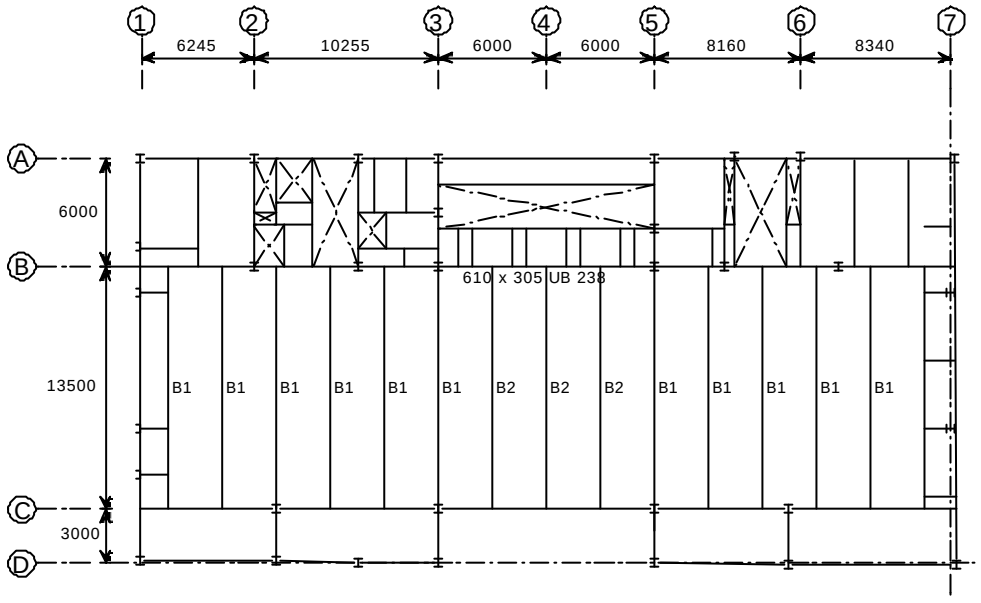
London Office 4

London Office 4 is a recently constructed composite steel framed building using cellular beams. On plan, the building uses 13.5 m secondary beams, comprising asymmetric cellular sections, spanning from a lift core area to the exterior building line, with their spacing at 3.0 m cross-centres. The composite slab consists of 130 mm deep lightweight concrete on a 1.2 mm thick Super Holorib re-entrant decking, by Richard Lees Steel Decking Ltd. A general plan arrangement of the building is shown in Figure 1.



Main beam sizes:

Floor beam B1	*516 mm deep cellular beam 457 × 152UB60 top/254 × 245UC89 bottom with 350 mm diameter cells at 500 mm centres.*
Floor beam B2	500 mm deep cellular beam 356 × 171UB67 top/305 × 305UC137 bottom with 350 mm diameter cells at 500 mm centres.

Figure 1 General arrangement of London Office 4

From an analysis of the floor area using the principles given within the SCI design guide, it was predicted that the vibration mode which gave the lowest natural frequency occurred within grid-lines B-C/3-5 from the motion of the primary beam on grid-line B, behaving as a simply-supported element. Using the permanent loads consistent with that which were present on the floor at the time of testing, it was estimated that the fundamental frequency would be 5.48 Hz. Also, as the floor was in its bare state, it was expected that the maximum level of damping would be below 1.5%.

Impact tests through instrumented hammer excitation were undertaken at a number of selected positions around the floor, in order to identify a critical area. From the transfer function, it was found that the lowest frequency occurred in the critical area

predicted using the principles of the SCI design guide. Namely, the panel bounded by grid-lines 3-5/A-B. In this area, a well-defined peak in the transfer function at 4.40 Hz was found (see Appendix J of report of Design for Vibrations of Long Span Composite Floors). In addition, the damping was found to be extremely high on this floor, with a value of 5.7%.

From this experimental investigation, it can be seen that the estimated fundamental frequency over predicted the measured frequency by 24%. Furthermore, the estimated damping is very conservative (by approximately, a factor of four), compared to that which was measured *in situ.*

