

# Review on the study of high rise R.C.C. chimney

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**Abstract-** Despite high demands of the high-rise chimney in the industrial, the performance of the slender structure is to be checked by understanding actual behavior of the chimney under seismic and wind and other impact load. In addition, due to slenderness ratio of the chimney, the load performed wind and earthquake are to retain critical task to understand actual behavior. In this paper, it has been quickly reviewed on effects of high rise R.C.C. chimney that is carried out under the certain loads by several research papers and in conclusion with lack of study on above 500m chimney still required to study.

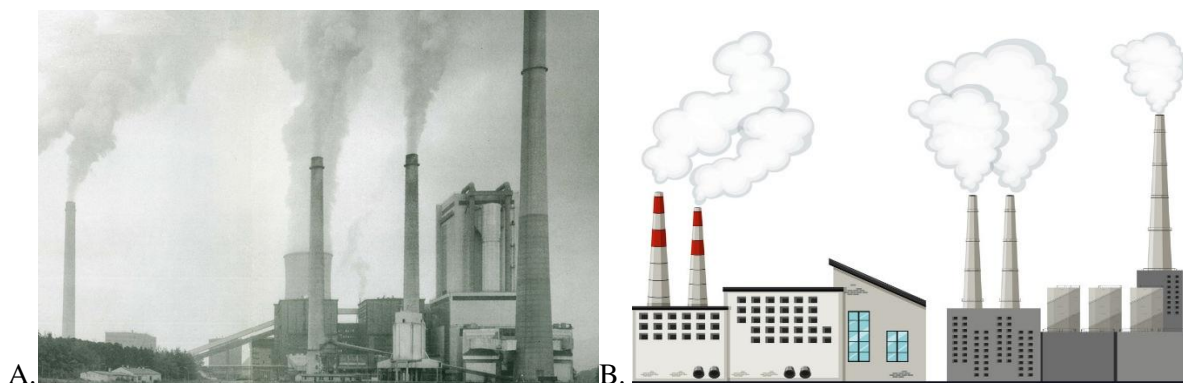
**Index Terms:** Slope gradient, High Rise RCC chimney, Geometry of Chimney.

## I. INTRODUCTION

The chimney is defined to provide high elevation for flume gasses from the industry and power plants. To discharge waste gasses at suitable height it is known as Chimney.

There are varieties of chimney based on materials, based on height, based on flues, based on support, based on lining which is vast constructing in contemporary era. Moreover, the height of the chimney depends on the capacity of plants and diameter that is obtained limitation from the client.

The main function is to dilute flumes and to maintain temperature from inner side of chimney to the outer side of chimney. Furthermore, the component of chimney is different as per materials. For the high rise, suitable option is R.C.C. chimney.



## II. HISTORICAL REVIEW:

Man has always looked for efficient ways to get rid of unwanted gaseous combustion by-products. Small vents were used in the initial versions of such a device. Small brick chimneys took the role of vents as the volume of gases to be handled and the amount of draught required increased over time. Similar to that, it was replaced by the various chimney types listed in Table 1.

## III. FUNCTION OF CHIMNEY:

The paramount aim of the chimney parts to reduce temperature from inside to outside. Similarly, the temperature gradient shown in Figure 1 that is high inside the chimney which consumes high amount of temperature one element which is made by fire brick lining. On the other hand, to maintain air pressure inside the chimney there is kept a gap between R.C.C. element and fire brick lining which is around 100 mm to 150 mm wide. Lastly, the R.C.C. element is provided to withstand the structure and provide high elevation for flumes.

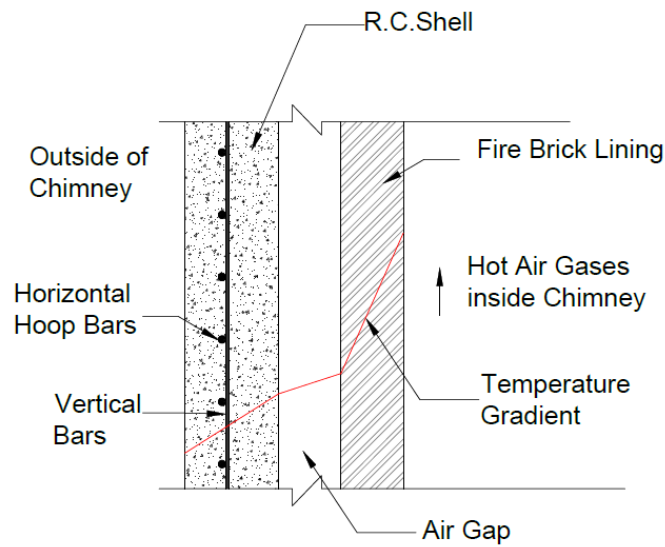
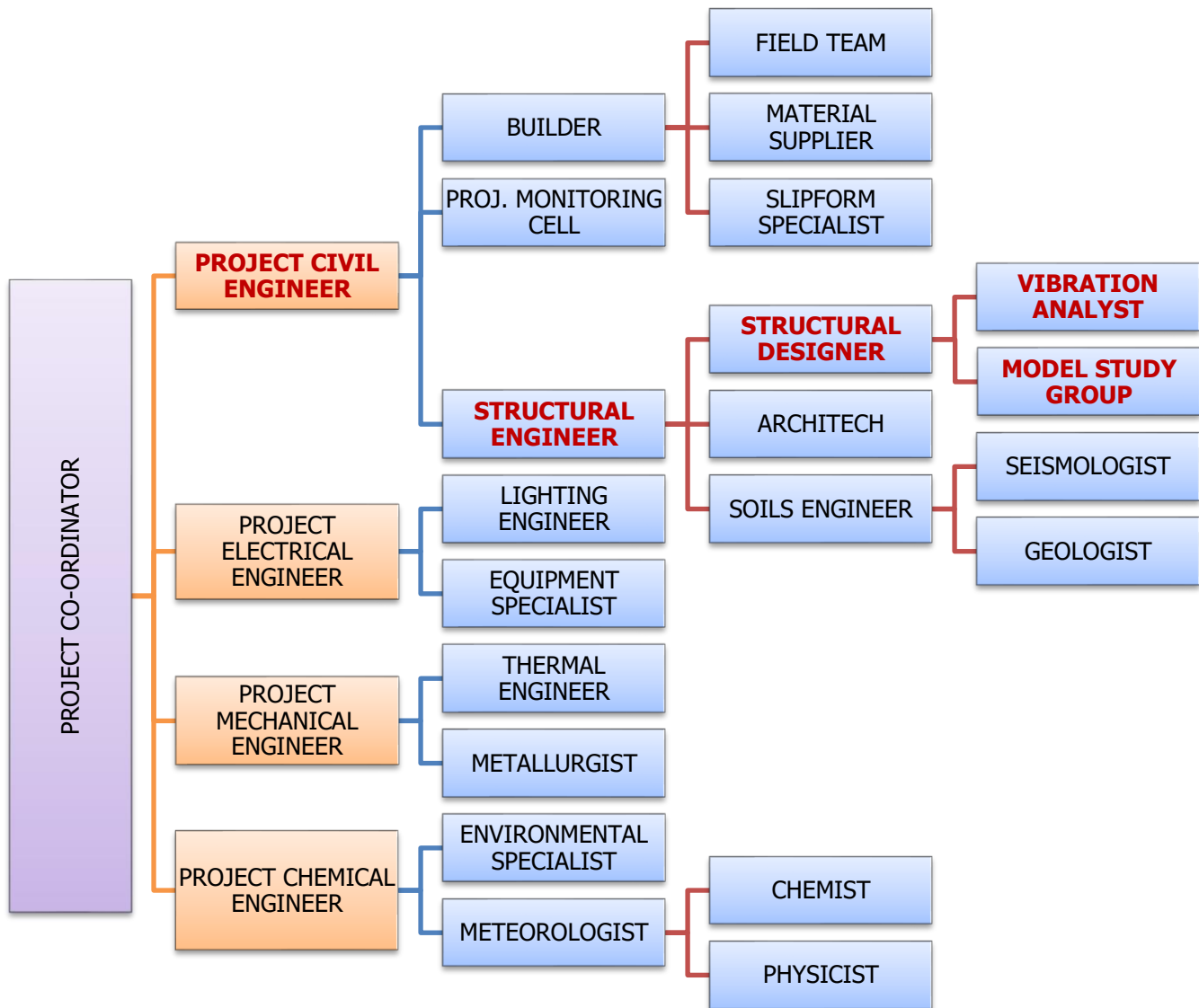


Figure 1 Components of R.C.C. chimney

Table 1 India's largest chimneys

<b>India's largest chimneys</b>		
<i>Chimney</i>	<i>Location</i>	<i>Height (m)</i>
Dahanu thermal power station	<b>Dahanu</b>	<b>275.3</b>
Adhunik Power & Natural Resource Ltd	<b>Padampur, Jharkhand.</b>	<b>275</b>
Korba Power Plant	<b>Korba, Chhattisgarh.</b>	<b>275</b>
Deenbandhu Chhotu Ram Thermal Power Station	<b>Yamunanagar, Haryana.</b>	<b>275</b>
Captive Power Plant, Vedanta Aluminum Ltd	<b>Jharsuguda, Odisha</b>	<b>275</b>
Sagardighi Thermal Power Station	<b>Sagardighi, Murshidabad, West-Bengal.</b>	<b>275</b>
Rihand Thermal Power Station	<b>Sonbhadra district, Uttar Pradesh.</b>	<b>275</b>

#### IV. R.C.C. CHIMNEY IMPLEMENTATION TEAM:



**Figure 2 Implementation team**

These are the team required to complete the chimney project shown in Figure 2. Four major parties handle the project such as Project civil engineer, Project electrical engineer, Project mechanical engineer, Project chemical Engineer. These teams have different teams Civil engineer has three cell Builder, Project Monitoring cell and Structural Engineer. The field team, Material supplier and Slip Form Specialist are under Builder work. Structural Designer, Architect and soils Engineer comes from Structure engineer. Structural Designer has to prepare Model Study Group to analysis and design chimney as well as to check vibration for under responsibility of Vibration Analyst. On the other hand, Soils Engineer has two team like Seismologist and Geologist. Electrical, Mechanical and Chemical engineers have two group Lighting engineer, Equipment Specialist and Thermal engineer, Metallurgist and Environment specialist, Meteorologist respectively. The chemist and physicist work under meteorologist.

#### V. LITERATURE REVIEW:

**K. Rahul, Divya Vani B, Archana** has studied dynamic analysis of RCC chimney Height of 275m located in Telangana state. they Applied External Loadings Such as Wind, Seismic and temperature according to Indian Codes. Analysis done by SAP2000 Version 16.00 Software and Results are Compare against Lateral Forces. Maximum deflection occurred in ELCENTRO ground motion in X-direction 0.02424 and Y-direction 0.02424 as well as LOMA ground motion occurred In X-direction 0.01919 and Y-direction 0.00698. [1].

**K.R.C. Reddy, O.R. Jaiswal, P.N. Godbole** has investigated the loads is calculated as per given in ACI307-98 code. It has seen that, the seismic forces acting on the chimney zone-v are slightly close with wind loads whose basic wind speed is 44 m/s.[2].

**Rajib Sarkar, Devendra Shrimal and Sudhanshu Goyal** has observed that different types of foundation have significant influence on the design forces in chimney section and also did dynamic analysis with time history for analysis and design of tall RCC chimney.[3].

**M.G. Shaikh, MIE, H.A.M.I. Khan** has comparison wind analysis result with that due to seismic one over 220m height RCC chimney. Wind analysis is carried out using the peak factor approach for along wind, the gust factor method, and the simplified method as well as the random response method for across wind. The response spectrum approach is used to accomplish the seismic analysis. As the forces acquired by the gust factor approach are relatively high where the forces obtained in seismic analysis greater, the gust wind over a significant height of chimney plays essential role. [4].

**Amitha Baiju, Geethu S** has found the difference of deflection at top by varying of the height above 275 m. For design author used CED 38:7892 and for the analysis used IS: 4998:1992[part 1] respectively. Along wind and temperature are taken for the research and wind are major impact compared to temperature also found that the lateral deflection at top of chimney increase with the increase in height.[5].

**Bolem Priyanka, K Sundara Kumar** has studied effect of wind load earthquake load and temperature effect, the wind effect analysis by using simplified method and seismic analysis by time history analysis for different height varying from 275 m to 400 m with three different radius-thickness ratio and for longitudinal section such as tapered and partially tapered using ETABS V 9.7.4 Software. The results indicated that as the radius-thickness ratio increases the displacement value were decreasing. Fully tapered chimney structure has minimum displacement.[6].

**Kirti S. Padmawar** has research in when height increase the more vulnerable to earthquake force. It was examined using the Response Spectrum Method for a number of parameters, including Shell force, Joint drift, Design reaction, Design moment, Joint displacement, Base reaction, Base moment, and Joint reaction, Joint moment. The H/D ratio increased as a result, and the chimney's deflection increased by a factor of 55 percent.[7].

**C.V. Siva Rama Prasad, Y. Vijaya Simha Reddy, J. Prashanth Kumar, A. Vijay Kumar, S. Sreevastav Reddy** has compared the wind analysis result with earthquake result of a 100m RC chimney. IS:1893(part-4):2005 for Earthquake and CED38(7892):2013 for wind analysis were used. Shear and Bending increases with increases in zone factor values also wind force is quite significant as compared with the earthquake forces over 100m RCC chimney. In addition, the geometry of chimney has to be chosen in order to that the deflection produced at top is well within the permissible limits. [8].

**Reinhard Harte, Martin Giaffmann and Wilfried B. Kratzing** has investigated on Solar Updraft Chimney (SUCs) with High Chimney multiple flue gas ducts. The SUCs height reaches up to 1000m. The first design that was created using linear elastic models. Strong ring stiffeners are needed for optimization, either as spoke wheels in SBP designs or as external stiffeners in K&P designs. Applying medium-soft exterior rings to the SUC shell and allowing large-width cracking in the limit condition of failure are alternatives to this stiffening.[9].

**Choppalli Kalyani Ramarao, Patil Yogesh D.** has observed stress developed in chimney shell at openings. They had taken two condition without opening and with functional opening and analysis done using STAAD Pro and MS Excel software they found that the stresses in shell with openings have been higher 10-16% than the stresses in shell without openings.[10]

**Tulasi Sai Krishna and CH Mallika Chowdary** has studied that how to calculate the height, area and volume if the thermal plant generates 800MW. Analysis was calculated by using Indian code 4998-2015 and conclude that this chimney design strength  $F_c=14.7033 \text{ N/mm}^2$ . Maximum displacement 2.3279mm [11].

**R.D. Sharpe, R.I. Skinner** has studied that chimney with thirty-five-meter height has been rest to rock along with huge earthquake. Moreover, hand dynamic analysis carried out by the author and time history analysis were done using software. In conclusion, internal load in the chimney only increased with maximum displacement enhancing with spectral velocity. As well as, rocking model has been done which is compatible with in-elastic Time History Analysis computer software. That model used to make parametric analysis of responding rock of proposed structure when the design process.[12]

## VI. OBJECTIVE OF STUDY:

1. To review on behavior of high rise R.C.C. chimney

## VII. CONCLUSION:

To recapitulate, the prime object to transfer or discharge fumes or unwanted gasses from the industrial or companies to the air and provide high elevation to this process. To be clear, the majority of the researches has been done in high rise R.C.C. chimney. It is must be considered seismic load as well as wind load. Apart from that, some researcher did analysis under wind load, while, others did design based on seismic load. Likewise, most of the research has been performed using difference kind of software for modelling and analysis and design of chimney. However, there is still lack of study to understand performance and behavior of more than 400m to 500m height of the R.C.C. and steel Chimney. Besides, there is the missing research in the shape of the chimney such as Hexagonal, Octagonal, elliptical shape and somehow rectangular with rounded edge. Hence, it is essential to find behavior of this sort of chimney by using some newly recommended software like Tekla Structure Designer, ETABS, ANSYS etc. Also, comparison between different slope gradient H/D ratio for above 400m to 500m height of the chimney.

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