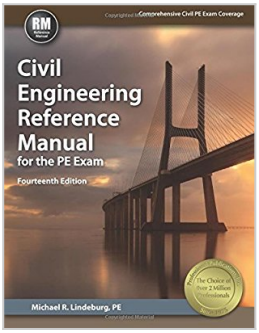

Civil Engineering Reference Manual for the PE Exam, 14th Ed

By Michael R. Lindeburg PE

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- **Transportation:** Traffic Analysis; Geometric Design; Transportation Planning; Traffic Safety
- **Water Resources and Environmental:** Closed Conduit Hydraulics; Open Channel Hydraulics; Hydrology; Groundwater and Well Fields; Wastewater Treatment; Water Quality; Water Treatment; Engineering Economics

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Editorial Review

About the Author

Michael R. Lindeburg, PE, is one of the best-known authors of engineering textbooks and references. His books and courses have influenced millions of engineers around the world. Since 1975, he has authored more than 30 engineering reference and exam preparation books. He has spent thousands of hours teaching engineering to students and practicing engineers. He holds bachelor of science and master of science degrees in industrial engineering from Stanford University.

1. INTRODUCTION
Structural members subjected to axial compressive loads are often called by names identifying their functions. Of these, the best-known are *columns*, the main vertical compression members in a building frame. Other common compression members include *chords* in trusses and *bracing members* in frames.

The selection of a particular shape for use as a compression member depends on the type of structure, the availability, and the connection methods. Load-carrying capacity varies approximately inversely with the slenderness ratio, so stiff members are generally required. Rods, bars, and plates, commonly used as tension members, are too slender to be used as compression members unless they are very short or lightly loaded.

For building columns, *W shapes* having nominal depths of 14 in or less are commonly used. These sections, being rather square in shape, are more efficient than others for carrying compressive loads. (Deeper sections are more efficient as beams.) *Pipe sections* are satisfactory for small or medium loads. Pipes are often used as columns in long series of windows, in warehouses, and in basements and garages. In the past, square and *rectangular tubing* saw limited use, primarily due to the difficulty in making bolted or riveted connections at the ends. Modern welding techniques have essentially eliminated this problem.

Built-up sections are needed in large structures for very heavy loads that cannot be supported by individual rolled shapes. For bracing and compression members in light trusses, single-angle members are suitable. However, *equal-leg angles* may be more economical than unequal-leg angles because their least radius of gyration values are greater for the same area of steel. For *top chord* members of bolted roof trusses, a pair of angles (usually unequal legs, with long legs back-to-back to give a better balance between the radius of gyration values about the x-and y-axes) are used with or without gusset plates. In welded roof trusses, where gusset plates are unnecessary, structural tees are used as top chord members.

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