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Durability Aspects of Cylindrical Roof Construction in Ferrocement

Durabilité de toitures cylindriques en béton armé

Dauerhaftigkeit von Tonnendächern aus Stahlbeton

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SUMMARY

Architectural considerations in modern building construction demand curved roof construction in parts of the building. These roofs, when cast by conventional techniques, require costly shuttering and consume more materials and labour. Analysis design and construction technique used for a ferrocement hood roof convering an area of 3.0 m x 4.8 m have been discussed. Considerations for durability of the structure have also been discussed.

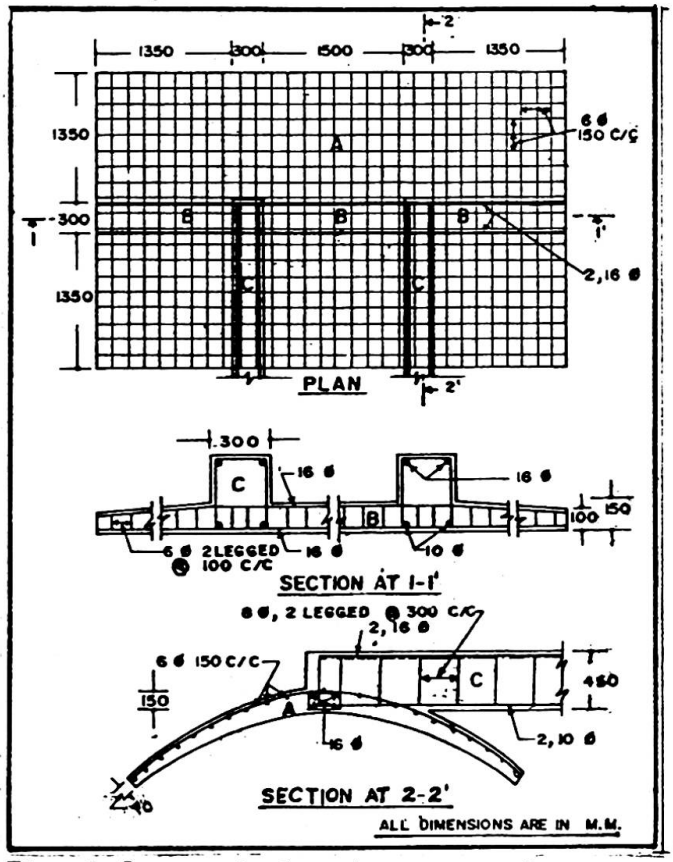

Fig. 1 Geometrical and structural details

1. DESCRIPTION OF STRUCTURE

The geometrical and structural details are shown in Fig. 1. The structural components are : The cylindrical hood roof (A); The central beam (B) and The cantilever beams (C).

2. ANALYSIS AND DESIGN

Components A,B and C the structure have been conventionally analysed for loads as per IS:875-1964[1] to obtain design values of bending moments and shearing forces. The stability of the structure has been ensured as per IS:456-1978[2]. Working stress method of design, as applicable to reinforced concrete, has been used.

3. EXECUTION PROCEDURE

The cantilever beams (C) and the central beam (B) were cast with shuttering. The curved reinforcement bars of the hood shell (A) were embedded into the central hood beam (B) prior to its casting. The making of the hood shell was taken up after completion of curing of (B) and (C) and removal of formwork. The reinforcement along the length of the shell was tied to the curvilinear reinforcement of the hood shell. Two layers of chicken-mesh, one at the top and the other at the bottom of the

Fig. 2 Front view of hood

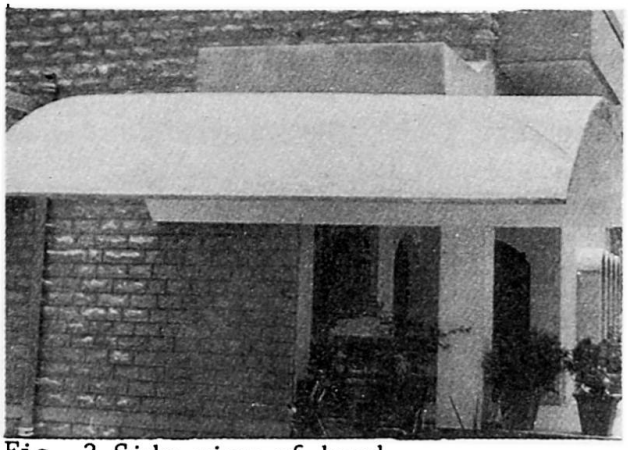

Fig. 3 Side view of hood

reinforcement grid of the shell, were used. Cement-sand mortar, with some coarser particles up to 10 mm size,was splashed on to the bottom surface of the shell in strips of 300 mm width and 50-75 mm thickness along the axis of the shell. Strip formation was commenced on the sides of the central hood beam and terminated at the free edges of the shell. Each strip of 300 mm width on each side of the hood beam was splashed one after the other with an interval of 24 hours to ensure initial hardening and gain of strength. This process was repeated till the formation of full shell. The shell was then finished at the top surface as well as the bottom surface. The finished hood structure is shown in Fig. 2 and 3.

4. DURABILITY CONSIDERATIONS

The successful performance of the ferrocement depends greatly on its durability than on its strength properties. Freezing and thawing; wetting and drying; attack of chemicals, bacteria, wind and water waves; free lime and calcium hydroxide in cement; impurities in aggregates and water; prolonged chemical reactions of concrete ingredients; poor construction practices, reversal of stress cycles and overloading are the factors effecting durability. Staining; scaling and pitting; wear; dimensional instability, cracking, reduction in strength due to corrosion of steel are the symbols of deterioration and ageing.

The damage to the structure of mortor, which is the main corrosion resistant cover to reinforcement, is retarded in ferrocement construction due to efficient arrest of the cracks by chicken-mesh and also due to the presence of high cement content. Proper design, selection of proper material, control on execution, provision of protective coatings and avoiding overloads are the measures to further ensure the durability of ferrocement construction.

5. CONCLUSION

- The ferrocement technique is useful for innovative applications in modern building construction.
- A greater durability is ensured due to richer concrete mix and efficient arrest of cracks by chicken-mesh.
- Economy in the cost of shuttering, use of materials and labour is enherant with the ferrocement construction.

REFERENCES

1. IS:875-1964,'Code of Practice for Structural Safety of Buildings:Loading Standards',Indian Standards Institution, New Delhi.
2. IS:456-1978,'Code of Practice for Plain and Reinforced Concrete', Indian Standards Institution, New Delhi.