

ARCHITECTURAL STRUCTURES I:  
STATICS AND STRENGTH OF MATERIALS

ENDS 231

DR. ANNE NICHOLS

SPRING 2008

lecture  
twenty eight



the semester  
and beyond

Review 1  
Lecture 28

Architectural Structures I  
ENDS 231

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DESIGN CRITERIA	Light frame timber	Heavy-frame timber	Masonry bearing wall	Steel frame (hinge connections)	Steel frame (rigid connections)	Steel open-web joists	Steel space frame	Steel decking	Site-cast concrete: one-way slab	Site-cast concrete: two-way plate	Site-cast concrete: two-way slab	Site-cast concrete: waffle slab	Pre-cast concrete: solid slab	Pre-cast concrete: hollow-core slab	Pre-cast concrete: single tee	Pre-cast concrete: double tee	RATIONALE
Exposed, fire-resistant construction																	Inherently fire-resistive construction
Irregular building form																	Simple, site-fabricated systems
Irregular column placement																	Systems without beams in roof or floors
Minimize floor thickness																	Precast-concrete systems without ribs
Allow for future renovations																	Short-span, one-way, easily modified
Permit construction in poor weather																	Quickly erected; avoid site-cast concrete
Minimize off-site fabrication time																	Easily formed or built on site
Minimize on-site erection time																	Highly prefabricated; modular components
Minimize low-rise construction time																	Lightweight, easily formed or prefabricated
Minimize medium-rise construction time																	Precast, site-cast concrete; steel frames
Minimize high-rise construction time																	Strong; prefabricated; lightweight
Minimize shear walls or diagonal bracing																	Capable of forming rigid joints
Minimize dead load on foundations																	Lightweight, short-span systems
Minimize damage due to foundation settlement																	Systems without rigid joints
Minimize the number of separate trades on job																	Multipurpose components
Provide concealed space for mech. services																	Systems that inherently provide voids
Minimize the number of supports																	Two-way, long-span systems
Long spans																	Long-span systems

Review 2  
Lecture 28

Architectural Structures I  
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Office Hours

	Professor Anne Nichols (845-6540)				
	Spring 2008				
	April 30 (Wednesday)	May 1 (Thursday)	May 2 (Friday)	May 5 (Monday)	May 6 (Tuesday)
8 am					
9 am					
10 am	office hours	office hours	office hours	office hours	office hours
11 am					
12 pm					
1 pm			office hours	exam	exam
2 pm					
3 pm				office hours	
4 pm			exam		

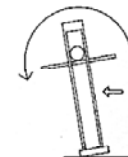
Supervision 2  
Lecture 28

Architectural Structures III  
ARCH 631

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Structural Design Criteria

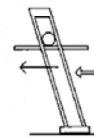
- components stay together
  - resist sliding
  - resist overturning
  - resist twisting and distortion
- internal stability
  - interconnectedness
- strength & stiffness



Overturning: wind or earthquake



Twisting



Lateral racking

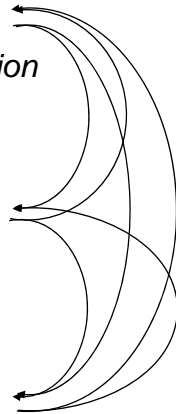
Review 3  
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# Structural Design Sequences

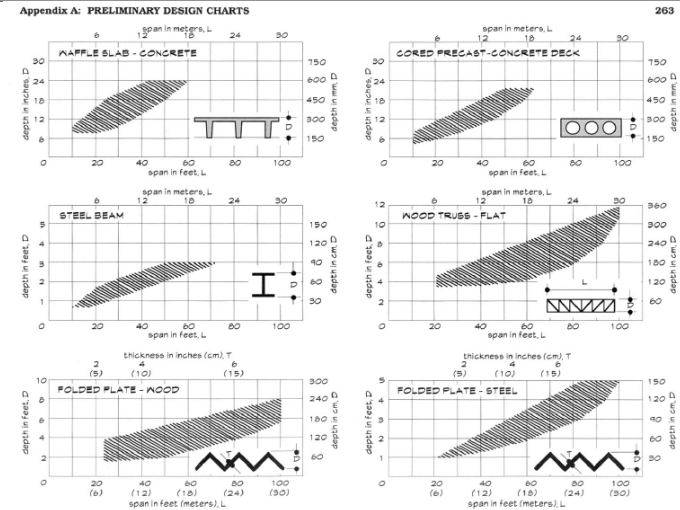
- *first-order design*
  - structural type and organization
  - design intent
  - contextual or programmatic
- *second-order*
  - structural strategies
  - material choice
  - structural systems
- *third-order*
  - member shaping & sizing



# Final Exam Material

- *my list:*
  - equilibrium -  $\Sigma F$  &  $\Sigma M$ 
    - supports, trusses, cables, beams, pinned frames
  - materials
    - strain & stress ( $E$ ), temperature, constraints
  - beams
    - distributed loads, tributary width,  $V$ & $M$ , stresses, design, section properties ( $I$  &  $S$ ), pitch, deflection

# Component Design Guides



# Final Exam Material

- *my list (cont'd):*
  - columns
    - stresses, design, section properties ( $I$  &  $r$ )
  - frames
    - $P$ ,  $V$  &  $M$ ,  $P$ - $\Delta$ , connection design, tension member design
  - design
    - ASD
    - LRFD
    - wood peculiarities