SEISMIC PERFORMANCE EVALUATION OF REGULAR AND IRREGULAR RC BUILDING BY PUSHOVER ANALYSIS THROUGH STAAD PRO

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ABSTRACT

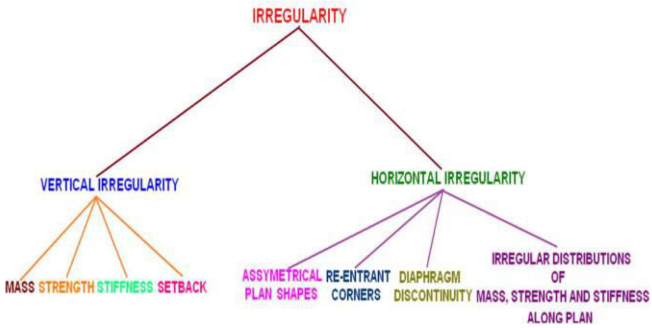
The buildings are built to meet our basics and to improve serviceability in these current times. It is not an issue to create a building as it is necessary to design an effective building that serves without failure for many years[1]. Project seeks to develop better geometry creation techniques, Defines column and beam cross sections etc. The loads are then defined by creating specifications and supports (it is fixed or pinned to set support for weather). The model is then analyzed using 'run analysis.' A material with linear static properties is assumed for dynamic analysis[2]. These analyses are done with regard to various seismic zones and behavior evaluations by taking the soft soil for each zone. Displacing the base shear and shelf drift in various areas for different soil types might be reported differently. Then, the findings (whether loaded or failed beam column) have been checked. The design is then carried out.

KEYWORDS: Seismic Evaluation, Pushover Analysis, Reinforced-Concrete Buildings

I. INTRODUCTION

The fundamental goals of any structural design are safety, serviceability and economy. Achieving these goals for design in seismic region is especially important and difficult to achieve. Uncertainty and unpredictability of when, where and how an earthquake event will strike a community increases the overall difficulty. In addition, lack of understanding and ability to estimate the performance of constructed facilities makes it difficult to achieve the above mentioned goals[1]. In some cases, especially under strong earthquake excitations, these can cause the structural damage or even collapse of structure. For the structures that have high in hereunto natural damping, the likelihood of damage will be decreased. However, for structures subjected to strong vibrations, the in hornet damping in the structure is not sufficient to mitigate the structural response[3]. In many situations, supplemental damping devices may be used to control the response of structure.

The construction component that is resistant to seismic forces is known as a side resistant system (L.F.R.S). The building's L.F.R.S may be of several kinds. Special instantaneous frames, shear walls and dual frames wall systems comprise the most often used shapes of these systems in a construction[4]. Due to damage to a structure, the structural weak planes in the building systems usually are located. These deficiencies cause additional degradation of the structure leading to a structural collapse. The structural abnormalities in the rigidity, strength and weight of a structural system are typically the reason of these vulnerabilities. The structural abnormalities can be widely categorized as plane and vertical. If a structure has uneven distribution of mass, strength and steepness along the height of the building, it can be characterized as vertically irregular. According to IS 1893:2016[11], a building floor is deemed to possess mass irregularities if its mass exceeds 200% of that of the surrounding floor. If a shelf's rigidity is less than 60% of the next shelf, a floor is called the "weak shelf." When a floor's rigidity is under 70 percent or more than that of the neighboring floor, the floor is called a soft shop. Many extant structures in fact have irregularities, some of which were originally meant to carry out irregular roles, e.g. for commercial reasons produced by removing centre columns.



Failures occurred during the past earthquakes

Because of rapid mass changes, steadiness and strength along vertical or horizontal lines, a building structure might collapse or be seriously damaged by seismic forces. As mentioned in the last section, structural abnormalities lead to the structural collapse. The next sections show building failure caused by various sorts of structural defects during the historical earthquakes.

Figure1 Over view of building :(a) West side view ,(b) East side view, (c) South side view and close-up , (d) Plan view , (e) Details of the main collapse at story12 ,(f)Damage in short columns in axis , (g)Overall condition of the 21st story

II. OBJECTIVE OF VIEW

There is a comparison of two 30-story buildings utilizing a different load combination with the same beam and column size.

Buildings are loaded by seismic criteria and another one is loaded by regular circumstances of loading.

The columns are compared with the area of steel and the % of steel.

The test will be carried out on the STAAD.PRO FEM programme.

Dead load (DL) ,LIVE LOAD (LL), WL (WL) and SEISMIC LOAD are the kind s of loads that are employed (SL).

LOAD COMBINTION

1. For seismic load analysis of a building the code refers following load combination.
   2. 1.5(DL+IL)
   3. 1.2(DL+IL±EL)
   4. 1.5(DL±EL)
   5. 0.9DL±1.5EL

2. For wind load analysis of a building the code refers following load combination.
   1. DL+LL
   2. DL+WL
   3. DL+0.8LL+0.8WL

It took larger internal size since it always took more charge than the outward one.

If larger dimensions are not provided, compression will fail.

I. METHODOLOGY

In general, design activities are carried out. STAAD-PRO is used to achieve the objective in four stages.

• Input file preparation.
• Input file analysis.
• Monitor and verify the outcomes.
• Send the results of the investigation to developing steel or concrete motors.

1. Input file- Prepare
   We described the structure first of all. Geometry, materials, cross sections and supporting circumstances are covered in the description section.
2. Input file analysis
   We need to make certain that we are syntaxing with STAAD-PRO. So, it's going to be mistaken.
   We should be sure that whatever we enter creates a stable framework. It is going to show mistake, otherwise.
   Finally, to ensure that the input data are accurately entered we should validate our output data.
3. Look and check the findings.
   POST PROCESSING is used to read the results. We first choose the output file (as different loads or load combinations) we wish to examine. Then the results will be shown.
4. Send the results of the analysis to the design engines or concrete design engines for the purpose of design.
   If someone wants to create following analysis, he may ask STAAD-PRO to use the findings of the analysis as a design

Through the design beams and design column, data such as Fy main, Fc are allotted to the views.
It shows the entire design structure while doing the analysis.

III. RESULTS AND DISCUSSION

COMPARISION OF WO 30-STOREY BUILDING

Then two alternative combinations of load were produced. The first 30-story skyscraper with seismic load, live and dead load was constructed[6]. The second 30-story structure has been constructed with wind load, live load and dead load. Both structures have the same beam and column size. The inner size of the column is (0.8m to 0.8m). External column size (.75m/0.75m) has been taken. This is the size of the beam (0.45m to 3m). It took larger internal size since it always took more charge than the outward one. If larger dimensions are not provided, compression will fail[7,8].

DATA REQUIRED FOR THE ANALYSIS OF THE FRAME.

•Type of structure-->multi-storey fixed jointed plane frame.
•Seismic zone II (IS1893 (part1):2016)
•Number of stories 30,(G+29)
•Floor height 3.5m
•No. of bay sand bay length 4 nos,5 m each.
•Imposed load 2kn/m2 on each floor and 1.5kn/m2 on roof.
•Materials Concrete (M35) and Reinforcement (Fe500).
•Size of column. 8m×.8m internal column size,.75m×.75m external column size.
•Size of beam.45m×.45m
•Depth of slab 125mm thick
•Specific weight of RCC 25 kN/m3.
•Specific weight of infill 19.2kN/m3
•Type of soil Medium soil.
•Response spectra As per IS1893.

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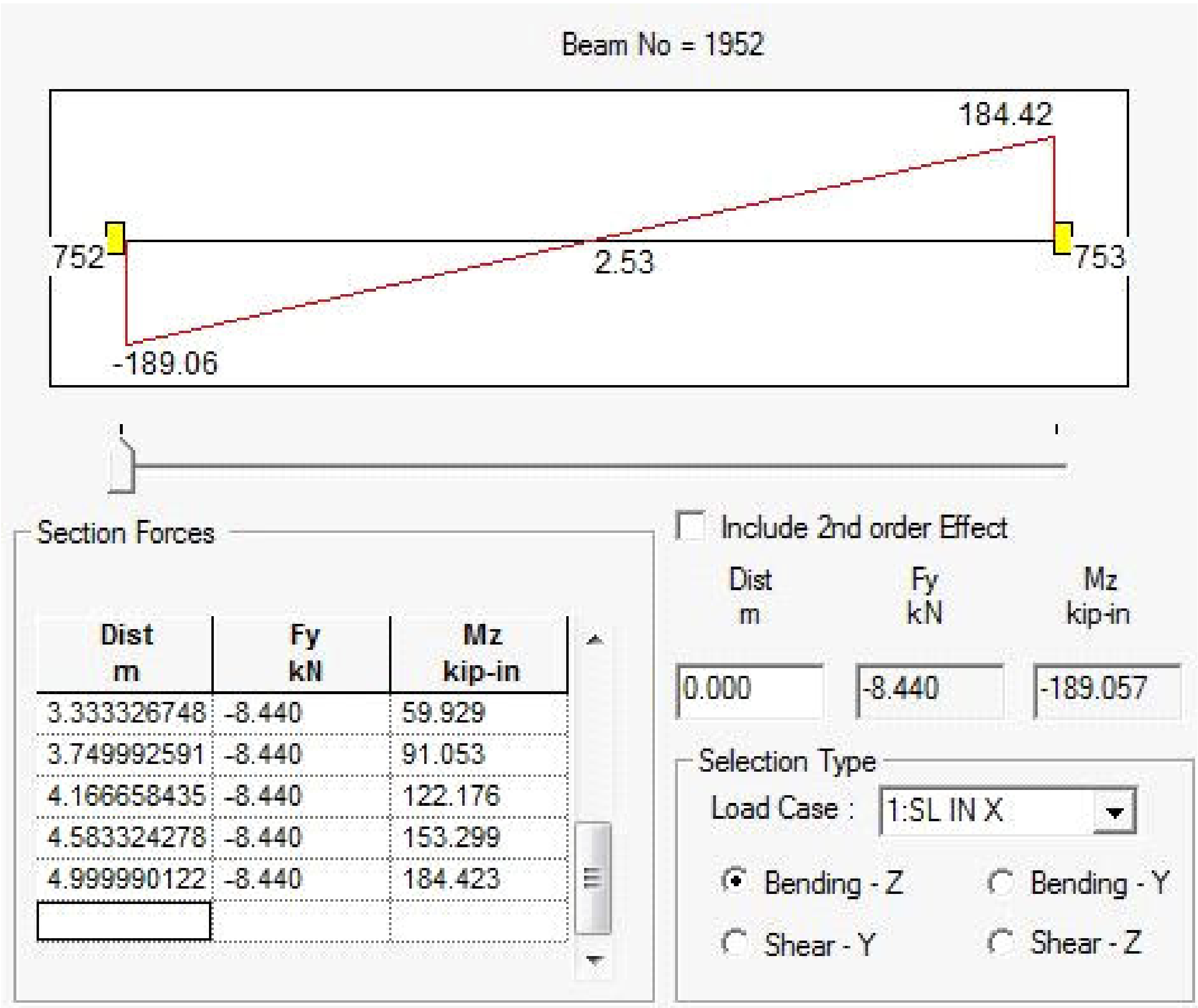
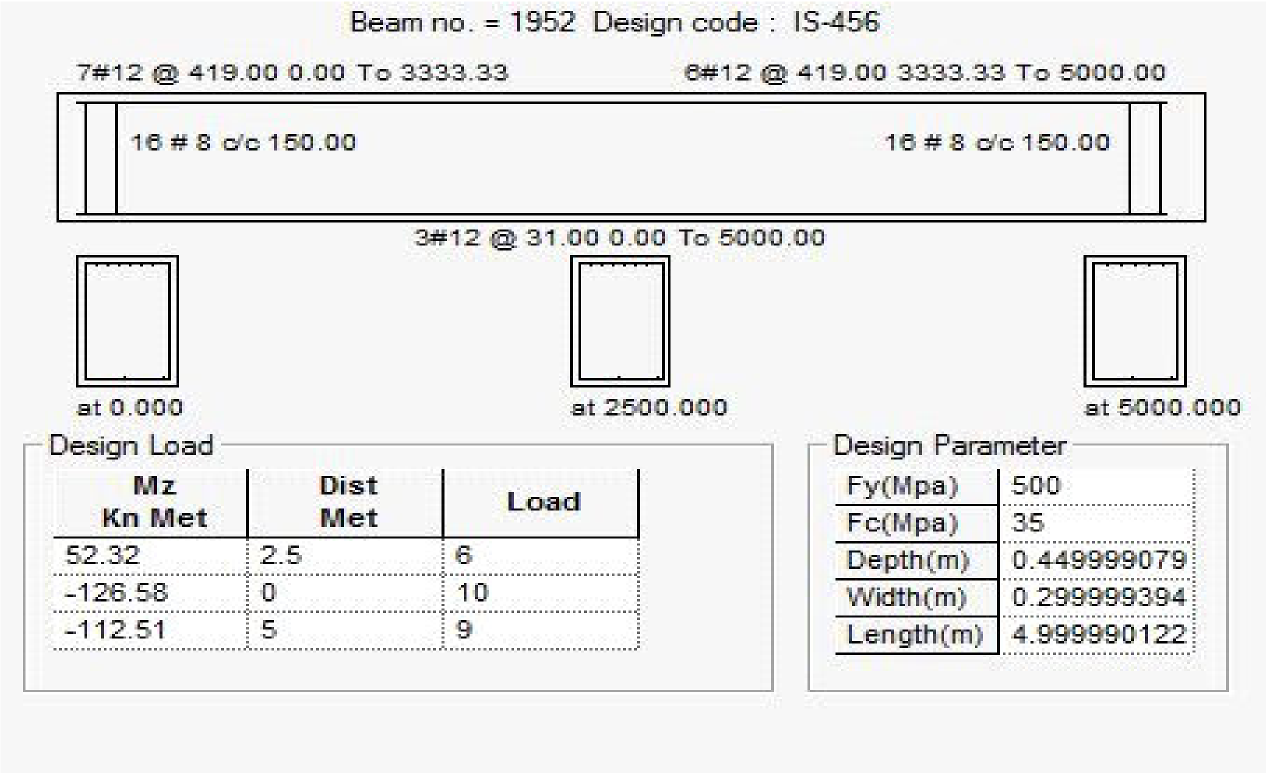
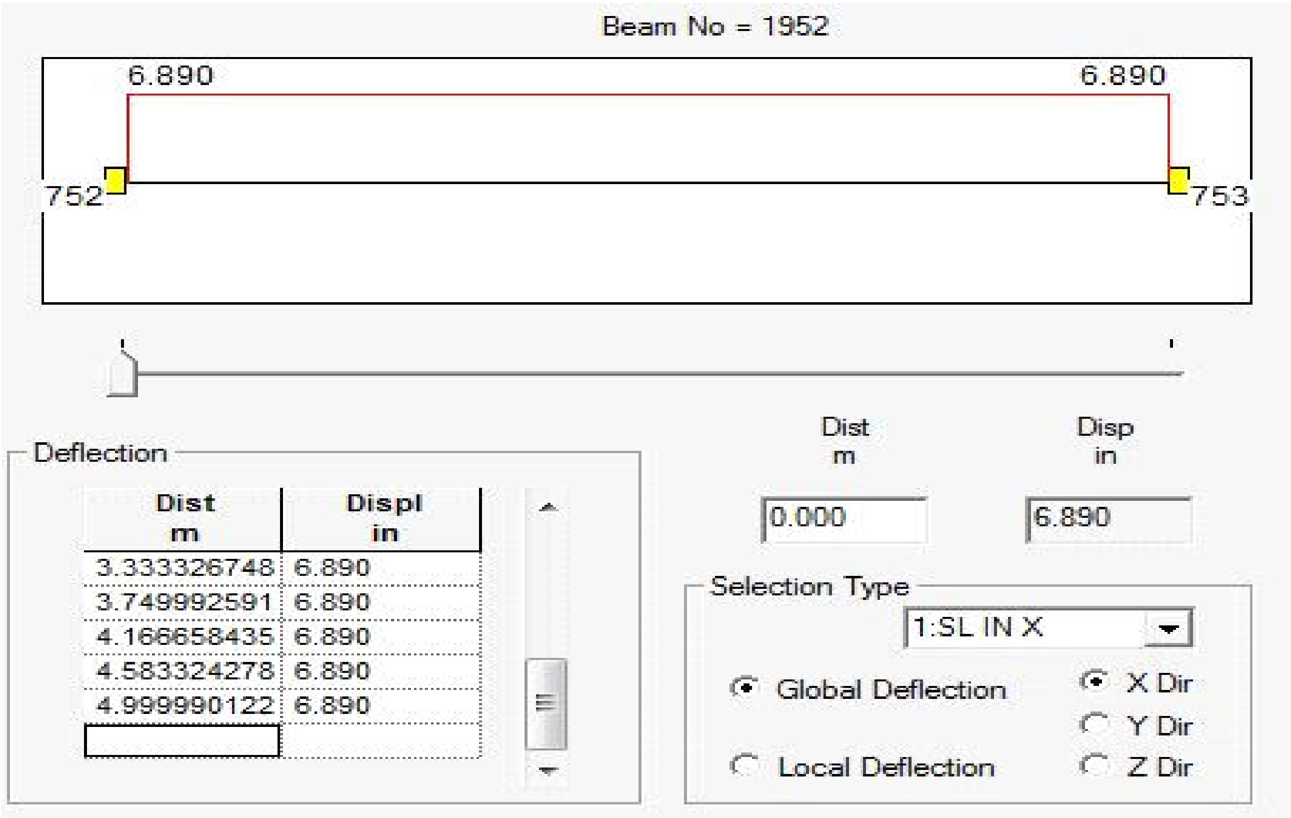


(Shear bending of beam no.1952)



(Concrete design of the beam no. 1952)



(Deflection of the beam no.1952)

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C O L U M N   N O.   1934  D E S I G N   R E S U L T S

M35                     Fe500 (Main)              Fe500 (Sec.)

LENGTH:  3500.0 mm   CROSS SECTION:  800.0 mm X  800.0 mm  COVER: 40.0 mm

** GUIDING LOAD CASE:    2 END JOINT:   734  SHORT COLUMN

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 STAAD SPACE                                                -- PAGE NO. 2666


REQD. STEEL AREA    :      5120.00 Sq.mm.
REQD. CONCRETE AREA:    634880.00 Sq.mm.
MAIN REINFORCEMENT : Provide  48 - 12 dia. (0.85%,   5428.67 Sq.mm.)
                     (Equally distributed)
TIE REINFORCEMENT  : Provide  8 mm dia. rectangular ties @ 190 mm c/c

SECTION CAPACITY BASED ON REINFORCEMENT REQUIRED (KNS-MET)
----------------------------------------------------------
Puz :  11919.36   Muz1 :     778.52   Muy1 :     778.52

INTERACTION RATIO: 0.01 (as per Cl. 39.6, IS456:2000)

SECTION CAPACITY BASED ON REINFORCEMENT PROVIDED (KNS-MET)
----------------------------------------------------------
WORST LOAD CASE:      6
END JOINT:     759 Puz :  12030.25   Muz :    947.82   Muy :    947.82   IR: 0.12
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(REQUIRED STEEL AND CONCRETE AREA, MAIN AND RENFORCEMENT, SECTION CAPACITY FOR COLUMN NO. 1817 AND 1934)

IV. CONCLUSION

From the above comparison, it was clear that the top beams of a seismic-loft building required more strengthening than the buildings in combination with wind load (for example, for beam 1952, 7 no 12 mmØ was necessary, whereas for wind load combined it required 7 no of 12 mmØ and 6 no of 12 mmØ bars).But in the combination of wind load deflection and shear bending greater than in the seismic one. But for wind load combinations, greater strengthening is needed in lower beams.

For a steel surface and a proportion of steel, the wind load combination always requires more than the seismic load.

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[14] IS 456-2000 Plain and reinforced concrete code of practice.