



## Experimental Study on the Behavior of Single Bolted Joints for UHPC Panels

Sung-Gul Hong

*Department of Architect, Seoul National University, Seoul, Korea*

Soo-Hyung Chung

*Department of Architect, Seoul National University, Seoul, Korea*

Contact: [sglhong@snu.ac.kr](mailto:sglhong@snu.ac.kr)

### Abstract

Single bolted joints for UHPC panels are essential components in prefabrication of precast construction. The bolt connection method can be one of possible options for UHPC structural system, particularly architectural design. To identify the economic and safe use of bolted joints of UHPC panels, a clear understanding of their mechanical behavior is necessary. This paper investigates the tensile behavior of bolted joints for UHPC panels through direct tensile tests, especially focused in identifying the failure modes, strengths and stress distribution, the variables of the experiments including the specimen thickness, width and edge distance..

**Keywords:** joint; UHPC; tensile behavior; failure mode; predict equation; strain concentration.

### 1. Introduction

Recently, as the technology of freeform design is evolving, the interest in freeform architectures is rising up. Metal or concrete are used to fabricate the freeform façade. However, these materials for freeform architecture cause high-cost problem and environmental problem due to complications of design. Therefore, ultra-high performance concrete of this experiment can be viable option for freeform façade. UHPC has high compressive strength, self-compacting ability and high liquidity. Also, construction cost can be decreased, because UHPC member is generally fabricated by precast and it is assembled by simple bolted connection. However, the study of the bolted joints for UHPC panels is inadequate yet. Therefore, to identify the economic and safe use of bolted joints for UHPC panels, a clear understanding of their mechanical behavior by experiment is necessary.

### 2. Experimental Program

#### 2.1. Variables

The experimental program was designed to investigate the effects of the panel geometry. The three basic geometric parameters studied in this investigation, which influence the strength and failure mode of a joint. The parameters varied are illustrated in Fig. 1, and they are:

- 1) Ratio  $e/d$  is the ratio between the end distance  $e$  (distance between the center of the bolt and the panel edge) to the hole diameter  $d$ . The three ratios investigated were  $e/d=2$ ,  $e/d=3$  and  $e/d=4$ , corresponding to end distances of 48mm, 72mm and 96mm (the hole diameter was kept constant at  $d = 24$ mm).
- 2) Ratio  $w/d$  is the between the width of panel  $w$  to the hole diameter  $d$ . the three ratios