

I.7.1. Long-Span Beams:

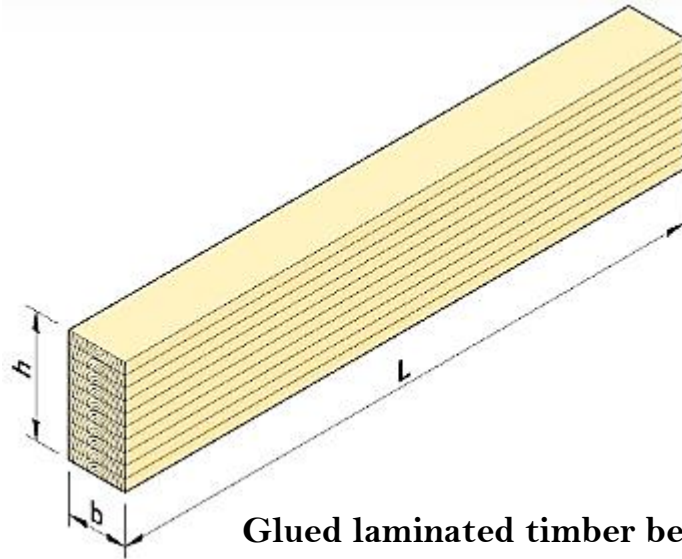
I.7.1.1. Definition

Flat beam structures are the most suitable option, when there is a need for a limited amount of space within a specific range. The depth of the beams is consequently directly proportional to the span that can be supported, and for glue-laminated beams and steel girders, this requires a depth-to-span ratio of around **1:20** for typical loads. Despite the fact that solid web beam systems have a depth to span ratio advantage, they have a high self-weight and do not easily accommodate mechanical services as do open-web or trussed beam structures.

I.7.1.2. Types

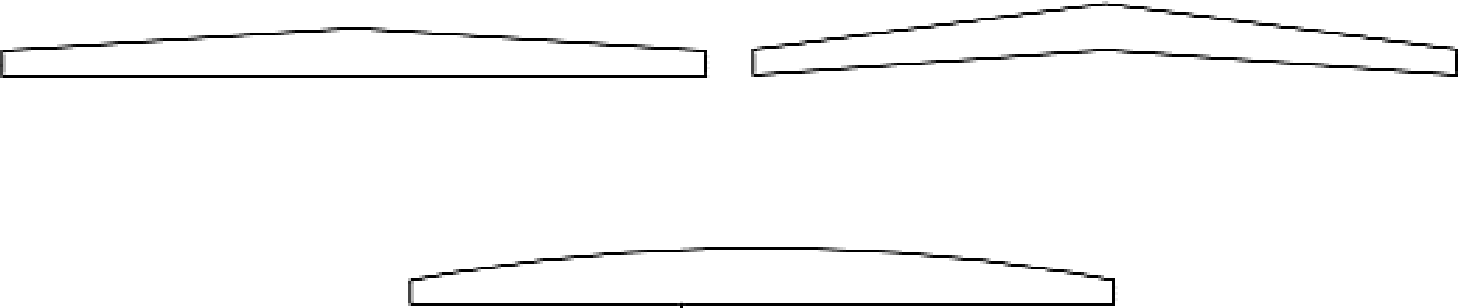
A- Glue-Laminated Beams

Solid-sawn timber beams cannot be used for long spans, but it is possible to use glue-laminate (glulam) timber beams which have the ability to span up to **24.4 m**. Glulam beams possess exceptional strength and can be produced with sizable cross-sectional areas, as well as curved or tapered shapes.



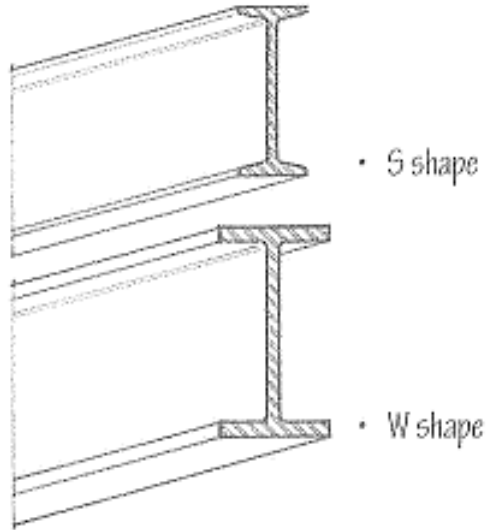
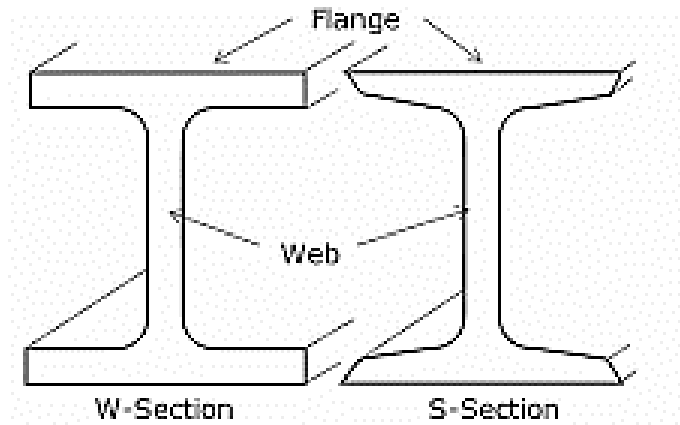
Glued laminated timber beam sizes

Some various profiles of long-span glulam beams

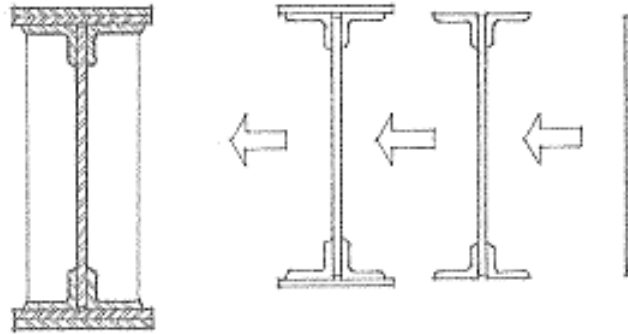


B- Steel Beams

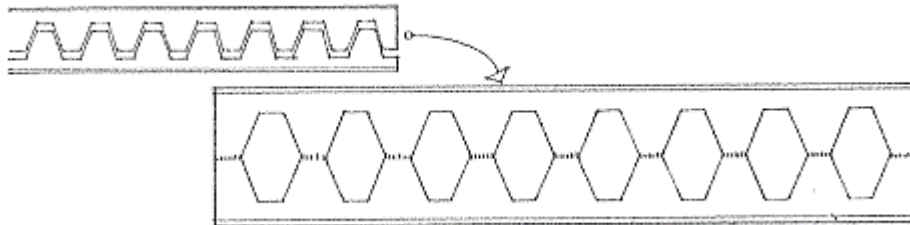
Wide-flange steel sections are capable of spanning up to 21 m with a depth of 1120 mm. More structurally efficient wide-flange (W) shapes have largely superseded the classic beam (S) shapes



Deeper sections for longer spans are possible by fabricating **plate girders** built up from steel plates and sections welded together to create the equivalent of a rolled beam.

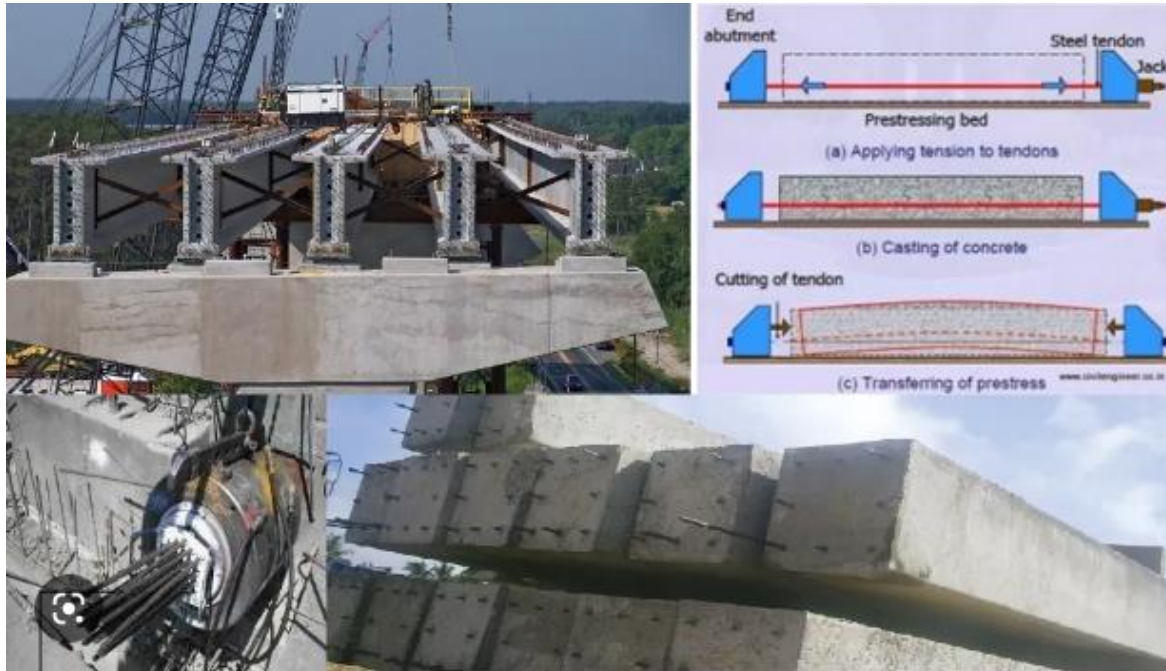


Castellated beams are fabricated by building the web of a wide-flange section with a lengthwise zigzag cut, then welding both halves together at the peaks, thus increasing its without increasing its weight.



C- Concrete Beams

The usage of Conventional reinforced concrete members for a long span is possible, but they become overly large and bulky. As comparison to regular reinforced concrete, **pre-stressed concrete** has more effective, smaller, and lighter cross sections that experience fewer cracks than standard reinforced concrete.



Precast, pre-stressed concrete members are available in standard shapes and sizes. The two most commonly used shapes are the **single-tee** and **double-tee**. Double tees are commonly used for spans up to **21 m** while single tees are used for spans up to **30 m** or more.



Double Tee



Single Tee

References

1. Francis, D K C. Onouye, B. Zuberbuhle, D. 2014. **Building Structures Illustrated. Second Edition, John Wiley & Sons, New Jersey.**
2. Francis, D K C. 2008. **Building Structures Illustrated. Forth Edition, John Wiley & Sons, New Jersey.**