



Comparison design and analysis of RCC and steel chimney

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Abstract: A 90m height steel chimney and RCC chimney was considered for the study. A steel chimney with diameter 4.8 m at base and 3m at top was taken and the thickness of the chimney was kept different for all the section. Design a steel chimney as per IS 6533(part-1 and 2): 1989. Maximum bending moment, shear at base was calculated. The stability checks against overturning and sliding are also been carried out. Then, a 90m height RCC chimney with top diameter 3.3m and base diameter 5.5m was taken. the thickness of RCC chimney varies from 0.4m at base to 0.2m at top of the chimney. Design a RCC chimney as per IS4998 with a suitable circular foundation. The stresses at various sections were calculated and checked whether they were in permissible limits. Reinforcement of RCC chimney were properly calculated. Then, the cost estimation has been done for both steel and RCC chimney. Finally, the comparison between RCC and steel chimney has been carried out.

Keywords: Steel chimney, RCC chimney

Introduction

Industrial chimneys are tall, vertical structures built primarily to expel combustion gases, smoke, and pollutants from industrial facilities, power plants, refineries, or other structures where fuel is burned. They serve as a means of ventilation and are designed to safely disperse emissions into the atmosphere at a higher elevation, reducing their impact on the immediate surroundings.

They are typically constructed using materials like reinforced concrete, steel, or brick, based on the specific requirements of the facility and the environment.

Chimney height is a crucial factor. Taller chimneys increase the draft, which helps in efficient dispersion of emissions and prevents pollutants from affecting the surrounding area. The diameter of the chimney is determined by factors like the volume of gases to be emitted, flow rate, and other engineering considerations.

Chimneys often have inner linings, such as refractory bricks or steel liners, to protect the structure from corrosion and heat. Industrial chimneys primarily serve as exhaust systems, ensuring the safe release of

pollutants and gases produced during industrial processes, including combustion, chemical reactions, and manufacturing.

Efforts are made to control emissions by employing scrubbers, filters, and other technologies before releasing gases into the atmosphere. Compliance with environmental regulations is crucial. Regular inspections and maintenance are essential to ensure the structural integrity of the chimney and its efficient functioning. Chimneys or stacks are very important industrial structures for emission of poisonous gases to a higher elevation such that gases do not contaminate surrounding atmosphere. These structures are tall, slender and generally with circular cross sections. They are typically vertical or as near as possible vertical, to ensure that gases flow smoothly, drawing air into the combustion is known as stack or chimney effect. Different construction materials such as concrete, steel, masonry is used to build chimneys.

Conclusion

The main object of the present study was to explain the comparison between RCC and steel chimney on grounds of design, analysis and estimation. A detailed literature review is carried out as a part of this present study on design and an analysis of steel and RCC chimneys.

In the project it was studied, the stimulation and design Process of 90 meters height, steel and RCC chimneys.

1. It is found from this analysis that the stability of the chimney appears to be mostly affected by wind load and temperature of the gases, which are passed out.
2. Total weight of the chimney is more for RCC when compared to steel for some height.
3. Maximum moment at base is higher for steel chimney when compared to RCC chimney. Whereas Shear force is higher for RCC chimney than steel chimney.
4. RCC chimneys are more preferable for chimneys of height, waiting up to 300meters. In full contrast, steel chimneys are limited to lower height, such as up to 60 to 90.

LITERATURE CITED

R. Ciesielski (1996) Aerodynamic effects on a non-typical steel chimney 120 m high”Journal of Wind Engineering and Industrial Aerodynamics” 65 (I 996) 77-86

P. Kuras, L. Ortyl(2016) Analysis of effectiveness of steel chimneys vibration dampers using surveying methods” In: Proc. of Joint International Symposium on Deformation Monitoring (JISDM), Vienna, Austria, 2016

V. Michalcova, L. Lausova (2017) Numerical approach to determination of equivalent aerodynamic roughness of Industrial chimneys <http://dx.doi.org/10.1016/j.compstruc.2017.03.013>

Shubham Baghel, Dr. J.N Vyas(2019) Comparative Analysis of RC & Steel Chimney with Varying the Height of Stack: Technical Paper

<https://www.irjet.net/archives/V6/i7/IRJET-V6I719.pdf>