

## ARCH 611L Seminar, 4 Units:

# Advanced Building Systems Integration

Prerequisite: Departmental approval, ARCH 211, 213a and 213b, 215, 313, 315, 411, or equivalent  
Course management web site: Blackboard 6.1 <http://totale.usc.edu>



## Synopsis:

### Building Fabric

- Structural Systems
- Enclosure Systems
- Interior Systems

### Technical Installation

- HVAC Systems
- Lighting Systems
- Connectivity Systems
- Control Systems

This seminar reflects a "project-based learning" educational approach of "Design Process Development and Building Systems Integration" for interdisciplinary teams between architects and engineers. The seminar is delineating the full range of performance mandates required for today's architecture, including building integrity in the sustainable urban system.

The course is focusing on macro and micro considerations of the whole building design process and highlights the state-of-the-art, and major innovations in building technologies for structure, enclosure and material systems, hybrid systems, flexible infrastructures of mechanical, lighting, connectivity and control systems. The course will explore real world relationships, opportunities, and conflicts of the performance mandates, and the integration of building systems necessary to achieve total building performance.

The course will also re-evaluate and update the basic design, construction, and building systems integration methods that have constrained the building industry throughout its history. Today, we look also at the automobile, shipbuilding, and aerospace industries to learn how to incorporate collective intelligence and effective production structures.

Through this course, students should be able to bring leadership to multi-disciplinary design and engineering processes.

## Seminar Structure

The teaching/learning will be supported by lectures, based on **international case studies** (using plans, sections, details, diagrams, simulations, total performance evaluations), seminar handouts, Web-based resources, construction site visits, team investigations and discussions. The lectures provide the conceptual framework for the course and will also be supplemented with assigned readings and building systems integration project studies. Students are recommended to complete all the assigned readings on time so that questions which may arise can be discussed/presented in-depth. The format for the lectures includes digital multimedia presentations, slides, and video. All course data will be organized in the CSI Master format – the US industry standard for materials, constructions and building systems. The usage of the digital blackboard course system will support the individual research on building systems integration and material data.

### **Course Website**

Updated information of the seminar can always be found on the course website. All lectures will be posted on the course web site after the presentation as pdf-files. Students are encouraged to visit and make use of the website to support their research and learning. <http://totale.usc.edu>

**Readings: All lectures with links will be posted on the course web site: <http://totale.usc.edu>**

### **Field Trips:**

Throughout the semester we will attempt to visit several construction sites together with students from Arch 511 (Building Systems) of the Department of Civil Engineering to conduct research studies and hands-on explorations. All joint-fieldtrips will fall outside of scheduled class time to include Saturdays. We will do our best to announce and schedule these fieldtrips to fit your schedule during the week and provide you as much time as possible to make the necessary arrangements.

### **Assignments and Grading:**

The total grade for this course will be based on attendance, 3 class assignments (including the mid-term presentation), and three obligatory field case study trips with a written summary report, a written building system integration project report and a final power point presentation on the last day of the course (12/29/2004).

10%	Attendance
30%	Three Class Assignments
10%	Midterm Presentation (of one of the 3 class assignments)
10%	One Field Trip Summary Report
40%	Final Building System Integration Project Report

### **Final Building System Integration Project Report:**

There will be one individual project to be completed over the course and it will comprise forty (40) percent of the final course grade. The purpose of the project is to provide students with an opportunity to apply the knowledge to real world problems. The projects will also provide a chance for students to strengthen their general systems integration thinking, organizational, and written communication skills. Additional information about the nature and scope of the project will be provided over the course.

### **Students with Disabilities:**

Any student requesting academic accommodations based upon a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. Your letter must be specific as to the nature of the accommodations granted. DSP is located in STU 301 and is open from 8:30 am to 5:00 pm, Monday through Friday. The telephone number for DSP is (213) 740-0776.

### **Academic Integrity:**

The University, as an instrument of learning, is predicated on the existence of an element of integrity. As members of the academic community, faculty, students and administrative officials share the responsibility for maintaining this environment. Faculty have the primary responsibility for establishing and maintaining an atmosphere and attitude of academic integrity such that the learning environment may flourish in an open and honest manner. Students share this responsibility for maintaining standards of academic performance and classroom behavior conducive to the learning process. Administrative officials are responsible for the establishment and maintenance of procedures to support and enforce those academic standards. Thus, the entire University community bears the responsibility for maintaining an environment of integrity and for taking the appropriate action to sanction individuals involved in a violation. When there is a clear indication that any individual is unwilling or unable to support these standards, the individual should not be allowed to remain at the University.

<b>Class</b>			
<b>Schedule:</b>			
<b>Week Day</b>	<b>Course Topics</b>	<b>Seminar Lectures, Case Study Trips, Discussions and Readings</b>	<b>Assignments</b> <b>See also</b> <b>Course</b> <b>Web page</b>
<b>1</b> 08/23/04	<b>First Day: Introduction</b>	Introduction to climate, cultural, social and technological pre-building factors for the intended occupancy determining resource-based construction and building systems, materials and technical installations	
<b>1</b> 08/28/04	<b>Field Trip</b> (approximate)	L.A. - Case Study Trip: High-performance building systems with students from the Department of Engineering	
<b>2</b> 08/30/04	<b>Pre-Building Factors</b>	<b>Pre-Building Factors (Input Criteria) profile of the existing site conditions, and user requirements</b>  <b>Sustainable Sites:</b> Land use, Regulatory Constraints, Zoning codes, Occupancy, Infrastructure Systems	<b>Assignment 01</b>
<b>3</b> 09/06/04	<b>University Holiday</b>	<b>Flows, Circulation, Energy Use Estimation</b> Input criteria and consumption requirements for the intended occupancy determining resource-based construction and building systems, materials and technical installations	
<b>4</b> 09/13/04	<b>Occupancy types</b>		
<b>5</b> 09/20/04	<b>Building Fabric:</b> Structural Systems Enclosure Systems Material Systems	<b>Structural Systems and Dynamics</b> —form the initial response to the environment. The Synergy of Structural Elements, Horizontal Framing, Vertical/Lateral Framing, Foundations, Vertical Load Bearing Envelope, Non-vertical Load Bearing Envelope, Curtain Wall, etc.	<b>Assignment 02</b>
<b>6</b> 09/27/04	<b>Building Fabric:</b> High-Performance Hybrid Façade Systems	<b>Measurement and Verifications (Int'l Comparison U.S.A. and E.U.)</b> Standards: Visual Quality, Thermal Quality, Acoustic Quality, Indoor Air Quality, Spatial Quality & Ergonomics, Energy Performance and Conservation,	
<b>7</b> 10/04/04	<b>Building Fabric:</b> Interior Systems, Plug-And-Play-Systems		
<b>8</b> 10/11/04	<b>Technical Installation:</b> HVAC Systems Building Integrated	<b>Integrative Design Strategy</b> Building Systems Integration transforms the input criteria and consumption requirements into <b>the final design and engineering</b> of building systems, design features, and technical systems that reduce load in the overall design.	
<b>8</b> 10/23/04	<b>Field Trip</b> (approximate)	L A - Case Study Trip with students from the Department of Engineering	
<b>9</b> 10/18/04 Mid-term	<b>Mid-term Presentation</b>	<b>Individual</b> <b>Mid-term Presentations (Assignments!)</b>	

**10**  
10/25/04 HVAC Systems Façade  
Integrated as Hybrid Systems

**11**  
11/01/04 Lighting Systems:  
Visual Performance:  
Daylight vs. Electric Light

**12**  
11/08/04 Connectivity Systems  
Control Systems

11/13/04 **Field Trip**  
(approximate)

**13**  
11/15/04 Building Delivery Process,  
Building Service, Operation and  
Maintenance, Monitoring

**14**  
11/22/04 Life-Cycle Costs of Buildings,  
Change of Use, Demolition,  
Re-use, Recycling

**15**  
11/29/04 **Final presentation**

**Energy sources - Ascending Energy Strategy:**  
Understanding Design Features, Building Systems,  
Equipment, and Consumption Patterns to Create Load  
Reduction In Design Before Energy Source Selection

**Passive and Active Building Energy Concepts**  
Examples of Non-Renewable and Renewable Sources,  
HVAC and CHP Systems, Fuel Cells, Solar Thermal  
and PV application, etc.

**Flexible Infrastructures**, Plug-and-Play-Technology,  
Communication and Control Systems,

L.A. - Case Study Trip with students from the  
Department of Engineering

**Building System Commissioning**  
(Reduced Consumption, Resource Flow and  
Building Utilization Costs Management, Monitoring,)

**International Building Standard Comparisons**  
Life expectancy, Life span of Building Structures,  
Systems, and Components (ISO, SIA D0123, EU-DIN,  
IEMB 1998, BREAM, US-LEED, etc.)

**Final Building System  
Integration Project Report**

**Assignment 03**

## **References and Readings:**

There is no specific required textbook for this course. However, there are many competitive useful books, detail manuals and general documents that are used for the lectures and assignments.

For your own intellectual development you should endeavor to become familiar with as many of these books as possible in the next years. The following are reference books and documents useful for the students in this course. Additional reference sources on the course topics will be provided over the course. Students may also find other information and Internet resources on the course website. Additional references and materials on the course topics will be provided over the course.

### **Basic US Books/Manuals**

Francis D.K. Ching and Cassandra Adams. In: Building Construction Illustrated, 2000

Francis D.K. Ching. In: A Visional Dictionary of Architecture, 2002

Edward Allen. In: Fundamentals of Building Construction: Materials and Methods by, 2002

Francis D.K. Ching and Steven R. Winkel. In: Building Code Illustrated – A Guide to Understanding the International Building Code:

Allen, Edward. In: Fundamentals of Building Construction: Materials and Methods;

Stephen Kieran, James Timberlake. In: Refabricating Architecture – How Manufacturing Methodologies are praised to Transform Building Construction, McGraw-Hill, 2004

Richard D. Rush. In: The Building Systems Integration Handbook by American Institute of Architects, 1986

Ben Stein, John S. Reynolds. In: Mechanical and Electrical Equipment for Buildings, 9th Edition,

### **Advanced International Books/ Manuals with more detailed measurements from the European Union, mostly from Germany**

Klaus Daniels. In: The Technology of Ecological Building: Basic Principles and Measures, Birkhauser Basel-Boston-Berlin, 2000

Klaus Daniels. In: Advanced Building Systems: A Technical Guide for Architects and Engineers, Birkhauser Basel-Boston-Berlin, 2002

#### **More Birkhauser Edition Detail Books, Munich**



In Detail: Steel Construction Manual by Helmut C. Schulitz, Werner Sobek, Karl J. Habermann, 2000

In Detail: Concrete Construction Manual by Kaunston, Barkauskas, Polo, Friedbert Kind-Barkauskas, Bruno Kauhsen, Jorg Brandt, 2002

In Detail: Masonry Construction Manual by Gunter Pfeifer, 2001

In Detail: Glass Construction Manual by Christian Schittich, Gerald Staib, Dieter Balkow, Matthias Schuler, Werner Sobek, 2001

In Detail: Building Skins: Concepts, Layers, Materials by Christian Schittich, 2001

In Detail: Roof Construction Manual by Schunck, Oster, Barthel, Kiessl, 2003

In Detail: Timber Construction Manual by Julius Natterer, Thomas Herzog, Roland Schweitzer, Michael Volz, Wolfgang Winter, completely revised, edition 2003

Johann Eisele Ellen Kloft. In: High-Rise Manual, Typology and Design, Construction and Technology, Birkhauser Basel-Boston-Berlin, 2003

Ken Yeang. In: The green skyscraper – the basis for designing sustainable intensive buildings, Prestel Publishing House, Munich (Germany)- London-New York, 1999

Ken Yeang. In: The skyscraper bioclimatically reconsidered, Wiley-Academy, 1996

Norbert Lechner. In: Heating, Cooling, Lighting - Design Methods for Architects, Second Edition, John-Whiley-Sons, Inc., Boston-Weinheim-New York-Chicester-Singapore, 2002

Oesterle-Lieb-Lutz-Heusler. In: Double-Skin Facades – Integrated Planning, Building Physics, Construction, Airophysics, Air-Conditioning, Economic Viability, Prestel publishing house Munich-London-new York, 2003