

Review on Seismic Behavior of R.C.C Chimney

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Abstract

Chimneys are generally provided in the industries to discharge pollutants into the atmosphere at certain heights and velocities 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 this paper deals with the literature review of different authors on seismic behavior of reinforced concrete chimney. The object of this study is to modal analysis in ANSYS using Time history and to find optimum (best suited) chimney for different loads, stresses and material properties.

Keywords: R.C.C Chimney, ANSYS, Modal analysis, Time History Analysis

I. INTRODUCTION

Chimneys or stacks are very important industrial structures for emission of poisonous gases to a higher elevation such that the gases do not contaminate surrounding atmosphere. These structures are tall, slender and generally with circular cross-sections. Different construction materials, such as concrete, steel or masonry, are used to build chimneys. Steel chimneys are ideally suited for process work where a short heat-up period and low thermal capacity are required. Also, steel chimneys are economical for height up to 45m. As large scale industrial developments are taking place all around, a large number of tall chimneys would be required to be constructed every year. The primary function of chimney is to discharge pollutants into atmosphere at such heights and velocities that the concentration of pollutants deemed harmful to the environment are kept within acceptable limits at ground level. Due to increasing demand for air pollution, height of chimney has been increasing since the last few decades, and these are valid reasons to believe that this trend towards construction of taller chimneys will continue. However, chimneys being tall slender structures, they have different associated structural problems and must therefore be treated separately from other forms of tower structure.

II. LITERATURE REVIEW

YOGANATHAM .C, HELEN SANTHI .M (2013) "MODAL ANALYSIS OF RCC CHIMNEY", the analysis and design of chimneys are normally governed by wind or earthquake load. In this paper modal analysis of a RCC chimney in a cement factory is carried out using the FEM software package ANSYS. The effects changes in the dimensions of the chimney on the modal parameters such as fundamental frequency, displacement etc are evaluated. The displacement of chimney is found to decrease with increase in all geometric parameter ratios.

SREERATH S, ANOOJA BASHEER "COMPARISON OF WIND AND SEISMIC EFFECTS ON A REINFORCED CONCRETE CHIMNEYS", when designing any high rise structure, wind and seismic forces are the major lateral forces that have to be dealt with. As by the code recommendations, it is very unlikely that maximum wind accompanying maximum earthquake activity, we just have to design the structure for the maximum load which is induced by either wind or seismic. A comparison study of wind and earthquake forces on reinforced concrete chimney is discussed. The chimney is analyzed individually for wind and earthquake induced lateral forces in order to determine the governing factor on stack design. The slenderness of the structure demanded to investigate the along and across wind behaviors of the structure.

RAJESH M.N AND S.K PRASAD (2014) "SEISMIC PERFORMANCE STUDY ON RC CHIMNEYS FROM PUSH OVER ANALYSIS". Rapid growth of industrialization and increasing need for air pollution control has made long RC chimneys a common structure in modern scenario. Owing to their long and narrow structure, earthquake forces are one of the important loads to be considered for the design of chimneys. Present paper aims to study the effect of various geometric and material properties of the chimney on the fundamental time period of the chimney and to compare it with that obtained ,the present study performance study on chimneys is carried out considering a 160m tall chimney From push over analysis it was found that the presence of openings significantly reduces the base shear capacity and slightly From push over analysis was found that the presence of openings significantly reduces the base shear capacity and slightly decreases displacement ductility of the chimneys. Openings of size above 1.2% should possibly be avoided in chimneys. In the present study performance study on chimneys is carried out considering a 160m tall chimney.

K.R.C. REDDY. JAISWAL and P.N.GODBOLE discusses about wind and earthquake analysis of tall reinforced concrete chimney. In this paper two reinforced concrete chimneys are analyzed for wind and earth quake loads. Earth quake analysis is

done as per IS 1893 (part 4): 2005 and wind analysis is done as per IS 4998 (part 1): 1992. The combination of along & across wind loads of chimney is done as per ACI 307-98 code. Finally they computed the governing load for design of chimneys.

M.G.SHAIKH, MIE, H.A.M.I.KHAN, "GOVERNING LOADS FOR DESIGN OF A TALL RCC CHIMNEY", the present paper discusses governing loads acting on 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 compared 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.

J.L.WILSON, (2000) "CODE RECOMMENDATIONS FOR THE ASEISMIC DESIGN OF TALL REINFORCED CONCRETE CHIMNEYS", This paper presents results of recent experimental tests which indicate that reinforced concrete chimneys possess some ductility when subjected to cyclic loads. Based on these tests an inelastic procedure has been established for assessing the performance of reinforced concrete chimneys subject to severe earthquake ground shaking. This procedure has been used to analyses a number of chimneys, develop design recommendations and establish appropriate ductility factors. Tall reinforced concrete chimneys being highly tuned, profiled cantilevers respond in a complex manner to earthquake excitation, with the response dominated by higher mode effects, in both the elastic and inelastic range.

LEONARDO E CARRION, RODRIGO A DUNNER AND IVAN FERNANDEZ-DAVILA (2000 "SEISMIC ANALYSIS AND DESIGN OF INDUSTRIAL CHIMNEYS" This paper describes a simplified method that allow obtaining the fundamental period of vibration, lateral displacement, shear force and bending moment through a set of equations, obtaining for all cases studied an error below 10% the results obtained in this study were applied to a total of 9 real chimneys built in Chile, with the objective of calibrating founded expressions. When chimney is analyzed by the three effects (flex ion, shear and rotational inertia), the number of elements to be discrete no longer influences the estimated responses because the height of the element is controlled by shear if $h/D < 2$, and by flex ion if $h/D > 2$, h the height of the element .

ALOK DAVID JOHN, AJAY GAIROLA, ESHAN GANJU AND ANANT GUPTA (2011) "DESIGN WIND LOADS ON REINFORCED CONCRETE CHIMNEY-AN EXPERIMENTAL CASE STUDY". The present paper aimed at providing a better understanding the effect of interference and influence streaks for wind load on thermal power station (TPS) chimneys. Measurements of across and along vibration have been made on scale model of Panipat power station chimney, India .In the present study particular attention has been given to bending moment due to across wind vibration, because it has been found that across wind vibration is more predominant for the case of interference is found to be approximately double compare to that of standalone condition. In this paper, the amplification of wind loads on 100m tall chimney due to interference of surrounding structures and influence of streaks has been studied.

K.ANIL PRADEEP, C.V.SIVARAMA PRASAD, (2014) "GOVERNING LOADS FOR DESIGN OF A 60m INDUSTRIAL RCC CHIMNEY "in his experiment he described that industrial chimneys are generally intended to support critical loads produced by seismic activity. 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 II and III. Moment due to earthquake in zone III is almost equal to the combined moment due to wind speed of 55m/s.

M. SHIVAJI, AND V.S.N.RAJU worked on "DYNAMIC ANALYSIS RCC CHIMNEYS" This paper discusses the dynamic analysis of 220m high RCC chimney for free vibration analysis and response spectrum analysis using MSC/Nastran. Analysis has been carried out for fixed base case and base soil structure interaction case. The coupling between structure and its supporting soil generally results in system which has a longer fundamental period than the same structure fixed to a rigid base. It has also been observed from this study that the effect of considering soil structure interaction on the stresses originating from earthquake response analysis in the reinforced concrete chimney structure is highly beneficial.

III. CONCLUSION

It is thus concluded that seismic response of tall chimneys is influenced greatly by soil supporting its base and nature of earthquake excitation's striking the base. Ignoring any one of them, can significantly affect the performance of chimney during earthquake and lead to devastating effects. Most of the researchers did analysis on RCC Chimney under seismic loading. Most of them used STADD and SAP2000 software for modeling and analysis of chimney, but still there is a lack of study on structural behavior and performance of RCC Chimney, So now it is necessary to find out seismic behavior of RCC Chimney by modal analysis using time history method in ANSYS and check and compare range of H/D ratio and find optimum (best suited) chimney for different loads, stresses and material properties.

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