Good Evening

LOGISTICS

October 3 Class will be held October 2.

October 3, all students are strongly adviced to attend the “Turner Prize” Event at the National Building Museum. Tickets are $10, payable to me... now, or as soon as possible.

Who will have a problem getting there? I can carpool 3 people from Baltimore; other folks should talk among yourselves to arrange transportation.

BOOKS

You should all have the textbook and the exercise book by now. No more scanning and posting on the internet, except for special material.

* * *

CHAPTER ONE: Building Code

I understand that for many of us the first exposure to building code analysis is a bit traumatic, like being asked to do brain surgery when given only a pair of chopsticks. Don’t worry, it feels that way for everybody.

Don’t be too intent right now about *memorizing* the code or its requirements. In fact, there are only two ways to put these things in one’s head: rote memorization and repeated exposure. And folks who can simply memorize pages of numerical data like this usually become rocket scientists, not architects.<g>

Only through repeated exercises with the code will you (slowly, like everyone) get the hang of it.

In lieu of remembering *everything* right away, at least try to familiarize yourself with The Process. In fact, the code itself is a guide to itself. If you are aware that *for every project you have to go through the motions systematically*, you are already more than half-way to “understanding” the code.

We’ll get to an encore review of last session’s exercise in a moment. But I want to review the major concepts of what one should keep in mind with respect to Building Code:

OCCUPANCY GROUPS

CONSTRUCTION TYPES

FIRE RESISTANCE RATINGS

AREA / HEIGHT LIMITATIONS

REQUIRED EGRESS

ACCESS STANDARDS

If you understand that all buildings must be conceived from the perspective of these categories, and that a code review for each building will need to touch upon the interrelationships of each of these, you will understand that you will need to systematically work through the code to satisfy the requirements defined by the facts of the building.

EXERCISE 1.1 REVIEW

* * *

CHAPTER 2 FOUNDATIONS

So let's put the Code aside and let's talk about something really exciting: *Foundations*.

FOUNDATION LOADS

Dead Load
Live Load
Wind Load
Lateral soil/water pressure
Seismic Loads

A Foundation must not fail;
A Foundation must remain in place
(no or controlled settlement);
A Foundation must be technically and economically feasible; a foundation must be practical to build, and must not affect surrounding areas.

FOUNDATION SETTLEMENT

Uniform Settlement
Differential Settlement

Differential settlement is the most typical sturctural failure associated with building foundations.

SOILS

ROCK
SOIL (Particulate Matter)
- Boulders
- Cobble
- Gravel
- Sand
- Silt
- Clay
- Peat/Organic Matter

Soils can be cohesive or cohesionless (frictional); excavation geometry will differ accordingly.

Most sites have ground conditions which are arranged into Strata, in which different soils occur at various depths, usually statified vertically. But sometimes ground conditions vary horizontally.

SUBSURFACE EXPLORATION AND TESTING

CONSIDERATIONS FOR SUSTAINABILITY (CHART)

EXCAVATION

TO PLACE FOOTINGS (FROST LINE)
TO INTRODUCE PROGRAMMED SPACE
TO PREPARE THE GROUND PLANE

Different soil conditions require different techincal approaches to excavation: blasting, ripping, hammering, digging, bull-dozing...

SLOPED SUPPORT

SHEETING (WOOD, METAL, CONCRETE)
REQUIREMENTS FOR BRACING AND TIE-BACK:
Cross-lot bracing;
Rakers (diagonal bracing);
Tie-back to a soil anchor;

The book also mentions these two techniques:

SLURRY WALL & SOIL MIXING (I've never seen these.)

* * *

Once you've dug out a big hole in the ground, you've effectively created a big, reverse bathtub, in which the water is on the *outside* of the vessel, wanting to get in. Much of what we do as architects is to try keep the water out, but you'll find that it comes as much from below as from above.

DEWATERING

Sumps
Well points (to affect water table)
Barrier (A real bathtub)

Barriers can extend down to water-impermeable soil, much like a caisson, or they can extend both down and under the foundation structure, like a real bathtub.

* * *

FOUNDATIONS

With respect to the ground plan, a building has three components: Superstructure
Substructure
Foundation.

A foundation is the physical element which transfers a building's loads to the soil.

Shallow Foundations (footings, slabs-on-grade)
Appropriate when the upper strata is sound;

Deep Foundations (piles, caissons)
Appropriate when the upper strata is undependable.

* * *

Shallow Foundations: Column Footing, Wall Footing, Floating Foundation.
Deep Foundations: Caisson, Socketed Caisson, End-bearing Pile, Friction Pile.

Piles and Pile Caps; Grade Beams;

Pile Driving; Pile Materials; Piles Piles Piles.

* * *

SEISMIC BASE ISOLATION: Shock Absorbers for Buildings.

UNDERPINNING: Remedial intervention for an existing building.

* * *

RETAINING WALLS
Failure types: Overturning, Sliding (shear), Undermining

Each of these failure modes correspond to constructional solutions for retaining walls: Cantelever (asymetrical footing), keyed footing, and tie-back.

Additional Approach: Earth Reinforcing. (The book mentions “geotextiles”. What is a geotextile?)

* * *

WATER-PROOFING: Drainage and barriers.
DAMP-PROOFING: Light-duty to resist non-pressure infiltra.

Typical Foundation Assembly: (inside out) Wall, waterproofing membrane, drainage mat, protection board, soil...
Don’t forget the drainage piping at the base of the assembly!

TYPES OF MEMBRANES:

bituminous (asphaltic), plastic, synthetic rubber;
sheet-applied or liquid applied;
clay-based (bentonite);
miscellaneous cementitious/ plaster-based coatings,
sometimes known as parging... light-duty

SHALLOW FROST-PROTECTED FOUNDATIONS

(Not used in typical practice.) But it does raise the question about why we do put our footings as deep as they are. What is the danger of “frost” to foundations?

UP-DOWN CONSTRUCTION (never seen it).

* * *

DESIGNING FOUNDATIONS

Foundation design often drives much of the logistical issues surrounding buildng constructability and cost. Foundation challenges may even determine the type of superstructure due to trade-offs concerning dead load and construction speed. The book cites these “thresholds” which significantly change the cost impact of your design decisions:

Building below the Water Table;
Building Close to an Existing Structure;
Increasing Building Load beyond what can be handled
by shallow foundations;

In certain regions deep foundations are a given; otherwise, in most places the rationale is to “keep it cheap.”

In-class discussion review: Exercise 2.1, #1 & 2.

In-class student exercise: Exercise 2.1, #3.

In-class discussion review: Exercise 2.2, #1, 2, 3.

In-class student exercise: Exercise 2.2, #3.

In class discussion review: Exercise 2.2, # 4

Home-work assignment: Exercise 2.2, #5.