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Review Article

Modal Analysis of RCC Chimney with and without Adding Silica Fume

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Abstract

All the chimneys are slender shaped & high-rise assemblies. which is castoff to discharge or releases waste/flue/poisonous smokes at the higher raise with enough leaving speed so that toxic gases and the suspended things are distributed into troposphere over an exact spread so their concentration on reaching the earth level is within the adequate limes which is according to specified by the pollution control regulatory authority. Fast and inexpensive creation of chimney or stake is the essential of the industries. By adding some acceptable percentage of silica fume which can improve the construction result as they can have the ability to fight the effect of toxic smoke like CO_2 and others. We all are see that the concrete is the greatest regularly used material (highly costly material) as an important creation material and adding/fully, replacement / partially replacement of silica fume can improve the properties of concrete like fire resistance, low permeability, high early tensile strength, high compressive strength and high bond strength. This project is about model analysis of RCC chimney with or without adding silica fume or micro silica and compare their result on the basis of strength. Basically, author will replace 10% of micro silica with the cement on the basis of literature survey she observed that after 7, 14, and 28 days, when 10% silica fume is added, there is a significant increase in strength.

Keywords: RC chimney, silica fume, Compressive strength, flexural strength, wind analysis, thermal analysis, STAAD pro.

1. Introduction

Chimneys are the very important industrial structure at present-day for discharge of the toxic or damaging smokes to a higher altitude so the smokes cannot pollute the surrounding atmospheric AIR. Smokestacks are often elevated, slender and commonly with the circular cross- sections. Industrial chimneys are commonly implemented to as a flue gas stacks. Different materials such as steel, reinforced concrete, mortar, and bricks are used for creation of chimneys. [1,3]

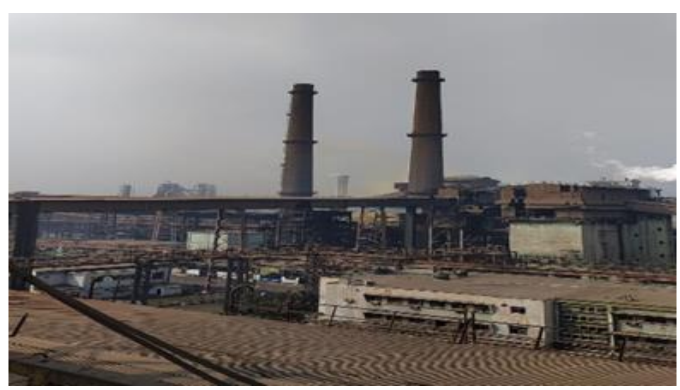

Fig. 1 BHILAI STEEL PLANT (RCC Chimney)

At present Reinforced Concrete is leading material which is used for creation of high or slender chimneys & for the short height of precast concrete stakes with and without prestressing are used. Recent Industrial stacks involves the concrete windshield with a mandatory number of steel stacks on inside. As we know that the RCC can take both tension as well as compression so that the tall smokestacks are possible. we can decrease the diameter & the thickness of smokestacks. Presently tapering smokestacks are likewise used which saves construction material & later the cost will save. Elevation of chimney is based on the requirement of ability to handover flue gases to the outside environment through the stack effect. Mostly, chimneys are planned or constructed at least 5m higher than the highest structure in the neighboring area of about 150 m radius. [1,3,5]

1.1 Altitude or elevation of chimney

- According to the Environment Protection Act &pollution control standards flue gas must be taken into a notice that the greater altitude for diffuse the smokes into the outside atmosphere do that there it will not source of any type of ill effects to the eco system or our environment.[1]
- considering into the attention, the elevation of the smokestacks which is used in power plants are generally very high. It should be ranging from 200-400m. Chimneys with the elevation greater than 150m are measured as the tall smokestacks. It's not only the matter of height but also the aspect ratio when it comes to the different classification of a smokestack as tall or slender. [2,4]

1.2 Smokes releases from the industrial smokestacks or from chimneys

Some are the fuel burning industrial apparatuses doesn't rely upon the natural draft. Many this type of apparatus usages a huge fans and blowers to achieve the same aims, namely:

- flow of the ignition air into an ignition chamber
- flow of warm flue gas out of a chimney or stacks.

Many power plants are prepared with the services for elimination of the Sulphur dioxides, oxides of nitrogen & particulate matter. At that kind of power plants, it's likely to use cooling tower as the smoke stack. [5]

1.3 Classification of Chimneys or Stacks

a) On the basis of numbers of flues

- Single flue system & multi flue system

Figure 2. SMOKE RISING FROM THE CHIMNEY

b) on the basis of material of creation

- Concrete stacks – pre-stressed concrete stacks and reinforced concrete stacks
- Masonry stacks
- Steel stacks

c) On the basic of supporting conditions

- Guyed stacks (for deflection control)
- Self-supporting stacks (cantilever structures)

d) On the basis of lining

- Lined chimney (With using Lining)
- Unlined chimney (Without using lining) [1,5,6]

1.4 Lining in the Chimney

Previously, chimneys had been left unlined. Boiler and fuel skill expansions resulted in low flue air temperatures. This aggravated the corrosion issue, necessitating a defensive liner assessment. Protective bricks were invented in 1950, and initially, self-supporting, acid-resisting brickwork aided by the protecting media was discarded as a lining. As a result of the expansion, the concrete shell's corbels held the lining in place, rather than the shell being self-governing. Gases leaking through the brick lining, on the other hand, corroded the concrete shell, eventually overcoming the flaw. Between the lining and the concrete shell, an aired gap for ventilation was created. Steel liners are currently in use, and they are the most popular since they are resistant to air, have a connection to the bricks, and can withstand high air velocity. Significant mechanisms of the Reinforced cement concrete chimney are Flue lining & Flue, Corbel, Flue channels & insulating medium, Landings & internal Platforms or external platform for the inspection and maintenance purpose and Stairway/elevators. [2,5]

1.5 Purpose of the Smokestack Lining

There are many types of Liners which defends smokestack shell from the erosion which is the byproduct of burning. If the gases of flue infiltrate to the smokestack shell it will be a reduction in the serviceable lifespan of smokestack.

- Smokestack Lining decreases the thermal pressures & accidental chances of the fire.
- Lining protects the smokestack shell from the flue and acid fumes' chemical effects.[4]

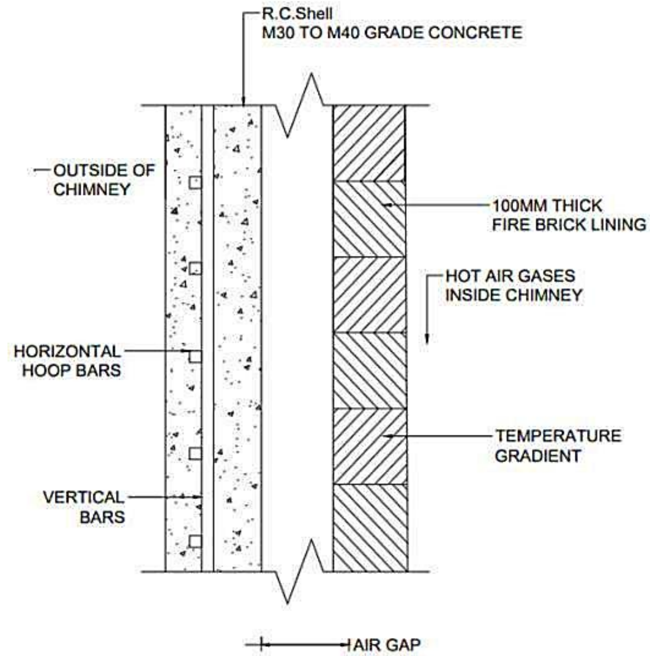

Figure 3. AUTOCAD DWG (Cross-section of RC chimney)

1.6 Leading Loads for the Design of Chimney

According to the IS: 4998 many loads to be taken into the account for the design of smokestacks as follows:

- DL (Dead Load) [4,7]
- LL (Live Load) [4,7]
- Lateral (Adjacent) and circumferential WL [4,7,8]
- Temperature effect on the vertical & circumferential [4,7]
- Earthquake load (EL) or seismic load [4,7]

a) Dead Load

DL to be measured the design mostly includes of the following:

- Flue channels
- Lining with brackets and Insulation media
- Stairways
- Concrete wind shield
- Platform for the maintenance and inspection purpose.

b) Wind Load

WL exercised at the any point or space on a stacks or chimneys which may be measured the sum quantity of the quasi-static & dynamic load section. Static load section is the load in which wind will exerts.it blow at mean stable speed, it will try to produce shift in the particular structure. Dynamic mechanisms can source of the oscillation of the structure. The effects of wind on high-rise constructions can be divided into the following categories:

i. Along Wind Effects- This effect is caused by the wind's direct buffeting action. The assembly's surface is subjected to the effects of the wind. The smokestack is treated as a cantilever structure that is immovable/fixed to the soil for the purpose of estimating these loadings. The wind load is then modelled to turn on the smokestack's exterior face, creating dominating moments in the chimney.
ii. Across Wind Effects- Tall or slender body such as smokestack is the basically forthright body as opposite to the streamline. Streamlined body reasons approaching flow of wind to drive effortlessly & hereafter it’s not exposed to the any kind of additional loads.

c) Temperature Effects

The shell cover of the smokestack should have to live effect of the Thermal gradient. So due to this thermal gradient vertical stresses & circumferential stresses are established and this is the estimated value which is by the greatness of thermal gradient underneath the stable state conditions. Analysis process for seismic load as per the IS1893(part 4):2005. earthquake actions on the stack are the extra sources of the loads acted on the stacks.

There are Following step is required for the calculating of the moment and shear force.

- Design shear force & BM
- Horizontal earthquake forces
- Fundamentals time period

1.7 Silica Fume / Micro Silica

Silica fume is the non-natural Pozzolanic natural materials consuming high Pozzolanic action. It is a by-product. This by-product is formed from electronic arc incinerator which is used to manufacture of silicon metallic and alloy. Silica fume is high silica contented which is about added more than 80%. this is an outstanding supplement usage as the Portland cement. [10]. Table 1 presents general properties of silica fume and Figure 4 shown fume powder.

Table 1. Physical & Chemical Properties of Silica Fume [10,11]

Sr. No	**Physical Properties**	**Range**
1.	Bulk density	450-850 Kg/m3
2.	Surface Area	20000 m2/kg
3.	Shape of Particle	Irregular
4.	Size of Particle	< 1 micron
5.	Specific gravity	2.90
6.	PH value	4.7

Fig. 4. SILICA FUME POWDER

2. Literature Review

The literature reviews are based on the analysis and design of the Reinforced concrete chimney, with special emphasis paid to the effect of geometry parameters on a variety of loading actions and the use of micro silica as a construction material with concrete, either partially or in a percentage. The following are the literatures about the RCC Chimney design that were available:

Roy and Sil (2012) [12] discussed the partial replacement of cement by silica fume on the hardened concrete. They conclude that silica fume concrete has good quality control, high early strength can achieve. According to the researcher's cost estimate, the cost of building of M25 grade SF concrete is around 4.0 percent lower than that of M20 grade regular concrete.

Yoganantham and Santhi (2013) [13 explained the dynamic analysis of the RC chimney in cement factory. The analysis was done by using FEM software package. They concluded that as shift of the smokestack decreases with rise in all geometry parametric ratio.

Prasad and C.S.R. (2014) [14] analyzed the RCC chimney for wind effect and for seismic effect as per IS 1893(part4):2005 and (IS 4998 part 1:1992) respectively. STAAD.pro software is used for the analysis by considering 60m height of RC chimney with basic wind speed 55m/s. They compare both analysis and concluded that if value of zone factor rises then the shear force & bending moment value also rises.

Nagar et al. (2015) [15] studied displacement graphs for numerous heights of the chimney. Up to one third of the height of the 300m chimney, all types of displacement values such as displacement by wind analysis, joint displacement by seismic analysis, peak displacement by time history analysis are calculated. They concluded that when the slender structure's height increases, the displacements values for the chimneys increase. The displacement values will start to rise until they reach the chimney's maximum height of 300 metres.

Kumar et al. (2016) [2] analyzed the dynamic behavior of pre-exciting tall RC chimney of 275m height. STAAD Pro is used for this analysis. This chimney is positioned at Worora in Maharashtra. Author studied stress concentration of the chimney in flue duct and concluded that the effect of along wind has chief prime effect compared to a cross wind effect on chimney and along wind rises with rising the speed of wind.

Shaikh et al. (2016) [3] analysed wind & earthquake as per (IS 4998 part 1:1992). Seismic analysis is done by the response spectrum method. Author considered the single flue 220m height of Reinforced Concrete chimney with basic wind speed of 44m/s. For the Wind analysis, along wind is calculated by across wind and the gust factor. Peak factor method is calculated by the random response method & basic method. They concluded that the effect of earthquake force is comparatively less than the wind load effect.

Baiju and Geethu (2016) [4] reflects the design and analysis of RC chimney of 5 different height. Single flue Circular chimney having brick lining which varies from 275 to 315m and considered basic wind speed of 39m/s. Analysis is done with the help of ANSYS software analysis as per (IS 4998 part 1:1992). Where load combination DL+ Wind load (WL) + Temperature Load (TL) is considered. They concluded that the effect of wind is the main related to Temperature effect.

Veena and Suresh (2016) [6] created the model of RCC chimney by using STAAD.PRO as per (IS 4998 part 1:1992). Author considered 2 types of models; 1st model was generated with the 8 nodes of solid elements & 2nd with the line elements. Author analysed both the model and deflections was calculated. Author concluded following points-

- values of shear force and bending moment rise as the zone factor increases. When compared to earthquake forces in Zone II

and Zone III, the influence of wind force at a 55m/s wind speed is quite large.
- In Zone III, the moment caused by an earthquake is about equal to the combined moment caused by a wind speed of 55 m/s.

Kumar and Dhaka (2016) [11] experimentally conducted out to discuss the partially replacement with micro silica at different percentage such as the 0, 5, 9, 12 & 15% by weight of the cement concrete by the scholar. They also discuss the result of the SF on concrete property. They conclude that the optimal proportion of the partial/fully replacement of the cement with SF is about 12% for the flexural & compressive strength & about 9% for the split tensile strength.

Singh et al. (2016) [16] has taken silica fume which was utilized to substitute 0% to 15% of cement by weight. The results showed that substituting silica fume for cement had a substantial impact on the compressive strength of the cube and the split tensile strength of the cylinder. The compressive strength of concrete increases rapidly as the silica fume content is increased, and the optimum value is obtained at 10% replacement. Under a uniform load condition of 4 KN, it starts to decrease after 10%, and similarly, the split tensile strength increases up to 10% before starting to decrease under a uniform load condition of 2KN.

Snehavi and Yashwanth (2016) [17] highlights partial replacement of cement by the fly ash, silica fume and sand with quarry dust by the author. They have concluded following points-

- Compression strength of concrete tested on cubes for 28 days with various substitutions of fly ash has the highest strength at 5%.
- Compression strength of concrete evaluated on cubes for 28 days with various silica fume substitutes shows the highest strength at 5%.
- The highest strength was found in a split tensile strength of concrete test on cylinders for 28 days with varying substitutions of fly ash.
- The highest strength was found in a split tensile strength of concrete test on cylinders for 28 days at varying replacements of silica fume.
- The compression strength of silica fume is higher than that of fly ash.
- The optimum amount can be employed up to 15% because the replacement of cement with fly ash has met or exceeded the required strength.
- The optimum percentage can be employed up to 25% because the replacement of cement with silica fume has met more than the desired strength.

Vananje et al. (2016) [18] examined Comparison between Steel chimney and R.C.C. chimney analysis as per (IS 4998 part 1:1992). Author examined the issue from a fundamental standpoint. They concluded that a steel fireplace is preferable than a R.C.C. fireplace. This smokestack has a positive vent gas release, such as COxSO2, NOX. As far as cost analysis is concerned, it is entirely dependent on the stack height, because as stature grows, the area of steel in R.C.C. increases.

Prajapati et al. (2017) [19] considered at tackling the earthquake analysis of the RCC chimney. Examiner performed analysis in STAAD.pro software. Author selected the elevation of the chimney 150m with 15m intervals for the parametric study. The analysis is done at the location of BHUJ, which found in zone V with the consideration of basic wind speed of 50m/s. They conclude RCC chimneys are suitable than the steel chimneys. According to them because of using grade of concrete less than M25 grade it fails in permissible stresses. Steel chimneys are ideally constructed up to 45 m height and more than 45m height RCC chimneys are suitable.

Rashmi and Kumar (2017) [20] carried out a parametric analysis of RCC chimney. Analysis is done by using SAP 2000. They investigated the effect of various parameters on the fundamental time periods and base shear of the chimney. They also calculated the difference between the values according to IS codal provision. Concrete grade, thickness variation, distinct zones, different soil types, varying top diameters, and the presence of an opening are all factors considered.

Ratnadeep and Fulari (2017) [21] created the chimney model and reflects the seismic response of chimney. Author used STAAD.pro, SAP2000 and ANSYS software. They perform a modal analysis using the time history approach in ANSYS to determine the seismic behaviour of the RCC Chimney. They compared the range of H/D ratios, and given the values of various loads, stresses, and material attributes for the optimum chimney selection.

Naik and Bhatt (2018) [5] described the seismic and wind analysis of the RCC chimney in this paper. For the analysis STAAD Pro v8i software is used. They compared provisions of Draft code IS 4998:2013 and provisions of the Indian Standards IS 4998 (Part - 1) 1992. They conclude that the point where the chimney is changes its shape or changed after tapered to cylinder-shaped resulting to concentration of stress at the changed point. At that case principal stress always increases.

Saida and Narasaiah (2018) [22] analyzed the RCC chimney and explained the differences between draft code CED 38(7892) and existing code (IS 4998 part 1:1992) with respect to its codal parameters. They have done analysis based on geometric parameters and various wind speeds such as 39 m/s, 47m/s and 55m/s. They conclude that in case of static loads as H/Db ratio increases then the moment and base shear decreases.

Prasad et al. (2018) [23] presents wind & earthquake analysis based on Indian Standards IS 4998 (Part - 1) 1992. Staad.pro software is used for the analysis. Authors consider the industrial RCC chimney having elevation of 100m with basic wind speed of 50m/s. They compared both analysis for deciding the design criteria values. They conclude that the bending moment & shear force rises with rise in the value of zone factor of earthquake zones in India.

K Rahul et al. (2018) [24] analysed the RCC chimney and discusses the external applied loadings affect after the chimney constructions such as wind, earthquake, and temperature. SAP2000 version 16.00 software is used for modelling with reference to Indian codes. The analysis and design approach used to evaluate the RCC chimney under the influence of wind and EQ forces is discussed in this study. Analytical data are evaluated to determine the best resistant system and economic structure against lateral forces.

Gagandeep et al. (2018) [25] experimentally conducted the replacement of the cement by different percentages such as 5, 7.5, 10, 15, 20, and 30% of silica fume. Compressive strength is calculated and compared with traditional concrete and with replaced different percentages of silica fume of concrete at 7days, 14days and 28days. They concluded that the following points:

- After the 7 days of testing cement which is replaced by 15%, 20% & 30%, they observed that strength will decreases by increasing percentage of the micro silica
- After the 14 days of testing, strength of a cube which is replaced by the 20% of silica fume is more than cube which is replaced by the 15%. And strength of the cube which is replaced by 30% of cement by silica fume is less as compared to the 15% & 20%.
- After 7 days testing, cubes replacing 5%, 7.5% & 10% cement by the micro silica, maximum strength is obtained in case of 10%.
- After the 14 days testing maximum strength is achieved at 10% & after 28 days testing, maximum value obtained in case of 10%.
- Observed that the 10% is best for the replace cement with micro silica as comparison to

the 7.5% & 5%. because it gave the greater strength than 5% &7.5%.

Thakur and Singh (2018) [26] worked on the use of silica fume and fly ash as a partial replacement of cement will be beneficial and given following points -

- The amount of cement and fine aggregate used will be reduced as a result of their use.
- Concrete's early properties, such as bleeding, segregation, and slump, will be enhanced.
- When high-strength performance concrete is made, the strength of the concrete will rise.
- The usage of both fly ash and silica fume in concrete will improve all the properties of concrete, and high strength concrete can be created by partially replacing silica fume and fly ash in concrete.

Sharma (2018) [27] the researcher deliberates strength and durability properties of concrete mixtures by replacing 5%, 10%, 15%, and 20% silica fume with cement. Author has given some points which are as follows-

- When 5% silica fume is added to the mix, the strength of the cube increases after 7 days when compared to concrete without replacement. In comparison to the control mix, there is a massive improvement in strength after 28 days.
- After 7, 14, and 28 days, when 10% silica fume is added, there is a significant increase in strength. The proportion of silica fume in the mix tends to increase the compressive strength.
- After 7 and 28 days, respectively, there is a greater improvement in strength when 15 percent S.F is added. The compressive strength of S.F. tends to grow as the percentage increases and decreases after 15% replacement.
- For all 7, and 28 days, the ideal strength of cube is gain at 15 percent replacement.

Selvapriya (2019) [28] partially replaced the cement by 0%, 5%, 10%, 15%, and 20% of silica fume. Based on the results of an experiment conducted on concrete with varied concentrations of silica fumes. For each 3 no. of cube, cylinder, and prism casted, concrete compositions with varied concentrations of SF ranging from 0%, 5%, 10%, 15%, and 20% were used.

- After 7 & 14 days, compressive strength of silica fume increased by 15%.
- Split tensile strength rose by 15% in SF after 7 & 14 days.
- Flexural strength increased by 15% in SF after 7 & 14 days.

Shanmugapriya and Uma (2019) [29] experimentally conducted out to discuss on the replacement of the cement by 7.5% of silica fume by the writer. They concluded that the Compressive strength, split tensile strength, and flexure strength of high-performance concrete generated from cement replacement up to 7.5 percent silica fume are all increased. They explained the Concrete's compressive strength, split tensile strength, and flexure strength all decline beyond 7.5 percent. At the age of 28 days, replacing 7.5 percent of cement with silica fume resulted in a 15% increase in compressive strength, a 20% rise in split tensile strength, and a 23% increase in flexure strength. The ideal percentage of silica fume replacement for cement is 7.5 percent.

Pathak (2020) [10] considered the partial replacement of cement by the different percentage of the silica fume and fly ash in this article. Author discussed the Individual impacts of Silica Fume and Fly Ash as partial replacements for Ordinary Portland Cement (OPC) on compressive, flexural, and split tensile strength of concrete. They concluded the better strength will be produced by using Silica fume and Fly ash, which will result in less cement being used, and if used for a long period, this can prove to be more than 70% cement replacement by making a certain alteration that informs how to use waste from coal power plants in a good quantity.

Jadhao and Dahake (2020) [30] examined two RC Chimneys for earthquake loads and wind loads. STAAD-PRO software is used for the analysis. The earthquake analysis and the wind analysis were done as per 1893 (Part 4): 2005 and 4998 (Part 1) :1992 respectively. Working stress approach is used for the calculation. A chimney is a wind structure in which the design of wind loads is the most important factor. Analysis for the tall RC chimney is performed in terms of forces and stresses.

Malviya et al. (2020) [31] deliberates partial replacement of cement in concrete by using SF as 0%,5%,10% and 15% respectively. They have concluded based on the result silica fume has great potential for the utilization in concrete as replacement of cement.

Various group has performed the earthquake analysis of RCC chimney to assess the efficiency by using numerous software including STAAD.pro. [33-34]

Pro and con included following points -

- When a nearfield earthquake occurs, seismic reactions are shown to be much higher than when a far field earthquake occurs. As a result, structures near faults should be designed with a long term and careful thought.
- To lessen seismic reaction, it is preferable to develop structures near faults that are more ductile.
- Shell stress is greatest around the chimney's base, which is why most chimneys fail at or near the base.

With replacement of the 5% and 10% silica fume with cement in the concrete mix researcher reported

- After 7, 14, and 28 days, 10 percent silica fume results in a significant improvement in strength. Compressive strength increases as the quantity of silica fume in the mix increases but declines after 10% replacement. The cube's maximum strength is gained at 10% replacement for all 7, 14, and 28 days, respectively.
- When 5 percent silica fume is added to the mix, the strength of the cube increases after seven days when compared to concrete without replacement. In comparison to the control mix, there is a massive gain in strength after 14 and 28 days. After 7, 14, and 28 days, adding 1.0 percent silica fume results in a significant improvement in strength.

Krishna and Chowdary (2021) [32] worked on the analysis of the chimney manually and by software. The analysis was calculated using the Indian code IS 4998-2015. Validation was performed using STAAD Pro and ANSYS software. Dead, Wind, Earthquake, and Temperature loads are calculated. The location of the thermal power plant was chosen as Vijayawada for the chimney analysis. They have calculated highest displacement value 2.32798mm.

3 Review Perspective

All literatures are about the design of RCC chimney, Wind analysis, seismic analysis, thermal analysis and parametric study. There are no literatures are about to study, analysis & design of the smokestack after adding or replacing partially/fully silica fumes or any other waste product, by product and other product or material. Authors Majority says that after 7, 14, and 28 days, when 10% silica fume is added, there is a significant increase in strength. The proportion of the micro silica in the mix tends to rise the compressive strength.

- Availability of different types of waste product that can also be used to construct Chimney.
- Experimentation with ratios of the micro silica as a replace of cement in concrete.
- Analysis & observation of the experiments for the best suitable application of such concrete.

3.1 **Advantages**

- SF is unbiased mineral grout. It has the actual steady physical properties & chemical properties. It does not comprise crystal-like water and does not contribute in the hardening reaction. Afterward the mixtures It does not disturb reactions mechanism.
- SF is actual decent infiltration for several kinds of resin. It consumes decent adsorption performances capacity.
- Size distribution of the silica fume is an actual sensible and durable densification. It consumes a great hardness & wear or tear resistance property.
- It has the ability to increase the thermal conductivity & change adhesive viscosity.
- Silica fumes are made up of silica. Silica is a non-reactive substance. It is unaffected by the majority of alkaloids and acids. We can see that the silicon powder is equally dispersed and covered on the object's surface after it has been used. It has a greater level of corrosion resistance and cavitation resistance, which has grown by 3 to 16 times.
- It has a low bulk density, ranging from 0.2 to 0.8 or 1 to 2.2. The polymers are known to be filler materials. It can lower the cost of the product by lowering the amount of loading and conserving polymers.
- Micro silica has a high frost resistance property, with a relative elastic modulus of 10 to 20% after 300 to 500 fast freeze-thaw cycles. The average elastic modulus of traditional concrete is roughly 30 to 73 percent after 25-50 cycles. As a result, the frost resistance of the concrete can be improved.
- Micro silica concrete's initial strength can condense induction TIME and it possesses initial strength properties. [34,45]

3.2 Disadvantages

- Dry shrinkage-concrete contain silica fume has much large shrinkage rate as compare to conventional concrete. especially initial dry shrinkage is informal to make the cracks.
- Creation is tough- concrete contain silica fume has poor workability. As we know that the concrete's workability is a chief parameter in any design work of the different types of concrete mix proportioning. This isn't as simple to makes the concrete closed grained vibrating, isn't simple to make plaster, making concrete's surface quality smooth and uniform.
- Easier to produce cracks owing to temperature-concrete containing silica fumes has a quick early strength, and the heat of hydration dissipates quickly, leading the hydration heat temperature to rise, making high temperature strains in concrete easy to spot. [11,40]

3.3 **Future scope**

The current study's goal is described as follows, based on the literature review presented in the next section:

- Assessment of the geometry limitations imposed by IS: 4998 (Part 1):1992 for designing RCC chimney will be highly beneficial.
- Use the mix design by adding or partially replacing cement by silica fume about 10% might provide satisfactory outcome.
- Analysis of the RCC smokestack with and without adding or using micro silica will done by with the help of STAAD.Pro software is needed to be checked.

Conclusions

Concrete is the greatest commonly usable material on earth as a construction material in many construction industries or areas. It is a very important material which is used to construct buildings, water treatment plants, roads, dam, chimney and other tall structures. It is also used to construct many other things like pipes, drains etc., but due to continuously or rapid growth of construction activities and industries, manufacturing of cement is limited as compare to its demand and it becomes costlier day by day due to high demand so that there are so many waste products available which we can use it as a binding material by using partially or fully replacement of cement.

Conflict of interest

The author declares no conflict of interest.

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