INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title:
Performance-Based Capacity and Demand Estimate and Fragility Analysis of Prestressed Concrete And Reinforced Concrete Nuclear Containment Panels Subject To Missile Impact

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SHORT ABSTRACT

In the modern world, the majority of structures mainly made up of concrete due to its inexpensiveness and excellent stability. Due to hike in civil engineering structures globally over the years, natural and human-made offensive events increased eventually on these structures. Projectile impacts are one of them and seen in the case of the 9/11 attacks, World war – II, Persian – Gulf war, etc. These attacks greatly affected in the failure of structures, economic decline, nations nobility, losing many human lives, including soldiers and, etc. One of the majorly considered sources for electricity is nuclear power plants. The outer casing of power plants called Nuclear containment structures are primarily made of the two-layered wall structure. Many of the structures are made up of reinforced concrete (RC) wall without rear side steel liner as outer case, and prestressed concrete comprises reinforcement (PC) with a rear side steel liner. Based on past attacks, there is a chance of missile attacks on these structures in the coming days due to anti-social activities. The existing codal provisions are not accurate enough to account for local damage effects due to high dynamic load imposed due to missile impact on Nuclear containment structure. Therefore, there is a need to assess the vulnerability of the structure against such impacts.

This present research aim is to develop a framework for the performance-based analysis and design of the nuclear containment structures subject to missile impact. Current research helps to diminish the damage and provide economical design guidelines. The present study considers into account performance-based analysis and design as opposed to only collapse prevention design. Proposed performance levels are tied to impact levels to estimate the reliability of the containment structure for the desired performance objectives. The performance-based probabilistic models for estimating the capacity of containment structure and demand on containment structure are developed. The fragility (vulnerability) of the containment structure subject for selected performance levels is evaluated. In addition to performance-based analysis and design, probabilistic formulations are developed for local missile impact effects on containment structures.