Strategies for evaluating residual capacity of fire exposed concrete structures

Summary:

Reinforced concrete (RC) construction forms a major percentage of built-infrastructure in Pakistan (and other developing countries) owing to speed of construction and low life cycle costs and maintenance costs. With the increased fire risk hazard in modern construction, due to higher population density and increased combustible materials, fire resistance has become a key consideration in structural design. Moreover, statistical data suggest that while fires do occur in buildings, complete collapse of structural members due to fire is a rare event. This is a consequence of active protection systems and improved firefighting strategies adopted in recent years. Also, RC structural members have high inherent fire resistance due to relatively low thermal conductivity, high thermal capacity, and slower degradation of mechanical properties of concrete with temperature. Thus, RC structural members retain much of their structural capacity after a moderate fire incident. However, this does not ensure safety of the building for immediate reoccupation after fire is extinguished. Unlike fire induced spalling, which is a visible sign of damage, structural deterioration due to degradation of mechanical properties at elevated temperatures and redistribution of stresses within the member is not too apparent. This makes it imperative to ascertain the residual capacity of structural members through rational engineering methods before reoccupation. Such an assessment would be indispensable for subsequent retrofitting strategies as well. At present there is serious lack of methodologies and guidance in literature for evaluating residual capacity of fire exposed structural members. With such considerations it is imperative to develop strategies for evaluating residual capacity of fire exposed concrete structures for minimizing fire damage and also for evaluating overall fire safety exhibited by concrete structures.

Impact:

At present, there are no reliable test data, guidelines and calculation methods for evaluating the residual strength of fire exposed reinforced concrete structural members. There is significant variability in reported test and numerical data on capacity degradation on fire exposed concrete members. The bond between concrete and reinforcement (steel) is critical in determining residual performance and residual capacity of fire exposed concrete structures. Significant degradation in bond strength at elevated temperatures has been reported in literature. However, there is lack of reliable data on variation of bond strength between steel and concrete especially at higher temperatures. No clearly established principles for non-destructive evaluation of fire damaged reinforced concrete structures exist in literature particularly for newly developed types of concrete. To overcome some of these knowledge gaps, the research team is working towards developing needed data on material and structural level for evaluating residual capacity of fire exposed RC structural members.
Publications:

- **Conference presentation(s):**
  

- **Conference proceeding(s):**
  


- **Journal paper(s):**
  
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