

Structural Concrete Structures

Reinforced Concrete Construction

Reinforced Concrete Construction

- Formwork
 - Flat surfaces (element bottom: slabs, beams)
 - Vertical Surfaces (element sides: walls, beams, columns)
- Reinforcing bar cage fabrication
 - Placing bars and tying
- Concrete fabrication and placing
 - Bucket placing
 - Pumping

Wall Formwork



Slab Formwork



Slab Formwork



Footing Reinforcing Cage



Finished Wall Footing



Slab Reinforcement



Concrete Truck and Pump





Concrete Pump



Wall Construction



Concrete Pumping







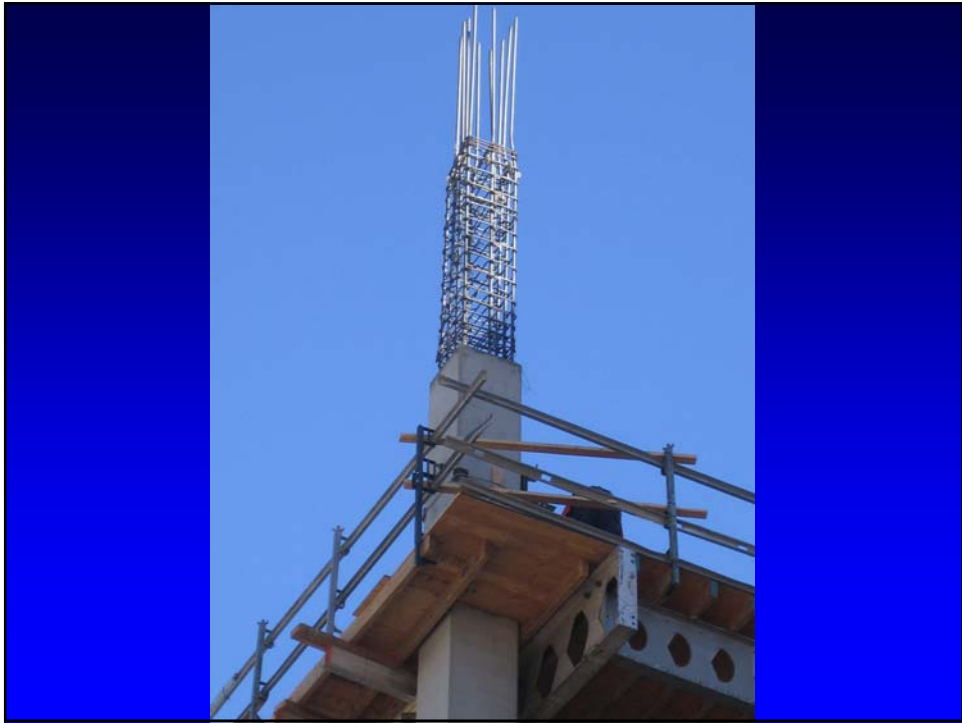
Concrete
Building:
San Francisco,
CA



Concrete Building:
Phoenix, AZ

Post-tensioned
slabs
Reinforced
concrete shear
walls







Bridges



Rigid Frames – Overpass



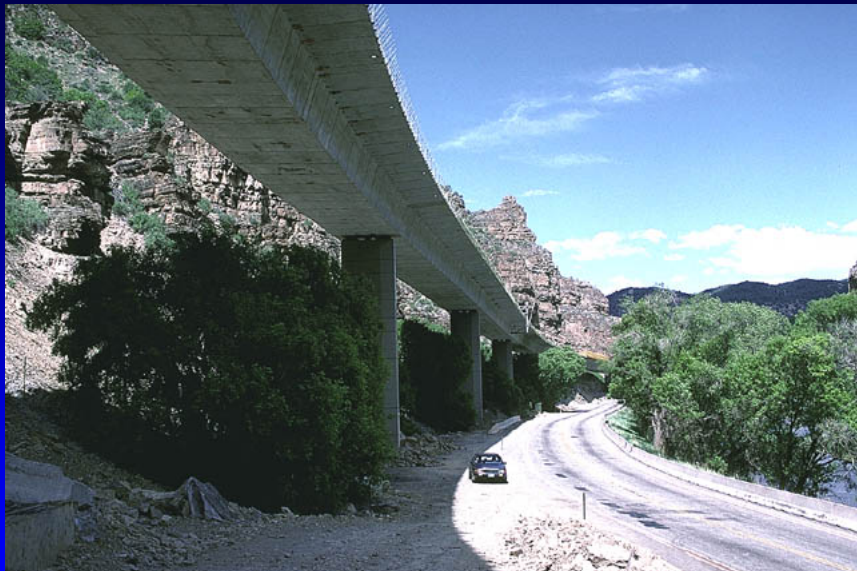
Slab and Beam Bridge



Bridge Frames Supporting Precast Concrete
and Steel Beams



Flat Slab-Column Bridge



Box Girder Bridge



Post-Tensioned Segmental Bridge (I-70, Colorado)



Interior of Box Girder



Cantilever Bridge – Variable Cross-Section



Arch Bridges: Natchez Trace Parkway



Salginatobel, Austria



Salginatobel Bridge



Selah Creek, Yakima, Washington

Twin fixed concrete arch highway bridges.
Heavy arch ribs designed to resist axial force and bending.
Columns and deck not designed to resist longitudinal bending (very flexible).



Twin fixed concrete arches (supported on rock).

Bending stiffness of arch and deck are comparable indicating deck is relied upon for longitudinal flexural moment.

Gotteron Bridge, Fribourg, Switzerland



Concrete Arch, Austria



Alex Fraser Bridge – Cable-Stay Construction



Alex Fraser Bridge

Location: Annacis, British Columbia, Canada (Fraser River)
Construction duration: 1983-1986
Main span: steel deck/reinforced concrete slab; 465 m (1540 ft); Total Length 930 m
Pylons: reinforced concrete, height 153.8 m
Volumes: concrete: 80,000 m³; reinforcing steel: 11,600T; prestressing steel 800 T



Normandy Bridge

Location: Seine River (Le Havre, France)
Construction duration: 1988-1994 (Opened Jan. 20, 1995); \$465 M
Approaches: prestressed concrete
Main Span: steel and prestressed concrete; 856 m (2810 ft); Total Length 2141 m
Pylons: reinforced concrete, height 215 m
Volumes: concrete: 80,000 m³; reinforcing steel: 11,600T; prestressing steel 800 T

Roofs



Folded Plate, Las Vegas



Barrel Shells, Oakland Airport



Cantilever Shell



Hyperbolic-Paraboloid (Hypar) Roof, Berkeley



Thin Shell Dome



Y-Shaped Precast Roof Beams



Variable Section Precast Members



Double-Tee Precast
Roof Beams

Buildings



Interaction Between Frames and Walls



Marina Towers, Chicago



Year built: 1964
Structural system: Reinforced concrete
Concrete shear wall core
No. stories: 60 (bottom 18 parking)

Marina City
Chicago, IL



Year built: 1990
Structural system: Reinforced concrete
No. stories: 65
Height: 292 m (960 ft)

311 South Wacker Dr.
Chicago, IL



Deep Beam (Transfer Girder), Chicago



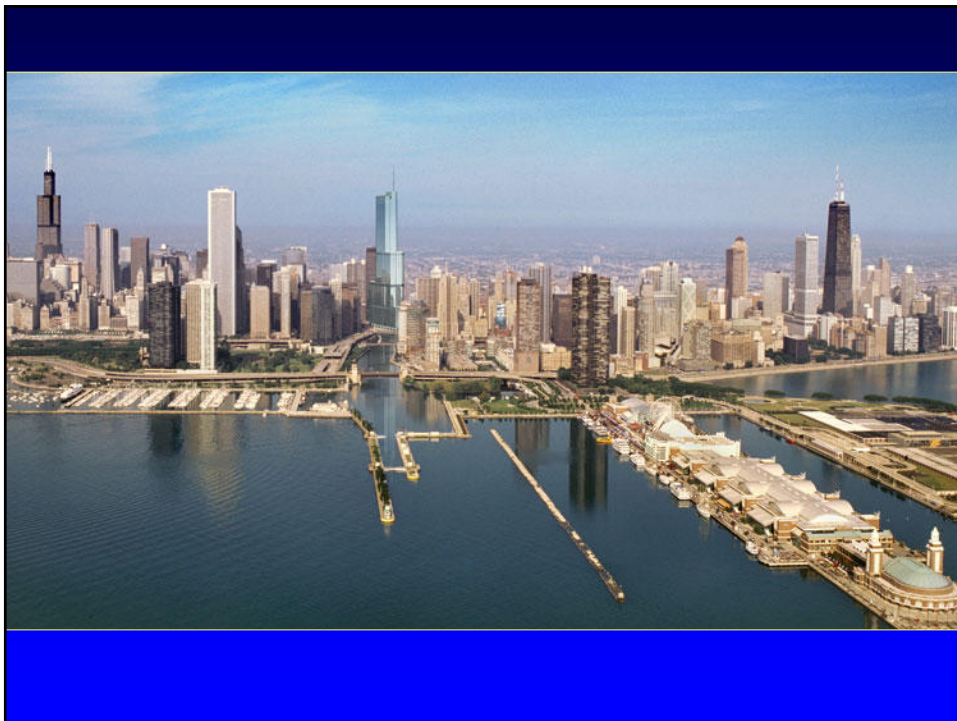
Year built: 1998
Structural system: Steel,
Reinforced concrete
The world's tallest building (tip of
spire) – 452 m (1483 ft)

Petronas Towers
Kuala Lumpur, Malaysia



Completion: 2008
Structural system: Steel,
Reinforced concrete
92 stories – 415 m (1362 ft)

Trump International Hotel & Tower
Chicago, IL



Other Structures



Year built: 1976
Structural system: Reinforced concrete
The world's tallest freestanding structure at time of construction

CN Tower
Toronto, Canada



Year built: 1931-1936
Structural system: Concrete arch-gravity dam
Length: and 1,244 ft (379 m)
Height: 726 ft (221 m)
Concrete volume: 3.25 M cu yd

Hoover Dam
Black Canyon, Nevada

Concrete Structures at UMass



Campus Center



Graduate Research Center



Agricultural Engineering



Tobin Hall







