A Review Analysis of Multistory Buildings With Different Types of Loading Using Staad Pro

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Abstract- *STAAD Pro's user interface is fairly interactive, allowing users to create the frame and input load numbers and dimensions. The structure is then analysed and members having reinforcement detailing of R.C.C. frames are designed based on the supplied criteria. We continued to experiment with multi-storeying 2-Dimensional or 3-Dimensional frames underneath a variety of stress conditions. The appropriate analysising and designing of G + 29 R.C.C. frame underneath diverse loading combinations was our final project.*

Buildings are designed to meet our basic needs and provide improved serviceability in today's world. It is not difficult to construct a structure; nonetheless, it is critical to construct an efficient structure that will serve for many years without fail. The project, titled "A Comparative Analysis of Multistory Buildings with Different Types of Loading Using Staad Pro," tries to identify a better way to create geometry. Defining the cross sections of columns and beams, among other things Then the loads are described by creating specifications and supports (to define whether a support is fixed or pinned). The model is then examined using 'run analysis.' Then reviewing (whether beam column passed in loads or failed) results. Then the design is performed.

Complex and high-rise constructions necessitate lengthy and time-consuming computations utilising traditional manual methods. STAAD.Pro gives us with a platform for analysing and creating structures that is quick, efficient, simple to use, and accurate.

Keywords- Staad Pro, multistory Buildings, 3-D frames, Geometry, high-rise structures, run analysis

I. INTRODUCTION

In 21st century due to huge population the no of areas in units are decreasing day by day. Because the population was not as great a few years ago, they stayed in the Horizontal system (due to large area available per person). However, nowadays, individuals prefer the Vertically System. In high-rise buildings, we must consider all of the forces acting on the structure, including its own weight and the soil bearing capability. External forces acting on the building should be able to be successfully countered by the beam, column, and reinforcement. Furthermore, the earth must be suitable for successfully passing the load to the foundation. We wanted a deep foundation for loose soil (pile). If we perform all of the calculations for high-rise building manually, it will take longer and may result in human errors. As a result, using STAAD-PRO will make things simple. STAAD-PRO is capable of resolving common issues such as static analysis, seismic analysis, and natural frequency. STAAD-PRO, in conjunction with IS-CODE, can tackle these types of problems. Furthermore, STAAD-PRO has a significant benefit over manual techniques in that it produces much more perfect or specific results.

STAAD-PRO was born a colossus. Its largly using programme nowadays. Basically, it entails doing out design work. To achieve the purpose, STAAD-PRO is used in four steps

- Preparing input files.
- Analyzing input file.
- Watch results and verifying them.
- Sending all the analysing result to steel or concrete designing engines for designing purpose.

1. Prepare the input file-

- First of all we described the structure. In description part we include geometry, the materials, cross sections, the support conditions.

2. Analyze the input file-

- Make certain you're using STAAD-PRO syntax. Otherwise, an error will occur.
- We must ensure that everything we enter in stable structure.
- Otherwise, an error message will appear.
- Finally, we must double-check our output data to ensure that the input data was entered accurately.

3. Watching results and verifying them.

- The result is read in the POST PROCESSING Mode.
- We begin by selecting the output file that we want to examine (for example, various loads or load combinations). The results will then be displayed.

4. Sending analysing result to steel or concrete designing engines for designing purpose.

- If someone wishes to undertake design after analysis, they can ask STAAD-PRO to design based on the analysis results.
- The data, such as Fy main and Fc, will be assigned to the view. • The design beam and design column will then be added.
- When you run the analysis, it will display you the entire design structure.

STAAD.Pro having various parts:

***The STAAD.Pro Graphical User Interface*:** Its using for generating models, so its analysis by STAAD engine. After analyzing, designing is completely done, GUI is using for viewing results graphically.

The STAAD analysing and designing engine: It's a multi-purpose computation engine for structural analysis and integrated steel, concrete, wood, and aluminium design.

To begin, we used STAAD Pro to answer some sample issues and double-checked the accuracy of the results with hand calculations. Obtained result is satisfying or accurate. At the starting days of period firstly calculating loads and seismic and wind loading.

Structural analysis is the study and prediction of the behaviour of structures using a set of physical rules and mathematics. It thought of more broadly as a way to influence the engineering designing processes or to show the soundness of designing with no having to test it firsthand.

Support responses, strains, and displacements are common outcomes of such an investigation. After then, the data is evaluated for criteria which indicating failure circumstances. Dynamic response, stability, and non-linear behaviour can all be studied using advanced structural analysis.

II. OBJECTIVE OF STUDY

The goal of design is to achieve sensible chance that buildings being created will work adequately for duration of their planned lives. They should be able to withstand all of the loads and deformations that come with typical construction and operation, as well as have acceptable durability and resilience to the effects of earthquake and wind. The Limit State Method is typically used to design structures and structural parts. Accepted theories, experimentation, and experience, the necessity to design for endurance, should all be considered. Design, including durability design, construction, and use in service, should all be taken into account. Compliance with well specified standards for materials, manufacture, workmanship, as well as maintenance and use of the structure in service is required to achieve design objectives.

The building's design is dictated by the minimum standards set forth in the Indian Standard Codes. The minimum criteria for structure safety of buildings are handled by establishing minimum design loads that must be understood for D.L., I.L., externally loading that the structure must bear. It is envisaged that strict adherence to the loading criteria proposed in this code will not only assure structure safety of buildings being developed.

III. LITERATURE REVIEW

Viviane Warnotte summarized basic concepts on which the seismic pounding effect Occurs between adjacent buildings. He identified the conditions under which the seismic Pounding will occur between buildings and adequate information and, perhaps more Importantly, pounding situation analyzed. From his research it was found that an elastic model cannot predict correctly the behaviors of the structure due to seismic pounding. Therefore non-elastic analysis is to be done to predict the required seismic gap between buildings.

Shehata E. Abdel Raheem developed and implemented a tool for the inelastic analysis of seismic pounding effect between buildings. They carried out a parametric study on buildings pounding response as well as proper seismic hazard mitigation practice for adjacent buildings. Three categories of recorded earthquake excitation were used for input. He studied the effect of impact using linear and nonlinear contact force model for different separation distances and compared with nominal model without pounding consideration.

Robert Jankowski addressed the fundamental questions concerning the application of the nonlinear analysis and its feasibility and limitations in predicting Seismic pounding gap between buildings. In his analysis, elastoplastic multi-degree of freedom. Lumped mass models are used to simulate the structural behavior and non-linear viscoelastic impact elements are applied to model collisions. The results of the study Prove that pounding may have considerable influence on behavior of the structures.

M.S. Medhekar & Sudhir K. Jain, [1993] carried out an extensive study of the codes of other countries on design and detailing of RC shear wall and presented an example of design and detailing of shear wall for a two storey building. On the basis of the study, authors recommended various provisions for shear strength requirements, flexural strength, boundary elements and reinforcement around openings which were not incorporated at that time by Indian standards.

Naofumi Teramoto et al [2000] carried out pseudo dynamic test on RC shear walls and also carried out analysis by nonlinear finite element method in order to study the seismic behaviour and damage patterns on RC shear walls under seismic loading. They prepared two specimen of double storey cantilever shear wall with the same scale and same geometry and tested them using two motion waves with different time duration (1) long time duration wave and (2) short time duration wave having same response spectrum acceleration. Response displacement and load displacement relationships obtained from both test results and dynamic analysis were compared to find whether experimental test results were successfully simulated by the finite element method of analysis or not. They observed that the load-displacement behaviour for short duration wave and long duration wave showed a large difference and as the duration of motion increases maximum response displacement also increases and concluded that the analytical calculated response verifies the experimental results in all the cases.

Dan Palermo [2002] et al, presented in Journal of the American Concrete Institute, Results from two extensive scale flanged shear dividers tried under static cyclic removals are introduced. The targets of the tests were to give knowledge into the conduct of shear dividers under cyclic relocations, and all the more significant, to give information to help confirm constitutive models for concrete presented to discretionary stacking conditions. The outcomes showed that the nearness of a hub stack, albeit moderately little, and the solidness of spine dividers significantly affect the quality, flexibility, and disappointment instruments of the shear dividers. Limited component examinations utilizing temporary constitutive models are likewise given to demonstrate that the methodology utilized is steady, agreeable, and give sensibly exact re-enactments of conduct. The investigations displayed likewise showed that two-dimensional examinations catch primary highlights of conduct, however, three-dimensional examinations are required to catch some imperative second-arrange instruments.

Bouchon Marc et al [2004] conducted a cyclic loading test on low rise reinforced concrete shear wall to define the crack geometry. Three concrete shear wall having low slenderness ratio and varying percentage of steel were subjected to sequence of three increasing load and one wall out of three was loaded till failure. Parameters like displacement as a function of horizontal force, cracking states during loading cycle and deformation of rebar were measured to define a relationship between crack geometry and diagonal elongation. Based on the test result they concluded that crack density increases with an increase in percentage of rebar and formula in CEB-FIP-1978 (model code as a means of assessing crack spacing and opening of France) for predicting crack width is not satisfactory for shear cracks in shear walls and this subject needs further studies.

A Ghobarah and AA Khalil [2004] presented the test result of the numerical analysis obtained during analysis of RC structural walls models strengthened by using CFRP sheets (carbon fibre reinforced polymer sheets) and FRP (Fibre reinforcement polymer) reinforcement. They utilized the test results obtained from the laboratory testing of eight scaled, low rise shear walls with boundary elements having same geometry performed at Barda (1972). They observed the horizontal displacement, ductility, energy dissipation capacity and hysteretic loops and compared the envelops of cyclic load with the displacement curves to conclude that the confinement of concrete in the plastic hinge region increases the ductility of the RC wall and use of an extra layer of FRP on the plastic hinge area improves the behaviour of shear wall during the seismic loading. Also, the application of externally bonded carbon fibre sheet is an effective way of strengthening a RC shear wall.

IV. FORMULATION OF PROBLEM

TYPES OF LOADING USED

DEAD LOAD (DL):-

It caused by its own weight is known as DEAD LOAD (self-weight). If a permanent structure is built to that structure, it also adds additional loads.

LIVE LOAD (LL):-

It caused by moving weight is known as L.L. or I.L.. Its completely depends on structure. For example, the LIVE LOAD for a residential building is typically 2kn/m2.

WIND LOAD (WL):-

WIND LOAD is the load placed on structure as resulting of wind speeds. The intensity of wind varies from time to time. As a result, it is recommended that maximum possible wind intensities be calculated for a structure to avoid damage.

SEISMIC LOAD (SL):-

The SEISMIC LOAD can be computed based on the ground's acceleration response to the superstructure. They are classified into four zones based on strictness of earthquake.

1. Zone I and II are combined as zone II.
2. Zone III.
3. Zone IV.
4. Zone V.

3.2 CALCULATION OF LOADS

1. DEAD LOAD CALCULATION:

The cross sectional area of wall multiplied by unit wt. of brick should be the MAIN WALL LOAD. (The unit weight of a brick is 19.2 kn/m3)

PLINTH should be half of MAIN WALL LOAD, according to IS-CODE.

P.L. shall be halfed of the internal PLINTH LOAD.

The cross sectional area should be multiplied by the unit weight for PARAPATE LOAD.

The SLAB LOAD shall mix of slab and floor finishes. The slab thickness multiplied by the unit wt. of concrete (As per IS-CODE, the unit wt. of concrete is 25 kn/m3) yields SLAB LOAD. FLOOR FINISHES are calculated at.5-.6 kn/m2.

2. LIVE LOAD CALCULATION:

Except for the plinth, LIVE LOAD is used throughout the superstructure. The amount of LIVE LOAD varies depending on buildings type. LIVE LOAD is calculated as 2kn/m2 on every floor and -1.5kn/m2 on the roof for residential buildings. It is acting in a downward direction, as indicated by the negative sign.

3. WIND LOAD CALCULATION:

As per IS CODE (875 PART 3),

$$V_z = V_b \times K1 \times K2 \times K3$$

Here Vz=designing speed of wind at ht. z meter in m/s.
Vb=basic designing speed of wind at 10m ht. For ex. Vb is 50 m/s for cities like Cuttack and Bhubaneswar and 39 m/s for Rourkela.K1, K2, K3 calculating as IS-CODE(875 part3).
Pz=Designing wind pressure at a ht. z meter.
Pz=0.6 Vz2

4. SEISMIC LOAD CALCULATION:

As per IS-CODE 1893(part 1) the horizontal Seismic coefficient Ah for a structure showing as

$$Ah=ZISa/2RG$$

Here

Z=Zone factor depending on structural zone belonging to.
For Zone II (z=0.1)
For Zone III (Z=0.16)
For Zone IV (Z=0.24)
For Zone V (Z=.36)
I=Importance factor.

For buildings like hospital its taking as 1.5 and for other buildings its taking as 1.

R=Response reduction factor.
Sa/g=Average Response Acceleration coefficient.
Yet its noticed that ratio of I and R shouldn't be more than 1.

3.3. LOAD COMBINTION

1. For seismic loading analysis of a building.

- 1.5(DL + IL)
- 1.2(DL + IL ± EL)
- 1.5(DL ± EL)
- 0.9 DL ± 1.5 EL

2. For wind loading analysis of a building.

- DL +LL
- DL+WL
- DL+0.8LL+0.8WL

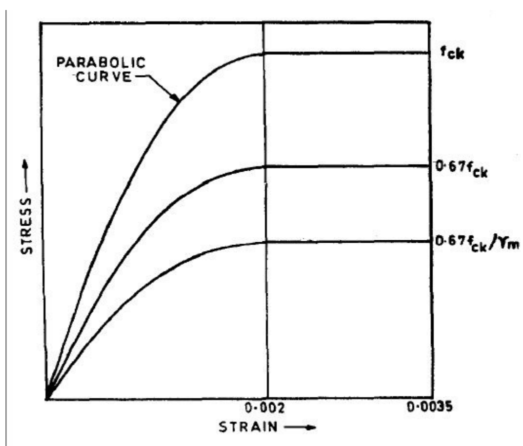
Both W.L. and E.L. applying in X and Z direction. This loading system are also appling in -ve X and Z direction.

So for Seismic analyses total 18 loading grouping and for W.L. analyses total 11 loading grouping.

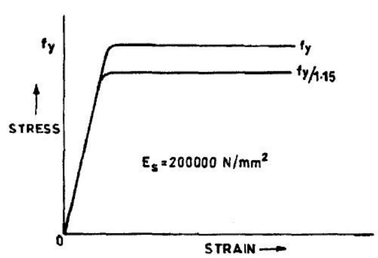
REINFORCED CONCRETE CEMENT:

Commonly concrete is enough stronger in compression and approximately zero to tension. So reinforced (steel bars) is providing for resisting tensioning and to counteract the moment which can't resist by the concrete. Due to non-uniform compaction and poor curing, F.O.S. for concrete is usually 1.5, while F.O.S. for steel is 1.15. Because compressive strengthening of concrete is always less than the cube strength, it is always used. As a result, the maximum concrete strength is used in the design work.

0.67fck/1.5=.45fck and for steel is fy/1.15=.87 fy



STRESS-STRAIN CURVE FOR CONCRETE



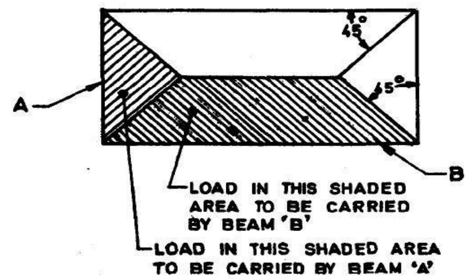
STEEL BAR WITH DEFINITE YIELD POINT

REPRESENTATIVE STRESS-STRAIN CURVES FOR REINFORCEMENT

BEAM:- The distance b/w centroid area of the tension member and the highest compression member is known as eff. depth of beam. For various beams, the span length to eff. depth ratio is calculated as follows.

CANTILEVER-7
SIMPLY SUPPORTED-20
CONTINUOUS-26

Both transversally and longitudinally, the Reinforced should be supplied. To keep the longitudinal bar in place, transverse reinforcement is supplied. The maximum amount of reinforcing for a beam should not exceed 6%.



LOAD CARRIED BY SUPPORTING BEAMS

A beam should have a minimum shear reinforcement of.75d or 300mm, whichever is less.

COLUMN OR STRUT: A column or struct is a member that bears compressional load.
Depends on L and D ratio, a column might be classified as Long or Short.
Long column is when lex/B or ley/D is greater than or equal to 12; otherwise, short column.

Where

lex is the effective length in X-axis.
ley is the effective length in Y-axis.
B is the breadth of member.
D is eff. depth of member.

In general, the code allows for up to 6% column reinforcement. However, only a maximum of 2.5 percent reinforcement is used on site condition. In general, more sizes are taken in the middle of the column because it bears greater weight than the others.

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