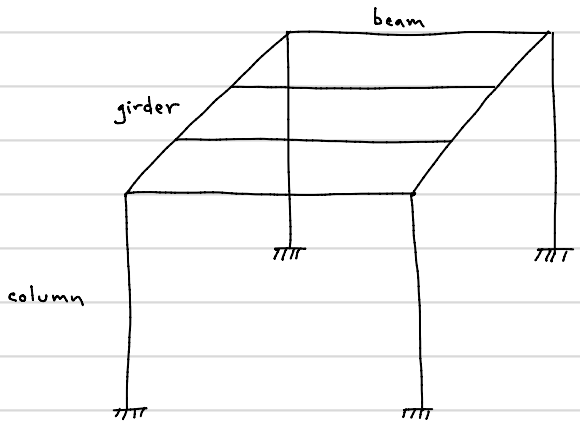
April 21, 2026
"Realistic Structures"
Load Path, Lateral Bracing

Realistic Structures



How do we determine loading on structure?

Types of loading

Dead loads (D): static forces that are relatively constant for an extended time
e.g. self-weight of structural elements, permanently attached equipment

Live loads (L): forces that change over time
e.g. occupancy weight, snow, wind, earthquake
(S) (W) (E)

Loads are "factored" depending on type that is based upon uncertainty and probability of occuring simultaneously

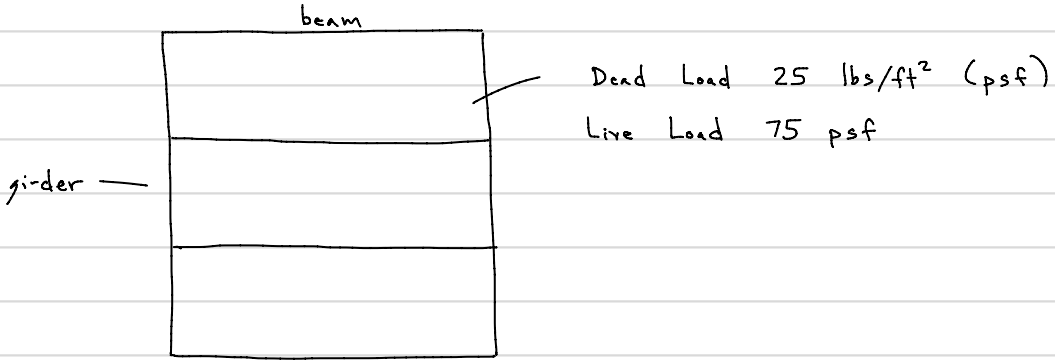
e.g. 1.4 D

1.2D + 1.6L + 0.5S

0.9D + 1.0W Note: +/- W/E direction unknown

many load combinations exist, summarized in ASCE 7-16

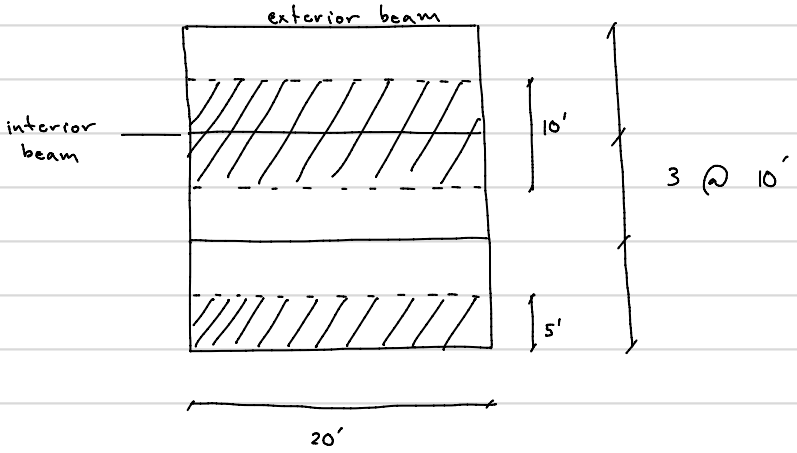
"Minimum Design Loads and Associated Criteria for Buildings and other Structures"

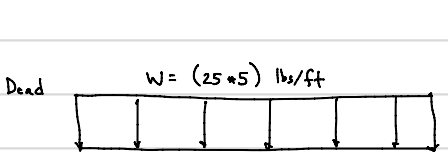


PLAN VIEW

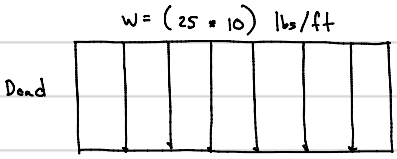
How can we resolve areal loads onto individual structural elements that we can analyze with tools developed in CE 325?

Technique known as "tributary area" (load path)

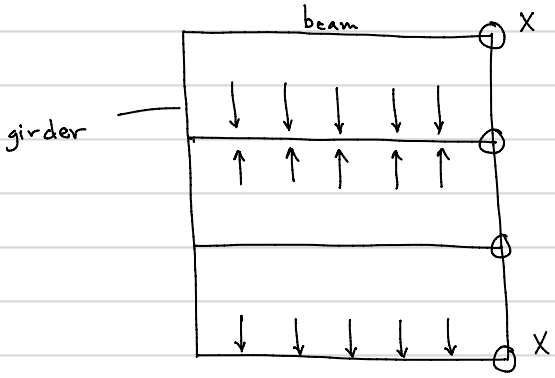




exterior beam



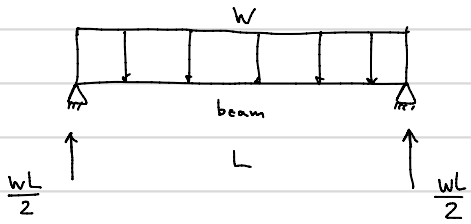
interior beam

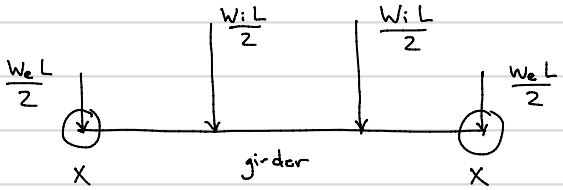


What about loads on girders that beams frame into?

depends on type of connection ...

Let's assume pin connection, i.e. no moment transfer





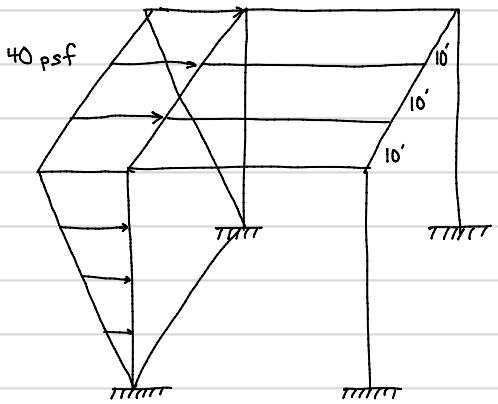
What about column load transfer?

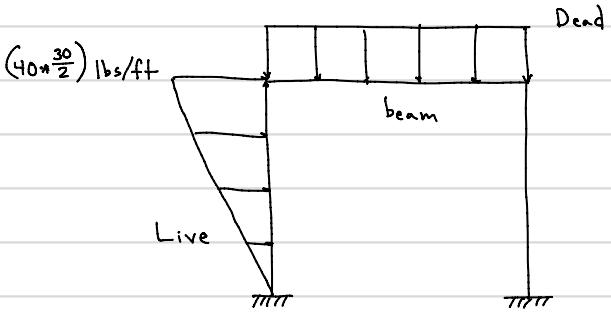
again, depends on connection detail!

* also account for girder self-weight

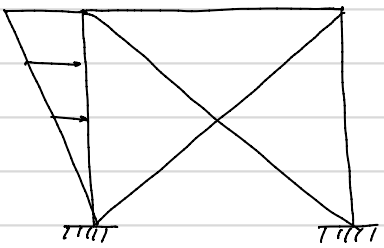
Since we know how to handle 2D Frames we can actually analyze these components

What about lateral forces, e.g. wind?



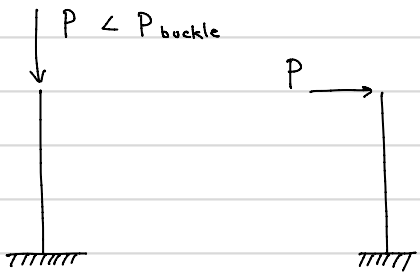


Need to consider wind from any direction .... computers !!

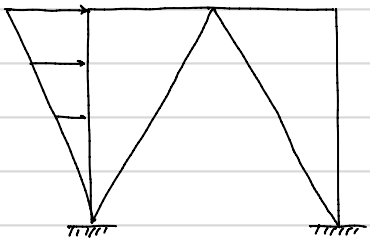


lateral bracing is critical to resist lateral loads

"X" bracing



$\delta_{axial} = \frac{PL}{EA}$ $\delta_{lateral} = \frac{PL^3}{3EI}$



provides midspan support for beam

"chevron" bracing

numerous bracing strategies

(take a closer look at structures you encounter day to day ....)