Large-scale fire test on concrete flat slabs

Due to strict design guidelines and building regulations, fire-resistant design of concrete flat slabs has been one critical factor that governs the overall design of the slab. These guidelines are based on a limited number of punching shear tests on flat slabs at elevated temperatures. Among the limited number of fire test data available for flat slabs, most test specimens are smaller than 1.5m in size. Since the failure shear stress is influenced by the size effect, it is important to have data on real-scale specimens subjected to fire. The fire test presented here was conducted on a full-scale specimen which was laterally restrained against longitudinal expansion and measurements were taken during the cooling phase as well.

Methodology
- Load was first applied at room temperature and maintained until deformation stabilized.
- Then specimen was subjected to a standard ISO 834 fire from the tension side while maintaining the load.
- Temperature measurements were taken on the exposed side, unexposed side, and across the slab.
- Deformation along the two span directions were measured.

Key Findings
- Flat slab specimen did not fail for 3.5 hrs of ISO 834 standard fire exposure in contrast to the fire resistance levels specified by the standards.
- The use of restrained support conditions to replicate the actual condition of a flat slab in a building has increased the fire resistance level.
- No spalling occurred during the test although it was cured only for 28 days. The addition of fibre to the concrete mix has prevented spalling.
- Data was recorded during the cooling phase as well due to the tendency of failure specially in restrained specimens.