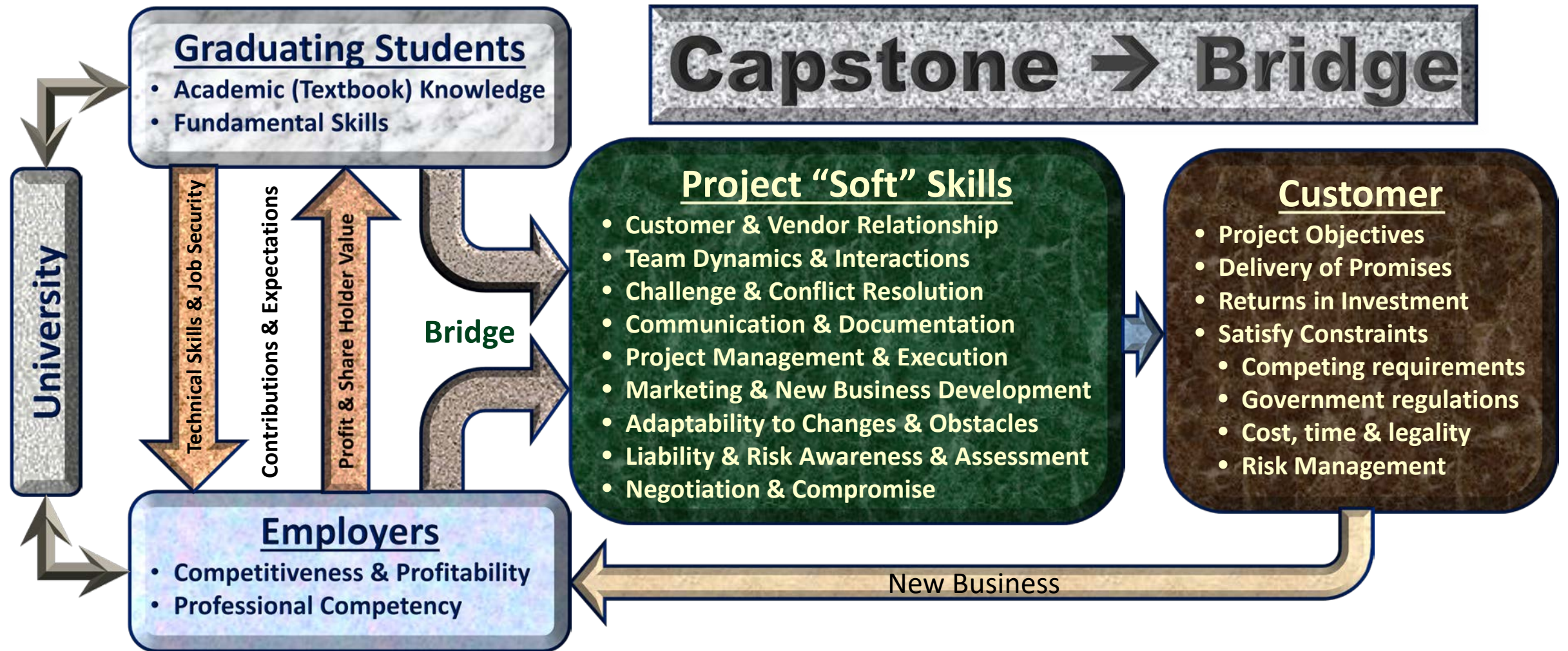


BYU-CEEn Capstone Program

Wayne Y. Lee, E. James Nelson, M. Brett Borup

September 22, 2017

Introduction to BYU CEEEn Capstone



Capstone Program Challenges

- **Program Funding & Resources**
- **Students**
 - Busy work vs. project ownership & responsibilities
- **Faculty**
 - Extra burden in addition to academic responsibilities
- **Sponsors ↔ Relevant Projects**
 - What equity do we get out of it?
- **Project Planning, Management & Execution**
 - Flexible & adaptable, schedule, time, cost, minimize project creep, etc.

Enhanced Capstone Project Perspective

Traditional Approach + Additional Strategy → Enhanced Capstone Program

Traditional Approach

- **Sponsors:** Instructors & “good will” entities
- **Objectives:** Project experience for students
- **Projects:** Often with known solution

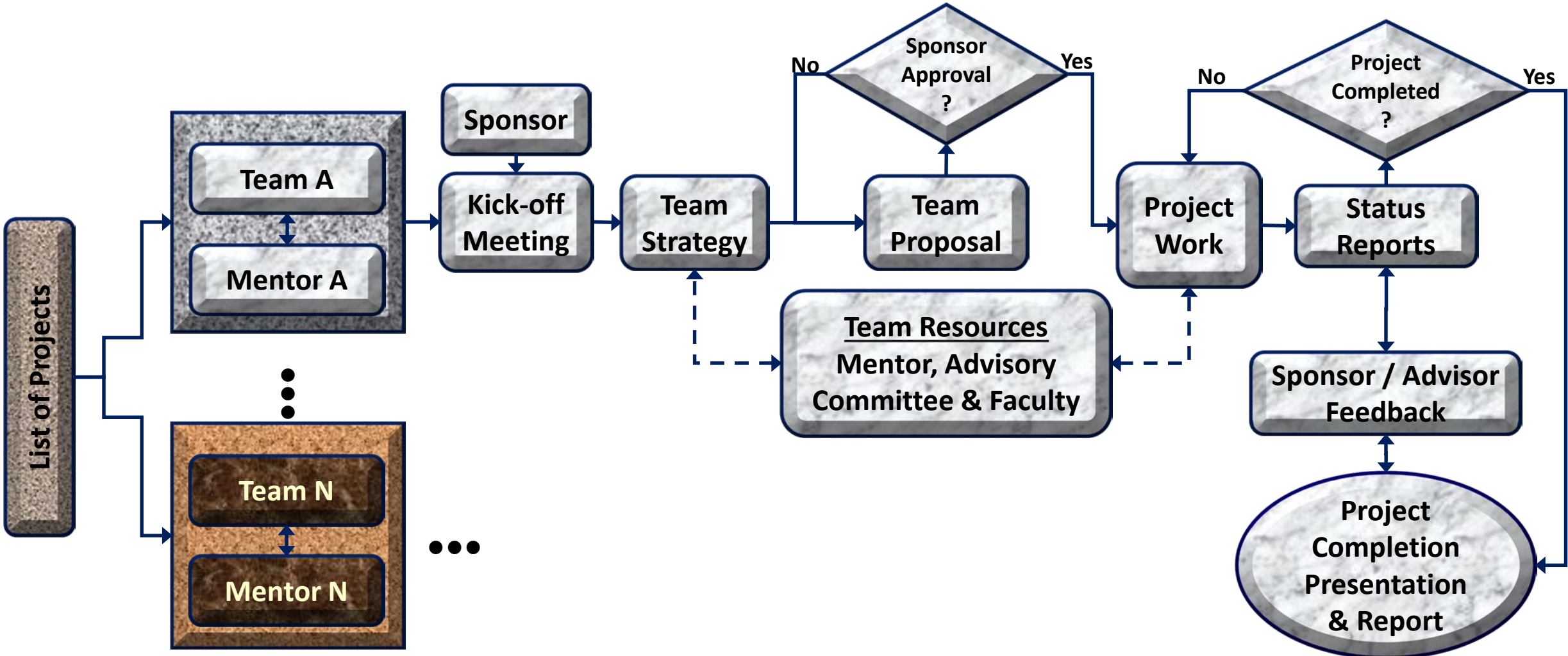
- **Student:** Practice for materials learned in school
- **Faculty:** Help students prepare to enter work field
- **Sponsors:** Preview students to be hired → reduce hiring risks

Additional “Win-Win” Strategy

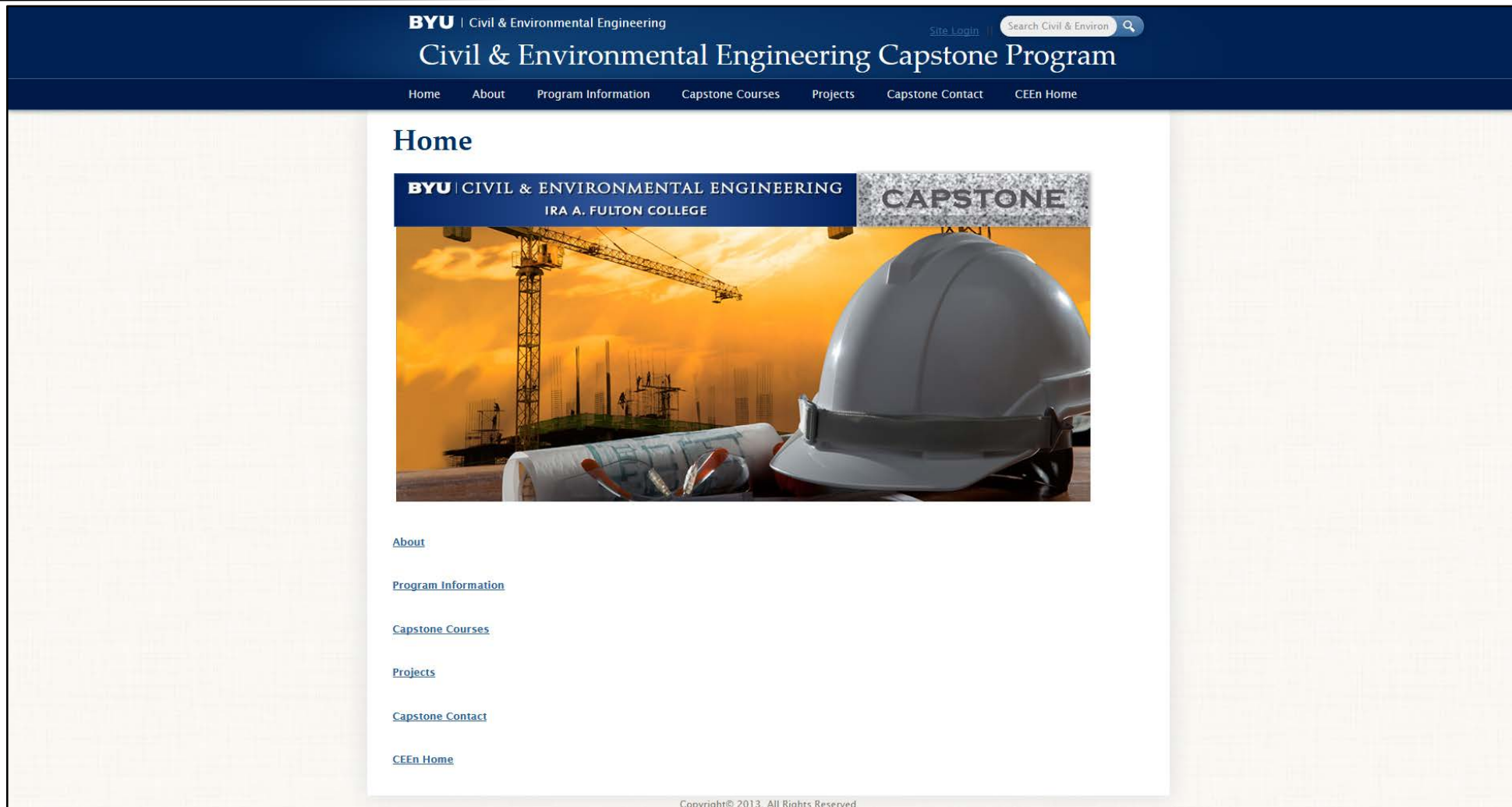
- **Sponsors:** Business entities, government agencies, etc.
- **Objectives:** Academic ↔ Industry collaboration on proof-of-concept, process improvement, cost reduction, product optimization, etc.
- **Projects:** Engineering judgment - solution options, with no specific solution, marketing & business development assessment, etc.

- **Students:** Showcase students work → personal responsibilities & project ownership, foster innovations, team dynamics, customer relations, risk assessment, time/cost management, communications, flexibility & adaptability etc.
- **Faculty:** Funding potential, publish innovative project results, etc.
- **Sponsors:** Tangible benefits → Low cost investment justifications, proof-of-concept, cost & time savings → improve competitiveness/financial bottom line, etc.

Capstone Program Implementation: Projects Execution Process



Capstone Program Implementation: Website



- **Showcase Student's Work**
 - Project team interactions
 - Interview reference
 - Foster project ownership
 - Two-edge sword



BYU CEEEn Capstone Website: Student Teams' Project Work

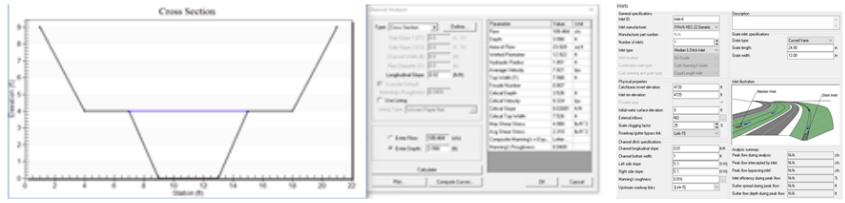
BYU | Civil & Environmental Engineering
Civil & Environmental Engineering Capstone Program

Home About Program Information Capstone Courses Projects Capstone Contact CEEEn Home

2016-2017 Projects

< Past Domestic Capstone Projects

Projects for the 2016-2017 Academic Year



CEEn-2016CPST-001: Development Accommodation - Realignment Study
Graduate Mentor: **Michael Souffront** Team Members: **Brad Mason, Tavin Griffith, Kevin Woolf**

CEEn-2016CPST-002: Soil Data Percolation App Development
Graduate Mentor: **Alex Arndt** Team Members: **Cameron Lusvardi, William Shelton, Jacob Wadman**

CEEn-2016CPST-003: LID Approach Effectiveness & Functionality Study
Graduate Mentor: **John De Leon** Team members: **Treyton Moore, Kevin Liang, Jingwen He**

CEEn-2016CPST-004: Engineering Changes vs. Neighborhood Impact Assessment
Graduate Mentor: **Spencer McDonald** Team members: **Martin Seneca, Brad Fellows, Kaylee Bateman**

CEEn-2016CPST-005: Power Transmission Foundation Design
Graduate Mentor: **Mikayla Hatch** Team members: **Daniel Pope, McKay Harper, Todd Weichers**

CEEn-2016CPST-006: Pressure Zones Update Feasibility Study
Graduate Mentor: **Mckell Sanderson** Team members: **Spencer Stanley, Michael Freeman, Ryan Harwell**

BYU | Civil & Environmental Engineering
Civil & Environmental Engineering Capstone Program

Home About Program Information Capstone Courses Projects Capstone Contact CEEEn Home

CEEn-2016CPST-001

[CEEn-2016CPST-001 Project Team Information](#) | [Previous Project](#) | [Next Project](#) | [2016-2017 Projects](#)

Title	Development Accommodation: Realignment Study
Project Sponsor	City of Riverton
Project Manager (Graduate Student Mentor)	Michael Souffront
Project Team Members	Brad Mason, Tavin Griffith, Kevin Woolf
Faculty Advisor	Dr. Rollin Hotchkiss
Project RFP	CEEn-2016CPST-001_RFP.pdf
Project Proposal	CEEn-2016CPST-001_Proposal.pdf
Project Management Plan	CEEn-2016CPST-001_PMP.pdf
50% Completion Report & Status Reports	CEEn-2016CPST-001_IanStatusReport.pdf CEEn-2016CPST-001_FebStatusReport.pdf CEEn-2016CPST-001_MarchStatusReport.pdf CEEn-2016CPST-001_HalfCompletionReport.pdf
Final Report & Presentations	CEEn-2016CPST-001_FinalReport.pdf CEEn-2016CPST-001_FinalPresentation.pdf CEEn-2016CPST-001_Poster

Copyright© 2013, All Rights Reserved

- **Project Ownership**
 - Encourage project responsibilities
- **Employer Preview**
 - Beyond resume & job interviews
- **Documentations**
 - Project histories (NDA compliance)
- **Communications**
 - Project sponsors
 - Faculty
 - Potential employers

Sample 2016 Capstone Project Status Report

<p>BYU CIVIL & ENVIRONMENTAL ENGINEERING IRA A. FULTON COLLEGE</p>		<p>CAPSTONE</p>	
<p>Project Status Report: CEEen-2016CPST-007: Flood Control Plan Feasibility Study Team Members: Matthew Johnson, Fabian Zamorano, Donald Anderson Date: 1/30/2017</p>			
<p>1) Summary of technical/non-technical challenges encountered</p> <p>We encountered several obstacles to overcome before being able to analyze the Ridge Lane area. One obstacle that we had was determining the contributing watershed area for Ridge Lane. The exact area and water flow was not known. In addition, there are no local streams nearby, so it was difficult to find the area using Watershed Modeling System (WMS). Another obstacle that we faced was learning unfamiliar engineering programs. This is the first time anyone in our group had used WMS and AutoCAD Civil 3D for storm water and flood analysis.</p>	<p>2) Team approaches/resolutions to overcome challenges</p> <p>We did a lot of background research this month to get a better understanding of the process of designing a storm water system. Initially, we had a couple of spreadsheets that was given to us from our sponsor. The research helped us to understand what the spreadsheet was computing, how it was computing it, and what all the variables meant. We also drove to Ridge Lane in Payson to view the project site in person. This gave us a first hand understanding of the area and helped us to determine what homes experienced flooding, directions the water might flow during the storm, and locations on where collections basins should be. In addition, we were able to speak to one of the residents in the area about the flooding and he confirmed our suspicions.</p>		
<p>3) Status of challenge resolutions & potential project impacts</p> <p>We are still experience problems with using the new programs, but we are getting a better idea on how they work. These problems have not caused any schedule or cost impacts for the project. These were initially planned and accounted for in the project proposal. Overall, we feel we have made good progress on the project and are confident in future progress.</p>	<p>4) Project Status & Summary</p> <p>There have been no delays or scopes changes due to additional customer request. We have completed most of the research that we need for this project. We have just started the design of the storm water system. We plan on finishing the design in the upcoming week and start putting together the report. At this point, we are plan on completing the project on time, perhaps even a little early.</p>		

- **Communication**
 - Project status
 - Documentation of challenges & obstacles
 - Customer relations
- **Team dynamics**
 - Team work
 - Lessons learned
 - Conflict resolution
 - Obstacle management
 - Project's mid-course adjustments & adaptation

Sample 2016 Capstone Project Final Presentation

BYU | CIVIL & ENVIRONMENTAL ENGINEERING
 IRA A. FULTON COLLEGE

CAPSTONE

CEEn-2016CPST- 003

LID Approach Effectiveness & Functionality

Team members: John De Leon, Treyton Moore, Jingwen He, Kevin Liang

June 2, 2017

Background Information

- Recently, the EPA has required municipalities in Utah to design their stormwater systems to retain the 90th percentile storm on site
- In the past, stormwater would be piped to a river or stream
- Spanish Fork City has implemented a LID stormwater system that utilizes R-Tanks to retain the water on site
- Our job was to analyze the system to check its compliance, provide possible design improvement suggestions, and to investigate silt build-up to develop a maintenance schedule.



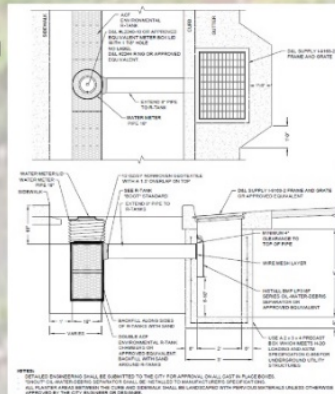
Findings

- 90th percentile storm = 0.54in
- LID systems exceeded EPA standards in Spanish Fork
 - Total runoff volume = 2301 ft³
 - Total system volume = 4635 ft³
- LID performance varied for the 5, 10, 25, 50, and 100 year storms depending on soil quality.
 - Poor soil drainage caused R-tanks to overtop in these cases analyzed
- We observed problems with leaf build up in R-tank entrances
- Poor initial layout of R-tanks by contractors resulting in complications

Storm Intensities	Runoff Volume (pcf)	Drainage Time (hrs)
100 years storm	28002	0.306
50 years storm	23727	0.259
25 years storm	19608	0.214
10 years storm	14730	0.161
5 years storm	11274	0.123
90th percentile storm	2301	0.025

Recommendations

- Use water meter vault to provide access to already constructed systems to provide access for cleaning
- For future systems, use a wire mesh (i.e. Chicken wire) to cover the entrance and “filter” leaves and larger debris
- Improve inspection procedures during construction
- For sites with poor soil, if overtopping is a concern, the R-tanks could be stacked deeper to increase storage volume.



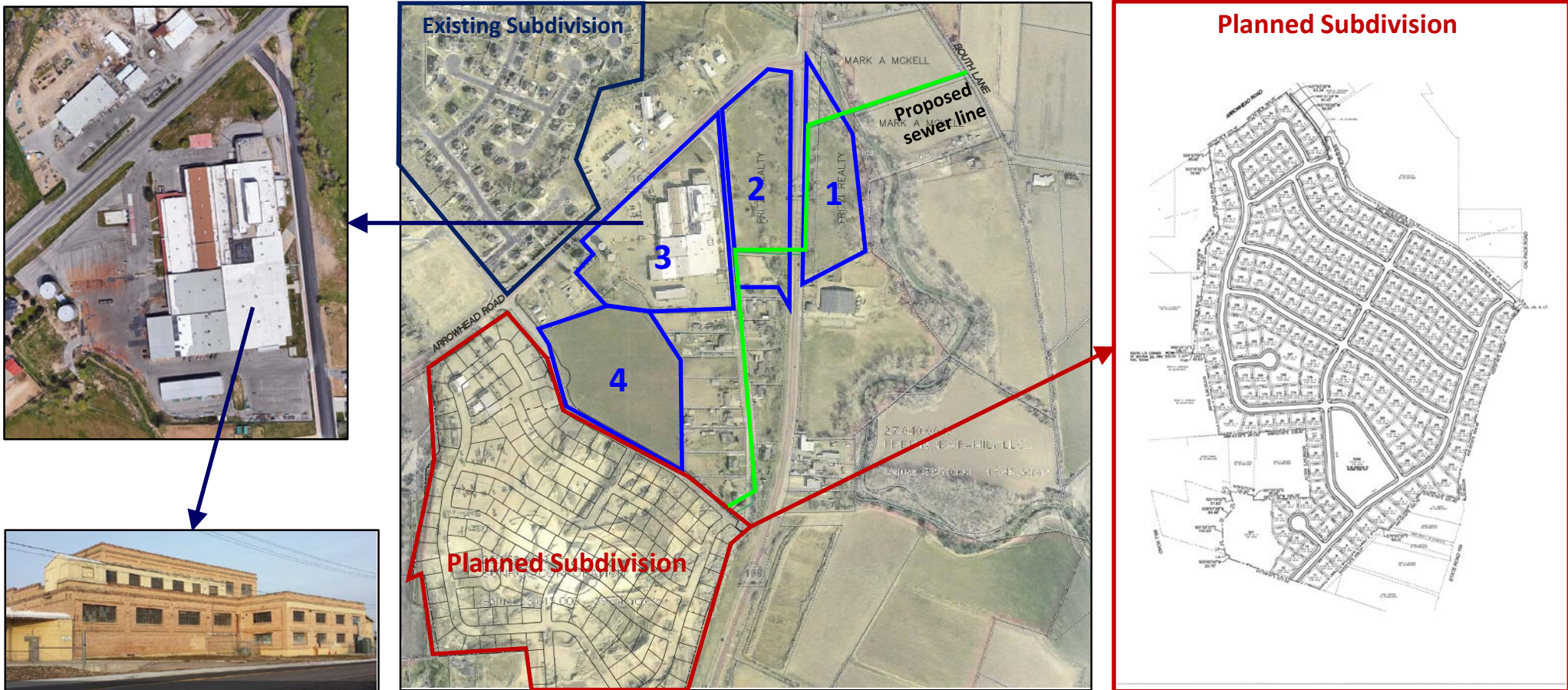
- **Project ID**
 - CEEEn-2016CPST-003
- **Title**
 - Low Impact Development (LID) Approach Effectiveness & Functionality
- **Sponsor**
 - Spanish Fork City, UT
- **Soft Skills**
 - Documentations, presentations, communications, project close-out & completion of deliverables

2016 Capstone Program Lessons Learned

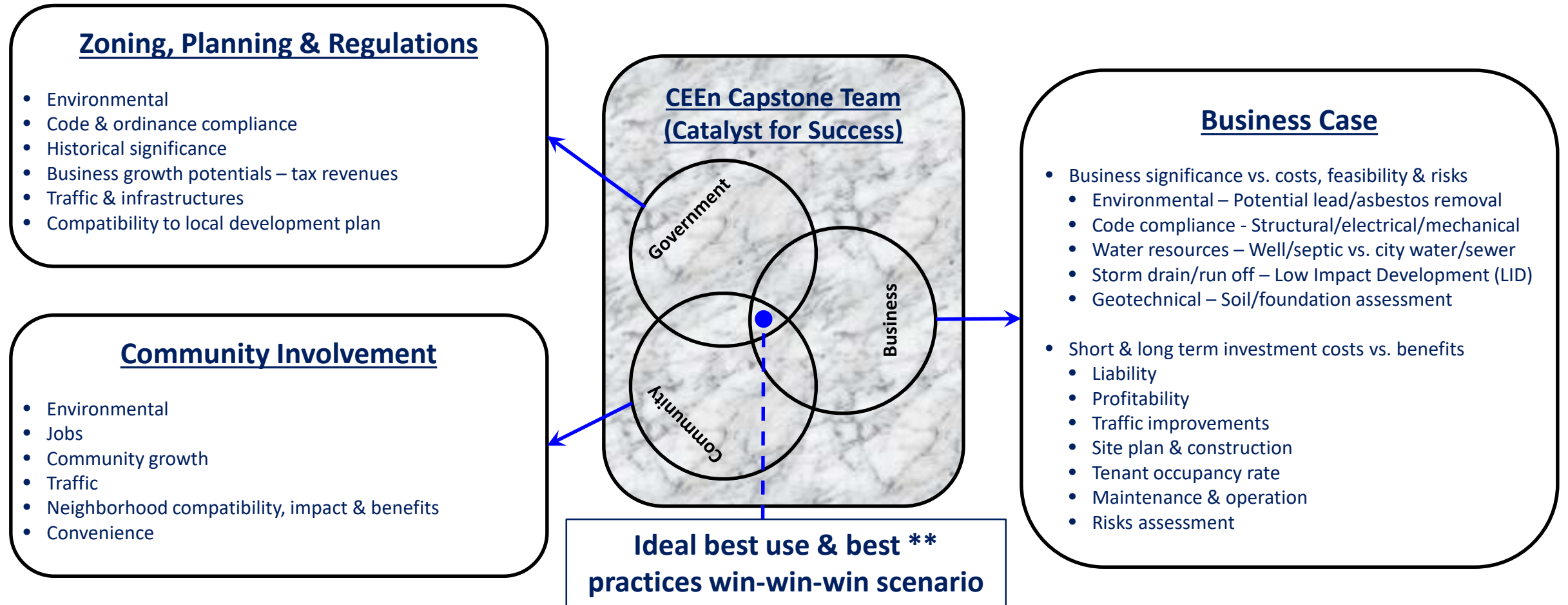
- **Communications & Understanding sponsors' objectives**
 - Regular contacts & project updates
 - Ask & learn
 - Improve students ↔ sponsor (customer) relationship
- **Adaptable & Flexible Project Schedule & Duration**
 - Not all projects start/end with respect to academic year
- **Ease students' anxiety toward failure**
 - Accept, learn and grow from mistakes
 - Accept responsibilities & consequences through honesty and timeliness

2017 Sample Project

- Arrowhead Center Development Project
 - Capstone collaboration with Sustainable Infrastructures class, government, developer, community



Collaborative Project Environment



** Best acceptable compromises under conflicting requirements & interests

Conclusions

- **Capstone: Experiential Learning Opportunity**
 - Safe mean for students exposure to “soft skills”
- **Win-Win-Win Strategy**
 - Benefits for all parties involved: Students, sponsors and faculty
- **Raise both the bar of performance expectation and equity/reward**
 - Remove stigma of “busy work”
 - Students rise up to the occasion via project ownership & responsibilities
 - Encourage team work
 - Improved professionalism
- **Cross-discipline projects → Way of the future**
 - Collaboration among sponsors, professionals, students and all interested entities
 - Negotiations and compromises to achieve project objectives

Any Questions ?