

## **CHAPTER 7**

### **CONCLUSIONS AND RECOMMENDATIONS**

A study of the strength and behavior of composite slabs in general, with a particular investigation of the use of long span composite slab systems, has been carried out analytically and experimentally. Two new methods of predicting composite slab strength and stiffness based on simple mechanical models have been developed. The methods, which are supported by experimental data obtained from elemental tests of shear bond and end anchorages, offer an alternative solution to the m-k method, which requires a number of full-scale tests. Experimental test results conducted on full-scale composite slab specimens reveal that the methods predict the slab strength more accurately than the SDI-M method. This is due to the ability of these methods to include the effects of shear bond strength, weld strength, end anchorage strength and any remaining strength of the deck.

The nonlinear finite element method was used to model the complex nature of composite slabs. From this analysis, a response history of virtually any point of the system can be obtained. The development and use of a special purpose finite element code, which is particularly designed for composite slabs and incorporates a concrete plasticity model with three or higher number of parameters for the concrete failure surface and an energy based path following technique is recommended. This is based on the fact that the concrete material is one of the most sensitive aspects of the composite slab analysis, particularly when the concrete is in tension. The suggested energy based path following technique is due to the inconsistency of the physical units in the arc length method, which may lead to numerical problems.

Application of the methods of analysis described earlier shows a promising ability in providing analytical tools and an alternate solution to performing a large number of full-scale tests. These later tests can be replaced by elemental tests of shear bond and end anchorages, which are less expensive.

The study on the long span composite slab systems indicates that the system can be used without significantly increasing the depth or weight of a floor system. This promises a potential advantage over the *slimflor* systems that are now used in European countries. With the long span systems, more efficient use of the material can be expected as some of the filler beams and their connection to the girders can be eliminated, and therefore, less construction work is required. More detailed study regarding the economy of the system is recommended for future research. Further study on the vibration behavior of the long span system is also recommended for future research.

Finally, the study on the resistance factor,  $\phi$ , for flexure design of composite slabs concluded that  $\phi=0.90$  and  $\phi=0.85$  can be used for the SDI-M and direct method, respectively. As more databases on the shear bond strength become available, further study of these  $\phi$  factors is suggested. It is also recommended to extend the study to  $\phi$  factors for other limit states of the design used for composite slab.