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IDD-4 – Friction-based structural components for high-performance buildings

Experimental characterization of composite materials in bolted force-limiting connections with reliable long-term friction force

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Abstract:

The force capacity in friction-based bolted structural connections that rely on bi-metallic friction interfaces may be reduced by more than 50% due to galvanic corrosion [1]. Non-metallic composite materials can be used in the friction interfaces of these structural components to prevent the formation of galvanic corrosion and ensure the development of reliable long-term friction forces. However, the effect of creep in composite materials may result in the loss of the initial bolt force acting normal to the friction interface. This presentation disseminates results from the experimental characterization of composite materials used in friction interfaces of bolted force-limiting connections ([2], [3]) in high-performance earthquake-resistant buildings. Six types of fiber-reinforced composite friction materials [4] are considered. These materials are made into flat plates by saturation and compression molding under high temperature and pressure. The molded plates are machined into testing specimens using subtractive milling manufacturing methods in a dry laboratory environment. Four types of tests are conducted to assess the short-term and long-term mechanical properties of these materials, including (1) coupon tensile tests, (2) plate hole bearing tests, (3) long-term through-thickness creep tests, and (4) quasi-static friction tests. A detailed analysis of the collected experimental data is discussed. The analysis results are used to create recommendations for the design of bolted force-limiting connections with a reliable long-term friction force. The design recommendations are presented.

Keywords: Composite friction materials; Force-limiting connections; Creep effect; Friction coefficient evolution

References:

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