

Study of Shell Structure and Analysis of Structure Failure

Shraddha Malviya¹, Ketan Jain²

¹Student, Department of Architecture, SDPS Women's College, Indore, India

²Associate Professor, Department of Architecture, SDPS Women's College, Indore, India

Abstract: Shell structures are basically inspired from natural element named "SHELL". Some of natural elements showing these properties are egg shell, sea shell, fruit shells such as walnut etc. Shell structures are also called "FORM RESISTANCE STRUCTURES". A clear mathematical model of shell growth based on equiangular spirals was first given by Henry Moseley in 1838.

Shells structures are classified by its different shapes regarding different geometry. The motive behind the study of shell structures is to know about easy and interesting construction of clear span structures. In this research paper I tried to brief about origin of shell structures, its types, design consideration, material use etc. This paper also includes the study of structure failure and some common examples of shell structures.

Keywords: Form resistance structure, thin structure, clear span construction and uniform load distribution.

1. Introduction



Fig. 1. Shell Structure

A shell structure is a thin structure composed of curved sheets of different materials, so that curvature plays an important role in the structural behaviour realising a spatial form. It poses uniform load so can be used in fluid or solid storage.

We may assume even earlier people use large areas for gatherings for variety of purpose such as religious, political, artistic or competitive etc. It is found that making clear span is quite difficult. The large roofs unsupported expect at its boundary arose to shelter these gatherings. Even with wood material that can span relatively short horizontal distances by beam action, has to be combined in conical cylindrical or spherical shapes whenever large distances are to be spanned [1].

As the stiffness of flat slab is derived by its thickness if too thin they become too flexible and strength of sheet like elements can be obtained not only by increasing their thickness

and hence the amount of required material. Nature knows well the principle of strength through curvature and uses it whenever possible to protect life with minimum of material. Shell structures are becoming popular for industrial buildings, hangers and other large buildings because they provide uninterrupted space without columns.

2. Scope of research

The main objective of conducting study is to investigate about clear span construction or large column free structures to have interesting structural forms using less material and more stability. So far this study is helpful in understanding the geometrical behaviour of shell structures. This study makes it possible to understand that a structure can result in good stability even when thickness of slab is less.

3. Methodology and discussion

The knowledge obtained from the study of shell structures adopts the following methodology:

- The study of natural shell.
- The geometrical behavior and formation of shells and shell structures.
- Shell structures and its history.
- The study based on types of shell, design consideration, shell dimension.
- Discussion about designing process and management for the construction of shell structures.
- Construction through different materials.

A. Design consideration

Slope: Generally, if the slope of shell exceeds 45° , it will be too steep for easy concreting.

Thickness: For singly curved shell it should be no less than 5cm.

For doubly curved thickness should not less than 4cm.

Transverse: Transverse is also called end frame. It is provided to preserve the shape of shell.

Reinforcement: Reinforcement shall not be less than 5mm in the thicker span of shell and shall not be greater than:

- 10mm dia - For shell from 4cm up to less than 5cm thick.
- 12mm dia - For shell from 5cm up to less than 6.5cm thick.

- 16mm dia. – For shells for thickness from 6.5cm and above.

B. Concrete mix

Generally, 1:2:4 is taken for shells of smaller or medium dia shells and 1:3/2:3 when the dia of shell is very large.

- Edge members and end frame shall be concreted first.
- Concrete shall have slump not less than 5cm.
- Shell structure should be covered with wet canvas or gunny bags for atleast 24hrs.

4. Conclusion

This paper presented a study on shell structure and analysis of structure failure.

References

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