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Analysis and Design of Residential Building (g+2) using STAAD Pro

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ABSTRACT

Structural design is the primary aspect of Civil Engineering. To construct any building, bridges, dams, canals etc., the base is designing. The main objective of our project is analysis and design of residential building (G+2) using STAAD Pro. The present project deals with the analysis of a residential building which consists of 3 Storeys. By using AutoCAD Plan of Building is drawn. After the initialisation of plan, the centre line diagram is drawn. Later it is inserted in STAAD Pro software and frame structure is generated. Then analysis and design of structure has been carried in the STAAD Pro software. In this project the g+2 residential building is analysed for finding shear force, bending moment and deflection for design elements such as beams, columns and slab to develop economical design.

KEY WORDS: Analysis and Design, Residential Building, STAAD Pro, AutoCAD, STAAD Foundation.

1. INTRODUCTION

Building construction is the engineering which deals with the construction of building such as residential houses. In a simple building which is defined as an enclosed space by walls with roof, food, cloth and also the basic needs of human beings. To construct any structure which must satisfy the need and it should be durable for its desired life span. The design of any structure is categorized into the following two main types.

1. Functional design
2. Structural design

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Functional design: The structure to be constructed should primarily serve the basic purpose for which it is to be used and must have a pleasing look. The functional planning of a building must take into account the proper arrangements of rooms has to satisfy the need of the client, good ventilation, lighting proper water supply and drainage arrangement etc. All these aspects are interlinked and final decision has to be taken considering requirements of the user, functional aspect and cost.

Structural design: once the form of the structure is selected the structural design process starts. Structural design is an art and science of understanding the behaviour of structural members subjected to loads and designing them with the economy and elegance to give safe, serviceable and durable structure.

OBJECTIVE:

- Analysis and Design of Residential Building (g+2) using STAAD. Pro
- To learn design concept of Residential Building.
- Getting familiar with structural software's (STAAD. Pro, AutoCAD).

2. LITERATURE REVIEW:

- V.Varalakshmi: The design and analysis of multi-storeyed G+5 building at Kukatpally, Hyderabad, India. The Study includes design and analysis of columns, beams, footings and slabs by using well known civil engineering software named as STAAD.PRO.
- P.Jayachandran: The design and analysis of multi-storied G+4 building at Salem, Tamil Nadu, India. The study includes design and analysis of footings, columns, beams and slabs by using 2 Software's named as STAAD.PRO and RCC Design.
- L.G. Kalurkar: The design and analysis of multi-storied G+5 building using composite structure at earthquake zone-3. A three dimensional modelling and analysis of the structure are carried out with the help of SAP 2000 software. Equivalent Static Method of Analysis and Response spectrum analysis method are used for the analysis of both Composite and RCC structures. The results are compared and found that composite structure more economical.

3. METHODOLOGY

- Drawing Plan and Elevation Using AutoCAD.
- Drawing Centre line diagram of plan.
- Inserting centre line diagram in STAAD. Pro generating frame structure.
- Analysis and design of beams, columns, slab and footing as per IS Codes using STAAD. Pro..

4. BUILDING DATA FOR ANALYSIS:

No of storeys**:** g+2 (3 Storeys).

Length of building along X-direction**:** 20.54m.

Length of building along Y-direction**:** 9m.

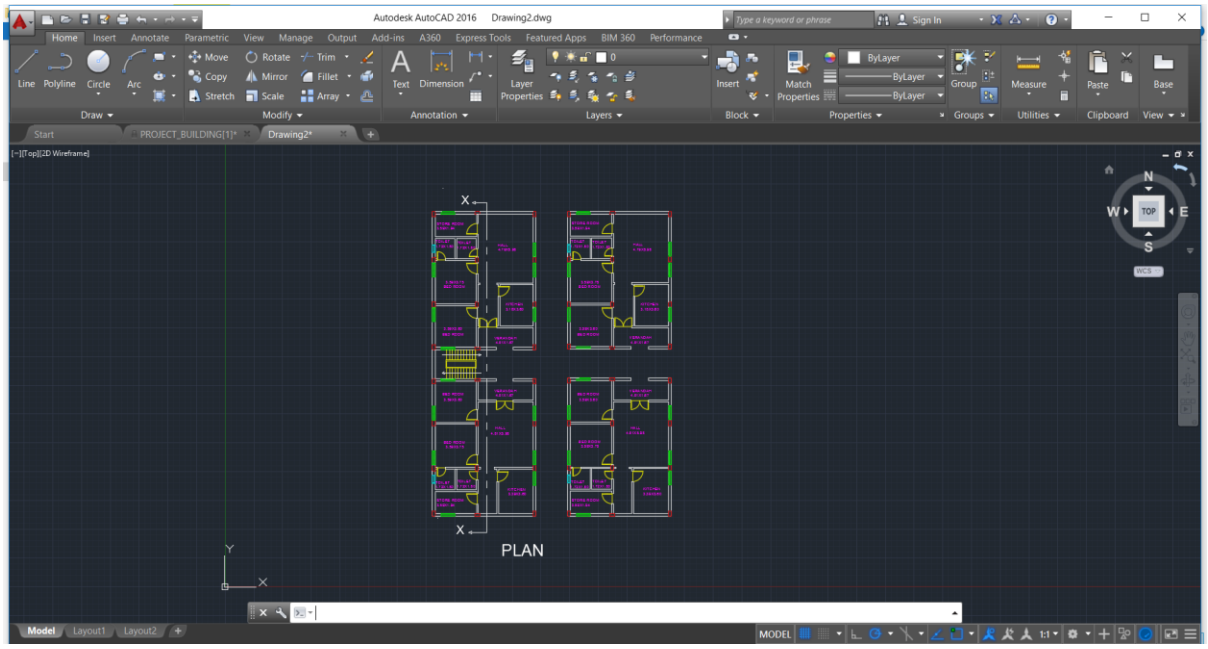
Length of building along Z-direction**:** 26.27m.

Load combinations**:** 1.5(DL+LL), 1.5(DD+WL), 1.2(DD+LL+WL)

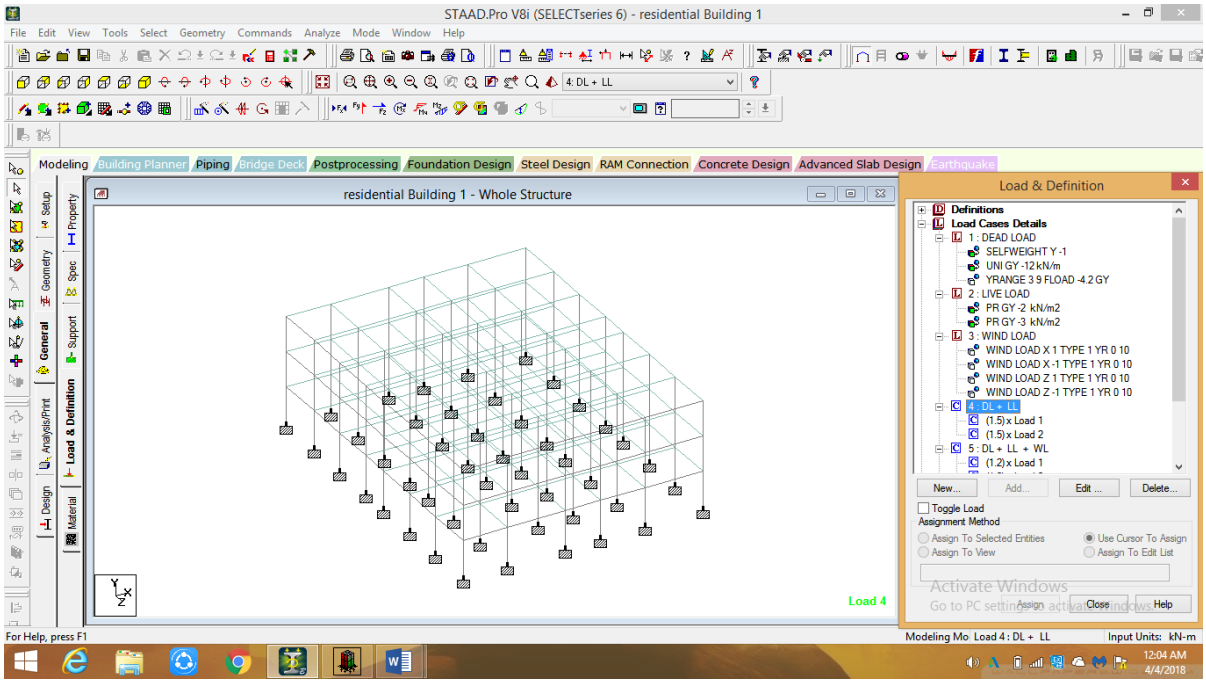
Geometric parameters

- Beam: 250*400mm
- Column: 300*300mm
- Slab: 125mm

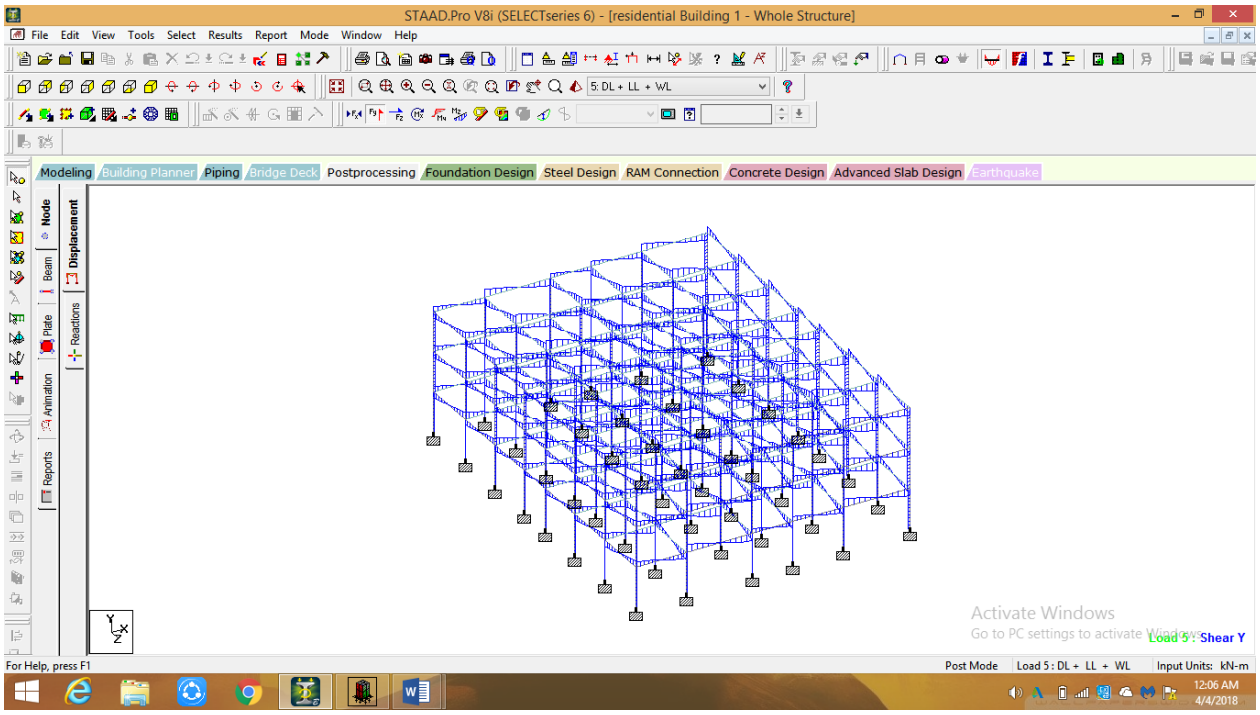
5. PLAN OF RESIDENTIAL BUILDING:



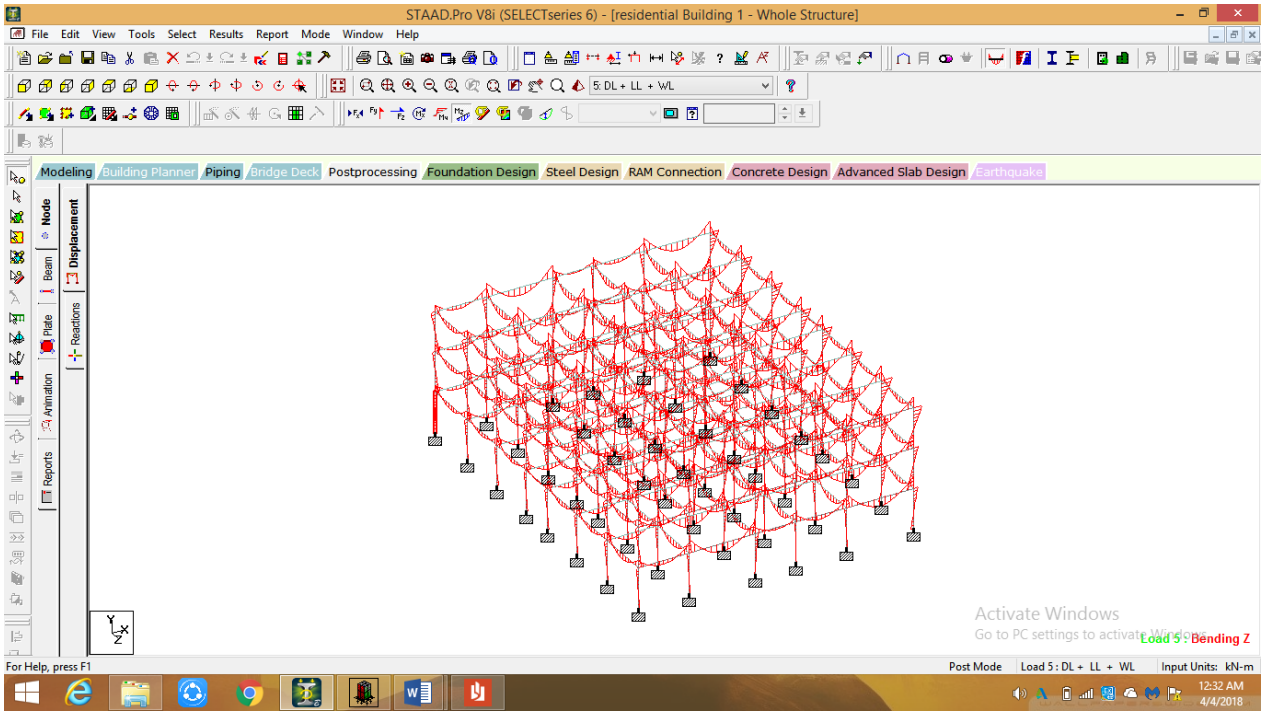
6. ANALYSIS AND DESIGN OF STRUCTURE:



MODELLING



SHEAR FORCE



BENDING MOMENT

BEAM DESIGN

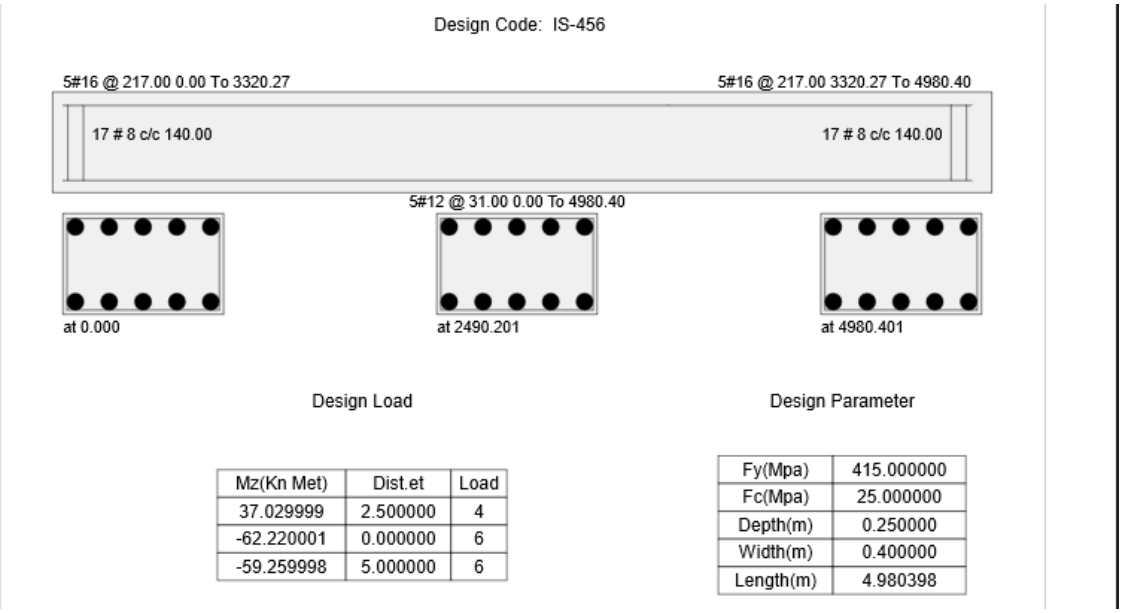
It is a structural element that primarily resists the loads applied laterally to the beam axis.

Singly reinforced beam:

This has steel reinforcement only one side that is tension face. It is used where there is no restriction on the depth of the beams. It is practically rare to find solutions where this can be effectively done. This beam is designed based on the assumption that the depth of the concrete section is enough to resist the maximum bending moments that are induced due to the imposed load condition**.**

Doubly reinforced beam:

This contains steel in both compression and tension zones. The depths of the beams are not sufficient to withstand the external moments and hence extra steel is provided in the compression zone. This is practically more common.



Mz(Kn Met)	Dist.et	Load
37.029999	2.500000	4
-62.220001	0.000000	6
-59.259998	5.000000	6

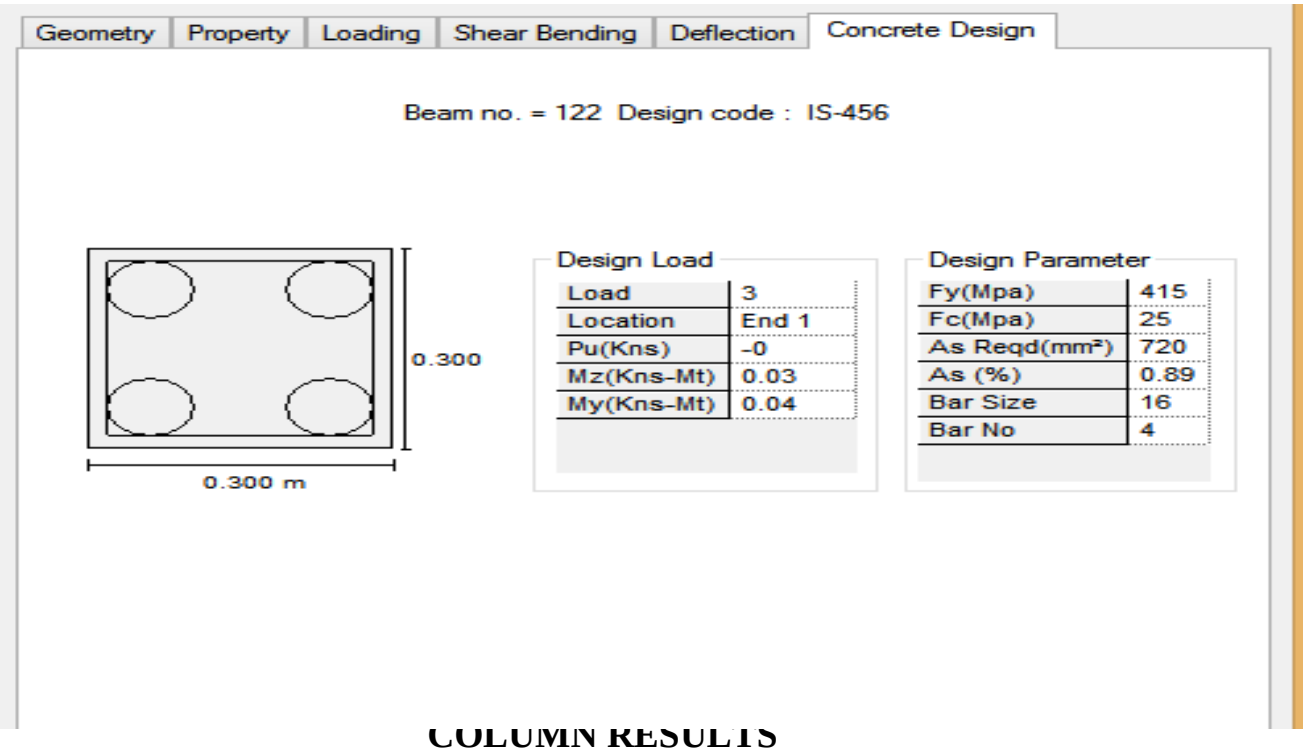
Fy(Mpa)	415.000000
Fc(Mpa)	25.000000
Depth(m)	0.250000
Width(m)	0.400000
Length(m)	4.980398

BEAM RESULTS

Column design:

A column is a vertical structural member. It transmits the load from roof slab and beam, including its self weight to the foundation.

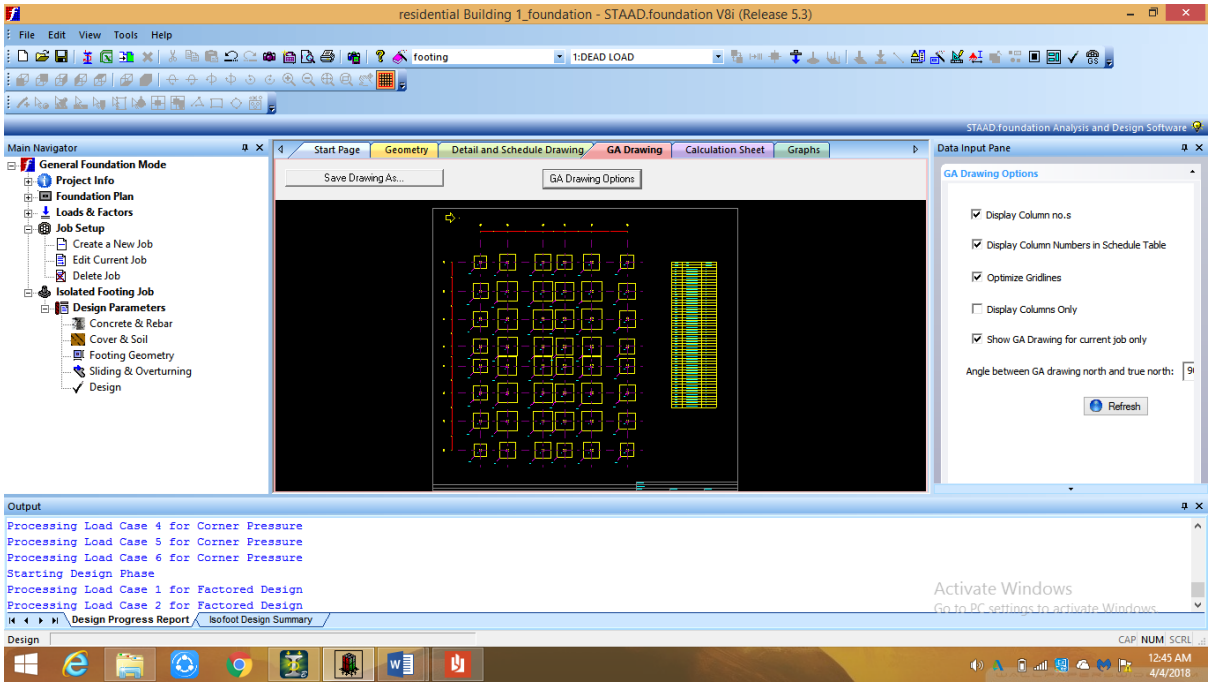
Columns may be subjected to pure compressive load. R.C.C columns are the most widely used now- a- days. Depending upon the structural requirements and loads to be supported**,** R.C columns may be cast in various shapes i.e., square, rectangle, hexagonal, octagonal, and circular. Columns of L-shaped or T-shaped are also used



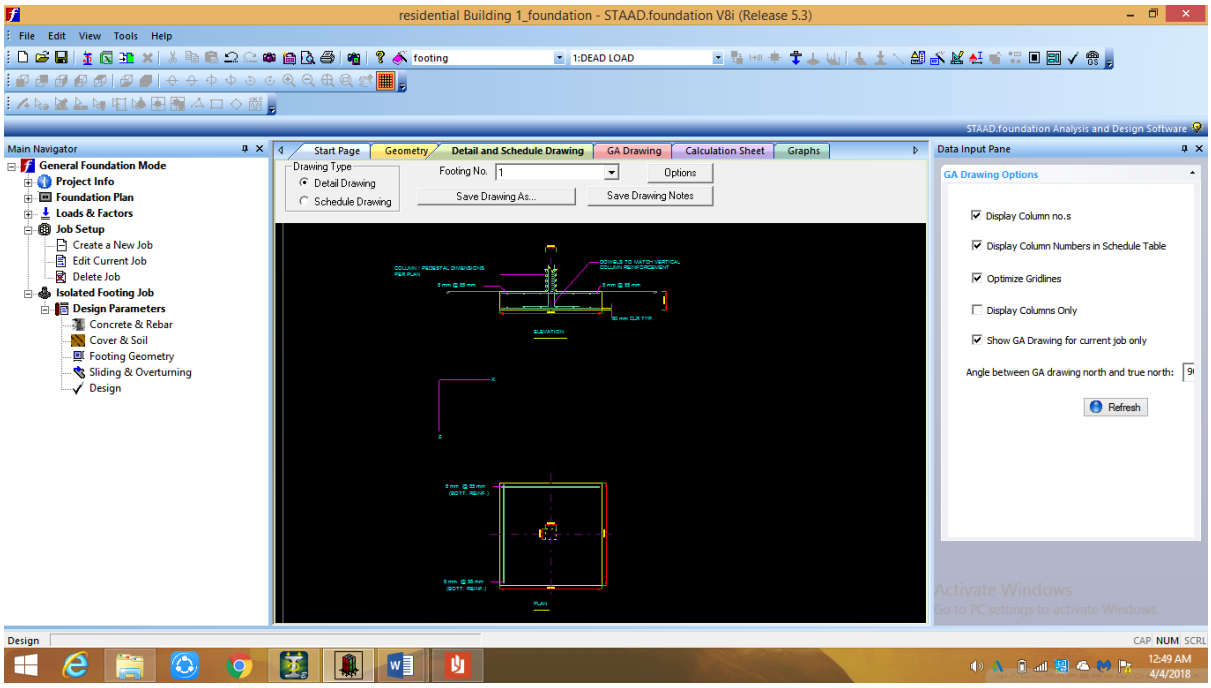
COLUMN RESULTS

7. FOUNDATION DESIGN

The foundations are the structural elements which transfer the loads from the building or an individual column to the earth.



GA Drawing of Footings



Detail Drawing of Footing

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[3] D. Ramya, A.V.S. Sai Kumar, comparative study on design and analysis of multi-storeyed building (G+10) by using STAAD PRO and ETABS software-2015.

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CONCLUSION

In this report, a design of multi-storey building for the residential purpose is presented. We have successfully completed the planning and designing of a multi-storey (G+2) structure.

1. The structural components of the safe in shear and failure.
2. The proposed sizes of the elements can be used in the structure.
3. Amount of steel provided for the structure is economic.