CALCULATION MODELS FOR WOOD ROOF FRAMING MADE FOR A FAMILY HOUSE

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Abstract

This paper aims to highlight specific calculation models for roof framing for i.e. rafters, props, purlins made for a family house consisting of masonry load-bearing walls, with items calculated and sized for values quasi-similar to those provided in standards and calculation models specific to wood construction.

Key words: roof framing, wood, rafters, props, purlins, structural frame.

INTRODUCTION

Wood roof framing elements are made for a family home that has its structural frame consisting of masonry load-bearing walls with items sized for values quasi-similar to calculation norms for rafters, props, and purlins. The roof of the family house construction is made in a wood roof framing engineering with covering in gauged tiles according to the following coating:

- Ceramic tile
- 3.8 X 5.8cm laths
- 12 X 15cm rafters
- 15 X 19cm purlins
- 12 X 12cm props

MATERIAL AND METHOD

Calculation models for rafters, purlins and props:

Calculation of rafters:

Fixed dimensions for the cross section of the rafters are as follows:

$b = 12cm, h = 15cm;$

The distance between the rafters is as follows:

$d_r = 0.75m;$

Calculation opening:

$l_c = 2.95m$

In terms of strength calculations, the static scheme for calculating the rafters is considered a beam simply supporting on the purlins having the opening equal to the greatest distance between the axes of constructive purlins:

Determining the cross section characteristics

$$w_y = \frac{b \times h^2}{6} = \frac{12 \times 15^2}{6} = 450\,cm^3$$

$$I_y = \frac{b \times h^3}{12} = \frac{12 \times 15^3}{12} = 3375\ cm^4$$

$A = b \times h = 12 \times 15 = 180\ cm^2$

1. Determining the actions:
   - permanent action
2. Calculation of stress resulting from the basic combination with the worst case scenario effect
3. Calculation for ultimate stress strength
4. Checking the symmetrical strength
5. Calculation for ultimate bending strength:
   - Initial phase
   - The final phase

Calculation of purlins:

The dimensions chosen for the cross section of the purlins are as follows:

- b = 15cm
- h = 19cm

Distance between purlins:

- $d_p = 2.95m$

Calculation opening:

- $l_c = T \cdot 0.8 = 3.30 \cdot 0.8 = 2.64m$

Static scheme for purlins calculation is considered a beam simply supporting on props.

Determining the cross section characteristics

$$w_y = \frac{b \cdot h^2}{6} = \frac{15 \cdot 19^2}{6} = 902.5cm^3$$

$$I_y = \frac{b \cdot h^3}{12} = \frac{15 \cdot 19^3}{12} = 8573.75cm^4$$

$A = b \cdot h = 15 \cdot 19 = 285cm^2$

1. Determining the actions:
   - permanent action
2. Calculation of stress resulting from the basic combination with the worst case scenario effect
3. Calculation for ultimate stress strength
   - Checking the symmetrical strength
4. Calculation for ultimate bending strength:
   - Initial phase
   - The final phase

Calculation of props:
The dimensions chosen for the cross section of the props are as follows:

- b = 12cm
- h = 12cm

Distance between props:

- d_{prop} = 2.95m

Calculation opening:

- T = 3.30m
- H_{prop} = 4.05m

Determining the cross section characteristics

$$w_y = \frac{b \cdot h^2}{6} = \frac{12 \cdot 12^2}{6} = 288cm^3$$

$$I_y = \frac{b \cdot h^3}{12} = \frac{12 \cdot 12^3}{12} = 1728cm^4$$

$$A = b \cdot h = 12 \cdot 12 = 144cm^2$$

1. Determining the actions:
   - permanent action
2. Calculation for ultimate stress strength
   - checking in the case of compression parallel to the fibers

RESULTS AND DISCUSSION

The calculations submitted reveal the following results:

a) In the case of rafters, one obtains the dimensions and characteristics specific for the cross section b x h (12 x 15), A = 180cm^2, the distance between rafters d_r = 0.75m, calculation opening l_c = 2.9 m as well as computed values for actions and strength on the checks imposed by the strengths conditions specific to rafters.

b) In the case of the purlins, one obtains the dimensions and characteristics specific for the cross section b × h (15 × 19), A = 295cm^2, the distance between purlins d_p = 2.95m, calculation opening l_c = 2.64m, as well as computed values for actions and strength on the checks imposed by the strenght conditions specific to purlins.

c) In the case of props one obtains the dimensions and characteristics specific for the cross section b × h (12 × 12), A = 144cm^2, the distance between props d_{prop} = 2.95m, calculation opening T = 3.30m, H_{prop} = 4.05 m, as well as computed values for actions and strength on the checks imposed by the strenght conditions specific to props.

CONCLUSIONS

For rafters and purlins one followed the next algorithm:

- Determining the cross-section characteristics,
- Determining the actions i.e. permanent and under snow loading,
- Calculation of stress resulting from the basic combination with the worst case scenario effect,
- Calculation for ultimate stress strength and checking the symmetrical strength,
- Calculation for ultimate bending strength in the initial and the final stage

As for the rafters one followed the next algorithm:

- Determining the cross-section characteristics,
- Determining the actions i.e. permanent and under snow loading,
- Calculation for ultimate stress strength and checking in the case of compression parallel to the fibers

The results obtained after performing the strength related calculations highlight conclusive numerical values for determining the engineering characteristics of wood roof framing structure.

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