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Study of Structural Analysis of Roof Structure Steel Truss

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Abstract: ***Development of three-dimensional geometry for roof truss has been analyzed and design. This presents study on behavior and economical of roof truss by using spatial geometry. In this study, the structure that is based on geometry as well as analytical and numerical representation of the relation between form and force. This paper presents a study on behavior and economical of roof trusses, in truss provided along large span due to material saving as compare roof truss provided along width. This study involves in examination of theoretical investigations of specimens in series. Overall two trusses were designed and comparison of all the internal force, economical, and hence, to evaluate the co-existing moments and shear forces at the critical cross-section with same configuration area by keeping all other parameters constant. This paper presents a study on behavior and economical of various types of roof trusses, this study involves in examination of theoretical investigations of specimens in series. This study provides a study of various levels of research work done in computational structural analysis. The crust of our review focuses on the analysis of optimization of truss, complex or simple because truss is the most widely used and fundamental building block of any structure.***

Keywords: Roof Truss, bending strength, Deflection, Structural analysis, Optimization.

I. INTRODUCTION

Truss is very important for a construction, such as construction for roof, bridge and high-rise building. Truss can give high esthetic value for mega construction such as Eiffel Tower, Paris and for building like stadium for football in Europe. In architecture and structural engineering, a truss is a structure comprising one or more triangular units constructed with straight members whose ends are connected at joints referred to as nodes. External forces and reactions to those forces are considered to act only at the nodes and result in forces in the members which are either tensile or compressive forces. Moments are explicitly excluded because all the joints in a truss are treated as revolute. Nowadays, the analysis of truss is concerned of many designers and consultants. The truss structures are required to be designed in such a way that they have enough strength and rigidity to satisfy the strength and serviceability limitation. In order to archive the minimum requirement, it is necessary to carry out an accurate analysis to investigate the reaction and stress that acting inside the member of the truss. When the load acting on a truss, the structure may deform and change to different shape or size. This can be a result of compression (pulling) stresses or tension (pushing) stresses inside the truss members. A truss is a structure composed of slender members joined together at their end points. Roof trusses in general, the roof load is transmitted to the truss by a series of purlins. The roof truss along with its supporting columns is termed a bent. The space between bents is called a bay Planar trusses lie in a single plane. Typically, the joint connections are formed by bolting or welding the end members together to a common plate, called a gusset plate Double cantilever truss or roof truss. The double cantilever truss or roof truss is used as a main structure to cover industrial buildings; it allows to build aisles with large spans. walls, panels, slabs.

II. STEEL TRUSS

Steel is broadly used around the world for the development of workshops structures of various sizes. It is a flexible and powerful material that offers green and sustainable answers. Steel has long been known as the financial option for a variety of bridges. It dominates the markets for long-span bridge structure, workshops roof structures, footbridges, and medium span dual carriageway bridges. It is now increasingly more the selection for shorter span dual carriageway systems as properly. The connected elements (usually directly) can be pressured from tension, compression, or now and again each in response to dynamic loads [4]. These trusses can be made from wooden, steel or can be composite shape. In this thesis, metal trusses used for constructing bridges are considered. Steel has higher strength, ductility and durability than many different structural materials inclusive of concrete or wooden. However metallic should be painted to prevent rusting [10]. Like other bridge sorts, there is each simple and continuous truss bridge. The individuals of a truss may be arranged in a nearly unlimited wide variety of ways, but the big majority of trusses encountered in bridge belong to one of the commonplace kinds listed under. Some of these commonplace varieties of trusses are the

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Baily truss, Warren truss, Warren truss with verticals, subdivided Warren truss, the Pratt truss, subdivided Pratt (Baltimore) truss, K truss, and the Howe truss. The essential participants of a roof truss are shown in determine 1.1.

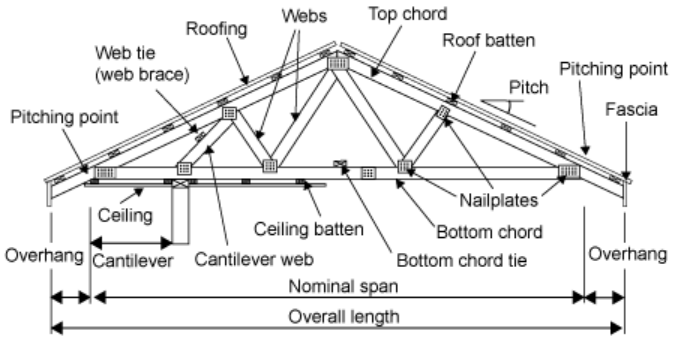


Figure 1.1: Skeleton of a typical Roof truss

III. TRUSS PATTERNS

Although the trusses include triangles, there are a super variety of geometrical styles. In many times a particular design characteristic has been named after the authentic designer. Several of the more commonplace truss patterns utilized in truss patterns are: Howe truss, Pratt truss, warren truss, Quadrangular warren truss, Baltimore truss, camelback truss and K truss which are shown in figure 1.2. Among these truss patterns, the three great regarded are the warren, Howe and Pratt truss, which are prominent by the route of the diagonal individuals in each panel.

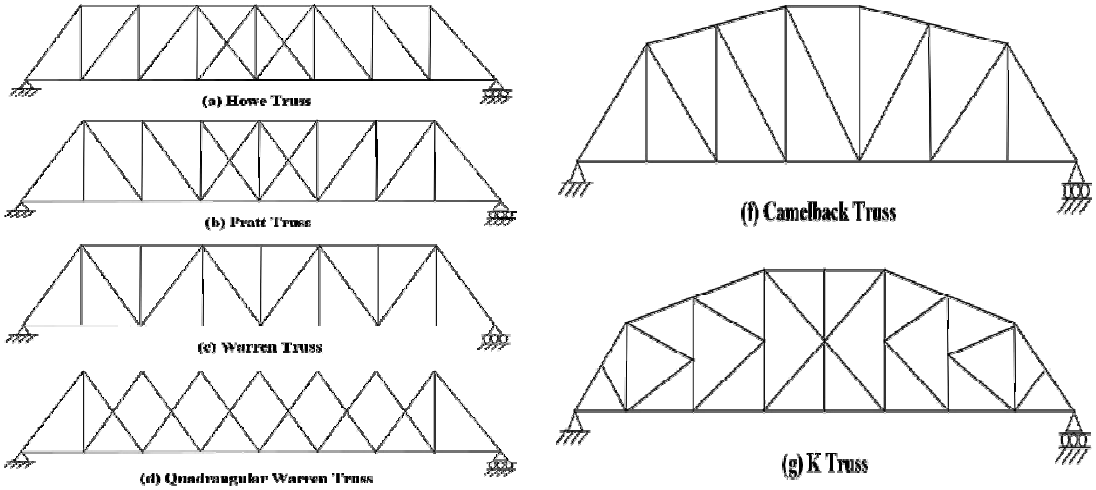


Figure 1.2: Various Truss structures patterns

The nature of design truss allows the analysis of the structure using a few assumptions and the application of Newton's laws of motion according to the branch of physics known as statics. For purposes of analysis, trusses are assumed to be pin jointed where the straight components meet. This assumption means that members of the truss (chords, verticals and diagonals) will act only in tension or compression. A more complex analysis is required where rigid joints impose significant bending loads upon the elements [3].

The members are generally arranged to form a series of triangles that act together to form the structural system. The chords are the top and bottom members that behave as the flanges of a girder. Diagonals and verticals function in a manner similar to the web in a plate girder. Diagonals generally provide the necessary shear capacity. Verticals carry shear and provide additional panel points through which deck and vehicle loads can be applied to the truss. Tension verticals are commonly called hangers, and compression.

Verticals are often called posts. They also serve to limit the dead load bending stresses in the chord members by reducing the unsupported member length. Joints are the locations where truss members intersect and are referred to as panel points.

The deck is the structural element that directly supports applied pedestrian loads. Stringers are longitudinal beams, generally placed parallel to traffic, that carry deck loads to the floor beams.

IV. LITERATURE STUDY

A simplified method was followed so that you can execute an immediate analysis of the effects of the parameters involved within the hassle. The deformation of the roof truss structure to the applying load is incredibly extensive; hence it's far clear that the dynamic reaction of the roof truss structure underneath the shifting load should be taken into consideration within the technique of structural design.

Chitte (2018) The main aim is to provide the method which is economical, more load carrying capacity and high flexural strength. The studies give conclusion that the limit state method design gives high load caring capacity with minimum quantity of steel required as compare to working stress method, which results in economical design of truss design. Objective of this study is to analyze and design Pratt truss of 30m span with Limit State Method (LSM) and Working Stress Method (WSM) of design of steel structures. Pratt truss model is analyzed in STAAD Pro. The truss is analyzed for the dead load, live load and wind loads.

Gehan A. Hamdy et. al. (2018) This study investigates the structural response of wide span structures where the primary structural system is cable-stayed roof, and aims at optimizing the design of such structures. A numerical study is conducted where four different systems are suggested for the same structure: plane truss, space truss, cable-stayed plane truss and cable-stayed space truss systems. The numerical results indicate the capability of the proposed approach in predicting the forces and deformations of cable structures and optimizing the design of structural element. It was concluded that the space truss and the cable-stayed space truss providing efficient performance as well as economy.

Kavita. K. Ghogare et. al. (2018) This study will give us the suitable configuration of industrial shed by making and comparing design and analysis of various configuration of industrial shed. This structure is proposed to design according to IS: 800 - 2007 and the dead, live and the wind load analysis is done according to IS :875 -1987 (Part-I, Part-II, Part-III). Design of industrial shed by using STADD Pro-2007 which gives vary quickly and accurately. Comparison between various configurations of industrial shed using various types of truss type which gives us that which shed is suitable for the industrial shed and which is more effective in strength and economical point of view.

M Urdea (2018) Studied about truss deformations. the designed truss is supporting a pipe, it can be a bridge, or another structure and can be necessary for protecting rivers. The truss is a welded structure modelled with Weldment Structural Members, which is often found in industrial constructions and it can be constructed in different shapes. In order to sustain a pipeline over a damaged area, some trusses structures were modelled. The pipeline is supported by some support brackets mounted on the truss nodes. Finite Element Analysis is a process which can predict deflection and stress on a structure, here on a truss. The purpose of this study is to find the best form for trusses using SolidWorks and to avoid oversizing these structures.

M. Indrajit et. al. (2018) studied about study about the Standardization of truss profile of various span with various section to obtain the minimization of the steel quantity for various sections like Channel, Angle, and Tubular sections. Here, double Howe truss and Double Fink truss profile of various span of 15m, 20m, and 25m are taken. It is analyzed with Coimbatore wind zone. The Structure is Modeled and analyzed with help of Staad Pro v8i.

Manoj Nallanathe et. al. (2018) the steel roof truss having 18m and 30 m span has been analyzed with design of tubular sections of truss members. In this truss I have to designed in two ways one is conventional and prefabricated. And the main point is first trying to check and the efficiency of truss. In this case truss was drawn by using STAAD Pro v8i 2007.Actually conventional is better than the prefabricated and utility, safety, economical and must be fulfilled. This study presents a analysis on behaviour and economical of roof trusses and purlins by comparison of limit state and working stress method. Roof trusses and purlins are therefore an integral part of an industrial building and the like for supporting the roofing system. This paper presents a study on behaviour and economical of fink type roof trusses, channel section purlins by comparison of limit state and working stress method.

Sunil. C et. al. (2018) The present paper describes design and analysis of industrial roof truss using manual method and staad pro method. For present work the equivalent static analysis is carried out for single storey steel building with pitched roof in zone II. It is nothing but the industrial structure. The industrial structures shall be designed and constructed to resist the wind effects in accordance with the requirements and provisions of IS: 875 (Part 3):1987. This standard describes the procedure for wind resistant of such structures. The stability analysis of single storey steel building with pitched roof is carried out using Software Computer Aided Design i.e., (STAAD PRO). the study is done for stability analysis of industrial

Kiran S, et. al. (2017) In this study considering roof truss with two cross-sections. The shapes are double cantilever truss. When wind load acts on these truss shapes the behavior of the structure and the impact over the floor is changed. So, a study is done using computational techniques to get the deformed structural results. The trusses are modelled, and using FEM techniques the model is analyzed using ANSYS software. The flexibility in the roof design and complexity that roof trusses enable have also made them increasingly popular.

Kunal Porwal et. al. (2017) This study presents a comparative study of roof truss for different configuration and also a comparison is done for different sections such as conventional steel sections, hollow sections and angle sections and pre-engineered sections. The trusses used for the comparison are N- type truss, Howe truss, Warren truss, A –type truss, Portal truss, etc. All the models of the truss were analyzed in Staad pro V8i software. The parameters used for the comparison are the weight of the truss & cost effectiveness. The comparison gives us the suitable configuration from weight and cost point of view.

P. Roshani Rambhau et. al. (2017) This study presents a study on behavior and economical of fink type roof trusses, this investigation involves in inspection of theoretical investigations of specimens in series. Overall two trusses were designed and comparison of all the internal force, economical, and hence, to evaluate the co-existing moments and shear forces at the critical cross-section with same configuration area by keeping all other parameters constant. The specimens are designed under uniformly distributed loading with simply supported condition. The research project aims to provide which span of truss is economical, high bending strength, more load carrying capacity and high flexural strength. The studies reveal that the theoretical investigations roof truss provided along large span design is high bending strength, high load caring capacity, save material, economical as compare truss provided along small span.

Ololy Pradeep Kumar et. al. (2017) In this study analysis of double Howe steel truss and cantilever truss are carried out and the results of nodal deflections, stresses in elements for both cases were determined. ANSYS is general purpose software used to simulate interactions of all disciplines of physics, structural, vibrations, fluid dynamics, heat transfer and electromagnetic uses for engineers. Analysis of any fames (or) truss by conventional method is very difficult and time-consuming process which may leads to error in calculation of results. In order to overcome this problem most of them will use ANSYS software to analyze the frames and truss cases.

Rajat Palya et. al. (2017) The present work presents a sizing optimization procedure for composite steel-3-dimensinal frames. The results obtained demonstrate the effectiveness of the proposed optimization approach of particular importance is the investigation of the variation in the structural cost achieved when collapse resistance constraints are incorporated in the design process. By enforcing the satisfaction of additional design requirements on system resistance and safety against local failure, structural cost is inevitably increased.

Tejas D. parekh et. al. (2017) In the present study, howe type of truss has been taken using various span and rise. Four different spans such as 7m, 14m, 21m and 28m have been taken into consideration. The safe and economical steel section was decided on the weight obtained of each truss after the analysis. Analysis and design an economical and stable 2D truss for the usage in industrial purpose like storage rooms, workshops, warehouses etc., using STAAD. Pro.Vi8. It follows the method of design steps of steel truss type structures as per the guidelines of IS: 800-2007 and IS: 875-1987 part 1, 2 and 3 codes and certain amount of decision based on engineering judgments / practices and information from past experiences.

Vikas et. al. (2017) The need of this study arises where sometimes it is difficult or taking much time to choose effective and economical truss geometry during the design period. In investigating the effectiveness of various truss geometry, a total of nine-truss geometry with simply pinned supports are chosen. This study shows that there is no certainty in determining the most effective geometry neither with same span, height nor height over span ratio. The most effective truss geometry is actually specific for every truss span and height. It has been observed from the results that warren truss is the most effective truss system in carrying the design loads. This feature has been attributed to the alignment of the compression chords and tension chords in a symmetric manner, which allows the truss to distribute the load in most effective way.

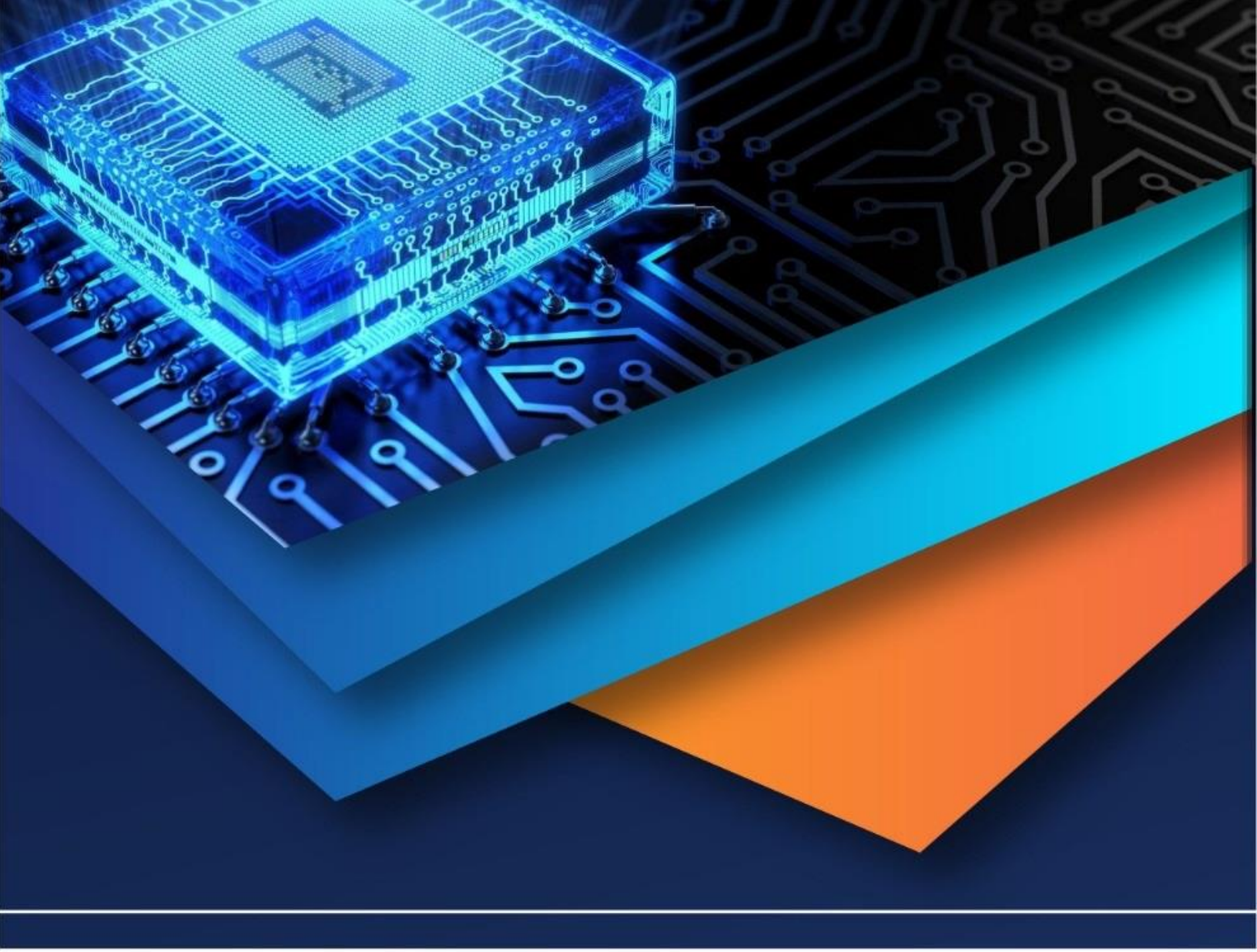
Ankush Limbage et. al. (2016) The comparative study is carried out on four different spans of A- type truss given in SP 38 (S & T): 1987; Handbook for typified designs for structures with steel roof trusses. A detailed comparative study is carried out on a 9m span truss by using Indian Standard code IS 875 (part 3): 1987 and SP 38: 1987. In IS 875 (Part 3): 1987, the intensity of wind load is calculated considering different conditions of class of structure, terrain, height and structure size factor, topography factor and permeability conditions. therefore, the comparative study is carried out with the help of commercial software Ansys 11.0.

V. CONCLUSION

In this paper investigation, comparing the roof truss provided along length to truss provided along width of span and truss structure designs. The studies reveal that the truss provided along length required less material as compare to truss provided along width of span. Due to this investigations cost of construction should be lass as compare to truss placed along width of span. This is new method of truss placing in roofing system. Literature review discusses briefly the previous work done on the truss on steel structure. From these published works it can be concluded that steel structure is more stable and can be utilized for rapid construction also can be economical by different section and various truss structures.

REFERENCES

[1] Chetan Jaiprakash Chitte, " Analysis and Design of Pratt Truss by IS: 800: 2007, & IS: 800: 1984, IJCEM International Journal of Computational Engineering & Management, Vol. 21 Issue 2, March 2018.
[2] Gehan A. Hamdy, Emad A. El-Dardiry, "Optimum design of wide span cable-stayed roof structures", International Journal of Scientific & Engineering Research, Volume 9, Issue 5, May 2018.
[3] Kavita. K. Ghogare, Vishakha. O. Dange, "Analysis Of An Industrial Structure For Wind Load", International Journal Of Current Engineering And Scientific Research (IJCESR), Volume-5, Issue-2, 2018.
[4] M Urdea, "Static linear analysis for trusses structure for supporting pipes", Materials Science and Engineering, 3rd China-Romania Science and Technology Seminar, 399, CRSTS 2018.
[5] M. Indrajit, V. Senthil kumar, "Standardization of Truss Profile for Various Span and Loading Conditions", International Research Journal of Engineering and Technology (IRJET), Volume: 05 Issue: 04, Apr-2018.
[6] Manoj Nallanathe, Ramesh bhaskar, Kishore, "Efficency Study of Different Steel Truss Using (STAAD.PRO)", International Journal of Pure and Applied Mathematics, Volume 119, No. 17 2018, 3095-3101.
[7] Sunil. C. Sodhai,R. M. Phuke,"Design & Analysis of Industrial Roof Truss", International Journal for Scientific Research & Development, Vol. 6, Issue 02, 2018.
[8] Kiran, Hariprasad, "Cyclonic Wind Analysis on Roof Truss of Building At Coastal Area-Using Ansys", International Journal of Advance Engineering and Research Development, Volume 4, Issue 5, May -2017.
[9] Kunal Porwal, Jasmin Gadhiya, Hardik Patel, "Comparative Study of 2D Roof Truss Configuration", International Journal of Advance Engineering and Research Development, Volume 4, Issue 11, November -2017.
[10] Phatangare Roshani Rambhau, Wakchaure M.R., "A Review Paper on Alternate Design of Roofing System", International Journal of Engineering Sciences & Research Technology, February, 2017.
[11] Ololy Pradeep Kumar, Sree Vani Yabaluri, Venkata Muralidhar Reddy, "Analysis of Double Howe Steel Truss & Cantilever Truss Using Ansys Software", Volume 14, Issue 6, Dec. 2017, PP 09-14.
[12] Rajat Palya, Deependra Singh Raghuvanshi, "Study on Different Truss Structures for Ware House Design", International Journal of Mechanical and Production Engineering, Volume- 5, Issue-11, Nov.-2017.
[13] Tejas D. parekh, Disha parmar, Yati tank,"Analysis of Howe Roof Truss using Different Rise and Span", International Journal of Engineering Trends and Technology, Volume 47, Number 3, May 2017.
[14] Vikas, Bhupinder Singh, "Effect of Variation in Geometrical Parameters on the Roof Trusses", International Journal on Recent and Innovation Trends in Computing and Communication, Volume: 5, Issue: 7, 2017.
[15] Ankush Limbage, Kshitija kadam, "Analysis of Steel Roof A- Type Truss for Four Different Spans (comparison of Design Presented in SP38 and IS 875)", International journal of latest Trends in Engineering and technology, Volume 6, Issue 4, March 2016.



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