The Judicious Section:
Integrator of Construction Technology

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THE JUDICIOUS SECTION

The building section makes visible the unity of the architectural concept; it is judgment itself. It integrates structure, enclosure, environmental controls, energy efficiency and resource use as related to the total design process of a building. This course allows students to explore the ways in which the various elements of a building come together to make the whole entity that we call Architecture. It provides an opportunity to analyze and postulate solutions to concerns of qualities of human occupation, to the concerns of how Architecture can enrich our daily lives, and how resources can be conserved in the making of the building and its ongoing operation.

The final assignment presented in this essay pulls together the many topics addressed in the yearlong Construction Technology course. It addresses the design of a framed concrete or steel structural system, heavyweight or lightweight cladding, a deep basement, and the climatic and other controls needed for human comfort. The assignment also seeks to integrate the topics addressed in the Environmental Controls course and Structures course.

METHOD OF STUDY

The lecture course covers the basic topics of framed structures, heavy and lightweight enclosure systems, demolition, temporary support work, deep foundations, deep basements and their drainage systems, metals, composite materials, an overall review of emerging technologies and hybrid structural systems and a final lecture on appropriate technologies for developing countries.

Three preliminary assignments are used to inform the final project where a 1/2" to 1'-0 scale sectional model is used as a vehicle to develop a holistic view of the design and construction process.

The first preliminary assignment requires individual students to make a thin strip model at 1/2" scale of an assigned, steel or concrete, column and floor system. For the concrete floor system the whole range of possible alternative beam and slab, rib and band-beam, flat slab and "mushroom" columns etc. is explored in model form with structural depths sized and related to attitudes of any HVAC or other systems appropriate to the design approach.

The second assignment involves the preparation of fragment sketch proposals related to possible enclosure systems and their relationship to the structural system at one or other of the outer edges and at "roof-level".

The third assignment studies the temporary support system for excavating the basement, the retaining wall and sub-floor drainage system for the basement with an assumed water table condition and an assumed foundation system for the columns and retaining wall. These studies are done in 1/2" scale sectional drawings.

For the main and final project, students work in groups of three or four and each group produces a 1/2" scale design1 construction drawing of a building of their own design which has a basement of approximately 12'-0" floor-to-ceiling depth, a street level (or ground level) floor of 12'-0" to 14'-0" floor-to-ceiling height, and two upper floors of approximately 12'-0" to 14'-0 floor-to-ceiling height. The top most floor has a roof above it so the "ceiling" form can be of a non-horizontal shape, with skylights, light-scoops or other systems for taking light or ventilation through the roof. The structure can be of reinforced concrete or structural steel of a 27'-0" central span with a 9'-0 cantilever extension at each end. The enclosing skin for the walls and the roof must accommodate the needs of the occupants and moderate the climatic conditions of the region and latitude chosen for the building. Individual student groups determine the specific use of the building.

TYPOLOGICAL OPTIONS

There are two climatic settings offered.

1. 40° North, *which is the approximate latitude of Philadelphia, Indianapolis, Denver, Salt Lake City, Mendocino in California, Lisbon, Rome, Ankara, Bakau, Beijing and* Akita *in Japan.*

2. *34 South, which is the approximate latitude of Montevideo,* Cape Town, *Adelaide, Melbourne and Auckland.*

Each latitude and geographic position has a different climate varying from hot and humid, hot and dry, cold and wet, and cold and dry, across the yearly seasons. The student groups choose a latitude, location and climate for which climatic data is available, and they begin to design a building profile that responds to the following:

1. Optimize the use of the sun's heat and light, while controlling them carefully.
2. Control heat gain and loss effectively.
3. Optimize systems of natural ventilation.
4. Give good and varied views to the outside world.
5. Acknowledge the phases of daily, weekly and seasonal use.
6. Reduce energy costs for artificial heating, ventilation and cooling as much as possible.
7. Take care in how material resources are used.
8. Understand how local craft skills and traditions may influence the design.

SUBMISSION OF THE FINAL/ MAIN ASSIGNMENT

The final/ main assignment is conducted in the three phases.

Phase A A preliminary 1/2" section drawing is submitted, one per student group

Phase B **A** revised 1/2" section drawing is submitted

Phase C These 1/2" section drawings are converted into a 3-1/3" deep section model, which are set in set in the pre-constructed wooden bases.

EVOLUTION OF THE JUDICIOUS SECTION APPROACH

The work of the students in the Fall 1997 Construction Technology class illustrated in this paper is part of an evolving study system developed by the University of Pennsylvania over the last eight years. Early studies involved the building of shallow strip-sections through a designed building skin. (Figure 1) Later sectional studies used the same 27'-0" center-span with 9'-0" cantilevers, but used a depth into the model of 6'-0', 18'-0' span and 6"-0" so as to establish an understanding of the depth continuity of the structural, enclosure and service systems. (Figure2, 3) These studies proved to be excessive in time commitment so were scaled back to the current study system as illustrated in Figures 4, 5, 6, 7, and 8.

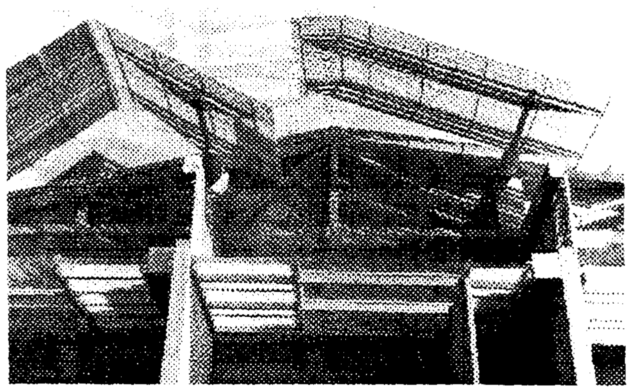

Fig. 1. Shallow strip section model.

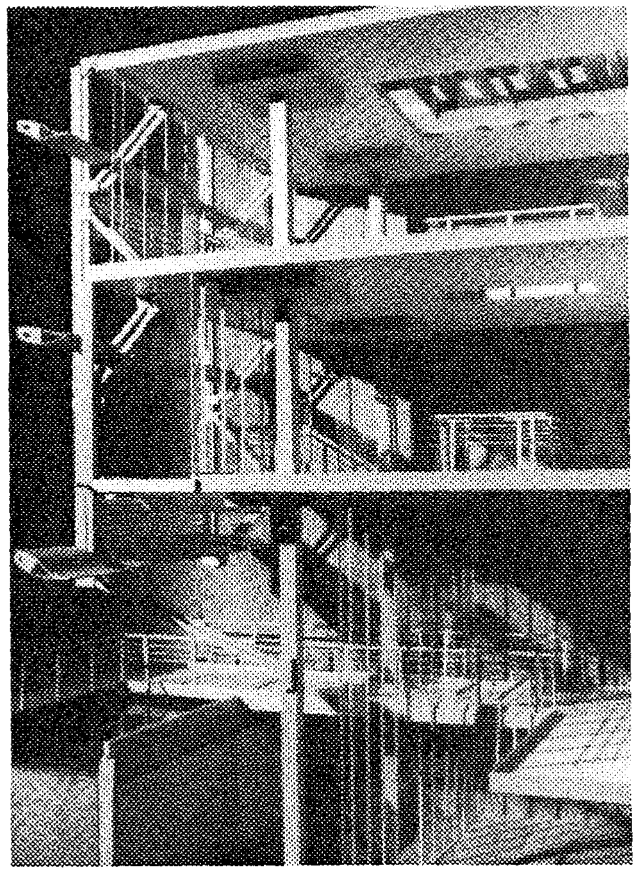

Fig. 2. Deep section model.

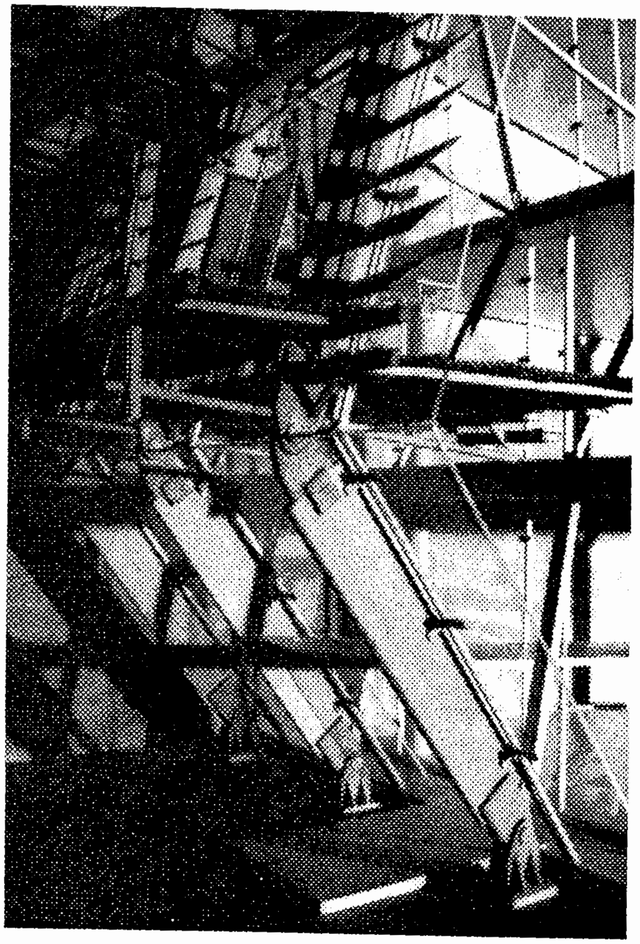

Fig. 3. Deep section model.

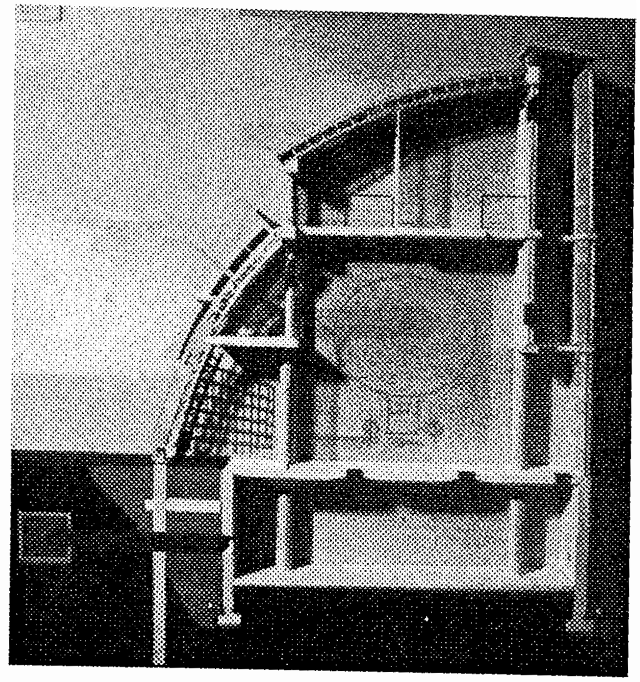

Fig. 5. Group section projects, Spring 1997.

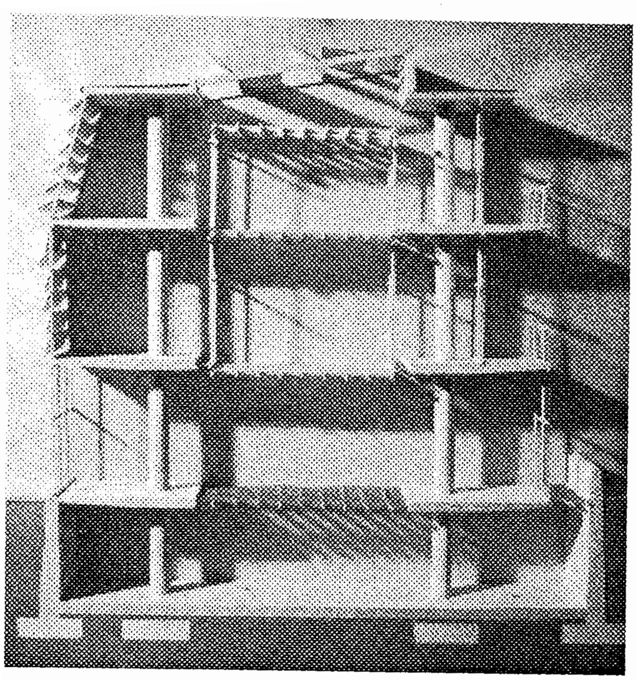

Fig. 4. Croup section projects, Spring 1997.

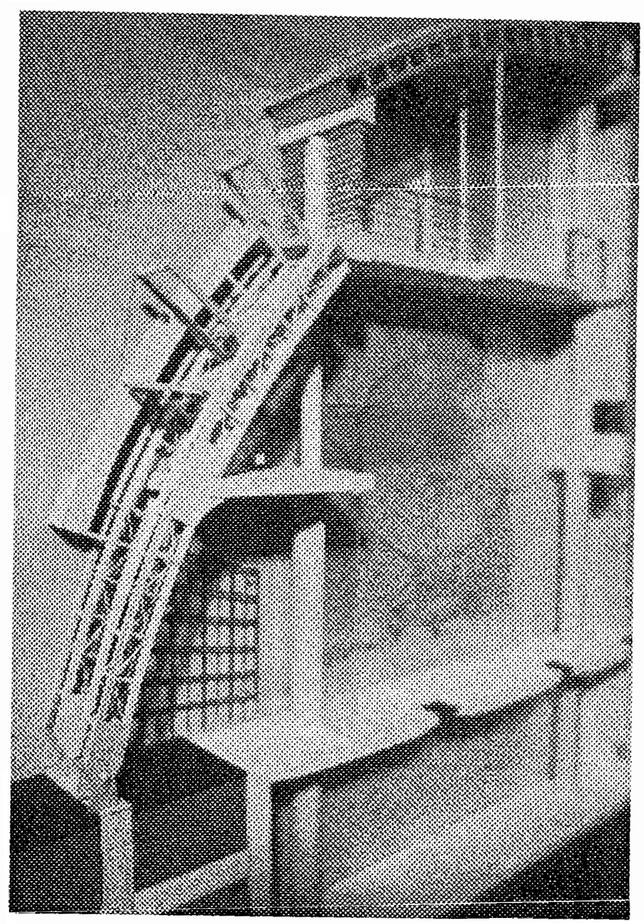

Fig. 6. Group section projects, Spring 1997.

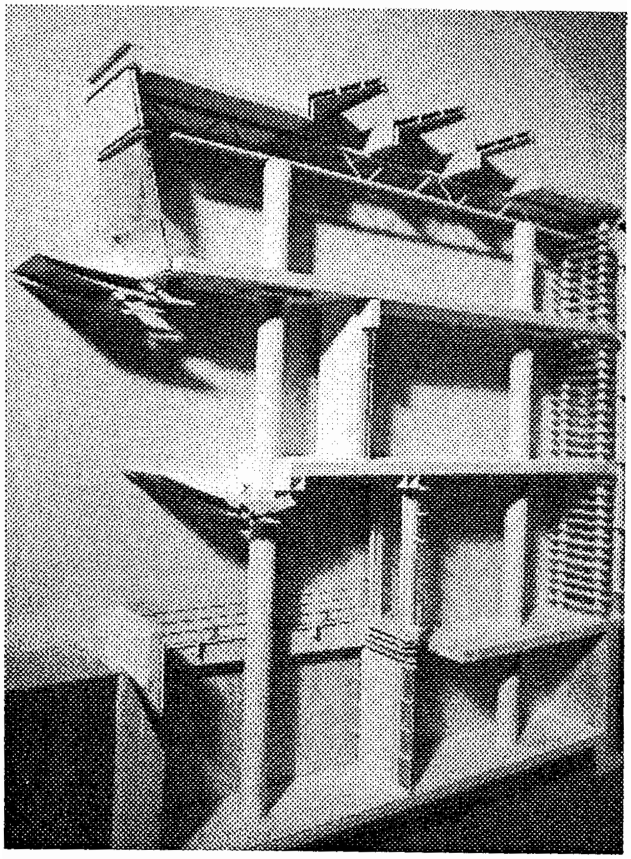

Fig. 7. Group section projects, Spring 1997.

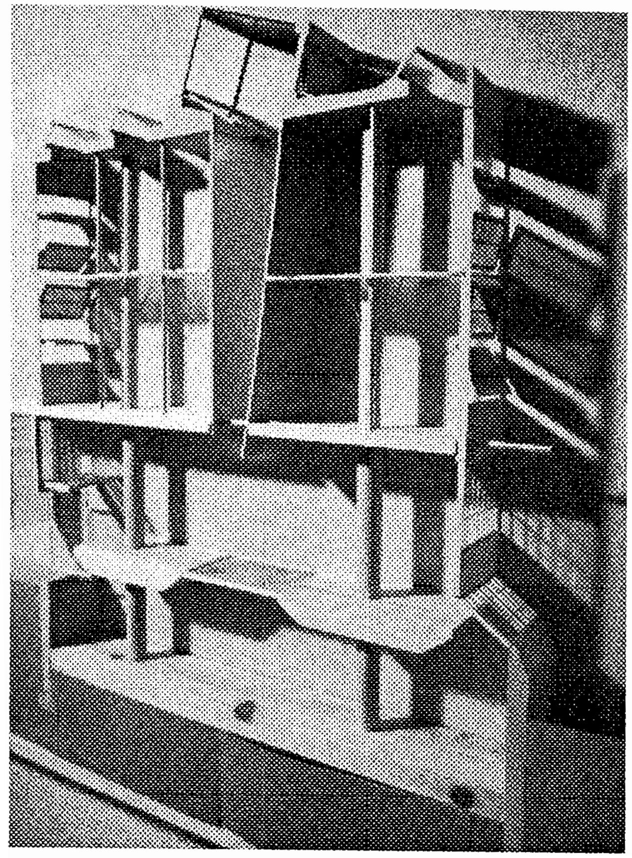

Fig. 8 Group section projects, Spring 1997.