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Comparative Analysis & Design of Industrial Shed.

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ABSRACT

An industry shed can be defined as a building that is used for production, storage, and other industrial activities.The design process is based on selection of structural support systems,materials,and construction methods that are appropriate to the cost, life expectancy, or structural integrity goals. This study presents a comparative evaluation of industrial shed designs, focusing on structural performance, materials used, overall cost, and construction practicality .This study compares various structural designs, including steel trusses, portal frames, and Pre-Engineered Buildings (PEBs), analyzing their performance under different loads. It highlights that while conventional steel structures can be flexible and economical, PEBs are often more efficient in terms of construction time, material waste, and cost, with the optimal design depending on site conditions and cost factors.

INTRODUCTION

Industrial sheds play a crucial role in various sectors, providing efficient and cost-effective spaces for manufacturing, storage, and other industrial activities. The design of these structures is critical, as it directly impacts their functionality, durability, and economic viability. must carefully consider factors such as material selection, load-bearing capacity, environmental conditions, and cost-effectiveness to create optimized industrial sheds. This research paper presents a comparative analysis of different industrial shed designs, evaluating their structural efficiency, construction methods, and economic feasibility. In between there are some classification of truss for the structure as follows:

1. CONVENTIONAL SECTION
2. TAPERED SECTION
3. LACED SECTION

HISTORY ANALYSIS

3.1 Topic: Comparison of inspection shed with different steelsections.

Authors: Nithin chakravarthy, DR. Manju,ER.Hariprasad

Publish: 7 July 2023 - Internationalresearch Journal of modernizationn in engineering technology science.

Summary: The study analyzed an inspection shed using STAAD Pro software, considering dead, live, wind, and seismic loads as per Indian Standards (IS 875 and IS 1893). The shed was modeled and compared using: Conventional steel sections (ISMB, NPB).Pre-Engineered Building (PEB) sections.The analysis focused on structural weight, deflection, and cost-effectiveness. Conventional Model 2 (NPB columns) is more economical and lighter than Model 1 (ISMB columns). PEB sections showed improved deflection performance but were significantly heavier (94%-100% more) and costlier.PEB structures are unsuitable for spans around 30m due to higher material and construction costs.

3.2 Topic: Literature study on comparitive analysis of long span peb indutrial shade

Authors: Sahro k Proff eswara murthy

Publish: 18 March 2023 Int Journal for research in applied science and engineering technology

Summary: Studies on the comparative analysis of long-span pre-engineered building (PEB) industrial sheds typically involve structural modeling and design comparison using software like STAAD.Pro. A common approach includes designing both PEB and conventional steel building (CSB) structures for similar spans and load conditions. Parameters like weight, material cost, and construction time are compared. Art of study said that PRE engineered building are easy to construct, time saving in construction, easy to design as per country standards, cost efficiency, easy to eruption, easily installed and energy consumption. Steel material reflects the implement of sustainable development.

3.3 Topic: Analysis and design of conventional steel shade

Authors: Bhumi D. Bhandarkar, Dr. S.G. Makarnde, Mr. Amar Dehane

Publish: 3 March 2023 International Journal of Creative Research Thoughts (IJCRT)

Summary: Studies show that Pre-Engineered Buildings (PEBs) are more economical and efficient than Conventional Steel Buildings (CSBs). Key advantages include 30-40% less steel usage, 20-37% lower costs, faster construction with prefabricated components, and eco-friendliness due to recyclable materials and reduced energy consumption. Shed design involves clear span rigid frames, with materials like Universal Columns and beams chosen based on structural demands. Load calculations include dead, live, wind, and earthquake loads. Tools like STAAD.Pro model the structure, and design optimization focuses on steel consumption, weight, and displacement, following IS 800 design standards

3.4 Topic: Comparative study of analysis and design for industrial shade by WSM and LSM

Authors: Maghrabi, Sanika Patil, Nikita Singala, Shubham Mundhe

Publish: 07 July 2022 International Research Journal of Engineering and Technology (IRJET)

Summary: Structural Model: The industrial shed was modeled in STAAD Pro software with a portal frame configuration, including columns, rafters, bracings, and a gantry girder. Studies show that the Limit State Method (LSM) is more efficient than the Working Stress Method (WSM) for conventional steel sheds, reducing steel consumption by 12-23%. Conventional sheds use about 60% more steel than Pre-Engineered Buildings (PEBs), leading to higher displacement and less optimal performance under wind and live loads.

3.5 Topic: Comparativee study of hot rolled steel sections and cold formed steelsections for industrial shed.

Authors: Shah foramashok bhai,Mr paresh, N. Nimodiya, ,Mr Kaushal, R. Thakkar

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Publish: 4 April 2018 InternationalResearch Journal of Engineeringand Technology (IRJET)

Summary: The primary goal is to analyze and design industrial sheds with a 15m span using both Hot Rolled Steel Sections (HRSS) and Cold Formed Steel Sections (CFSS) to achieve the minimum structural weight.The weight of industrial shed with cold formed sections are 10435 Kg reduced than industrial shed structure with hot rolled sections. The weight of industrial shed with cold formed sections are reduced with 32.03% than industrial shed structure with hot rolled sections. So from the above conclusion, Industrial shed with cold formed sections is very economical than Industrial shed with hot rolled sections.

3.6 Topic: A study on the analysis and design of the steel warehouse.

Authors: Hemanth kumar, AR.Pradeep

Publish: 3 March 2018 International Journal of Creative Research Thoughts (IJCRT)

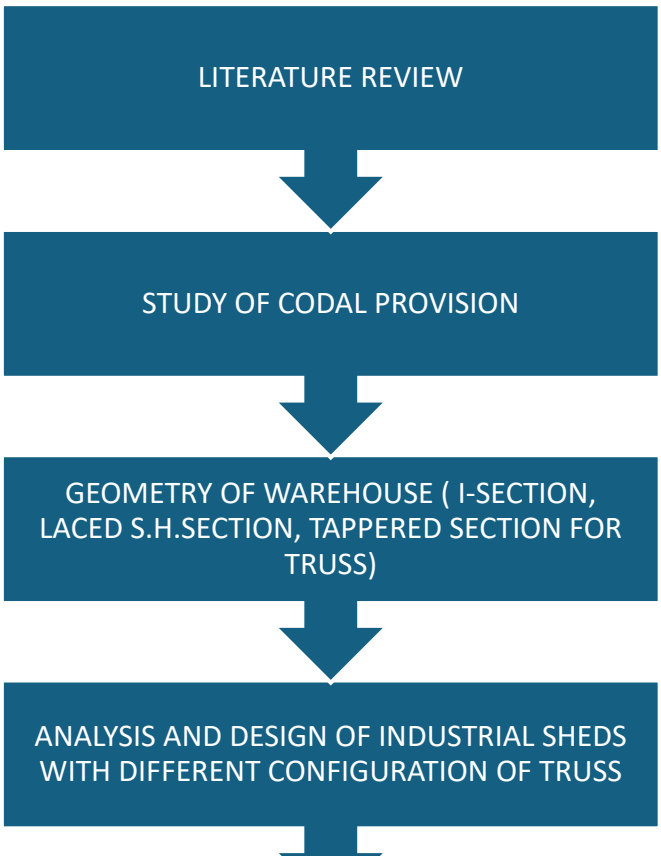
Summary: Modelling Warehouse is selected for the analysis and all the parameters required for fixing up the warehouse geometry are prepared. The steel warehouse is analyzed for the respected loads acting on the structure as per the codes. The warehouse structure is analyzed for the different load combinations. The materials quantity is calculated for the optimized design of the structure. Time saving design with respect to computer aided design of structure (CADS).

FOR CODAL PROVISION WE USED :

Codal Studying (IS-800:2007)

Link – IS-800:2007 -code of practice for construction of steel structure.

METHODOLOGY



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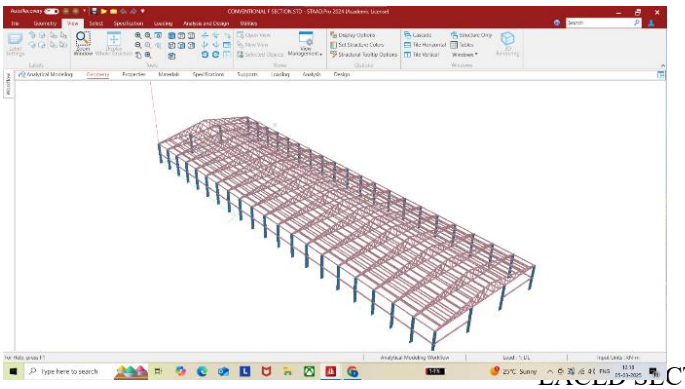
LOADINGS

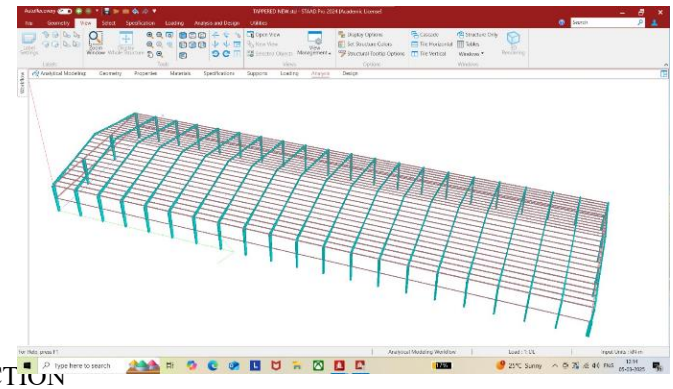
- Dead Load (Self Weight) : The value of dead load for sytucture id taken from IS:875 PART 1.
- Dead Load (Self Weight) : The value of dead load of sheets on purlin is 0.12kN/m
- Live Load : The value of live load is 0.9kN/m IS:875 PART 2.
- Wind Load : The value of wind load is 1.2kN/m^2 from reference of IS:875 PART 3.

MODELLING OF SHED

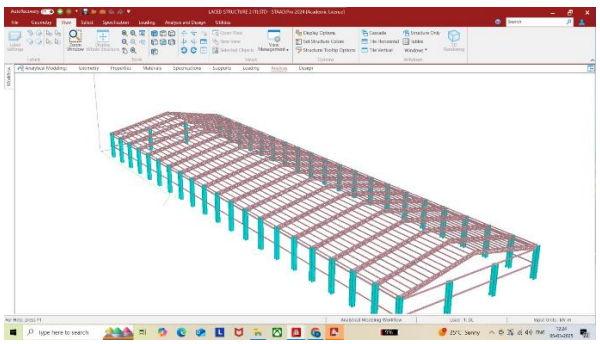
CONVENTIONAL SECTION



TAPERED SECTION

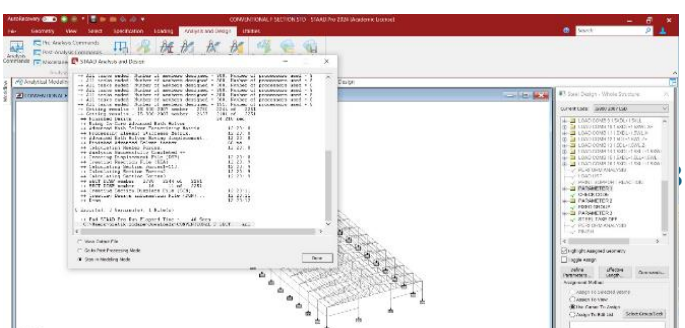


LACED SECTION

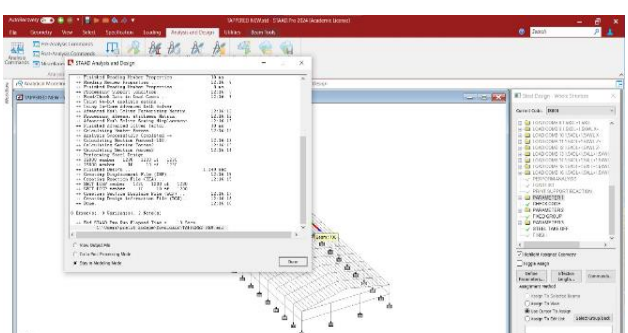


ANALYSIS

CONVENTIONAL SECTION



TAPERED SECTION



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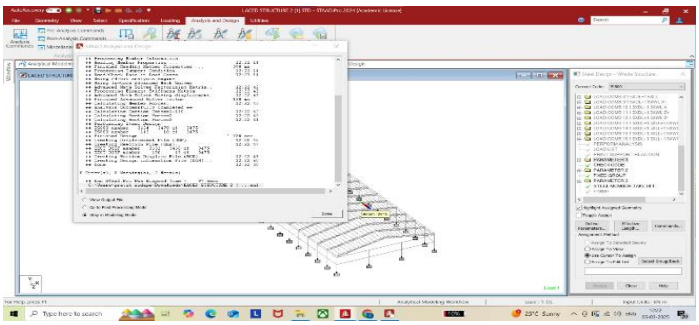
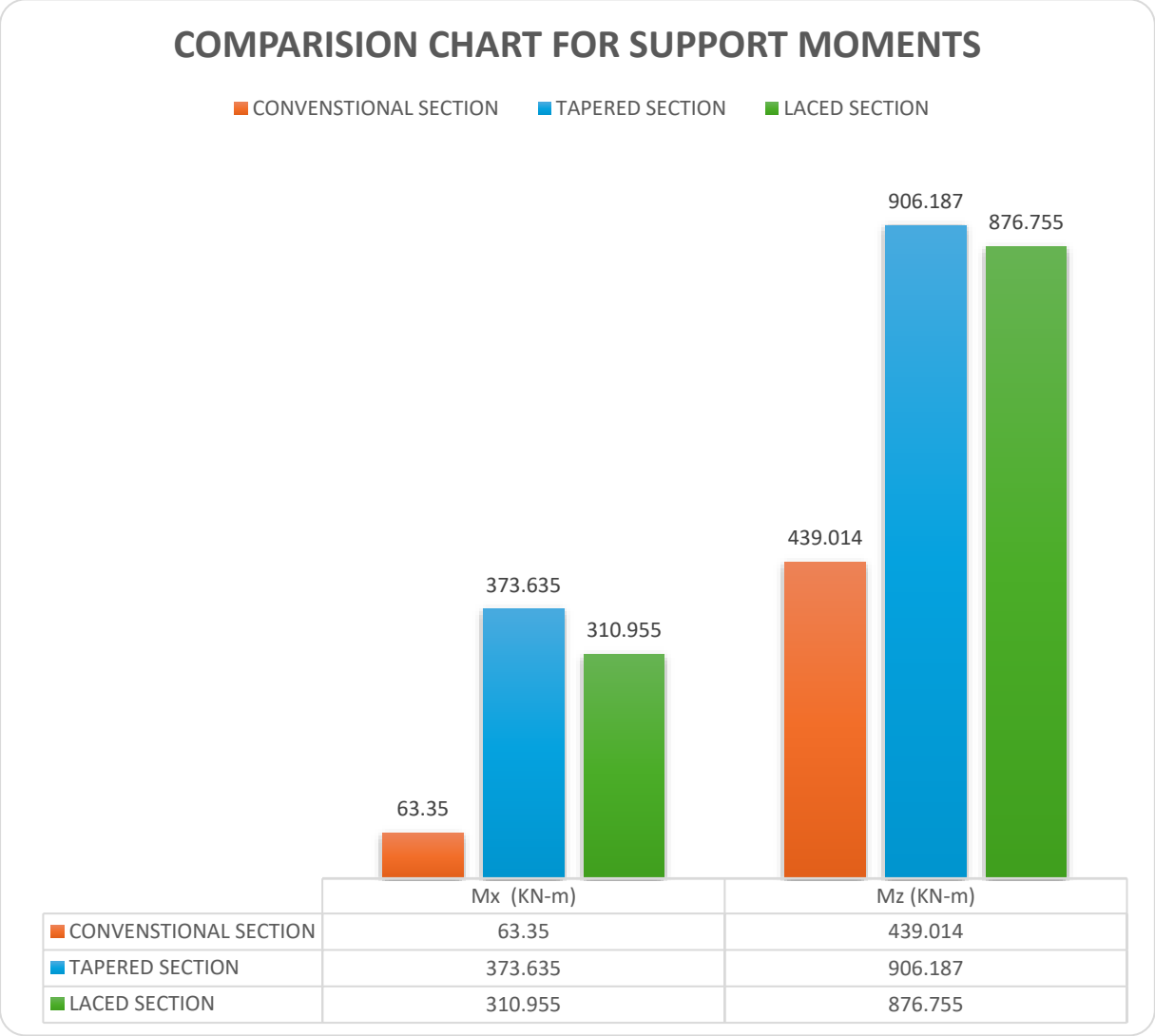
LACED SECTION



RESULTS (COMPARISON)

1. Bar charts of support moment :



	Mx (KN-m)	Mz (KN-m)
CONVENSTIONAL SECTION	63.35	439.014
TAPERED SECTION	373.635	906.187
LACED SECTION	310.955	876.755

Discussion-

1. Moment Distribution: How loads create bending in columns, rafters, and trusses.
2. Load Impacts: How dead, live, and wind loads change moment values.
3. PEB Efficiency: PEBs reduce moments compared to conventional steel through optimization.
4. Wind Importance: Wind significantly affects moments, requiring careful consideration.
5. Design Comparison: Different shed designs yield varying moments, guiding optimal choices.

2. Bar charts of support reaction:

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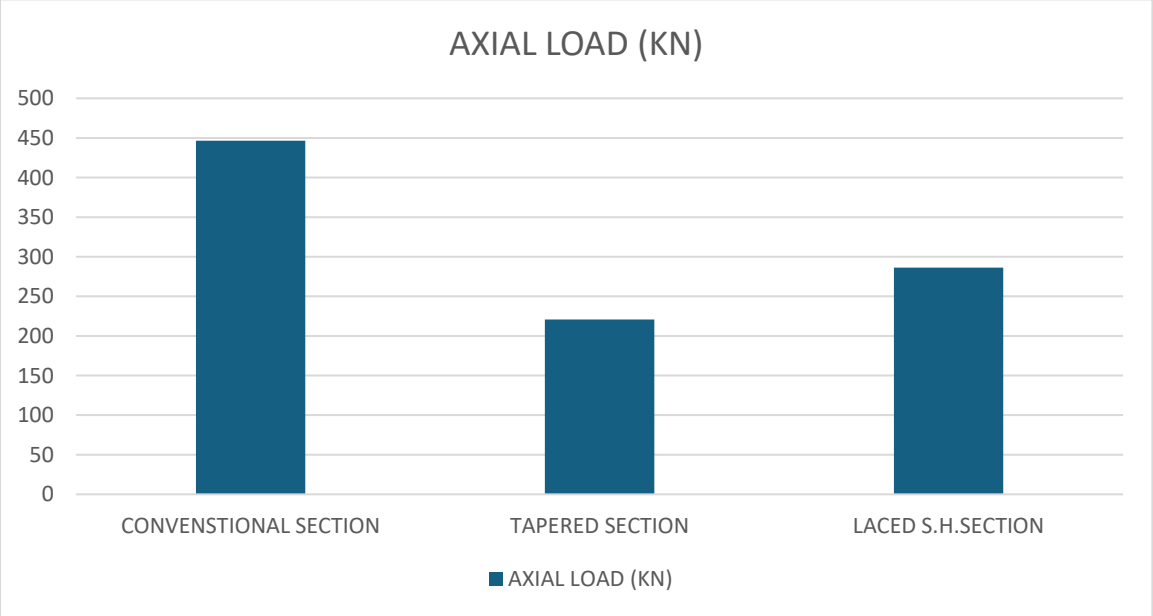

Discussion -

Based on the graph, here are five discussion points regarding axial load:

1. Conventional Section Highest: The conventional section shows the highest axial load capacity at 446.603 kN.

2. Tapered Section Lowest: The tapered section shows the lowest axial load capacity at 220.813 kN.

3. Laced Section Intermediate: The laced section's axial load capacity falls between the other two, measuring 286.302 kN. This suggests a moderate performance in resisting axial forces.

4. Material and Geometry Influence: The conventional section's design appears to be the most effective for handling axial loads.

5. Design Optimization: The data suggests potential areas for design optimization. For ex, if minimizing weight is a priority, the tapered section might be suitable despite its lower axial load.

3. Bar charts of shed total weight:

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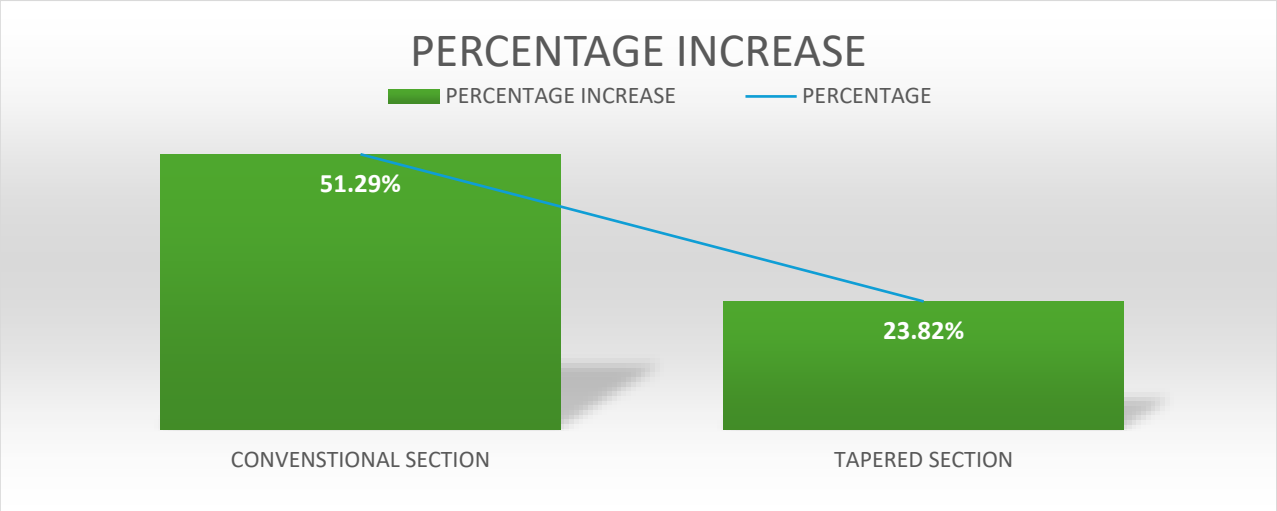
Discussion on Total weight-

1. The provided bar chart illustrates the weight in tonnes of different structural sections, with the "Conventional Section" weighing the most at 334.67 tonnes. This is significantly heavier compared to the "Tapered Section" at 237.3 tonnes and the "Laced S.H. Section" at 200 tonnes.
2. Here's a comparison focusing on the lower values:
3. Laced S.H. Section vs. Conventional Section:
4. The laced section is approximately 40% lighter than the conventional section (200 tonnes vs 334.67 tonnes).
5. Laced S.H. Section vs. Tapered Section:
6. The laced section is about 16% lighter than the tapered section (200 tonnes vs 237.3 tonnes).

Tapered Section vs. Conventional Section:

The tapered section is roughly 29% lighter than the conventional section (237.3 tonnes vs 334.67 tonnes).

4. COMPARISION OVER PERCENTAGE



1. The provided bar graph illustrates the percentage increase across three sections: conventional, tapered, and laced S.H. section. The data shows a decreasing trend in percentage increase from the conventional section to the laced S.H. section.
2. Conventional Section: Displays the highest percentage increase at 51.29%.
3. Tapered Section: Shows a significantly lower percentage increase of 23.82%.
4. Laced S.H. Section: Indicates a 0% increase.
5. The line graph overlaying the bars visually represents the decline in percentage increase across the sections. This type of graph, combining bar and line elements, is effective for comparing magnitudes

and showing trends simultaneously. The graph effectively communicates that the conventional section experienced the most substantial increase, while the laced S.H. section showed no increase.

CONCLUSION -

After all the test and analysis we came up with the discussion that the tapered is more suitable for construction of sheds as the section has less resultant forces.
Also the section is light weight form others making it for suitable for large sheds.
As the weight of section is less the cost for section is less.
In consideration the lace section is also less in weight compared to tap per section but taper genes less amount of moments and resistance forces that leads it to more suitable section over the shed.
Taped section why do wider space and head room as compared to other sections because the size of the section is less.