection failure for all the DSs, and failure of the back skin-frame connection occurred remarkably from the distant edges.

Keywords : computational analysis, damage scenarios, electronic road signs, finite element, welded connections
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