



## Etihad Stadium – Challenges of the South Stand Expansion

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### Abstract

The South Stand of the Etihad Stadium in Manchester was recently expanded by approximately 6000 seats, all the while maintaining access to covered spectator seating during matchdays. A team consisting of BuroHappold Engineering, Populous, Laing O'Rourke, and Severfield collaborated to produce innovative design solutions to this brief, receiving an IStructE award in 2016.

This paper discusses several of the key areas of the modifications to the structure, not only from the point of view of the roof, but also regarding the challenges of integrating a new steel upper tier bowl structure above, behind, and within the existing bowl.

**Keywords:** Stadium; Existing building; Reinforced Concrete; Cable-net;

### 1 Introduction

Following the meteoric rise of the football club since 2008, the client developed a brief to expand the stadium to approximately 55,000 seats.

One of the key requirements of the brief was to retain as much of the existing South Stand to be useable on matchdays as possible. This required modifications to the existing roof in the interim state to create space behind, while maintaining coverage.

The relationship of the new works to the existing is an important part of the design. It is clearly an important part both architecturally and structurally.

For the structural engineering, such relationships between new and old are also important. Engineering relationships are very critical in understanding and developing loadpath relationships between existing and new structure.

As with any refurbishment project, the key is having a good understanding of the existing stadium. In the case of cable-net roofs such as the existing Etihad Stadium roof, where non-linearity is vital to the understanding of the roof's behaviour, it is necessary to use existing building information on geometry; as-built cable-lengths; and forces to generate a comprehensive structural model of the building. It is vital to make sure new interventions and changes are not going to distress the existing stadium.

Where possible, the new structure of the South Stand expansion attempts to avoid interventions to the existing roof and bowl. Some interaction with both the roof and the bowl structures were nevertheless inevitable, and this paper describes some of the key interfaces involved in this work.

### 2 Existing Building Description

The existing stadium roof consisted of a series of steel roof rafters supported on a cable-net towards the front, with the rear of the rafters