



# Numerical Simulation Analysis of the Connection Structure Between the Pier and Pile Cap of Precast Concrete Bridge Piers

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## Abstract

The precast concrete bridge pier in Ganzhou City, Jiangxi Province, China, was used as the research object to compare the longitudinal and transverse force differences of the bridge pier and further analyze the force characteristics of the bridge pier connection structure. The refined nonlinear finite element model with the load direction and axial pressure ratio as the variation parameters was established to analyze the horizontal force-displacement curve, anchor force, shear force of notched perfobond connector, strain distribution of steel jacket and notched perfobond connector-concrete relative slip. The results show that the concrete damage, anchor bolt action, strain distribution of steel jacket and notched perfobond connector-concrete relative slip are different in the longitudinal and transverse direction of the bridge pier. The bearing capacity of large axial pressure piers is larger than that of small axial pressure piers. The compression side damage of precast piers occurs at the concrete interface above the connection device. The shear force of outer notched perfobond connector is less than that of inner notched perfobond connector.

**Keywords:** precast concrete pier; pier-pile cap joint; load direction; notched perfobond connector; finite element analysis.

## 1 Introduction

Precast assembly bridge pier has the advantages of high components quality, short construction time and green environmental protection [1]. Various connection methods have been developed such as grouting sleeve connection and grouting bellows connection [2]. However, the connection strength of grouting sleeve and other connection methods is closely related to their quality of construction, which is prone to grout uncompacted, grout leakage, and grout quality is difficult to detect [3], thus affecting the normal performance of the

precast pier. Therefore, the connection structure of precast pier needs to be studied.

Nzabonimpa [4] et. al and Kim [5] et. al adopted the metal plates to carry out column-column connection of precast concrete column and precast concrete pier-pile cap connection, and verified that the structure with metal plate connection has a good structure performance through pseudostatic test and nonlinear finite element analysis. Xie [6] et al. performed the assembly of piers with outsourced steel plates and steel flanges, and experimentally demonstrated that the outsourced steel plates enhanced the traditional plastic zone.