CHAPTER 8

CONCLUSIONS

8.1 INTRODUCTION

The concluding remarks and scope for future work has been discussed separately in this chapter in the following section presented below. The chapter incorporated with the precise content of the summary produced in the relevant previous chapters.

8.2 CONCLUSIONS

To mitigate the effect of the shear lag phenomenon, an extensive investigation has been made by using analytical as well as the numerical method in tubular structures. An experimental observation has also been conducted for a shear beam model. The brief conclusions of the present thesis are presented as follow:

1. Shear lag is more pronounce as the relative stiffness of cover sheet increase. In simply supported case, it is noted that the parameter I_s/I, and the parameter *l/w* in the case of the built-up beam, which have great impact on shear lag. The parameters I_s/I, *l/w* and *G/E* are the main features in the design of tubular structures. The effect of variation of all parameters, i.e., I_s/I, *l/w* and *G/E* estimated precisely and accurately. Also, the monographs developed in the dissertation are applicable to the both tubular framed buildings and box girder bridges as well.
2. The structural efficiency against lateral loads increases significantly with additional corner columns when provided in the manner proposed in the present study and

results into an appropriate reduction of the shear lag effect. The technique proposed is very efficient to neutralize the negative shear lag and it makes a reduction in positive shear lag without changing as much in the plan of tubular structure since dimension of the tube is preserved throughout. The variations of the axial force normalized and the value of normalization factors ranges from 1.4 - 2.

3. The variation of axial force in the columns is quite regular through the height of the building. The negative shear lag does not appear in model 6 presented in the thesis. The optimum length of the overhanging can be estimated for other tubular building plans of different width/depth.

4. The corner modification of type second also has a significant impact on axial forces and lateral displacement of the buildings. The corner cut, corner roundness and corner recessions are more suitable for reduction in shear lag effect under lateral loading. Among these three basic modifications, it is concluded that the corner roundness has relatively higher resistance against shear lag effect as the axial forces in the corner column reduces and the lateral displacement is nearly equal to other two basic modifications.

5. In the upper storey, the reversal of the deflection in the central column of the modified model (Type Second) is least as compared to the basic example model. The reversal of lateral deflections in the upper story of the building in the central columns is a reason of negative shear lag produced at the upper level. Since the reversal of the deflection in the corner column is less as compared with central column in the upper storeys of the tube, it may produce warping in the cross-sections of the tube.

6. The inflection point for framed tube structure necessarily does not fall for all columns within 1/4th of the span from the support as applicable for box girders. Variation of axial forces in columns is altered by the variation of the stiffness of beam as well as column. In the flange columns, axial force increases with increasing relative stiffness of beams as well as columns.
7. Base bending moment reduces consistently as the relative stiffness of beam increases. The increase in column stiffness has increased base bending moment in both flange & web columns. Some column of compression flange may also develop tension right from the support depending upon the height of the structure and loadings. Columns in upper storeys are critical columns for the designer as they may develop tension.
8. It is observed that the support condition may have a profound effect on the global dynamic response of the shear beam. In particular, it is found that the influence of the soil-structure interaction may increase the maximum overall displacement of the shear beam significantly. Also, it is concluded that (i) The peak model displacement (PMD), increases significantly as the stiffness of the base decreases (ii) The peak model velocity (PMV) of shear beam decreases along with as base stiffness (iii) The spectral acceleration response of the model (PMA) changes drastically as stiffness of base decreases.

8.3 SCOPE FOR FUTURE WORK

However, the work specified in the present thesis elaborated various aspect of the shear lag phenomenon in tubular tall building analyzed with analytical as well as numerical methods along with the experimental examination of the shear beam. The plenty of the area where shear lag phenomenon creates difficulty in design and cost are untouched.

The following scopes for future work are listed as follow:

1. The cost estimations of the modified plans of the tubular building are essential for the real application of the technique in the field. The individual member force in the entire structures needs a proper evaluation to study the cost of such corner modifications.
2. Some experimental observations are required to verify the utility of the modified plan in the dynamic conditions.
3. The shear lag phenomenon in tubular structures should be analyzed for the axial loading in the form of the water tank; swimming pool etc. on the top of the building and specify the suitable position in the plan of the structure.
4. The shear lag phenomenon in the tubular tall building analyzed for the horizontal load, i.e., wind load converted in the form of the equivalent static load by the various researcher. Through the rigorous literature review, it is concluded that the analysis of shear lag phenomenon in the tubular building for the earthquake loading (under dynamic condition) is absent. Although, a shear beam is tested and results are presented in the respective chapter, however, some experiment of a proto type scaled model essence to conclude the result.