USE OF PRECAST REINFORCED CONCRETE ELEMENTS FOR CONSTRUCTION OF PROTECTED SPACES

S. Schwarz, A. Hanaor, Y. Karinski & D. Z. Yankelevsky

National Building Research Institute (NBRI)
Faculty of Civil and Environmental Engineering, Technion I.I.T.,
Technion City, Haifa 32000, Israel

The proposed paper will present the results of the first two stages of a long term experimental and analytical research program aimed at investigation of various theoretical and practical aspects of the behavior of precast reinforced concrete protected spaces to military effects and their implementation as lateral load resistance elements in multi-storey buildings. A commonly employed precast system was tested, including the comparison of its response to that of similar conventional monolithic reinforced concrete elements. The investigation focused on the behaviour of the connection details and employed precast and monolithic specimens representing typical wall or corner segments under various load and support conditions. Specimens were subjected to in-plane and lateral monotonic loading, as well as quasi-static cyclic loading, under flexure and shear actions. Both types of specimens incorporated two layers of cold drawn welded steel mesh, or two layers of reinforcing mesh consisting of deformed steel bars as the main element reinforcement. Precast panel connections incorporated loop and sheathing rod reinforcement in cast-in-situ joints.

Results of the investigation indicate that while conventional monolithic reinforced concrete specimens possess their predicted design strength, according to codes, their failure mode is highly brittle, due to the brittle behaviour of the cold-drawn steel wires constituting the mesh reinforcement. In the case of using deformed steel bars in such specimens, their failure mode is somewhat more ductile than that of the specimens with cold-drawn steel wires reinforcement, but still it is considerably less ductile than that of the precast specimens. Precast specimens, on the other hand, fail at lower load than predicted on the basis of material strength, but their failure mode, which is associated with bending of the joint reinforcement components, is ductile.

In addition to the experimental test program, a special purpose computational tool was developed to enable evaluations of the dynamic response of multi-storey buildings incorporating conventional or precast protected spaces and staircase shafts, under different types of blast or earthquake loadings.