ULTIMATE BEHAVIOUR OF CONTINUOUS COMPOSITE CONCRETE SLABS

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ABSTRACT

Composite one-way concrete slabs with profiled steel decking as permanent formwork are commonly used in the building construction industry. In addition to carry the gravity loads, composite slabs act as a diaphragm to distribute the lateral (wind and earthquake) forces to the vertical elements of the lateral load resisting systems. As ground motions occur in both horizontal and vertical directions concurrently, many design codes consider the vertical effects of earthquake by means of introducing a static load equivalent to about 25% of the dead load applied in the upward and downward directions. Thus, the design of a composite slab as a diaphragm to carry the vertical earthquake load will be very similar to that in gravity loads.

Design codes require the experimental evaluation of the load bearing capacity of each type of steel decking using full scale tests in simple-span slabs. There is no procedure in current codes to evaluate the ultimate strength of continuous composite slabs and this is often assessed by full scale tests. This paper presents the results of three full-scale tests on continuous composite concrete slabs cast with using trapezoidal steel decking profile (KF70) that is widely used in Australia. Slab specimens were tested in four-point bending at each span with shear spans of span/4. The longitudinal shear failure of each slab is evaluated and the measured mid-span deflection, the end slip and the mid-span steel and concrete strains are also presented and discussed. The slabs are also modelled in a finite element (FE) software package using interface elements to model the contact between the steel decking and concrete slab.

INTRODUCTION

Composite slabs consisting of profiled steel decking and structural concrete are increasingly used in buildings worldwide. In this system, the steel decking is normally continuous over two-spans between the supporting steel beams and during construction the concrete is poured to form a continuous one-way composite slab. The composite action between the steel decking and the hardened concrete is dependent on the transmission of horizontal shear stresses acting on the interface between the concrete slab and the steel decking.

In addition to carry the gravity loads, composite slabs act as a diaphragm to distribute the lateral (wind and earthquake) forces to the vertical elements of the lateral load resisting systems (such as frames and structural walls). Ground motions however occur in both horizontal and vertical directions concurrently. In Northridge Earthquake (1994), a number of recorded ground accelerations indicated that the vertical component was much greater than what was typically considered in design and the effects of vertical accelerations could no longer be ignored. Hence in reality, the slab transmits the gravity load and vertical and