

Cost Comparison of Roof Truss Angle Section and Channel Section Purlins by Working Stress and Limit State Method

A Jayaraman, N Sathyakumar, S B Prasath

Abstract: Industrial structural design to be adequate, usually four main aims of this study – value, protection, cost-effective and stylishness must be fulfilled. This paper reported that, the performance and reasonable of industrial structures by evaluation of LSM and WSM. This paper presents a study on performance and reasonable of purlins of roof trusses by LSM and WSM. The conjectural data are designed using IS –code of IS 875-1975 (part III), IS 800 – 2007 using LSM, IS 800- 1984 using WSM and the section properties of the specimens are obtained using steel table. The research project aims to provide which method is cost-effective, more load transport capability and high flexural strength. The angle section less economical compare with channel section section. The cost of channel section is 54.31 % and 60.12% is less than the angle section in similar organization load in WSM and LSM.

Key words: Working stress method, limit state method, roof trusses, purlins industrial structures,

I. INTRODUCTION

The Industrial structures are mostly constructed by steel section due fast construction of work, most economical, flexible, high bending strength and low high shear resistance compare with other structures .The olden days most of the structures are constructed by timber , concrete and other material etc.. Now recently developed by cold formed steel section are widely used for all type structures such as industrial building , storage bin , railway coaches, transmission line towers, petrol bunk , car and bus shelter etc.. In generally most of the country purlins are used by Cold formed steel section. The maximum lengths of purlins are used by basically ‘Z’ shape sections are mostly used compare with other shape of sections. The mainly used the cold formed section are light weight, minimum bending strength, minimum shear force and high economical compare with rolled steel section. The thickness of cold steel member ranges from 0.1 mm to 7.2.

The yield point and ultimate strength compare with rolled steel sections by Anbuchejian (et al) [1]. Workshop are used for industrial, where house etc. steel is lengthily used in the construction of industrial building of big spans anywhere concrete construction is not practicable or what time construction time is large. The significant elements of industrial buildings are purlins, rafters, roof truss, wind bracing and columns.

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In India predictable steel construction are most accepted since of their no difficulty in construction, low cost, accessibility of manpower for assembly & production of standard provision 7 codes of practice. From the design it is obvious that by channel section for purlins and angle section for truss, Steel truss building by means of pipe section and PEB is originate to be inexpensive compared to Steel truss structure using angle section. Also From judgment it is clear from the result that heaviness of single truss using Angle and Pipe both is less Compared to PEB but due to Weight of Channel Purlins, mass of Steel truss Building is on elevated side by Sager D (et al) [2]. The cold formed steel section are different shape of sections are used .but Z –purlins are most widely used in all type of structures. High flexural capacity, maximum load carrying capacity, low deflection and most economical section by Z shape of –purlins compare with other type of section by Govindasamy. P (et al) [3]

II. AIM OF THE STUDY

The main objective of this study is witch method is most economical method by both WSM and LSM

III RESULT AND DISCUSSIONT

The theoretical results of the LSM, the bending moment is 80.25 % and 70.88 % higher than the WSM for channel section and angle section purlins. The bending stress and deflection is similar in both WSM and LSM method. But WSM method is more economical when compare with the LSM. In general the research report is, the LSM the total member weight is 34.78 % is higher compare with LSM. Similarly the total cost of structures is 48.30% higher compare with WSM. The channel section is most economical section compared to angle section. The cost of angle section is 54.31 % and 60.12% more than the channel section in same configuration load in working stress method and limit state method. Weight and cost comparison of WSM and LSM is shown in Table & Figure .1

A. Comparisons of cost & weight of C- Section purlins by LSM and WSM.

a. Comparisons of cost & weight of C-Section purlins by LSM and WSM.

Comparison of weight and cost of channel section purlins using WSM is 36.75 kg and the cost is Rs 2021..2 5/ C/C spacing of the truss and LSM is C /C the member weight 58.15 kg and total cost is Rs 3170.75 /- .



Cost Comparison Of Roof Truss Angle Section And Channel Section Purlins By Working Stress And Limit State Method

The results are shown in Table 1. Compare with cost of WSM and LSM of C / C spacing of trusses is shown in Figure 1.

C / C spacing of roof truss in m	LSM		WSM	
	Weight in (kg)	Cost (Rs)	Weight in (kg)	Cost (Rs)
4	58.15	3210.25	38.12	2123.23
8	117.23	6425.23	75.23	4123.23
12	181.25	9412.36	121.02	6123.23
16	241.25	13101.2	142.23	8523.56
20	288.12	15975.23	174.25	10112.32

Table 1. Comparison of Weight and Cost of Channel section by WSM and LSM

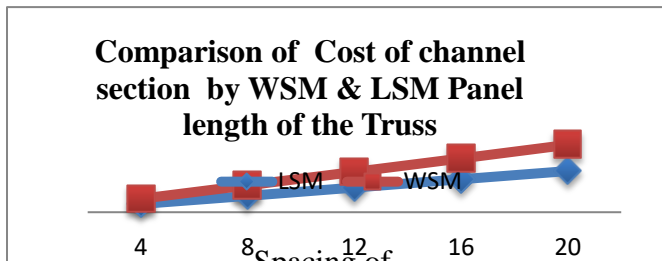


Figure 1. Cost Comparison of channel section purlins by WSM & LSM spacing of truss

b. Comparisons of cost & weight of channel section purlins by LSM and WSM for length of panel.

Comparison of weight and cost of channel section purlins by LSM is 292.53 kg and cost is Rs 14697.6 /- for length of 20 m truss. The WSM the member weight is 187.75kg and total cost is Rs 81230.12 /-. The result is given in Table2. Compare with of cost & weight of channel section purlins by WSM and LSM of trusses shown in Figure 2& 3.

Length of panel in m	LSM		WSM	
	Member weight in (kg)	Cost in (Rs)	Member weight in (kg)	Cost in (Rs)
2.5	292.5	14697.6	147.23	11321.23
5	566.7	32145.5	389.12	21452.23
7.5	862.36	48632.02	578.36	31002.21
10	1163	62145.23	775.12	40253.28
12.5	1475.2	78996.5	942.36	52132.17
15	1730.2	94352.10	1210.23	64203.13
18	2369	123654.12	1586.23	81230.12

Table 2. Member Weight and Cost of Channel section Purlins by WSM and LSM

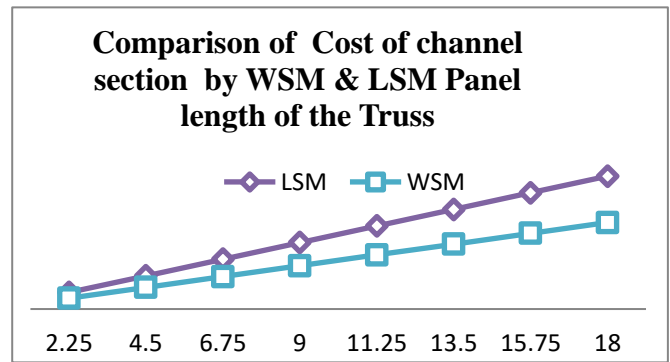


Figure 2. Comparison of Cost of channel section by working stress method and limit state method.

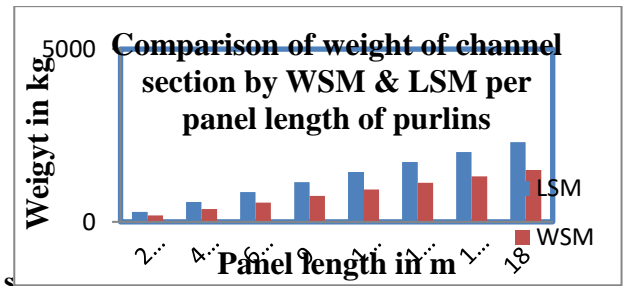


Figure 3. Member weight of channel section purlins by working stress and limit state method

B. Comparisons of cost & weight of angle section purlins by WSM & LSM

a. Member weight and cost of angle section by WSM and LSM Centre to centre roof truss spacing

Compare with total member weight and cost of roof truss angle section purlins by WSM is 59.85 kg and cost is Rs 3,286.25/- C /C spacing of roof truss and LSM ,the member weight is 115.58 kg and cost is Rs 81230.23/-

The results are shown in Table 3. And comparison of cost & weight of angle section purlins by WSM and LSM shown in Figure 4 & 5.

S.n	Spacing of Roof truss in m	WSM		LSM	
		Member weight in (kg)	Cost in (Rs)	Member weight in (kg)	Cost in (Rs)
1	4	59.75	3,286.25	115.58	6,356.90
2	8	119.50	6,572.50	231.16	12,713.80
3	12	179.25	9,858.75	346.74	19,070.70
4	16	239.00	13,145.00	462.32	25,427.61
5	20	298.75	16,431.25	577.90	31,784.51

Table 3. Member Weight and cost of angle section by WSM & LSM C/ C spacing of the roof trusses

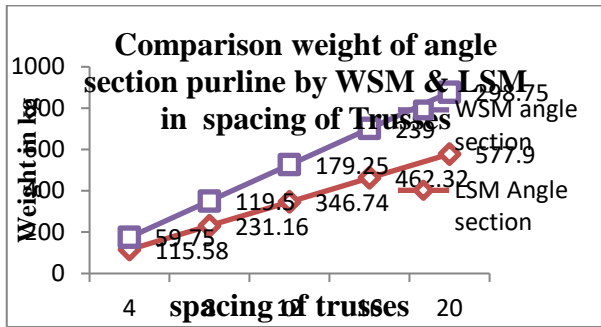


Figure 4. Comparison weight of angle section purlins by WSM & LSM spacing of truss

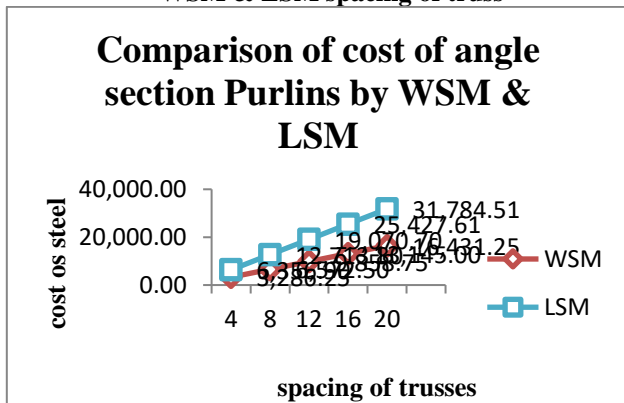


Figure 5. Comparison cost of angle section purlins by WSM & LSM spacing of truss

b. Compare with total member weight and cost of angle section by WSM and LSM Centre to centre Spacing of the Truss

Compare with total member weight of section and cost of angle section by LSM is 577.91 kg and RS 31785.43/- for 20 m span of truss. The WSM is 298.5 kg cost is RS 16432.40. The results are shown in Table.4 and comparison of cost & weight of angle section purlins by WSM and LSM shown in Figure 6 & 7.

S.no	Length of panel in m	WSM		LSM	
		Member weight in (kg)	Cost in (Rs)	Member weight in (kg)	Cost in (Rs)
1	2.25	298.71	16,432.40	577.91	31,785.43
2	4.5	597.54	32,864.81	1155.83	63,570.87
3	6.75	896.313	49,297.21	1733.75	95,358.30
4	9	1153.00	63,415.00	2311.66	1,27,141.74
5	11.25	1493.85	82,162.02	2889.58	1,58,927.45
6	13.5	1792.62	98,594.43	3467.50	1,90,712.5
7	15.75	2091.39	1,15,026.4	4045.41	2,22,497.5
8	18	2390.16	1,31,459.2	4623.33	2,54,283.3

Table .4 Comparison of Weight and Amount of Angle section Purlins by working stress and limit state method

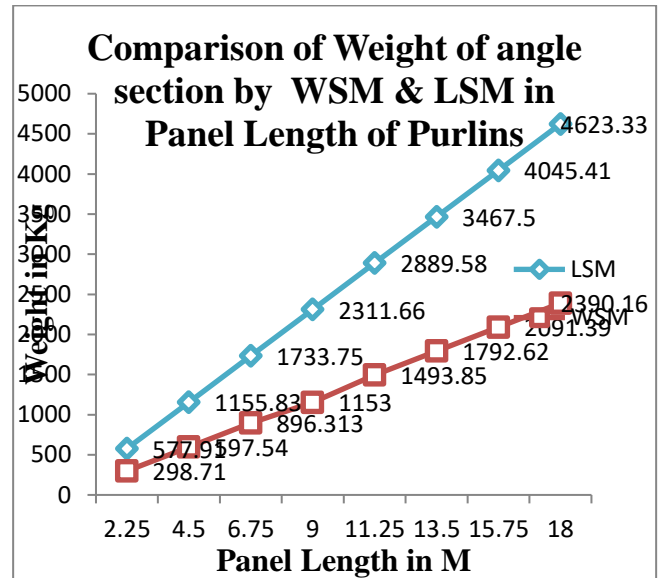


Figure 6. Comparison of weight of angle section purlins by WSM & LSM panel length of purlins

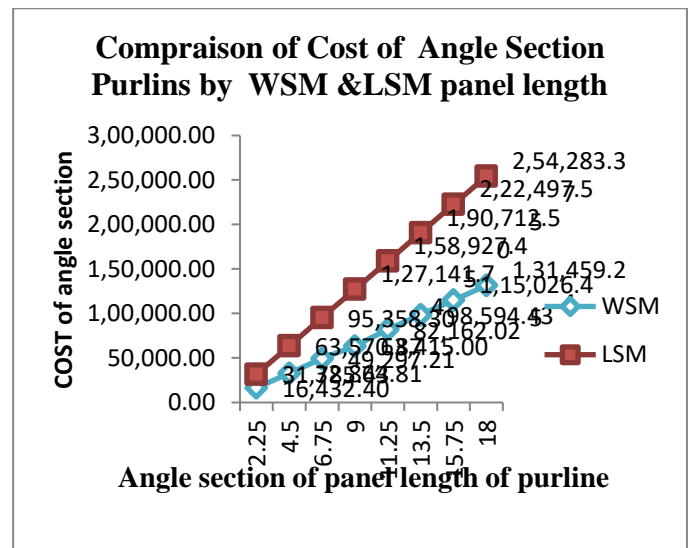


Figure 7. Comparison of cost of angle section purlins by WSM & LSM panel length of purlins

C. Comparison of Channel Section and Angle Section purlins by WSM & LSM

a. Comparison of Channel Section and Angle Section purlins by WSM & LSM 3.3.1 Comparison of cost & weight of Channel Section and Angle Section purlins in WSM & LSM in panel length of trusses

An angle section, the weight & cost of the steel is 37.15% , 50.12 % more than the channel section in WSM and LSM for panel length of purlins. The results are shown in Table 5 & 6. & Comparison of cost of angle and channel section purlins by WSM and LSM for panel length of purlins shown in Figure 8.



Cost Comparison Of Roof Truss Angle Section And Channel Section Purlins By Working Stress And Limit State Method

S.no	Panel length in m	Angle section purlins		Channel section purlins	
		Member weight in (kg)	Cost in (Rs)	Member weight in (kg)	Cost in (Rs)
1	2.25	298.71	16,432.40	187.75	10,312.50
2	4.5	597.54	32,864.81	375.50	20,625.00
3	6.75	896.313	49,297.21	559.28	30,937.50
4	9	1153.00	63,415.00	751.00	41,250.00
5	11.25	1493.85	82,162.02	938.75	51,562.50
6	13.5	1792.62	98,594.43	1126.50	61,875.00
7	15.75	2091.39	1,15,026.45	1314.25	72,187.50
8	18	2390.16	1,31,459.24	1502.00	82,500.00

Table 5. Comparison of Weight & Cost of Channel Section and Angle Section purlins in WSM in panel length.

S.no	Panel length in m	Angle section purlins		Channel section purlins	
		Member weight in (kg)	Cost in (Rs)	Member weight in (kg)	Cost in (Rs)
1	2.25	577.91	31,785.43	288.25	15,853.75
2	4.5	1155.83	63,570.87	576.50	31,707.50
3	6.75	1733.75	95,358.30	864.75	47,561.25
4	9	2311.66	1,27,141.74	1153.00	63,415.00
5	11.25	2889.35	1,58,927.45	1441.25	79,268.75
6	13.5	3467.50	1,90,712.50	1729.50	95,122.50
7	15.75	4045.41	2,22,497.55	2017.75	1,10,976.25
8	18	4623.33	2,54,283.37	2306.00	1,26,830.00

Table 6. Comparison of channel section and angle section purlins in limit state method in panel length

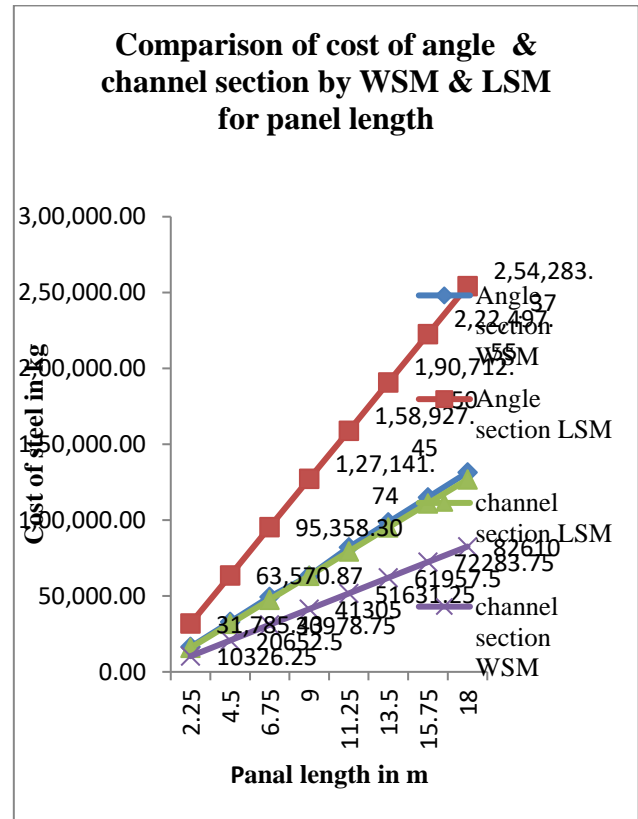


Figure 8. Comparison of cost of angle and channel section purlins by WSM & LSM panel length of purlins

b. Comparison of cost & weight of channel section and angle section purlins in WSM and LSM

An angle section, the total member weight of the steel and cost of amount is 37.82 %, 50.12% more than the channel section in WSM and LSM for panel length of purlins. The result is shown in table 7 & 8. Comparison of cost and weight of angle and channel section purlins by WSM and LSM for Spacing of truss purlins shown in Figure 9 & 10.

S.no	Spacing of roof truss in m	Angle section purlins		Channel section purlins	
		Member weight in (kg)	Cost in (Rs)	Member weight in (kg)	Cost in (Rs)
1	4	59.75	3,286.25	36.75	2,021.25
2	8	119.50	6,572.50	73.50	4,042.56
3	12	179.25	9,858.75	110.25	6,063.75
4	16	239.00	13,145.00	147.00	8,085.00
5	20	298.75	16,431.25	187.75	10,106.25

Table 7. Comparison of cost & weight of Channel section and Angle section purlins in working stress method in Spacing of truss

S.no	Spacing of roof truss in M	Angle section		Channel section	
		Member weight in (kg)	Cost in (Rs)	Member weight in (kg)	Cost in (Rs)
1	4	115.58	6,356.90	57.65	3170.75
2	8	231.16	12,713.80	115.30	6341.50
3	12	346.74	19,070.70	172.95	9512.25
4	16	462.32	25,427.61	230.60	12683.00
5	20	577.90	31,784.51	288.25	15853.75

Table 8. Comparison of Cost & weight of channel section and angle section purlins in LSM

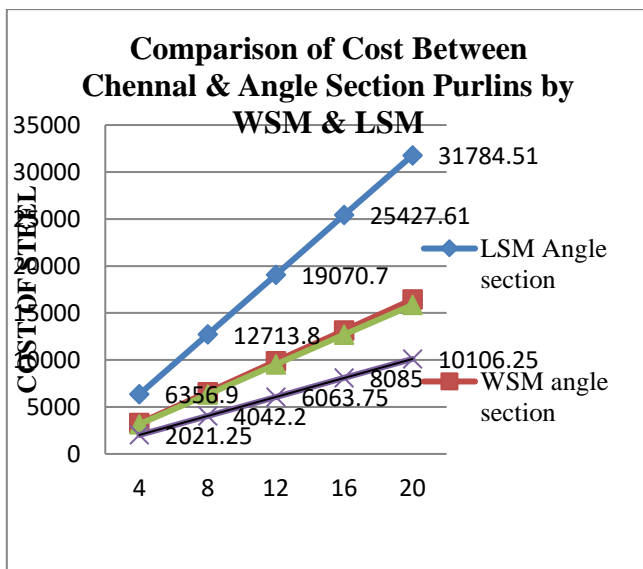


Figure 9. Comparison of cost of angle and channel section purlins by WSM & LSM spacing of purlins

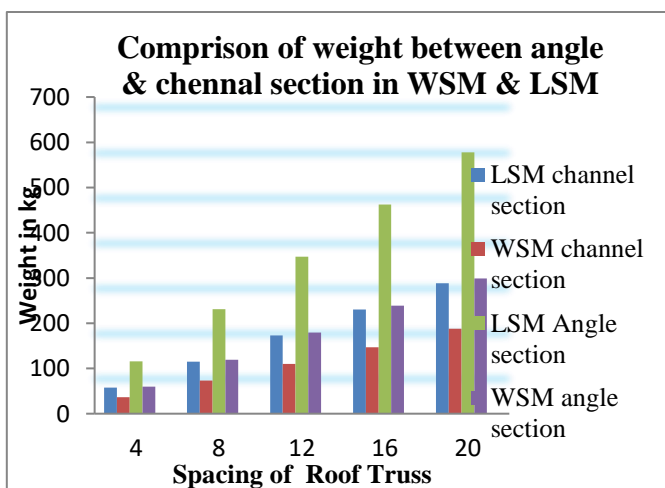


Figure 10. Comparison of weight of angle and channel section purlins by WSM & LSM spacing of purlins

c. Difference between cost & weight of angle and channel section purlins by WSM & LSM for panel length

The angle section per panel length (20 m length of the building) the weight of the steel is 111.023 kg, 289.67 kg more than the channel section in working stress method and LSM. The angle section is the total member and total cost of the steel is 48.31% and 50.12% is more than the channel section in same configuration load in WSM and LSM. The result is shown in table 9. And difference between cost of angle & channel section purlins by WSM & LSM panel length purlins shown in Figure 11.

S.no	Length of panel in m	WSM		LSM	
		Member weight in (kg)	Cost in (Rs)	Member weight in (kg)	Cost in (Rs)
1	2.25	111.02	6106.26	289.67	15,931.85
2	4.5	222.04	12,212.52	579.33	31,863.70
3	6.75	333.06	18,318.78	869.01	47,795.55
4	9	444.09	24,425.04	1158.68	63,727.40
5	11.25	555.11	30,531.30	1448.35	79,659.25
6	13.5	666.13	36,637.56	1738.02	95,591.10
7	15.75	777.16	42,743.56	2027.69	1,11,522.95
8	18	888.18	48,850.08	2317.36	1,27,454.80

Table 9. Difference between cost & weight of angle and channel section purlins by WSM & LSM for panel length

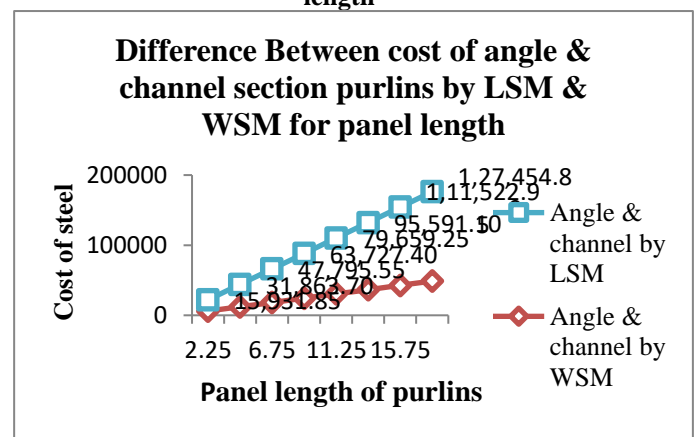


Figure 11. Difference between cost of angle & channel section purlins by WSM & LSM panel length purlins

d. Difference between cost of angle & channel section purlins by WSM & LSM Spacing of purlins

The angle section c/c spacing of the trusses weight of the steel is 23 kg, 57.93 kg more than the channel section in WSM and LSM. The angle section is the total member weight and total cost of the steel is 54.31% and 60.12% is more than the channel section in same configuration load in WSM and LSM.

Cost Comparison Of Roof Truss Angle Section And Channel Section Purlins By Working Stress And Limit State Method

The results are shown in table.10 and difference between cost of angle & channel section purlins by WSM & LSM Spacing of purlins shown in Figure 12.

S.no	Spacing of roof truss in m	Angle section purlins		Channel section purlins	
		Member weight in (kg)	Cost in (Rs)	Member weight in (kg)	Cost in (Rs)
1	4	23	1,265.00	57.93	3,186.15
2	8	46	2,530.00	100.24	6,372.15
3	12	69	3,795.00	150.36	9,558.45
4	16	92	5,060.00	200.48	12,744.60
5	20	115	6,325.00	250.60	15,930.75

Table 10. Difference between cost & weight of angle and channel section purlins by WSM & LSM for spacing of purlins

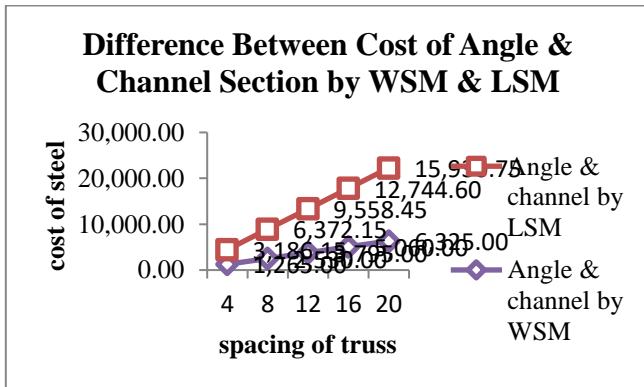


Figure 12. Difference between cost of angle & channel section purlins by working stress & limit state method

IV. CONCLUSION

- In general the research report is , the LSM the total member weight is 34.78 % is higher compare with WSM.
- Similarly the total cost of structures is 48.30% higher compare with WSM. The channel section is most economical section compared to angle section. The cost of angle section is 54.31 % and 60.12% more than the channel section in same configuration load in working stress method and limit state method.
- The channel section most economical section compared to angle section. The cost of angle section is 54.31 % and 60.12% is more than the channel section in same configuration load in WSM and LSM.

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