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Cost comprisonbetween r.c.c.beam& steel composite beam structure of g+5 storeyed building the overall plan dimenssion of the building is 56.3 m x 31.94m

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ABSTRACT

The Project involves Planning, Analysis, Design & Cost Comparison of an Institutional Building with steel-concrete composite construction. The proposal structure is a G+5 building, with 3.658m as the height of each floor. The overall plan dimension of the building is 56.3 m x 31.94m.

I. METHODOLOGY

The Analysis and design involves the structure planning, load calculation, analysis it by 2D modeling using STAAD-Pro 2003, design of composite floors and columns, design of steel beams and design of foundation. Analysis has been done for various load combinations including seismic load, wind load, etc. as per the Indian standard Code of Practice.

The project also involves analysis and design of an equivalent R.C.C. structure so that a cost comparison can be made between a steel-concrete composite structure and an equivalent R.C.C. structure.

II. NEED OF STEEL IN CONSTRUCTION

In building construction, role of steel is same as that of bones is a living being. Steel is very advantages because it:-

- Officer considerable flexibility in design and is easy for fabrication
- Facilities faster construction scheduling of projects.
- Enables easy construction scheduling even in congested sites.
- Permits large span construction repair/modification.
- In an ideal material in earthquake prone locations due to high strength stiffness, ductility.
- Is environment friendly and fully recyclable on replacement.

III. ADVANTAGES OF COMPOSITE CONSTRUCTION

IN conventional composite construction, concrete slabs rest over steel beams and are supported by them. Under load, these two components act independently and a relative slip occurs at the interface if there is no connection between them. With the help of deliberate and appropriate connection provided between the beam and the concrete slab, the slip between them can be eliminated. In this case, the steel beam and the slab act as a "Composite beam" and their action is similar to that of a monolithic Tee beam. Since concrete is stronger in compression than in tension, and steel is acceptable to book ling in compression, by the composite action between the two, we can utilize their respective advantages to the fullest extent. There are many advantages associated with steel-concrete composite construction. Some of these are listed below:-

- The most effective utilization of steel and concrete is achieved.
- Keeping the span and loading unaltered, a more economical steel section (in terms of depth and weight) is achievable in composite construction compared with conventional non-composite construction.
- As the depth of beam reduces, the construction depth reduces, resulting in enhanced headroom.
- Because of its larger stiffness, composite beams have less deflection than steel beams.
- Composite construction is amenable to "fast-track" construction because of using rolled steel and pre-fabricated components, rather than case-in situ concrete.
- Encased steel beam sections have improved fire resistance and corrosion.
- Considerable flexibility in design, pre-fabrication and construction schedule in congested areas.

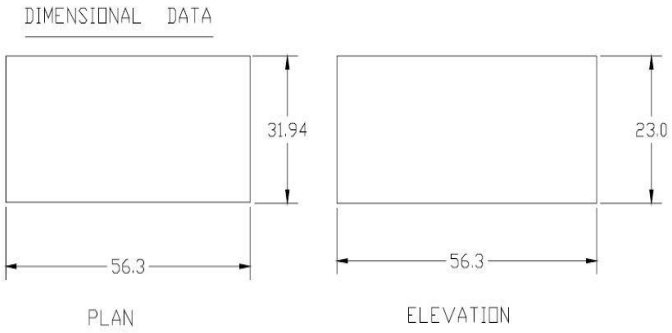
IV. DESIGN CONSIDERATIONS

Composite floors are developed based on limit state design philosophy. Since IS 456:2000 is also based on limit state methods, the same has been followed wherever it is applicable.

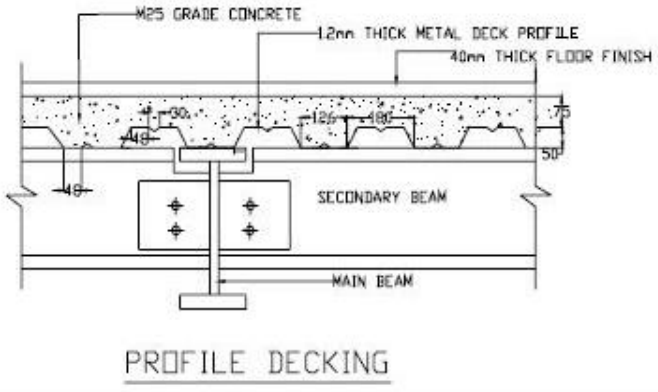
The design should ensure an adequate degree of safety and serviceability of structure. The structure should therefore be checked for ultimate and serviceability limit states.

The main economy in using profiled deck is achieved due to speed in construction. Normally 2.5 to 4.0m spans can be handled without propping and spans in excess 4m will require propping. The yield strength of decking steel is in the range of 220 to 460 N/mm2- Though light – weight concrete is preferable both from reducing the effect of ponding deflection as well as increasing the fire resistance, the normal practice in India is to use concrete of grade M20 to M30.

The analysis of composite section is made using Limit state of collapse method. IS:11384-1985 Code deals with the design and constructions of only simply supported composite beams. Therefore, the method of design suggested in EC 4 is also referred along with IS: 11384.



PLAN & ELEVATION



CROSS SECTION OF PROFILED DECK SLAB

COSTCOMPARISIONCHART

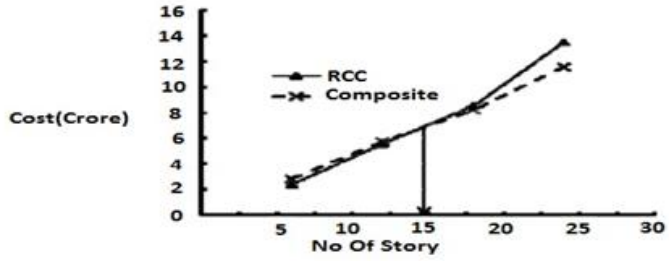
BEAMS

a. Considering shorter span beams,

Material	Rate	Composite Design	Amount	R.C.C. Design	Amount
Steel	Rs. 45/Kg.	1839 Kg.	Rs. 82755	650 Kg.	Rs. 29250
Concrete	Rs. 4390/m^3	--	--	2.46 m^3	Rs. 10800
Form work	Rs. 219/sq.m	--	--	19.194Sq.m./m	Rs. 4202
		Total	Rs. 82755	Total	Rs. 44252

b. Considering longer span beams.

Material	Rate	Composite Design	Amount	R.C.C. Design	Amount
Steel	Rs. 45/Kg.	277.2 Kg.	Rs. 12474	131.5 kg	Rs. 5917
Concrete	Rs. 4390/m^3	--	--	0.675 m^3	Rs. 2963
Form work	Rs. 219/sq.m	--	--	6.525 Sq.m./m	Rs. 1429
		Total	Rs. 12474	Total	Rs. 10309



Cost Versus number of storey curve for composite and RCC building

SUMMARY AND CONCLUSION

1) A G + 5 structure of plan dimensions 56.3m x 31.94m has beenanalyzed, designed and cost per unit quantities worked out.
2) An equivalent R.C.C. structure has also been analyzed, designed and cost per unit quantities worked out.
3) (A) A comparative study of the quantity of material and cost has been worked out both for composite and concrete construction.

(B) Though, the cost comparison reveals hat Steel-Concrete composite design structure is more costly, reduction in direct costs of steel compositestructure resulting from speedy erection will make Steel Composite structure economically viable. Further, under earthquake considerations because of the inherent ductility characteristics, Steel Concrete structure will perform better than a conventional R.C.C. structure.

4) For analysis,STAADPro-2003 software has been used.
5) Manual design has been carried out both for Steel-Concrete composite and R.C.C. structure.
6) Sufficient insight into the analysis and design of Steel-Concrete composite structure which is an emerging area has been gained
7) Immense confidence has been gained in the analysis and design of a multi-storeyed structure using STAAD Pro 2003 software.

REFRENCES

[1]. Handbook on Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures (IS : 875(Part 1) – 1987),Bureau of Indian Standards, New Delhi, 1989.
[2]. Handbook on Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures (IS : 875(Part 2) – 1987),Bureau of Indian Standards , New Delhi ,1989.
[3]. Handbook on Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures (IS : 875(Part 3) – 1987),Bureau of Indian Standards , New Delhi, 1989.
[4]. Handbook on Criteria for Earthquake Resistant Design of Structures (IS : 1893(Part 1) – 2002),Bureau of Indian Standards , New Delhi, 1989...
[5]. IS-456:2000 Indian Standards Code.
[6]. BS 5950 (Part 3),Design of Simple and Continuous Beams, British Standards Institution, London
[7]. Eurocode 4:Design of Composite steel and Concrete Structures, British Standards Institution, London,1994
[8]. M.P. SOR -2009.