

Chapter 1. Introduction

This project deals with the analysis and design of Reinforced Concrete (RC) chimneys. Such chimneys (with heights up to 400m) are presently designed in conformity with various codes of practice (IS 4998, ACI 307, CICIND etc.). The main loads to be considered during the analysis of tall structures such as chimneys are wind loads, temperature loads and seismic loads in addition to the dead loads. The design is done using limit state concepts (which are yet to be incorporated into IS 4998).

The wind load effects are of two distinct types – along-wind effects and across-wind effects. While the along-wind loads deal with the effect of direct action of the wind on the face of the chimney, the across-wind loads deal with the aerodynamic action of the bluff body cross section of the chimney in a wind flow. The evaluation of along-wind is straight forward, while the across-wind load estimation is more involved requiring dynamic analysis. The loads are idealized as those acting on a cantilever, for the purpose of evaluation of the load resultants on the chimney.

The seismic loads are another cause of natural loads on the chimney. These loads, caused by earthquakes are generally dynamic in nature. However the codes provide for quasi-static methods for the evaluation of these loads. Code provisions normally recommend amplification of the ‘normalized response’ of the chimney with a factor that depends on the local soil conditions and the intensity of the earthquake.

The temperature load effects too are an important consideration in the analysis of loads effects on chimneys taking into consideration the fact that the chimneys are used for the venting of hot gasses. This develops a temperature gradient with respect to the ambient temperature outside and hence causes stresses in the reinforced concrete shell.

There is a considerable difference between the methods employed and the assumptions made by the various codes. Hence the values predicted by the various codes too vary a lot. A comparison has also been done between the values reported by the various codes for the wind load effect analysis.

The design of the chimneys requires the estimation of the resistance of the tubular cross section of the chimney. Also suitable design charts were constructed to serve as design aids.