Reviews On Wind And Temperature Effects On Rcc Chimneys

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Abstract- Chimneys are characterizing landmarks of power plants and industrial setups. Chimneys are required to carry vertically and discharge, gaseous products of combustion, chemical waste gases, and exhaust air from and industry to the atmosphere. Rapid growth of industrialization and increasing need for air pollution control as made RC chimneys a common structure in the modern scenario. With large scale industrialization, number of chimneys and stacks being constructed is increasing year by year. In many industries chimneys are required to leave hot waste gasses at greater height. Tall RCC chimneys are commonly used in major industries and power plants. The analysis and design of chimneys are normally governed by wind or earthquake load. Reinforced chimneys are used in Power plants to take the hot and poisonous flue gas to a great height. In our project basalt fibers are used as partial replacement and strength tests and thermal tests are carried out. In our project modal analysis of a RCC chimney is carried out using the ETAB & FEM software package ANSYS. The height of the chimney is taken as 15 m. The outer diameter of the chimney at top and bottom are 1 m and 2 m, respectively. The thickness at top and bottom are taken as 150 mm and 300 mm, respectively. M25 grade of concrete is used in the analysis. The effects of changes in the dimensions of the chimney on the modal parameters such as fundamental frequency, Displacement etc. are evaluated. The objective of our project is to justify the code criteria with effect of wind and seismic load on industrial chimney also analysis will be carried out using ETAB & ANSYS software.

INTRODUCTION

A Structure which provides ventilation for hot flue gases or smoke from a boiler, stove, furnace or fireplace to the outside atmosphere is known as chimney. Chimneys may be found in buildings, steam locomotives and ships. During the last few decades the use of reinforced concrete chimneys in place of brick masonry and steel chimneys have become very popular due to their low cost and durability. Composite material like reinforced concrete is eminently suited for chimney stacks. The height of a chimney influences its ability to transfer flue gases to the external environmental via stack effect. The maintenance of steel chimneys are minimum in the case of concrete stacks. The thickness of the concrete shell generally varying from 120 to 300 mm is considerably smaller than that required in the case of brick chimneys. Concrete stacks with lesser maintenance costs are architecturally superior to masonry and steel chimneys.

Chimneys are generally provided in the industries to discharge pollutants into the atmosphere at certain heights and velocities so that the pollutants do not harm the environment. The heights of the chimneys are increased to lessen the atmospheric pollution. The changes in the dimensions may have the influence on the dynamic properties of chimneys. Chimneys are the structures which are built to greater heights as tall slender structures. In early days, as household vents and over the years; they are popularly known as chimneys. Chimneys or stacks are used as a medium to transfer highly contaminated polluted gases to atmosphere at greater heights.

Over the years due to development of large scale industries, a large number of tall slender chimneys are required to be designed every year. Chimneys are answerable for industrial growth in any country and changes in the various parameters in any country and changes in the various parameters or dimensions such as increasing the height of the chimneys is more independent on the structural analysis such as response to earthquake is become more critical criteria. Diameter of the top the chimney and height of the chimney, exit velocity at the top, dispersion of gases are within the allowable limits. Mainly bottom diameter is also controlling by the various structural requirements of the both the concrete shell and foundation base of the chimney. For the development of large scale industries all over the country, enormous numbers of tall structures all over the design every year and proper care is to be taken for the design of chimneys.

LITERATURE REVIEWS

"Reliability analysis of wind sensitive structure" Kareem and Hseih (1986) carried out the reliability analysis of concrete chimneys under wind loading. In this paper, safety criteria are taken into consideration. Excessive deflection at the top of the chimney and exceedence of the ultimate moment capacity of the chimney cross-section at any level were taken as failure criterion. Formulation for wind-induced load effects, in the both along-wind and across-wind directions, is presented according to the probabilistic structural.

"Governing loads for design of a tall RCC chimney" M.G. Sheikh, Mie, H.A.M.I. Khan [10],1975, the present paper discuses reinforced concrete tall chimney. The main focus is to compare the wind analysis result with that due to seismic one. Wind analysis is done for along wind by peak factor method as well as by gust factor method and for across wind by simplified method as well as by random response method. The results obtain in above cases are compared. The seismic analysis is performed using response spectrum method. Finally, the maximum value obtained in wind analysis and seismic analyses are then compared for deciding the design value. The effect of wind forces is quite significant as compare to earthquake forces over 220m height RCC chimney. The geometry of chimney has to be so chosen that deflection of chimney at the top is within permissible limits.

"Respone of mild steel chimney under winds" G. Murali, B. Mohan[2] 2012- This paper studies analysis and design of three chimneys of 55m high above ground level. The chimneys were designed with three different wind speeds. The force of wind depends upon its speed and turbulence. The parametric study of static and dynamic forces, the static moment and dynamic moment and thickness of chimney shell and a comparison is made for three chimneys. The results showed that the static and dynamic moments are minimum for short chimney with lowest wind speed and more for tall chimney with greatest wind speed. Thickness of chimney is independent of wind speed, height and earthquake zone.

"A new vibration damping facility for steel chimneys" H.W.Klien, W.Kaldenbach [6], (2014) The article outlines various means of damping and their technical implementation. A concept for passive vibration damping by means of fluid dampers is proposed using a 125m high chimney as an example. Using standard pipe-engineering components, a damper unit has been constructed which has none of the drawbacks of the classical chimney-head damper. The unit functions during the construction of chimneys, is effective over the entire frequency range, is easily maintained and can be extended at any time.

"Thermal analysis of reinforced concrete chimneys with fiber glass plastic liner in uncontrolled fires" Artemis agelaridow- two hig, Franco tamaning, hosam ali, amin adjari, ashcan vaziri, [22], (2014) , This paper presents a simple method to calculate fire duration and flue gas temperatures for reinforced concrete chimneys with fibre glass reinforced plastic (FRP), liners based on experimentally determined burning characteristics of the liner material. Two chimney designs were used to demonstrate a calculation of the transient temperature profiles across the concrete thickness based on the fire duration scenario dependent average temperature of the air inside the chimney. Due to the high thermal inertia of concrete, the temperature profiles across the chimney thickness will be very steep for short fire durations and the structural capacity of large RC chimneys may not suffer as dramatic a reduction as fire temperature suggest.

"Analysis and design of RC chimney" Veena R N, Suresh S (2016) discusses about the limit state of serviceability of an RC chimney under different wind and earthquake conditions. This paper suggests that the moment due to earthquake in Zone III is almost equal to the combined moment due to wind speed of 55m/s is quite significant as compared with the earthquake forces in zone 2 and zone 3. Moment due to earthquake in zone 3 is almost equal to the combined moment due to wind speed of 55 m/s.

"Reliability analysis of wind sensitive structure" Kareem and Hseih (1986) carried out the reliability analysis of concrete chimneys under wind loading. In this paper, safety criteria are taken into consideration. Excessive deflection at the top of the chimney and exceedence of the ultimate moment capacity of the chimney cross-section at any level were taken as failure criterion. Formulation for wind-induced load effects, in the both along-wind and across-wind directions, is presented according to the probabilistic structural.

"Governing loads for design of a 60m industrial RCC chimney" K. Anil Pradeep, C.V. Sivarama Prasad [5], (2014) "in his experiment he described that industrial chimneys are generally intended to support critical loads produced by seismic activity wind. So it is essential to evaluate the dynamic response of chimney to seismic activity and wind loads. As per draft code the deflection at the free end of the chimney should be well within the +permissible limit. The effect of wind force for 55m/s wind speed is quite significant as compared with the earthquake forces in zone 2 and 3. Moment due to earthquake in zone 3 is almost equal to the combined moment due to wind speed of 55m/s.

"Analysis of self supporting chimney" Rajkumar, Vishwanath. B. Patil[3] 2013- The authors discusses about the parametric study of RC chimney of varying heights, diameter, wind zones and earthquake zones, different soil conditions and for various load conditions. The response of chimney to earthquake and wind oscillations becomes more critical influencing response and design of chimney. Microsoft Visual Basic 6.0 software programming were used for the analysis is carried out using. The above cases are compared and the results were extracted. The maximum values for wind and seismic analysis were obtained and referred for the further design. They concluded that, wind load governs the design of RC chimney. The oscillation is dependent upon the slenderness of chimney. Gust factors should be accounted in the dynamic analysis along with the wind factor. Grade of concrete should be greater than M25.

"Respone of mild steel chimney under winds" G. Murali, B. Mohan[2] 2012- This paper studies analysis and design of three chimneys of 55m high above ground level. The chimneys were designed with three different wind speeds. The force of wind depends upon its speed and turbulence. The parametric study of static and dynamic forces, the static moment and dynamic moment and thickness of chimney shell and a comparison is made for three chimneys. The results showed that the static and dynamic moments are minimum for short chimney with lowest wind speed and more for tall chimney with greatest wind speed. Thickness of chimney is independent of wind speed, height and earthquake zone.

CONCLUSION

The present paper focuses on review articles on modelling aspects of industrial chimney, this review article includes case studies, software analysis, design aspects, modelling of superstructure, experimental studies etc. The modelling of chimney (superstructure) involves accurate analysis, design involves various parameters which should be carried out with standard code of practices. The industrial chimney is greatly influenced by dynamic loadings. The earthquake and wind being major dominant loads, the analysis must be made for all possible critical loads and load combinations.

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