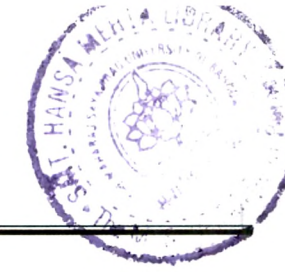

ABSTRACT

Advances that have been made recently in the field of structural engineering in the form of new methods of analysis, design and construction, new materials, environmental impact etc. have greatly influenced the people involved in the research, teaching, design, fabrication and construction. In the past, for the design of a building, the choice was normally between a concrete structure and a masonry structure. But the failure of many multi-storeyed and low-rise R.C.C. and masonry buildings due to earthquake has forced the structural engineers to look for the alternative method of construction. Use of composite or hybrid material is of particular interest, due to its significant potential in improving the overall performance through rather modest changes in manufacturing and constructional technologies.

In steel-concrete composite construction, structural steel work is typically used together with concrete; for example, composite deck slabs comprise profiled steel decking as permanent formwork to support the underside of the concrete slab spanning between supporting steel beam or steel beam with concrete floor slabs or composite columns and steel beam etc. or the entire frame may perform as a composite assemblage. The use of composite elements has become quite popular in some of the countries due to the significant economy resulting from reduced materials, more slender floor depths and faster construction and earthquake resistance. However, in India, it is comparatively new and no updated design codes are available for the same.

In the present work, analysis and design software are developed with pre-, main- and post- processing facilities in VB.NET for the design of composite slabs, beams, columns, frames and multi storey buildings based on IS codes, Euro codes and British codes. The calculation of the limit state of different types of composite structural elements and frame is considered. All principal design checks are incorporated in the software. The full and partial shear

connection and the requirement for transverse reinforcement are also considered. To facilitate direct selection of steel section, a database is prepared and is available at the back end with the properties of all standard steel sections. The concept of equivalent stiffness is used for composite steel-concrete members and the analysis is also carried out using the moment distribution method through a program developed in Excel.

For the size optimization of steel-concrete composite beams, composite columns and composite plane frames, programs are developed in Visual Basic based on the Genetic Algorithm (GA). Also, optimization modules are developed for the configuration optimization of Warren truss, Pratt truss and Warren truss with Vierendeel panel.

Push-out tests are commonly used to determine the capacity and load–slip behaviour of the shear connector. In the present work, a 2D finite element model is developed to simulate the push-out test using ANSYS software. A parametric study is carried out to study the effects on the capacity and behaviour of shear connection of changing the profiled steel sheeting geometries, the diameter and height of the headed stud, as well as the strength of concrete. Further, the results of the proposed FE model are compared with the Indian and European specifications.

A parametric study of G+3 storied residential composite building is carried out using various profile decks, beam sections, load pattern, country codes, orientation of columns and grades of concrete using the software STAAD.Pro V8i. Further, a G+10 storey steel-concrete composite commercial building is considered under three different earthquake zones with medium class soil. Total 10 models are analyzed and designed using the Equivalent Static Method of Analysis and Response Spectrum Method of Analysis. For the purpose of comparison, best efficient and economical section sizes are selected through optimization process. Also, the response of a steel-concrete building vis-a-vis a R.C.C. building under seismic forces is critically examined.