

Studies on V-Type R.C.C Folded Plate Roofs

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ABSTRACT: Reinforced concrete(RCC) is widely used for construction on a large scale due to its desirable mechanical properties and flexibility of its form. In order to study the economical configuration of RCC folded plate roofs one hundred and eighty V-type folded plates have been analyzed and designed by Iteration method. Spans taken: 10m, 15m, 20m, 25m, 30m.

Angle of inclination of plates: 20° to 45°.

Width of covering : 4m, 6m, 8m.

Thickness of folded plates: 75mm and 100mm.

The cost per sq.m for folded plate roofs have been estimated for all the spans.

NOTATIONS:

d = Effective depth of the section

b = Breadth of the section

I= Moment of inertia

K= Stiffness of a member

Z= Section modulus

M= Bending moment

KEYWORDS: Folded plate, Angle of inclination, Thickness, Grade of Concrete.

I. INTRODUCTION

Folded plates are series of thin plates, usually rectangular joined monolithically along their common edges and supported on diaphragms. They are also known as hipped plates.

It is ideally suited for variety of structures such as factory buildings, assembly halls, godowns, auditoriums and gymnasia, requiring large column free area. Folded plates were first used for large coal bunkers by G.Ehlers of Germany in 1924-25. The various types of folded plates available are Prismoidal, Prismatic, Pyramidal and the commonly used shapes of folded plates are V-type, Trough type, Polygonal type, Combination of V and Trough type, Butterfly type and North light. Some of the applications are Factory buildings ,Assembly halls, Godowns Auditoriums , Gymnasia.

II. RELATED WORK

Cost optimization of V type folded plate- international journal of advance engineering and research development volume 2, issue 3, March 2015-Bhavin j.Punjani, Kaushik c.koradia. In this study, different types of the folded plate roof are designed and analyzed by classical methods. Parameters used in this study are span, thickness , width, inclination angle, height. Excel programming is used for the design and analysis for smart solution. This smart solution helps the designer to reach the economy. It saves in time and iteration method is applicable for symmetrical V-type folded plates By the slab action, the loads are transmitted to the joints by the transverse bending of the slabs. By plate action, the loads carried to the end diaphragms by the longitudinal bending of the slabs in their own planes. From the above study, derived matrix of economic sections with different span, height, thickness and angle as for 10 meter span 0.1m thickness, 45 degree angle, and L/15 height is economical. Similarly, for 15 meter span 0.12m thickness, 50

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 3, March 2016

degree angle and L/11 height, for 20 meter span 0.13m thickness, 50 degree angle and L/15 height, for 25 meter span 0.16m thickness, 50 degree angle and L/13 height are economic sections.

III. DESIGN PROCEDURE

V-type folded plate has been designed by using iteration method. The iteration method is applicable for symmetrical folded plates with similar computational effort in comparison with the whitney and simpsons method. The iteration method has been found to converge rapidly for symmetrical V-type folded plates while it diverges when applied to north-light folded plate. Folded plates are designed as per IS:2210-1988 (Criteria for design of reinforced concrete shell structures and folded plates) and IS 456:2000.

IV. RESULTS AND DISCUSSIONS

The effect of changing the Span, Angle of inclination and width of covering on the cost of V-type RCC folded plate roofs are discussed below:

The following figures (Fig 4.1- 4.5) shows the comparison between Cost and angle of inclinations for different spans and width of covering with thickness of plate as 75mm

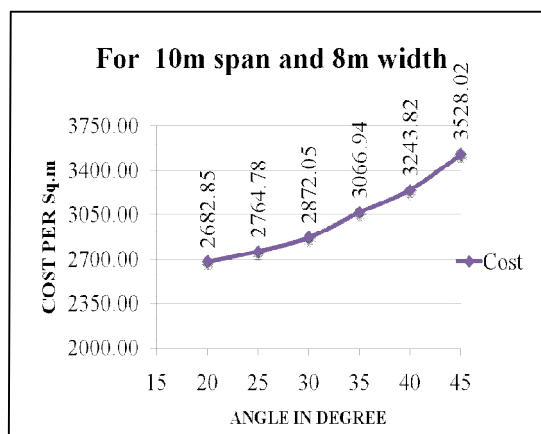


Fig 4.1 For 10m span and 8m width

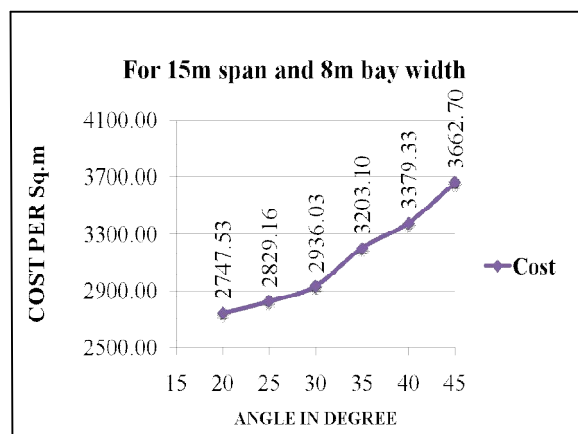


Fig 4.2 For 15m span and 8m width

Fig 4.1 shows that for a span of 10m, an angle of inclination of 20° and a bay of width of 8m results in the economical configuration. As the angle of inclination increases, the cost also increases. Fig 4.2 shows that for a span of 15 m, an angle of inclination of 20° and a bay of width of 8m results in the economical configuration. As the angle of inclination increases, the cost also increases.

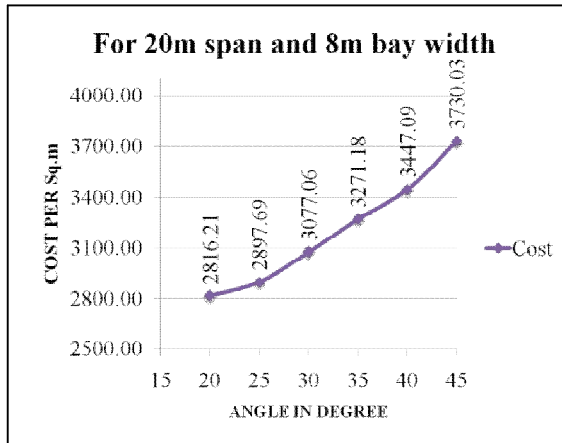


Fig 4.3 For 20m span and 8m width

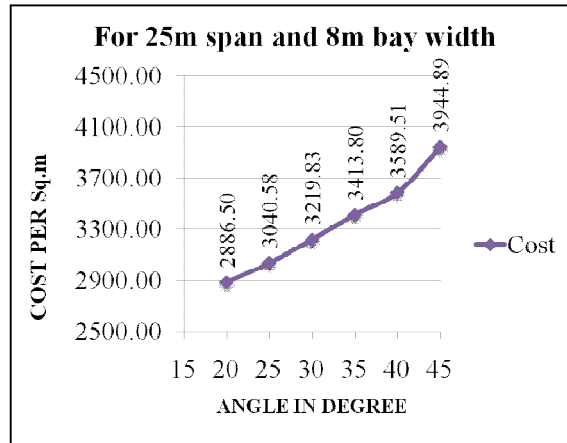


Fig 4.4 For 25m span and 8m width

Fig 4.3 shows that for a span of 20m, an angle of inclination of 20° and a bay of width of 8m results in the economical configuration . As the angle of inclination increases, the cost also increases. Fig 4.4 shows that for a span of 25 m, an angle of inclination of 20° and a bay of width of 8m results in the economical configuration . As the angle of inclination increases, the cost also increases.

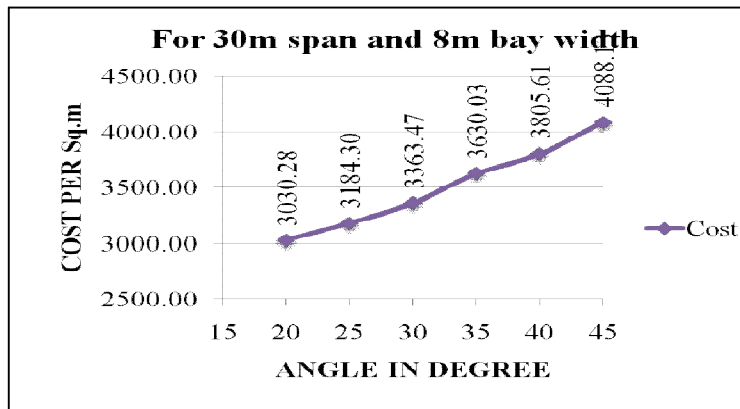


Fig 4.5 For 30m span and 8m width

Fig 4.5 shows that for a span of 30m, an angle of inclination of 20° and a bay of width of 8m results in the economical configuration . As the angle of inclination increases, the cost also increases.

The following figures (Fig 4.6- 4.10) shows the comparison between Cost and angle of inclinations for different spans and width of covering with thickness of 100mm

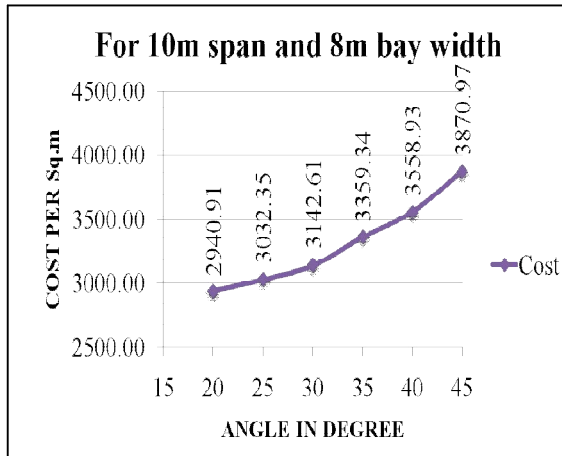


Fig 4.6 For 10m span and 8m width

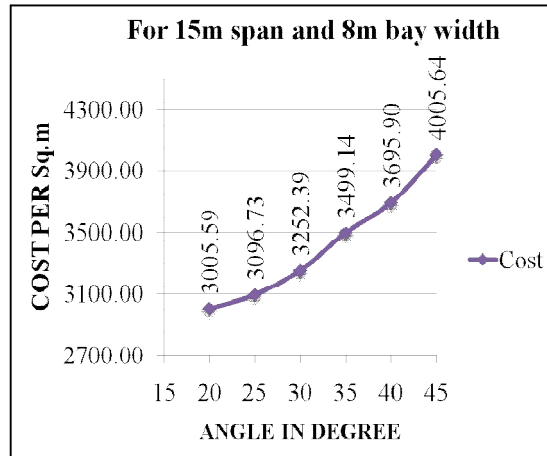


Fig 4.7 For 15m span and 8m width

Fig 4.6 shows that for a span of 10m, an angle of inclination of 20° and a bay of width of 8m results in the economical configuration . As the angle of inclination increases, the cost also increases. Fig 4.7 shows that for a span of 15 m, an angle of inclination of 20° and a bay of width of 8m results in the economical configuration . As the angle of inclination increases, the cost also increases.

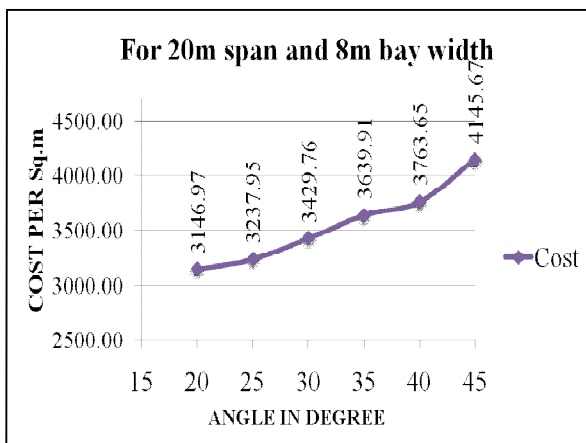


Fig 4.8 For 20m span and 8m width

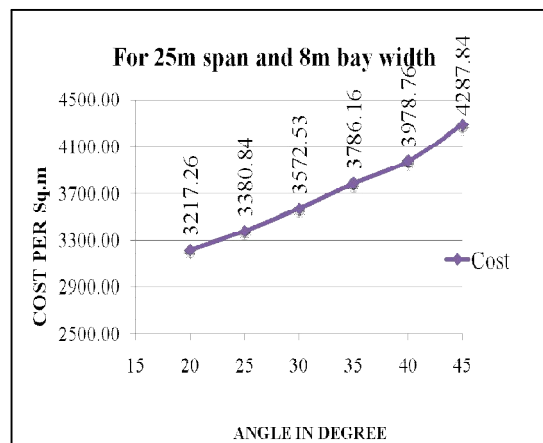


Fig 4.9 For 25m span and 8m width

Fig 4.8 shows that for a span of 20m, an angle of inclination of 20° and a bay of width of 8m results in the economical configuration . As the angle of inclination increases, the cost also increases. Fig 4.9 shows that for a span of 25 m, an angle of inclination of 20° and a bay of width of 8m results in the economical configuration . As the angle of inclination increases, the cost also increases.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 3, March 2016

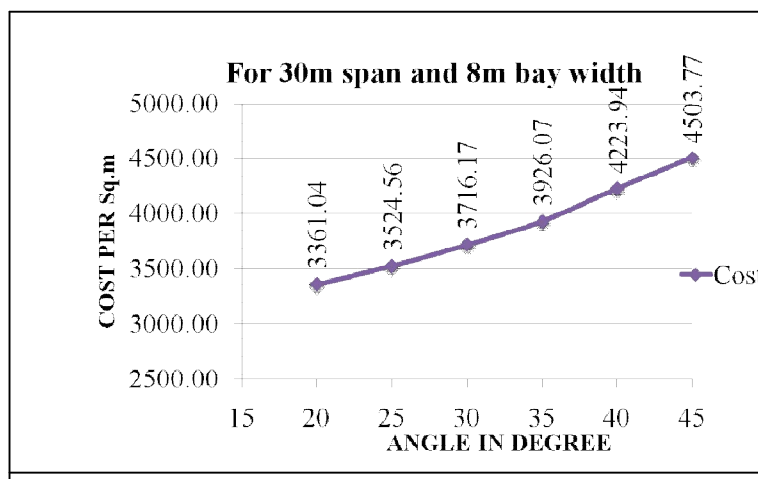


Fig 4.10 For 30m span and 8m width

Fig 4.10 shows that for a span of 30m, an angle of inclination of 20° and a bay of width of 8m results in the economical configuration. As the angle of inclination increases, the cost also increases.

V. CONCLUSIONS

- To cover a given area, lesser the angle of inclination of plates, more is the saving in cost irrespective of span. This is due to following reason
- As the angle of inclination of the plate is increased, the surface area of the plates will be more and the concrete required will be more resulting in more cost.
- If flat R.C slab is adopted, thickness required will be more which results in more cost compared to folded plate roofs.
- From Fig 4.1 to 4.6, it is observed that for 75mm, the total cost will be the least irrespective of the angle of inclination of the plates if the angle is 20°.
- From Fig 4.6 to 4.10, it is observed that for 100mm, the total cost will be the least irrespective of the angle of inclination of the plates if the angle is 20°.
- As the angle of inclination of the plate is increased, the cost also increases.

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