



1 Triton Square – Structural reuse for low-carbon architecture.

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Abstract

1 Triton Square is exemplary for how ingenious structural engineering can be instrumental in maximising the value of the existing building stock as part of a low-carbon agenda.

A commercial office development built in the late 1990s in the London West End, 1 Triton Square had been designed to height limits which were no longer relevant when the tenant vacated the premises at the end of a twenty-year lease. When the building owner approached Arup to examine the possibility of enhancing the value of their asset, it was decided, instead of designing a taller new build, to develop a refurbishment and extension scheme, in line with both organisations' low-carbon agenda.

The proposed scheme included the part-infilling of existing atria and the addition of three new levels, thus increasing the number of storeys from six to nine, and the floor area by 70%. Columns and foundations had to be strengthened to cater for the resulting uplift in loading. The original structure was predominantly a concrete frame, with steel-framed cores. Due to this variety of structural forms as well as to access constraints, a palette of strengthening methods was implemented, including concrete encasement and fibre-reinforced polymer (FRP) wrapping for concrete columns, and concrete encasement and welding of strengthening plates for steel columns. Existing piled foundations were strengthened with small-diameter supplementary piles installed from within the existing basement and connected to them within new pile caps or within a new piled raft, depending on locations.

1 Triton Square has been completed in May 2021, achieving BREEAM Outstanding rating. The structural embodied carbon associated with the redeveloped scheme has been estimated at 136 kgCO₂e/m², to be compared to the October 2020 “best-practice” target of 350 kgCO₂e/m² for a new build, thus demonstrating the pivotal role of structural reuse in reducing carbon emissions.

Keywords: Foundation, Pile, Raft, Column, Reuse, Strengthening, Encasement, Plating, FRP

1 Introduction

The original 1 Triton Square was a commercial office building designed by Arup, acting for this project as architects, engineers, and specialist consultants, and completed in the late 1990s. It is located in the West End of London.

With the 20-year lease nearing its end, the building owner, British Land, approached Arup again, looking for opportunities to maximise the value of their asset. New planning rules had been introduced since its construction, and a taller, more profitable building could be envisaged.