Scan to know more about us

APL APOLLO STEEL PIPES

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STAY CONNECTED. STAY UPDATED.

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INDIA'S No.1 STEEL PIPES COMPANY

APL APOLLO STEEL PIPES

THE GAME CHANGER
IN CONSTRUCTION IS HERE

APL APOLLO column®
The FUTURE is Exciting

CONTENT

COMPANY OVERVIEW

APL Apollo Tubes Limited is the largest producer of Electric Resistance Welded (ERW) steel pipes and tubes in India with an annual capacity of more than 2.5 million tons. It caters extensively to the domestic region and exports to over 30 countries globally. The company's vast distribution network is spread across India, with warehouses and branch offices in various cities.

At APL Apollo, we believe in bringing change to meet the needs of an ever evolving economy by infusing superior cutting-edge technology and innovative solutions. Founded in 1986 in Delhi, it has catapulted to newer heights in the last three decades with newer products, improved quality, increased productivity and by benchmarking its entire product line to international standards. This has helped it to gain mind space of a large number of customers, thereby redefining the market space for steel pipes.

The organisation believes in measuring its success and pushing its limits through regular review and by generating feedback. Add to this, its customer-centric approach and best practices from across the globe enables the organisation to upscale its core business with creativity and purpose.

The Company's products are certified by reputed international agencies like SGS (France), CE (Europe), UL (USA) and many more. It has received the Recognised Export House status and is also ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018 certified. Our all products are BIS – marked.

BIG SHIFT IN PRE-ENGINEERED BUILDING

USE OF HOLLOW STEEL SECTIONS (HSS)

Around the world, there is a shift toward high-performance materials in structural engineering. In the steel construction sector, this has been more evident with built-up sections, but hollow sections are now in the process of raising the strength levels of their products. The use of HSS has the potential to reduce material costs and project cost.

The popularity of HSS in construction has increased dramatically over the years as engineers have become aware of the advantages of steel tubes. The incorporation of HSS connections in the AISC standard have simplified connection design and contributed to the rise in use of hollow structural steel. HSS are very efficient sections and their major benefits are inherent in their shape and engineering properties. The closed shape and relatively large moment of inertia about the weak axis make them highly resistant against the torsional effects. Architects & Engineers can take advantage of the modern and aesthetically pleasing appearance of exposed HSS structures.

Why HSS in PEB?

PEB has seen tremendous growth in the last decade over the conventional steel building. Currently PEB manufacturers are using built-up sections manufactured by welded plates .

Constraints of PEB

Higher Steel Consumption

High Project Costs

Long Project Duration

Higher Wastage

Can we make PEB better?

Advantages of using HSS in PEB

Lower Steel Consumption

L ow Project Costs

Lower Project Duration

Minimal Wastage

Comparison of structural properties between HSS and Built-Up Section

	I Shape	C Shape	L Shape	T Shape	HSS
Axial - Axial Strength	Good	Moderate	Moderate	Moderate	Good
Flexure X-X - Bending capacity of steel in X-X direction	Poor	Poor	Moderate	Poor	Good
Flexure Y-Y - Bending capacity of steel in Y-Y direction	Good	Moderate	Poor	Moderate	Good
Buckling - Bending due to stress	Poor	Poor	Poor	Poor	Moderate
Torsion - Twisting of steel	Poor	Poor	Poor	Poor	Good
Shear - shearing steel into short lengths to a high heat	Good	Moderate	Moderate	Moderate	Good
Example(s)	Steel Girders/Floor Beams/Columns	Joints in roof framing system	Truss bracing members	Truss chord members	Columns

THE GAME CHANGER IN CONSTRUCTION

Introducing Apollo Column

Apollo Column is a range of hollow structural sections that gives a futuristic edge to construct structures of any design & elevation. It offers India's largest range of hollow structural sections ranging from 12x12 mm to 300x300 mm in size. Apollo Columns are suitable building material for infrastructure, commercial as well as residential projects.

Apollo Column is the irreplaceable member of structural buildings due to its high load bearing capacity & strength-to-weight ratio. It offers higher radii of gyration about both axes providing superior compression performance and significant weight savings.

Advantages

Flexibility in design
Gives the engineer & architects enough flexibility to create unique structures

Uniform strength
No weaker axis due to uniform distribution of material around its axis

Aesthetically pleasing
Smooth profile of Apollo Columns enhances the aesthetic appeal of the structures.

Easy to paint
Apollo Columns are easily painted due to uniform & smooth shape

Higher torsional strength
Apollo Columns delivers exceptional torsional resistance. 200 times greater torsion than open sections

Less wastage of material
Apollo Column provides cut to length sizes from 4 to 12 mm to avoid wastage

Environmental friendly
Conventional construction methodology causes severe pollution

Less consumption of steel
Use of HSS sections reduces the weight of steel structure

Lower project cost
Low erection & Low transportation cost saves overall project cost

Easy to install
Use of conventional bolting system makes the installation easier

Ease of fabrication
Ease of welding, punching, bending & drilling makes Apollo Column a perfect choice

High strength-to-weight ratio
High Strength to weight ratio results savings in steel consumption

10 - 20% CHEAPER THAN CONVENTIONAL PEB

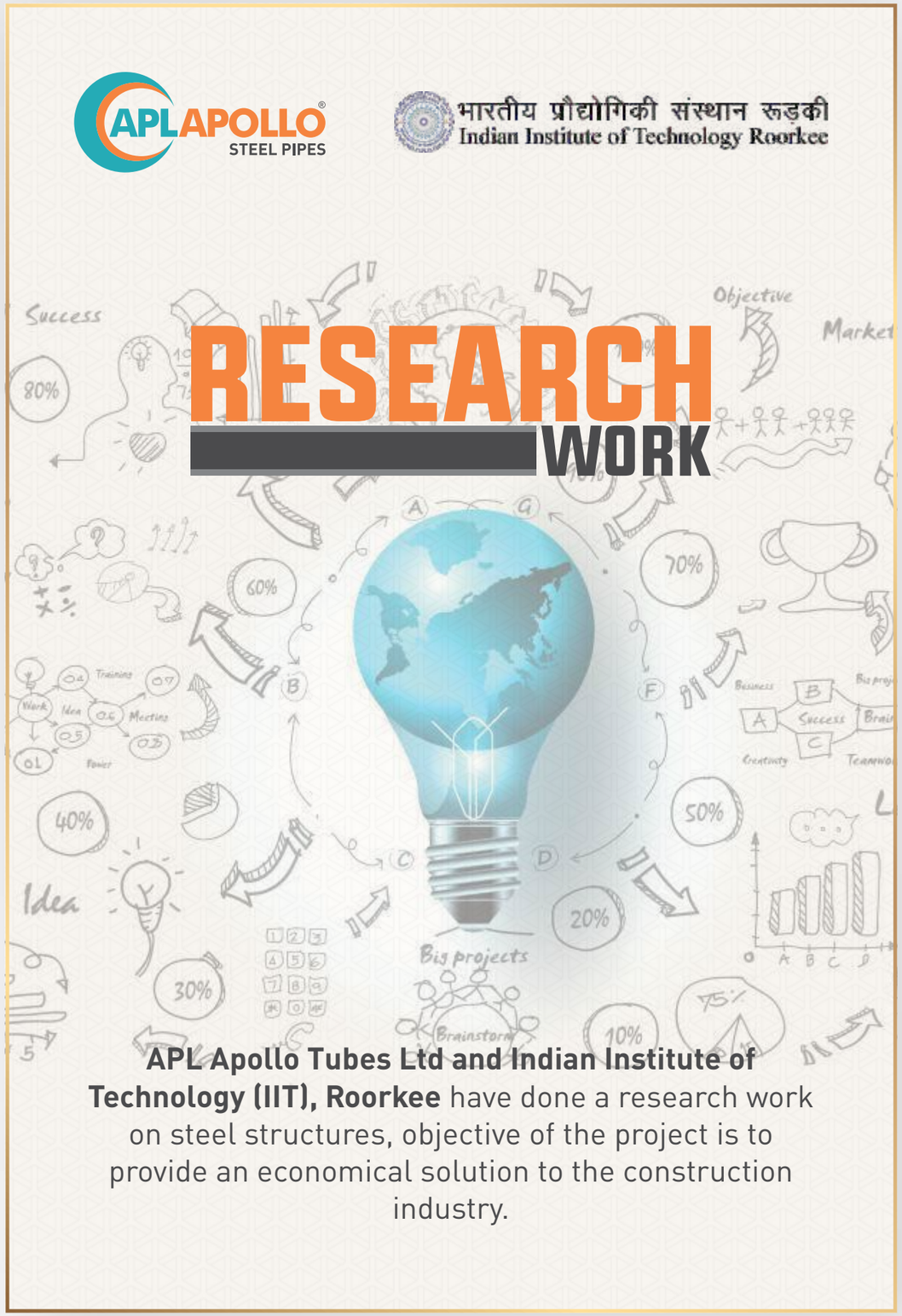
HSS structures reduce overall project cost

The unit material cost of HSS is higher than that of open built-up sections, but that's not the whole story. The additional strength of steel tube permits an optimum design. Use of HSS sections against Built-up sections significantly reduces weight. Reducing the weight also saves in transportation and erection cost. In those applications where paint is required, the fact that hollow sections have 30-40% less surface area than equivalent built-up sections can result in using less material and reducing application time, both of which reduce costs. Furthermore, the smooth corners in HSS structures reduce susceptibility to corrosion which lessens the life cycle cost.

Research work with IIT Roorkee

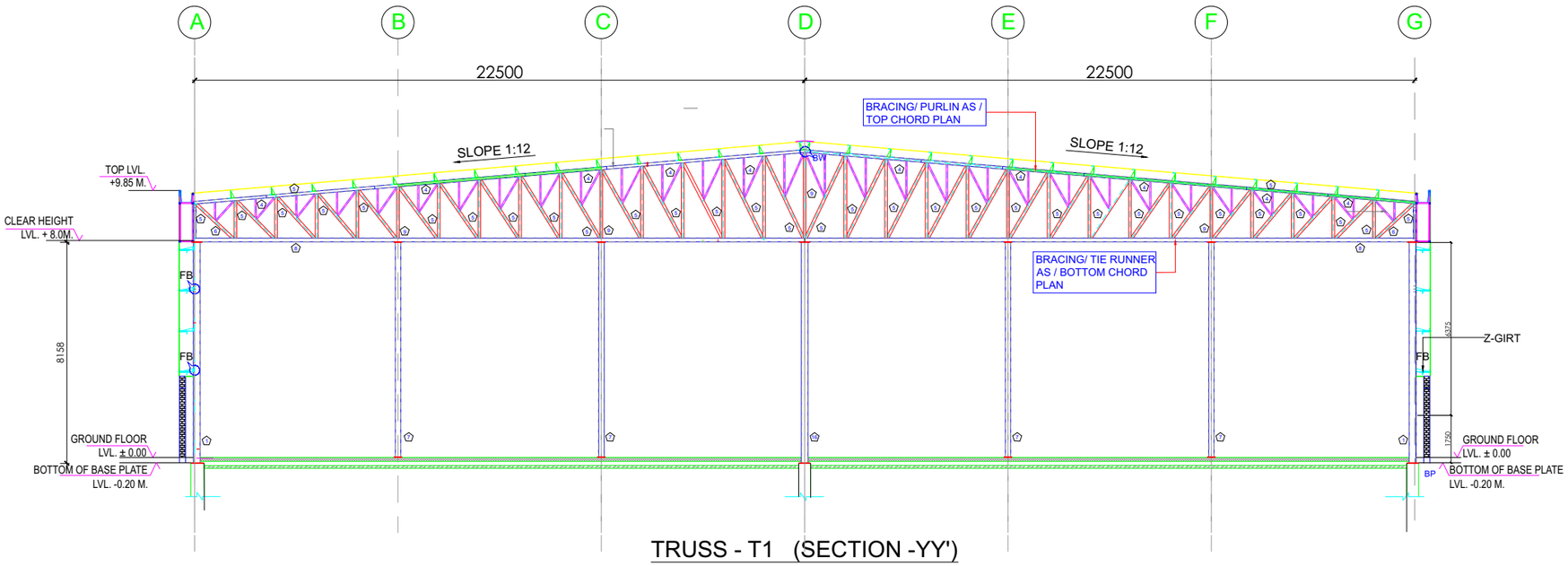
To understand & advocate the benefits of Hollow Steel sections in steel structures, APL Apollo has done extensive research work with Indian Institute of Technology, Roorkee. The research work comprises of the case studies intended to compare the tonnage and indicative costing of HSS & Built-up Sections Steel Structures for Industrial Shed, Warehouse Shed and Commercial Multi-Storey Building. Our extensive research shows that use of HSS sections in structural buildings reduces the consumption of steel by 15-25% and ultimately reduces the project cost.

APL Apollo is doing a live project to build an Industrial shed using Apollo Column at Dujana Plant to put all the research findings into a real-time activity.

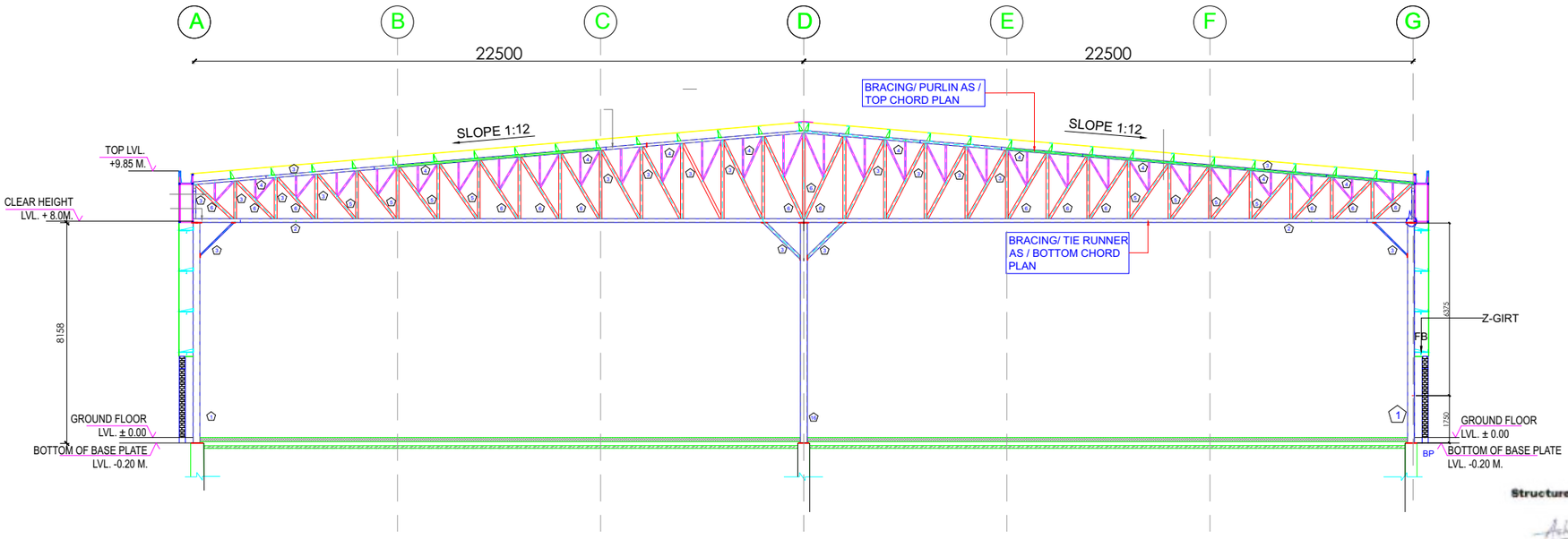


APL Apollo Tubes Ltd and Indian Institute of Technology (IIT), Roorkee have done a research work on steel structures, objective of the project is to provide an economical solution to the construction industry.

WAREHOUSE DRAWINGS - VETTED BY IIT ROORKEE



TRUSS - T1 (SECTION -YY')



TRUSS - T2 (SECTION -XX')

Structure Design Vetted by:

(Dr. P.C. Ashwin Kumar)
Assistant Professor
Dept. of Earthquake Engg.
IIT Roorkee, Roorkee - 247667

1	RHS 250X150X10.0
2	SHS 140X140X3.6
3	SHS 100X100X2.9
4	SHS 30X30X2.6
5	SHS 50X50X2.9
6	SHS 75X75X2.6
7	SHS 200X200X6.0
8	SHS 120X120X2.9
9	SHS 240X120X6.0
10	CHS 88.9X2.6
11	CHS 101X2.6
12	CHS 76.2X2.6
13	CHS 127X2.6
14	CHS 139.7X2.9
15	CHS 114.3X2.6
16	RHS 250X150X5.0

PROJECT :::

WAREHOUSE CASE STUDY

CLIENT :::

APL APOLLO column® The FUTURE is Exciting

GENERAL NOTES :::

THIS DRAWING IS THE PROPERTY OF APL APOLLO TUBES LTD AND SHALL NOT BE COPIED OR USED IN ANYWAY WITHOUT THEIR PRIOR PERMISSION.

ALL DIMENSIONS AND LEVELS ARE IN METERS UNLESS OTHERWISE MENTIONED.

DRAWING NOT TO BE MEASURED, WRITTEN DIMENSIONS TO BE FOLLOWED.

NOTE:
GRADE OF PLATES - YST 345
(YIELD STRENGTH Fy- 345 N/MM2)

GRADE OF PIPES - YST210,

THE SHED IS SYMMETRIC ABOUT GRID 'D'

FB FLANGE BRACING
BW BUTT WELDING
CP CONNECTION PLATE
TP TOP PLATE
SP SPLICE PLATE
BP BASE PLATE

REV NO.	DATE	DESCRIPTION	ISSUED BY
R0	22.09.2020		TAPESH

REVISIONS

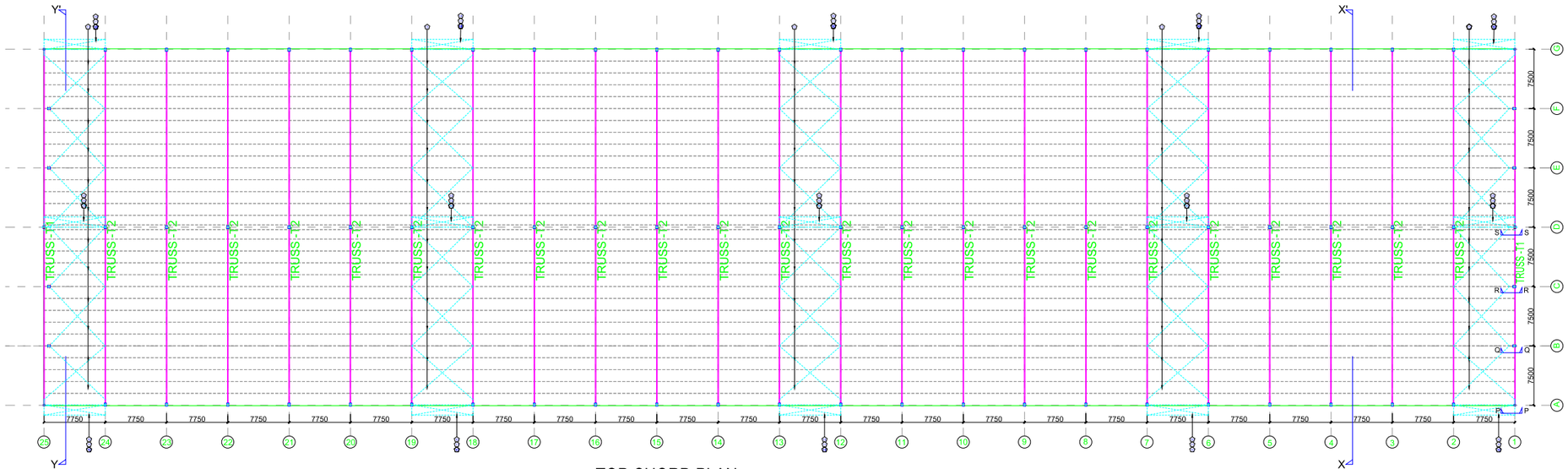
DEALT	:::	CHECKED	:::
DESIGN	::: TAPESH	APPROVED :::	PRO. ASWHIN

DRAWING TITLE.:
TRUSS SECTIONS & DETAILS
WAREHOUSE

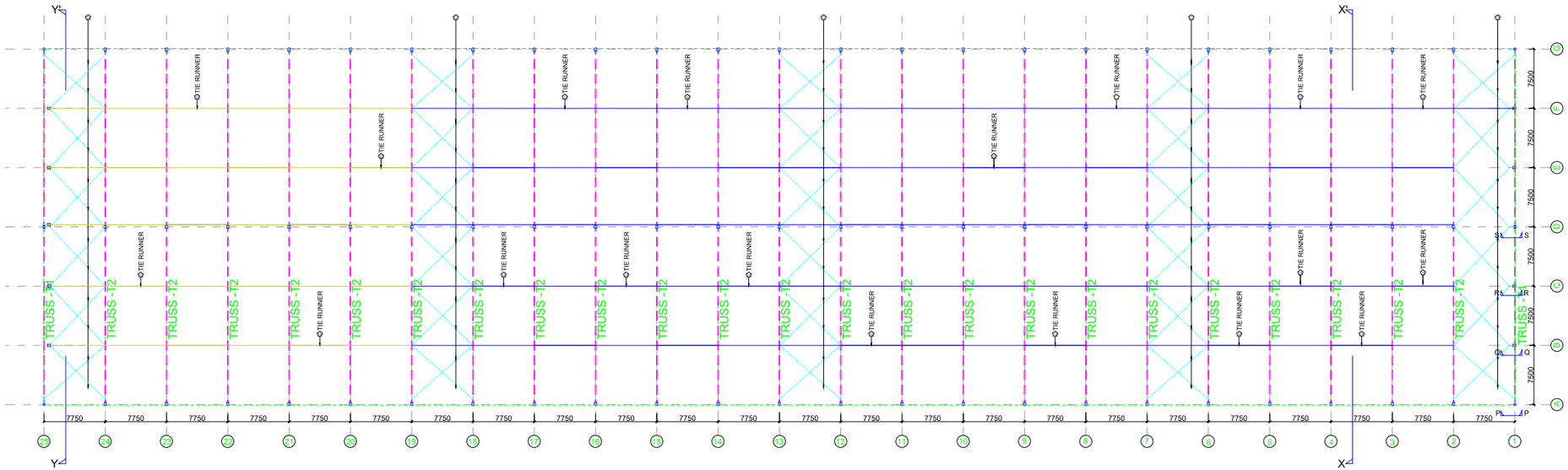
APL APOLLO TUBES LTD

APL APOLLO® STEEL PIPES

WAREHOUSE DRAWINGS - VETTED BY IIT ROORKEE



TOP CHORD PLAN



BOTTOM CHORD PLAN

Structure Design Vetted by:

(Dr. P.C. Ashwin Kumar)
Assistant Professor
Dept. of Earthquake Engg.
IIT Roorkee, Roorkee - 247667

PROJECT :::

WAREHOUSE CASE STUDY

CLIENT :::

APL APOLLO column
The FUTURE is Exciting

GENERAL NOTES :::

ALL DIMENSIONS AND LEVELS ARE IN METERS UNLESS OTHERWISE MENTIONED.

DRAWING NOT TO BE MEASURED, WRITTEN DIMENSIONS TO BE FOLLOWED.

S.No	Section Sizes	Quantity	Total Weight	Grade
1	250X150X10.0RHS			YST210
2	140X140X3.65HS			YST210
3	200X200X6.05HS			YST210
4	250X150X5.0RHS			YST210
5	240X120X6.0RHS			YST210
6	100X100X2.95HS			YST210
7	30X30X2.65HS			YST210
8	50X50X2.95HS			YST210
9	75X75X2.65HS			YST210
10	120X120X2.95HS			YST210
11	88.9X2.6CHS			YST210
12	101.6X2.6CHS			YST210
13	76.2X2.6CHS			YST210
14	127X2.6CHS			YST210
15	139.7X2.9CHS			YST210
16	Purlin			
17	Girt			

REV NO.	DATE	DESCRIPTION	ISSUED BY
R0	22.09.2020	TAPESH	

REVISIONS

DEALT :::		CHECKED :::	
DESIGN ::: TAPESH		APPROVED :::	PRO. ASWHIN

DRAWING TITLE.:

TRUSS SECTIONS & DETAILS
WAREHOUSE

APL APOLLO TUBES LTD

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APL APOLLO STEEL PIPES

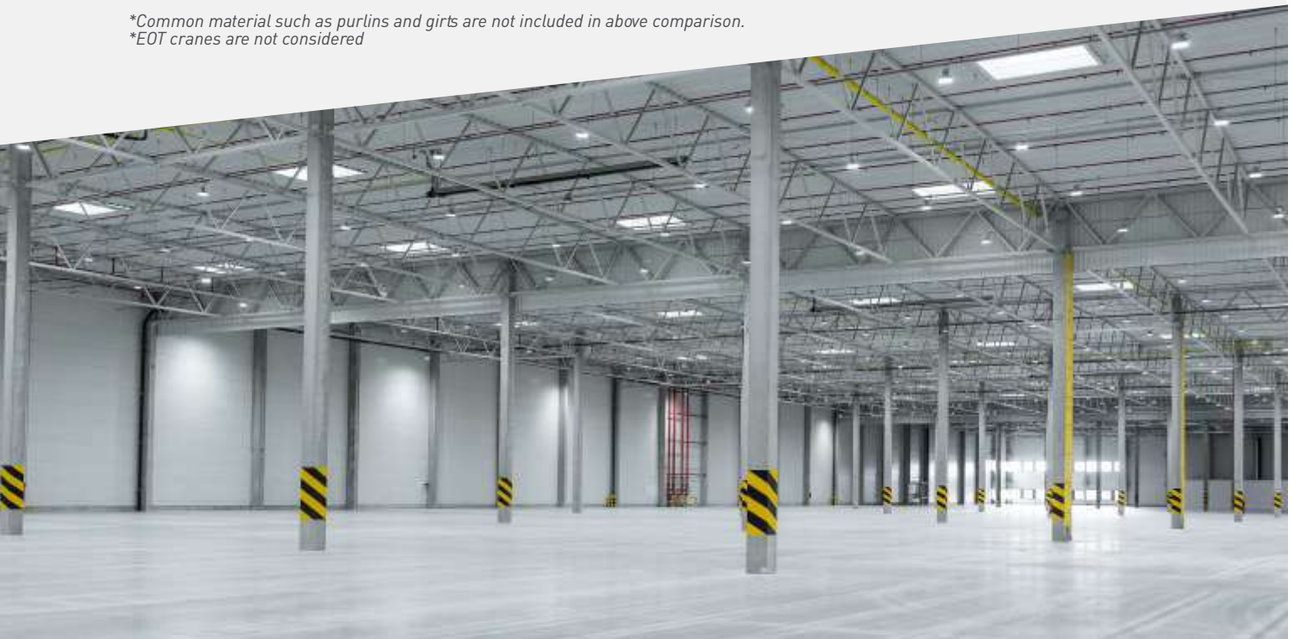
CASE STUDY 1

WAREHOUSE SHED USING APOLLO COLUMN

COST COMPARISON OF WAREHOUSE SHED

Particulars	PEB – Using Built - Up Section	PEB – using Apollo Column
Main Steel Consumption (Ton)	161.10	120.50 25% ↓
Raw Material (Rs/kg)	41.50	46.50
Conversion Cost (Rs/kg)	15.00	16.00
Transportation (Rs/kg)	1.00	1.20
Erection (Rs/kg)	5.00	5.00
Total cost (Rs/kg)	62.50	68.70
Project Cost (Rs Cr)*	1.01	0.83 18% ↓

**Common material such as purlins and girts are not included in above comparison.*
**EOT cranes are not considered*



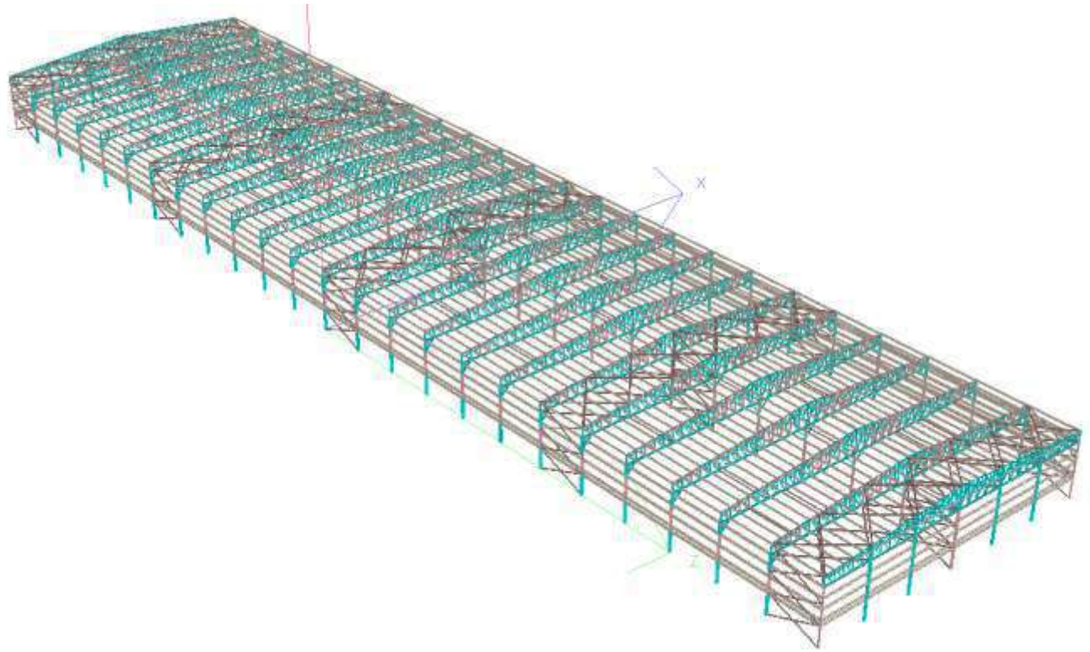
WAREHOUSE SHED

OVERVIEW:

The Warehouse Shed of 9000 sq. m designed having with equal bays and single pitched roof. The structure designed with 2 configurations, one using Built-up I sections and another using Hollow steel section (HSS). The structures are designed for the Dead Load, Live Load, Wind Load & Seismic Load

APPROACH:

The building is designed with the two structural configurations for optimizing the material consumption while meeting structural strength requirements. After preliminary sizing of various structural members, 3-D CAD Model of the structural frame of the building has been generated using STAAD-Pro Connect The permissible values of the load factors and stresses has been considered as per guidelines of Indian Standards.



ISOMETRIC VIEW

MATERIAL

Tubular sections : Conforming to IS:4923 & IS 1161

Built-up sections : Conforming to IS:2062 for HR plates

Roofing Sheet : 0.47 mm thick (TCT) Bare Galvalume Sheet of 550 MPa Grade

Wall Cladding : 0.5 mm thick (TCT) Colour Coated Sheet of 550 MPa Grade

LOAD CALCULATIONS

(i) DEAD LOAD

The dead load on structure includes all the permanent loads attached with structure i.e. self-weight of structure, roofing sheet. Following are the permanent loads which have been considered in design & analysis.

Weight of structure	-	Self weight
Weight of connections	-	15 % of self-weight
Weight of roof sheeting	-	4.5 kg/sqm
Weight of wall cladding	-	4.5 kg/sqm
Load on purlins	-	(.03+0.045)*1.42 = 0.1065 kN/m
Load on girts	-	0.045*1.42 = 0.0639 kN/m

(ii) IMPOSED LOADS

Imposed loads as per IS: 875 (Part-2), acting on the structure have been considered

Roof live load	-	0.75 kN/sqm

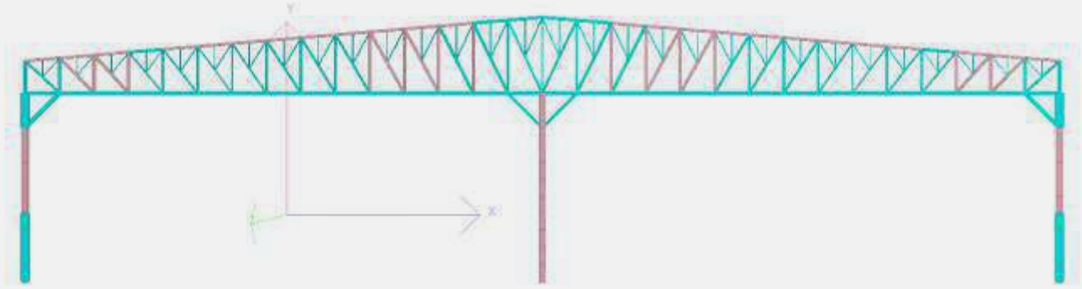
(iii) WIND LOAD

Wind loads has been calculated as per IS:875 part 3-2015.

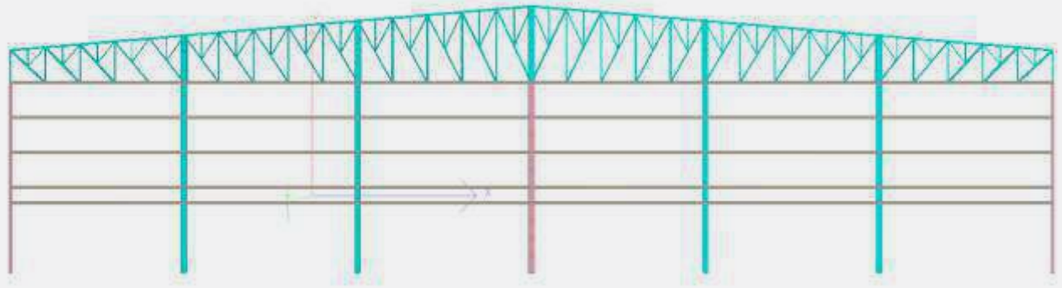
Basic wind speed of	-	47 m/s, (as per NBC 2016)
Terrain category	-	2
Design Life	-	50 years
Percentage openings	-	5 to 20% of wall

(iv) SEISMIC LOAD

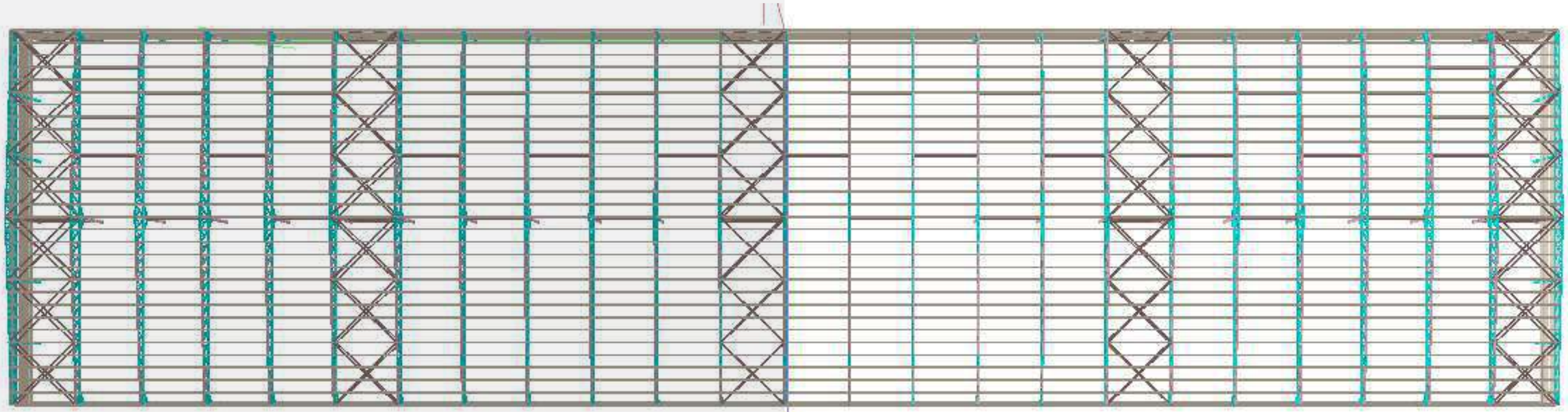
In light weight low-rise structures such as the proposed building, seismic loads are inconsequential while wind load affects are pre-dominant, still seismic loads as per IS 1893 have been evaluated by static method and the structure have been checked for adequacy for relevant seismic load combinations.



MID FRAME



GABLE END FRAME



PLAN

COMPARISON OF STEEL CONSUMPTION:

Element	Tonnage (MT)	
	Built-up Sections	Apollo Column
HR Plate sections with web stiffeners	122.20	-
Pipe/Tube sections	9.20	95.50
Connection plates and stiffeners	11.30	10.00
Anchor bolts & connection bolts	10.80	12.50
Flange brace angles	7.60	2.50
Total Steel Consumption(MT)	**161.10**	**120.50**

RESULT & CONCLUSIONS

25% Less Steel Consumption

18% Saving In Total Project Cost

Design documents for above case study are available on our website

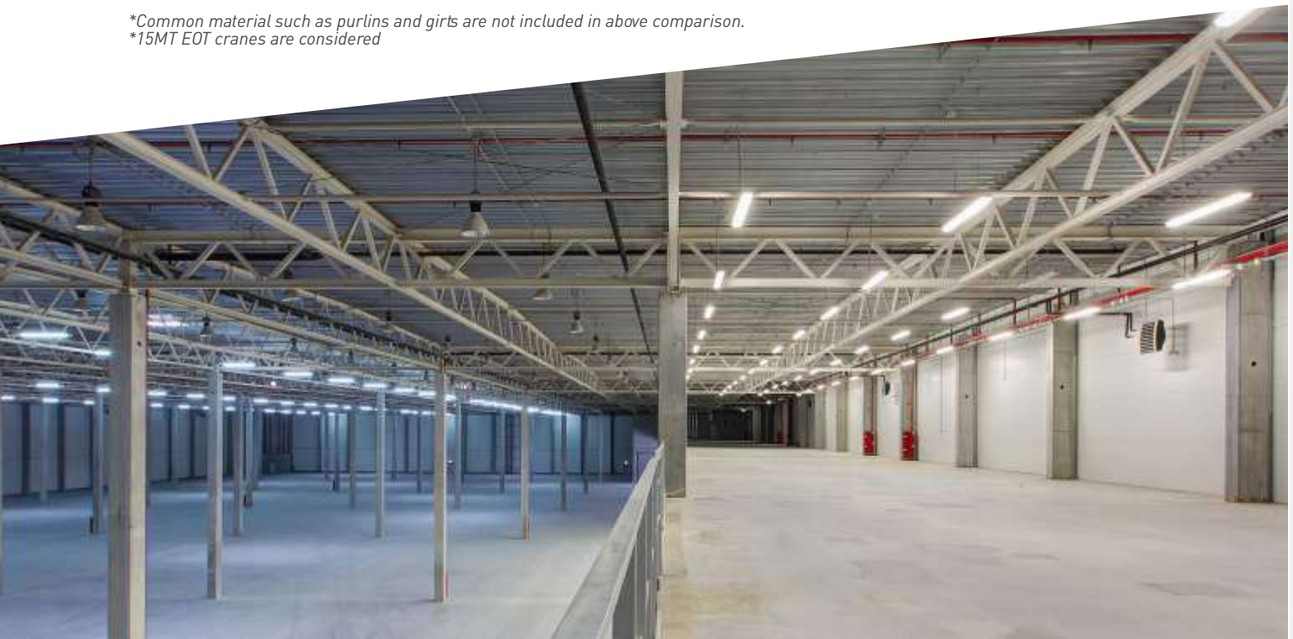
CASE STUDY 2

INDUSTRIAL SHED USING APOLLO COLUMN

COST COMPARISON OF INDUSTRIAL SHED

Particulars	PEB – Using Built - Up Section	PEB – using Apollo Column
Main Steel Consumption (Ton)	376.70	327.50 13% ↓
Raw Material (Rs/kg)	41.50	46.50
Conversion Cost (Rs/kg)	16.00	16.00
Transportation (Rs/kg)	1.00	1.20
Erection (Rs/kg)	5.00	5.00
Total cost (Rs/kg)	63.50	68.70
Project Cost (Rs Cr)*	2.39	2.25 06% ↓

**Common material such as purlins and girts are not included in above comparison.*
**15MT EOT cranes are considered*



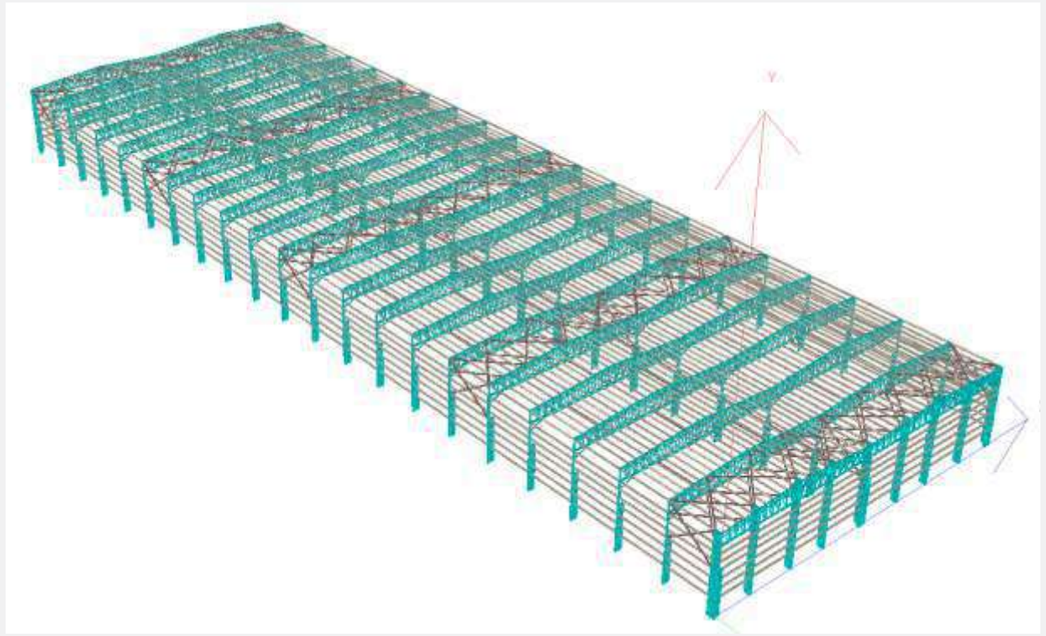
INDUSTRIAL SHED

OVERVIEW

The Industrial Shed of 11500 sq. m designed having with 2 equal bays, double pitched roof and 15 MT cranes. The structure designed with 2 configurations, one using Built-up I sections and another using HSS sections. The structures are designed for the Dead Load, Live Load, Wind Load, Earthquake Load and Crane Load.

APPROACH

The building is designed with the two structural configurations for optimizing the material consumption while meeting structural strength requirements. After preliminary sizing of various structural members, 3-D CAD Model of the structural frame of the building has been generated using STAAD-Pro Connect The permissible values of the load factors and stresses has been considered as per guidelines of Indian Standards.



ISOMETRIC VIEW

MATERIAL

Tubular sections : Conforming to IS:4923 & IS 1161

Built-up sections : Conforming to IS:2062 for HR plates

Roofing Sheet : 0.47 mm thick (TCT) Bare Galvalume Sheet of 550 MPa Grade

Wall Cladding : 0.5 mm thick (TCT) Colour Coated Sheet of 550 MPa Grade

LOAD CALCULATIONS

(i) DEAD LOAD

The dead load on structure includes all the permanent loads attached with structure i.e. self-weight of structure, roofing sheet and solar panels. Following are the permanent loads which have been considered in design & analysis.

Weight of structure	-	Self weight
Weight of connections	-	15 % of self-weight
Weight of roof sheeting	-	4.5 kg/sqm
Weight of wall cladding	-	4.5 kg/sqm
Load on purlins	-	(.03+0.045)*1.42 = 0.1065 kN/m
Load on girts	-	0.045*1.42 = 0.0639 kN/m
Utilities weight on side column	-	300 kg/m
Walkway	-	100kg/m

(ii) IMPOSED LOADS

Imposed loads as per IS: 875 (Part-2), acting on the structure have been considered

Roof live load	-	0.75 kN/sqm
Load on walkway	-	1 KN/m

Crane live load - Multiple EOT cranes of 15 MT capacities and M5 duty with 2 wheels have been considered in both bays. Working in tandem in each 30 m bay with hook c/c of 2 cranes not closer than 9 mt. in any bay (with all probable critical conditions).

(iii) WIND LOAD

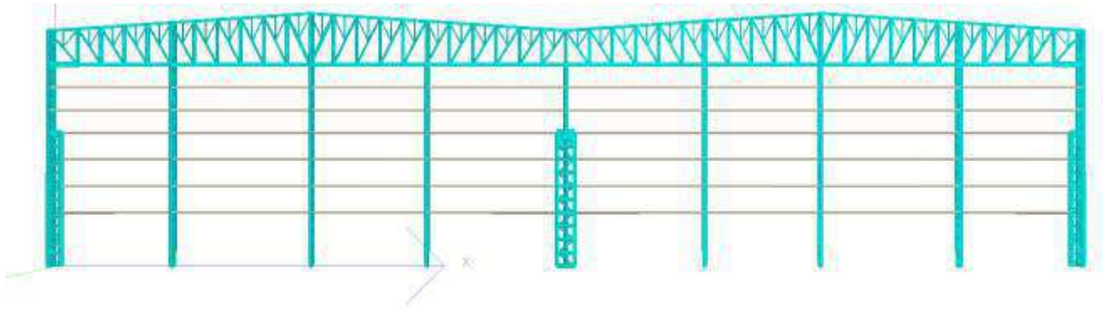
Wind loads has been calculated as per IS:875 part 3-2015.

Basic wind speed of	-	47 m/s, (as per NBC 2016)
Terrain category	-	2
Design Life	-	50 years
Percentage openings	-	5 to 20% of wall

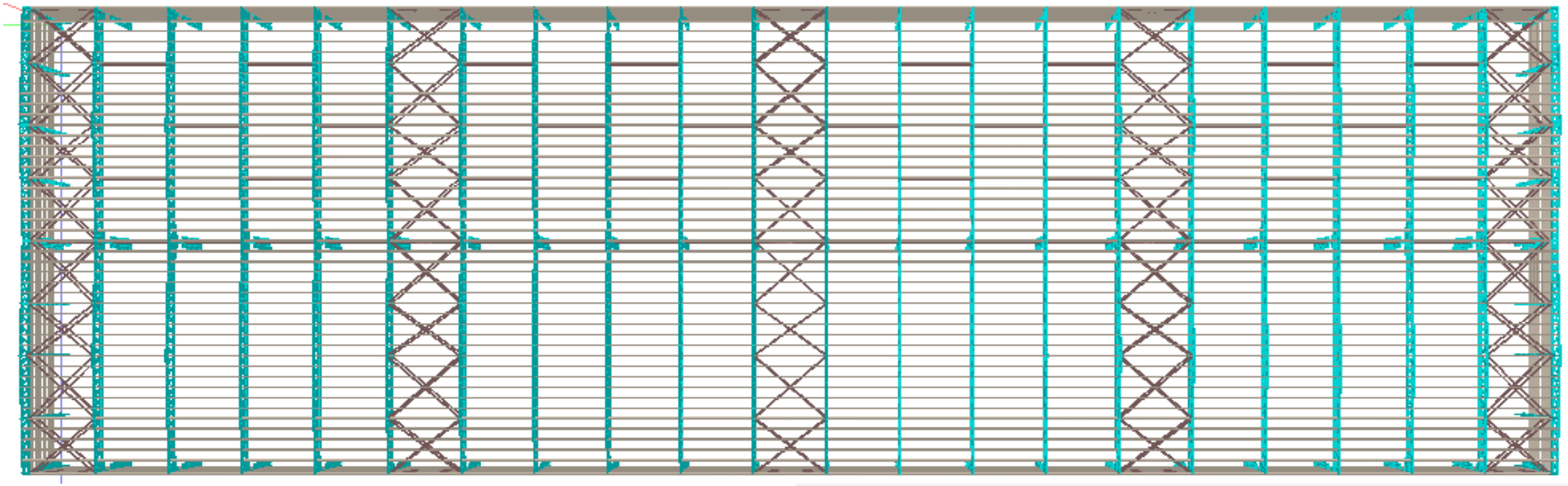
(iv) SEISMIC LOAD

Seismic loads as per IS 1893 have been evaluated by static method and the structure have been checked for adequacy for relevant seismic load combinations.

MID FRAME



GABLE END FRAME



COMPARISON OF STEEL CONSUMPTION:

Element	Tonnage (MT)	
	Built-up Sections	Apollo Column
HR Plate sections with web stiffeners	279.76	-
Pipe/Tube sections	38.72	287.50
Connection plates and stiffeners	32.20	28.50
Anchor bolts & connection bolts	11.96	7.00
Flange brace angles	14.06	4.50
Total Steel Consumption(MT)	**376.70**	**327.50**

RESULT & CONCLUSIONS

13% Less Steel Consumption

06% Saving In Total Project Cost

CASE STUDY 3

COMMERCIAL BUILDING USING APOLLO COLUMN

COST COMPARISON OF COMMERCIAL BUILDING

Particulars	PEB – Using Built - Up Section	PEB – using Apollo Column
Main Steel Consumption (Ton)	309.32	261.00 15% ↓
Raw Material (Rs/kg)	41.50	46.50
Conversion Cost (Rs/kg)	16.00	16.00
Transportation (Rs/kg)	1.00	1.20
Erection (Rs/kg)	5.00	5.00
Total cost (Rs/kg)	63.50	68.70
Project Cost (Rs Cr)*	1.97	1.79 9% ↓

**Common material such as purlins and girts are not included in above comparison.*

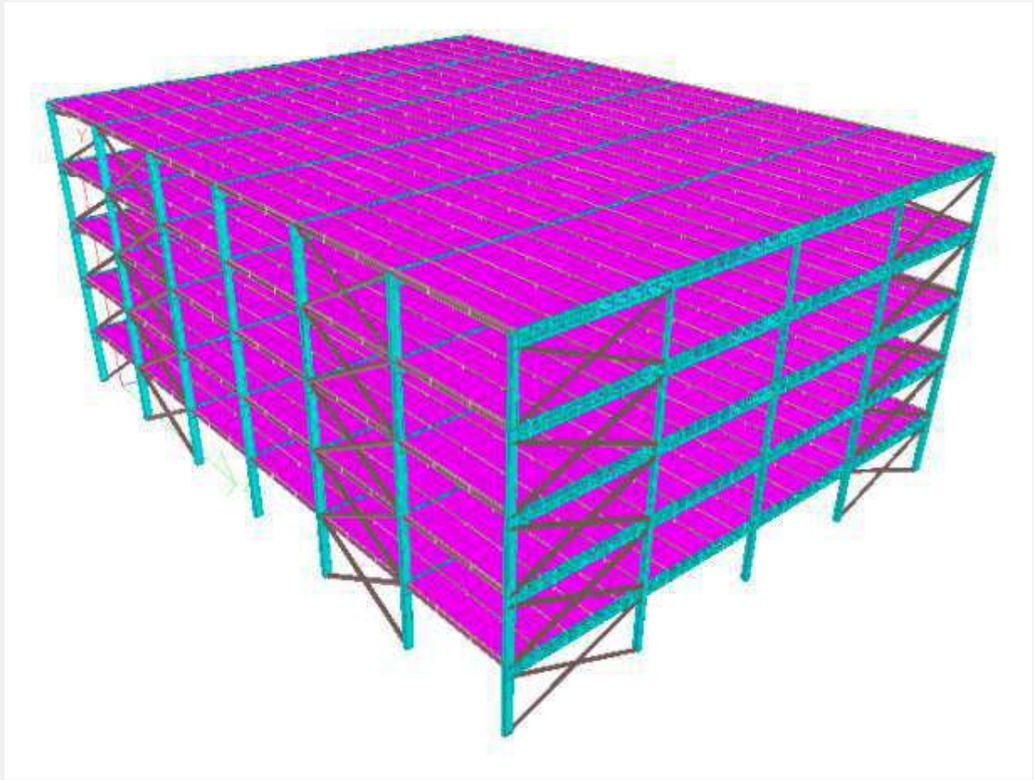
COMMERCIAL BUILDING

OVERVIEW:

The G+4 Commercial Building consists of 40 m long building having 30 m width with equal bays and flat roof. The structure designed with 2 configurations, one using Built-up I sections and another using HSS sections. The structures are designed for the Dead Load, Live Load, Wind Load & Earthquake Load.

APPROACH:

The building is designed with the two structural configurations for optimizing the material consumption while meeting structural strength requirements. After preliminary sizing of various structural members, 3-D CAD Model of the structural frame of the building has been generated using STAAD-Pro Connect The permissible values of the load factors and stresses has been considered as per guidelines of Indian Standards.



ISOMETRIC VIEW

MATERIAL

Tubular sections : Conforming to IS:4923 & IS 1161

Built-up sections : Conforming to IS:2062 for HR plates

Roofing Sheet : 0.47 mm thick (TCT) Bare Galvalume Sheet of 550 MPa Grade

Wall Cladding : 0.5 mm thick (TCT) Colour Coated Sheet of 550 MPa Grade

LOAD CALCULATIONS

(i) DEAD LOAD

The dead load on structure includes all the permanent loads attached with structure i.e. self-weight of structure, roofing sheet and solar panels. Following are the permanent loads which have been considered in design & analysis.

Weight of structure	-	Self weight
Weight of connections	-	15 % of self-weight
Weight of roof sheeting	-	4.5 kg/sqm
Weight of wall cladding	-	4.5 kg/sqm
Load on purlins	-	(.03+0.045)*1.42 = 0.1065 kN/m
Load on girts	-	0.045*1.42 = 0.0639 kN/m

(ii) IMPOSED LOADS

Imposed loads as per IS: 875 (Part-2), acting on the structure have been considered

Periphery partition load	–	19.2 kN/cum
Intermediate partition load	-	1 kN/sqm
Floor live load	-	4 kN/sqm
Roof live load*	-	4 kN/sqm

(iii) WIND LOAD

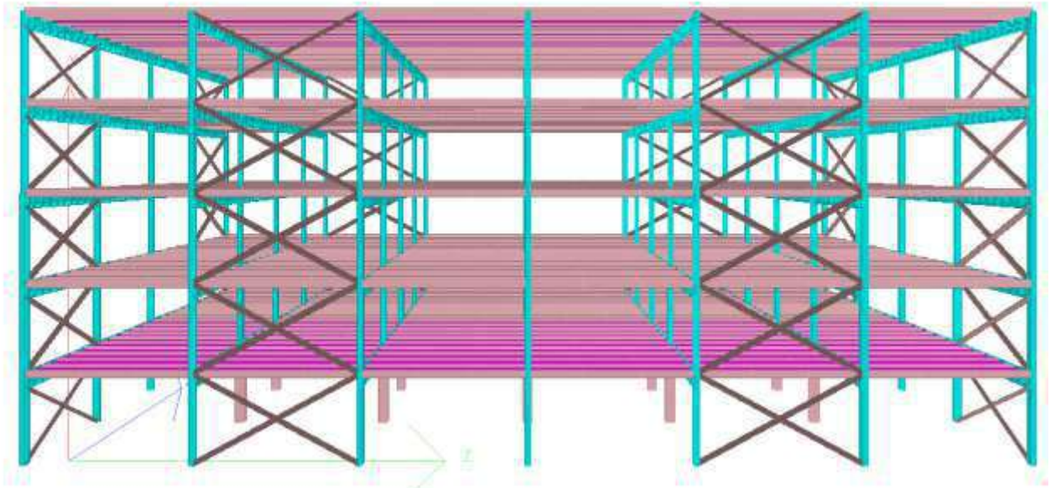
Wind loads has been calculated as per IS:875 part 3-2015.

Basic wind speed of	-	47 m/s, (as per NBC 2016)
Terrain category	-	2
Design Life	-	50 years
Percentage openings	-	5 to 20% of wall

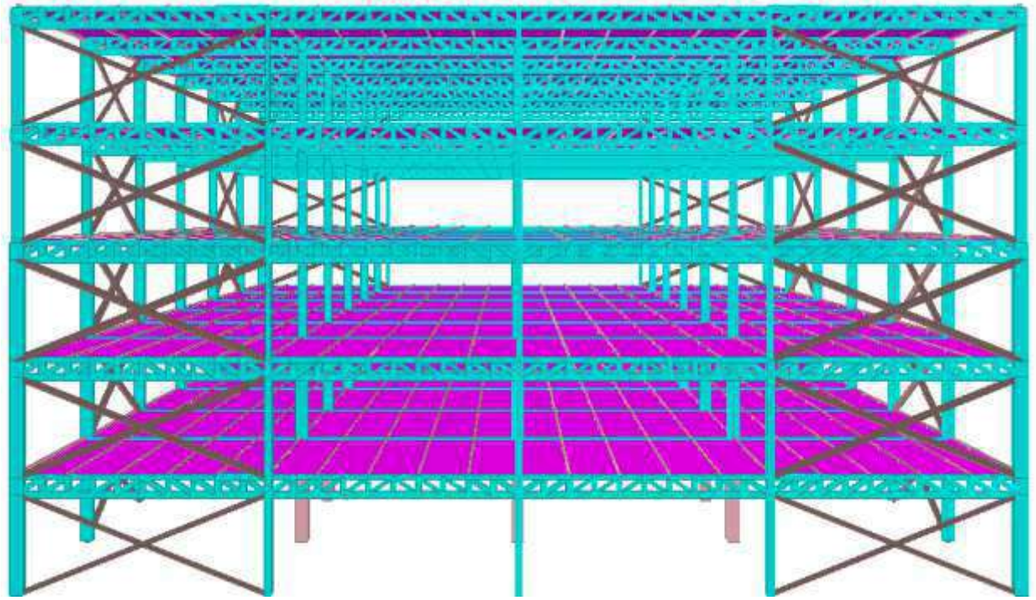
*With provision for full floor load/roof utilities.

(iv) SEISMIC LOAD

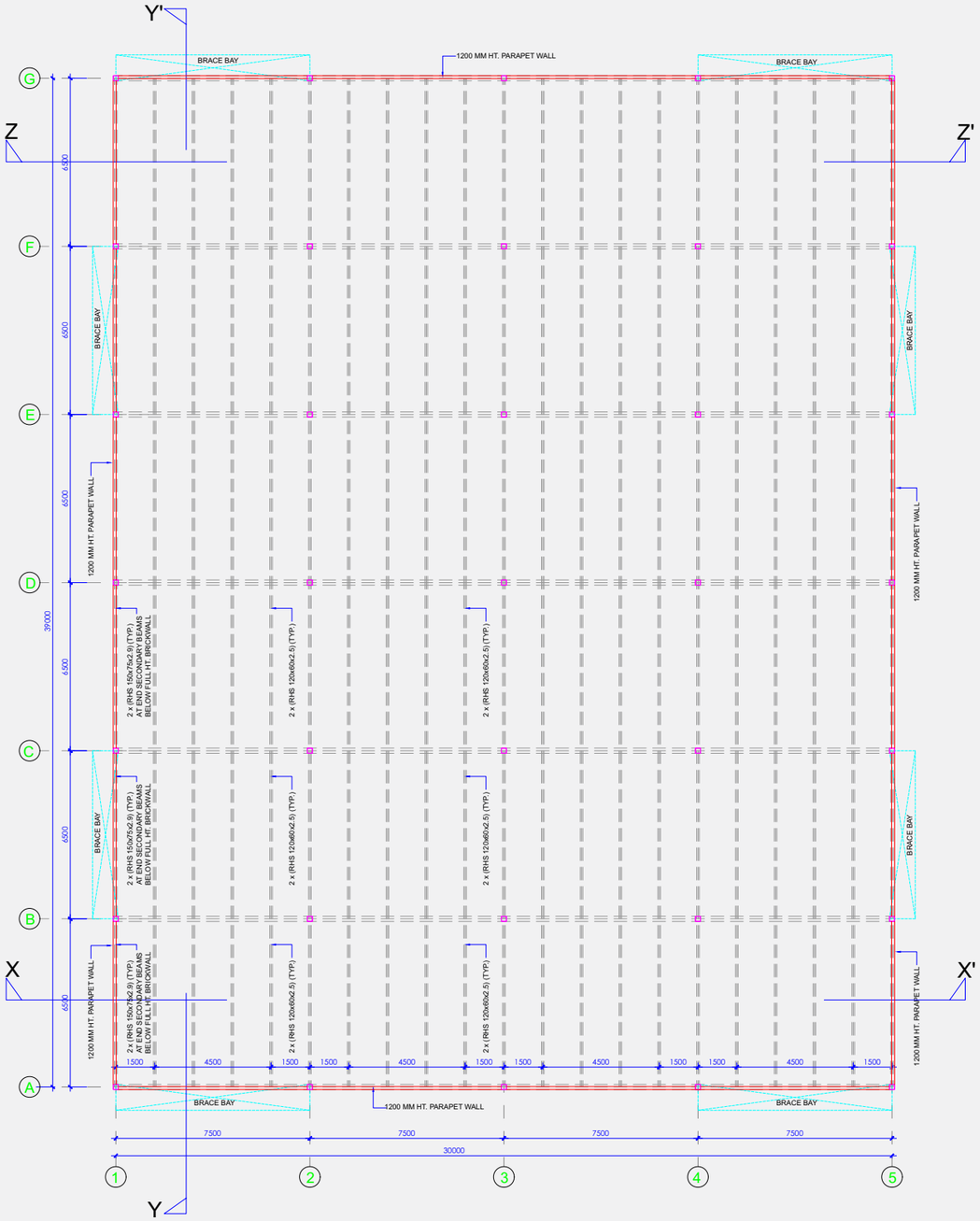
Seismic loads as per IS 1893 have been evaluated by static method and the structure have been checked for adequacy for relevant seismic load combinations.



MID FRAME



GABLE END FRAME



TERRACE FLOOR PLAN

COMPARISON OF STEEL CONSUMPTION:

Element	Tonnage (MT)	
	Built-up Sections	Apollo Column
HR Plate sections with web stiffeners	122.18	-
Pipe/Tube sections	7.20	109.00
Composite slab steel	144.04	121.50
Connection plates and stiffeners	33.40	28.00
Anchor bolts & connection bolts	2.50	2.50
Flange brace angles	-	-
Total Steel Consumption(MT)	**309.32**	**261.00**

RESULT & CONCLUSIONS

15% Less Steel Consumption

09% Saving In Total Project Cost

APL APOLLO LIVE PROJECT
Dujana Industrial Shed

ABOUT THE PROJECT

Apollo Tricoat Tubes Ltd has an upcoming Greenfield Project at Dujana, UP. The proposed Industrial Structure of 78000 sq. ft. consists of 146 m long shed having 49 m width with clear height of 11 m and 15 MT crane. The shed is constructed using APL Apollo Steel Tube. The structure is well designed for the Dead Load, Live Load, Wind Load, Earthquake Load and Crane Load.

CHALLENGES

The challenge was to reduce the weight and cost of the industrial shed. Our findings in the research work showed a significant reduction in steel consumption in HSS structures as compared to built-up structures. The project aimed at developing an optimised industrial shed with minimum construction time and zero onsite fabrication.

SOLUTION

APL Apollo Steel Tube & Cladding Project Pvt. Ltd. worked together to achieve the results received from the research work & put it all theoretical research work in real time project.The optimised steel structure was designed & constructed using APL Apollo Steel Tube.

RESULT & DISCUSSION

340 MT Steel Consumption

25% less steel consumption

15% saving in total project cost

MYTH ABOUT HSS BUILDINGS

Myth

Bolted connections are difficult in HSS structure

1

Fact

Bolted connections are easily implementable in HSS structure as per code compliance. Extended end plate to HSS beam permits the use of conventional bolted connection

Myth

High raw material cost increases the project cost

2

Fact

Use of HSS sections against Built-up sections in steel structures significantly reduces weight which decreases the overall project cost

Myth

Unavailability of bigger sizes in the market

3

Fact

APL Apollo provides tubes of sizes up to 300x300.

MYTH BUSTERS

Myth

HSS structures need site fabrication

4

Fact

Zero onsite fabrication using automatic welding equipment is possible

Myth

HSS structures are architecturally borings

5

Fact

Ease of fabrication using HSS sections provides flexibility to the architects to shape their structures and express their creativity.

Myth

Wastage of material is high

6

Fact

APL Apollo provides cut to length sizes from 4 to 12 mm to avoid wastage

HOW TO MAKE A SUCCESSFUL BUILDING USING HSS?

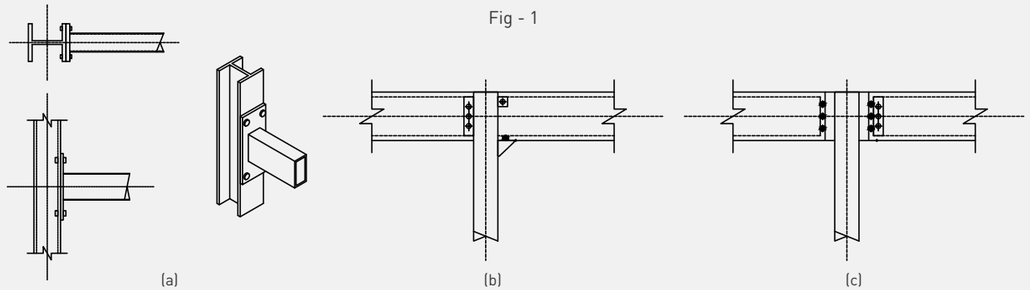
1. HSS CONNECTIONS

WELDED AND BOLTED CONNECTION

Beams and columns are usually connected on site by bolting. In the case of an RHS beam connection to an I-section column, a welded extended end-plate to the RHS beam permits the use of a conventional bolted connection to the column flange or web (see Figure 1.a). The bolts may be countersunk into the thick end-plate if the connection is important visually.

A number of typical simple connections using cleats welded to an RHS column are shown in Figures 1.b to c. Figure 1(b) shows a fin plate welded to the face of the column and the supporting bracket can be detailed to be visually interesting. Figure 1(c) shows the use of channels welded at the tips of their flanges.

Fig - 1



(a) Connection of RHS beam to I-section column

(b) Conventional cleats welded to an RHS column

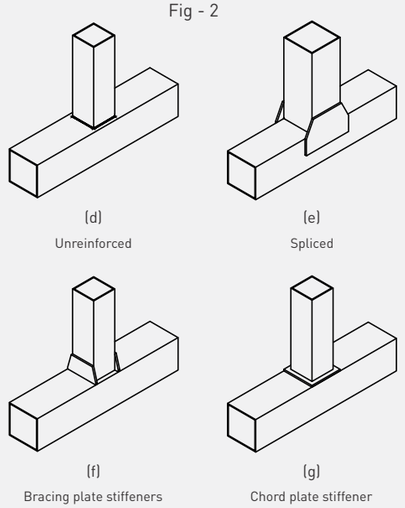
(c) C-sections welded to an RHS column to facilitate the use of a bolted connection

VIERENDEEL TRUSSES

are relatively inefficient at resisting high shear-forces because of the lack of diagonal bracing and, therefore, it is necessary to use thicker or larger chord members than in triangulated trusses. Ideally, the chord and vertical members should be the same external size. If not, stiffening elements are generally inserted to increase the local bending resistance of the connections. Figure 2 shows various ways in which nominally pinned connections can be strengthened in Vierendeel trusses.

Various ways in which normally pinned connection can be strength Fig - 6 (c)(d)(e)(f)(g)

Fig - 2



(d) Unreinforced

(e) Spliced

(f) Bracing plate stiffeners

(g) Chord plate stiffener

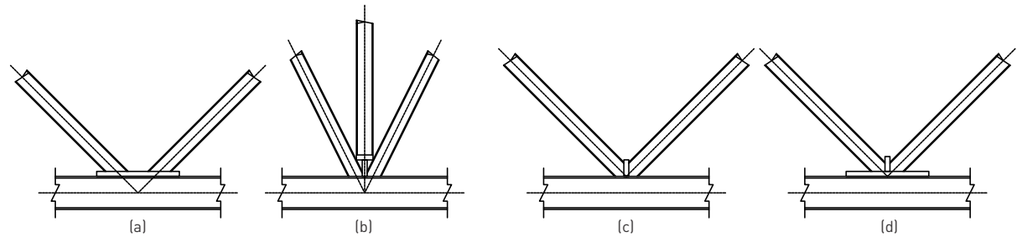
REINFORCEMENT OF CONNECTIONS

For maximum resistance of the members, it is usually more efficient to select larger HSS sections with thin walls. However, when designing the connections, it is more advantageous to use chord members that are thicker and smaller in section (provided that they are not smaller than the bracing members). Therefore, a compromise is necessary for overall design and fabrication efficiency.

In some cases, connections may have to be strengthened locally to resist the applied forces, if it is not possible to increase the member size or thickness. This can be achieved by welding plates to the chord face (see Figure 3(a)). It should also be noted that overlaps will also increase the connection resistance, especially for RHS members. When a third member is required at the intersection, a 'T' piece can also be used (see Figure 3(b)).

Other non-standard stiffened K connections can be used to increase the load capacity of the connection, as illustrated in Figure 3(c&d).

Fig - 3

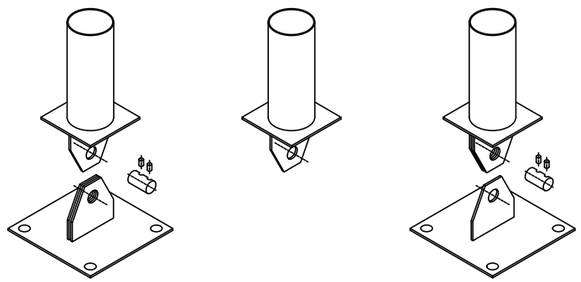


(a) (b) (c) (d)

COLUMN BASES

Bases to HSS columns take two basic forms: pinned and rigid (or moment-resisting). The details employed reflect the transfer of forces and moments. A genuine pinned connection can be achieved by a single pin from a projecting plate, as shown in Figure 4.

Fig - 4



(a) (b)

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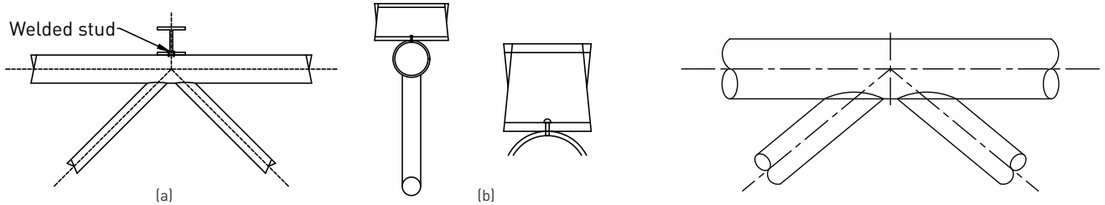
Some examples of HSS connections with pinned ends

WELDED FINS

Fins or brackets may be welded to the side of CHS or SHS/RHS sections to provide direct attachment of secondary members such as purlins (see Figure 5). Connections of this type require careful design because of the possible local distortion of the walls of larger hollow sections. Alternatively, welded threaded studs with extended washers may be used to attach the purlins to the section.

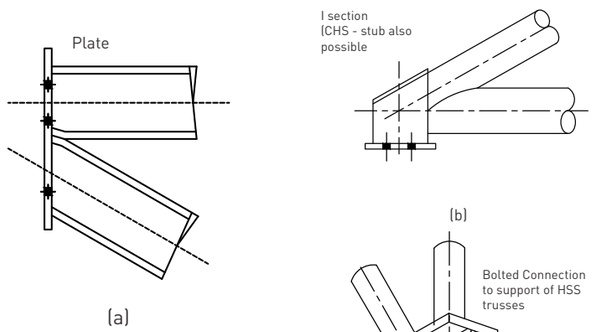
The attachment of tension-ties or rod-bracing members requires similar details. High local forces from ties may also be transferred by 'patch-type' connections, which may be profiled around the circular section so that weld forces are transferred smoothly to the walls of the section. Multiple welded fin connections have been used successfully on a number of major projects, such as at the column bases at the Cologne Airport terminal, as shown in Figure 5(d)

Fig - 5



Bolted connections are desirable for site assembly, and large welded sub-assemblies that are prefabricated and bolted together on site at suitable locations. The practical aspects of installation should be considered in the design process. For example, Figure 6 shows

Fig - 6



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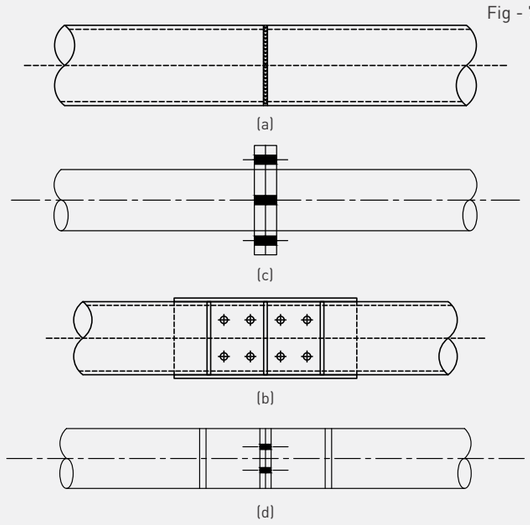
5(d)

HSS SPLICE CONNECTION

FLANGE PLATES (Figure - 7) are simple to make but are not aesthetically pleasing. They are suitable for compression but are less efficient for tension because of bending in the end plate, requiring thicker plates and more bolts. Fillet welding around the section could cause distortion of thin flange plates.

Fig - 7



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Moment - resisting connection is achieved by a welded end- plate with four or more bolts. The thickness of the end plate depends on the moment to be transferred

SPLICE CONNECTION WITH PLUG WELDING

Fig - 8

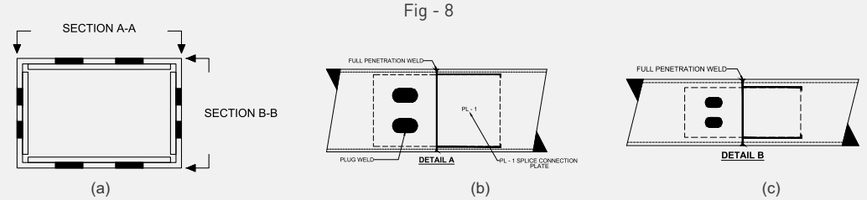

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Fig - 9

Interesting details can be created using cast iron or cast steel nodes in a pinned connection

HSS TRUSS

For the connection of HSS trusses to RHS columns, typical bolted details are shown in Figure 10. High shear-forces may require the use of more bolts than shown. The sharing of load between the upper and lower chords in the connection depends on the presence of a vertical bracing member at the end of the truss. In the detail of Figure 11(a), the upper connection will resist all of the applied shear-force. In Figure 10(b), the upper and lower parts of the connections may be assumed to resist equal shear-force.

Fig - 10

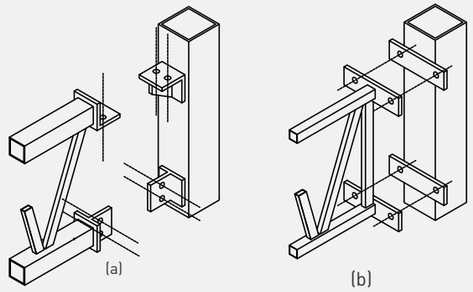
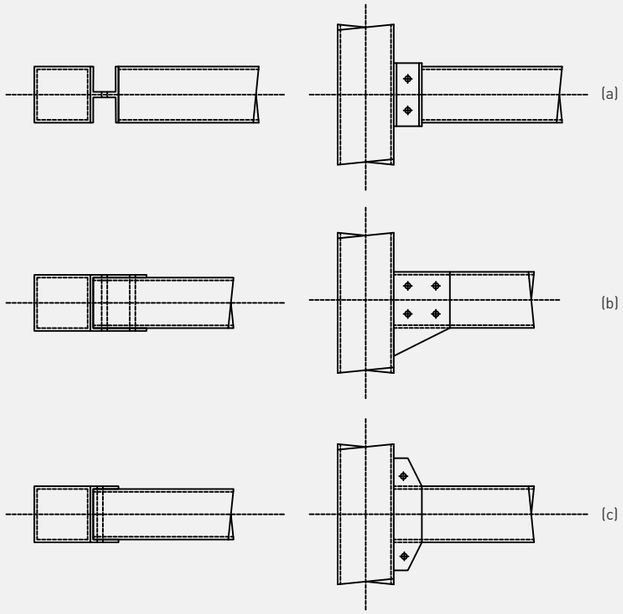


Figure 10(a&b) - Truss to SHS/RHS column connection

HSS BEAM TO AN HSS COLUMN

Figure 11 shows other typical connections of an RHS beam to an RHS column. For lightly loaded connections, the T-section shown in Figure 11(a) may be replaced with a fin plate. Where through bolting is used (as in Figure 11(b) and Figure 11(c)), spacer tubes

Fig - 11



Typical connection of an RHS beam to an RHS column a,b&c

2. FACTORY CONTROLLED FABRICATION

Prefabrication is the singled out approach to build steel structures using HSS because it allows the considerable part of the process to happen on the workshop floor where more tools and materials are readily available, thus reducing the costs of transportation and enabling for faster modification & conversion. Fabrication of hollow steel sections carried out in shops is precise and of assured quality.

3. AUTOMATION IN WELDING

With advancement in engineering & technology, automatic weld beam welding lines are available for fabrication of HSS structures. The automated process ensures superior weld quality due to the electronic controller and also the results are much more consistent than in manual welding.

Benefits

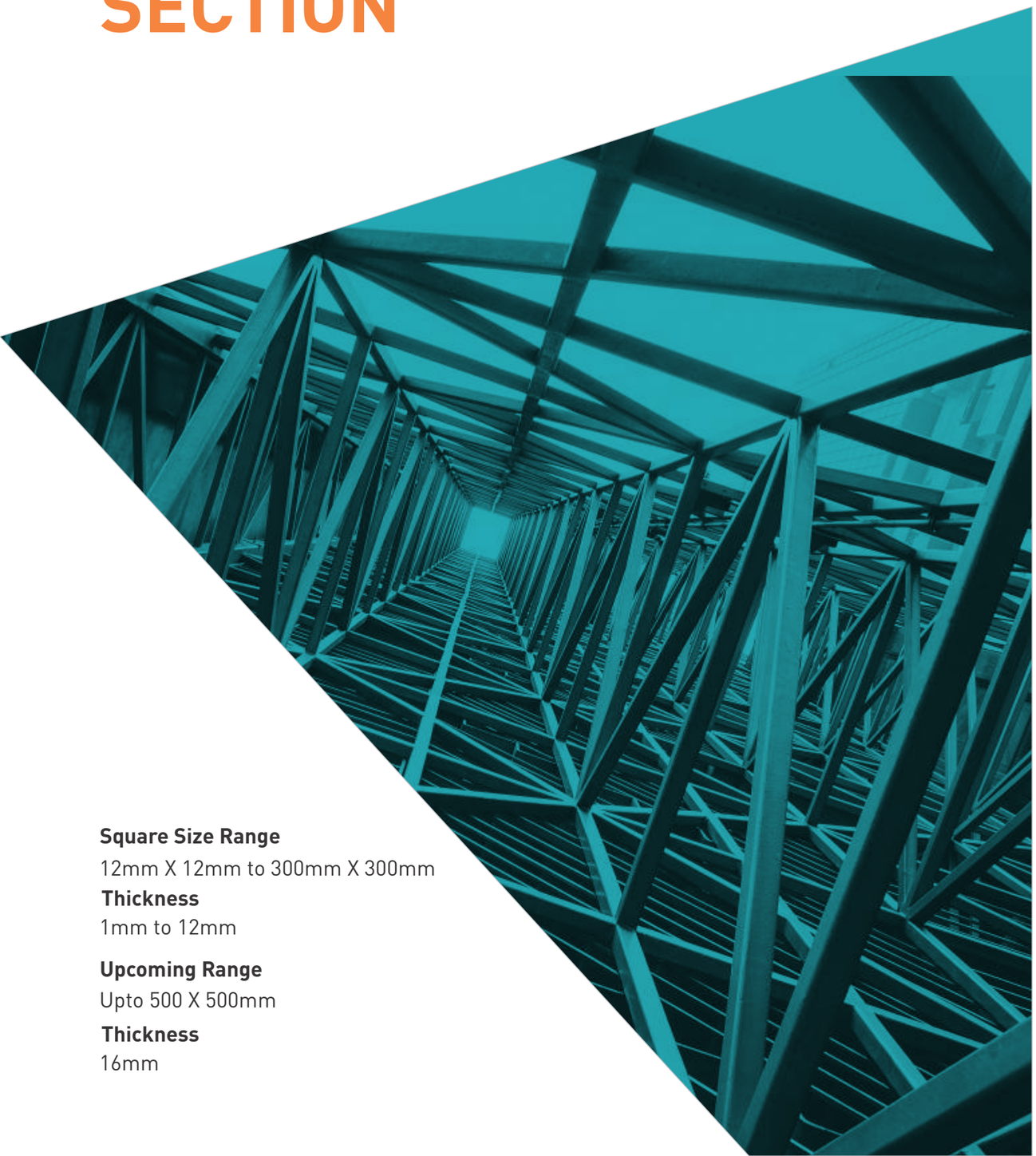
1) Cost reduction 2) Increased productivity

3) Consistent accuracy 4) Minimum wastage 5) Lower labour cost

4. ERECTION USING BOLTING CONNECTION

Erection involves the assembly of HSS components into a desired frame at site. Hollow steel sections are fabricated at the factory to the exact size, transported to site and assembled at site using bolted connections. Bolted connections are easily implementable in HSS structure (Refer: HSS connections). Extended end plate to HSS components permits the use of conventional bolted connections.

SQUARE HOLLOW SECTION



Square Size Range

12mm X 12mm to 300mm X 300mm

Thickness

1mm to 12mm

Upcoming Range

Upto 500 X 500mm

Thickness

16mm

SQUARE HOLLOW SECTION (SHS) IS : 4923 : 2017/EN 10219-1 : 2006*/ASTM A-500

Dimension	Weight	Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants	
mm	kg/m	cm2	I_{xx}	I_{yy}	R_{xx}	R_{yy}	Z_{xx}	Z_{yy}	S_{xx}	S_{yy}	J	C
			cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3
12X12X1.6	0.47	0.60	0.10	0.10	0.41	0.41	0.17	0.17	0.22	0.22	0.12	0.18
12X12X2.0	0.55	0.70	0.11	0.11	0.40	0.40	0.19	0.19	0.25	0.25	0.07	0.13
15X15X1.6	0.62	0.79	0.23	0.23	0.54	0.54	0.31	0.31	0.39	0.39	0.32	0.38
15X15X2.0	0.74	0.94	0.25	0.25	0.52	0.52	0.34	0.34	0.44	0.44	0.28	0.35
15X15X2.2	0.79	1.00	0.25	0.25	0.50	0.50	0.34	0.34	0.46	0.46	0.24	0.32
20X20X1.6	0.87	1.11	0.61	0.61	0.74	0.74	0.61	0.61	0.75	0.75	0.95	0.84
20X20X2.0	1.05	1.34	0.69	0.69	0.72	0.72	0.69	0.69	0.88	0.88	1.01	0.90
20X20X2.2	1.13	1.44	0.73	0.73	0.71	0.71	0.73	0.73	0.93	0.93	1.00	0.90
20X20X2.5	1.25	1.59	0.77	0.77	0.70	0.70	0.77	0.77	1.00	1.00	0.95	0.87
25X25X1.6	1.12	1.43	1.28	1.28	0.95	0.95	1.03	1.03	1.24	1.24	2.05	1.46
25X25X2.0	1.37	1.74	1.48	1.48	0.92	0.92	1.19	1.19	1.47	1.47	2.32	1.64
25X25X2.2	1.48	1.88	1.57	1.57	0.91	0.91	1.26	1.26	1.57	1.57	2.40	1.70
25X25X2.5	1.64	2.09	1.69	1.69	0.90	0.90	1.36	1.36	1.71	1.71	2.46	1.75
25X25X2.8	1.79	2.28	1.79	1.79	0.89	0.89	1.44	1.44	1.84	1.84	2.44	1.76
30X30X1.6	1.37	1.75	2.31	2.31	1.15	1.15	1.54	1.54	1.84	1.84	3.73	2.24
30X30X2.0	1.68	2.14	2.72	2.72	1.13	1.13	1.82	1.82	2.21	2.21	4.35	2.59
30X30X2.2	1.82	2.32	2.91	2.91	1.12	1.12	1.94	1.94	2.37	2.37	4.60	2.72
30X30X2.5	2.03	2.59	3.16	3.16	1.10	1.10	2.11	2.11	2.61	2.61	4.89	2.89
30X30X2.8	2.23	2.84	3.37	3.37	1.09	1.09	2.25	2.25	2.83	2.83	5.06	2.99
30X30X3.2	2.49	3.17	3.62	3.62	1.07	1.07	2.42	2.42	3.08	3.08	5.10	3.05
30X30X3.6	2.72	3.47	3.82	3.82	1.05	1.05	2.55	2.55	3.31	3.31	4.92	2.99
30X30X4.0	2.94	3.75	3.97	3.97	1.03	1.03	2.65	2.65	3.50	3.50	4.52	2.84
30X30X4.5	3.19	4.07	4.09	4.09	1.00	1.00	2.73	2.73	3.70	3.70	3.72	2.49
30X30X5.0	3.42	4.36	4.16	4.16	0.98	0.98	2.78	2.78	3.84	3.84	2.69	1.98
30X30X5.4	3.58	4.56	4.17	4.17	0.96	0.96	2.78	2.78	3.93	3.93	1.80	1.49
30X30X6.0	3.79	4.83	4.12	4.12	0.92	0.92	2.75	2.75	4.01	4.01	0.69	0.76
32X32X1.6	1.48	1.88	2.84	2.84	1.23	1.23	1.78	1.78	2.12	2.12	4.59	2.60
32X32X2.0	1.81	2.30	3.36	3.36	1.21	1.21	2.10	2.10	2.54	2.54	5.40	3.02
32X32X2.2	1.96	2.50	3.60	3.60	1.20	1.20	2.25	2.25	2.74	2.74	5.74	3.19
32X32X2.5	2.19	2.79	3.92	3.92	1.19	1.19	2.45	2.45	3.02	3.02	6.15	3.41
32X32X2.8	2.41	3.07	4.21	4.21	1.17	1.17	2.64	2.64	3.28	3.28	6.44	3.56
32X32X3.2	2.68	3.42	4.54	4.54	1.15	1.15	2.84	2.84	3.59	3.59	6.62	3.68
38X38X1.6	1.77	2.26	4.92	4.92	1.48	1.48	2.59	2.59	3.06	3.06	7.93	3.82
38X38X2.0	2.18	2.78	5.88	5.88	1.45	1.45	3.10	3.10	3.70	3.70	9.49	4.51
38X38X2.2	2.38	3.03	6.32	6.32	1.44	1.44	3.33	3.33	4.00	4.00	10.19	4.81
38X38X2.5	2.66	3.39	6.94	6.94	1.43	1.43	3.66	3.66	4.44	4.44	11.11	5.21
38X38X2.8	2.94	3.74	7.51	7.51	1.42	1.42	3.96	3.96	4.84	4.84	11.88	5.55
38X38X3.2	3.29	4.19	8.18	8.18	1.40	1.40	4.31	4.31	5.34	5.34	12.64	5.89
38X38X3.6	3.63	4.62	8.76	8.76	1.38	1.38	4.62	4.62	5.80	5.80	13.07	6.10
40X40X1.6	1.88	2.39	5.79	5.79	1.56	1.56	2.90	2.90	3.41	3.41	9.32	4.28
40X40X2.0	2.31	2.94	6.94	6.94	1.54	1.54	3.47	3.47	4.13	4.13	11.20	5.07
40X40X2.2	2.51	3.20	7.47	7.47	1.53	1.53	3.74	3.74	4.48	4.48	12.05	5.42

SQUARE SIZE RANGE

SQUARE SIZE RANGE

SQUARE HOLLOW SECTION (SHS) IS : 4923 : 2017/EN 10219-1 : 2006*/ASTM A-500

Dimension	Weight	Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants	
mm	kg/m	cm2	I_{xx}	I_{yy}	R_{xx}	R_{yy}	Z_{xx}	Z_{yy}	S_{xx}	S_{yy}	J	C
			cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3
40X40X2.5	2.82	3.59	8.22	8.22	1.51	1.51	4.11	4.11	4.97	4.97	13.19	5.90
40X40X2.8	3.11	3.96	8.90	8.90	1.50	1.50	4.45	4.45	5.43	5.43	14.17	6.30
40X40X3.2	3.49	4.45	9.72	9.72	1.48	1.48	4.86	4.86	6.01	6.01	15.19	6.73
40X40X3.6	3.85	4.91	10.45	10.45	1.46	1.46	5.23	5.23	6.53	6.53	15.86	7.02
40X40X4.0	4.20	5.35	11.07	11.07	1.44	1.44	5.54	5.54	7.01	7.01	16.15	7.19
40X40X4.5	4.61	5.87	11.73	11.73	1.41	1.41	5.87	5.87	7.55	7.55	15.97	7.20
40X40X5.0	4.99	6.36	12.26	12.26	1.39	1.39	6.13	6.13	8.02	8.02	15.15	6.99
40X40X5.4	5.28	6.72	12.59	12.59	1.37	1.37	6.30	6.30	8.35	8.35	14.06	6.66
40X40X6.0	5.68	7.23	12.94	12.94	1.34	1.34	6.47	6.47	8.76	8.76	11.76	5.89
40X40X8.0	6.74	8.59	13.03	13.03	1.23	1.23	6.52	6.52	9.50	9.50	2.17	1.81
45X45X1.6	2.13	2.71	8.41	8.41	1.76	1.76	3.74	3.74	4.38	4.38	13.47	5.54
45X45X2.0	2.62	3.34	10.12	10.12	1.74	1.74	4.50	4.50	5.32	5.32	16.31	6.61
45X45X2.2	2.86	3.64	10.92	10.92	1.73	1.73	4.86	4.86	5.78	5.78	17.63	7.10
45X45X2.5	3.21	4.09	12.06	12.06	1.72	1.72	5.36	5.36	6.43	6.43	19.45	7.77
45X45X2.8	3.55	4.52	13.12	13.12	1.70	1.70	5.84	5.84	7.05	7.05	21.07	8.37
45X45X3.2	4.00	5.09	14.41	14.41	1.68	1.68	6.41	6.41	7.83	7.83	22.91	9.05
45X45X3.6	4.42	5.63	15.57	15.57	1.66	1.66	6.92	6.92	8.55	8.55	24.33	9.58
45X45X4.0	4.83	6.15	16.61	16.61	1.64	1.64	7.39	7.39	9.22	9.22	25.31	9.96
50X50X1.6	2.38	3.03	11.71	11.71	1.97	1.97	4.69	4.69	5.46	5.46	18.68	6.95
50X50X2.0	2.94	3.74	14.15	14.15	1.95	1.95	5.66	5.66	6.66	6.66	22.75	8.35
50X50X2.2	3.20	4.08	15.30	15.30	1.94	1.94	6.12	6.12	7.24	7.24	24.66	9.00
50X50X2.5	3.60	4.59	16.94	16.94	1.92	1.92	6.78	6.78	8.07	8.07	27.35	9.90
50X50X2.8	3.99	5.08	18.49	18.49	1.91	1.91	7.40	7.40	8.87	8.87	29.81	10.72
50X50X3.2	4.50	5.73	20.40	20.40	1.89	1.89	8.16	8.16	9.89	9.89	32.72	11.68
50X50X3.6	4.98	6.35	22.15	22.15	1.87	1.87	8.86	8.86	10.84	10.84	35.16	12.49
50X50X4.0	5.46	6.95	23.74	23.74	1.85	1.85	9.50	9.50	11.73	11.73	37.09	13.14
50X50X4.5	6.02	7.67	25.50	25.50	1.82	1.82	10.20	10.20	12.76	12.76	38.72	13.72
50X50X5.0	6.56	8.36	27.04	27.04	1.80	1.80	10.82	10.82	13.70	13.70	39.43	14.04
50X50X5.4	6.97	8.88	28.11	28.11	1.78	1.78	11.25	11.25	14.39	14.39	39.32	14.10
50X50X6.0	7.56	9.63	29.45	29.45	1.75	1.75	11.78	11.78	15.32	15.32	37.97	13.86
50X50X8.0	9.26	11.79	31.94	31.94	1.65	1.65	12.78	12.78	17.55	17.55	24.10	10.19
60X60X2.0	3.56	4.54	25.14	25.14	2.35	2.35	8.38	8.38	9.79	9.79	40.19	12.44
60X60X2.2	3.89	4.96	27.27	27.27	2.34	2.34	9.09	9.09	10.66	10.66	43.74	13.46
60X60X2.5	4.39	5.59	30.34	30.34	2.33	2.33	10.12	10.12	11.93	11.93	48.84	14.91
60X60X2.8	4.87	6.20	33.27	33.27	2.32	2.32	11.09	11.09	13.16	13.16	53.66	16.26
60X60X3.2	5.50	7.01	36.94	36.94	2.30	2.30	12.32	12.32	14.73	14.73	59.61	17.92
60X60X3.6	6.12	7.79	40.37	40.37	2.28	2.28	13.46	13.46	16.22	16.22	64.96	19.39
60X60X4.0	6.71	8.55	43.55	43.55	2.26	2.26	14.52	14.52	17.64	17.64	69.66	20.68
60X60X4.5	7.43	9.47	47.20	47.20	2.23	2.23	15.74	15.74	19.32	19.32	74.54	22.04
60X60X5.0	8.13	10.36	50.49	50.49	2.21	2.21	16.83	16.83	20.88	20.88	78.24	23.09
60X60X5.4	8.67	11.04	52.88	52.88	2.19	2.19	17.63	17.63	22.05	22.05	80.29	23.71
60X60X6.0	9.44	12.03	56.07	56.07	2.16	2.16	18.69	18.69	23.68	23.68	81.77	24.26

SQUARE HOLLOW SECTION (SHS) IS : 4923 : 2017/EN 10219-1 : 2006*/ASTM A-500

Dimension	Weight	Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants	
mm	kg/m	cm2	I_{xx}	I_{yy}	R_{xx}	R_{yy}	Z_{xx}	Z_{yy}	S_{xx}	S_{yy}	J	C
			cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3
60X60X8.0	11.77	14.99	63.48	63.48	2.06	2.06	21.16	21.16	28.01	28.01	72.24	22.68
72X72X2.0	4.32	5.50	44.46	44.46	2.84	2.84	12.35	12.35	14.34	14.34	70.60	18.39
72X72X2.2	4.73	6.02	48.35	48.35	2.83	2.83	13.44	13.44	15.64	15.64	77.05	19.96
72X72X2.5	5.33	6.79	53.99	53.99	2.82	2.82	15.00	15.00	17.55	17.55	86.43	22.23
72X72X2.8	5.93	7.55	59.42	59.42	2.81	2.81	16.51	16.51	19.41	19.41	95.47	24.39
72X72X3.2	6.70	8.54	66.32	66.32	2.79	2.79	18.43	18.43	21.80	21.80	106.90	27.08
72X72X3.6	7.47	9.52	72.86	72.86	2.77	2.77	20.24	20.24	24.11	24.11	117.58	29.57
72X72X4.0	8.22	10.47	79.03	79.03	2.75	2.75	21.96	21.96	26.32	26.32	127.44	31.84
72X72X4.5	9.13	11.63	86.24	86.24	2.72	2.72	23.96	23.96	28.97	28.97	138.51	34.38
72X72X5.0	10.02	12.76	92.91	92.91	2.70	2.70	25.81	25.81	31.47	31.47	148.08	36.58
72X72X5.4	10.70	13.63	97.87	97.87	2.68	2.68	27.19	27.19	33.38	33.38	154.57	38.08
72X72X6.0	11.70	14.91	104.71	104.71	2.65	2.65	29.09	29.09	36.08	36.08	162.23	39.90
72X72X8.0	14.78	18.83	122.48	122.48	2.55	2.55	34.03	34.03	43.72	43.72	168.14	42.04
75X75X2.0	4.51	5.74	50.49	50.49	2.97	2.97	13.47	13.47	15.61	15.61	80.04	20.06
75X75X2.2	4.93	6.28	54.93	54.93	2.96	2.96	14.65	14.65	17.03	17.03	87.39	21.79
75X75X2.5	5.57	7.09	61.38	61.38	2.94	2.94	16.37	16.37	19.12	19.12	98.13	24.29
75X75X2.8	6.19	7.88	67.60	67.60	2.93	2.93	18.03	18.03	21.16	21.16	108.48	26.67
75X75X3.2	7.01	8.93	75.53	75.53	2.91	2.91	20.15	20.15	23.79	23.79	121.65	29.66
75X75X3.6	7.81	9.95	83.06	83.06	2.89	2.89	22.15	22.15	26.32	26.32	134.02	32.44
75X75X4.0	8.60	10.95	90.19	90.19	2.87	2.87	24.06	24.06	28.76	28.76	145.52	34.99
75X75X4.5	9.55	12.17	98.55	98.55	2.85	2.85	26.28	26.28	31.68	31.68	158.59	37.87
75X75X5.0	10.49	13.36	106.33	106.33	2.82	2.82	28.36	28.36	34.46	34.46	170.06	40.40
75X75X5.4	11.21	14.28	112.13	112.13	2.80	2.80	29.91	29.91	36.58	36.58	178.01	42.15
75X75X6.0	12.27	15.63	120.16	120.16	2.77	2.77	32.05	32.05	39.58	39.58	187.76	44.34
80X80X2.0	4.82	6.14	61.70	61.70	3.17	3.17	15.43	15.43	17.85	17.85	97.58	23.00
80X80X2.2	5.28	6.72	67.17	67.17	3.16	3.16	16.80	16.80	19.49	19.49	106.61	25.01
80X80X2.5	5.96	7.59	75.15	75.15	3.15	3.15	18.79	18.79	21.90	21.90	119.85	27.91
80X80X2.8	6.63	8.44	82.85	82.85	3.13	3.13	20.72	20.72	24.25	24.25	132.67	30.70
80X80X3.2	7.51	9.57	92.71	92.71	3.11	3.11	23.18	23.18	27.29	27.29	149.08	34.21
80X80X3.6	8.38	10.67	102.11	102.11	3.09	3.09	25.53	25.53	30.23	30.23	164.62	37.50
80X80X4.0	9.22	11.75	111.04	111.04	3.07	3.07	27.76	27.76	33.07	33.07	179.21	40.56
80X80X4.5	10.26	13.07	121.58	121.58	3.05	3.05	30.40	30.40	36.48	36.48	196.03	44.05
80X80X5.0	11.27	14.36	131.44	131.44	3.03	3.03	32.86	32.86	39.74	39.74	211.11	47.16
80X80X5.4	12.06	15.36	138.85	138.85	3.01	3.01	34.72	34.72	42.23	42.23	221.85	49.38
80X80X6.0	13.21	16.83	149.18	149.18	2.98	2.98	37.30	37.30	45.79	45.79	235.58	52.23
91.5X91.5X2.0	5.54	7.06	93.52	93.52	3.64	3.64	20.45	20.45	23.57	23.57	147.16	30.52
91.5X91.5X2.2	6.07	7.73	101.95	101.95	3.63	3.63	22.29	22.29	25.76	25.76	160.99	33.24
91.5X91.5X2.5	6.86	8.74	114.29	114.29	3.62	3.62	24.99	24.99	28.98	28.98	181.36	37.20
91.5X91.5X2.8	7.64	9.73	126.27	126.27	3.60	3.60	27.60	27.60	32.14	32.14	201.23	41.03
91.5X91.5X3.2	8.67	11.04	141.69	141.69	3.58	3.58	30.98	30.98	36.25	36.25	226.89	45.90
91.5X91.5X3.6	9.67	12.32	156.49	156.49	3.56	3.56	34.21	34.21	40.24	40.24	251.52	50.52
91.5X91.5X4.0	10.67	13.59	170.68	170.68	3.54	3.54	37.31	37.31	44.12	44.12	275.03	54.88

SQUARE SIZE RANGE

SQUARE SIZE RANGE

SQUARE HOLLOW SECTION (SHS) IS : 4923 : 2017/EN 10219-1 : 2006*/ASTM A-500

Dimension	Weight	Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants	
mm	kg/m	cm2	I_{xx}	I_{yy}	R_{xx}	R_{yy}	Z_{xx}	Z_{yy}	S_{xx}	S_{yy}	J	C
			cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3
91.5X91.5X4.5	11.88	15.14	187.57	187.57	3.52	3.52	41.00	41.00	48.79	48.79	302.71	59.96
91.5X91.5X5.0	13.08	16.66	203.55	203.55	3.50	3.50	44.50	44.50	53.29	53.29	328.34	64.62
91.5X91.5X5.4	14.01	17.85	215.68	215.68	3.48	3.48	47.15	47.15	56.77	56.77	347.27	68.04
91.5X91.5X6.0	15.38	19.59	232.81	232.81	3.45	3.45	50.89	50.89	61.76	61.76	372.82	72.65
100X100X2.2	6.66	8.48	134.20	134.20	3.98	3.98	26.84	26.84	30.95	30.95	211.23	40.07
100X100X2.5	7.53	9.59	150.63	150.63	3.96	3.96	30.13	30.13	34.86	34.86	238.22	44.92
100X100X2.8	8.38	10.68	166.62	166.62	3.95	3.95	33.33	33.33	38.69	38.69	264.65	49.61
100X100X3.2	9.52	12.13	187.28	187.28	3.93	3.93	37.46	37.46	43.69	43.69	298.95	55.63
100X100X3.6	10.64	13.55	207.19	207.19	3.91	3.91	41.44	41.44	48.56	48.56	332.08	61.37
100X100X4.0	11.74	14.95	226.35	226.35	3.89	3.89	45.27	45.27	53.30	53.30	363.96	66.82
100X100X4.5	13.09	16.67	249.29	249.29	3.87	3.87	49.86	49.86	59.04	59.04	401.89	73.25
100X100X5.0	14.41	18.36	271.10	271.10	3.84	3.84	54.22	54.22	64.59	64.59	437.53	79.22
100X100X5.4	15.45	19.68	287.77	287.77	3.82	3.82	57.56	57.56	68.89	68.89	464.27	83.66
100X100X6.0	16.98	21.63	311.47	311.47	3.79	3.79	62.30	62.30	75.10	75.10	501.21	89.77
100X100X8.0	21.82	27.79	379.77	379.77	3.70	3.70	75.96	75.96	93.83	93.83	593.41	105.11
110X110X2.5	8.31	10.59	202.38	202.38	4.37	4.37	36.80	36.80	42.47	42.47	318.92	54.92
110X110X2.8	9.26	11.80	224.13	224.13	4.36	4.36	40.76	40.76	47.18	47.18	354.70	60.75
110X110X3.2	10.53	13.41	252.31	252.31	4.34	4.34	45.88	45.88	53.33	53.33	401.33	68.25
110X110X3.6	11.77	14.99	279.58	279.58	4.32	4.32	50.84	50.84	59.34	59.34	446.64	75.46
110X110X4.0	12.99	16.55	305.94	305.94	4.30	4.30	55.63	55.63	65.21	65.21	490.52	82.35
110X110X4.5	14.50	18.47	337.63	337.63	4.28	4.28	61.39	61.39	72.35	72.35	543.21	90.54
110X110X5.0	15.98	20.36	367.95	367.95	4.25	4.25	66.90	66.90	79.27	79.27	593.30	98.24
110X110X5.4	17.14	21.84	391.23	391.23	4.23	4.23	71.14	71.14	84.65	84.65	631.37	104.04
110X110X6.0	18.86	24.03	424.57	424.57	4.20	4.20	77.20	77.20	92.46	92.46	684.89	112.13
110X110X8.0	24.33	30.99	522.39	522.39	4.11	4.11	94.98	94.98	116.29	116.29	828.32	133.69
120X120X2.8	10.14	12.92	293.54	293.54	4.77	4.77	48.93	48.93	56.50	56.50	463.02	73.00
120X120X3.2	11.53	14.69	330.88	330.88	4.75	4.75	55.15	55.15	63.93	63.93	524.57	82.16
120X120X3.6	12.90	16.43	367.12	367.12	4.73	4.73	61.19	61.19	71.21	71.21	584.63	90.98
120X120X4.0	14.25	18.15	402.28	402.28	4.71	4.71	67.05	67.05	78.33	78.33	643.08	99.48
120X120X4.5	15.91	20.27	444.70	444.70	4.68	4.68	74.12	74.12	87.01	87.01	713.71	109.63
120X120X5.0	17.55	22.36	485.47	485.47	4.66	4.66	80.92	80.92	95.45	95.45	781.43	119.26
120X120X5.4	18.84	24.00	516.92	516.92	4.64	4.64	86.16	86.16	102.03	102.03	833.37	126.57
120X120X6.0	20.75	26.43	562.16	562.16	4.61	4.61	93.70	93.70	111.61	111.61	907.27	136.89
120X120X8.0	26.84	34.19	696.82	696.82	4.51	4.51	116.14	116.14	141.14	141.14	1114.50	165.47
125X125X2.8	10.58	13.48	333.05	333.05	4.97	4.97	53.29	53.29	61.48	61.48	524.57	79.55
125X125X3.2	12.03	15.33	375.64	375.64	4.95	4.95	60.11	60.11	69.59	69.59	594.61	89.59
125X125X3.6	13.46	17.15	417.03	417.03	4.93	4.93	66.73	66.73	77.54	77.54	663.08	99.29
125X125X4.0	14.88	18.95	457.23	457.23	4.91	4.91	73.16	73.16	85.33	85.33	729.85	108.65
125X125X4.5	16.62	21.17	505.83	505.83	4.89	4.89	80.94	80.94	94.84	94.84	810.75	119.85
125X125X5.0	18.34	23.36	552.62	552.62	4.86	4.86	88.42	88.42	104.10	104.10	888.58	130.52
125X125X5.4	19.69	25.08	588.77	588.77	4.85	4.85	94.21	94.21	111.33	111.33	948.47	138.65
125X125X6.0	21.69	27.63	640.89	640.89	4.82	4.82	102.55	102.55	121.87	121.87	1034.09	150.16

SQUARE SIZE RANGE

SQUARE HOLLOW SECTION (SHS) IS : 4923 : 2017/EN 10219-1 : 2006*/ASTM A-500

Dimension	Weight	Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants	
mm	kg/m	cm2	I_{xx}	I_{yy}	R_{xx}	R_{yy}	Z_{xx}	Z_{yy}	S_{xx}	S_{yy}	J	C
			cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3
125X125X8.0	28.10	35.79	796.96	796.96	4.72	4.72	127.52	127.52	154.47	154.47	1278.30	182.55
140X140X3.2	13.54	17.25	533.76	533.76	5.56	5.56	76.26	76.26	88.01	88.01	841.30	113.80
140X140X3.6	15.16	19.31	593.44	593.44	5.54	5.54	84.78	84.78	98.18	98.18	939.53	126.36
140X140X4.0	16.76	21.35	651.62	651.62	5.52	5.52	93.09	93.09	108.15	108.15	1035.76	138.54
140X140X4.5	18.74	23.87	722.24	722.24	5.50	5.50	103.18	103.18	120.37	120.37	1153.06	153.21
140X140X5.0	20.69	26.36	790.56	790.56	5.48	5.48	112.94	112.94	132.30	132.30	1266.79	167.29
140X140X5.4	22.23	28.32	843.58	843.58	5.46	5.46	120.52	120.52	141.65	141.65	1355.03	178.10
140X140X6.0	24.52	31.23	920.43	920.43	5.43	5.43	131.49	131.49	155.33	155.33	1482.50	193.59
140X140X8.0	31.86	40.59	1153.92	1153.92	5.33	5.33	164.85	164.85	198.05	198.05	1859.75	238.59
150X150X3.6	16.29	20.75	735.09	735.09	5.95	5.95	98.02	98.02	113.28	113.28	1160.76	146.21
150X150X4.0	18.02	22.95	807.82	807.82	5.93	5.93	107.71	107.71	124.87	124.87	1280.69	160.46
150X150X4.5	20.15	25.67	896.30	896.30	5.91	5.91	119.51	119.51	139.08	139.08	1427.31	177.70
150X150X5.0	22.26	28.36	982.12	982.12	5.88	5.88	130.95	130.95	152.98	152.98	1570.02	194.30
150X150X5.4	23.93	30.48	1048.88	1048.88	5.87	5.87	139.86	139.86	163.89	163.89	1681.17	207.11
150X150X6.0	26.40	33.63	1145.91	1145.91	5.84	5.84	152.79	152.79	179.88	179.88	1842.55	225.53
150X150X8.0	34.38	43.79	1443.00	1443.00	5.74	5.74	192.40	192.40	230.11	230.11	2328.39	279.93
150X150X10.0	41.93	53.42	1701.21	1701.21	5.64	5.64	226.83	226.83	275.67	275.67	2720.95	323.18
175X175X4.0	21.16	26.95	1303.12	1303.12	6.95	6.95	148.93	148.93	171.90	171.90	2053.97	222.27
175X175X4.5	23.68	30.17	1448.83	1448.83	6.93	6.93	165.59	165.59	191.75	191.75	2293.76	246.80
175X175X5.0	26.19	33.36	1590.86	1590.86	6.91	6.91	181.82	181.82	211.24	211.24	2528.72	270.58
175X175X5.4	28.17	35.88	1701.86	1701.86	6.89	6.89	194.50	194.50	226.57	226.57	2712.97	289.06
175X175X6.0	31.11	39.63	1864.03	1864.03	6.86	6.86	213.04	213.04	249.15	249.15	2982.78	315.88
175X175X8.0	40.66	51.79	2367.89	2367.89	6.76	6.76	270.62	270.62	320.75	320.75	3818.44	397.28
175X175X10.0	49.78	63.42	2817.20	2817.20	6.66	6.66	321.97	321.97	386.83	386.83	4540.40	465.99
180X180X4.0	21.78	27.75	1421.74	1421.74	7.16	7.16	157.98	157.98	182.21	182.21	2238.61	235.83
180X180X4.5	24.39	31.07	1581.26	1581.26	7.13	7.13	175.70	175.70	203.30	203.30	2500.75	261.96
180X180X5.0	26.97	34.36	1736.87	1736.87	7.11	7.11	192.99	192.99	224.02	224.02	2757.85	287.33
180X180X6.0	32.05	40.83	2036.52	2036.52	7.06	7.06	226.28	226.28	264.35	264.35	3255.59	335.75
180X180X8.0	41.91	53.39	2590.73	2590.73	6.97	6.97	287.86	287.86	340.68	340.68	4175.84	423.14
180X180X10.0	51.35	65.42	3086.93	3086.93	6.87	6.87	343.00	343.00	411.31	411.31	4978.18	497.54
200X200X4.5	27.22	34.67	2191.54	2191.54	7.95	7.95	219.16	219.16	252.86	252.86	3452.29	327.13
200X200X5.0	30.11	38.36	2410.09	2410.09	7.93	7.93	241.01	241.01	278.87	278.87	3811.54	359.35
200X200X5.4	32.40	41.28	2581.45	2581.45	7.91	7.91	258.15	258.15	299.39	299.39	4094.48	384.51
200X200X6.0	35.82	45.63	2832.75	2832.75	7.88	7.88	283.28	283.28	329.67	329.67	4511.01	421.22
200X200X8.0	46.94	59.79	3621.63	3621.63	7.78	7.78	362.17	362.17	426.39	426.39	5823.37	534.59
200X200X10.0	57.63	73.42	4337.63	4337.63	7.69	7.69	433.77	433.77	516.73	516.73	7000.54	633.74
200X200X12.0	67.93	86.53	4983.59	4983.59	7.59	7.59	498.36	498.36	600.81	600.81	8019.34	718.18
220X220X5.0	33.25	42.36	3238.02	3238.02	8.74	8.74	294.37	294.37	339.73	339.73	5102.67	439.36
220X220X5.4	35.80	45.60	3470.96	3470.96	8.72	8.72	315.55	315.55	364.93	364.93	5485.51	470.58
220X220X6.0	39.59	50.43	3813.36	3813.36	8.70	8.70	346.67	346.67	402.18	402.18	6050.76	516.29
220X220X8.0	51.96	66.19	4894.99	4894.99	8.60	8.60	445.00	445.00	521.70	521.70	7848.38	658.83
220X220X10.0	63.91	81.42	5887.19	5887.19	8.50	8.50	535.20	535.20	634.16	634.16	9492.81	785.91

SQUARE SIZE RANGE

SQUARE SIZE RANGE

SQUARE HOLLOW SECTION (SHS) IS : 4923 : 2017/EN 10219-1 : 2006*/ASTM A-500

Dimension	Weight	Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants	
mm	kg/m	cm2	I_{xx}	I_{yy}	R_{xx}	R_{yy}	Z_{xx}	Z_{yy}	S_{xx}	S_{yy}	J	C
			cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3
220X220X12.0	75.46	96.13	6793.08	6793.08	8.41	8.41	617.56	617.56	739.66	739.66	10958.24	897.07
225X225X5.0	34.04	43.36	3471.05	3471.05	8.95	8.95	308.54	308.54	355.88	355.88	5465.36	460.61
225X225X5.4	36.64	46.68	3721.40	3721.40	8.93	8.93	330.80	330.80	382.32	382.32	5876.33	493.45
225X225X6.0	40.53	51.63	4089.57	4089.57	8.90	8.90	363.52	363.52	421.43	421.43	6483.49	541.55
225X225X8.0	53.22	67.79	5254.21	5254.21	8.80	8.80	467.05	467.05	547.03	547.03	8418.11	691.89
225X225X10.0	65.48	83.42	6325.02	6325.02	8.71	8.71	562.23	562.23	665.39	665.39	10194.92	826.45
225X225X12.0	77.35	98.53	7305.19	7305.19	8.61	8.61	649.36	649.36	776.62	776.62	11787.46	944.78
250X250X6.0	45.24	57.63	5672.00	5672.00	9.92	9.92	453.76	453.76	524.45	524.45	8956.46	676.88
250X250X8.0	59.50	75.79	7315.65	7315.65	9.82	9.82	585.26	585.26	682.67	682.67	11677.65	869.16
250X250X10.0	73.33	93.42	8841.86	8841.86	9.73	9.73	707.35	707.35	832.79	832.79	14217.20	1044.13
250X250X12.0	86.77	110.53	10254.21	10254.21	9.63	9.63	820.34	820.34	974.94	974.94	16545.51	1201.32
275X275X6.0	49.95	63.63	7617.53	7617.53	10.94	10.94	554.01	554.01	638.71	638.71	11986.16	827.20
275X275X8.0	65.78	83.79	9855.94	9855.94	10.85	10.85	716.80	716.80	833.31	833.31	15676.96	1066.43
275X275X10.0	81.18	103.42	11950.66	11950.66	10.75	10.75	869.14	869.14	1018.95	1018.95	19161.08	1286.77
275X275X12.0	96.19	122.53	13905.64	13905.64	10.65	10.65	1011.32	1011.32	1195.75	1195.75	22405.82	1487.80
300X300X8.0	72.06	91.79	12925.07	12925.07	11.87	11.87	861.68	861.68	998.95	998.95	20491.03	1283.68
300X300X10.0	89.03	113.42	15713.90	15713.90	11.77	11.77	1047.60	1047.60	1223.86	1223.86	25120.26	1554.40
300X300X12.0	105.61	134.53	18334.49	18334.49	11.67	11.67	1222.30	1222.30	1439.07	1439.07	29480.79	1804.25

ALLOWABLE STRESS VALUES (IN MPA) AND DIMENSIONAL TOLERANCE IS 4923:2017, TABLE 4, (Clauses 19.2)

S. No.	Grade	Tensile Strength	Yield Strength	Elongation
		Min	*Min*	*Min*
		MPa	MPa	Percent
1	YSt 210	330	210	20
2	YSt 240	410	240	15
3	YSt 310	450	310	10
4	YSt 355	490	355	10

*Galvanised sections can also be manufactured

DIMENSIONAL TOLERANCE					
Outside Dimensional	Thickness	Squareness	Corner radius	Weight	
				Individual Lengths	On lot of 10 MT
+/-1% with a minimum of +/-0.50 min	±7.5%	90 deg. +/-2 deg.	3t max	10% -8%	±7%

*Customised sections can also be manufactured.

TENSILE PROPERTIES OF STEEL TUBES FOR STRUCTURAL PURPOSE
IS 1161:2014, TABLE 2, (Clauses 3.1 and 11.2)

S. No.	Grade	Tensile Strength	Yield Strength	Elongation on Gauge Length
		Min	*Min*	5.65 $\sqrt{S_o}$ *Min*
		MPa	MPa	Percent
1	YSt 210	330	210	20
2	YSt 240	410	240	17
3	YSt 310	450	310	14
4	YSt 355	490	355	10

TENSILE PROPERTIES OF STEEL TUBES SECTIONS
IS 4923:2017, TABLE 4, (Clauses 19.2)

S. No.	Grade	Tensile Strength	Yield Strength	Elongation
		Min	*Min*	*Min*
		MPa	MPa	Percent
1	YSt 210	330	210	20
2	YSt 240	410	240	15
3	YSt 310	450	310	10
4	YSt 355	490	355	10

SQUARE HOLLOW SECTION (SHS) IS : 4923 : 2017/EN 10219-1 : 2006*/ASTM A-500

Dimension	Weight	Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants	
mm	kg/m	cm2	I_{xx}	I_{yy}	R_{xx}	R_{yy}	Z_{xx}	Z_{yy}	S_{xx}	S_{yy}	J	C
			cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3
200X200X14.0	77.80	99.11	5562.26	5562.26	7.49	7.49	556.23	556.23	678.74	678.74	8857.57	787.40
220X220X14.0	86.59	110.31	7615.74	7615.74	8.31	8.31	692.34	692.34	838.33	838.33	12219.62	991.79
225X225X14.0	88.79	113.11	8197.88	8197.88	8.51	8.51	728.71	728.71	880.86	880.86	13170.00	1046.37
250X250X14.0	99.78	127.11	11556.23	11556.23	9.53	9.53	924.50	924.50	1109.22	1109.22	18633.47	1340.24
275X275X14.0	110.77	141.11	15724.81	15724.81	10.56	10.56	1143.63	1143.63	1363.84	1363.84	25378.84	1669.04
300X300X14.0	121.76	155.11	20791.11	20791.11	11.58	11.58	1386.08	1386.08	1644.70	1644.70	33537.11	2032.77
300X300X16.0	137.51	175.17	23088.02	23088.02	11.48	11.48	1539.21	1539.21	1840.89	1840.89	37254.21	2239.48
325X325X14.0	132.75	169.11	26842.64	26842.64	12.60	12.60	1651.86	1651.86	1951.82	1951.82	43239.38	2431.45
325X325X16.0	150.07	191.17	29879.43	29879.43	12.50	12.50	1838.74	1838.74	2188.44	2188.44	48219.82	2688.89
350X350X8.0	84.62	107.79	20849.89	20849.89	13.91	13.91	1191.43	1191.43	1375.23	1375.23	32863.45	1778.17
350X350X10.0	104.73	133.42	25453.75	25453.75	13.81	13.81	1454.50	1454.50	1689.92	1689.92	40459.45	2164.61
350X350X12.0	124.45	158.53	29824.41	29824.41	13.72	13.72	1704.26	1704.26	1993.20	1993.20	47724.46	2527.06
350X350X14.0	143.74	183.11	33966.90	33966.90	13.62	13.62	1940.97	1940.97	2285.19	2285.19	54616.80	2865.08
350X350X16.0	162.63	207.17	37886.23	37886.23	13.52	13.52	2164.93	2164.93	2566.00	2566.00	61095.07	3178.23
400X400X10.0	120.43	153.42	38561.41	38561.41	15.85	15.85	1928.08	1928.08	2230.98	2230.98	60984.67	2874.77
400X400X12.0	143.29	182.53	45323.97	45323.97	15.76	15.76	2266.20	2266.20	2637.33	2637.33	72176.20	3369.78
400X400X14.0	165.72	211.11	51783.59	51783.59	15.66	15.66	2589.18	2589.18	3030.67	3030.67	82921.80	3837.25
400X400X16.0	187.75	239.17	57946.03	57946.03	15.57	15.57	2897.31	2897.31	3411.12	3411.12	93173.85	4276.74
450X450X10.0	136.13	173.42	55536.88	55536.88	17.90	17.90	2468.31	2468.31	2847.04	2847.04	87445.83	3684.90
450X450X12.0	162.13	206.53	65433.18	65433.18	17.80	17.80	2908.15	2908.15	3371.45	3371.45	103735.86	4332.43
450X450X14.0	187.70	239.11	74941.19	74941.19	17.70	17.70	3330.72	3330.72	3881.15	3881.15	119501.71	4949.30
450X450X16.0	212.87	271.17	84067.43	84067.43	17.61	17.61	3736.34	3736.34	4376.24	4376.24	134689.76	5535.09
500X500X12.0	180.97	230.53	90752.04	90752.04	19.84	19.84	3630.09	3630.09	4195.58	4195.58	143303.32	5415.05
500X500X14.0	209.68	267.11	104139.70	104139.70	19.75	19.75	4165.59	4165.59	4836.63	4836.63	165406.33	6201.28
500X500X16.0	237.99	303.17	117050.41	117050.41	19.65	19.65	4682.02	4682.02	5461.36	5461.36	186842.34	6953.31

UPCOMING SIZES

RECTANGULAR HOLLOW SECTION

Rectangular Size Range

26mm X 13mm to 400mm X 200mm

Thickness

1mm to 12mm

Upcoming Range

Upto 600 X 400mm

Thickness

16mm

RECTANGULAR HOLLOW SECTION (RHS) IS : 4923 : 2017/EN 10219-1 : 2006*/ASTM A-500

Dimension	Weight	Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants	
mm	kg/m	cm2	I_{xx}	I_{yy}	R_{xx}	R_{yy}	Z_{xx}	Z_{yy}	S_{xx}	S_{yy}	J	C
			cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3
26 X 13 X 1.6	0.85	1.08	0.83	0.27	0.88	0.50	0.64	0.42	0.84	0.51	0.63	0.66
26 X 13 X 2.0	1.02	1.30	0.94	0.30	0.85	0.48	0.73	0.47	0.98	0.59	0.64	0.67
30 X 20 X 1.6	1.12	1.43	1.66	0.88	1.08	0.78	1.11	0.88	1.39	1.05	1.85	1.38
30 X 20 X 2.0	1.37	1.74	1.94	1.02	1.06	0.77	1.30	1.02	1.65	1.24	2.08	1.55
30 X 20 X 2.2	1.48	1.88	2.05	1.08	1.04	0.76	1.37	1.08	1.76	1.32	2.15	1.60
40 X 10 X 1.6	1.12	1.43	2.25	0.22	1.25	0.39	1.13	0.44	1.57	0.54	0.65	0.76
40 X 10 X 2.0	1.37	1.74	2.60	0.25	1.22	0.38	1.30	0.50	1.85	0.63	0.65	0.78
40 X 20 X 1.6	1.37	1.75	3.43	1.15	1.40	0.81	1.72	1.15	2.18	1.34	2.83	1.92
40 X 20 X 2.0	1.68	2.14	4.05	1.34	1.38	0.79	2.03	1.34	2.61	1.60	3.25	2.19
40 X 20 X 2.2	1.82	2.32	4.32	1.43	1.36	0.79	2.16	1.43	2.81	1.71	3.40	2.29
40 X 20 X 2.5	2.03	2.59	4.69	1.54	1.35	0.77	2.35	1.54	3.09	1.88	3.55	2.40
40 X 25 X 1.6	1.50	1.91	4.02	1.93	1.45	1.01	2.01	1.55	2.49	1.80	4.25	2.51
40 X 25 X 2.0	1.84	2.34	4.77	2.28	1.43	0.99	2.39	1.83	2.99	2.16	4.99	2.91
40 X 25 X 2.2	1.99	2.54	5.11	2.43	1.42	0.98	2.56	1.95	3.23	2.32	5.28	3.07
40 X 25 X 2.5	2.23	2.84	5.57	2.64	1.40	0.96	2.79	2.12	3.56	2.56	5.64	3.27
50 X 25 X 1.6	1.75	2.23	7.02	2.37	1.77	1.03	2.81	1.90	3.53	2.17	5.83	3.21
50 X 25 X 2.0	2.15	2.74	8.38	2.81	1.75	1.01	3.36	2.25	4.26	2.62	6.90	3.76
50 X 25 X 2.2	2.34	2.98	9.01	3.01	1.74	1.01	3.61	2.41	4.61	2.82	7.35	3.99
50 X 25 X 2.5	2.62	3.34	9.89	3.28	1.72	0.99	3.96	2.63	5.11	3.12	7.93	4.29
50 X 30 X 1.6	1.88	2.39	7.96	3.60	1.82	1.23	3.19	2.40	3.91	2.75	8.07	3.96
50 X 30 X 2.0	2.31	2.94	9.54	4.29	1.80	1.21	3.82	2.86	4.74	3.33	9.65	4.67
50 X 30 X 2.2	2.51	3.20	10.27	4.61	1.79	1.20	4.11	3.08	5.14	3.60	10.35	4.99
50 X 30 X 2.5	2.82	3.59	11.30	5.05	1.77	1.19	4.52	3.37	5.70	3.98	11.28	5.40
50 X 30 X 2.8	3.11	3.96	12.24	5.45	1.76	1.17	4.90	3.64	6.23	4.35	12.05	5.75
50 X 30 X 3.2	3.49	4.45	13.38	5.93	1.73	1.15	5.36	3.96	6.89	4.80	12.81	6.11
50 X 30 X 3.6	3.85	4.91	14.38	6.34	1.71	1.14	5.76	4.23	7.50	5.21	13.25	6.33
50 X 30 X 4.0	4.20	5.35	15.25	6.69	1.69	1.12	6.10	4.46	8.05	5.58	13.33	6.42
50 X 30 X 4.5	4.61	5.87	16.16	7.05	1.66	1.10	6.47	4.70	8.67	5.99	12.94	6.35
50 X 30 X 5.0	4.99	6.36	16.87	7.33	1.63	1.07	6.75	4.89	9.20	6.34	12.00	6.06
50 X 30 X 6.0	5.68	7.23	17.77	7.65	1.57	1.03	7.11	5.10	10.04	6.89	8.67	4.86
50 X 30 X 8.0	6.74	8.59	17.66	7.57	1.43	0.94	7.07	5.05	10.83	7.36	1.34	1.45
60 X 40 X 1.6	2.38	3.03	15.22	8.16	2.24	1.64	5.08	4.08	6.12	4.64	17.10	6.63
60 X 40 X 2.0	2.94	3.74	18.41	9.83	2.22	1.62	6.14	4.92	7.47	5.65	20.77	7.96
60 X 40 X 2.2	3.20	4.08	19.92	10.62	2.21	1.61	6.64	5.31	8.12	6.14	22.49	8.56
60 X 40 X 2.5	3.60	4.59	22.07	11.74	2.19	1.60	7.36	5.87	9.06	6.84	24.89	9.41
60 X 40 X 2.8	3.99	5.08	24.10	12.78	2.18	1.59	8.04	6.39	9.95	7.51	27.08	10.17
60 X 40 X 3.2	4.50	5.73	26.61	14.07	2.15	1.57	8.87	7.04	11.09	8.36	29.63	11.05
60 X 40 X 3.6	4.98	6.35	28.90	15.23	2.13	1.55	9.64	7.62	12.16	9.15	31.72	11.79
60 X 40 X 4.0	5.46	6.95	30.99	16.28	2.11	1.53	10.33	8.14	13.16	9.89	33.31	12.36
60 X 40 X 4.5	6.02	7.67	33.31	17.44	2.08	1.51	11.11	8.72	14.32	10.75	34.57	12.85
60 X 40 X 5.0	6.56	8.36	35.33	18.43	2.06	1.48	11.78	9.22	15.38	11.52	34.95	13.08
60 X 40 X 6.0	7.56	9.63	38.50	19.95	2.00	1.44	12.84	9.98	17.20	12.84	33.01	12.74

RECTANGULAR SIZE RANGE

RECTANGULAR SIZE RANGE

RECTANGULAR HOLLOW SECTION (RHS) IS : 4923 : 2017/EN 10219-1 : 2006*/ASTM A-500

Dimension	Weight	Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants	
mm	kg/m	cm2	I_{xx}	I_{yy}	R_{xx}	R_{yy}	Z_{xx}	Z_{yy}	S_{xx}	S_{yy}	J	C
			cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3
60 X 40 X 8.0	9.26	11.79	41.68	21.39	1.88	1.35	13.90	10.70	19.69	14.62	19.37	8.85
66 X 33 X 1.6	2.36	3.00	16.85	5.74	2.37	1.38	5.11	3.48	6.34	3.92	14.01	5.94
66 X 33 X 2.0	2.90	3.70	20.37	6.90	2.35	1.37	6.18	4.19	7.73	4.77	16.94	7.09
66 X 33 X 2.2	3.17	4.04	22.03	7.43	2.34	1.36	6.68	4.51	8.40	5.17	18.28	7.61
66 X 33 X 2.5	3.56	4.54	24.40	8.19	2.32	1.34	7.40	4.97	9.37	5.75	20.14	8.33
66 X 33 X 2.8	3.95	5.03	26.62	8.90	2.30	1.33	8.07	5.40	10.29	6.31	21.80	8.97
66 X 33 X 3.2	4.44	5.66	29.37	9.75	2.28	1.31	8.90	5.91	11.46	7.01	23.67	9.70
70 X 30 X 3.0	4.25	5.41	30.57	7.90	2.38	1.21	8.74	5.27	11.38	6.20	20.51	8.87
70 X 30 X 3.2	4.50	5.73	32.04	8.24	2.36	1.20	9.16	5.50	11.98	6.51	21.26	9.18
70 X 30 X 3.6	4.98	6.35	34.76	8.87	2.34	1.18	9.94	5.92	13.12	7.11	22.45	9.69
70 X 30 X 4.0	5.46	6.95	37.23	9.42	2.31	1.16	10.64	6.28	14.20	7.66	23.22	10.04
70 X 30 X 4.5	6.02	7.67	39.95	10.01	2.28	1.14	11.42	6.68	15.43	8.29	23.55	10.27
70 X 30 X 5.0	6.56	8.36	42.30	10.49	2.25	1.12	12.09	7.00	16.56	8.84	23.16	10.25
70 X 30 X 6.0	7.56	9.63	45.88	11.18	2.18	1.08	13.11	7.46	18.47	9.77	20.29	9.46
70 X 30 X 8.0	9.26	11.79	48.98	11.61	2.04	0.99	14.00	7.74	21.02	10.88	8.59	5.18
70 X 50 X 3.0	5.19	6.61	44.05	26.10	2.58	1.99	12.59	10.44	15.40	12.21	53.15	16.52
70 X 50 X 3.2	5.50	7.01	46.33	27.42	2.57	1.98	13.24	10.97	16.25	12.88	55.82	17.28
70 X 50 X 3.6	6.12	7.79	50.65	29.92	2.55	1.96	14.48	11.97	17.91	14.18	60.72	18.68
70 X 50 X 4.0	6.71	8.55	54.67	32.22	2.53	1.94	15.62	12.89	19.48	15.41	64.99	19.90
70 X 50 X 5.0	8.13	10.36	63.46	37.20	2.47	1.89	18.14	14.88	23.06	18.20	72.57	22.12
70 X 50 X 6.0	9.44	12.03	70.52	41.14	2.42	1.85	20.15	16.46	26.15	20.60	75.26	23.11
70 X 50 X 8.0	11.77	14.99	79.91	46.23	2.31	1.76	22.84	18.50	30.94	24.27	64.82	21.23
75 X 25 X 1.6	2.38	3.03	19.74	3.47	2.55	1.07	5.27	2.78	6.81	3.11	9.94	4.97
75 X 25 X 2.0	2.94	3.74	23.84	4.14	2.52	1.05	6.36	3.32	8.31	3.77	11.88	5.88
75 X 25 X 2.2	3.20	4.08	25.77	4.44	2.51	1.04	6.88	3.56	9.02	4.08	12.75	6.28
75 X 25 X 2.6	3.74	4.76	29.40	5.00	2.49	1.02	7.84	4.00	10.40	4.67	14.26	6.99
75 X 50 X 1.6	3.01	3.83	30.51	16.39	2.82	2.07	8.14	6.56	9.75	7.40	34.07	10.70
75 X 50 X 2.0	3.72	4.74	37.16	19.91	2.80	2.05	9.91	7.97	11.96	9.06	41.75	12.96
75 X 50 X 2.2	4.07	5.18	40.35	21.59	2.79	2.04	10.76	8.64	13.03	9.87	45.43	14.02
75 X 50 X 2.5	4.58	5.84	44.95	24.00	2.77	2.03	11.99	9.60	14.59	11.04	50.72	15.54
75 X 50 X 2.8	5.09	6.48	49.35	26.30	2.76	2.01	13.16	10.52	16.10	12.18	55.71	16.96
75 X 50 X 3.2	5.75	7.33	54.90	29.18	2.74	2.00	14.64	11.68	18.04	13.63	61.88	18.69
75 X 50 X 3.6	6.40	8.15	60.10	31.86	2.72	1.98	16.03	12.75	19.90	15.01	67.44	20.23
75 X 50 X 4.0	7.03	8.95	64.96	34.34	2.69	1.96	17.33	13.74	21.66	16.33	72.33	21.59
80 X 40 X 1.6	2.88	3.67	30.71	10.52	2.89	1.69	7.68	5.26	9.47	5.87	25.48	8.99
80 X 40 X 2.0	3.56	4.54	37.36	12.72	2.87	1.67	9.34	6.36	11.61	7.17	31.08	10.84
80 X 40 X 2.2	3.89	4.96	40.53	13.76	2.86	1.67	10.14	6.88	12.64	7.80	33.72	11.71
80 X 40 X 2.5	4.39	5.59	45.11	15.26	2.84	1.65	11.28	7.63	14.15	8.72	37.49	12.92
80 X 40 X 2.8	4.87	6.20	49.46	16.66	2.82	1.64	12.37	8.33	15.60	9.60	40.99	14.05
80 X 40 X 3.2	5.50	7.01	54.94	18.41	2.80	1.62	13.74	9.21	17.46	10.72	45.21	15.39
80 X 40 X 3.6	6.12	7.79	60.05	20.02	2.78	1.60	15.02	10.01	19.23	11.77	48.88	16.56
80 X 40 X 4.0	6.71	8.55	64.79	21.49	2.75	1.59	16.20	10.75	20.91	12.77	51.97	17.55

RECTANGULAR SIZE RANGE

RECTANGULAR HOLLOW SECTION (RHS) IS : 4923 : 2017/EN 10219-1 : 2006*/ASTM A-500

Dimension	Weight	Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants	
mm	kg/m	cm2	I_{xx}	I_{yy}	R_{xx}	R_{yy}	Z_{xx}	Z_{yy}	S_{xx}	S_{yy}	J	C
			cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3
96 X 48 X 1.6	3.49	4.44	54.03	18.57	3.49	2.05	11.26	7.74	13.82	8.58	44.69	13.26
96 X 48 X 2.0	4.32	5.50	66.04	22.59	3.47	2.03	13.76	9.42	17.00	10.52	54.83	16.09
96 X 48 X 2.2	4.73	6.02	71.82	24.51	3.45	2.02	14.97	10.22	18.54	11.47	59.70	17.44
96 X 48 X 2.5	5.33	6.79	80.23	27.29	3.44	2.00	16.72	11.38	20.81	12.85	66.75	19.37
96 X 48 X 2.8	5.93	7.55	88.32	29.94	3.42	1.99	18.40	12.48	23.01	14.19	73.46	21.19
96 X 48 X 3.2	6.70	8.54	98.61	33.28	3.40	1.97	20.55	13.87	25.85	15.91	81.83	23.43
96 X 48 X 3.6	7.47	9.52	108.35	36.40	3.37	1.96	22.58	15.17	28.58	17.56	89.50	25.47
96 X 48 X 4.0	8.22	10.47	117.54	39.32	3.35	1.94	24.49	16.39	31.21	19.14	96.41	27.30
96 X 48 X 4.5	9.13	11.63	128.30	42.68	3.32	1.92	26.73	17.79	34.34	21.01	103.91	29.30
100 X 50 X 1.6	3.63	4.63	61.29	21.08	3.64	2.13	12.26	8.44	15.04	9.33	50.65	14.45
100 X 50 X 2.0	4.51	5.74	74.98	25.67	3.61	2.11	15.00	10.27	18.50	11.46	62.21	17.57
100 X 50 X 2.2	4.93	6.28	81.59	27.87	3.60	2.11	16.32	11.15	20.19	12.50	67.79	19.05
100 X 50 X 2.5	5.57	7.09	91.20	31.06	3.59	2.09	18.24	12.43	22.67	14.01	75.87	21.18
100 X 50 X 2.8	6.19	7.88	100.47	34.10	3.57	2.08	20.10	13.64	25.09	15.48	83.59	23.19
100 X 50 X 3.2	7.01	8.93	112.29	37.95	3.55	2.06	22.46	15.18	28.20	17.37	93.28	25.70
100 X 50 X 3.6	7.81	9.95	123.51	41.56	3.52	2.04	24.71	16.63	31.21	19.19	102.23	27.99
100 X 50 X 4.0	8.60	10.95	134.14	44.95	3.50	2.03	26.83	17.98	34.10	20.93	110.37	30.06
100 X 50 X 4.5	9.55	12.17	146.61	48.87	3.47	2.00	29.33	19.55	37.56	23.00	119.34	32.35
100 X 50 X 5.0	10.49	13.36	158.19	52.45	3.44	1.98	31.64	20.98	40.84	24.95	126.87	34.28
100 X 50 X 6.0	12.27	15.63	178.75	58.67	3.38	1.94	35.75	23.47	46.90	28.52	137.24	37.07
100 X 50 X 8.0	15.54	19.79	210.07	67.65	3.26	1.85	42.02	27.06	57.03	34.35	137.46	38.16
120 X 60 X 1.6	4.39	5.59	107.43	37.05	4.38	2.57	17.91	12.35	21.89	13.60	88.45	21.18
120 X 60 X 2.0	5.45	6.94	131.92	45.33	4.36	2.56	21.99	15.11	27.00	16.75	109.10	25.89
120 X 60 X 2.2	5.97	7.60	143.82	49.33	4.35	2.55	23.97	16.45	29.51	18.29	119.15	28.15
120 X 60 X 2.5	6.74	8.59	161.23	55.15	4.33	2.53	26.88	18.39	33.20	20.56	133.86	31.43
120 X 60 X 2.8	7.50	9.56	178.13	60.77	4.32	2.52	29.69	20.26	36.81	22.77	148.10	34.58
120 X 60 X 3.2	8.52	10.85	199.88	67.95	4.29	2.50	33.32	22.65	41.51	25.63	166.31	38.56
120 X 60 X 3.6	9.51	12.11	220.75	74.77	4.27	2.48	36.80	24.93	46.07	28.40	183.57	42.29
120 X 60 X 4.0	10.48	13.35	240.74	81.25	4.25	2.47	40.13	27.09	50.49	31.08	199.79	45.76
120 X 60 X 4.5	11.67	14.87	264.52	88.88	4.22	2.44	44.09	29.63	55.82	34.30	218.51	49.75
120 X 60 X 5.0	12.84	16.36	286.97	95.99	4.19	2.42	47.83	32.00	60.95	37.38	235.39	53.33
120 X 60 X 6.0	15.10	19.23	328.01	108.77	4.13	2.38	54.67	36.26	70.57	43.12	263.07	59.24
150 X 25 X 1.6	4.26	5.43	124.73	6.76	4.79	1.12	16.64	5.41	22.68	5.92	22.78	10.23
150 X 25 X 2.0	5.29	6.74	152.77	8.11	4.76	1.10	20.37	6.49	27.95	7.22	27.42	12.24
150 X 25 X 2.2	5.79	7.38	166.32	8.74	4.75	1.09	22.18	7.00	30.52	7.84	29.56	13.16
150 X 25 X 2.6	6.80	8.66	192.52	9.91	4.71	1.07	25.67	7.93	35.54	9.04	33.47	14.85
150 X 50 X 1.6	4.89	6.23	168.78	30.45	5.20	2.21	22.51	12.18	28.62	13.21	85.50	21.95
150 X 50 X 2.0	6.08	7.74	207.53	37.20	5.18	2.19	27.68	14.88	35.35	16.26	105.19	26.79
150 X 50 X 2.2	6.66	8.48	226.40	40.45	5.17	2.18	30.19	16.18	38.65	17.75	114.73	29.11
150 X 50 X 2.5	7.53	9.59	254.08	45.17	5.15	2.17	33.88	18.07	43.52	19.95	128.65	32.47
150 X 50 X 2.8	8.38	10.68	281.01	49.72	5.13	2.16	37.47	19.89	48.30	22.09	142.06	35.68
150 X 50 X 3.2	9.52	12.13	315.76	55.50	5.10	2.14	42.11	22.20	54.52	24.86	159.12	39.73

RECTANGULAR SIZE RANGE

RECTANGULAR HOLLOW SECTION (RHS) IS : 4923 : 2017/EN 10219-1 : 2006*/ASTM A-500

Dimension	Weight	Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants	
mm	kg/m	cm2	I_{xx}	I_{yy}	R_{xx}	R_{yy}	Z_{xx}	Z_{yy}	S_{xx}	S_{yy}	J	C
			cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3
150 X 50 X 3.6	10.64	13.55	349.22	60.98	5.08	2.12	46.57	24.40	60.58	27.54	175.17	43.51
150 X 50 X 4.0	11.74	14.95	381.39	66.16	5.05	2.10	50.86	26.47	66.47	30.13	190.15	47.02
150 X 50 X 4.5	13.09	16.67	419.82	72.23	5.02	2.08	55.98	28.90	73.60	33.24	207.28	51.02
150 X 50 X 5.0	14.41	18.36	456.29	77.87	4.99	2.06	60.84	31.15	80.48	36.20	222.54	54.59
150 X 75 X 2.5	8.51	10.84	322.07	110.68	5.45	3.20	42.95	29.52	52.74	32.72	266.35	50.56
150 X 75 X 2.8	9.48	12.08	356.85	122.36	5.44	3.18	47.58	32.63	58.60	36.32	295.74	55.86
150 X 75 X 3.2	10.78	13.73	401.98	137.44	5.41	3.16	53.60	36.66	66.26	41.02	333.85	62.65
150 X 75 X 3.6	12.05	15.35	445.69	151.94	5.39	3.15	59.43	40.52	73.75	45.60	370.65	69.13
150 X 75 X 4.0	13.31	16.95	488.00	165.88	5.37	3.13	65.07	44.24	81.07	50.06	406.04	75.31
150 X 75 X 5.0	16.38	20.86	587.74	198.36	5.31	3.08	78.37	52.90	98.61	60.71	487.77	89.38
150 X 75 X 6.0	19.33	24.63	679.08	227.56	5.25	3.04	90.55	60.69	115.08	70.63	558.76	101.46
150 X 100 X 2.8	10.58	13.48	432.70	232.78	5.67	4.16	57.70	46.56	68.90	52.30	481.30	76.06
150 X 100 X 3.2	12.03	15.33	488.19	262.27	5.64	4.14	65.10	52.46	78.01	59.18	545.15	85.60
150 X 100 X 3.6	13.46	17.15	542.16	290.86	5.62	4.12	72.29	58.18	86.93	65.91	607.44	94.81
150 X 100 X 4.0	14.88	18.95	594.60	318.57	5.60	4.10	79.28	63.72	95.67	72.50	668.04	103.67
150 X 100 X 5.0	18.34	23.36	719.20	384.02	5.55	4.05	95.90	76.81	116.73	88.34	811.48	124.31
150 X 100 X 6.0	21.69	27.63	834.69	444.19	5.50	4.01	111.30	88.84	136.68	103.30	941.95	142.74
150 X 100 X 8.0	28.10	35.79	1039.29	549.48	5.39	3.92	138.58	109.90	173.31	130.63	1157.28	172.73
200 X 100 X 2.8	12.78	16.28	867.33	298.93	7.30	4.29	86.74	59.79	106.12	65.91	714.79	102.51
200 X 100 X 3.2	14.55	18.53	980.69	337.26	7.27	4.27	98.07	67.46	120.32	74.67	810.37	115.59
200 X 100 X 3.6	16.29	20.75	1091.47	374.54	7.25	4.25	109.15	74.91	134.30	83.26	903.95	128.26
200 X 100 X 4.0	18.02	22.95	1199.71	410.78	7.23	4.23	119.98	82.16	148.04	91.70	995.40	140.54
200 X 100 X 5.0	22.26	28.36	1459.25	496.94	7.17	4.19	145.93	99.39	181.37	112.09	1213.91	169.44
200 X 100 X 6.0	26.40	33.63	1703.31	576.91	7.12	4.14	170.34	115.39	213.27	131.50	1416.41	195.77
200 X 100 X 8.0	34.38	43.79	2146.21	719.19	7.00	4.05	214.63	143.84	272.79	167.43	1765.96	240.49
240 X 120 X 4.0	21.78	27.75	2110.72	725.35	8.72	5.11	175.90	120.90	216.01	134.01	1745.55	207.11
200 X 100 X 6.0	26.40	33.63	1703.31	576.91	7.12	4.14	170.34	115.39	213.27	131.50	1416.41	195.77
200 X 100 X 8.0	34.38	43.79	2146.21	719.19	7.00	4.05	214.63	143.84	272.79	167.43	1765.96	240.49
240 X 120 X 4.0	21.78	27.75	2110.72	725.35	8.72	5.11	175.90	120.90	216.01	134.01	1745.55	207.11
240 X 120 X 5.0	26.97	34.36	2579.67	882.47	8.66	5.07	214.98	147.08	265.58	164.45	2141.72	251.48
240 X 120 X 6.0	32.05	40.83	3025.91	1030.45	8.61	5.02	252.16	171.75	313.41	193.69	2517.16	292.80
240 X 120 X 8.0	41.91	53.39	3851.84	1299.95	8.49	4.93	320.99	216.66	403.89	248.66	3196.64	366.11
250 X 100 X 4.0	21.16	26.95	2091.66	502.99	8.81	4.32	167.34	100.60	210.41	110.90	1335.40	177.41
250 X 100 X 5.0	26.19	33.36	2553.76	609.85	8.75	4.28	204.31	121.97	258.51	135.84	1631.59	214.59
250 X 100 X 6.0	31.11	39.63	2992.34	709.63	8.69	4.23	239.39	141.93	304.85	159.70	1908.64	248.83
250 X 100 X 8.0	40.66	51.79	3800.53	888.89	8.57	4.14	304.05	177.78	392.27	204.23	2397.53	308.31
250 X 150 X 4.0	24.30	30.95	2696.87	1234.24	9.33	6.31	215.75	164.57	259.61	183.27	2696.49	274.12
250 X 150 X 5.0	30.11	38.36	3304.18	1507.95	9.28	6.27	264.34	201.06	319.76	225.48	3322.96	334.43
250 X 150 X 6.0	35.82	45.63	3885.56	1768.35	9.23	6.23	310.85	235.78	378.05	266.28	3924.87	391.36
250 X 150 X 8.0	46.94	59.79	4972.24	2250.41	9.12	6.14	397.78	300.06	489.07	343.71	5043.97	494.90
250 X 150 X 10.0	57.63	73.42	5960.20	2682.88	9.01	6.04	476.82	357.72	592.79	415.67	6032.07	584.33
280 X 100 X 4.0	23.04	29.35	2785.31	558.32	9.74	4.36	198.96	111.67	252.63	122.42	1543.27	199.54

RECTANGULAR SIZE RANGE

RECTANGULAR HOLLOW SECTION (RHS) IS : 4923 : 2017/EN 10219-1 : 2006*/ASTM A-500

Dimension	Weight	Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants	
mm	kg/m	cm2	I_{xx}	I_{yy}	R_{xx}	R_{yy}	Z_{xx}	Z_{yy}	S_{xx}	S_{yy}	J	C
			cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3
280 X 100 X 5.0	28.54	36.36	3406.60	677.60	9.68	4.32	243.33	135.52	310.80	150.09	1886.82	241.68
280 X 100 X 6.0	33.94	43.23	3998.76	789.27	9.62	4.27	285.63	157.86	367.00	176.62	2209.32	280.67
300 X 150 X 4.0	27.44	34.95	4196.67	1447.46	10.96	6.44	279.78	193.00	341.98	212.47	3455.16	330.97
300 X 150 X 5.0	34.04	43.36	5153.13	1770.87	10.90	6.39	343.55	236.12	421.90	261.73	4261.58	404.51
300 X 150 X 6.0	40.53	51.63	6073.51	2079.57	10.85	6.35	404.91	277.28	499.63	309.48	5039.24	474.31
300 X 150 X 8.0	53.22	67.79	7807.95	2654.12	10.73	6.26	520.53	353.89	648.55	400.51	6496.60	602.47
300 X 150 X 10.0	65.48	83.42	9403.90	3173.71	10.62	6.17	626.93	423.17	788.86	485.67	7804.31	715.07
300 X 200 X 4.0	30.58	38.95	5072.88	2736.56	11.41	8.38	338.20	273.66	401.18	304.84	5589.58	447.72
300 X 200 X 5.0	37.96	48.36	6241.05	3360.92	11.36	8.34	416.07	336.10	495.65	376.37	6919.17	549.43
300 X 200 X 6.0	45.24	57.63	7370.23	3962.19	11.31	8.29	491.35	396.22	587.83	446.07	8214.59	646.97
300 X 200 X 8.0	59.50	75.79	9513.66	5097.04	11.20	8.20	634.25	509.71	765.35	579.99	10688.71	829.36
300 X 200 X 10.0	73.33	93.42	11507.24	6144.30	11.10	8.11	767.15	614.43	933.86	706.73	12983.61	994.50
300 X 200 X 12.0	86.77	110.53	13354.97	7107.11	10.99	8.02	890.34	710.72	1093.47	826.41	15071.27	1141.95
350 X 250 X 5.0	45.81	58.36	10519.88	6305.84	13.43	10.39	601.14	504.47	709.04	564.76	12375.85	814.43
350 X 250 X 6.0	54.66	69.63	12457.31	7458.44	13.38	10.35	711.85	596.68	842.61	670.85	14733.26	962.58
350 X 250 X 8.0	72.06	91.79	16170.48	9659.06	13.27	10.26	924.03	772.73	1101.63	876.27	19295.99	1243.82
350 X 250 X 10.0	89.03	113.42	19672.08	11723.53	13.17	10.17	1124.12	937.89	1349.92	1072.79	23627.09	1504.66
350 X 250 X 12.0	105.61	134.53	22966.89	13655.73	13.07	10.08	1312.40	1092.46	1587.60	1260.54	27692.08	1744.69
400 X 200 X 5.0	45.81	58.36	12489.82	4311.75	14.63	8.60	624.50	431.18	762.43	473.87	10269.69	739.55
400 X 200 X 6.0	54.66	69.63	14789.35	5091.63	14.57	8.55	739.47	509.17	905.99	562.47	12205.15	872.78
400 X 200 X 8.0	72.06	91.79	19195.28	6572.45	14.46	8.46	959.77	657.25	1184.31	733.59	15926.47	1124.29
400 X 200 X 10.0	89.03	113.42	23348.08	7950.97	14.35	8.37	1167.41	795.10	1450.98	896.73	19422.50	1355.55
400 X 200 X 12.0	105.61	134.53	27252.93	9230.63	14.23	8.28	1362.65	923.07	1706.13	1052.01	22662.53	1566.20

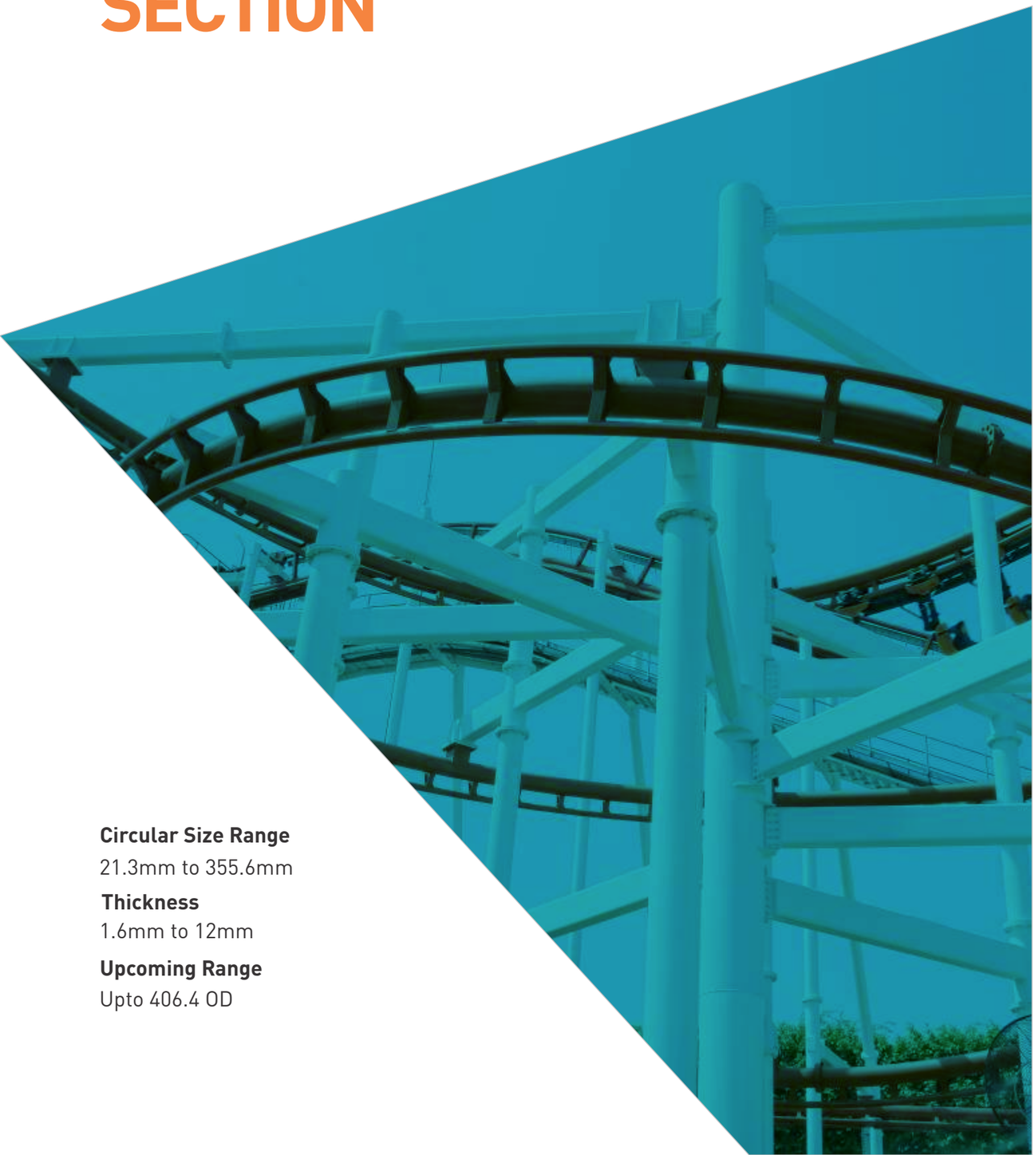

MOTERA STADIUM, AHMADABAD

UPCOMING SIZES

RECTANGULAR HOLLOW SECTION (RHS) IS : 4923 : 2017/EN 10219-1 : 2006*/ASTM A-500

Dimension	Weight	Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants	
mm	kg/m	cm2	I_{xx}	I_{yy}	R_{xx}	R_{yy}	Z_{xx}	Z_{yy}	S_{xx}	S_{yy}	J	C
			cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3
300 X 200 X 14.0	99.78	127.11	15060.82	7988.55	10.89	7.93	1004.06	798.86	1244.30	939.14	16924.33	1271.23
400 X 200 X 16.0	137.51	175.17	34339.42	11507.00	14.00	8.10	1716.98	1150.70	2182.32	1339.45	28255.38	1923.95
400 X 300 X 6.0	64.08	81.63	19446.79	12557.11	15.43	12.40	972.34	837.15	1142.39	940.63	23929.98	1338.20
400 X 300 X 8.0	84.62	107.79	25342.70	16336.49	15.33	12.31	1267.14	1089.10	1497.91	1232.55	31464.16	1738.28
400 X 300 X 10.0	104.73	133.42	30954.74	19920.57	15.23	12.22	1547.74	1328.04	1840.98	1513.86	38709.68	2114.80
400 X 300 X 12.0	124.45	158.53	36288.45	23314.01	15.13	12.13	1814.43	1554.27	2171.73	1784.67	45625.84	2467.39
400 X 300 X 14.0	143.74	183.11	41349.30	26521.41	15.03	12.03	2067.47	1768.10	2490.27	2045.10	52172.04	2795.60
400 X 300 X 16.0	162.63	207.17	46142.73	29547.33	14.92	11.94	2307.14	1969.83	2796.72	2295.29	58308.01	3098.98
500 X 200 X 6.0	64.08	81.63	25690.13	6221.07	17.74	8.73	1027.61	622.11	1284.16	678.87	16353.70	1098.63
500 X 200 X 8.0	84.62	107.79	33466.50	8047.87	17.62	8.64	1338.66	804.79	1683.27	887.19	21366.48	1419.28
500 X 200 X 10.0	104.73	133.42	40860.16	9757.63	17.50	8.55	1634.41	975.77	2068.10	1086.73	26105.40	1716.72
500 X 200 X 12.0	124.45	158.53	47877.48	11354.15	17.38	8.46	1915.10	1135.42	2438.78	1277.61	30538.24	1990.64
500 X 200 X 14.0	143.74	183.11	54524.82	12841.14	17.26	8.37	2181.00	1284.12	2795.43	1459.94	34633.43	2240.67
500 X 200 X 16.0	162.63	207.17	60808.49	14222.30	17.13	8.29	2432.34	1422.23	3138.16	1633.85	38360.40	2466.45
500 X 300 X 8.0	97.18	123.79	43149.92	19747.90	18.67	12.63	1726.00	1316.53	2076.87	1466.15	43143.80	2192.97
500 X 300 X 10.0	120.43	153.42	52866.82	24127.24	18.56	12.54	2114.68	1608.49	2558.10	1803.86	53167.39	2675.40
500 X 300 X 12.0	143.29	182.53	62169.00	28293.53	18.46	12.45	2486.76	1886.24	3024.38	2130.27	62797.85	3130.85
500 X 300 X 14.0	165.72	211.11	71063.12	32251.70	18.35	12.36	2842.53	2150.12	3475.83	2445.50	71991.13	3558.92
500 X 300 X 16.0	187.75	239.17	79555.80	36006.64	18.24	12.27	3182.24	2400.45	3912.56	2749.69	80703.46	3959.20
600 X 200 X 6.0	73.50	93.63	40672.54	7350.51	20.84	8.86	1355.76	735.06	1722.32	795.27	20598.47	1324.49
600 X 200 X 8.0	97.18	123.79	53127.31	9523.28	20.72	8.77	1770.92	952.33	2262.23	1040.79	26928.52	1714.30
600 X 200 X 10.0	120.43	153.42	65043.47	11564.30	20.59	8.68	2168.12	1156.43	2785.23	1276.73	32934.16	2077.94
600 X 200 X 12.0	143.29	182.53	76428.61	13477.67	20.46	8.59	2547.63	1347.77	3291.44	1503.21	38582.25	2415.16
600 X 200 X 14.0	165.72	211.11	87290.27	15267.43	20.33	8.50	2909.68	1526.75	3780.99	1720.34	43840.48	2725.67
600 X 200 X 16.0	187.75	239.17	97635.94	16937.61	20.20	8.42	3254.54	1693.77	4254.00	1928.25	48677.53	3009.14
600 X 300 X 8.0	109.74	139.79	67146.73	23159.31	21.92	12.87	2238.23	1543.96	2735.83	1699.75	55282.51	2647.72
600 X 300 X 10.0	136.13	173.42	82450.14	28333.90	21.80	12.78	2748.34	1888.93	3375.23	2093.86	68185.35	3236.10
600 X 300 X 12.0	162.13	206.53	97176.13	33273.05	21.69	12.69	3239.21	2218.21	3997.04	2475.87	80627.77	3794.47
600 X 300 X 14.0	187.70	239.11	111332.56	37981.99	21.58	12.60	3711.09	2532.14	4601.39	2845.90	92563.22	4322.49
600 X 300 X 16.0	212.87	271.17	124927.25	42465.94	21.46	12.51	4164.25	2831.07	5188.40	3204.09	103945.54	4819.77
600 X 400 X 8.0	122.30	155.79	81166.14	43784.94	22.83	16.76	2705.54	2189.25	3209.43	2438.71	89433.21	3581.75
600 X 400 X 10.0	151.83	193.42	99856.81	53774.74	22.72	16.67	3328.57	2688.74	3965.23	3010.98	110706.68	4395.41
600 X 400 X 12.0	180.97	230.53	117923.65	63395.01	22.62	16.58	3930.79	3169.76	4702.64	3568.53	131433.38	5175.73
600 X 400 X 14.0	209.68	267.11	135374.85	72652.18	22.51	16.49	4512.50	3632.61	5421.79	4111.47	151556.54	5922.35
600 X 400 X 16.0	237.99	303.17	152218.55	81552.65	22.41	16.40	5073.96	4077.64	6122.80	4639.92	171019.37	6634.88

CIRCULAR HOLLOW SECTION



Circular Size Range
21.3mm to 355.6mm

Thickness
1.6mm to 12mm

Upcoming Range
Upto 406.4 OD

CIRCULAR HOLLOW SECTION IS:1161 : 2014

Outside Diameter	Thickness	Mass	Area of Cross Section	Internal Volume	Moment of Inertia	Elastic Modulus	Plastic Modulus	Radius of Gyration	Square of Radius of Gyration	Torsional Constant
mm	mm	kg/m	cm^2	cm^3/m	cm^4	cm^3	cm^3	cm	cm^2	cm^3
21.3	1.6	0.78	0.99	257	0.48	0.45	0.62	0.70	0.49	0.91
21.3	1.8	0.87	1.10	246	0.53	0.50	0.69	0.69	0.48	0.99
21.3	2.0	0.95	1.21	235	0.57	0.54	0.75	0.69	0.47	1.07
21.3	2.2	1.04	1.32	224	0.61	0.57	0.81	0.68	0.46	1.15
21.3	2.5	1.16	1.48	209	0.66	0.62	0.89	0.67	0.45	1.25
21.3	2.8	1.28	1.63	194	0.71	0.67	0.97	0.66	0.44	1.34
26.4	1.6	0.98	1.25	423	0.96	0.73	0.99	0.88	0.77	1.46
26.4	1.8	1.09	1.39	408	1.06	0.80	1.09	0.87	0.76	1.60
26.4	2.0	1.20	1.53	394	1.15	0.87	1.19	0.87	0.75	1.74
26.4	2.2	1.31	1.67	380	1.23	0.94	1.29	0.86	0.74	1.87
26.4	2.5	1.47	1.88	360	1.35	1.03	1.43	0.85	0.72	2.05
26.4	2.8	1.63	2.08	340	1.47	1.11	1.57	0.84	0.71	2.22
33.7	1.6	1.27	1.61	731	2.08	1.24	1.65	1.14	1.29	2.47
33.7	1.8	1.42	1.80	712	2.30	1.37	1.83	1.13	1.28	2.73
33.7	2.0	1.56	1.99	693	2.51	1.49	2.01	1.12	1.26	2.98
33.7	2.2	1.71	2.18	674	2.71	1.61	2.19	1.12	1.25	3.22
33.7	2.5	1.92	2.45	647	3.00	1.78	2.44	1.11	1.22	3.56
33.7	2.8	2.13	2.72	620	3.27	1.94	2.68	1.10	1.20	3.88
33.7	3.2	2.41	3.07	585	3.60	2.14	2.99	1.08	1.18	4.28
33.7	3.6	2.67	3.40	552	3.91	2.32	3.28	1.07	1.15	4.64
38.1	3.2	2.75	3.51	789	5.39	2.83	3.91	1.24	1.54	5.66
38.1	3.6	3.06	3.90	750	5.87	3.08	4.30	1.23	1.50	6.16
38.1	4.0	3.36	4.29	712	6.31	3.31	4.67	1.21	1.47	6.63
38.1	4.5	3.73	4.75	665	6.82	3.58	5.11	1.20	1.44	7.16
38.1	5.0	4.08	5.20	620	7.28	3.82	5.52	1.18	1.40	7.65
38.1	6.0	4.75	6.05	535	8.07	4.23	6.25	1.15	1.33	8.47
38.1	8.0	5.94	7.56	384	9.17	4.82	7.42	1.10	1.21	9.63
42.4	1.6	1.61	2.05	1207	4.27	2.02	2.66	1.44	2.08	4.03
42.4	1.8	1.80	2.30	1182	4.74	2.24	2.97	1.44	2.06	4.47
42.4	2.0	1.99	2.54	1158	5.19	2.45	3.27	1.43	2.05	4.90
42.4	2.3	2.27	2.90	1122	5.84	2.76	3.70	1.42	2.02	5.51
42.4	2.6	2.55	3.25	1087	6.46	3.05	4.12	1.41	1.99	6.10
42.4	2.9	2.83	3.60	1052	7.06	3.33	4.53	1.40	1.96	6.66
42.4	3.2	3.09	3.94	1018	7.62	3.59	4.93	1.39	1.93	7.19
42.4	3.6	3.45	4.39	973	8.33	3.93	5.44	1.38	1.90	7.86
48.3	1.6	1.84	2.35	1598	6.41	2.65	3.49	1.65	2.73	5.31
48.3	1.8	2.06	2.63	1569	7.12	2.95	3.89	1.65	2.71	5.89
48.3	2.0	2.28	2.91	1541	7.81	3.23	4.29	1.64	2.68	6.47
48.3	2.3	2.61	3.32	1500	8.81	3.65	4.87	1.63	2.65	7.30
48.3	2.6	2.93	3.73	1459	9.78	4.05	5.44	1.62	2.62	8.10
48.3	2.9	3.25	4.14	1419	10.70	4.43	5.99	1.61	2.59	8.86
48.3	3.2	3.56	4.53	1379	11.59	4.80	6.52	1.60	2.56	9.59
48.3	3.6	3.97	5.06	1327	12.71	5.26	7.21	1.59	2.51	10.52
48.3	4.0	4.37	5.57	1276	13.77	5.70	7.87	1.57	2.47	11.40
48.3	4.5	4.86	6.19	1213	15.01	6.21	8.66	1.56	2.42	12.43
48.3	5.0	5.34	6.80	1152	16.15	6.69	9.42	1.54	2.37	13.38
48.3	6.0	6.26	7.97	1035	18.19	7.53	10.81	1.51	2.28	15.07

CIRCULAR SIZE RANGE

CIRCULAR SIZE RANGE

CIRCULAR HOLLOW SECTION IS:1161 : 2014

Outside Diameter	Thickness	Mass	Area of Cross Section	Internal Volume	Moment of Inertia	Elastic Modulus	Plastic Modulus	Radius of Gyration	Square of Radius of Gyration	Torsional Constant
mm	mm	kg/m	cm^2	cm^3/m	cm^4	cm^3	cm^3	cm	cm^2	cm^3
48.3	8.0	7.95	10.13	819	21.37	8.85	13.16	1.45	2.11	17.70
60.3	1.6	2.32	2.95	2561	12.72	4.22	5.51	2.08	4.31	8.44
60.3	2.0	2.88	3.66	2489	15.58	5.17	6.80	2.06	4.25	10.34
60.3	2.3	3.29	4.19	2437	17.65	5.85	7.74	2.05	4.21	11.71
60.3	2.6	3.70	4.71	2384	19.65	6.52	8.66	2.04	4.17	13.04
60.3	2.9	4.11	5.23	2333	21.59	7.16	9.56	2.03	4.13	14.32
60.3	3.2	4.51	5.74	2282	23.47	7.78	10.44	2.02	4.09	15.57
60.3	3.6	5.03	6.41	2215	25.87	8.58	11.59	2.01	4.03	17.16
60.3	4.0	5.55	7.07	2148	28.17	9.34	12.70	2.00	3.98	18.69
60.3	4.5	6.19	7.89	2067	30.90	10.25	14.04	1.98	3.92	20.50
60.3	5.0	6.82	8.69	1987	33.48	11.10	15.33	1.96	3.85	22.21
60.3	6.0	8.04	10.24	1832	38.18	12.66	17.76	1.93	3.73	25.33
60.3	8.0	10.32	13.14	1541	45.99	15.25	22.05	1.87	3.50	30.51
71.5	3.2	5.39	6.87	3329	40.13	11.22	14.94	2.42	5.84	22.45
71.5	3.6	6.03	7.68	3247	44.38	12.41	16.61	2.40	5.78	24.83
71.5	4.0	6.66	8.48	3167	48.48	13.56	18.25	2.39	5.72	27.12
71.5	5.0	8.20	10.45	2971	58.07	16.24	22.15	2.36	5.56	32.49
71.5	6.0	9.69	12.35	2781	66.77	18.68	25.81	2.33	5.41	37.35
71.5	8.0	12.53	15.96	2419	81.72	22.86	32.43	2.26	5.12	45.72
76.2	2.0	3.66	4.66	4094	32.11	8.43	11.01	2.62	6.89	16.85
76.2	2.3	4.19	5.34	4026	36.49	9.58	12.56	2.61	6.83	19.15
76.2	2.6	4.72	6.01	3959	40.76	10.70	14.09	2.60	6.78	21.40
76.2	2.9	5.24	6.68	3893	44.92	11.79	15.59	2.59	6.73	23.58
76.2	3.2	5.76	7.34	3826	48.98	12.86	17.06	2.58	6.67	25.71
76.2	3.6	6.45	8.21	3739	54.23	14.23	18.99	2.57	6.60	28.47
76.2	4.0	7.12	9.07	3653	59.30	15.56	20.87	2.56	6.54	31.13
76.2	4.5	7.96	10.14	3547	65.39	17.16	23.16	2.54	6.45	34.33
76.2	5.0	8.78	11.18	3442	71.22	18.69	25.39	2.52	6.37	37.39
76.2	6.0	10.39	13.23	3237	82.11	21.55	29.64	2.49	6.21	43.10
76.2	8.0	13.46	17.14	2846	101.03	26.52	37.38	2.43	5.89	53.03
88.9	2.0	4.29	5.46	5661	51.57	11.60	15.11	3.07	9.44	23.20
88.9	2.3	4.91	6.26	5581	58.70	13.21	17.25	3.06	9.38	26.41
88.9	2.6	5.53	7.05	5502	65.68	14.78	19.37	3.05	9.32	29.55
88.9	2.9	6.15	7.84	5424	72.52	16.31	21.46	3.04	9.26	32.63
88.9	3.2	6.76	8.62	5346	79.21	17.82	23.51	3.03	9.19	35.64
88.9	3.6	7.57	9.65	5242	87.90	19.77	26.21	3.02	9.11	39.55
88.9	4.0	8.38	10.67	5140	96.34	21.67	28.85	3.00	9.03	43.35
88.9	4.5	9.37	11.93	5014	106.54	23.97	32.09	2.99	8.93	47.94
88.9	5.0	10.35	13.18	4889	116.37	26.18	35.24	2.97	8.83	52.36
88.9	6.0	12.27	15.63	4645	134.94	30.36	41.31	2.94	8.64	60.72
88.9	8.0	15.96	20.33	4174	167.97	37.79	52.53	2.87	8.26	75.58
88.9	10.0	19.46	24.79	3728	195.98	44.09	62.59	2.81	7.91	88.18
88.9	5.0	10.35	13.18	4889	116.37	26.18	35.24	2.97	8.83	52.36
101.6	2.0	4.91	6.26	7482	77.63	15.28	19.84	3.52	12.41	30.56
101.6	2.3	5.63	7.18	7390	88.48	17.42	22.68	3.51	12.33	34.84
101.6	2.6	6.35	8.09	7299	99.14	19.52	25.49	3.50	12.26	39.03
101.6	2.9	7.06	8.99	7208	109.59	21.57	28.26	3.49	12.19	43.15

CIRCULAR SIZE RANGE

CIRCULAR HOLLOW SECTION IS:1161 : 2014

Outside Diameter	Thickness	Mass	Area of Cross Section	Internal Volume	Moment of Inertia	Elastic Modulus	Plastic Modulus	Radius of Gyration	Square of Radius of Gyration	Torsional Constant
mm	mm	kg/m	cm^2	cm^3/m	cm^4	cm^3	cm^3	cm	cm^2	cm^3
101.6	3.2	7.77	9.89	7118	119.85	23.59	31.00	3.48	12.12	47.19
101.6	3.6	8.70	11.08	6999	133.24	26.23	34.59	3.47	12.02	52.46
101.6	4.0	9.63	12.26	6881	146.28	28.80	38.12	3.45	11.93	57.59
101.6	4.5	10.78	13.73	6735	162.13	31.92	42.46	3.44	11.81	63.83
101.6	5.0	11.91	15.17	6590	177.47	34.93	46.70	3.42	11.70	69.87
114.3	2.0	5.54	7.06	9555	111.27	19.47	25.23	3.97	15.77	38.94
114.3	2.3	6.35	8.09	9452	126.95	22.21	28.86	3.96	15.69	44.43
114.3	2.6	7.16	9.12	9348	142.37	24.91	32.45	3.95	15.60	49.82
114.3	2.9	7.97	10.15	9246	157.55	27.57	36.00	3.94	15.52	55.13
114.3	3.2	8.77	11.17	9144	172.47	30.18	39.51	3.93	15.44	60.36
114.3	3.6	9.83	12.52	9009	191.98	33.59	44.13	3.92	15.33	67.19
114.3	4.0	10.88	13.86	8875	211.07	36.93	48.69	3.90	15.23	73.86
114.3	4.5	12.19	15.52	8709	234.32	41.00	54.28	3.89	15.10	82.00
114.3	5.0	13.48	17.17	8544	256.92	44.96	59.77	3.87	14.96	89.91
114.3	6.0	16.03	20.41	8219	300.21	52.53	70.45	3.83	14.71	105.06
127.0	2.6	7.98	10.16	11652	196.65	30.97	40.24	4.40	19.35	61.94
127.0	2.9	8.88	11.31	11537	217.78	34.30	44.67	4.39	19.26	68.59
127.0	3.2	9.77	12.45	11423	238.60	37.57	49.06	4.38	19.17	75.15
127.0	3.6	10.96	13.96	11272	265.87	41.87	54.83	4.36	19.05	83.74
127.0	4.0	12.14	15.46	11122	292.61	46.08	60.54	4.35	18.93	92.16
127.0	4.5	13.60	17.32	10936	325.29	51.23	67.56	4.33	18.78	102.45
127.0	5.0	15.05	19.16	10751	357.14	56.24	74.46	4.32	18.64	112.48
127.0	6.0	17.91	22.81	10387	418.44	65.90	87.92	4.28	18.35	131.79
139.7	2.6	8.79	11.20	14208	263.21	37.68	48.88	4.85	23.50	75.36
139.7	2.9	9.79	12.46	14082	291.68	41.76	54.28	4.84	23.40	83.52
139.7	3.2	10.77	13.72	13956	319.78	45.78	59.63	4.83	23.30	91.56
139.7	3.6	12.09	15.39	13789	356.65	51.06	66.70	4.81	23.17	102.12
139.7	4.0	13.39	17.05	13623	392.86	56.24	73.68	4.80	23.04	112.49
139.7	4.5	15.01	19.11	13417	437.20	62.59	82.29	4.78	22.87	125.18
139.7	5.0	16.61	21.16	13212	480.54	68.80	90.76	4.77	22.71	137.59
139.7	6.0	19.79	25.20	12808	564.26	80.78	107.33	4.73	22.39	161.56
139.7	8.0	25.99	33.10	12018	720.29	103.12	138.93	4.66	21.76	206.24
165.1	2.6	10.42	13.27	20081	438.23	53.09	68.66	5.75	33.02	106.17
165.1	2.9	11.60	14.78	19931	486.13	58.89	76.30	5.74	32.90	117.78
165.1	3.2	12.78	16.28	19781	533.48	64.63	83.89	5.73	32.78	129.25
165.1	3.6	14.34	18.27	19582	595.79	72.17	93.91	5.71	32.62	144.35
165.1	4.0	15.89	20.24	19384	657.16	79.61	103.83	5.70	32.46	159.22
165.1	4.5	17.83	22.70	19138	732.57	88.74	116.10	5.68	32.27	177.49
165.1	5.0	19.75	25.15	18894	806.54	97.70	128.20	5.66	32.07	195.41
165.1	6.0	23.55	29.99	18409	950.25	115.11	151.95	5.63	31.69	230.22
165.1	8.0	31.00	39.48	17460	1221.25	147.94	197.61	5.56	30.93	295.88
168.3	2.6	10.63	13.53	20893	464.63	55.21	71.39	5.86	34.33	110.43
168.3	2.9	11.83	15.07	20739	515.46	61.26	79.34	5.85	34.21	122.51
168.3	3.2	13.03	16.60	20587	565.74	67.23	87.24	5.84	34.09	134.46
168.3	3.6	14.63	18.63	20384	631.90	75.09	97.67	5.82	33.92	150.18
168.3	4.0	16.21	20.65	20182	697.09	82.84	108.00	5.81	33.76	165.68
168.3	4.5	18.18	23.16	19931	777.22	92.36	120.77	5.79	33.56	184.72

CIRCULAR SIZE RANGE

CIRCULAR HOLLOW SECTION IS:1161 : 2014

Outside Diameter	Thickness	Mass	Area of Cross Section	Internal Volume	Moment of Inertia	Elastic Modulus	Plastic Modulus	Radius of Gyration	Square of Radius of Gyration	Torsional Constant
mm	mm	kg/m	cm^2	cm^3/m	cm^4	cm^3	cm^3	cm	cm^2	cm^3
168.3	5.0	20.14	25.65	19681	855.85	101.70	133.38	5.78	33.36	203.41
168.3	6.0	24.02	30.59	19187	1008.69	119.87	158.12	5.74	32.97	239.74
168.3	8.0	31.63	40.29	18218	1297.27	154.16	205.74	5.67	32.20	308.32
193.7	2.6	12.26	15.61	27907	712.68	73.59	94.96	6.76	45.66	147.17
193.7	2.9	13.65	17.38	27730	791.21	81.69	105.58	6.75	45.52	163.39
193.7	3.2	15.04	19.15	27553	869.00	89.73	116.14	6.74	45.38	179.45
193.7	3.6	16.88	21.50	27318	971.55	100.31	130.11	6.72	45.19	200.63
193.7	4.0	18.72	23.84	27084	1072.79	110.77	143.97	6.71	45.00	221.54
193.7	4.5	21.00	26.75	26793	1197.52	123.65	161.12	6.69	44.77	247.29
193.7	5.0	23.27	29.64	26504	1320.23	136.32	178.08	6.67	44.54	272.63
193.7	6.0	27.78	35.38	25930	1559.72	161.05	211.46	6.64	44.08	322.09
193.7	8.0	36.64	46.67	24801	2015.54	208.11	276.05	6.57	43.19	416.22
219.7	2.6	13.92	17.73	36136	1044.90	95.12	122.55	7.68	58.92	190.24
219.7	2.9	15.51	19.75	35934	1160.68	105.66	136.31	7.67	58.76	211.32
219.7	3.2	17.09	21.76	35733	1275.49	116.11	150.00	7.66	58.60	232.22
219.7	3.6	19.19	24.44	35466	1427.08	129.91	168.13	7.64	58.39	259.82
219.7	4.0	21.28	27.11	35199	1576.96	143.56	186.13	7.63	58.18	287.11
219.7	5.0	26.48	33.72	34537	1944.29	177.00	230.52	7.59	57.65	353.99
219.7	6.0	31.63	40.28	33882	2301.27	209.49	274.08	7.56	57.13	418.98
219.7	8.0	41.77	53.21	32589	2984.92	271.73	358.71	7.49	56.10	543.45
219.7	10.0	51.72	65.88	31322	3629.46	330.40	440.07	7.42	55.09	660.80
254.0	4.0	24.67	31.42	47529	2455.00	193.31	250.02	8.84	78.15	386.61
254.0	5.0	30.71	39.11	46759	3032.52	238.78	310.05	8.81	77.53	477.56
254.0	6.0	36.70	46.75	45996	3596.01	283.15	369.10	8.77	76.93	566.30
254.0	8.0	48.54	61.83	44488	4681.82	368.65	484.30	8.70	75.73	737.29
254.0	10.0	60.19	76.65	43005	5714.24	449.94	595.69	8.63	74.55	899.88
273.1	5.0	33.06	42.11	54367	3785.05	277.19	359.43	9.48	89.88	554.38
273.1	6.0	39.53	50.35	53543	4492.13	328.97	428.13	9.45	89.22	657.95
273.1	8.0	52.31	66.63	51915	5858.34	429.03	562.39	9.38	87.93	858.05
273.1	10.0	64.90	82.66	50312	7162.25	524.51	692.55	9.31	86.65	1049.03
273.1	12.0	77.28	98.43	48735	8405.78	615.58	818.65	9.24	85.40	1231.17
323.9	5.0	39.33	50.09	77388	6369.42	393.30	508.53	11.28	127.15	786.59
323.9	6.0	47.05	59.92	76405	7572.47	467.58	606.43	11.24	126.37	935.16
323.9	8.0	62.34	79.39	74458	9910.08	611.92	798.51	11.17	124.82	1223.84
323.9	10.0	77.43	98.61	72536	12158.34	750.75	985.67	11.10	123.29	1501.49
323.9	12.0	92.32	117.58	70639	14319.56	884.20	1167.96	11.04	121.78	1768.39
355.6	6.0	51.74	65.90	92725	10070.55	566.40	733.39	12.36	152.82	1132.80
355.6	8.0	68.59	87.36	90579	13201.37	742.48	966.78	12.29	151.11	1484.97
355.6	10.0	85.25	108.57	88457	16223.50	912.46	1194.73	12.22	149.42	1824.92

UPCOMING SIZES

CIRCULAR HOLLOW SECTION IS:1161 : 2014

Outside Diameter	Thickness	Mass	Area of Cross Section	Internal Volume	Moment of Inertia	Elastic Modulus	Plastic Modulus	Radius of Gyration	Square of Radius of Gyration	Torsional Constant
mm	mm	kg/m	cm^2	cm^3/m	cm^4	cm^3	cm^3	cm	cm^2	cm^3
355.6	12.0	101.70	129.53	86361	19139.47	1076.46	1417.31	12.16	147.76	2152.92
377.0	6.0	54.91	69.93	104635	12035.01	638.46	825.92	13.12	172.10	1276.92
377.0	8.0	72.81	92.74	102354	15791.85	837.76	1089.46	13.05	170.28	1675.53
377.0	10.0	90.52	115.30	100098	19425.87	1030.55	1347.22	12.98	168.49	2061.10
377.0	12.0	108.04	137.60	97868	22939.76	1216.96	1599.28	12.91	166.71	2433.93
406.4	6.0	59.26	75.47	122170	15128.33	744.50	961.99	14.16	200.45	1489.01
406.4	8.0	78.62	100.13	119704	19873.89	978.05	1269.95	14.09	198.48	1956.09
406.4	10.0	97.78	124.53	117264	24475.81	1204.52	1571.66	14.02	196.54	2409.04
406.4	12.0	116.74	148.69	114849	28937.01	1424.07	1867.19	13.95	194.62	2848.13


ITO SKYWALK, DELHI


ITPO PRAGATI MAIDAN, DELHI

OUR PROJECTS

PROJECT - KEMPEGOWDA INTERNATIONAL AIRPORT, BENGALURU
CONTRACTOR - L&T
SUB CONTRACTOR - M/S. YONGNAM ENGINEERING INDIA PVT LTD
CLIENT - GMR/BIAL | **YEAR** - 2019

ABOUT THE PROJECT

Kempegowda International Airport, the third-biggest airport in India, is constructing a garden terminal called T2 to accommodate the increasing passenger traffic. The terminal will feature trees, small gardens and ponds with local species of plants. It is expected to serve approximately 25 million passengers a year. Operated by Bengaluru International Airport Limited (BIAL), it is claimed to be India's first greenfield airport terminal to be built under a public-private partnership. Construction of the terminal began in 2019. With the expected completion of phase one works in March 2021.

CHALLENGE

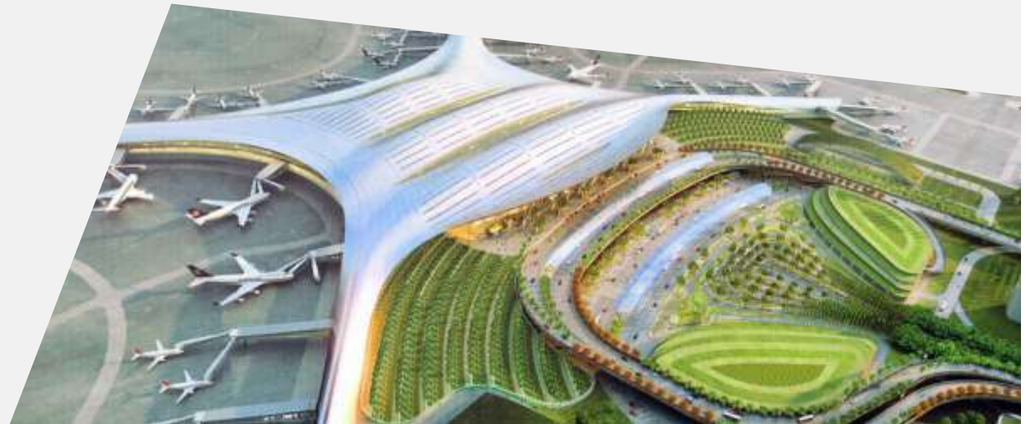
M/S. Yongnam Engineering Sub - Contractor for Bengaluru Airport had a requirement of hollow sections 350 mm x 250 mm X 10 mm from BIAL's preferred make list suppliers for constructing the Terminal building. The preferred make list suppliers were not able to manufacture the required sizes considering they had the capability and capacity constraints. Yongnam Engineering had almost decided to import these sizes from China with a 60 day lead time which would have increased costs.

SOLUTION

The contractor approached APL Apollo Tubes Ltd, for supplying Hollow Sections of size 350 mm x 250 mm x 10 mm. APL APOLLO was able to provide the required sizes and quantity within 7 days of issuing the purchase order.

RESULT AND CONCLUSION

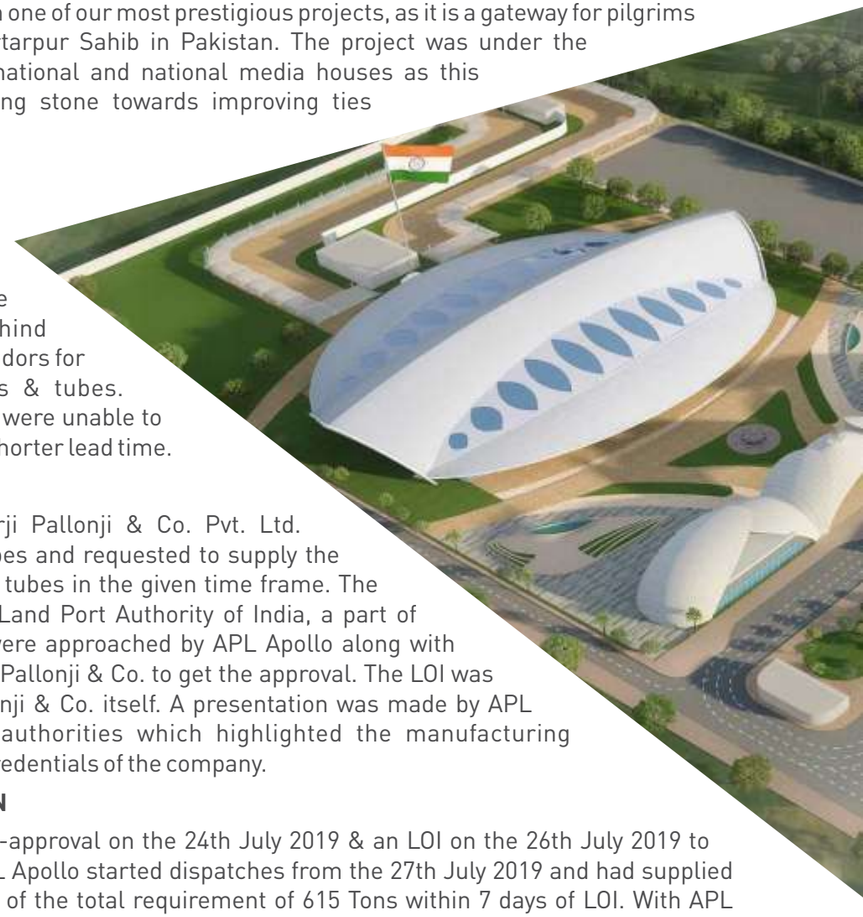
APL Apollo has the technology to service customized Sizes in Minimum Lead Time. This was possible because of DFT (Direct Forming Technology) which is connected only with APL APOLLO in India. This technology helps in giving customized size more exceptional flexibility and minimum lead time.



PROJECT - KARTARPUR CORRIDOR PASSANGER TERMINAL AT DERA BABA NANAK, PUNJAB
CONSULTANT - CREATIVE GROUP
CONTRACTOR - SHAPORJI PALLONJI & CO. PVT. LTD.
YEAR - 2019

ABOUT THE PROJECT

Kartarpur Corridor has been one of our most prestigious projects, as it is a gateway for pilgrims to visit the Gurudwara Kartarpur Sahib in Pakistan. The project was under the limelight of different international and national media houses as this project has been a stepping stone towards improving ties between the two countries.



CHALLENGE

The project was scheduled to be inaugurated as per the defined timeline. But the contractors of the project, were running behind time with their approved vendors for supplying structural pipes & tubes. However, approved vendors were unable to cater to the demand due to shorter lead time.

SOLUTION

Creative Group & Shapoorji Pallonji & Co. Pvt. Ltd. approached APL Apollo Tubes and requested to supply the required structural pipes & tubes in the given time frame. The principals to the project – Land Port Authority of India, a part of Ministry of Home Affairs, were approached by APL Apollo along with Creative Group & Shapoorji Pallonji & Co. to get the approval. The LOI was provided by Shapoorji Pallonji & Co. itself. A presentation was made by APL Apollo to the concerned authorities which highlighted the manufacturing capabilities along with the credentials of the company.

RESULTS AND CONCLUSION

APL Apollo was given a pre-approval on the 24th July 2019 & an LOI on the 26th July 2019 to supply structural pipes. APL Apollo started dispatches from the 27th July 2019 and had supplied approximately 500 Tons out of the total requirement of 615 Tons within 7 days of LOI. With APL Apollo Tube's faster delivery, pan India flexibility on sizes and proximity of plant locations, the company was able to complete the project with great precision.

* Photos are for representation purpose only
* Terms & conditions apply

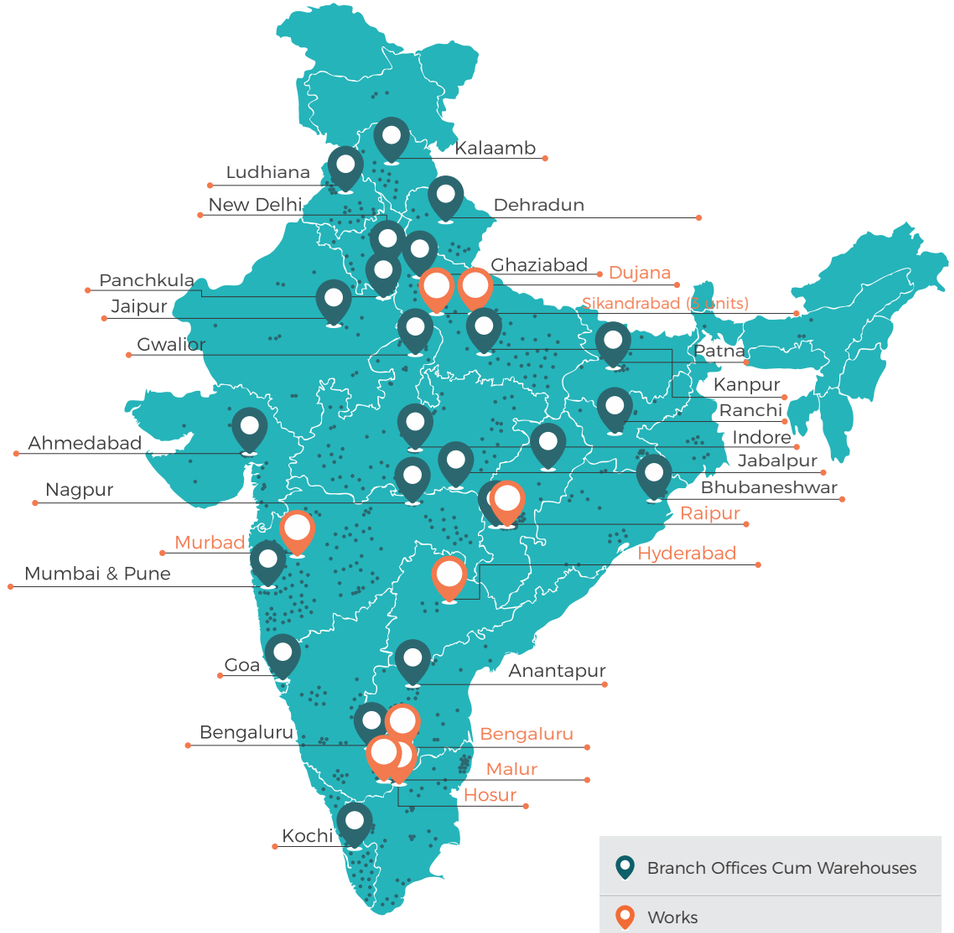
APPLICATIONS OF

APL APOLLO

column®

The **FUTURE** is *Exciting*

OUR NETWORK OF INNER STRENGTH



10 Plants

29 Sales Offices

800+ Dealers & Distributors

In **2000** Towns & Cities

1 Lakh+ Retailers & Fabricators

25.5 Lakh Tonnes Capacity

30+ Years of Experience