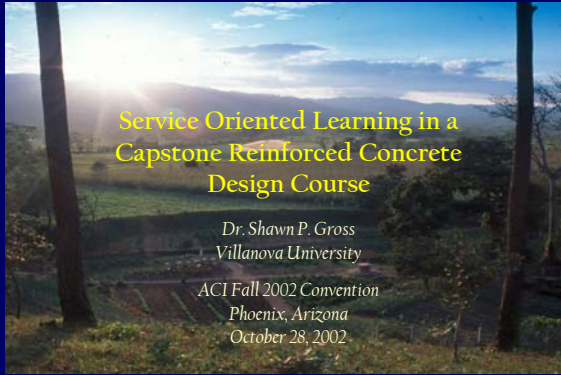


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**Service Oriented Learning in a Capstone Reinforced Concrete Design Course**


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Villanova University

ACI Fall 2002 Convention  
Phoenix, Arizona  
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### Villanova Background

- ❖ Villanova is a medium sized private Catholic institution located in suburban Philadelphia
- ❖ University has enrollment of 6,200 undergraduates
- ❖ College of Engineering has about 850 undergraduates
- ❖ CEE Department typically has about 40 to 50 students per graduating class



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### CEE Capstone Course

- ❖ CEE Department Capstone courses are offered in multiple disciplines in second semester of senior year
- ❖ Overall Capstone Course Objectives:
  - ❖ Complete the design of a “real world” design problem in a specific civil engineering discipline.
  - ❖ Apply current technology used in the practice of that discipline.
  - ❖ Effectively communicate the outcomes of a semester-long design project.

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### Structural Capstone Technical Course Objectives

1. Synthesize and apply previous coursework in Structural Engineering
2. Develop a better understanding of how different components of a structure fit together
3. Develop a better understanding of how real world constraints (cost, scheduling, material availability, etc.) affect a structural design
4. Develop a professional work ethic

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### Structural Capstone Technical Course Objectives

5. Practice technical presentation skills, including presentation of technical drawings, calculations, reports, and oral presentations
6. Further problem solving skills
7. Function as part of a team and work on teamwork skills
8. Feel more competent entering the workforce as a Structural Engineer






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### Amigos de Jesus

A Home for Boys  
Posas Verdes, Honduras



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- ❖ Construction at site began in 1999
- ❖ Partnership with Villanova began in Jan. 2000

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### Format of Course

- ❖ 2 ½ hours per week for guidance and lectures
- ❖ Groups of 3 to 5 students
- ❖ Significant portion of design completed before mid-semester
- ❖ At least one member of each group must go on mid-semester trip
- ❖ Group presentations and written progress reports to faculty every two weeks
- ❖ Major group presentation, written final report, and drawings due at end of semester

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### Project Considerations

- ❖ US Design Codes used (BOCA, UBC, ACI)
- ❖ Site-specific research on Honduras required
  - ❖ Seismic design categories and design wind speeds
- ❖ Material testing on samples from Honduras
- ❖ Schedule (Design and Construction)
- ❖ Third World Considerations
  - ❖ Construction Equipment
  - ❖ Material Availability
  - ❖ Construction Processes
  - ❖ Material Quality

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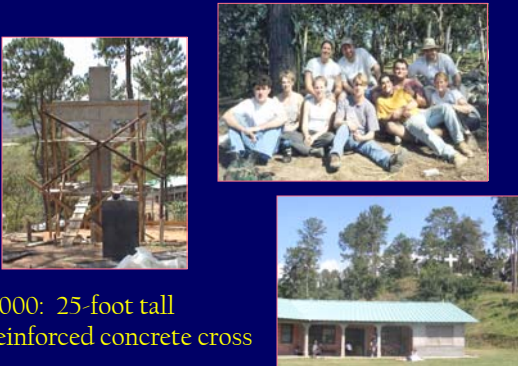
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### Design and Construction Constraints

- ❖ No plywood
- ❖ Hand cut lumber
- ❖ Limited sizes of rebar
- ❖ No forklift, crane, etc.
- ❖ No concrete mixer
- ❖ Limited "choices" for concrete materials

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2000: 25-foot tall reinforced concrete cross

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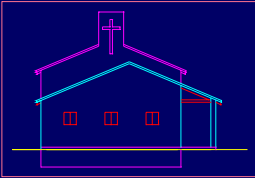

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2001: foundations for a 30 ft. x 60 ft. split level chapel & residence




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2002: columns for a 30 ft. x 60 ft. split level chapel & residence



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First hand student experiences



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### Unique Technical Outcomes

- ❖ Emphasize design-construction relationship
  - ❖ Design → Construction → Refined Design
- ❖ Real project emphasizes real constraints
- ❖ Third world aspects require development of engineering judgment based on principles

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### More Than a Technical Learning Experience

- ❖ Definition of service learning:
  - ❖ “The involvement of students in real-life settings where they can apply academic knowledge and previous experiences to meet real community needs”
- ❖ Service learning a natural fit for engineering, particularly civil engineering

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### Four Aspects of Service Learning

```
graph TD; A(Preparation) --> B(Service); B --> C(Reflection); C --> D(Celebration); D --> A;
```

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### Four Aspects of Service Learning

<u>Preparation</u> <ul style="list-style-type: none"><li>❖ Weekly meetings for organization and to learn more about Honduras</li></ul>	<u>Service</u> <ul style="list-style-type: none"><li>❖ Travel to Honduras to participate in week-long construction project</li></ul>
<u>Reflection</u> <ul style="list-style-type: none"><li>❖ Group discussions while in Honduras about aspects of the experience, and personal journals</li></ul>	<u>Celebration</u> <ul style="list-style-type: none"><li>❖ Website maintenance during trip; presentations and group activities after trip to promote pride</li></ul>

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### Structural Capstone Non-Technical Course Objectives

1. Develop an awareness of global issues
2. Become more involve in service-related activities
3. Become a more well-rounded individual
4. Feel better about oneself
5. Develop a better understanding of oneself
6. Develop a better understanding of others
7. Feel more spiritual
8. Feel a sense of accomplishment

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More student experiences

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### Service Related Outcomes

- ❖ Satisfies needs of a community
- ❖ Develops an understanding of societal impact of engineering works
- ❖ Promotes an appreciation of different cultures
- ❖ Facilitates interaction among faculty and students
- ❖ Imparts a true sense of accomplishment
- ❖ Encourages participation in service

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### New Developments

- ❖ Spring 2003: Development of a new 1 credit service learning course
- ❖ Taken in conjunction with capstone design course
- ❖ Formalizes service learning element

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Thank You!

Questions?