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# Failure Analysis and Design of a Hostel Building

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**Abstract:** ***Reinforced concrete has a high compressive strength compared to other building materials. Due to the provided reinforcement, reinforced concrete can also withstand a good amount tensile stress. The reinforced concrete building system is more durable than any other building system.This paper presents design and analysis of a concrete structure (a hostel building of Jharkhand) considering live load and Wind pressure. Beams and columns of the structure are designed and analyzed up to failure condition by increasing Wind load and live load.Now a day large number of application software's are available in the civil engineering field. All these software's are developed as the basis of advanced. Analysis & design of multistory concrete building is carried out using Software Computer Aided Design i.e., ( STAAD Pro. ) .***

**Keywords:** Concrete Structure, Reinforcement,STAAD.Pro, Wind pressure.

## 1. Introduction

Concrete is among the most used construction materials around the world. From buildings and landscaping to infrastructure, concrete is chosen for its strength, durability, and aesthetics. Concrete building construction is prominently featured in hospitals, offices, schools, apartments, hostels and more. Concrete is an agglomerate of stone and cement paste. Admixtures are chemical additives used to enhance the workability of concrete or reduce the cure time. Admixtures also can enhance the durability of concrete construction. Concrete strength is a function of the water/cement ratio.

Precast concrete is cast in a reusable mold in a factory setting where quality is strictly controlled. Precast components are usually manufactured while the job site is prepared, and often can be installed as soon as the slab is completed. Concrete building construction can include both structural and architectural cladding elements. As a building technology, precast concrete offers a wide variety of details and finish options. Its highly customizable array of shapes, colors and textures makes virtually any design aesthetic possible – from stucco to brick veneer to architectural stone. In addition, architects can specify elements like reveals, bullnoses, tile insets, parapets – just about anything that can be designed. On the job site, factory-cured precast products are delivered ready to erect in almost any weather, which reduces the potential for costly delays and takes up less space than cast-in-place concrete construction. And, single source fabrication anderection reduces delays anddefects that result from the coordination of multiple trades. The colors and textures of precast concrete are determined primarily by the pigments and aggregates that are used to make up the agglomerate. Factory precast allows consistent mixtures of exact colors and textures across and between batches.

## 2. Objective

Analysis and design up to failure condition of beams and columns of a concrete structure considering wind load and live load.

## 3. Introduction of STAAD.Pro

It is one of the effective software which is used for the purpose of analysis and design of structure by the structural engineers. My project is aimed to complete with the help of STAAD Pro .It gives more precise and accurate results than manual techniques.

**Advantages of STAAD pro :**

1) Extremely Flexible Modeling Environment.
2) Broad Spectra of Design Codes.
3) International Best Seller.
4) Interoperability and Open Architecture.
5) Covering All Aspects of Structural Engineering.
6) Quality Assurance.
7) Extremely Scalable.
8) Easy Reports and Documentation.

## 4. Mix Design of Concrete for Foundation of the Structure

**Material Testing**

- Specific Gravity Of Cement=3.1
- Specific Gravity Of Fine Aggregate=2.61
- Specific Gravity Of Coarse Aggregate=2.6
- Grading Of Fine Aggregate= (Zone-III)

**Mix Design**

1) GRADE DESIGNATION = M30
2) CEMENT =DALMIA CEMENT
3) TARGET MEAN STRENGTH =38.25 $N/MM^2$ (IS 10262 2009)
4) W/C RATIO =0.44 (IS 456 ,TABLE 5)
5) WATER CONTENT =197 KG (IS 10262, TABLE NO 2)
6) CEMENT CONTENT=W/C=0.44
   C=197/0.44
   C=447 KG
7) VOLUME OF COARSE AGGREGATES = 0.64
8) VOLUME OF FINE AGGREGATES =0.36

**Mix Calculation Per Unit Volume Of Concrete**

a) Volume of concrete = 1 $m^3$

b) Volume of cement =mass of cement/ specific gravity of cement X 1/1000 =447/3.1 X 1/1000 =0.14 $m^3$
c) Volume of water = mass of water/ specific gravity of water X 1/1000 =197/1 X 1/1000 =0.197 $m^3$
d) Volume of aggregates = (a -(b+c)) = (1-(0.14+0.19))=0.66 $m^3$
e) Mass of coarse aggregates = d X volume of coarse aggregates X specific gravity of coarseaggregates X 1000 = 0.66 X 0.64 X 2.6 X 1000 =1098 kg
f) Mass of fine aggregates = d X volume of fineaggregates X specificgravity of fineaggregates X 1000 = 0.66 X 0.36 X 2.61X 1000 =620 kg
g) Cement , fine aggregates and coarse aggregates ratio =447/447 :620/447:1098/447 =1:1.38:2.45

**Compressive Strength Test**
Compressive strength after 7 days =23.5 $n/mm^2$
Compressive strength after 28 days =39.2 $n/mm^2$

## 5. Analysis and Design of Structural Elements

The modeling analysis is done in the STAAD.Pro

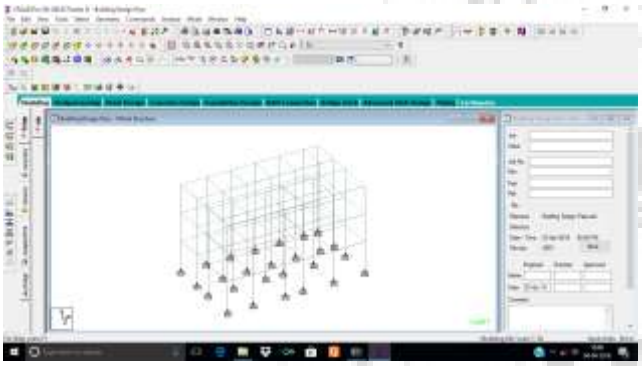


**Figure 1:** 3D modelling in STAAD.Pro

**Analysis and Design Considering Wind Load**
Wind is defined by its strength and direction of blowing. Sometimes because of unpredictable nature of wind it takes so devastating form during some Wind Storms that it can upset the internal ventilation system when it passes into the building.

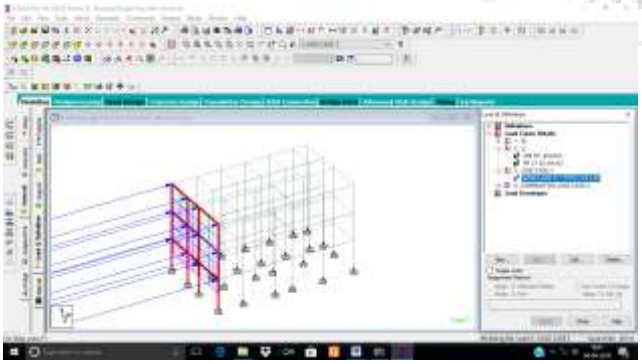


**Figure 2:** Wind Load

**Live Load and Dead Load**
Live load is a civil engineering term that refers to a load that can change over time. The weight of the load is variable or shifts locations, such as when people are walking around in a building. Anything in a building that is not fixed to the structure can result in a live load, since it can be moved around.Dead loads are static forces that are relatively constant for an extended time. They can be in tension or compression.

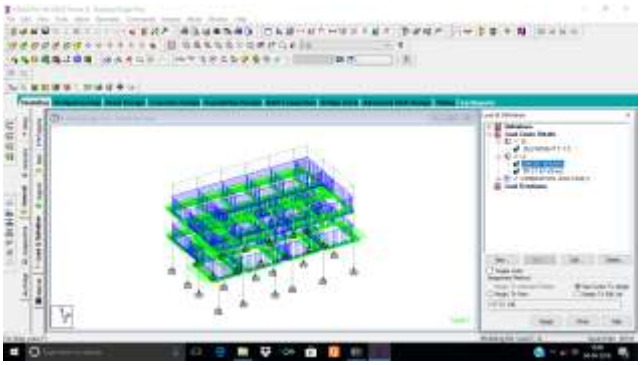


**Figure 3:** Member Load

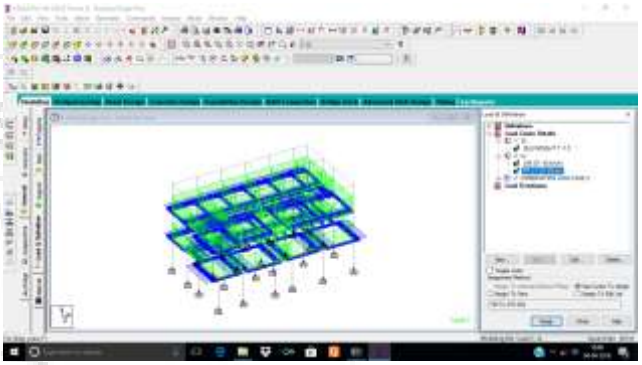


**Figure 4:** Floor Load

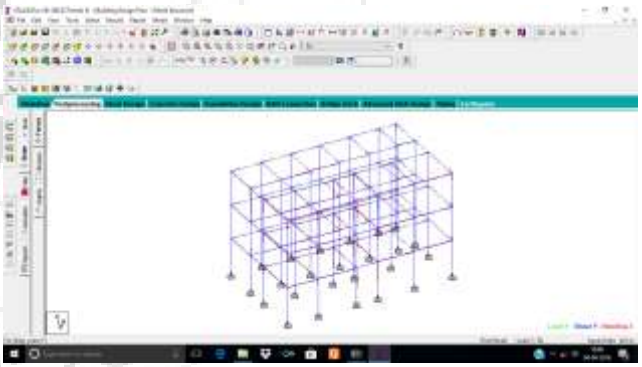


**Figure 5:** Bending Z

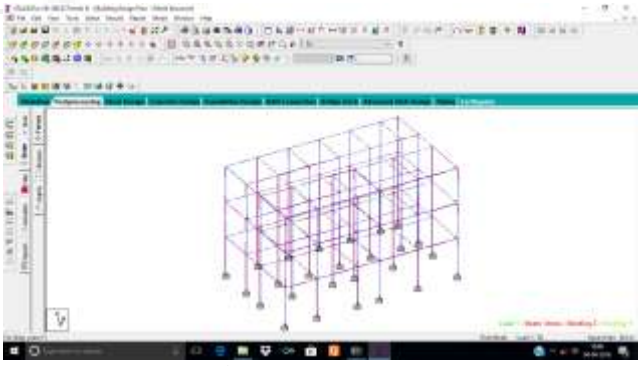
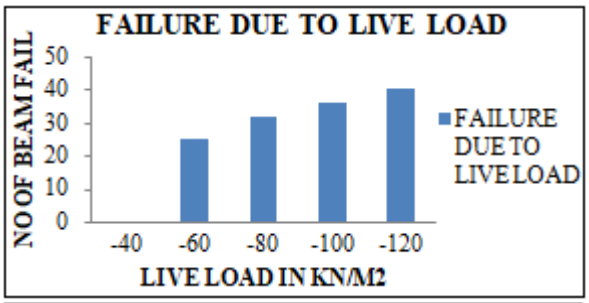
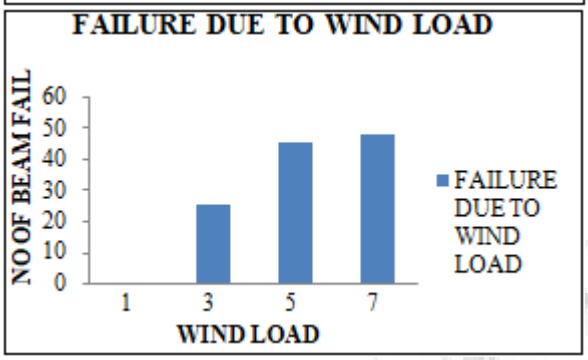


**Figure 6:** Beam Stress

## 6. Results and Discussion




## 7. Conclusion

It can be clearly observed that increase in live load and wind load causes failure of beams and columns in the structure.

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**IS CODES:**

* IS 456-2000 ( Design of RCC structural elements )
* IS 875-Part 1 ( Dead Load )
* IS 875-Part 2 ( Live Load )