CHAPTER 3

OBJECTIVES AND METHODOLOGY

3.1 RESEARCH OBJECTIVES

On the basis of literature review and research gap in the existing literature presented in chapter 2, the following objectives of the thesis have been made.

1. To analyze all parameters which affect the shear lag phenomenon (SLP) in box beam which resemble with tubular structures by assuming the displacement of the cover sheet as higher order polynomial.
2. To develop a numerical model to regulate the pattern of variation of stress along the height of the tubular structures, to fulfill the design criteria regarding the stiffness of column along the height of the structures as stipulated in IS 1983 (1984).
3. Based on the critical investigation of shear lag in tubular structures of different height, to facilitate the designer as to set out the preliminary dimension of the column, considering storey wise analysis and positioning the point of contraflexure in each flange columns along with the effect of beam and column stiffness on SLP.
4. To evaluate the changes in various responses of the shear beam for fixed base and with soil-structure interaction (SSI) and to find the factors affecting the dynamic responses of the model under any given earthquake excitation.

3.2 METHODOLOGY

The various analytical and numerical methods considered along with the experimental setup and equipment, for the analysis of the structures is presented in this section. The methods adopted are:

- The principle of minimum potential energy method is applied for the parametric analysis of the box beam.
- The proposed model is analysed by using the finite element method (ANSYS 14.5-2013)
- The two types of structures (high rise RCC structure and a low rise steel structure) are analysed by using the STAAD Pro. v8i-2007 software
- The responses of shear beam model with fixed base and flexible base are experimentally evaluated by application of FFT Spectrum Averaging Analyzer (B and K PULSE Lab Shop Version 18.1.0.28 - 2013-11-23). The model is prepared with the HSS of grade 202. The input sinusoidal excitation has been generated by the shake table

3.2.1 Validation of the Methodology

The validation of the mythology, i.e., the variational method applied for the parametric analysis of the box beam with the existing literature is reported in the corresponding chapters. However, the results obtained by Finite Element analysis and STAAD Pro., are compared with the various existing method in the literature and presented briefly.

For relative comparison purpose, the axial forces in the tubular structure (Fig. A.3) from all other studies have been compared with the result of matrix method [Ha et al.1978]. The percentage deviation in axial forces with respect to the axial force values of Ha et al.

(1978) has been calculated. The maximum percentage deviation varies approximately up to 22.8, 6.6, 24.09, 24.09 and 22.9 % for Finite Element Analysis, Haji-Kazemi and Company (2002), Kwan (1996); Coull and Bose (1975) and STAAD Pro., respectively. The deviation in magnitude of axial forces obtained in the present study is 22.8 and 22.9 %, which is lesser than that of Kwan (1996) and Coull and Bose (1975). The result obtained by the Finite Element Analysis and STAAD Pro., analysis are approximately similar. It is also worth mentioning that the methodology adopted in this thesis have been validated by performing statical checks. The deviation in results from matrix method [Ha et al.1978] are -3.27 and -3.8% respectively. Similarly the other methods, i.e., Haji-Kazemi and Company (2002); Kwan (1996) and Coull and Bose (1975) have deviations -1.37, 3.31 and 4.01% respectively (Table A.1). The probable reasons in the variability in axial force values from different studies may be attributed to the adopted assumptions in respective methods. Thus, it can be considered that the variability of results of Finite Element Analysis and STAAD Pro., are within an acceptable range.