



## Syllabus

### **CEE241: Managing Fabrication and Construction**

Tuesday, Thursday: 8:00 to 9:50 AM

CIFE iRoom: Y2E2, 292A&E

**Instructor:** Martin Fischer, Y2E2, 297, e-mail: [fischer@stanford.edu](mailto:fischer@stanford.edu)

**Teaching Assistant:** Maria Brilaki, e-mail: [mbrilaki@stanford.edu](mailto:mbrilaki@stanford.edu)

#### **Class Summary**

Sustainable building projects require the selection of the best possible building systems that are then produced and built in the most productive way achievable. This does not happen by accident, but only by the integrated design and management of the project's product, organization, and process. This class will teach you how to set up and use model-based project and production management methods to manage the scope, schedule, and cost of projects.

The class is project-based: teams with three students will study the pros and cons of DCHGlobal's innovative building system (see pictures and information below) for new markets. At the end of the quarter, each team will make a recommendation about the value of the DCHGlobal building system to a specific market. This recommendation will need to be supported by a thorough analysis of the project with an integrated 3D-schedule-cost model.

#### **DCHGlobal: An innovative company**

As mentioned above, deploying sustainable building projects globally requires innovative building systems and production and project management methods. DCHGlobal<sup>1</sup> has developed such a system. Through "learning by doing," you will immediately apply knowledge about project and production management to real-world case studies of DCHGlobal buildings. In doing so, you will not only learn project management concepts and methods, but also gain hands-on experience with integrated 3D-schedule-cost models with one of three suites of industry-leading software tools: Autodesk, VICO Software, or TEKLA (with support by BDS VirCon).

#### **Elements of learning:**

You will learn through:

1. Class lectures and discussions including accomplished and successful guests from industry.
2. Tutorial and example project: Through a series of tutorials and assignments, each of you will create an integrated 3D-schedule-cost model of a 21'x 21' DCHGlobal Schoolhouse.
3. Final project: In groups of three, you will create the integrated 3D-schedule-cost model of a residential DCHGlobal building to enable your analysis of the pros and cons of the DCHGlobal system in a new market.

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<sup>1</sup> DCHGlobal is a subsidiary of Optima. Optima has developed, designed and built some of the most striking urban and suburban luxury residential communities in Chicago and Phoenix. DCHGlobal is an innovative company launching a flexible prefabricated steel system and very quick erection times.

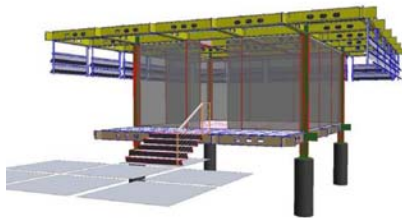


1 to 4-month construction schedules for 1,000 - 5,000 s.f. residences

Pre-fabricated architectural, structural and mechanical building system with flexibility and scalability

### Tutorial: Schoolhouse

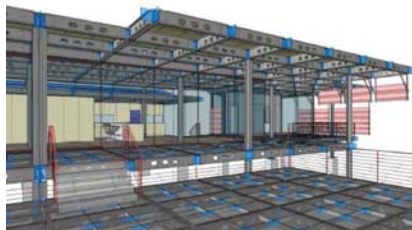
441 s.f. constructed by 1 crew in 80 hours



- provided with design, model components loaded with unit cost and productivity rates
- assemble components into a building model
- develop cost estimate
- create schedule & 4D model
- perform design/schedule/estimate what-if's
- compare with conventional method

### Final Project: Residence

1,800-3,200 s.f. Townhouse / House



- 3 students per team; about 10+ teams in total
- each team focuses on a particular project, with a particular technology platform, and a specific market
- perform same steps as schoolhouse tutorial
- come up with models, estimates, schedules and case studies
- insights for vendors, CIFE and optima/dch global

## Course Schedule

Date	Topics	Assignment Schedule	Assignment Description (Duration)
9/22	<p><b>Lecture 1:</b> Introduction to</p> <ol style="list-style-type: none"> <li>1) Course objectives and process</li> <li>2) Project management challenges for the 21<sup>st</sup> century</li> <li>3) The DCH Global building production system and digital warehouse, including an example building, cost, and production schedule</li> <li>4) Introduce software platforms available</li> </ol> <p>Instructors: Martin Fischer, David Hovey Jr., Calvin Kam</p>	<p><b>Assignment 1:</b> (individual): Assigned</p>	<p><b>Assignment 1:</b> (2 Days – 10 questions)</p> <ol style="list-style-type: none"> <li>1) Answer questions about the industry / prefabrication / standardization / mass production</li> <li>2) Answer questions about the DCH Global system</li> <li>3) Answer preliminary questions about software platforms</li> <li>4) Research software options</li> <li>5) Sign up for vendor preference online (to be activated at 9:00 PM 9/22)</li> </ol>
9/24	<p><b>Lab 1:</b> Understanding the application of the integrated scope-schedule-cost model using the tutorial and DCH Global digital warehouse.</p> <ol style="list-style-type: none"> <li>1) Individual students do tutorial with specific software vendor support</li> </ol> <p>Instructor: Maria Brilaki, Software Vendors</p>	<p><b>Assignment 1:</b> Due <b>Assignment 2</b> <b>(individual):</b> Assigned</p>	<p><b>Assignment 2:</b> (5 Days – 18 questions )</p> <ol style="list-style-type: none"> <li>1) Complete the DCH Global SCH-441 tutorial</li> <li>2) Answer questions about the DCH Global system</li> <li>3) Answer questions about the software suite</li> <li>4) Sign up for student teams including project and identify target market comparable project</li> </ol>
9/29	<p><b>Lab 2:</b> Looking under the hood of the DCH Global digital warehouse, understanding the integrated 3Dt\$ model's structure, system boundaries, dependent and independent variables, and key relationships.</p> <ol style="list-style-type: none"> <li>1) Guided session (use software to answer specific questions)</li> <li>2) Understand the value of integrated data set</li> </ol> <p>Instructors: Maria Brilaki, Calvin Kam, Vendors via GoToMeeting</p>	<p><b>Assignment 2:</b> Due <b>Assignment 3</b> <b>(individual):</b> Assigned <b>Assignment 4 (group):</b> Assigned</p>	<p><b>Assignment 3:</b> (2 Days – 5 questions)</p> <ol style="list-style-type: none"> <li>1) Answer questions about the DCH Global system</li> <li>2) Answer questions about the software suite</li> <li>3) Answer questions about the industry / prefabrication / standardization / mass production</li> <li>4) Answer questions about the value of the integrated model/data set</li> </ol> <p><b>Assignment 4:</b> (9 Days – 4 questions)</p> <ol style="list-style-type: none"> <li>1) Compile scope: PDF of drawings and design data/program</li> <li>2) Compile schedule: Microsoft project schedule or equivalent schedule</li> <li>3) Compile cost data: Gather cost and labor information for the design and construction (including entire life-cycle) of a typical building in their target market.</li> </ol>
10/1	<p><b>Lecture 2:</b> Production management and VDC concepts:</p> <ol style="list-style-type: none"> <li>1) Product-Organization-Process (POP)</li> <li>2) WBS</li> <li>3) CPM</li> <li>4) 4D models</li> </ol> <p>Instructor: Martin Fischer</p>	<p><b>Assignment 3:</b> Due <b>Assignment 5 (group):</b> Assigned</p>	<p><b>Assignment 5:</b> (5 Days – 5 questions)</p> <ol style="list-style-type: none"> <li>1) Create a Product-Organization-Process (POP) model for the DCH Global building from the perspective of a key stakeholder. Students shall pick from the provided list of stakeholders on a first come first serve basis.</li> <li>2) Answer questions about the DCH Global system (Answer questions about the POP model)</li> </ol>
<b>Week 2</b>	<p><b>Milestone: Students understand DCH Global system, integrated 3Dt\$ model, digital warehouse, key production management concepts, and operational level of software understanding</b></p>		

10/6	<b>Lab 3:</b> Production management games 1) Airplane game 2) Parade of trades (dice) game to introduce the effects of uncertainty on production and buffering and push/pull production management concepts Instructor: Martin Fischer	<b>Assignment 5:</b> Due	
10/8	<b>Lab 4:</b> Editing the integrated 3Dt\$ model for the example project and editing the DCH Global digital warehouse  Instructor: Maria Brilaki	<b>Assignment 4:</b> Due <b>Assignment 6 (group):</b> Assigned	<b>Assignment 6:</b> (12 Days) 1) Create a digital production model – schedule and cost estimate – for the comparable building type. 2) Presentation (x min): Student teams present comparable case and explain expected differences of the DCH Global system in their selected target market.
10/13	<b>Lecture 3:</b> Scheduling concepts 1) Use DCH Global 4,600 SF residence (Lot 89) to describe schedule / cost estimate process of real life project Instructor: Martin Fischer		
10/15	<b>Lab 5:</b> Student work session Instructor Maria Brilaki		
<b>Week 4</b>	<b>Milestone: Students have an initial understanding of the scope, schedule, 4D model, cost, key production factors and context issues, pros/cons of most prevalent approach/solution for the comparable case and a solid understanding of the example project</b>		
10/20	<b>Presentation 1:</b> Presentations by student teams: 1) Assignment 6 – Comparable case 2) DCH Global - Expectations for the performance for their selected market	<b>Assignment 6:</b> Due <b>Assignment 7 (group):</b> Assigned	<b>Assignment 7:</b> (16 Days) 1) Create the production management model for the selected DCH Global building type from the digital warehouse of parts and complete the cost estimate and schedule for the project in their specific market. 2) Presentation (x min): Student teams present findings for the DCH Global system applied in their target market.
10/22	<b>Lecture 4:</b> Managing the detailing process and managing a fabrication facility Instructors: Don Engler, Guest speaker from a fabrication facility		
10/27	<b>Lecture 5:</b> Managing a construction site Instructor: Guest speaker from a construction site		
10/29	<b>Lab 6:</b> Student work session with Detailed Q&A session on the design, fabrication, and installation of the DCH Global system, the integration with other systems, and the challenges of developing an innovative building system Instructor: David Hovey Jr.		

11/3	<b>Presentation 2:</b> Presentations by student teams on DCH Global system applied in new markets	<b>Assignment 7:</b> Due <b>Assignment 8 (group):</b> Assigned	<b>Assignment 8:</b> (9 Days) 1) Compare the DCH Global system (findings from Assignment # 7) and the prevalent building (findings from Assignment # 6) in the team's target market. 2) Refine final project model 3) Presentation
11/5	<b>Lecture 6:</b> Review of student solutions and planning for adjustments and final presentation Instructor: Martin Fischer		
<b>Week 7</b>	<b>Milestone: Students have developed a solid production model for the application of the DCH Global system for the new markets</b>		
11/10	Student work session		
11/12	<b>Presentation 3:</b> Review of comparisons by student teams 1) Discussion of assignment 8	<b>Assignment 8:</b> Due <b>Assignment (group):</b> 9 Assigned <b>Assignment (group):</b> 10 Assigned	<b>Assignment 9:</b> (19 Days) Peer review of the presentation 3 of the groups that used the same software  <b>Assignment 10:</b> (19 Days) 1) Finalize final project model, estimate, schedule 2) Produce 3D marketing documents and videos 3) Final presentation and report
<b>Week 9</b>	<b>Milestone: Students have fleshed out the most important issues/areas relevant for comparison (e.g., business arrangements, labor skills, industry organization, cost, ...) of the prevalent method and the DCH Global system</b>		
11/17	<b>Lecture 7:</b> Managing innovations in project-based industries Instructor: Guest, tba		
11/19	<b>Lecture 8:</b> Case study of Meadowlands 3D , 4D, RFID project Instructors: Martin Fischer, Sangwoo Cho, and possibly a guest from Skanska		
12/1	<b>Presentation 4:</b> Final presentations by student teams	<b>Assignment 9:</b> Due <b>Assignment 10:</b> Due	
12/3	<b>Presentation 4 (cont'd):</b> Final presentations (cont'd), conclusions, outlook, next steps		
<b>Week 10</b>	<b>Milestone: Students have delivered the case studies in the desired output to DCH Global</b>		
12/9	Final Exam (12:15 to 3:15 PM)		