# Analysis of A Steel Structure Using Analysis Software: A Review

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***Abstract-*** *Steel structures are generally use in places where long span spacing is required with stability and within time limit. These structures are stable and rigid with easy and early fixation at site. These structures are open structures where wind effect is nominal, rigidity of such structures are comparatively more than RCC structures. These structures are easy to fix and dismantle. These are casted along with bolt or rivet connection which minimizes moment. The Truss Structure consists of members/elements that takes only tension or compression and no bending moment in what so ever form.*

*In this paper we are presenting review of literature and publications related to analysis of steel framed structures using software's.*

***Keywords***- Steel structure, analysis, review, softwares, conditions, finite element.

## I. INTRODUCTION

Long span rooftops are commonly characterized as those that surpass 12 m in span. Long span rooftops can make adaptable, section free inside spaces and can lessen substructure expenses and development times. They are generally found in a wide scope of building types, for example, production lines, distribution centers, horticultural buildings, overhangs, huge shops, open lobbies, exercise rooms and fields.

As the examination is imperative in areas inclined to Steel structures, truss arrangements. A research survey is reviewed to determine the present development in our study area. An alternate writing survey from papers, diaries, sites, and thesis identified with our examination region has been undertaken.

**Jyoti .P. Sawant and VinayakVijapur(2013)[Analysis and Design of Tubular and Angular Steel Trusses By Post-Tensioning Method]** here the author applied post-tensioning to both angular and tubular trusses with a span of 30m Mansard and Pratt trusses with single and double drape tendons using the analytical tool SAP 2000v15 It was observed that with post tensioning members the pre-stressing force in the members have been reduced. External Post-tensioning was considered in the authors study since the tendons was outside the trusses and examined the trusses for member forces, pre-stressing stresses at 0 deflection observed at the mid-span of the member, this cause reduction in sectional size and weight of the structure.

Post tensioning by external tendon layout was suggested to strengthen and to increase useful life of steel truss. The trusses configuration with different tendon profile for post tensioning the truss with different eccentricities was considered and the effect of post tensioning on member forces, cross section of members and weight of truss is studied in the analytical work.

The results concluded that, in case of truss post tensioned with single drape tendon layout, there was a significant reduction in member forces and cross section members of all the bottom chord as well as top chord and web members. In case of truss post tensioned with Double drape tendon layout, there was a significant reduction in member forces and cross section members of all the bottom chord as well as top chord members and web members. The reduction in cross sections and member forces was more significant in case of double drape tendon layout as compared to single drape tendon layout. In case of Pratt trusses the reduction in cross sections, member forces, pre-stressing forces and weights of the trusses was more significant as compare to Mansard trusses.

Tubular trusses have good aesthetic view when compared to the angular trusses and Angular trusses were labour intensive when compared to the tubular trusses. Tubular trusses had lesser pre-stressing force when compared to the tubular.

**Ola Adel Qasim (2017)[Analysis and Design of Steel Truss Stadium]**the principle behind the authors study was to analyze and design steel stadium, where the designs were made manual calculations according to (AISC LRFD manual) and compare the results by using STAAD.PRO. The research

specified the design and analysis of steel truss stadium using Staad Pro program, with 28 m width and 44 m length and truss high of 9 m. Later, the manual calculus was compared with then data extracted from the analysis on Staad.Pro.

As the project dealt with two design criteria (by hand calculation and by staad pro program) in staad pro two design were used first by checking the adequacy of the section chosen and second, by least weight design. There was a difference between all design criteria which depend on the area of the section that gives different section.

**Chetan Jaiprakash Chitte (2018)[Analysis and Design of Pratt Truss by IS 800:2007 & IS 800:1984]** In this study author illustrated the performance of pratt type truss arrangement for long span area by limit state and working stress method considering dead load, live load and sections as per steel table. And in this study they considered lateral pressure (wind) for analysis. The structure was designed under Wind loading with fixed supported condition with a primary objective to provide the method which was economical, more load carrying capacity and high flexural strength. The research paper concluded that the limit state method design provided high load caring capacity with minimum quantity of steel required as compared to working stress method, which results in economical design of truss design (For the same configuration of truss, total percentage saving in weight of steel is by limit state method is 23% as compare to working stress method).

Further conclusions derived from the results were that the consumption of steel is less in LSM with respect to WSM. For same working forces, WSM will require higher steel section than LSM. Limit states design, by providing consistent safety and serviceability, ensures an economical use of materials and a wide range of applications.

**Chhasatia et.al (2016) [Analysis and Design of Conventional Industrial Roof Truss and Compare it with Tubular Industrial Roof Truss]** here the author main objective was finance management using tubular steel including examination of traditional structures with cylindrical structure for given conditions. Cylindrical steel is the most ideal options to the traditional with their similarly better particulars. Dead weight is having a tendency to be diminished for some basic individuals so plainly due to the cylinder area, it helps in lessening generally economy.

Results displayed that up to 15 to 25% sparing in cost is cultivated by utilizing cylindrical segments. Examination of shed's components was done by Staad Pro V8i PC programming, with physically applying IndianStandards. A few exceed expectations sheets for different basic components like Purlin, Roof Truss, pressure part, Tension part and so on. Were done utilizing Microsoft office exceed expectations. In conclusion estimation sheet was set up for each Conventional Roof Truss segment just as Tubular rooftop bracket area.
The author concluded this research work stating that the structural members having larger span length can be designed with tubular sections which will be benefitted in overall economy. For smaller span lengths one would have to design roof truss with minimum sections for both conventional steel sections and tubular steel sections which would affect overall economy due to larger initial cost. Even if cost for tubular sections is more compared to conventional sections, but because of comparatively less dead weight it has proved more economical for the industrial roof truss as well as for other steel structures.

**Heena dewangan & Kaushik majumdar(2018)[a review on comparison of different types of trusses in vibration analysis using staad pro]**here the author reviewed the past work done by various researchers on vibration analysis of steel truss bridge under moving loads by using STAAD Pro Software. The proposed bridge under study was pratt, warren, howe and K type.

The author further stated that the future direction proposed by the current review of the study, based on the gap or shortfall in existing studies linked with bridges conventional vibration test for detecting the effects of vibration scouring the work on the bridge. In addition, an investigation into the effect of vibration promotes integrated bridges also in the apparent since the behaviour of the bridge is an integral a static and different from the conventional part of the bridge. The effects of different types of sediment also are a possibility of establishing a new area of research to study the effect of vibration on the bridge.

**Parmar et.al.(2017)[ Analysis of Howe Roof Truss using Different Rise and Span]** here the author considered howe type of truss using various span and rise. Four distinct traverses, for example, 7m, 14m, 21m and 28m have been thought about. Four ascent criteria, for example, L/3, L/4 and L/5 were considered.. Point segment and Tube segment have been looked at for specific range and rise. Investigation was finished utilizing STAAD-Pro programming and different outcomes had been acquired. The sheltered and prudent steel segment was settled on the weight got of each support after the examination.

**Dheeraj Harod and Sumit Pahwa(2019)[ Static Structural Analysis of Pratt, Flink and Howe Steel Truss using Ansys Software]** the authors research paper presented the

examination of tubular and steel structure regarding weight, productivity and avoidance. This investigation and configuration was performed bit by bit utilizing Ansys programming seeing self as weight, Live Load. This exhibited examination on conduct and conservative of rooftop truss by utilizing spatial geometry. Right now, structure that depended on geometry just as logical and numerical portrayal of the connection among structure and power. The outcomes were looked at and checked demonstrates that tubular structure was affordable when contrasted with steel structure. Right now of Howe steel truss, flink truss and Pratt truss was done and the consequences of nodal avoidances, worries in components for every one of the three cases were resolved.

The end got from the outcomes expressed that all out misshapenings because of joined burden on rooftop truss structures showed Maximum distortions in Flink rooftop truss structure and least disfigurement found in Howe rooftop truss structure, according to add up to weight examination greatest weight found on Flink Roof truss structure and least weight found on Howe rooftop truss structure. Other than the outcomes obviously expressed that at Howe type rooftop structure having least diversion on least weight regarding other two rooftop trusses. Howe type rooftop truss structure has better stability with least weights on loading.

**Rajat palya & deependrasingh raghuvanshi (2017)[study on different truss structures for ware house design]** here the author presenteda sizing optimization procedure for composite steel-3-dimensinal frames. A transformative improvement strategy was utilized to limit auxiliary cost subject to imperatives related with right off the bat, Indian arrangements for wellbeing of steel structures, besides, I.S. 800:2007 arrangements for wellbeing of steel individuals and Structural framework.

The outcomes got show the adequacy of the proposed improvement approach of specific significance is the examination of the variety in the basic expense accomplished when breakdown obstruction requirements are joined in the structure procedure. By upholding the fulfillment of extra plan prerequisites on framework obstruction and wellbeing against nearby disappointment, basic expense is definitely expanded. This expansion is quantitatively investigated by contrasting structures got and without breakdown obstruction imperatives. Here right now we will examine two structures of same geometry and loadings with advancement of steel by utilizing two distinct areas.

In the comparative analysis results presented that results showed that Angle section is more economical. This deduction in cost was not disturbing the load carrying capacity of structure. Implementation of sections is as per practical use so that we can practically implement it.

**Upendra Pathak and Vivek garg(2015)[optimization and rationalization of truss design]** here the author analyzed roof truss of span 16m for different geometries and sections to get the desired optimum truss design. The plan is additionally improved for fluctuating inclines of truss. The help conditions (fixed/pivoted) and sort of association (welded/darted) between truss individuals additionally impact the powers in truss individuals. In spite of the fact that in the truss structure, it is expected that purlins are upheld on truss joints, however because of determination of rooftop sheet, there might be an impediment of greatest purlin separating which may cause the purlins laying on truss individuals rather than joints. The different truss investigations are performed by utilizing auxiliary examination programming for example STAAD Pro. The investigation results are contrasted with acquire ideal and exact truss plan. The outcomes demonstrate that A-type truss has lesser weight contrasted with different truss geometries.

The examination results expressed that the ideal truss slant was found about $24^0$. The truss with inflexible association between individuals is discovered heavier than the truss with pin association. So also truss upheld on fixed base/purlins laying on truss individuals causes twisting minute in top harmony of the truss individuals which thus adjust the sectional necessity of the individuals. Thus case explicit examination is fundamental for sane arrangement of truss structure.

**Avanti Patrikar & K. K. Pathak(2016)[ Fully Stressed Design of Fink Truss Using STAAD.Pro Software]** here the author dealt with optimization of Fink Truss by Fully Stressed Design (FSD) method using STAAD.Pro software version STAAD.Pro V8i (SELECT series 5). Three ranges of the trusses have been considered and each truss has been exposed to 27 kinds of burden cases by changing nodal load areas. Focal hub load has been kept consistent in each truss as 100 kn. Three arrangements of burden condition was embraced, viz,100kn, 120 kn and 150 kn. All out 81 trusses have been examined right now accomplish an objective worry of 100 mpa. Steel take-off for each case and most extreme relocation for each case have been determined and looked at right now it shows that weight doesn't generally increment with increment in the range or tallness.

It was reasoned that weight doesn't generally increment with increment in the range or stature. Thus, it is vital for configuration specialist to streamline the structure to have the best stature and length mix to spare the material and make the structure efficient.

**AzazPathan (2018)[ Design of Large Span Roof Truss under Medium Permeability Condition] here the author considered** a 20 metre span steel roof truss on basis of IS:875(Part I, II and III) for the calculation of loadings on roof truss and on the later staged the analysis as well as design of the roof truss has been carried out by STAAD Pro V8i adopting Limit State Method.

Here the results stated that All loads for the 20 metre span roof truss have been calculated by considering IS:875 (Part I, II and III). The analysis and design for the same have been carried out by STAAD.Pro v8i. Effect of stress reversal has been taken into account in the analysis of the truss.

**Pradeepa. S, Monika N.R (2015)[Design And Comparison Of Various Types Of Long Span Roof Trusses]** *here the author considered* three roof trusses mainly Warren, Howe and N-type, spans of 42m. Trusses were analyzed manually by the force coefficient method and designed using STAAD.Pro and total weight of truss was obtained. The one with minimum weight of the material was considered as economic truss.

From the results it was observed that Warren configuration behavior was economical while Howe and N configuration behavior was almost same. It was even observed that Warren was most economical among three configurations besides, which for lower panel lengths warren is more economical than Howe and N-type.

**J. Pavan Kumar et.at. (2016)[ Quantitative Study of Howe Truss (A- Type) and Parallel Chord Scissor Truss (B-Type) by Applying External Pre-Stressing]** here the primary objective of the author was to study the external pre-stressing on two different configuration of truss shapes for spans 8m,20m,30m,50m,50,100m and discover the most prudent area. The need of this examination emerges where now and again it is troublesome or requiring some investment to pick a powerful and efficient truss shape during the plan time frame. The plan loads are circulated to the joints so that there is no minute to be opposed by the individuals. An aggregate of two sorts of trusses i,e. Howe truss (A-type) and equal harmony scissor truss

(B-type), containing six ranges, with two distinct loadings broke down and structured. Ideal truss from each arrangement of trusses is to be contrasted with figure out which kind of truss is progressively efficient for various ranges. The heap conveying limit of the truss may shift with various kinds of truss shapes for a similar amount of steel. Oneself loads got from the STAAD PRO are in the unit of Kn and would then be able to be changed over into masses in Kg which are utilized in figuring the expense of the materials since the rates are in running meter per unit Kg.

However, close outcomes may be acquired where it helps to give a decent rule in picking a truss that doesn't squander a lot of material. This examination shows that by presenting outer pre-worrying in trusses there is an enormous sureness in deciding the best truss between these two shapes with various ranges.

The outcomes expressed that for length 20M, 30M, 50M, 75M, 100M, in the wake of watching the level of steel when pre-pushing both for A-type and B-type trusses, B-Type truss with prestressing is by all accounts affordable yet from the useful contemplations, applying pre-focusing on power to the truss is expensive procedure, along these lines whatever the level of sparing in material might be used for procedure of applying pre-focusing on power. Consequently it was viewed as that B-Type truss without pre-worrying as prudent truss for ranges 20M, 30M, 50M, 75M, and 100M.

**M.Indrajitet. al. (2018) [standardization of truss profile for various span and loading conditions]** here the author studied 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 was analyzed with Coimbatore wind zone. The Structure was Modeled and analyzed with help of Staad Pro v8i.

The research paper concluded that the trusses are analyzed for various spans and various section for truss member and various materials like Aluminum, timber, various configuration have been studied. Here an attempt was made on standardization of truss profile shape and minimization of weight for various span have been analyzed. It will be useful for any type truss with the minimization of the steel quantity.

**Takao nakazawaet. al. (2004)[ dynamic characteristics of king-post truss road bridge made of glued laminated wood]** here the author conducted field test and analysis were done to make clear the dynamic mechanical properties and to get the data for maintenance of this bridge. Moving truck and impact loading by jumping of three men were used in the field test. Three dimensional dynamic structural analyses were also conducted using FEM. In these experimental and theoretical analyses, the terms such as vibration mode, natural frequency, dynamic amplification factor (DAF), damping coefficient were evaluated.

Results obtained from the analysis stated that there is good agreement between the experimental and analytical natural frequency in the bending vibration mode. The torsional natural frequencies from experiment were higher than those from theoretical analyses. It may be caused that the actual torsional rigidity of this bridge was higher than the rigidity by structural design, because of effects of the cross beams that were not incorporated in theoretical analyses. The DAF of this bridge was in the range of 1.08 to 1.24, it can be said the DAF of 1.25 used in the design is a proper value. The damping coefficient of this bridge was similar to steel truss bridge, but lower than that of general steel bridge or concrete bridge.

**J.M. Branco& P.J.S. Cruz(2008)[ Diagnosis and analysis of two king-post trusses]** An exact geometric and mechanical assessment of two ruler post trusses, situated in reviewing results with information assembled from NDT just as from mechanical assessment, trailed by full-scale tests were performed. The trusses were reassembled in research facility and submitted to a progression of cyclic tests under symmetric and hilter kilter loading. Reinforcing strategies assessed in points of reference inquire about advances were utilized in a second period of the conveying tests. After a definite geometric appraisal of the two trusses, the reviewing criteria as per Italian norms (UNI 11035-1:2003 and UNI 11035-2:2003) have been applied. As keys parameters for visual reviewing and non-damaging assessment, dampness substance and thickness were estimated and recorded. After, some non-dangerous systems dependent on neighborhood assessment of the material were performed. Opposing boring got with the Resistograph, the infiltration profundity accomplished with the Pilodyn and the hardness Turrini-Piazza tests results were connected with the thickness esteems. In a subsequent stage, worldwide assessments strategies were utilized. Sylvatest, utilizing ultrasonic waves, and the mechanical assessment of the modulus of flexibility were performed. A few connections between's various test results, specifically, for the expectation of the modulus of versatility (moe) were built up. Accepting as reference esteems for the moe the consequences of the mechanical tests, the Turrini-Piazza Hardness test show to be an adequately exact non-damaging strategy in the expectation.

**Tejas D. parekh, Dishaparmaret.at(2017)[ Analysis of Howe Roof Truss using Different Rise and Span]** here the author embraced howe kind of truss utilizing different range and rise. Four distinct traverses, for example, 7m, 14m, 21m and 28m have been mulled over. Four ascent criteria, for example, L/3, L/4 and L/5 are taken. Edge area and Tube segment have been analyzed for specific range and rise. Examination was finished utilizing STAAD-Pro programming and different outcomes had been acquired. The protected and prudent steel area was settled on the weight got of each truss after the investigation.

**Chandresh Kumar Jha and M.C. Paliwal(2017)[ Fully Stressed Design of Howe Truss using STAAD.Pro Software]** here the author exhibited the investigation of advancement of Howe Truss by Fully Stressed Design (FSD) method using STAAD.Pro programming adaptation STAAD.Pro V8i (SELECT series4). Three range scopes of the trusses for example 8m, 10m and 12m have been considered and each truss has been exposed to 24 sorts of burden cases by changing nodal load areas however load applied will consistently be symmetric. The four game plans of burden condition are taken, i.e., 100 kN, 125 kN, 150 kN and 175 kN. The all out 72 number of trusses have been advanced right now accomplish an objective worry of 100 MPa. The ideal mass of the considerable number of trusses for each case and most extreme redirection for each case have been determined. Further redirection per unit mass have additionally been determined and looked at for each range.

It is inferred that weight consistently increment with increment in the range or stature. Thus, it is important for configuration architect to advance the structure to have the best tallness and range blend to spare the material and make the structure affordable.

**Goraviyala Yogesh and K. C. Koradiya(2016)[Design and Comparison of Steel Roof Truss with Tubular Section (using SP: 38 And IS: 800-2007)** here the authors inquire about paper included the investigation of similar examination of a truss utilizing tubular and calculated segments affected by common loading esteems. Diverse setup of steel rooftop trusses, for example, Howe type, Fan type, Fink Fan type, and N-type with various range has 9m, 12m, 15m, 18m and 21m, with shifting slants like 12, 14 and 16 degrees with various breeze zones, distinctive dividing have been break down and plan according to SP: 38 and IS: 800-2007 by utilizing tubular segment.

**Yash Patel, Shreepalsinh Gohilet. al. (2016)[ Analysis and Design of Conventional Industrial Roof Truss and Compare it with Tubular Industrial Roof Truss]** Economy is the primary objective of the present work including correlation of traditional structures with tubular structure for given conditions. Results show that up to 15 to 25% sparing in cost is practiced by utilizing tubular segments. Investigation of shed's components was done by Staad Pro V8i PC programming, with physically applying Indian Standards. A few exceed expectations sheets for different auxiliary components like Purlin, Roof Truss, pressure part, Tension part and so on were completed utilizing Microsoft office

exceed expectations. Ultimately estimation sheet is set up for each Conventional Roof Truss area just as Tubular rooftop truss segment.

The exploration results inferred that the auxiliary individuals having bigger range length can be planned with tubular areas which will be profited in by and large economy. For littler range lengths one would need to configuration rooftop truss with least segments for both traditional steel areas and tubular steel segments which would influence by and large economy because of bigger beginning expense. Regardless of whether cost for tubular areas is more contrasted with ordinary segments, but since of relatively less dead weight it has demonstrated progressively conservative for the modern rooftop truss just as for other steel structures.

**SoniPrabhat, Dubey S.K. et. al. (2013)[Comparison of Design of Steel Roof Truss using IS 875 and SP 38] here the author analyzed** the steel rooftop truss having 12 m length with design of tubular sections of truss individuals. The analysis presents examination for weight of tubular part sections, with the assistance of which, relative investigation has been done between design of truss according to reconsidered arrangements of wind load computations given in IS 875 (Part 3):1987 and designs acquired according to figurings made in SP 38(S&T):1987; Handbook for encapsulated designs for structures with steel rooftop trusses. Indian Standard Code IS: 875(Part 3)- 1987 incorporates thought for various states of class of structure, geology factor, amplified arrangements of penetrability conditions, Terrain, tallness and structure size factor and different wind zones. These arrangements of wind load figurings are not the same as the contemplations utilized in SP 38(S&T):1987.

The analysis results displayed that huge varieties in design of sections of truss individuals because of contrast of contemplations of wind load counts in SP 38 andIS 875.

## II. CONCLUSION

In above researches it can be concluded that in past authors analyzed 2-d structures using mathematical tools. But analysis of 3d framed structure and utilization of advance techniques like finite element, pushover, p-delta analysis are missing which are required in future researches to perform advance analysis of these structure.

Authors illustrated above that lateral forces create unbalanced condition which causes unstability of the structure which is required to eliminate using advance techniques.

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