



## London 2012 Olympic Stadium Transformation: Part 2: Engineering the Extraordinary

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### Abstract

The London 2012 Olympic Stadium was a popular success and ideas were developed to enhance its capability after the Olympics. Commercial discussions concluded with West Ham FC becoming a key tenant and requesting roof covering over spectators that would be located close to the pitch. This resulted in considerations for an extraordinary covering of 49000m<sup>2</sup>, double the original.

The paper explains how previous studies (see Ref 1) helped inform an engineering vocabulary of key issues; however the paper describes how a new radically inventive solution was necessary. It presents the extraordinary engineering challenges such as highly complex form-finding enabling a super-tuned structure to work within the existing constraints to maximise potential of the original structure and deliver a new iconic design faithful in character to the popular Olympic design.

**Keywords:** stadia, regeneration, refurbishment, tension, cable-nets, Olympics, London, form-finding;

### 1 Introduction

It had been known that interventions would be required to the London Olympic Stadium to turn it to a multi-use venue. Ref 1 describes early studies and describes architectural features that would be altered to facilitate all year use and consequent engineering changes.

The commercial negotiations concluded with West Ham FC becoming anchor tenant for most of the year, with the stadium being used potentially by UK Athletics and others outside of the football season. Under the conversion plans, it was proposed to have a movable lower tier seating system allowing the venue to be converted from an athletics arena to football stadium within days and that that the roof would be extended to cover all seats in all configurations.

The implications of this were a roof having an effective cantilever distance of over 80m and an area of 49000m<sup>2</sup>. The design team of Populous Architects and BuroHappold as Engineers continued in their role to develop the new best ideas for this transformation.

### 2 Design Options

#### 2.1 Introduction

The key project issues for the roof were developing a design for a new wonderful iconography with due consideration too of budget and programme. The specific engineering challenges had been articulated from the earlier studies, namely the constraints of the structural capacity of the existing structure designed for a much smaller area. The limits of capacity would influence all aspects of the structure: the “White