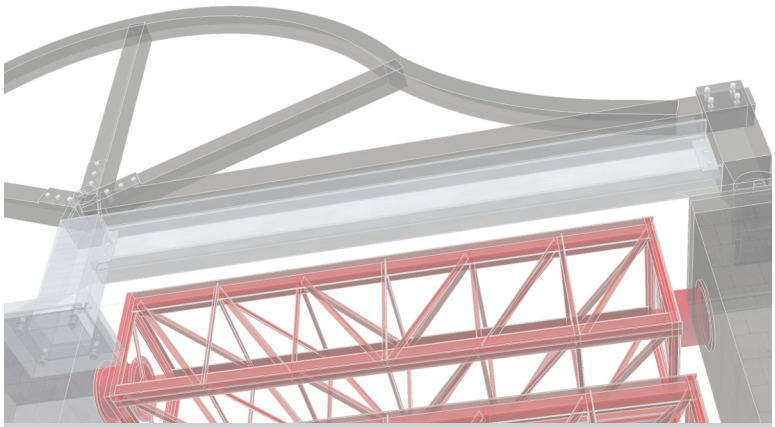
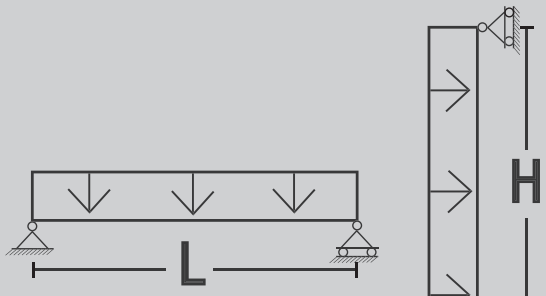
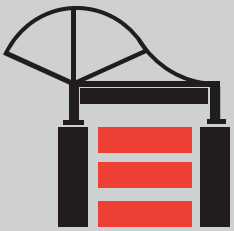


Structural Engineering Design Rules of Thumb

In the early stages of a project, we are often asked how large structural elements will be before we have had a chance to perform the necessary computations. We have found the following rules of thumb to be useful in estimating the approximate depth of a structural member as well as reviewing the reasonableness of a design.

It is important to note, however, that the depth of a member is influenced not only by the span but by such variables as spacing, loads, support conditions, deflections, and clearance requirements, as well. The final member design should be based on computations performed by a licensed structural engineer.





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Structural Element	Structural Depth
CONCRETE	
Hollow Core Floor Slab	L / 30 to L / 40
Hollow Core Roof Slab	L / 40 to L / 50
Prestressed Floor Tee	L / 25 to L / 35
Prestressed Roof Tee	L / 35 to L / 40
Prestressed Beam	L / 10 to L / 20
Posttension Beam	L / 21
Posttension Girder	L / 15
Posttension Joist	L / 36
Posttension Two-Way Slab	L / 40
Two-Way Slab	Slab Perimeter / 180
Flat Slab w/ Drop Panels	L / 33
Stair Slab	L / 26
One-Way Slab - Simple Supt.	L / 20
One-Way Slab - One End Cont.	L / 24
One-Way Slab - Both Ends Cont.	L / 28
One-Way Slab - Cantilever	L / 10
Beam/Joist - Simple Supt.	L / 16
Beam/Joist - One End Cont.	L / 18.5
Beam/Joist - Both Ends Cont.	L / 21
Beam/Joist - Cantilever	L / 8
Girder	L / 11
Tilt-Up Floor Slab	5” Min.
Tilt-Up Wall Panel	H / 48
Column	H / 14
First Floor Column	H / 10
MASONRY	
Wall w/ Nominal Reinforcing	H / 20
Wall w/ Heavy Reinforcing	H / 30
STEEL	
Floor Beam/Joist	L / 20
Floor Beam - Vibrating Machinery or Track Support	L / 16
Composite Floor Beam	L / 22
Roof Beam/Joist	L / 24
Joist Girder	L / 12
Truss	L / 12
Space Frame	L / 12 to L / 20
Girts	L / 60
WOOD	
Nominal Joist	L / 24
Nominal Scissor Truss	3:12 Diff. Between Top & Bot. Chord or Bot. Chord Pitch 1/2 of Top Chord Pitch
Nominal Flat Truss	L / 14
Timber Bowstring Truss	L / 6 to L / 8
Timber Gable Truss	L / 6 Min.
Timber Flat Truss	L / 8 to L / 10

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ALLOWABLE BEARING CAPACITY (ISOLATED SPREAD FOOTINGS)

Cohesionless Soils (Sands & Gravels)

Granular Type	Standard Penetration Test - "N" (blows/ft)	Allowable Soil Bearing Pressure (psf)	Friction Angle (deg)
Very Loose	< 4	< 1,600	< 30
Loose	4 - 10	1,600 - 4,000	30 - 32
Medium	10 - 30	4,000 - 12,000	32 - 36
Dense	30 - 50	12,000 - 20,000	36 - 42
Very Dense	> 50	> 20,000	> 42

Cohesive Soils (Clays)

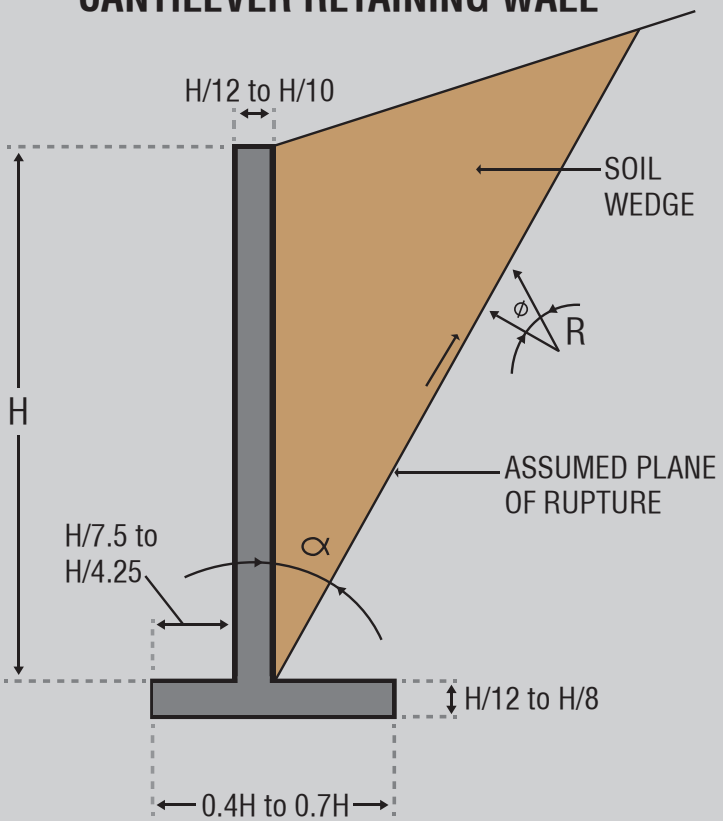
Clay Soil Consistency	Unconfined Compressive Strength (tsf)	Undrained Shear Stength (psf)	Allowable Soil Bearing Pressure (psf)
Very Soft	< 0.25	< 250	< 540
Soft	0.25 - 0.5	250 - 500	540 - 1,100
Medium	0.5 - 1.0	500 - 1,000	1,100 - 2,700
Stiff	1.0 - 2.0	1,000 - 2,000	2,700 - 6,000
Very Stiff	2.0 - 4.0	2,000 - 4,000	6,000 - 12,000
Hard	> 4.0	> 4,000	> 12,000

SLABS ON GROUND

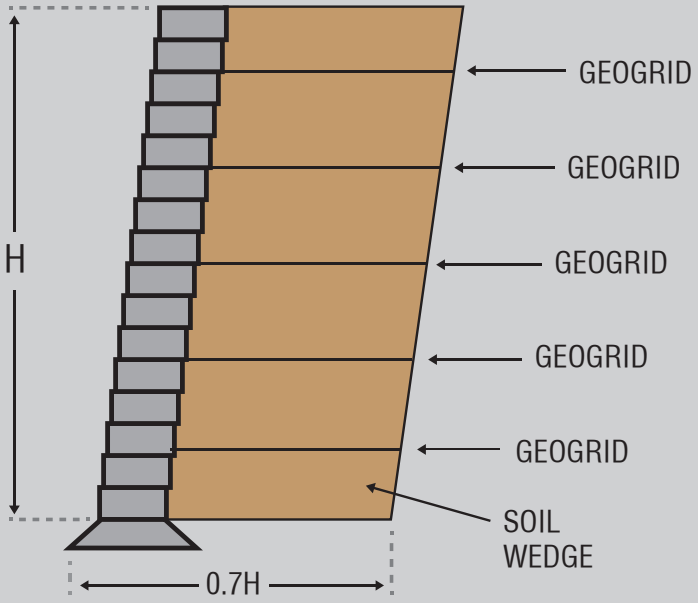
Occupancy	Min. Slab Thickness
Domestic or Light Commercial (loaded less than 100 psf)	4"
Commerical-Institutional-Barns (loaded 100-200 psf)	5"
Industrial (loaded at most 400-500 psf) and pavements for industrial plants, gas stations, and garages	6"
Industrial (loaded 600-800 psf) and heavy pavements for industrial plants, gas stations, and garages	7"
Industrial (loaded 1500 psf)	8"
Industrial (loaded 2500 psf)	9"
Industrial (loaded 3000-3500 psf)	10"

Geo-Structural Design

CANTILEVER RETAINING WALL



SEGMENTAL RETAINING WALL WITH GEOGRID



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