

Drop-weight impact tests of prestressed concrete panels

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ABSTRACT

Nuclear power plants and bridges are exposed to various debris collisions caused by tsunami and landslides. In this study, drop-weight experiments on post-tensioned panels of 2400 × 2400 × 350 mm with a nominal compressive strength of 40 MPa were carried out. About 4.5 MPa of pre-compression was applied to the concrete panel using stressing bars with a yield strength of 950 MPa. The drop-weight was designed to be 2,200 kg to consider actual collision scenarios (ASCE, 2017; U.S. NRC, 2007). The experiments with drop height of 2.10 to 4.09 m were conducted by Drop Weight Impact Tester in Extreme Performance Testing Center (EPTC) at Seoul National University.

As a result, a distinct difference in responses was observed in the reinforced concrete and post-tensioned concrete panel. Large scabbing fracture and deflection occurred on the reinforced concrete panel, while minor scabbing fracture occurred on the post-tensioned concrete panel. Prestressing force effectively reduced the number and width of cracks. In conclusion, it was confirmed that post-tensioning effectively improves the local and global resistance performance of concrete panels against heavy-mass and low-velocity collision. Also, it was shown that the prestressing force minimizes stiffness degradation and permanent deflection of concrete panels against repeated impact load. Further studies are required to analyze the effects of the degree of prestressing force, and additional experimental studies about impact resistance of prestressed concrete panels are planned in EPTC at Seoul National University.

REFERENCES

- American Society of Civil Engineers (ASCE) (2017), Minimum Design Loads and Associated Criteria for Buildings and Other Structures, American Society of Civil Engineers, Virginia, U.S.
U.S. NRC (2007), Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants, U.S. Nuclear Regulatory Commission, Maryland, U.S.

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