

Name of the Project:

Comparison of Design and Initial Cost Estimation of Typical G+4 Residential Building for Different Seismic Zones and Soil Conditions

Submitted by:



Institute for Steel Development and Growth (INSDAG)
ISPAT PRAGATI BHAWAN
793 Anandapur, Kolkata 700107

Submitted to:



Indian Institute of Engineering Science and Technology, Shibpur (IIST)
Botanical Garden Area, Howrah, West Bengal 711103



11-08-2025

August 2025

Vetted
h → *11/08/2025*

Dr. Soumya Bhattacharjya
Associate Professor
Department of Civil Engineering
Indian Institute of Engineering Science and Technology, Shibpur
West Bengal, India, Pin- 711 103



Department of Civil Engineering
INDIAN INSTITUTE OF ENGINEERING SCIENCE & TECHNOLOGY, SHIBPUR
Shibpur, Howrah – 711 103

Dr. Soumya Bhattacharjya
Associate Professor
& Associate Dean (Infrastructure Development), IEST, Shibpur
No. 24/CON/SB/CE/IEST

11th August, 2025

CERTIFICATE OF AUTHENTICATION

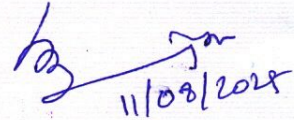
This is to certify that the project titled “**Comparison of Design and Initial Cost Estimation of Typical G+4 Residential Building for Different Seismic Zones and Soil Conditions**” has been **successfully completed** under the technical supervision and guidance of me.

The project involved the preparation of standard architectural layouts, structural designs, quantity estimations, and cost analyses for G+4 buildings with three different structural systems—**RCC, steel open section and steel tubular section**—across varying **seismic zones (III, IV, V)** and **soil types (soft, medium, hard)**, resulting in a total of **27 design and estimation combinations**.

The work has been carried out in accordance with relevant Indian Standards for structural design load considerations (dead, live, wind, and seismic). The results include detailed design documentation, quantity estimation and comparative cost analysis which have been reviewed and found to be technically sound and within reasonable limits.

This certificate is issued to the **Institute for Steel Development and Growth (INSDAG)** to acknowledge that the above-mentioned project has been **authentically executed** and duly verified for academic and professional purposes.

Yours sincerely,


11/08/2025


Dr. Soumya Bhattacharjya
Associate Professor
Department of Civil Engineering
Indian Institute of Engineering Science and Technology, Shibpur
West Bengal, India, Pin-711 103

(Soumya Bhattacharjya)

NB: Prepared in the capacity of regular Associate Professor of Civil Engineering Department, IEST, Shibpur

Table of Contents

Comparison of Design and Initial Cost Estimation of Typical G+4 Residential Building for Different Seismic Zones and Soil Conditions	1
Objectives:	1
Basic Considerations:	1
Other Considerations are as follows:.....	1
Variation of Earthquake Zone and Soil Type.....	2
Architectural Plan.....	3
RCC Beam Column Layout.....	4
Steel Beam Column Layout5	
Load Calculation.....	6
Slab Dimensions	6
Slab Design	6
Slab Load	8
Wall Load	8
Stair Case Load	9
Wind Pressure and Wind Load Calculation.....	10
Water Tank Load	10
Chajja Estimation	11
Estimation Sheet	12
RCC - Zone III; Soft Soil	12
RCC - Zone III; Medium Soil.....	12
RCC - Zone III; Hard Soil.....	13
RCC - Zone IV; Soft Soil.....	14
RCC - Zone IV; Medium Soil	15
RCC - Zone IV; Hard Soil	15
RCC - Zone V; Soft Soil.....	16
RCC - Zone V; Medium Soil	17
RCC - Zone V; Hard Soil	18
Open Section - Zone III; Soft Soil.....	18
Open Section - Zone III; Medium Soil.....	20
Open Section - Zone III; Hard Soil	21
Open Section - Zone IV; Soft Soil	22
Open Section - Zone IV; Medium Soil	23
Open Section - Zone IV; Hard Soil	24
Open Section - Zone V; Soft Soil	25

Open Section - Zone V; Medium Soil	27
Open Section - Zone V; Hard Soil	28
Tubular Section - Zone III; Soft Soil	29
Tubular Section - Zone III; Medium Soil.....	30
Tubular Section - Zone III; Hard Soil.....	31
Tubular Section - Zone IV; Soft Soil.....	33
Tubular Section - Zone IV; Medium Soil.....	34
Tubular Section - Zone IV; Hard Soil	35
Tubular Section - Zone V; Soft Soil.....	36
Tubular Section - Zone V; Medium Soil.....	37
Tubular Section - Zone V; Hard Soil.....	39
Comparison Graph (Cost per Square feet Vs Variation)	41
Conclusions	42
Reference.....	43
Input Files.....	44
ANNEXURE I: RCC – Zone III; Hard Soil.....	44
ANNEXURE II: RCC – Zone III; Medium Soil	56
ANNEXURE III: RCC – Zone III; Soft Soil	68
ANNEXURE IV: RCC – Zone IV; Hard Soil	80
ANNEXURE V: RCC – Zone IV; Medium Soil	92
ANNEXURE VI: RCC – Zone IV; Soft Soil.....	104
ANNEXURE VII: RCC – Zone V; Hard Soil	116
ANNEXURE VIII: RCC – Zone V; Medium Soil	129
ANNEXURE IX: RCC – Zone V; Soft Soil.....	141
ANNEXURE X: Open Section – Zone III; Hard Soil	153
ANNEXURE XI: Open Section – Zone III; Medium Soil.....	169
ANNEXURE XII: Open Section – Zone III; Soft Soil.....	184
ANNEXURE XIII: Open Section – Zone IV; Hard Soil	199
ANNEXURE XIV: Open Section – Zone IV; Medium Soil	215
ANNEXURE XV: Open Section – Zone IV; Soft Soil	230
ANNEXURE XVI: Open Section – Zone V; Hard Soil.....	245
ANNEXURE XVII: Open Section – Zone V; Medium Soil	261
ANNEXURE XVIII: Open Section – Zone V; Soft Soil	276
ANNEXURE XIX: Tubular Section – Zone III; Hard Soil.....	291
ANNEXURE XX: Tubular Section – Zone III; Medium Soil.....	304
ANNEXURE XXI: Tubular Section – Zone III; Soft Soil	317

ANNEXURE XXII: Tubular Section – Zone IV; Hard Soil	330
ANNEXURE XXIII: Tubular Section – Zone IV; Medium Soil.....	343
ANNEXURE XXIV: Tubular Section – Zone IV; Soft Soil.....	356
ANNEXURE XXV: Tubular Section – Zone V; Hard Soil	369
ANNEXURE XXVI: Tubular Section – Zone V; Medium Soil	382
ANNEXURE XXVII: Tubular Section – Zone V; Soft Soil.....	395

Comparison of Design and Initial Cost Estimation of Typical G+4 Residential Building for Different Seismic Zones and Soil Conditions

Objectives:

- To **prepare a standard architectural layout** and structural design for a G+4 building using both steel and RCC construction methods.
- To **estimate the quantity of materials and total cost** for constructing a G+4 steel framed building and an RCC building.
- To **compare the cost per square foot** between steel framed and RCC construction methods.
- To **identify and analyse cost variables** (concrete, steel, etc.) that affect the overall construction cost of both building types.
- To **prepare a comprehensive report** including plans, sections, and cost comparisons.
- To **get the design and cost estimations proof-checked** by an external expert for accuracy and reliability.
- To **disseminate the findings** by uploading the final design and cost data to the website for broader access and use.

Basic Considerations:

The Estimation is done for the three material considerations (*RCC foundation in all the cases*)

- **RCC Superstructure**
- **Open Section with Bracing**
- **Tubular Section with Bracing**

Other Considerations are as follows:

Earthquake Zones : 3, 4 & 5

Soil Type : Soft, Medium & Hard

Total 9 Nos. of Variations to be considered

In Total, a $9 \times 3 = 27$ combinations

Concrete Grade: M25

Steel Grade: Fe 500

Loadings Considered:

1. Dead Load
2. Live Load
3. Wind Load
4. Seismic Load