As discussed in the introductory paragraph of this paper, the Capstone Design Program at Florida Tech is intended to provide a near “real world” experience to graduating seniors in the civil engineering program. To accomplish this objective, a number of features have been added to the traditional “senior design” projects, including such functions as project management, teambuilding, oral and written presentations, time management, analysis of schedule and budget implications and consideration of societal impacts typically generated by civil engineering projects.

**Program Design:** To achieve a near “real world” experience the FIT program has been designed to emulate a formal design process that one might find in industry, beginning with the development of a “design proposal” with follow-on stages that require project management and design submittals at specified intervals. The program is divided into two phases which take place in the first and second semesters of the senior year. During the first semester students meet weekly to select a project and prepare a design proposal which includes a project management plan, a scope of work, a work breakdown structure, a design schedule and a design budget. Classroom lectures during this phase include instruction on the components of a proposal presented by faculty and industry guest speakers. The first phase culminates in the presentation of an oral and written proposal to the civil engineering faculty and “acceptance” of the project for design.

At the beginning of the second semester the team elects a project manager and commences work with a “15% concept design”. During this phase the team reviews the scope of work to validate the estimates made during the proposal phase. Upon approval of the concept design, the team begins the design process according to the approved work breakdown structure and design schedule. To simulate a “real world” design, the team is required to make formal project submittals to their “client” at the 35%, 65% and 95% design stages. These “submittals” include a written technical report covering the key elements of project management (status of scope, schedule and budget), a written description of the technical tasks due at that stage, according to the work breakdown structure, and the associated engineering calculations and drawings appropriate for that phase. In addition, the teams make an oral presentation explaining their progress, their technical approach and any problems or obstacles they have encountered. The design project culminates with a formal oral and written presentation of the 100% design solution to a panel composed of their “clients” and invited industry professionals. Both the oral and written aspects of the final design are included in the final team grade.
**Team Organization:** Since design work after graduation is almost always accomplished in a team environment within a matrix organization, students must learn to work in a group where team members will normally have responsibility for tasks on more than one project at a time. Therefore, it is important for students to understand the complex dynamics of a team environment interwoven with competing priorities and personalities. To simulate this environment, the students are required to work in groups with 4 to 5 team members. Because students take a varying mix of classes, they experience the same problems in coordination of their work and conflicting priorities as they will surely experience working on a design team after graduation. Consequently, project organization and time management are effectively simulated as a realistic part of the student’s design experience. In addition, a confidential “peer rating” is included at the end of the process, and as part of their individual final grade, to give the students a sense of how their contributions are viewed by the other members of their team.

**Secondary Objectives:** To round out the “reality” of the design experience, a number of constraints are injected into the design experience. For example, during the concept phase, students are required to investigate the zoning, permit and code requirements applicable to their project. In addition, during the preparation of their technical reports, students are asked to consider such societal impacts as energy conservation, green design, value engineering and similar contemporary professional issues which influence and impact virtually all engineering projects in the private and public sectors today. To accomplish this goal, the engineering faculty assigns a number of potential impacts to each team, tuned to the nature of the project, for analysis in the engineering and selection of project features. The analysis of these factors, and subsequent design decisions that result from them, must be included in the 65% and subsequent technical reports. Finally, since oral and written communications are the primary means by which engineering decisions and plans are communicated to clients, stakeholders and contractors, the students are required to present their solutions in both oral and written format approximately 3 times during the capstone design program. As mentioned before, all of these presentations are critiqued by the “clients” (faculty) and ultimately by industry professionals at the 100% presentation. The final element of reality, is a Design Showcase and competition for all senior design projects held by the College of Engineering about a month before graduation. This Showcase, which simulates an engineering trade show, occurs just after the 65% submittal and tasks the design team to prepare a “public” display of their project which is judged by practicing professionals from local engineering firms. Following the judging, the Showcase is open to the public, and more importantly, to prospective students as part of the Spring Open House.
Summary: In summary then, the senior design experience at Florida Tech simulates all of the key aspects of a “real world” engineering design process. In addition to the actual engineering work, the process begins with the development of a proposal and addresses the key aspects of project management to include the application of municipal codes, environmental matters and potential societal impacts. The design itself is partitioned into four stages which include a written technical report and an oral presentation to the team’s “clients” at each stage. The entire process culminates at the end of the second semester with a simulated trade show and a formal presentation of the completed design to a panel of industry professionals for review and ultimate “acceptance” of the completed design. Needless to say, the experience generates a considerable amount of team spirit and pride of accomplishment among the team members and the interaction with “clients” and practicing professionals certainly increases their confidence to do engineering work immediately upon graduation.