

Chapter 1:

General information about steel structures

1 . Historical overview:

In 1777: First use of metal (iron) as a building material in England for the construction of an arch with a span of 30 m;

1780-1820: Construction of a large number of bridges (casting slit)

1850: Construction of a post-beam framework ... Prefabrication Idea

1855: THOMAS BESSEMER had invented a converter for the refining of slit and steel

1889: Construction of the Eiffel Tower with a span of 310 m for the Universal Exhibition.

1930: Idea of using welded joints in metal constructions

1931: Construction of the EMPIRE STATE BUILDING in New York, a 380 m high steel frame

1973: Construction of the WORLD TRADE CENTRE (two towers of 110 floors and 410 m high)

1974: Construction of a 109-storey, 422-metre-high building is built by SEARS TOWER in Chicago

1981: Construction of Humber Bridge, a 1410m suspension bridge with a central span in Great Britain

1998: The construction of Akashi Kaikyo Bridge in Japan, a 1990 suspension bridge with a central span

1999: Two towers in Malaysia (PERTONAS towers)

2 . Steel construction:

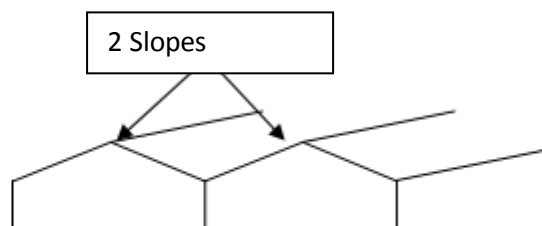
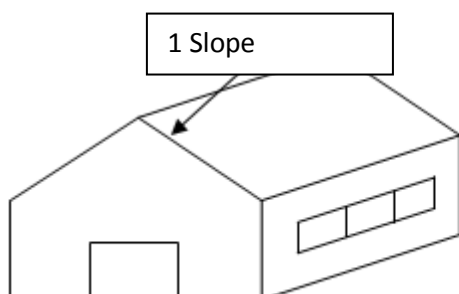
Steel has been widely used and in all areas, due to the advantages it offers to the structure, it is used in:

*Construction for residential use: -Single-family houses

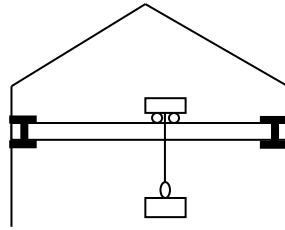
*Towers for residential and even administrative use

*School buildings

* Industrial sheds: large hall with a very large span ranging from 10m to 80m, they can be tiered or not, with a single slope, two slopes, or several.

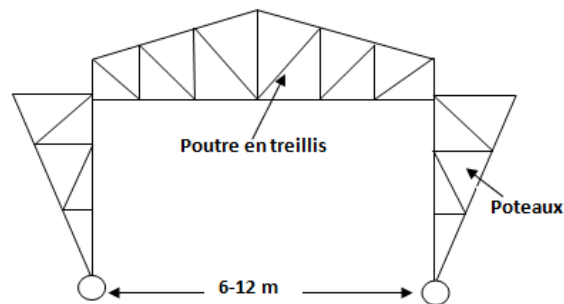


Equipped with overhead crane or not

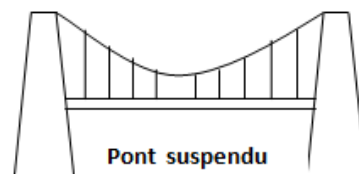
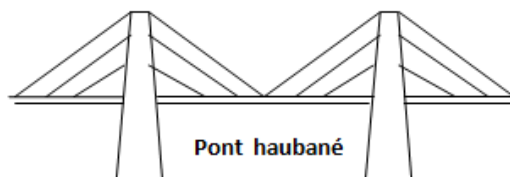


The industrial halls can be used as an assembly or repair room (factory, storage, and warehouse)

*Buildings with large lattice spans: such as sports halls, airport terminals, and construction shops



*Engineering structures: such as metal bridges, cable-stayed bridges, and suspension bridges.



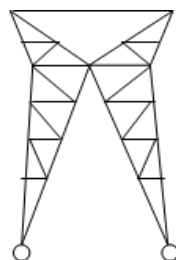
*Masterpiece: like the Eiffel Tower

*Silos: for the storage of materials (cement, aggregates), or food (wheat)

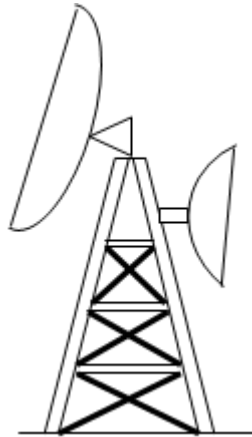
*Tanks: gas, liquid

*Oil rigs: for offshore oil extraction

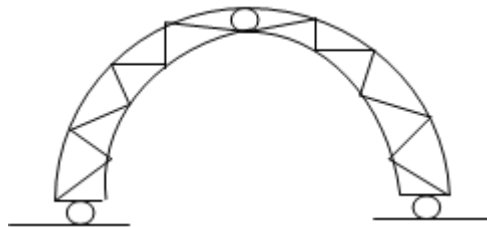
*Electricity pylons



*Radio and television masts (transmitter)



*Cupolas: either arch or shell

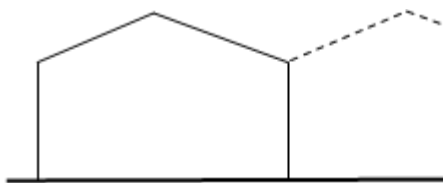


3/ Advantages and disadvantages of metal frames:

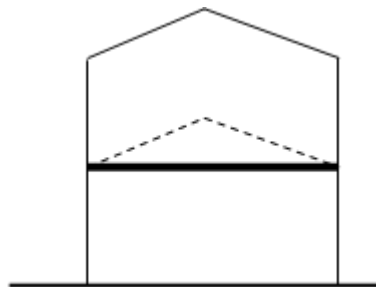
3.1- Advantages:

*Industrialization: possibility of pre-fabricating a building in the workshop with great precision and speed and then it will be assembled on site

*Transformation: can modify, adapt, elevate, or strengthen



Extension of an existant building



Existing elevated building

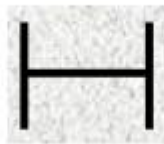
- *Significant architectural possibility
- *Retrieved elements from a hangar to reuse them again for a new structure
- *Use of different grades of steel
- *Easy movement of a metal building
- *Elasto-plastic character: the metal frame can be overloaded, without going to ruin thanks to the plastic adaptation of the steel which offers this possibility
- *Lightness: steel is a light material compared to concrete, e.g.: to an equal strength of the two materials; We have a section of concrete 5 times larger than the steel one.

3.2- Disadvantages:

- *Lightness: this is a characteristic that plays a double role
- *Susceptibility to instability phenomena due to the thinness of the elements (thin thicknesses)
- *Poor resistance of steel to fire (fire) steel melts at about 1500 °C temperature, so it requires expensive protection which is:
 - Special paint
 - Plaster to slow down heat flow



Concrete-coated metal profile



Hollow metal profile filled with concrete

*Corrosion: this is due to the rust of the steel elements, to protect against rust we must first clean the surfaces with rust:

- Simple cleaning with a wire brush
- By sanding
- By a stripper with acid

And then, one of the following solutions can be adopted:

- Use of paint (rustproof, bituminous)
- Metal coating: -Galvanizing steel
- Chromatization of steel

*Need for maintenance of metal structures

4 . Terminology of an industrial hangar:

The figure gives the main terms used for metal frames and cladding.

1	column (HEA or PEI)
2	Cross member (HEA or PEI)
3	Smooth
4	Bayonet
5	Slope diagonal
6	Failure (IPN or IPE)
7	Oak in folded sheet metal
8	Metal ridge
9	Metal Cover
10	Gutter 1/2 round
11	Glazed frame
12	Vertical wave metal cladding
13	Cladding Beam
14	St. Andrew's Cross
15	Gable post (HEA or IPE)
16	Hock

