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DESIGN AND ANALYSIS OF LOW COST MULTI STORED BUILDING USING STAAD PRO

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Abstract

By outlining the several prefabrication processes and the financial benefits gained by executing them, this project aims to showcase the numerous facets of prefabricated building procedures for low-cost school construction. It is possible to maximize construction speed while decreasing construction cost by analyzing the most crucial building components independently based on the demands. The foundation, walls, entryways, floors, and roof make up the structure of the building. A variety of modern building techniques are covered here, such as structure-block walls, mortarless block walls, prefabricated roofing components (such RC boards, hollow concrete panels, and concrete/ferro cement panels), and more. use of Staad Pro V8 in the creation of affordable educational facilities

Introduction

When we speak about affordability, we're referring to the amount of financial strain a property purchase might put on a specific salary level. Considering the diverse variety of talents and resources available in rural, urban, and suburban locations is crucial when developing and constructing technology house components in India.

Proven method for optimizing the results of do-it-yourself endeavors: With all the possibilities considered, including the technical and economic analyses, there must be a viable approach to supply the right technology.

The first rule of design is that there can be no empty space.

While designing structures, layouts, clusters, etc., bear economics in mind.

3. When creating the required specifications, remember to select building technologies that are budget-friendly.

The energy crisis has hit impoverished nations harder than wealthier ones, making energy efficiency all the more crucial. Landscape and context are important, but so are aspects like

orientation, built-form, apertures, and materials.
5. Establish a reliable framework to ensure that economically disadvantaged and vulnerable groups have access to technologically-based housing that meets their needs. A year later, R.K.

A "Low Cost School Building" scheme based on prefabrication was suggested by P.K. Adlakha and H.C. Puri (2002). Prefabrication has several benefits, including:
1. Prefabricated building components are self-supporting, therefore shuttering and scaffolding aren't needed. Shuttering expenses may be decreased in this way.
From September 25th to the 27th, 2009, ACSGE-2009 was held in India at BITS Pilani.

2. The repeated nature of conventional activities, including cutting and nailing, might potentially damage the shuttering. The per-unit cost is cheaper with precast components since the mold may be used for numerous products.
The time it saves during foundation building is the third benefit of a prefabricated housing system. This is because precast pieces are cast off-site, which is a huge boon. The finishing and services may be completed right under the slab. Traditional in-situ RCC slabs cannot be used for operations due to the presence of props and shuttering, which must be removed. Money is saved in direct proportion to the amount of time saved.
4. It offers better production and economic efficiency due to the fact that precast building components are often of the same sort.
5 More efficiency, less waste, and quicker execution are outcomes of precast building due to the mass-production of components with comparable shapes.
By reducing the amount of labor needed on-site, prefabricated buildings improve dependability, cleanliness, and overall project quality.
7, compared to traditional approaches, the execution time is much lower, which might mean a shorter building period and early returns on investment.

Precast RC boards are used above partly precast joists in this design. A thickness ranging from three to six centimeters is possible for rubber composite boards. The board's widening haunches are visible. In order to create the illusion of tee-beams, the space more than 3 cm thick is filled

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with in-situ concrete once the plank is installed between the joists. An additional concrete filler, three centimeters broad and tapering, is also supplied to strengthen the haunch piece during handling and installation. Twelve sets of six millimeter cross bars spaced twenty millimeters apart and three sets of six millimeter MS primary reinforcement fortify the planks. Planks cannot exceed 50 kg in weight, 150 cm in length, and 30 cm in module width, as seen in Figure 2. Precast joists are 15 cm wide and 15 cm deep when laid out in a rectangle (Figure 2). While pouring in-situ concrete over boards, the previously specified section is cast at the same time. On the prefabricated joist, you can still see the stirrups. Because of this, the total depth of the joists is 21 cm. Composite Tee-beam joists made from both in-situ and precast concrete have a 3-centimeter-thick flange, as shown in Figure 3. The maximum allowable span length for this joist segment is 400 cm. A deeper joist and a basic chain pulley block are all that's needed to lift over larger spans. You may utilize the polished slab as a landing floor leading out of the living area. It is possible to build balcony projections into residential buildings using partially prefabricated joists. Several weights, including the self-load, the railing load, and any additional loads indicated in IS: 875-1964, may be supported by the overhanging portion of these projections. The primary reinforcement of in-situ concrete that gives it enough strength is the top overhang. When compared to the standard RCC slab, the savings in real-world applications are around 25%. According to Adlakha and Puri (2002), the 2009 ACSGE conference took place from September 25th to the 27th at BITS Pilani in India.

Fig. 2 Precast R.C. Planks Fig.

Fig. 3 R.C. Planks laid over partially precast joists

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R.C. Planks laid over partially precast joists

STAAD.Pro

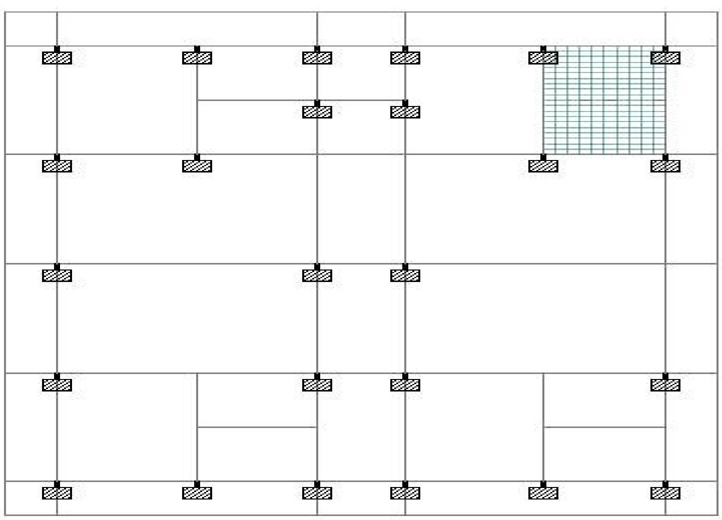

Fig 4.1: plan of the**Low Cost Multi Stored Building**

All columns = 0.50 * 0.50 m

All beams = 0.6 * 0.3 m

All slabs = 0.10 m thick

Terracing = 0.2 m thick avg.

Parapet = 0.10 m thick RCC

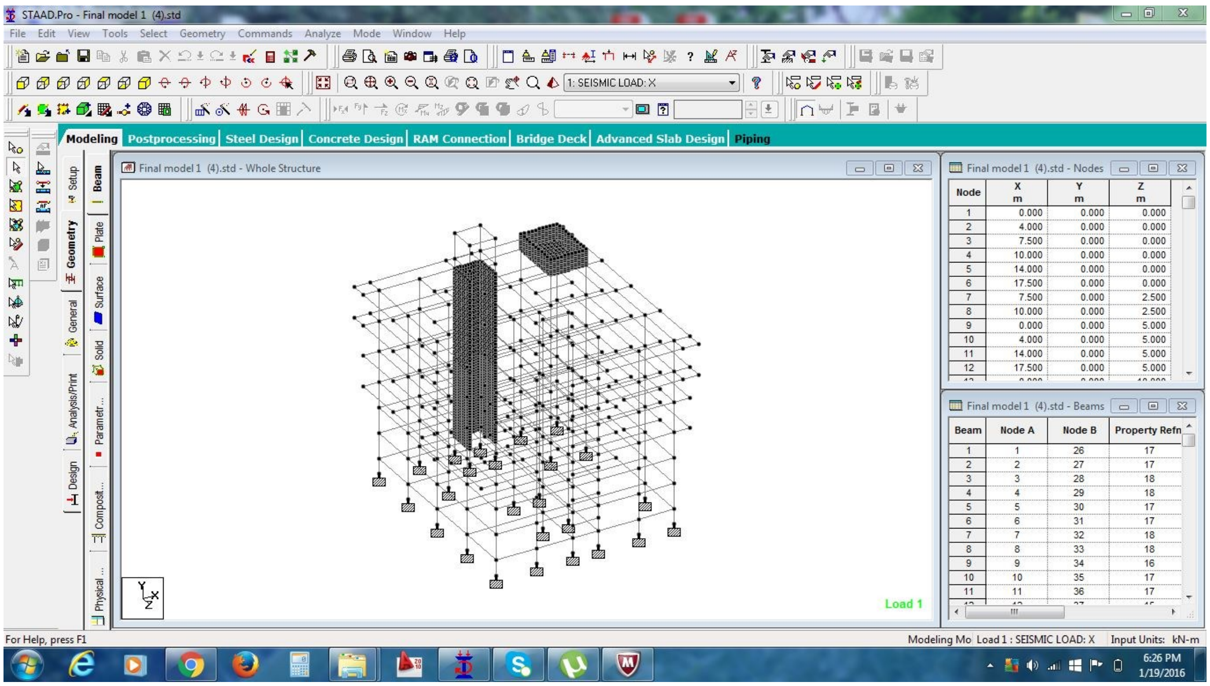

Fig 4.2: Elevation of the **Low Cost Multi Stored Building**

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4.1 Physical parameters of building:

Length = 3 bays @ 7.5m = 22.5 m

Width = 3 bays @ 7.5 m = 22.5 m

Height = 1.5 m + 10 storeys @ 3m = 33.5m

(1.0m parapet being non- structural for seismic purposes, is not considered of building frame height)

Live load on the floors is 3 kN/m^2

Live load on the roof is 1.5 kN/m^2

Grade of concrete and steel used:

Used M25 concrete and Fe 415 steel

Generation of member property:

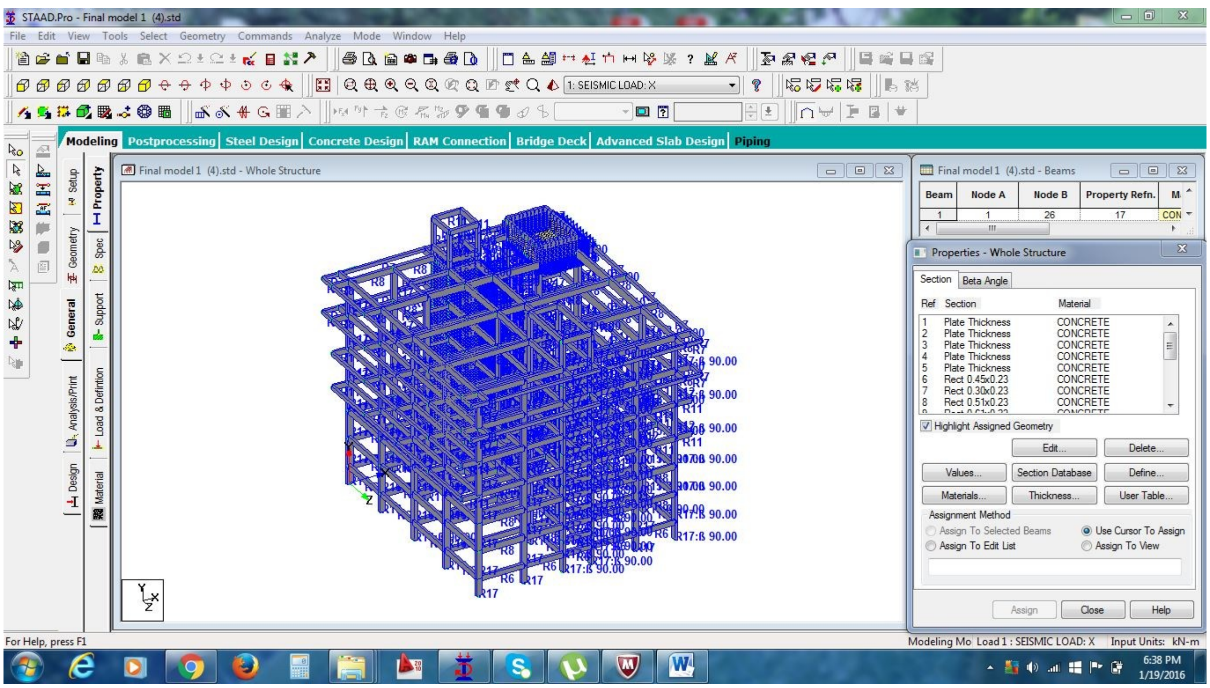

Fig 4.3: Generation of member property**Low Cost Multi Storedl Building**

In STAAD, you may create member property. Proficiently by using the window as shown above. The dimensions have been specified, and the portion of the member has been selected. The beams on the ground floor are 0.6 * 0.3 m in size, while the columns on the upper floors are 0.5 * 0.5 m.

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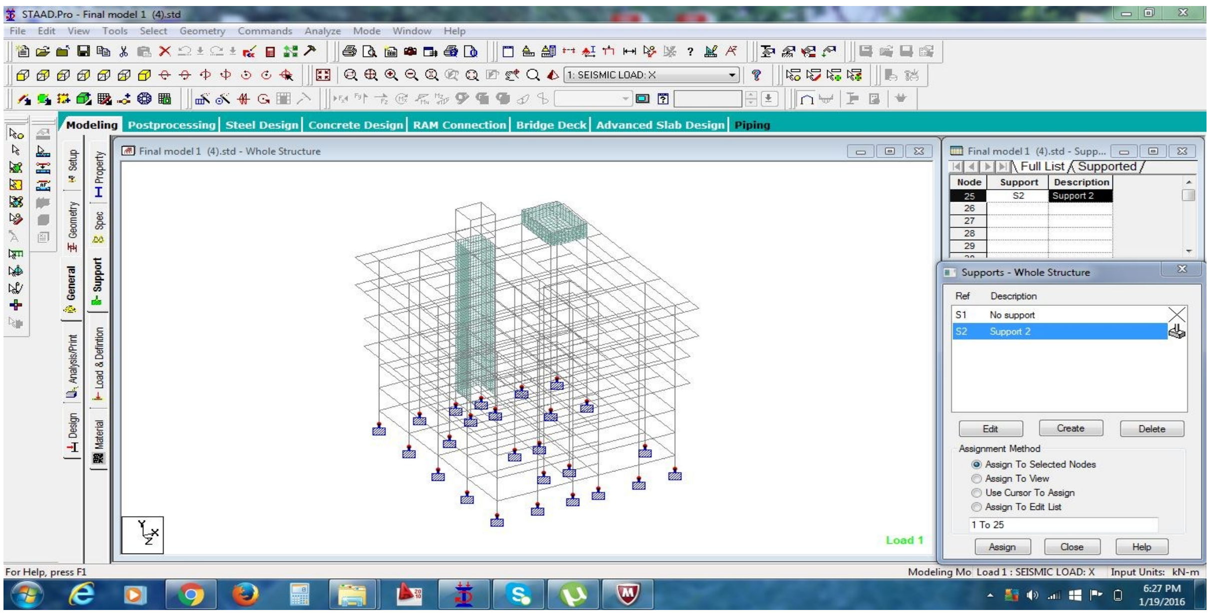
4.3 Continuity of Use:

The structural supports at the foundation were accorded a fixed status. The STAAD was used to generate the supports. Generator designed to assist professionals



fixing supports of the structure**LowCost Multi Stored Building**

4.4 Materials for the structure:

The construction materials, including concrete and its many constants, were specified according to the standard IS code of practice.

The Mechanism (Section 4.5):

The bulk of the loadings were generated via the STAAD.Pro load generator, however a small number were calculated manually. A wide variety of loading cases are listed below:

Personal weight, dead load from slab, live load, wind load, seismic load, and any combination thereof are all part of this equation.

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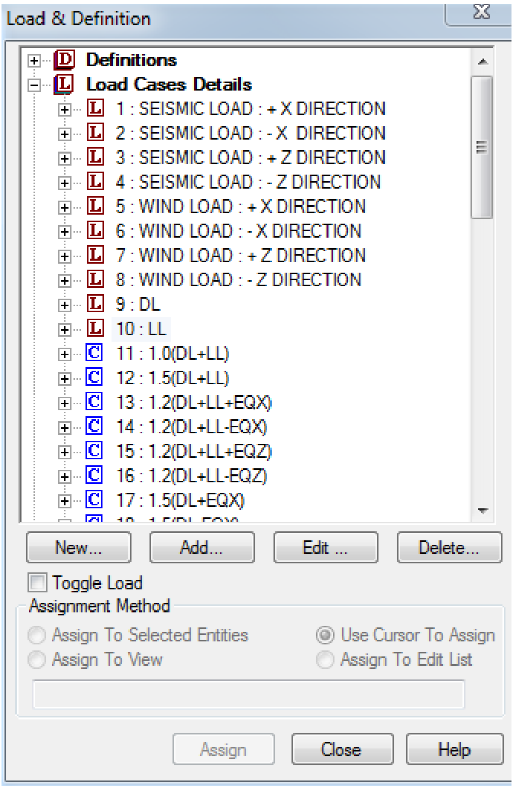

Fig 4.5: primary load cases**Low Cost Multi Stored Building**

Self-weight

The building may be made to self-support using STAAD. To start with a blank slate while making Pro, use the self-weight command located in the load case column.

Extra material that is not being used:

Another feature accessible in STAAD is the ability to load slabs silently. You can get in touch with a professional if you measure the floor's thickness and figure out its load per square meter. The weight of the roof parapet, outside walls, columns, RCC slab, terracing, and RCC slab were added together to get the load per square meter.

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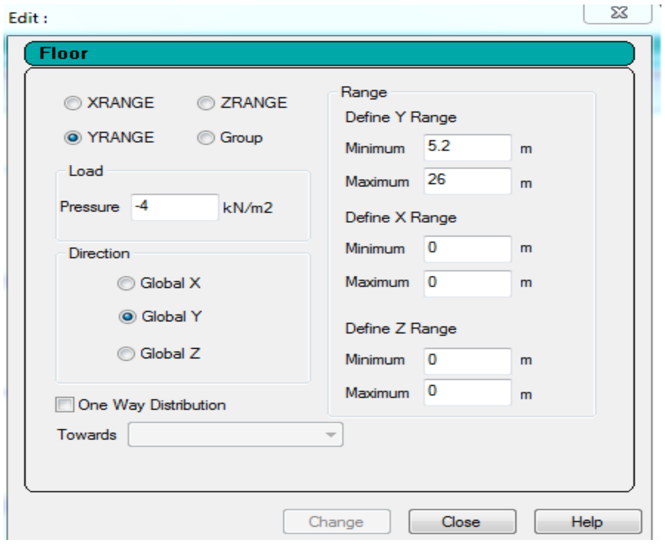

Fig 4.6: input window of floor load generator

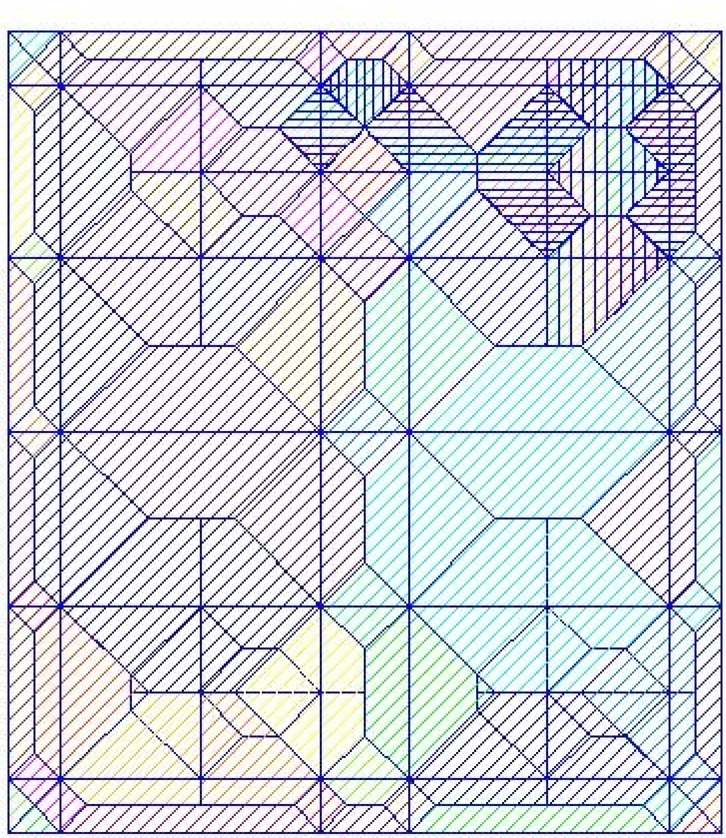

Fig 4.7: load distribution by trapezoidal method

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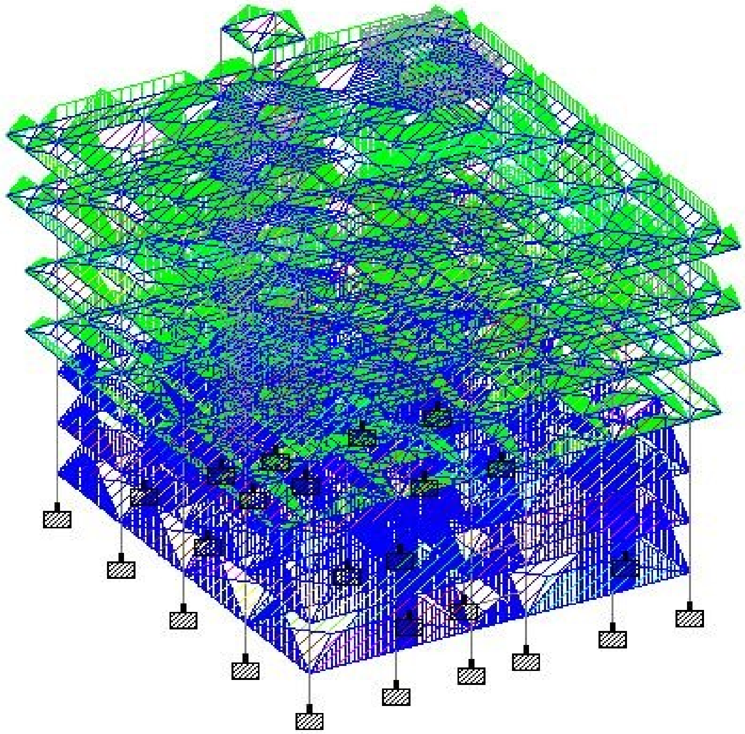

Fig 4.8: the structure under DL from slab

Live load:

Live load on other levels was 4 KN/sq m, while it was 1.5 KN/sq m on the patio level. Just like with the dead load, the procedure for making the live loads on each level was the same as before. To do this, go to the "load case" column and find the "member load" button.

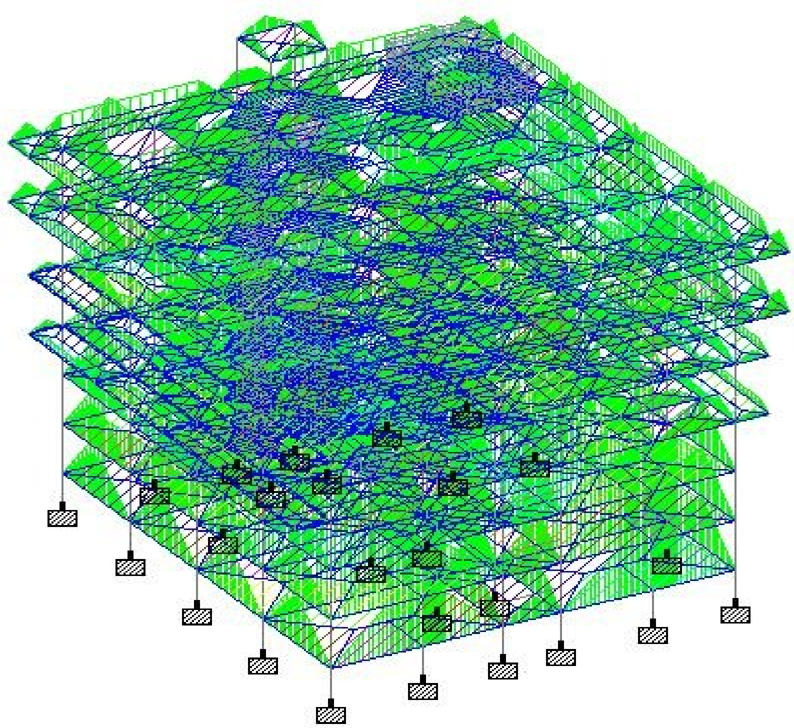

Fig 4.9: the structure under live load

Wind load:

The wind load figures were automatically calculated by the program in compliance with IS 875. You may find the definition of wind load in the "define load" portion of the command. Data from manual wind speed and direction measurements taken at different heights were fed into the program. Using those numbers, we can calculate the wind stress on various floors.

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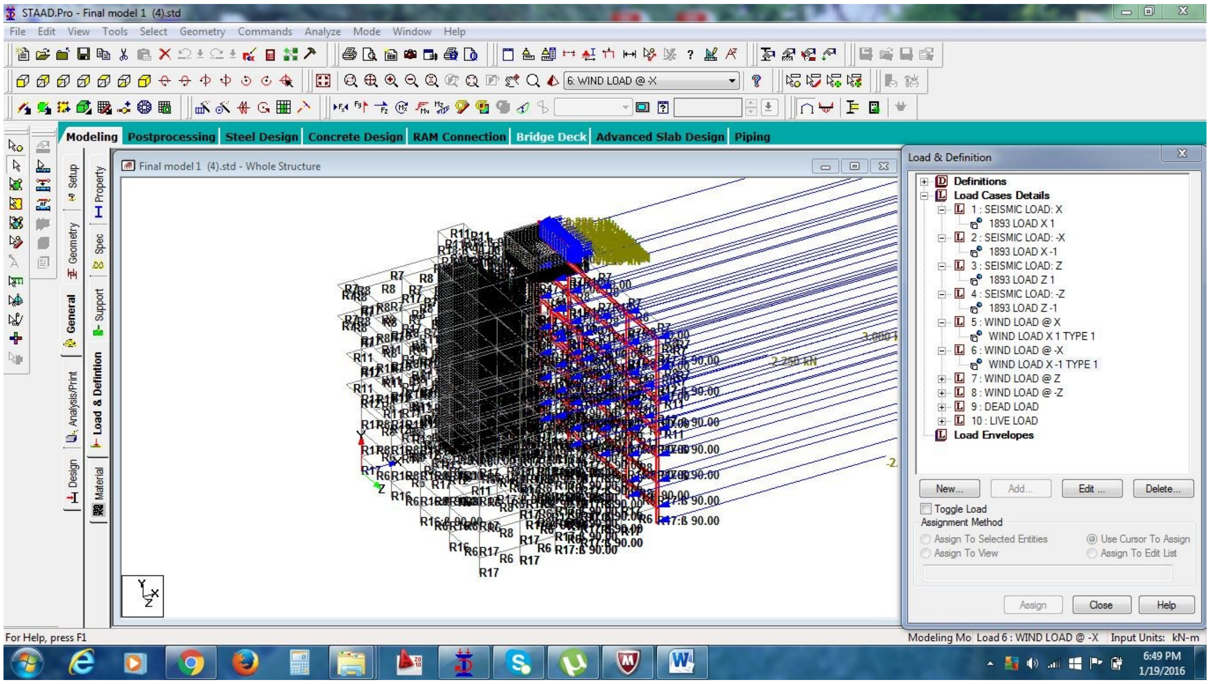

Fig 4.10: wind load effect on structure elevation and plan**Low Cost School Building**

Seismic load:

The seismic load values were computed in accordance with IS 1893-2002. Above ground. There is a seismic load generator available to Pro that complies with IS standards.

Description:

For some reason, the seismic load generator is limited to producing tertiary loads along the X and Z axes. Along the Y-axis, the pull of gravity acts. Using the "SET Z UP" command, which changes the Z-axis to the vertical axis, unfortunately disables this feature.

Approach to the Research:

While determining the design base shear, STAAD follows the guidelines provided by IS: 1893(Part 1)-2002.

$$V = Ah*W$$

Where, $Ah = (Z*I*Sa)/ (2*R*g)$

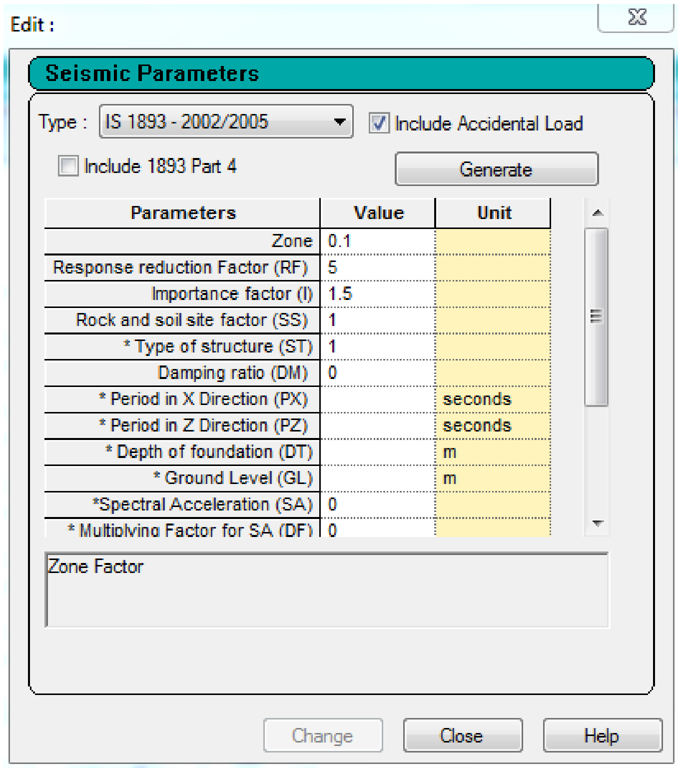

Fig 4.11: seismic load definition

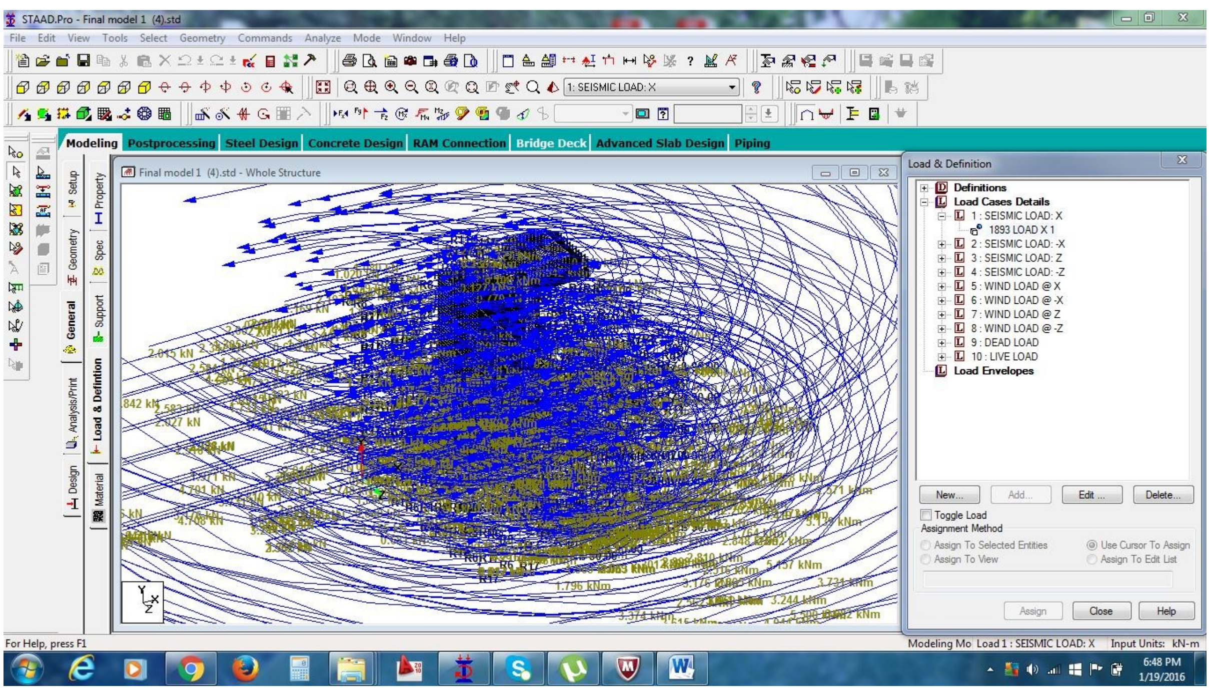

Fig 4.12: structure under seismic

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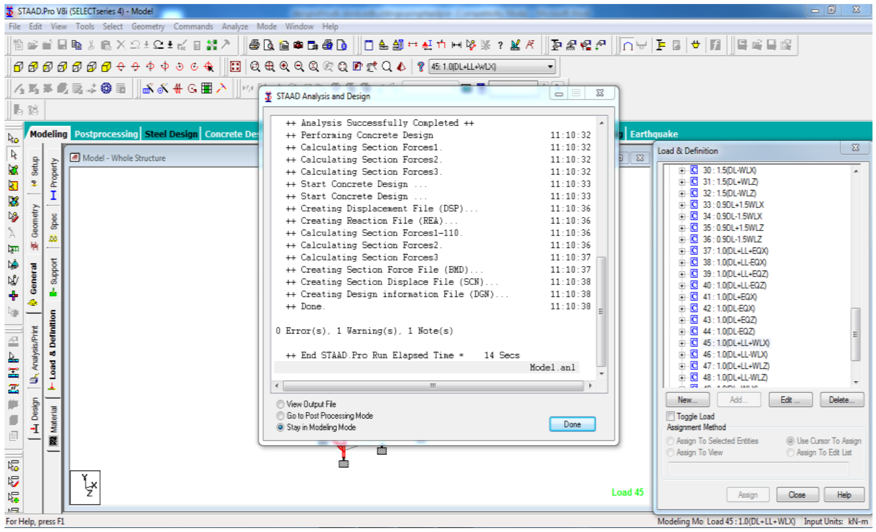

Fig 4.13: GUI showing the analyzing window**Low Cost School Building**

CHAPTER 5

Conclusions

By finding common ground based on demographic needs, surveys, and efficient use of resources, we may be able to construct affordable schools. When building and running the facility, this strategy differs from the norm by not catering to specific demands. Unless the product is cheap and efficient, alternative technologies will not gain widespread adoption. To accomplish the aforementioned objective in a controlled environment, partial prefabrication is one option. What matters most is not a certain style of architecture but rather a systematic approach to construction procedures. Simpler methods requiring less cash are required for affordable housing solutions. According to Adlakha and Puri (2002),

Any concrete segment's reinforcing requirements may be determined with the help of STAAD PRO. The design of the software adheres to the specifications specified in IS: 456(2000). The three main uses of beams are bending, twisting, and shearing.

Making a Beam:

As indicated earlier, the parts in question determine the maximum sagging and hogging seconds for any active load condition. When a beam hogs, the stress is applied to the top face of the beam, but when it sags, it applies to the bottom face as well. When it comes to sagging and hogging, these parts are built to last. A rectangular component that is double reinforced is an option to consider if the strength of a piece with one reinforcement is insufficient.

Shear Design:

Both the shear force resistance and the torsional moment are critical factors to think about while building shear reinforcement. The shear capacity is calculated for various sections that do not have shear reinforcement by using the real tensile reinforcement offered by the STAAD algorithm. When used with stirrups that have two legs, the components can endure the shear stresses that happen when balancing.

Beam Design Outcomes:

The default design outcome involves the pre-insertion of shear and flexural reinforcement at regular intervals throughout the length of the beam.

Designing Columns:

When columns are designed, axial forces and biaxial moments are considered. Reinforcement is determined by considering all possible active load scenarios. The critical load is the loading that stresses the material to its breaking point. Square parts are designed with columns. Reinforcement is equally distributed on both sides of square column sections subjected to biaxial stresses and on both faces of sections exposed to uniaxial moments. According to IS: 456, the STAAD column design satisfies all the necessary requirements for longitudinal and transverse reinforcement alternatives.

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