

**4000BC** Copper Age -smelting of copper in the Middle East, India and China

**3000BC** Bronze Age - copper with the addition of tin, zinc or other metals. This lasted until about 1200BC when there was a decay of societies.

**2000BC** Development of the Roman Empire.



**750BC** 1<sup>st</sup> Iron smelting Hallstatt period (Austria)

**450BC** 2<sup>nd</sup> Iron period La Tene period

**350AD** End of the Roman Empire.

**1700** Rolled **steel plates**.

**1720** Abraham Darby (England) began smelting iron with coke instead of charcoal. This began the mass production of pig iron.

**1779** 100 ft span cast iron bridge at Coalbrookdale (England)

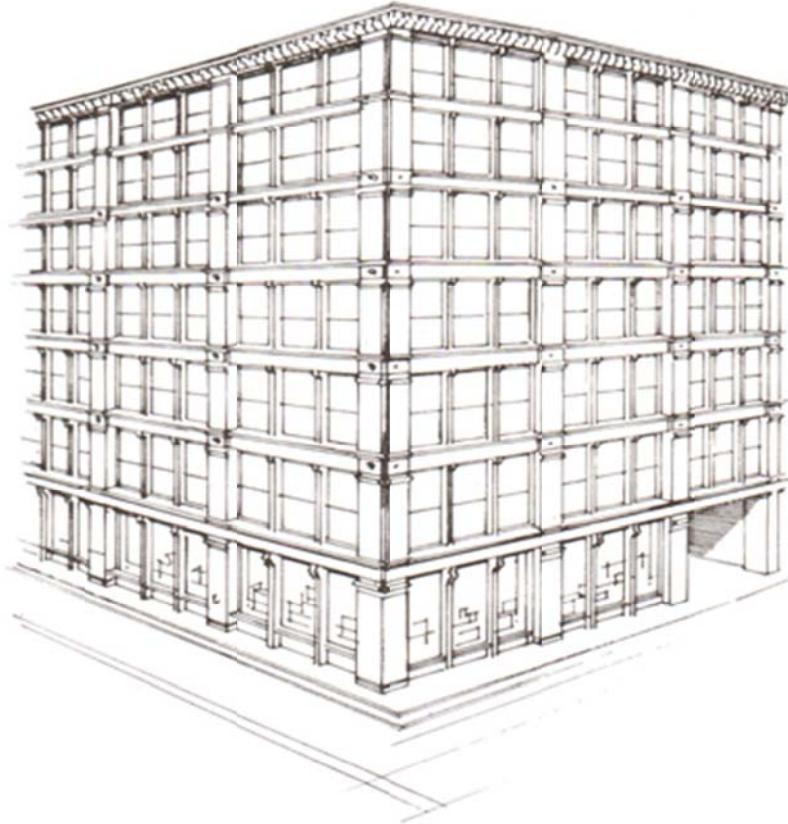


**1784** Puddling process began, changing pig iron into wrought iron.

**1826** Chain bridge 173 m long across the Menai Straits in England completed.



- 1830** Rolled railway rails.
- 1850** 300 m spans
- 1854** Rolling of I sections of wrought iron in France. The start of structural sections in Architecture.
- 1855** Henry Bessemer (England) invented the converter using air blown through the molten metal to remove unwanted impurities.
- 1864** Siemens-Martin invented the open hearth process to produce mild steel
- 1870 500m span Brooklyn Bridge New York.
- 1880 Chicago School of architecture.
- Chicago the gateway to the mid-west,  
A centre of commerce – demand for office and storage space.  
Demand for Office space led to the development of  
skyscrapers.



Chicago. Leiter Building I 1879



Leiter Building – a 5 storey skyscraper.

Developments making high rise buildings feasible:

Otis Elevator (1853)

Vacuum systems for delivery

Development of telephone and telegraph for communications.

**1946** Development and expansion of cable stayed-bridges as a short span alternative to suspension bridges.



Long's Creek Bridge (1967)



Helix Bridge in Seattle, designed by UBC engineers and fabricated by AMEC Dynamic Structures, Port Coquitlam