

# Moment Connections in Precast Concrete Structures

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## Abstract

Using precast concrete structures results in high speed and quality in manufacturing and reduces the manufacturing cost. Looking on damages caused by past earthquakes, shows that in principle, destruction in precast structures happens because of weakness in connections, while precast members were not damaged. These observations suggest this fact that designing of connections in precast structures possesses a significant position.

In this thesis it has been tried that with nonlinear static analysis of some precast beam column connections, their behavior be compared with a monolithic specimen and classified with respect to stiffness, resistance and ductility. Firstly studied connections were designed with due regard to existing building code. After designing the precast connections, modeling aspects were studied. Based on this, modeling of the monolithic connection by ANSYS software is described and the selected connection from the first phase of NIST was modeled successfully. Then the proposed precast connections are modeled in ANSYS by using contact elements between different areas and the connections are assessed with regard to resistance, stiffness and ductility by obtaining the load displacement curve of each connection. Ofcourse with due attention to the fact that the compressive strength of concrete is effective in connection's behavior, each precast connection is analyzed using three different concrete grades with concrete compressive strengths of 30, 35 and 40 MPa. The analytic results have shown that in each precast connection, the connection stiffness does not change by increasing the concrete compressive strength. But the rate of final capacity of connection and ductility of connection increase. Meanwhile all of the studied precast connections in this thesis except the SP4 specimen are almost identical to an equivalent monolithic connection in stiffness. The final capacity and ductility of precast connections depending on the concrete strength type are less in some cases and more elsewhere compared to the equivalent monolithic connection. So with due attention to accomplished analysis it can be said that the designed precast connections are an appropriate substitution for equivalent monolithic connections and can be used in concrete precast structures.

## Keyword:

Precast concrete, beam to column connection, nonlinear static analysis, stiffness, capacity, ductility.