ANALYSIS AND DESIGN OF HOSPITAL BUILDING (G+3)

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Abstract: Every building has got its form, function and aesthetics. We consider that the Architects will take of them and the structural engineer will be responsible for strength and safety of structure. A building or structure should be constructed according to Indian Standard specified by the concerned department. Generally, there are different types of buildings such as Residential, Commercial centers, Offices and Educational and Institutional buildings, Government offices, etc.. STAAD.Pro allows structural engineers to analyses and design virtually any type of structure through its flexible modelling environment, advanced features and fluent data collaboration. In this project we have designed a Primary health center building (RCC) using STAAD.Pro V8i which includes design of constituent elements such as slabs, beams, columns and footings. Study of loads acting on building and R.C.C design with reference to IS875 and IS456-2000. We conclude that Staad pro is a very powerful tool which can save much time and is very accurate in Designs. Primary Health Centre (PHCs), sometimes referred to as public health centers, are state-owned rural health care facilities in India. They are essentially single-physician clinics usually with facilities for minor surgeries, too. They are part of the government-funded public health system in India and are the most basic units of this system. Presently there are 25,308 PHCs in India. Thus, it is concluded that Staad pro package is suitable for the design of a multistoried building

KEYWORDS: IS Codes, Staad Pro V8i

INTRODUCTION

A civil engineer is responsible for planning and designing a project, constructing the project to the required scale, and maintenance of the product. A civil engineer requires not only a high standard of engineering knowledge but also supervisory and administrative skills. The planning part of their work involves site investigation, feasibility studies, creating solutions to complications that may occur and the actual designing of structures. They have to work with the guidelines of the local government authority and get plans approved by the relevant authority. They may prepare cost estimates and set construction schedules. Construction work involves dealing with clients, architects, government officials, contactors and the supervision of work according to standards. Their work also involves the maintenance and repair of the project.

The major specializations within civil engineering are structural, water resources, environmental, construction, transportation, geo-technical engineering etc. On most projects, civil engineers work in teams or in coordination with many other engineers. They can find work as a supervisor of a construction site or a managerial position or in design, research as well as teaching in government services or private concerns. They can also work as independent consultants.

National Building Code (NBC- Indian standard codes) is a document containing standardized requirement for the design & construction of most of types of building in the Country. Although codes may sometimes seem fussy, they are the result of years of experience and testing. Building codes exist to protect the public's health, Safety and welfare, National Building Code (NBC) regulates building construction & building use in order to protect the

health, safety & welfare of the occupant. One should always take the correct precautionary measures to assure the safety of Occupants.

LITERATURE REVIEW

A Study on Market Orientation and Service Quality in Primary Hospital in Telangana State"

Sampling Methods

Two stage sampling method is used, first Quata Sampling and then Convenience sampling. As sample unit in health care do not constitute a homogeneous group so for better analysis different geographical region are selected in Telangana state, quota sampling is used. The sample items are selected using Convenience sampling. To obtain better representation of the population, samples are consisting of respondents from different age group, gender, income range, employment, marital status and education level.

This study is limited to the Telangana state only. Keeping in view professional ethics and integrity names of the hospitals have been kept in abeyance.

Sources of data

Secondary Data: For conceptual clarity information that is obtained from previously published materials such as books, magazines, journals, health care publications and websites.

Primary data: Information will be gathered using Structured Questionnaires as the survey instrument.

Research objectives

The increasing perception of quality of services in healthcare customers' systematic demands and hospital core performance leads to an increasing concern for understanding patient/consumers and patient/consumer families' needs in a hospital environment. In fact, given the humanitarian nature of health services, patient/consumer satisfaction in healthcare is not only important for the sustained profitability or survival of the hospital, but also for increased effectiveness and efficiency, and for better treatment outcomes. Healthcare organizations, specifically hospitals, are continuously trying to improve on their image and their services.

The present study explores the relationships among market orientation and quality of services in multi-specialty hospitals.

- To study market orientation practices of selected multi-specialty hospitals in Telangana state.
- To study service quality dimensions of selected multi-specialty hospitals in Telangana State.
- To study the impact of market orientation practices on service quality dimensions of multi-specialty hospitals in Telangana state.
- To assess how demographic and other factors are affecting on perceptions of quality of services in multi-specialty hospitals in Telangana State.

SPECIALITIES OF HOSPITAL

At one-fourth the cost for the normal people and free for poor people.

Cancer, surgery, bone marrow, transplant, angioplasty, micro neurosurgery, Parkinson, paralysis, diabetes, HIV/AID, Tuberculosis, Gaynor, Child health etc.

Apart from India, Nepal, Bangladesh, Srilanka, Mauritius. Also Africa, Middle East, U.K., Europe & USA.

Apart from the state-an-art traditional/specialized medical facilities, Hospital will have Indian Heritage medical/medicine facilities such as Ayurvedic, homeopathic, Unani, Yoga, Meditation Holistic, Herbal, Stem cell etc.

Hospital will have the arrangement for all the indoor patient MEDICLAIM facilities with the association of various Govt. & other agencies for best treatment.
Initially charitable facilities will be available to the 20% of people against the full capacity of the hospital and then slowly-slowly these facilities will be extended up to 50% within period of 7 years after developing the corpus funds of Rs. 300 Crore.

STRUCTURAL ANALYSISING AND DESIGN (STAAD PRO)

Structural Design Using STAAD- PRO

"Concurrent Engineering" based user environment for model development, analysis, design, visualization and verification.
Full range of analysis including static, P-delta, pushover, response spectrum, time history, cable (linear and non-linear), buckling and steel, concrete and timber design.

Comparison

Limitations of Hand Computation Methods

- Applicable for small problems
- Tedious for even medium sized problems
- 3-d analysis almost impossible

Advantage for Invention of Computer

- Matrix methods of structural analysis
- Development of numerical techniques
- Finite element method

STAGES IN STRUCTURAL DESIGN:

The process of structural design involves the following stages.

1. Structural planning.
2. Action of forces and computation of loads.
3. Methods of analysis.
4. Member design.
5. Detailing, Drawing and Preparation of schedules.

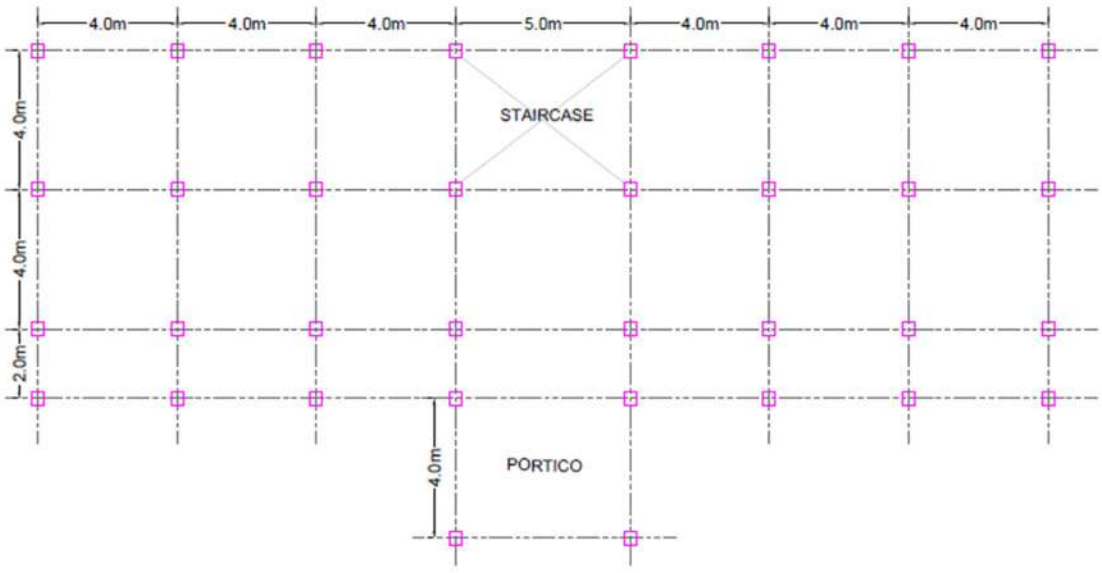


Fig. Showing the typical column layout G+2 RC Framed Building

Column – 230 x 380 mm

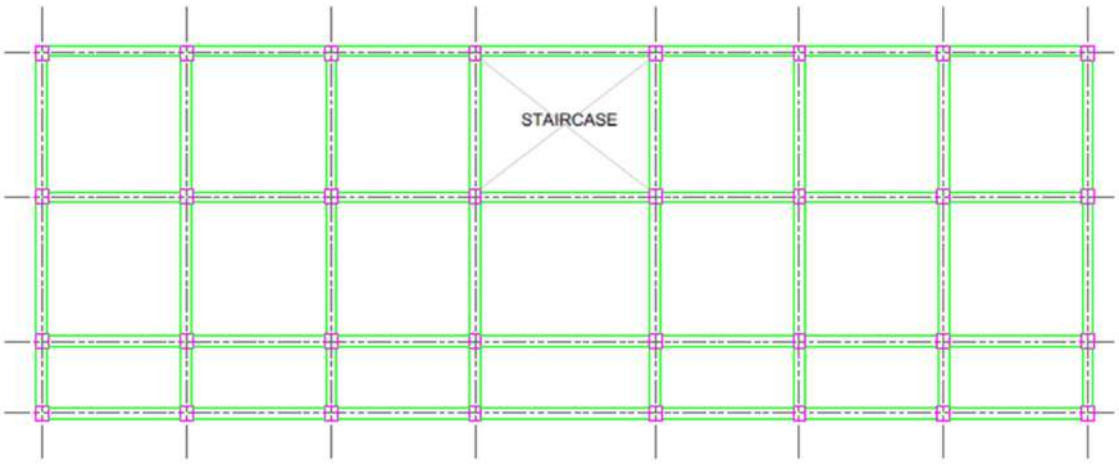


Fig. Showing the First Floor/Second Floor Beam Layout of G+2 RC Framed Building

- Beam – 300 x 450 mm

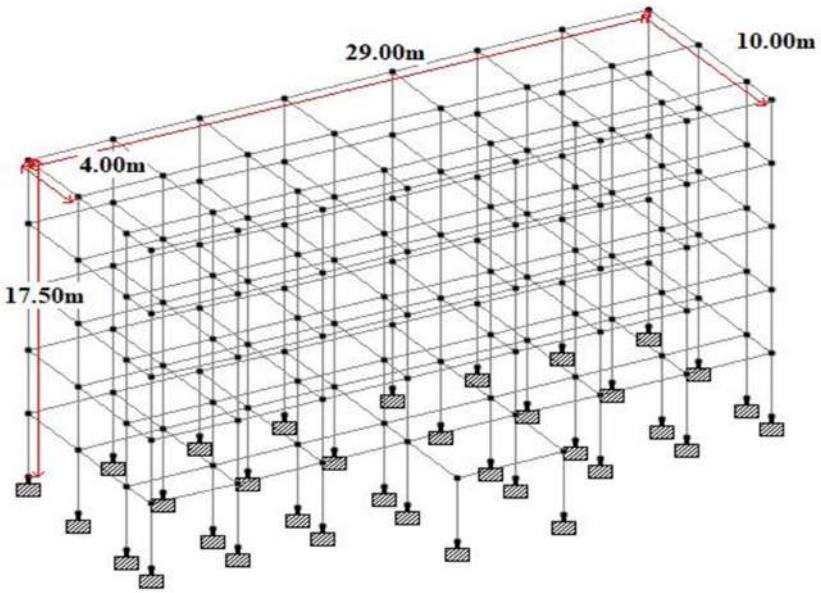


Fig. Showing the 3D View of G+2 Building

Dead load:

Dead loads are permanent or stationary loads which are transferred to structure throughout the life span. Dead load is primarily due to self-weight of structural members, permanent partition walls, fixed permanent equipment's and weight of different materials.

Load calculations

Self - weight of Slab load:
Floor loads for 150mm thick slab
Thickness of slab -150mm
Unit weight of reinforced concrete - 25.00kn/m3
= 0.15 x 1x 25
= 3.75 KN/m2
Dead load of slab= 3.75kn/m2
Floor finishes = 1.50kn/ m2
= 3.75 x 1. 5 = 5.25 Kn/m2
Total load of slab = 5.25kn/ m2
Self-weight of Beam Load:
Beam Size- 300x450mm
Unit weight of reinforced concrete - 25.00kn/m3
= 0.3 x 0.45 x 25
= 3.375Kn/m3
Wall loads
External Wall
230mm thick wall for 3.5 heights
Thickness of wall 'b' - 0.23m
Height of walls 'h' - 3.5mm
Unit weight of brick masonry γ - 19.2kN/m3
= 0.23 x 3.5 x 19.2
Total load h*b* γ = -15.456 kN/m3
Internal or Partition Walls
150mm thick wall for height 3.5m
Thickness of wall 'b' - 0.15m
Height of walls 'h' - 3.5m
Unit weight of brick masonry 'γ' - 19.2kN/m3
= 0.15 x 3.5 x 19.2
Total load h*b* γ = -10.08 kN/m3
Parapet & Balcony wall load
Thickness of wall 'b' - 0.115m
Parapet wall 'h' - 1.00m
Unit weight of brick masonry 'γ' - 19.20kn/m3
= 0.115 x 1 x 19.2
Total load h*b* γ = 2.208 kn/m3

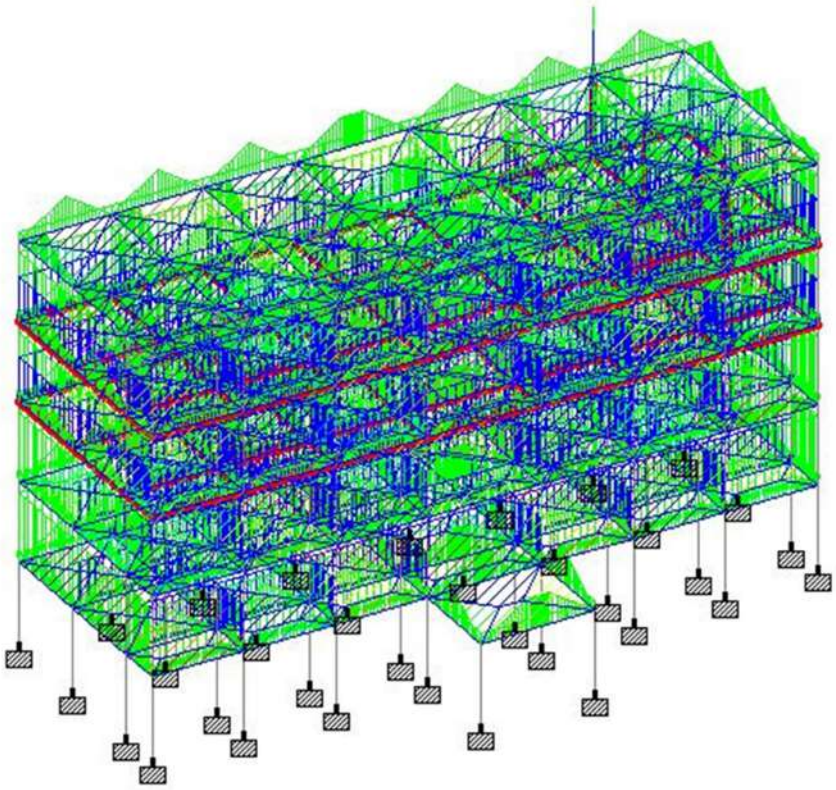


Fig. Showing the Dead load Application G+3 Building

Imposed loads or live loads:

Impact loads:

Impact load is caused by vibration or impact or acceleration. Thus, impact load is equal to imposed load incremented by some percentage called impact factor or impact allowance depending upon the intensity of impact.

Live load as per Code IS: 875 (Part-2)

Patient rooms - 4.000kn/ m2
Stair case, corridor - 3.000kn/ m2
Terrace, portico - 2.000kn/ m2

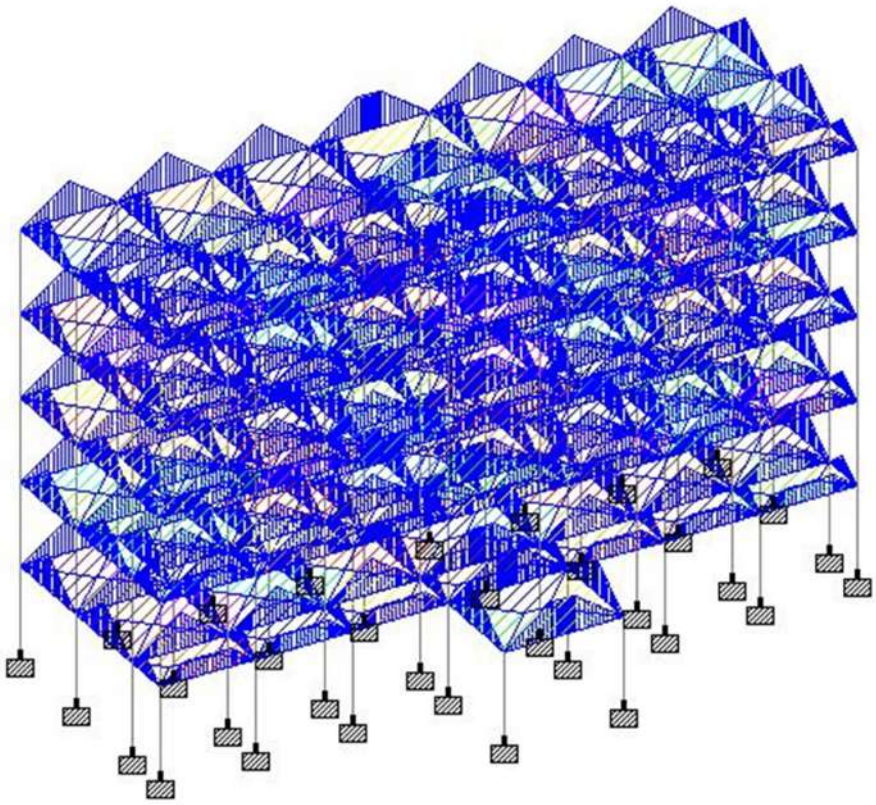


Fig. Showing the live load Application G+2 Building

Wind loads:

Wind load is primarily horizontal load caused by the movement of air relative to earth. Wind load is required to be considered in design especially when the heath of the building exceeds two times the dimensions transverse to the exposed wind surface. For low rise building say up to four to five story's, the wind load is not critical because the moment of resistance provided by the continuity of floor system to column connection and walls provided between columns are sufficient to accommodate the effect of these forces. Further in limit state method the factor for design load is reduced to 1.2 (DL+LL+WL) when wind is considered as against the factor of 1.5(DL+LL) when wind is not considered. IS 1893 (part 3) code book is to be used for design purpose.

Design Wind Speed Vz = Vb x K1 x K2 x K3

Where

Vb- Design Wind speed

K1- Probability factor

K2 – Terrain factor

K3- Topography Factor

Exposure factor is -1.0 (As per code)

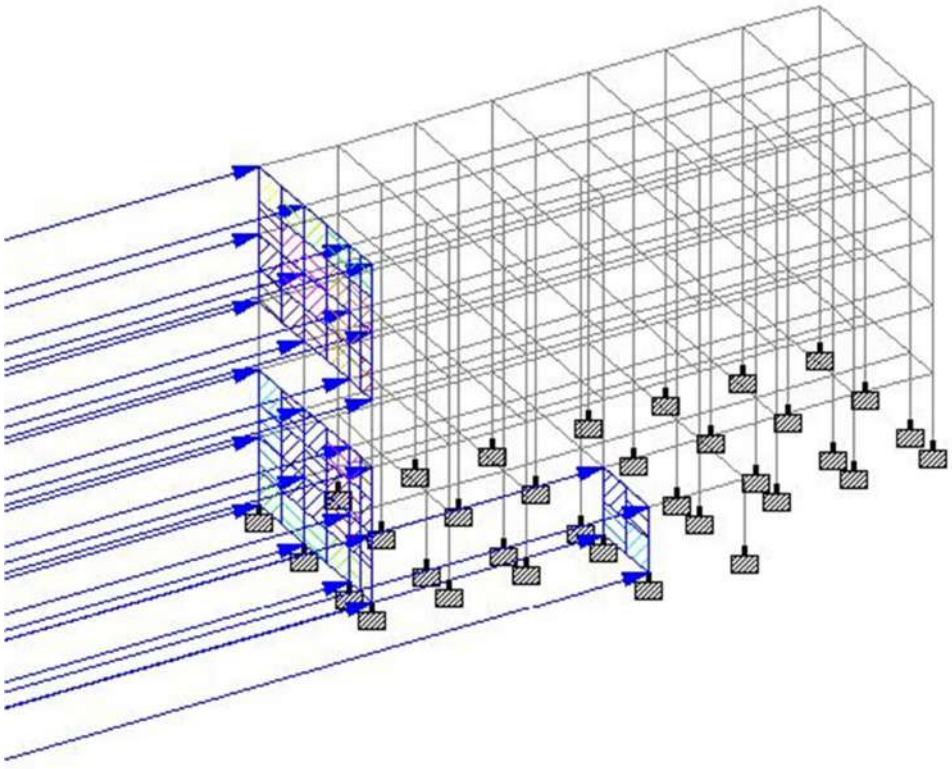


Fig. Showing the wind load Application on G+2 Building

ANAYLSIS RESULTS

Load combination:

The structure has been analyzed for load combinations considering all the previous loads in proper ratio. In the first case a combination of self-weight, dead load and live load (1.5(DL+LL)) was taken in to consideration. In the second combination case instead of wind load seismic load was taken into consideration.

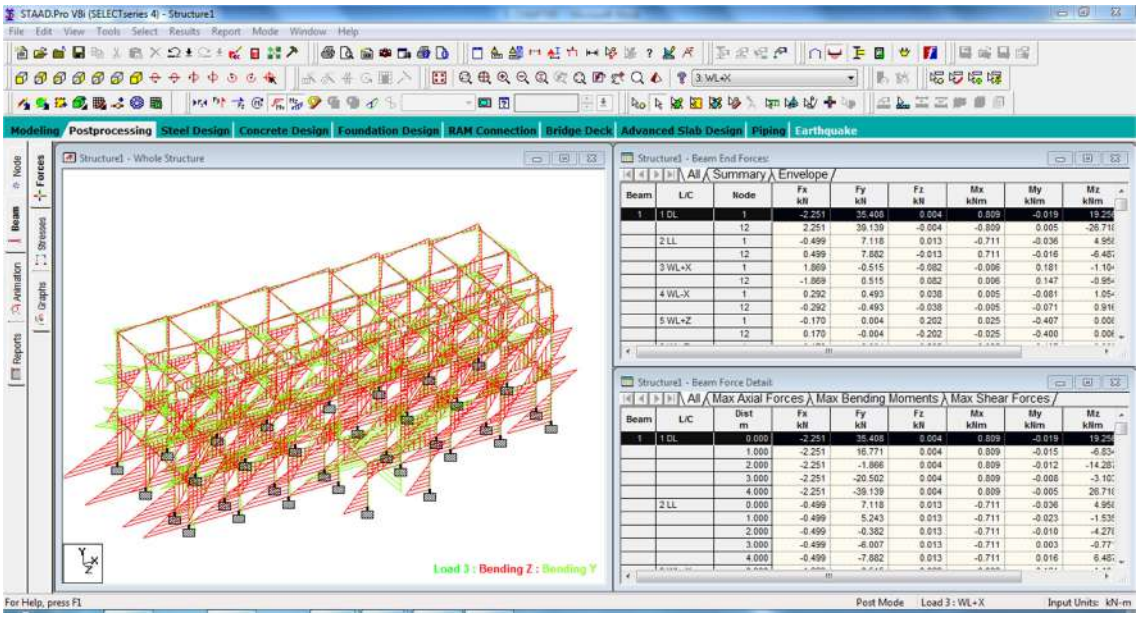


Fig: Bending forces at Direction –Z & Y

Analysis Methodology

Elastic analysis method is used to obtain the forces and moments for design. Analysis is done for the primary and combination loading conditions provided by the user. The user is allowed complete flexibility in providing loading specifications and using appropriate load factors to create necessary loading situations. Depending upon the analysis requirements, regular stiffness analysis or P-Delta analysis may be specified. Dynamic analysis may also be performed and the results combined with static analysis results.

Performing Analysis/Design

STAAD.Pro performs Analysis and Design simultaneously. In order to perform Analysis and Design, select the Run Analysis option from the Analyze menu.

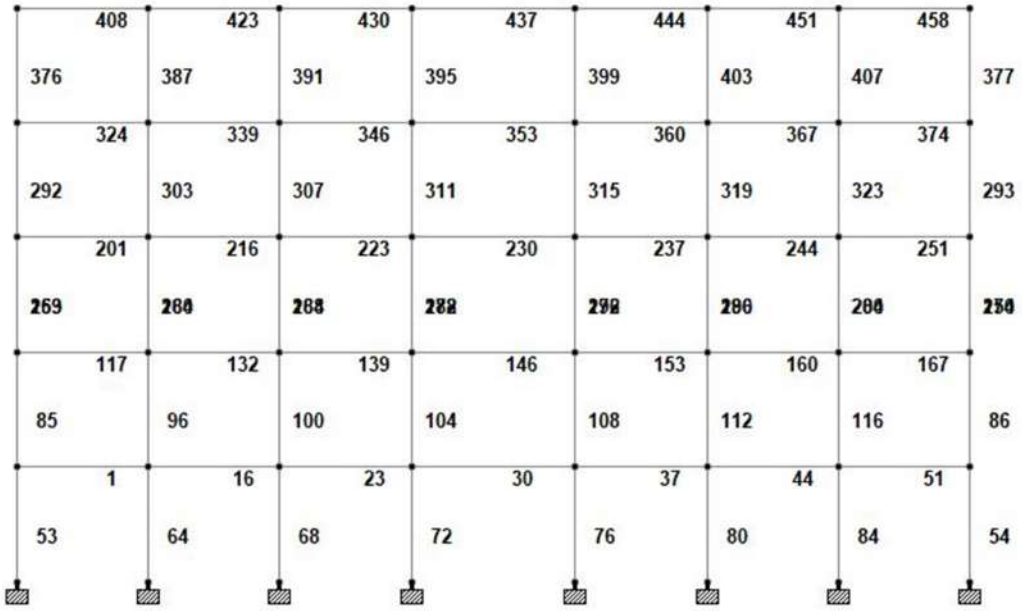
Fig: Run Analysis

If the structure has not been saved after the last change was made, you should save the structure first by using the Save command from the File menu.

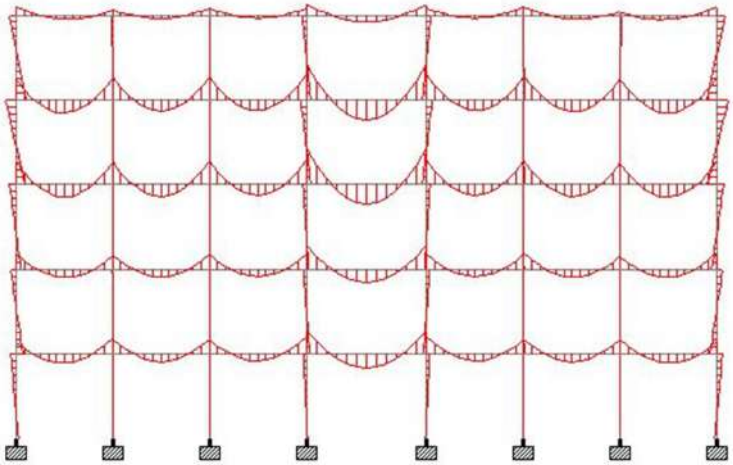
When you select the Run Analysis option from the Analyze menu, the following dialog box appears:

Click on the Run Analysis button.

As the analysis progresses, several messages appear on the screen as shown in the figure below.

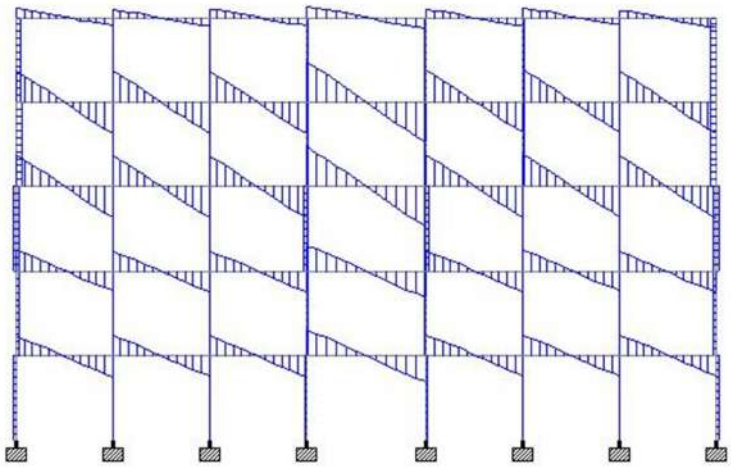


Frame A



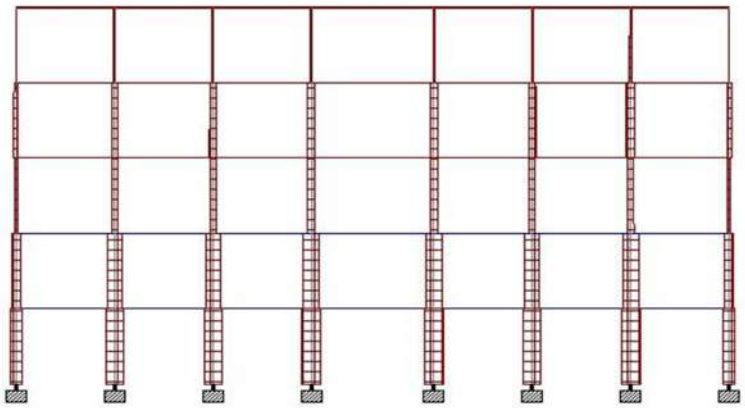
Load 35 : Bending Z

Bending Moment Frame A



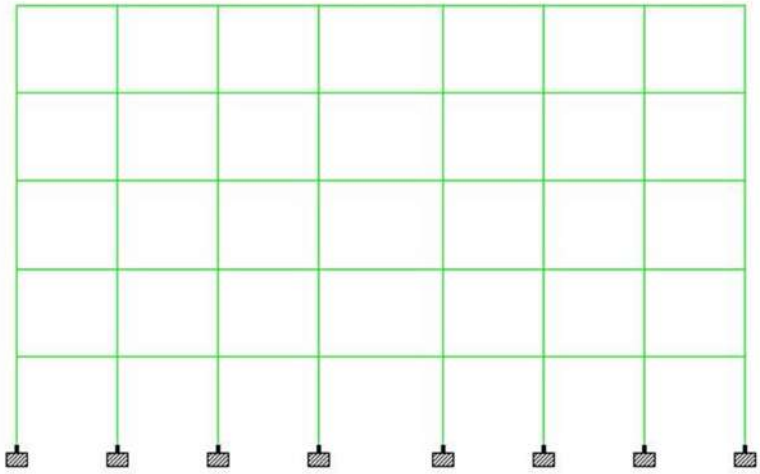
Load 35 : Shear Y

Shear Force Frame A



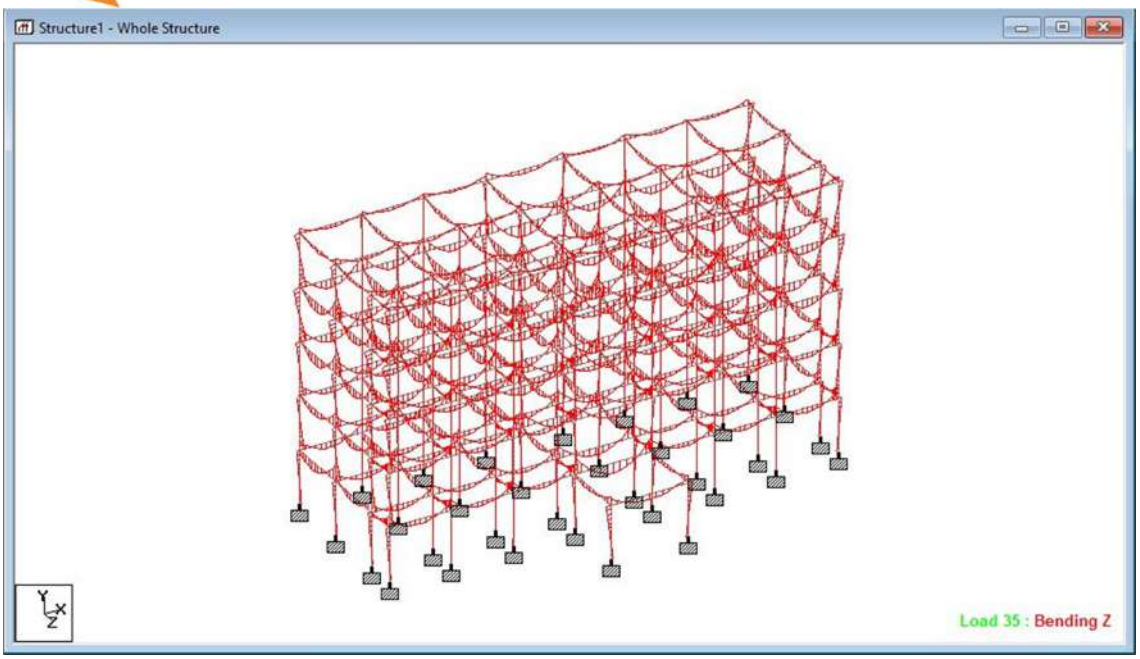
Load 35 : Axial Force

Axial force of a Frame A

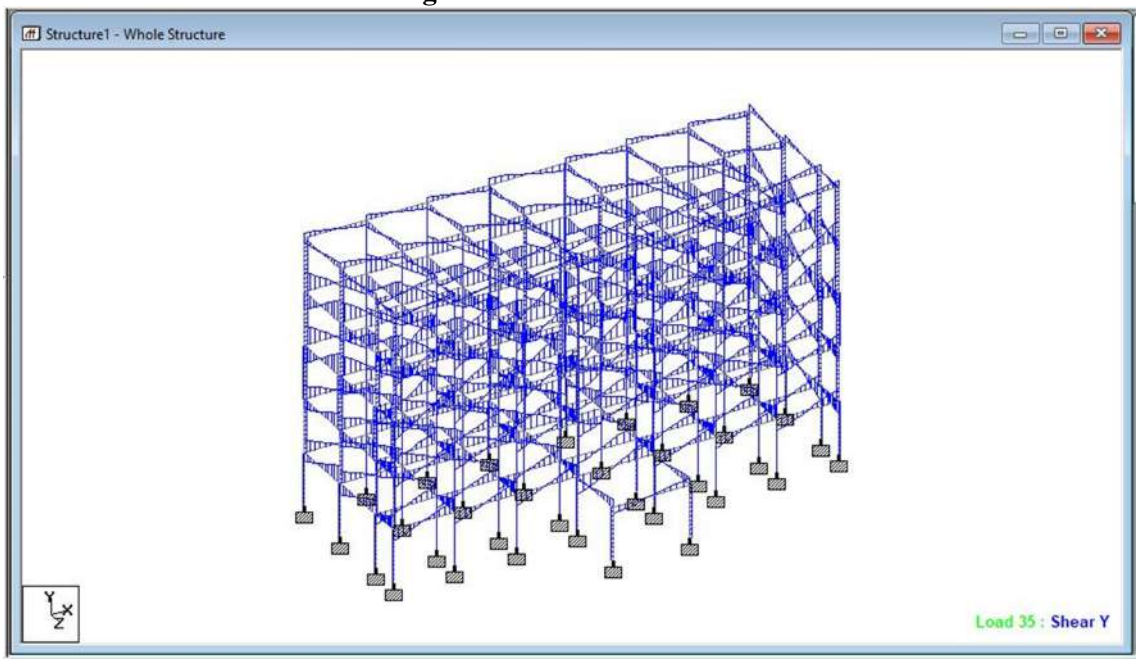


Load 35 : Displacement

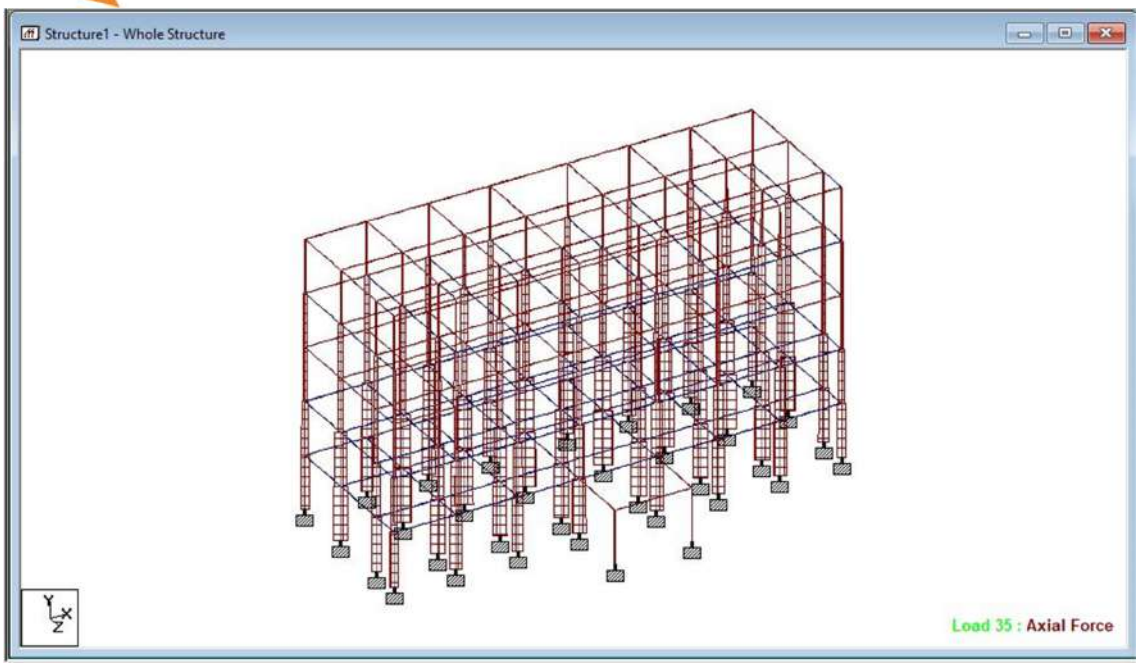
Deflection of Frame A



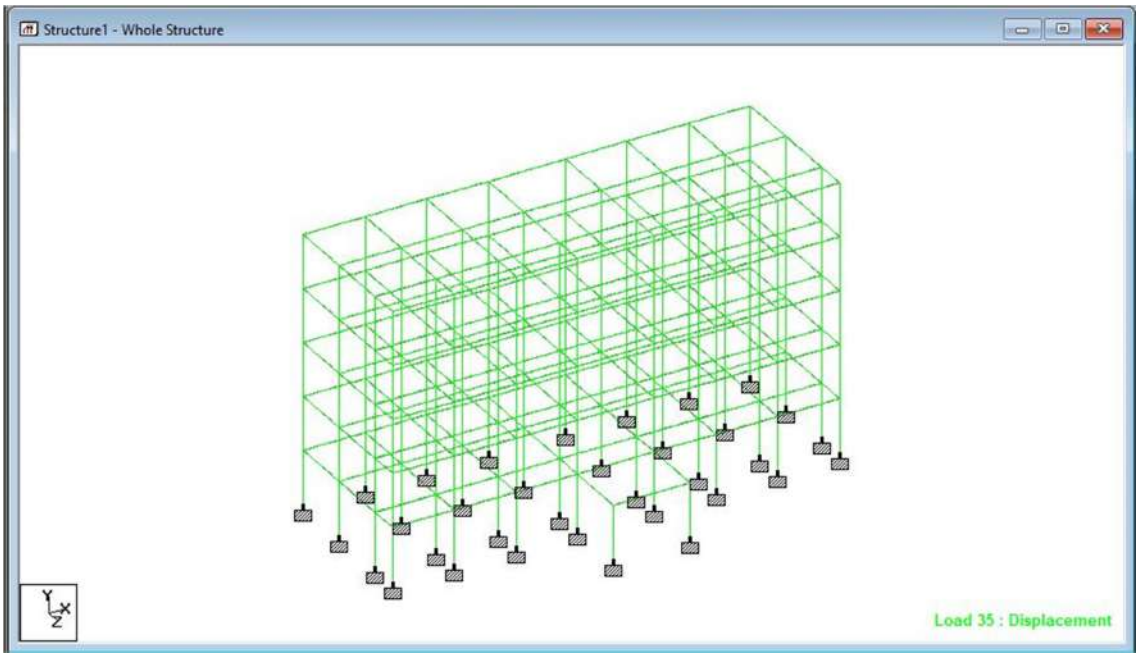
Bending Moment of Whole Structure



Shear Force of Whole Structure



Axial Force of Whole Structure



Deflection of Whole Structure

After doing all the structural analysis of our structure, we have designed it to find out the steel used for the reinforcement for the columns and beams.
By selecting the code IS: 456 2000 for the concrete design we will then define parameters for our design as:

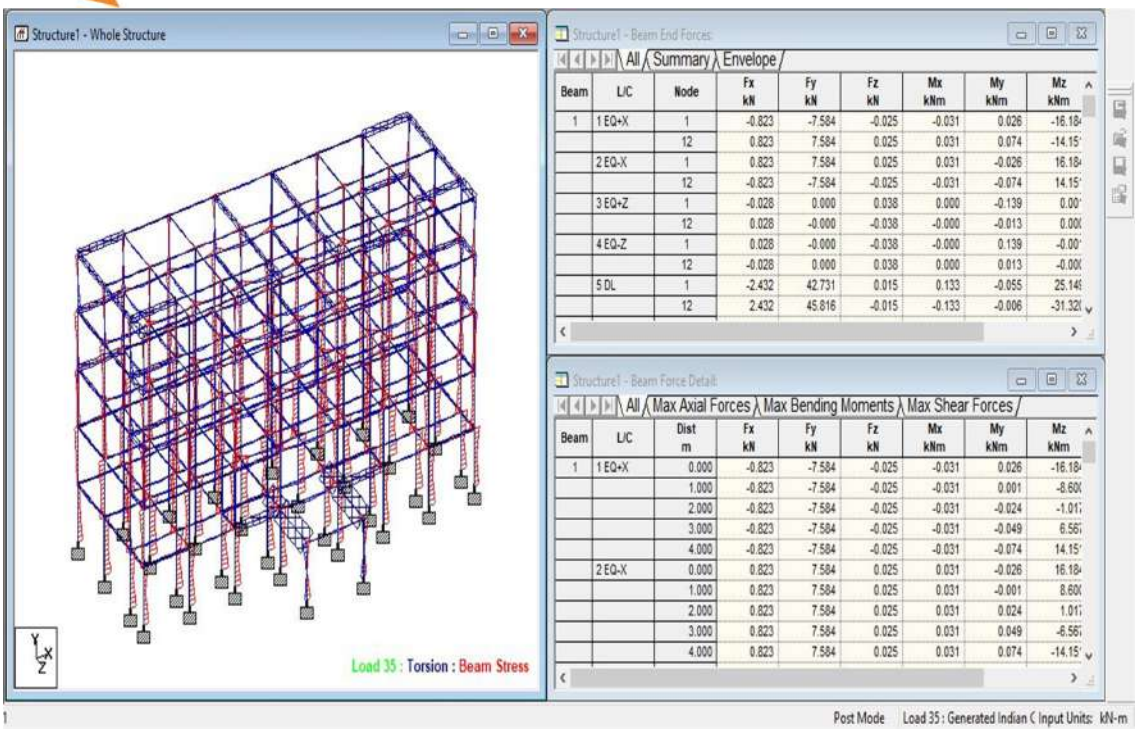


Fig: Torsional Force and Beam Stress on G+2 Primary Hospital Building

CONCLUSION

The empirical evidence examined in the research suggests that the notions of therapeutic or patient-friendly environments held by participants in the study were based upon three conceptual visions of the role and function of the built environments of health care facilities. They are: the notion of homeliness, the notion of physical and visual clarity and accessibility through the spaces, and the notion of supportive environments as discussed in the answers to the research questions below. The program contains a number of parameters which are designed as per IS: 456 (2000). Beams are designed for flexure, shear and torsion.

Columns are designed for axial forces and biaxial moments at the ends. All active load cases are tested to calculate reinforcement. The loading which yield maximum reinforcement is called the critical load.

We can conclude that there is theoretical and practical work done. As the scope of understanding will be much more when practical design work is done. We design basic structural elements (slab, beam, columns and footings). As we get more knowledge in such a situation where we have great experience doing the practical work

After obtaining STAAD Analysis and Design the results are seemed to be more accurate when compared to manual design results. During the project work many obstacles were faced to obtain error less STAAD output .The future work can be carried in continuation of this work. The main drawback of STAAD is Designing slabs is tedious job.

FUTURE IMPLICATION

This research is the first of its kind to study the building environment and human behavior in the context of Indian healthcare buildings and even so, for the aspect of therapeutic built environment in the cancer care built environment. The research on the therapeutic aspect in

the cancer care environment is a new conscious perspective in Indian hospital planning and is to be incorporated in all types of specialty hospital buildings. The research topic is a forerunner in identifying the significance and impact of the building on the human physical and physiological needs in Indian hospitals; the area of the study is complex and colossal and hence the research is restricted to Hyderabad with the focus on cancer care, while the intricacy and enormity of the issue is to be realized in future research.

- The research was focused on the cancer care facilities in Telangana state therefore, the work is representative of the users' therapeutic needs specific to the context. The future implications of the research are:
- To consider the research as a developing pilot work for the study of further therapeutic needs for cancer care facilities at various context - from city to region, to state and to national level.
- To serve as a design evaluation model, to provide insight into the degree of therapeutic need of the user degree in pre and post occupancy assessment.
- To further extend the study to physically map and quantify the specific therapeutic architectural spaces required in the
- Outpatient, Diagnostic and Inpatient areas of the cancer care facilities. Extension of the research further on the wider scale – regional and national level on the cancer specialty.
- To test, evaluate and integrate the therapeutic design aspects and elements in the existing or new cancer specialties.
- To decipher the wide diversity of citizens, and community views, including ethnic groups, socioeconomic, culturally relevant outlook as cancer healthcare design variables.
- Extension of the therapeutic need enquiry to other clinical specialties based on the illness or on the user types (children, older people, etc).
- Future research is required to study the therapeutic needs in healthcare facilities at the primary and secondary care level of the Indian healthcare system.
- Future enquiry into the therapeutic needs to be made multidisciplinary by including disciplines like management, medicine, art, product design etc
- Increase the level of enquiry and expand the area of study to dovetail future Medicare developments and subsequent changes in the socio-physical demand of the user.
- Future research should include health impact analysis of the built health care environment upon the health status of the local community.

The research concludes that the need for satisfaction is largely determined by three factors, namely, the strength of the needs and intensity of gratification, the socialized behavior patterns in conjunction with the person's previous experience of need gratification, and the perceived importance of the need. In reality, each person responds to a need as an organized whole and each processes is interconnected with the others.

In summary, the research has explicitly highlighted the users' preference and experience in a cancer care environment. However, the ecology of healthcare is necessarily a changing subject for research and evaluation, and improving the patient's experience will continue to be an issue for those involved directly and indirectly in healthcare. What is clear is that many of the principles that were adopted in planning this new environment, including those associated with the planning and consultation process, the integration of humane value, and the recognition of the fundamental and changing needs of the user groups, will continue to inform future developments in this and other care environments.

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