

NCEES Engineering Award Submission
Land Development Design Initiative Abstract
January 2009

A large team of professional engineers has rallied around a call for participation in the development of a new emphasis in land development design within a Department of Civil and Environmental Engineering (CEE) at a major land-grant institution. While as many as one third of graduating civil engineers go to work in the land development industry, few civil engineering programs in the country have any course or emphasis in land development within their curriculum. The Land Development Design Initiative (LDDI) involves more than 70 engineering and land development firms and directly involves industry professionals in teaching, mentoring, curriculum development, and promoting land development to undergraduate students. This paper describes LDDI and the effort to bring together undergraduate CEE students and faculty with industry professionals in order to improve land development design education.

Strategic planning for LDDI began in early 2006 with the development of an advisory board and continued with statewide outreach meetings in four major regions of the state. The purpose of these meetings was to share the LDDI vision and recruit industry professionals to participate in development of the land development design program at the University. These early efforts have resulted in over 150 practitioners who now participate in this initiative, donating time, energy, and their firms' resources to achieve LDDI priorities. Participation is kept active by the advisory board's biweekly teleconferences and quarterly meetings, semiannual general membership meetings, email, a quarterly newsletter, and a collaboration website that enables sharing files, discussions, and a chat room. Organization of the LDDI group has resulted in the creation of two major committees: Curriculum and Course Enhancement and Practitioner Involvement.

The major objective of the Curriculum & Course Enhancement Committee (CCEC) is to develop a strong land development design curriculum with coursework that prepares students for the land development design profession. The major objective of the Practitioner Involvement Committee (PIC) is to develop a strong and sustainable relationship between the private and public sectors of the land development profession and CEE students at the University. This relationship is intended to increase awareness of land development as a career path and to help students prepare for a career in the land development design profession.

The CCEC is chaired by a professional engineer not otherwise affiliated with the University, and is comprised of other practicing engineers and University faculty. Among the ways the CCEC is improving land development design education at the University is through the development of a land development design "track" within the CEE curriculum, inclusion of practitioners in existing courses, and creation of new courses.

The PIC facilitates numerous events each semester that bring students together with industry professionals. These events include presentations during "Land Development Information Nights", during classes, and at student club meetings, such as the student chapter of the American Society of Civil Engineers (ASCE). The committee has also developed a website, brochures about land development career opportunities, and has promoted the development of a student club to facilitate interactions between students and practitioners. Furthermore, the PIC has encouraged participating companies to ensure meaningful internship experiences for students by adopting a list of best practices.

NCEES Engineering Award Submission
Land Development Design Initiative Project Narrative
January 2009

Introduction and Background

A large team of professional engineers has rallied around a call for participation in the development of a new emphasis in land development design within a Department of Civil and Environmental Engineering (CEE) at a major land-grant institution. Land development design is the process of planning, design, and construction of infrastructure and facilities for residential, commercial, industrial, institutional, recreational, and government projects. Land development engineers must have strong knowledge about comprehensive plans, zoning, conceptual design, as well as the engineering background in water resources, transportation, environmental, surveying and project/construction management. While as many as one third of graduating civil engineers go to work in the land development industry (University placement statistics, 2001-2005), few civil engineering programs in the country have any course or emphasis in land development within their curriculum. This paper describes an ongoing initiative that brings together undergraduate CEE students and faculty with industry professionals in an effort to improve land development design education.

Prior to this initiative, the CEE Department has had one course titled Land Development Design available for more than 10 years. Historically, this course was always taught by an adjunct instructor, usually a fulltime practicing professional engineer. Constant turnover in the position was difficult to handle and an adjunct could not expand the course into a program. In 2006, a tenured faculty member began to teach the class and initiated a major collaborative effort with practitioners in the state in order to 1) improve land development design education, including increasing student awareness of land development design as a career path, and 2) increase student – practitioner interaction. The Land Development Design Initiative (LDDI) involves more than 70 engineering and land development firms and directly involves industry professionals in teaching, mentoring, curriculum development, and promoting land development to undergraduate students.

Strategic planning for LDDI began in early 2006 with the development of an advisory board and continued with statewide outreach meetings in four major regions of the state. The purpose of these meetings was to share the LDDI vision and recruit industry professionals to participate in development of the land development design program at the University. These early efforts have resulted in over 150 practitioners who now participate in this initiative, donating time, energy, and their firms' resources to achieve LDDI priorities. Participation is kept active by the advisory board's biweekly teleconferences and quarterly meetings, semiannual general membership meetings, email, a quarterly newsletter, and a collaboration website that enables sharing files, discussions, and a chat room. LDDI has established its own website as well as a non-profit corporate identity outside of the University. The creation of LDDI, Inc. provides a means to obtain working capital through various fundraising efforts. This working capital is used to directly support LDDI's primary goal of improving land development design education. Organization of the LDDI group has resulted in the creation of two major committees: Curriculum and Course Enhancement and Practitioner Involvement.

The major objective of the Curriculum & Course Enhancement Committee (CCEC) is to develop a strong land development design curriculum with coursework that prepares students for the land development design profession. The major objective of the Practitioner Involvement Committee (PIC) is to develop a strong and sustainable

relationship between the private and public sectors of the land development profession and CEE students at the University. This relationship is intended to increase awareness of land development as a career path and to help students prepare for a career in the land development design profession.

Curriculum Innovation

Upon creation of LDDI's Curriculum & Course Enhancement Committee (CCEC), the Committee was given the following charge:

“Develop a strong land development design curriculum and coursework that prepares students for the land development design profession.”

The CCEC is chaired by a professional engineer not otherwise affiliated with the University, and is comprised of other practicing engineers and University faculty. Among the ways the CCEC is improving land development design education at the University is through the development of a land development design “track” within the CEE curriculum, inclusion of practitioners in existing courses, and creation of new courses.

Currently, students pursuing a B.S. in civil engineering at the University must choose their courses based on four track options: General Civil Engineering; Environmental and Water Resources; Infrastructure Systems; or Structures, Foundations, and Construction. As previously noted, based on University placement statistics, as many as one third of graduating civil engineering students are employed in the land development industry. As a result, LDDI is committed to establishing a focus track for this specialty area. This effort is unique in that it seeks to expand upon traditional undergraduate engineering education by aggressively soliciting input from industry professionals regarding the skill set needed by new engineers and asks for their involvement in the educational process.

In order to create a viable land development design track, the CCEC must satisfy a number of requirements, including those of the Department, the College of Engineering, the University, and ABET. As of January 2009, the CCEC is nearing completion of a draft land development design track which it intends to submit to the Department for comment during the spring 2009 semester. In an effort to ensure that the proposed track provides a comprehensive educational experience for students, it is comprised of existing CEE courses, newly developed land development oriented courses, and courses from other University Schools and Departments including Architecture and Urban Studies, Building Construction, Landscape Architecture, and Business. While the CCEC works with the CEE Department to refine the proposed track, the Committee intends to begin simultaneously working with these other Departments to make provisions for accommodation of CEE students in their courses.

To date, the LDDI CCEC has achieved tremendous progress. In addition to the development of a Land Development graduation track the overall CEE curriculum has been expanded to include a number of new courses, all of which include significant practitioner involvement. Prior to creation of LDDI, students at the University had only one land development design course offering (Land Development Design). Due to the efforts of LDDI, the 2009-2010 academic year will provide students with seven course offerings. These courses are listed below followed by a more detailed discussion.

- Land Development Design (two sections)
- Advanced Land Development design
- Introduction to Land Development Design
- Sustainable Land Development
- Municipal Engineering
- Geotechnics for Land Development

Land Development Design

This course has been substantially modified to further engage industry professionals with students. The senior-level Land Development Design course has long been one of the department's "design courses", one of which must be taken by each student as a requirement for attainment of a Bachelor of Science degree in CEE at the University. Along with traditional means of individual student assessment in the form of tests, homework, and quizzes, students taking the course are assigned a semester-long design project which they complete in groups of three or four students. Beginning in the fall 2006 semester, student design groups have been paired with a professional engineer who serves as a mentor throughout the entirety of the course. The course offering is tremendously popular among students, and typically sees an enrollment of about 40 students per semester. Facilitated by LDDI, course instructors have been able to secure between 9 and 11 professional engineers each semester to serve as mentors to the student design groups.

With guidelines provided by the course instructor, mentors select a site that their firm has worked on. The mentor will then provide their assigned group with raw site data including topography, planimetrics, and various design guidance such as zoning and subdivision regulations for the locality in which the site is located. Practitioners typically visit campus during the third week of the semester, and spend a full class period acquainting themselves with their assigned student group and introducing the group to the characteristics of the site on which they will be designing. Throughout the semester, students and mentors communicate with weekly conference calls, email, and face-to-face meetings. The course does not include a final exam, opting instead to require student groups to give an oral presentation of their final, comprehensive design. Mentors attend and provide feedback on these final presentations.

The involvement of practitioners as mentors supplements traditional classroom instruction by 1) providing a real-world site design experience that is unique to that of other groups in the class, 2) providing technical expertise and design advice that extends beyond that which is possible solely by course instructors, 3) providing constructive criticism and feedback that is used by course instructors in assigning grades to the design project, and 4) reiterating to the students the importance of professional licensure. Since revising the Department's existing course to actively engage students and practitioners, more than 180 students have benefited from having a professional engineer mentor them throughout the semester-long design project.

Advanced Land Development Design

One of the most successful ways in which LDDI has expanded upon practitioner involvement in a formal classroom environment is through the creation of the Advanced Land Development Design course. The course is unique in the academic community in that it is coordinated by a tenured University faculty member, but taught exclusively by three teams of industry professionals. This arrangement ensures that course content

and structure meets University requirements while simultaneously exposing students to front line issues facing the industry. This course, first offered in the spring 2007 semester, expands upon topics first introduced in the aforementioned Land Development Design course by providing in-depth study of site grading, Americans With Disabilities Act (ADA) site design requirements, erosion and sedimentation control, and stormwater management including application of water quality best management practices (BMPs).

The University requires that a three credit course provide students and instructors with 45 contact hours per semester. In order to meet this requirement while accommodating the work schedule and travel time of the course's practitioner instructors, each spring semester the Advanced Land Development course is offered on Friday evenings (7-9pm) and Saturday mornings (9am-12pm) approximately biweekly. Practitioner teams from three engineering firms divide course content such that each team covers roughly one third of the course material. Despite the non-traditional meeting times, student interest in the course has been strong and the spring 2009 semester has an enrollment of 15 students. Solicited feedback from recent graduates who have taken the Advanced Land Development Design course has been very favorable, with students citing course value in terms of job attainment and easing the transition from an academic to a professional environment.

Introduction to Land Development

During its initial offering as a one credit seminar in the spring 2008 semester, Introduction to Land Development was coordinated by a tenured University faculty member, and taught by a licensed professional engineer. The course also included numerous guest lectures from LDDI's practitioner volunteers. Introduction to Land Development will be offered as a full three credit course beginning in the fall 2009 semester. This three credit offering is intended to introduce CEE students to a wide range of topics in the field of land development design. These topics include governmental roles and basic engineering principles underlying the land development design process. Additionally, the course addresses a diversity of non-engineering topics including planning, landscapes, neighborhood dynamics, finance, and sustainability. Current trends in development will be discussed to address the evolutionary nature of the industry. Upon inclusion of the Land Development graduation track in the CEE curriculum, Introduction to Land Development will become a prerequisite for Land Development Design.

Sustainable Land Development

A one credit Sustainable Land Development seminar was first offered in the spring 2008 semester. This seminar has already been expanded to a three credit course and is being taught during the spring 2009 semester. Similar to other newly created courses, the three credit Sustainable Land Development course is coordinated by a tenured University faculty member and taught by a licensed professional engineer whose firm specializes in sustainable development projects. In creating the Sustainable Land Development course, the CCEC felt that, due to its specialized nature, the course should be restricted to only those students with senior standing, but open to students from any major. This accomplishes two goals. First, students will be required to work alongside students from outside of their own major. This "cross pollination" will introduce various perspectives to classroom discussion and better prepare students for their careers where they will inevitably cross paths with professionals from a myriad of academic backgrounds. Second, offering this course to other Departments provides the CCEC

with a bargaining tool as the Committee approaches other University Departments about accommodating CEE students in their courses (as outlined in the proposed land development design track).

The Sustainable Land Development course will focus on the developed site's long term sustainability and preservation of the pre-development quality of its environment. Specific topics include site selection and linkage; development impacts on water, air, and soil; microclimate; industrial ecology and materials; energy; and incentive driven sustainability efforts. The course will also introduce students to third party site evaluation methods including Leadership in Energy and Environmental Design (LEED) and Earthcraft Communities. Students taking the class will visit development projects employing innovative, sustainable design features.

Municipal Engineering and Geotechnics for Land Development

The spring 2010 semester will introduce a three credit Municipal Engineering course to the CEE curriculum. The intent of this course is to provide the student with an understanding of the field of municipal engineering and the important role municipal engineers play in planning and managing large public projects, operating and maintaining public infrastructure, supporting community disaster response, and regulating development through permitting programs. The course is being developed by the Director of Public Works and Environmental Services for a municipality that has been actively involved in LDDI for over two years. The CCEC is also actively working with University faculty to develop a three credit Geotechnics for Land Development course which will focus exclusively on geotechnical issues as they pertain to land development projects.

Modification of the existing Land Development Design course and the development of these new courses has significantly expanded the Department's curriculum and introduced numerous opportunities to bring students together with industry professionals in the formal classroom environment. Working closely with the professional engineering community, this innovative curriculum provides students with a significant jumpstart into the land development profession.

Practitioner Involvement

Upon establishment of LDDI's Practitioner Involvement Committee (PIC), the Committee was given the following charge:

“Develop a strong and sustainable relationship between the private and public sectors of the Land Development Design profession and the students within the Department of Civil and Environmental Engineering. This relationship is intended to create interest and help students prepare for a career in the land development design profession.”

In support of this charge, the PIC initiated a number of activities to build student/practitioner relationships. The committee began presenting information about the land development industry to students at “Land Development Information Nights”, during classes, and at student club meetings, such as the student chapter of the American Society of Civil Engineers (ASCE). The committee has developed an LDDI website, brochures about land development career opportunities, and has promoted the development of a student club to facilitate interactions between students and practitioners. Furthermore, the PIC has encouraged participating companies to ensure meaningful internship experiences for students by adopting a list of best practices.

“Land Development Information Nights” are held prior to the department’s fall and spring civil engineering career fairs. During these information sessions, numerous industry professionals participate in presentations about the land development industry, and then answer student questions related to land development design. LDDI provides refreshments for the attendees, and the events have proven to be an excellent way to introduce students to industry professionals in a casual environment.

LDDI’s practitioner involvement committee has also provided support for the creation of a Sustainable Land Development Student Club (SLDC). The purpose of this club is to bring together students with common academic interests and professional goals related to land development. Since its creation in the spring semester of 2008, the SLDC has assembled for numerous social outings, including a highly successful tailgate party with practitioners at a home football game, has volunteered for a local charity organization, has organized field trips to land development sites, and has worked closely with LDDI’s corporate sponsors to hold the aforementioned Land Development Information Nights. LDDI is actively working with the student club to plan events for the spring 2009 semester. These events will include guest lectures from industry professionals and site visits to interesting and unique land development projects.

The PIC is responsible for the creation and maintenance of LDDI’s website. LDDI’s website is targeted largely toward students, and showcases interesting and/or unique land development projects, career spotlights on land development professionals, a blog with a recent graduate, and curriculum information and advice. The website also provides an outlet through which LDDI can communicate to industry firms about opportunities for them to become involved with the student mentoring program.

LDDI strongly believes that student internships should nurture the student’s professional development. LDDI’s partnering firms are committed to ensuring that internships are a learning and growth experience. These beliefs led to the PIC’s creation of a list of “Best Practices for Internships Principles.” Students can confidently accept an internship with LDDI’s partnering firms knowing that the experience will adhere to these principles.

Field Opportunities

Of immeasurable value to any undergraduate civil engineering curriculum is the opportunity for students to visit real-world projects during various stages of design and construction. Arising from its partnership with over 150 practicing engineers, the efforts of LDDI afford students unprecedented access to project sites throughout the state.

The Land Development Design course pairs students with industry professionals on a semester-long group design project. The first major learning module that students must complete is a feasibility study for their group’s subject property. This study encompasses typical due diligence efforts, and must address site topography, transportation and utility access, land use and land cover, environmentally sensitive site areas, and other issues impacting the site’s development potential. Since the mentoring program began in the fall 2006 semester, many practitioners have taken their student groups on site tours as they are working on the assigned feasibility study. These field visits increase student understanding of the value of familiarizing themselves with a site prior to and during its design.

There are several additional opportunities for field visits. Both the Advanced Land Development course and the Sustainable Land Development course include multiple field visits to project sites, some of which are in the early stages of construction while others are nearing completion. During these site visits, students are accompanied by the actual site design engineers who provide them with invaluable insight into some of the issues that arise during design and construction. As the Advanced Land Development course continues into the future and the Sustainable Land Development course evolves into a three credit offering, site visits will remain an integral part of course content. The new Sustainable Land Development Club has also made site visits a major event for the club, and plans are underway for spring 2009 visits.

Conclusion

A major collaborative effort between professional engineers, faculty, and students has produced a unique and innovative program in land development design within the civil and environmental engineering department at a major land grant university in the US. LDDI has made tremendous strides in educating students about land development as a career opportunity, developing a meaningful curriculum, and has involved the practitioner community in every step of the process.

Prior to LDDI, there existed one land development design course in the Department, offered only once per academic year. The efforts of the CCEC have resulted in the development of a Land Development graduation track and a number of new courses. As a direct result of LDDI, the 2009-2010 academic year will provide students with seven land development course offerings, all of which actively engage industry practitioners in the classroom. LDDI's practitioner mentorship program is tremendously popular among these students, with Department data revealing that roughly 40% of graduates elect to take the senior-level Land Development Design course. The course's popularity among students can be viewed as a success in terms of LDDI's mission to improve student awareness of land development design as a career path and to actively bring together students and industry professionals.

LDDI's practitioner involvement committee facilitates numerous events each semester that bring students together with industry professionals. LDDI-sponsored information sessions provide an opportunity for students and practitioners to meet, mingle, and discuss the land development profession. The new Sustainable Land Development Club continues to grow and build a network among students that will carry forward as they move into their professional careers. The website, brochures, newsletter, and regular emails to the general membership have proven to be very effective in building a true sense of purpose within the professional engineering community and has provided students with bonds to this community that are proving to be long lasting.

LDDI is making a significant impact in the lives of our students and providing a means for our profession to be integrated into the educational process of our next generation of engineers. The program has achieved strong financial support, even during this difficult economic time, attesting to the strong belief in the program from the professional community. Perhaps most flattering to those who have made and continue to make LDDI a reality were comments received during the fall 2008 ABET accreditation review of the Department, where the lead reviewer mentioned LDDI as one the major highlights of the department.