

## Lightweight Steel Trusses

**Truss definition** – a structural member joined together in a rigid framework. They are most often in the shape of a triangle or series of triangles. Trusses can be built of wood, steel, or aluminum. The design of a truss, which separates compressive and tensile stresses, allows for minimum of materials to be used, resulting in economic benefit.

The top and bottom members of a truss are called chords. The top chord of a truss is in compression, and the bottom chord is in tension.

Steel trusses are available in different types and shapes. The current trend is toward engineered, lightweight steel construction.

In newer construction, many of the support systems used for commercial building roofs are made of open web steel bar joists. These joists are spaced further apart than standard wood joists, sometimes up to 60 feet.

### **Truss Failure**

The danger of these systems is that they can be weakened by fire and heat. These trusses are lightweight and made from thin steel, so they have very little inherent fire resistance.

All parts and connections of a truss are vital to the stability of the truss system. The failure of any one element can lead to failure of the entire truss. The failure of a single truss transfers additional load to the surrounding trusses, which results in the multiple truss failures.

Findings reported by the *National Engineered Lightweight Construction Fire Research Project* showed that unprotected steel open-web bar joists reached 1,200 F in 6 to 8 minutes.

When steel absorbs heat at a rapid rate, it begins to expand, twist and bend.

Examples of steel truss failures

- Cold drawn steel cables can totally fail at 800 F
- At temperatures above 1,000 F the expanding steel in bar joist trusses can exert lateral thrust forces on surrounding masonry walls sufficient to cause their collapse.
- Expansion within metal trusses may also cause the bottom chord of buckle and fail, resulting in downward thrust and collapse of the roof or floor.