STRUCTURAL ENGINEERING BASICS

STRUCTURAL ENGINEERING BASICS

Tips for Architects

STRUCTURAL ENGINEERING BASICS

Reinforcing Floor/Roof Structures

- Change in occupancy →
  Office to Storage Space
- Change in Load Path
- Heavy Equipment
- Openings/Depressions
- Snow Buildup
- Reinforcing is labour intensive, material is often fairly inexpensive

STRUCTURAL ENGINEERING BASICS

Reinforcing Floor/Roof Structures

- Challenges with existing structures
→ Unknowns
→ existing services/conditions
→ connections different than what was shown on drawings
→ there aren't always as builts

STRUCTURAL ENGINEERING BASICS

Reinforcing Floor/Roof Structures

STRUCTURAL ENGINEERING BASICS

Reinforcing Floor/Roof Structures

- Steel Beams
- Steel Joists → designed to 99% capacity
- Concrete beams
- Floor slabs
- Hollowcore Slabs
- Wood Beams/Joists

STRUCTURAL ENGINEERING BASICS

Reinforcing Floor/Roof Structures

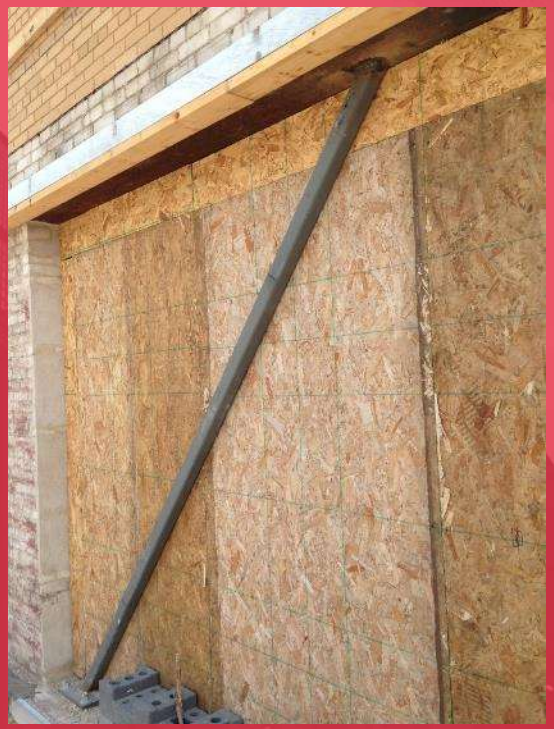
STRUCTURAL ENGINEERING BASICS

Reinforcing Walls/Columns

- New Openings in Walls
- Modified Openings
- Lateral Load Path Altered?

STRUCTURAL ENGINEERING BASICS

Reinforcing Walls/Columns



STRUCTURAL ENGINEERING BASICS

Reinforcing Walls/Columns

- Concrete and Masonry Walls
→ Need to reinforce each side of wall to transfer load to roof/floor structure above and below

- Wood and Steel Stud Walls
→ Less invasive

STRUCTURAL ENGINEERING BASICS

Reinforcing Walls/Columns

STRUCTURAL ENGINEERING BASICS

Reinforcing Foundations

- Underpinning
- Footing Extensions

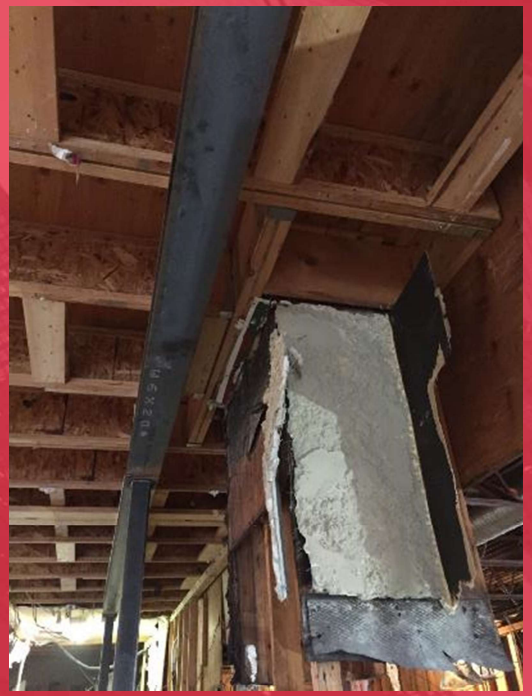
STRUCTURAL ENGINEERING BASICS

Column/Bearing Wall Removal

- Need to create new load path
- Foundations may increase
- Adjacent Columns may need reinforcing
- New supporting beams may cause headroom issues

STRUCTURAL ENGINEERING BASICS

Column/Bearing Wall Removal



STRUCTURAL ENGINEERING BASICS

Girt Requirements

- Walls can only span a certain height → Girts used to laterally support top of wall
- Architectural finishes require vertical support →brick veneer or stud wall
- Often HSS for steel frames structures

STRUCTURAL ENGINEERING BASICS

Girt Requirements

STRUCTURAL ENGINEERING BASICS

Partition Walls

- Non-Load Bearing → Requirement for Slip Tracks
- Heavier gauges for taller walls or exterior walls exposed to high wind pressures

STRUCTURAL ENGINEERING BASICS

Partition Walls

- Folding Partitions
→ Hung from structure above
→ Strict deflection criteria
→ Braces required for stabilty
→ Stacking end framing

STRUCTURAL ENGINEERING BASICS

Brick Veneer

- Weight is much higher than other cladding
- Support angles and loose-angle-lintels
- Connection to the structural elements → spacers and bracing

STRUCTURAL ENGINEERING BASICS

Brick Veneer

STRUCTURAL ENGINEERING BASICS

Beam Requirements

- Deeper beams are often the most economical option
- Shallower beams are going to be heavier and wider (more reinforcing for concrete beam)
- Masonry beams are in increments of 8 inches
- Concrete beams can be used for any dimension/shape

STRUCTURAL ENGINEERING BASICS

Shear Walls/Cross Bracing

- Ensure there are enough segments of wall to resist lateral loads
- Moment frames are possible but are costly and can have bulky connections → Pilasters at base
- Steel studs framing into cross brace means larger members

STRUCTURAL ENGINEERING BASICS

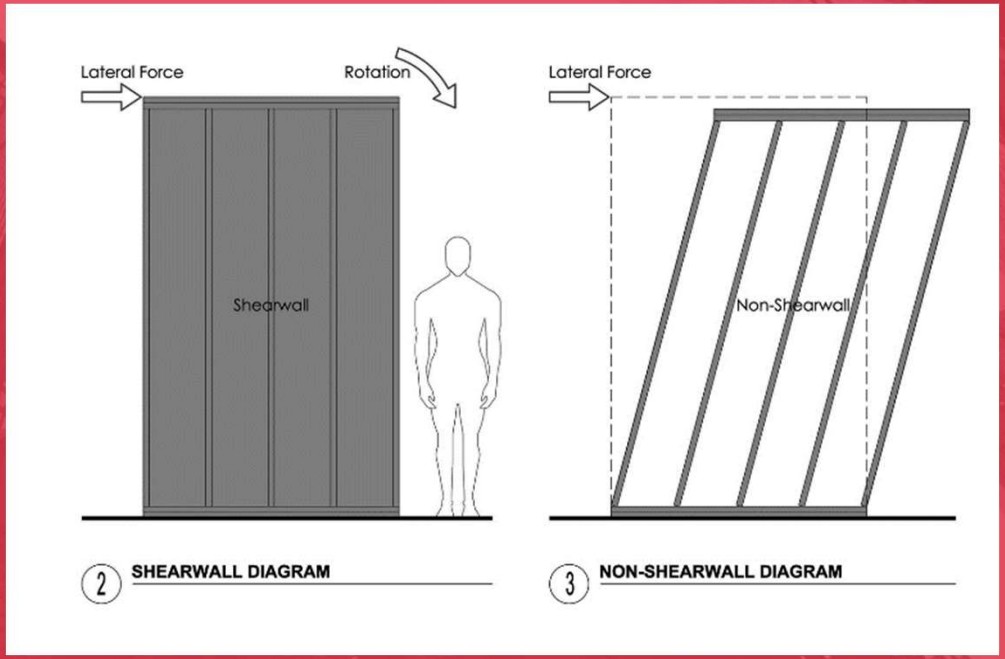
Shear Walls/Cross Bracing

Shear Walls/Cross Bracing

- For wood walls, plywood may be required on both sides
- Drywall has limited capacity for shear walls
- Ideal wall length is 1/3 of wall height or longer

STRUCTURAL ENGINEERING BASICS

Shear Walls/Cross Bracing



STRUCTURAL ENGINEERING BASICS

Shear Walls/Cross Bracing

- Discontinuing bearing walls or shear walls in tall buildings leads to a large transfer of load to a different part of the building
→ Results in large bulky elements at the transfer floor location
→ Non-typical framing and connection details
- Can use concrete walls as transfer beams if there are no openings

STRUCTURAL ENGINEERING
BASICS

Building Shape

- More straight lines means less foundation requirements → piles/footings required at most corners
- More different roof heights the more beams/connections required → more snow buildup zones → difficult connection details
- limits to parapet heights → steel reinforcing can be required (connection at base governs)