



# Structural Engineering Overview

**What do structural engineers do?**

**What are the principal technical aspects of structural engineering?**

**Where do structural engineers work?**

**What is special about civil structures?**

**Where does this course fit into the overall curriculum?**

# What do structural engineers do?

- Structural engineers have the responsibility of designing structures and structural components so that they are sufficiently *strong, stiff, stable, and safe* to meet client needs (e.g., sustainable, economical, etc.).
- Structural engineers typically work as part of a team that might include architects, contractors, fabricators, building officials, and numerous other engineering disciplines.
- Note that it is possible (and not uncommon) for the structural engineer to perform his or her job well, but for the structure itself to not succeed.

## What are the principal technical aspects of structural engineering?

- A structural engineer requires both a means to characterize how a given system or component will behave in service (analysis) and an ability to select and configure systems and components to behave well (design).
  - **Loads:** applied externally (e.g., a desk on a floor), or an inherent part of the structure itself (self-weight). They can be static (e.g., gravity), quasi-static (e.g., snow, thermal effects), or dynamic (e.g., wind, earthquakes, and traffic). For the most part, loads drive structural design, but they also are typically known with the least certainty.
  - **Geometry:** spatial location of the material that composes the structure, and the geometry of the environment in which the structure must exist.

- **Supports:** The nature of the interfaces between structural components, including the interaction of the structure and its foundation system.
- **Topology:** The form and connectivities that define the structural system.
- **Materials:** The stuff the structure is composed of, how it behaves mechanically, thermally, acoustically, and chemically.

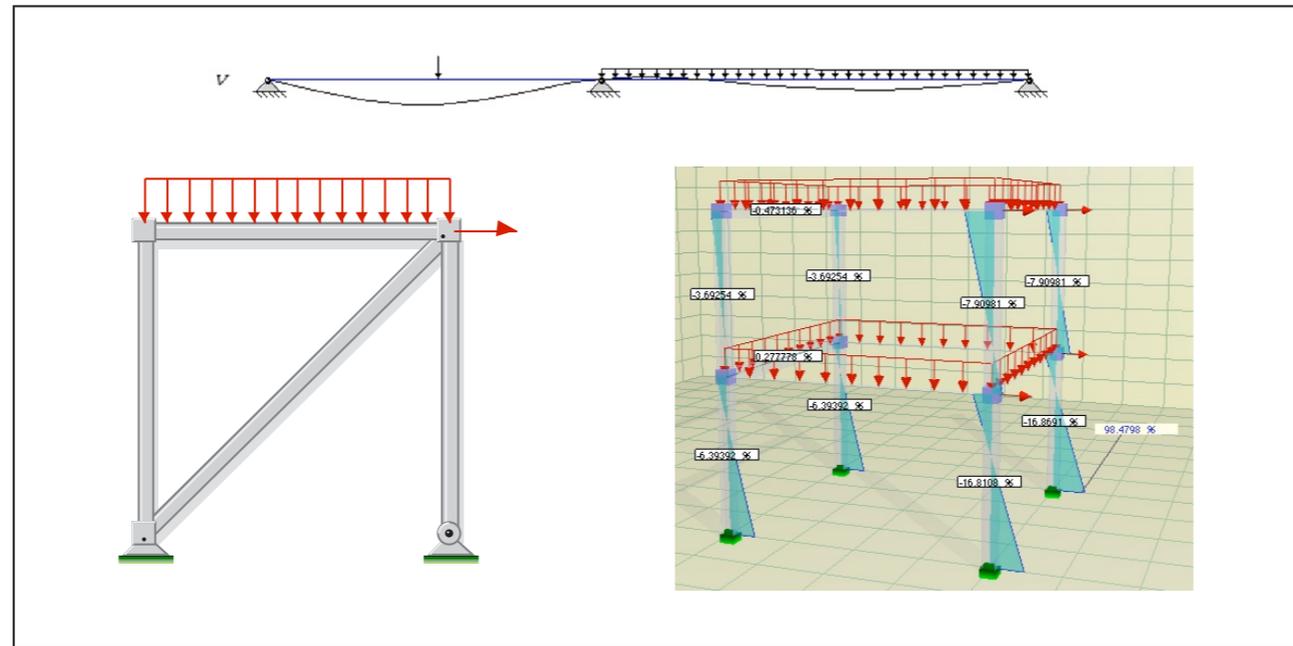
## Where do structural engineers work?

- Structural engineers typically work in a design office setting, but there is usually the opportunity or necessity for field inspection and problem solving.
- Meeting with clients and other design and construction team members is also a big part of the job, and this often includes a certain degree of marketing and sales (the design bidding process often includes a set of formal presentations).
- Depending on the firm one works for, the work itself might be largely local and small scale, or international and large-scale.
- Some firms are relatively large (100+ engineers), many are small (< 10 engineers), and it is not uncommon for structural engineers to work in a firm of one (i.e., to be their own firm).

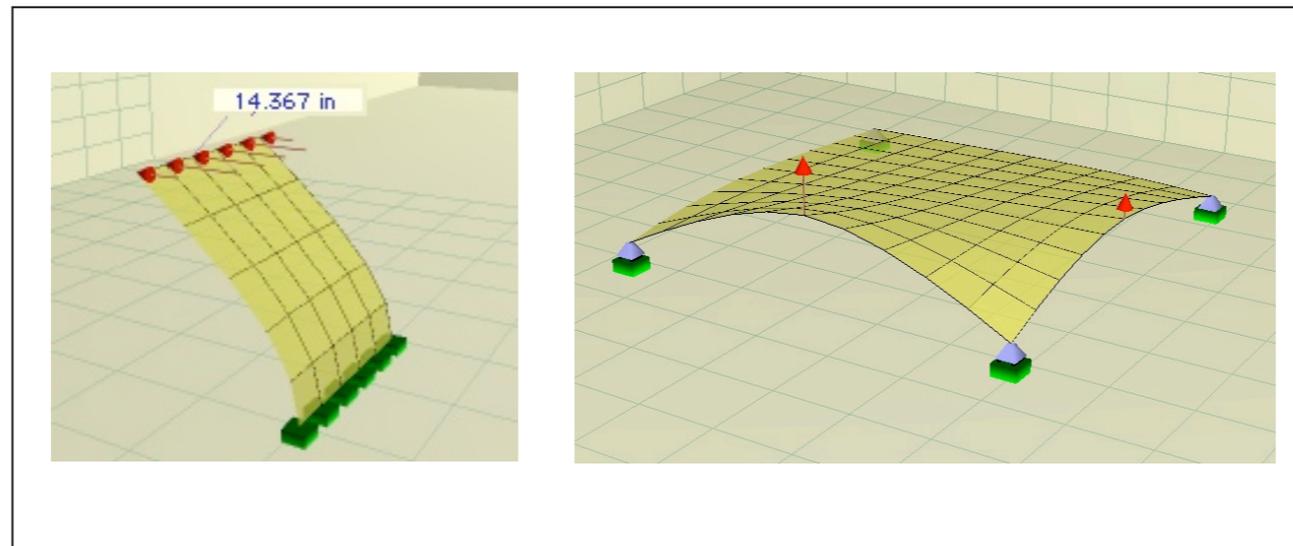
## What is special about civil structures?

- Civil structures share many common features with any designed physical device, be it an automobile fender or an airplane wing, but there are several characteristics of civil structures that are relatively specialized:
  - Civil structures tend to be relatively large in scale.
  - The infrastructure of a civilization normally is designed to last indefinitely, and so there are large time scales, too.
  - The environment must be dealt with on its own terms.
  - The creation of infrastructure has political, social, environmental and cultural implications.
  - There is no prototyping and full-scale testing with civil structures.
  - The ramifications of failures can be very expensive or even catastrophic, causing extreme disruption in people's lives or loss of life itself.

## Line Elements



## Plate/Shell Elements



## Continuum Elements

