Improving Residential Focus of the Construction Management Program at Michigan State University

2013 Homebuilding Education Leadership Program Grant: National Association of Home Builders Progress Report - Year I

Sinem Mollaoglu (Korkmaz), PhD
Matt Syal, PhD, CPC
Allison LaSota
Anthony Sparkling

January - December 2013

The goal of this report is to explain our strategies to increase the number of residential construction graduates in the future and continue to be one of the main schools to provide qualified Construction Managers to our nation's Residential Construction Industry.

Contents

List of Figures

List of Tables

Summary

Construction Management (CM) program at Michigan State University, established in 1948, is one of the strongest CM programs in the U.S. Our undergraduate program is accredited by American Council for Construction Education (ACCE). Fueled by cutting edge industry and government based research grants, our graduate program offers both Master's and doctoral degrees. Historically dominated by residential construction focus, our program has been recently challenged by the shrinking economy in Michigan.

Homebuilding Education Leadership Program Grant (HELP) 2013 grant will be critical to increase our number of residential construction graduates and continue to be one of the main schools to provide qualified construction managers to our nation's residential construction industry. The success of our plans will be measured mainly via the change in the number of students over the years in our program with residential construction interest.

Our HELP 2013 goals include:

- Adopting National Association of Home Builders (NAHB)'s Green Building Toolkit and the Purdue model for a new graduate/undergraduate course on residential construction;
- Increasing hands-on focus of our current program;
- Hire a short term professional and prioritize the long term hire of tenure stream faculty to sustain our plans;
- Revitalize student interest in residential construction at undergraduate and graduate levels via a fellowship program;
- Revitalize residential industry input to our program via a devoted and engaged advisory board; and
- Align our program with Residential Gold Standard Curriculum to improve the residential construction focus in existing courses.

This first year report presents the work our team conducted to: improve the residential construction focus of our curriculum; our review of existing NAHB resources, MSU program; and insights from students and faculty to achieve this aim. Results showed areas that our program also can contribute to residential curricula across the nation via recommendations for NAHB resources.

1. Introduction to MSU's CM Program and History of Residential Construction Focus

Michigan State University (MSU), the nation's pioneer land-grant university, is one of the top research universities in the world—on one of the biggest, greenest campuses in the nation. Home to nationally ranked and recognized academic, residential college, and service-learning programs, MSU strives to help create sustainable built environments through teaching, research and outreach via School of Planning, Design, and Construction (SPDC). Construction Management Program at SPDC, established in 1948, is accredited by the ACCE. It offers Bachelor, Masters, and PhD degrees and aims to successfully prepare students for management and technology aspects of the construction industry with dual focus on residential and commercial areas.

Our current CM program is ACCE accredited (i.e., renewed in 2012/ valid until 2016); has 60 undergraduate students; and annually enrolls 5-10 graduate students. Our faculty dedicated to home building curricula have diverse set of skills and experience in structural systems, codes, materials, utility systems, scheduling, estimating, safety, lean construction, sustainable construction, and project management. They reflect their know-how in the courses listed under Appendix A via residential related examples, modules, or assignments. Residential specific courses in our program (i.e., CMP 124, CMP 435, and CMP 491) are given by faculty (i.e., Dennis Welch, Paul Streng, and Marcus Metoyer) that have years of hands-on experience in residential construction. Most importantly, Dr. Matt Syal, an internationally recognized scholar and leader in residential construction/ housing, is one of the investigators of this proposal and will assist the PI with implementing the proposed improvements to our CM program.

Members of our NAHB student chapter have exceeded 100 for many years, placing it among the top 5 nationally recognized active student builder organizations. With 20-40 students attending its activities in the recent years, some of the annual activities SBCA undertakes include the CM Career Fair (with over 40 employers attending), sponsoring a team in the NAHB residential competition, Habitat for Humanity, and Safety Day. The MSU students secured 1st place in 2004 NAHB competition with an average place of 6th over 21 years. Our recognized success in the NAHB competitions, continuing annual scholarships from the Greater Lansing HBA, and our active student body for nearly 40 years, shows our NAHB student chapter's strength. Our students also participated in significant ways in the 1st ever campus built in the 2011 Whirlpool & Habitat for Humanity – Builders Blitz event.

MSU's Housing Education and Research Center is a part of the National Consortium of Housing Research Centers (http://www.housingresearch.net/). The NAHB Research Center is its founding partner and Dr. Matt Syal serves as its research director.

Our program has a balanced mix of industry and government based funds to run its research program. Our recent grants that will directly benefit this project include the Smart Grids for Alternative Energy and Energy Retrofit Program for Housing.

2. The need and Report Goals

Students and graduates with residential construction interest historically dominated MSU's CM program from the inception of the program in 1948 until the most recent residential downturn that began in 2007. This trend drastically changed in the recent years with 95% of our students being hired into other construction industry segments. This is due to the poor economy that included the set back of the automobile industry in Michigan, and shrinking housing market. Fortunately, nationwide improvements in the economy; automobile

industry's slow but steady return to Michigan; and rising home prices all point to improvements in the residential market. With our faculty's expertise in housing, we would like to use the HELP 2013 grant to position our program for the expected comeback of the residential construction industry. There is a need to reinforce residential construction's place in our program's curricula and increase the student numbers in residential construction.

Additional opportunities exist at our program relating to the most recent advancements to residential construction. New areas of expertise and advanced systems in building services are on the horizon for residential construction that contribute to overall energy efficiency built environments such as home area networks, smart meters, and new controls. Therefore, coordination and collaboration of electrical and mechanical contractors with suppliers, and other trades are of greater importance in today's residential construction setting from scheduling, estimating, system designs, and project management perspectives. With our recent grants in building science and technology for energy efficiency; we are now better positioned than ever to educate our students and benefit homebuilders to become leaders in the residential construction industry.

With the HELP 2013 grant, our primary goal is to increase the number of residential construction graduates in the long run and continue to be one of the main schools to provide qualified construction managers to our nation's residential construction industry. Specific goal of this report, reflecting some of the main work that was conducted as a part of the HELP 2013 grant, is to evaluate the Michigan State Construction Management Program Curriculum. The goal is provide insight on the following main two objectives:

1. Improve our program in a review of the NAHB Gold Standard, Michigan State Syllabus Review, Michigan State Faculty Review, East Carolina Syllabus Review and Competition Team Review; and

2. Improve existing NAHB resources in light of the Michigan State Construction Management Program.

3. Methods/Process

The information gathered for this report consists primarily of syllabus review and online resources. The first online resource our team reviewed was: the Gold Standard Residential Construction Curriculum, developed by East Carolina University, funded by NAHB. The website for this material included: curriculum development, learning outcomes, advice, consulting, model course flow templates, original construction degree, creating a residential degree, modified generic construction degree. Erichh Connell, the director of Residential Curriculum at East Carolina University, helped us gain additional insights to these materials.

Many interviews were also conducted of both faculty and students. This section summarizes the data collection procedure including how and what syllabi were used, what online resources were used, and what information was found online. This section also includes all information from interviews with faculty and competition team members (i.e., The National Association of Home Builders (NAHB) hosts Student Chapters' Residential Construction Management Competition. The competition is one of the highlights of the annual International Building Show. The competition gives all participating students an opportunity to apply skills learned during their classes and internships to a real life construction project by completing a management proposal. The competition consists of a submitted proposal and then a presentation to a panel of judges).

3.1 Curriculum Reviews Process for Residential Construction Programs

3.1.1 Syllabus Review Process for MSU's Construction Management Program

The report focuses on how residential construction topics are covered in Michigan State's Construction Management Program classes. The courses in the Table 1: Construction Management Classes Required at Michigan State University for an Undergraduate Bachelor of Science Degree, below are the required classes for each student to take to achieve a Bachelor of Science Degree in Construction Management at Michigan State University. This information was taken from the Office of Registrar Website. The Appendix has a complete description of each class. The link to the Office of Registrar Website is: http://www.reg.msu.edu/academicprograms/ProgramDetail.asp?Program=5257

Table 1: Construction Management Classes Required at Michigan State University for an Undergraduate Bachelor of Science Degree

Construction Management Classes Required at Michigan State University for an Undergraduate Bachelor of Science Degree	
CMP 101	Principles of Building Construction Management
CMP 124	Residential Construction Materials and Methods
CMP 210	Commercial Construction Methods
CMP 211	Building Codes
CMP 222	Statics and Strengths of Materials
CMP 230	Utility Systems
CMP 305	Site Construction and Measurement
CMP 311	Construction Project Scheduling
CMP 315	Construction Quantity Surveying
CMP 322	Structural Systems
CMP 325	Real Estate Principles and Construction Finance
CMP 328	Construction Presentation Graphics and Building Information Modeling
CMP 385	Construction Documents and Contracts
CMP 401	Construction Safety Management
CMP 415	Cost Estimating and Analysis
CMP 423	Construction Project Management

Not all of the classes required for a Construction Management Degree were reviewed for this report. The classes that syllabi were reviewed are in Table 2: Construction Management: Residential Focus Syllabus Review at Michigan State below. The learning outcome of each syllabus was the focus for each review. The second focus was how material was being taught for example, if material was covered by lecture, lab or project. Learning outcomes provided through Michigan State Residential Courses is shown in Figure 1, a screen shot of the information gathered from syllabus reviews. The complete chart can be seen in the Appendix B.

Table 2: Construction Management: Residential Focus Syllabus Review at Michigan State

Construction Management: Residential Focus Syllabus Review at Michigan State University	
CMP 101	Principles of Building Construction Management
CMP 124	Residential Construction Materials and Methods
CMP 211	Building Codes
CMP 230	Utility Systems
CMP 222	Statics and Strength of Material
CMP 305	Site Construction and Measurement
CMP 311	Construction Project Scheduling
CMP 315	Construction Quantity Surveying
CMP 322	Structural Systems
CMP 325	Real Estate Principles and Construction Finance
CMP 328	Construction Presentation Graphics and Building Information Modeling
CMP 385	Construction Documents and Contracts
CMP 401	Construction Safety Management
CMP 415	Cost Estimating and Analysis
CMP 423	Construction Project Management
CMP 453	Land Development
CMP 491	Competition Team

Learning Outcomes for MSU Residential Courses

CMP 101-Principles of Building Construction Management

Learning Outcome	How it is covered
List Contractor Types	Lecture
Differentiate between residential, commercial, industrial, institutional, and mixed-use projects	Lecture
Define union and non-union contractors	Lecture
Identify the steps required to obtain an accurate estimate	Lecture
Correctly identify the roles of owners, consultants, general contractors and subcontractors	Lecture
Distinguish between lump sump, cost-plus-fee, guaranteed maximum price and unit proce contracts	Lecture
Identify the various stages of a project from design through pos construction	Lecture
Identify successful construction processes	Lecture
Identify many ADA requirements and where they apply	Lecture
Differentiate between ethical and unethical behavior	Lecture

CMP 124-Residential Construction Materials and Methods

Learning Outcome	How it is covered
Discuss properties, uses and developments of the materials used in residential construction of todays structures	Lecture
Discuss the difference between S-DRY and S-GRN framing material	Lecture
Explain functional difference between housewrap and vapor barrier	Lecture
List 5 Cement Types	Lecture
Lists and discuss the different types of Masonry Types	Lecture

CMP 230-Utility Systems

Learning Outcome	How it is covered
Calculate Heat Loss of a structure	Lecture
Calculate Heat Gain of a structure	Lecture
Calculate the cost of heating a structure with readily available fuels	Lecture
Calculate the cost of cooling a structure	Lecture
Compute ventilation air requirements for healthy IAQ	Lecture
Compute voltage drop	Lecture
Use Ohm's law to compute a missing variable	Lecture
Compute the monthly cost of electricity for a home	Lecture
Size water piping systems	Lecture
Size duct systems	Lecture
Identify the various types of heating and cooling systems	Lecture
Identify unethical and eithical behavior	Lecture
Identify components of MEP drawings and list their functions	Drawings
Identify which parts of building meet energy star requirements	Lecture
identify the advantages and disadvantages of 6 alternative enery sources	Lecture

CMP 311-Scheduling

Learning Outcome	How it is covered
determine durations of common building construction activities	Lab
assess progress and status to pre-establish project milestones	Lab
track resource utilization and cash flow on projects	Lab
monitor timing and budgetary overruns	Lab
perform what-if-scenarios and make decisions on construction progress	Lab
understanding of master project scheduling concepts and	

Figure 2: Learning Outcomes for Michigan State Residential Courses shows a screen shot of the information gathered from syllabus reviews.

Flow charts of a student's journey through the construction management program were also developed. This information was taken from the Office of Registrar. Figure 3 below shows a screen shot of this flow chart. The complete flow chart can be found in the Appendixes. This flow chart was later compared with a similar chart at East Carolina University presented as a part of the NAHB Gold Standard.

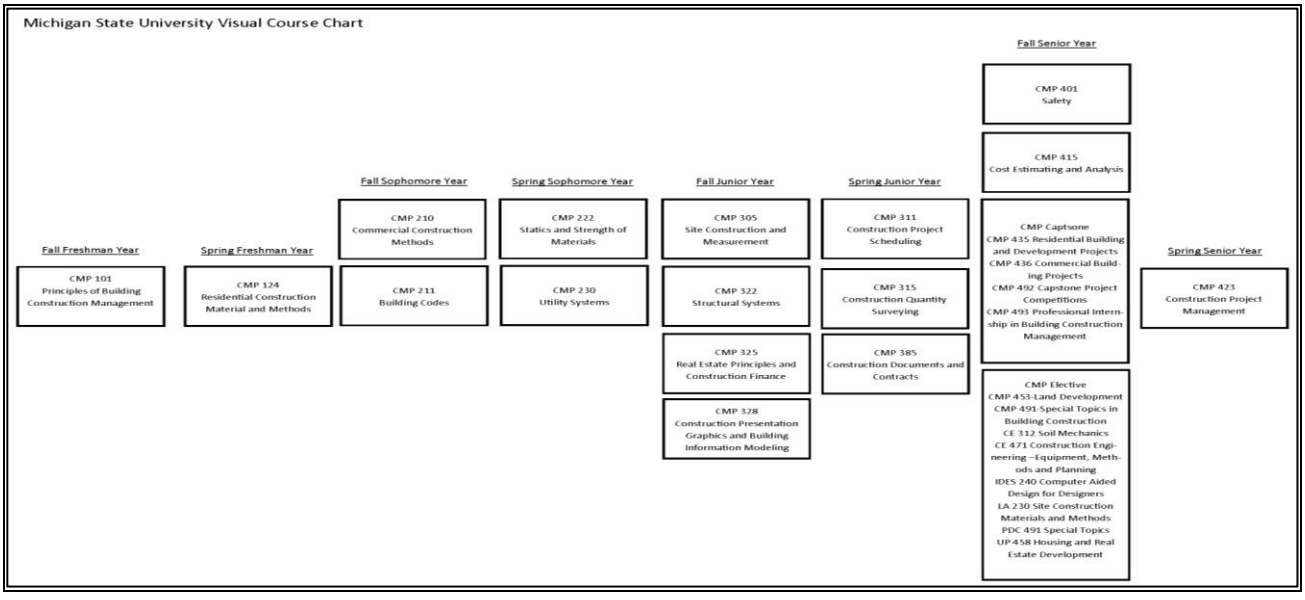


Figure 3: Michigan State University Course Flow Chart

3.1.1.1 Michigan State Faculty Interview Process

The following Michigan State faculty members were interviewed: Professor Metoyer, Professor Streng and Professor Welch. These interviews covered how residential construction was presented in their classes, if they would like anything else to incorporate more residential in their class, and the program as a whole. Professor Metoyer teaches Principles of Building Construction Management (CMP 101), Utility Systems (CMP 230), Construction Project Scheduling (CMP 311), and Real Estate Principles and Construction Finance (CMP 325). Professor Streng teaches Building Codes (CMP 211), and Land Development (CMP 453). Professor Welch teaches Residential Construction Materials and Methods (CMP 124), Site Construction and Measurement (CMP 305), Construction Quantity Surveying (CMP 315), and Construction Safety Management (CMP 405).

3.1.2 Syllabus Review Process for East Carolina University Construction Management Program

Erich Connell, the Director of Residential Construction at East Carolina sent Michigan State three syllabi. The syllabi he sent are in Table 3 below.

Table 3: East Carolina Syllabi Received

East Carolina Syllabi Reviewed	
CMGT 2558	Residential Construction Techniques
CMGT 3558	Residential Development
CMGT 4558	Residential Project Management

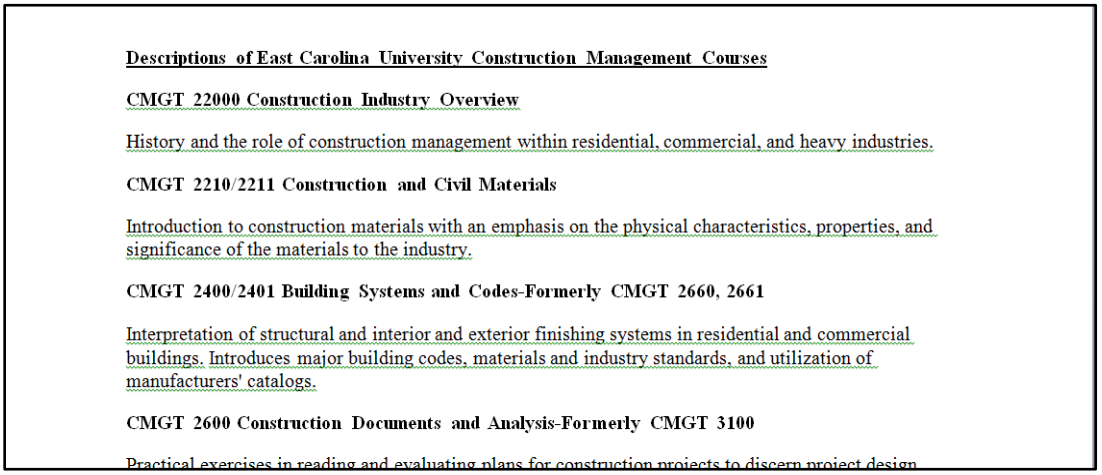
The course descriptions of all other Construction Management courses at East Carolina were also reviewed. A list of all Construction Management courses required for an undergraduate degree at East Carolina is presented below in Table 4. These were then matched with the most similar course at Michigan State. This list of similar courses is presented in Table 5.

The complete course descriptions can be found in Appendix G and a screen shot is below in Figure 4. The course descriptions were taken from the program website: http://www.ecu.edu/cs-acad/ugcat/CoursesC.cfm#cmgt Figure 4 below shows the snapshot of the comparison we performed between this program's courses and learning outcomes with the MSU - CM program's.

Table 4: Construction Management Courses at East Carolina (NAHB Gold Standard Curriculum)

Construction Management Courses at East Carolina	
CMGT 2200	Construction Industry Overview
CMGT 2210/2211	Construction and Civil Materials
CMGT 2400/2401	Building Systems and Codes
CMGT 2600	Construction Documents and Analysis
CMGT 3010	Construction Modeling and Information Technology
CMGT 3150	Residential Construction Techniques
CMGT 3400	Structural Analysis
CMGT 3500	Construction Contracts and Specifications
CMGT 3800/3801	Soils and Foundations
CMGT 3700/3701	Construction Surveying
CMGT 4000	Construction Estimating
CMGT 3900	Construction Project Safety Management
CMGT 3600	Mechanical and Electrical Construction

CMGT 3950	Residential Development
CMGT 4100	Construction Planning and Scheduling
CMGT 4300	Construction Quality and Human Resource Management
CMGT 4500	Construction Work Experience and Professional Development



Descriptions of East Carolina University Construction Management Courses

CMGT 22000 Construction Industry Overview

History and the role of construction management within residential, commercial, and heavy industries.

CMGT 2210/2211 Construction and Civil Materials

Introduction to construction materials with an emphasis on the physical characteristics, properties, and significance of the materials to the industry.

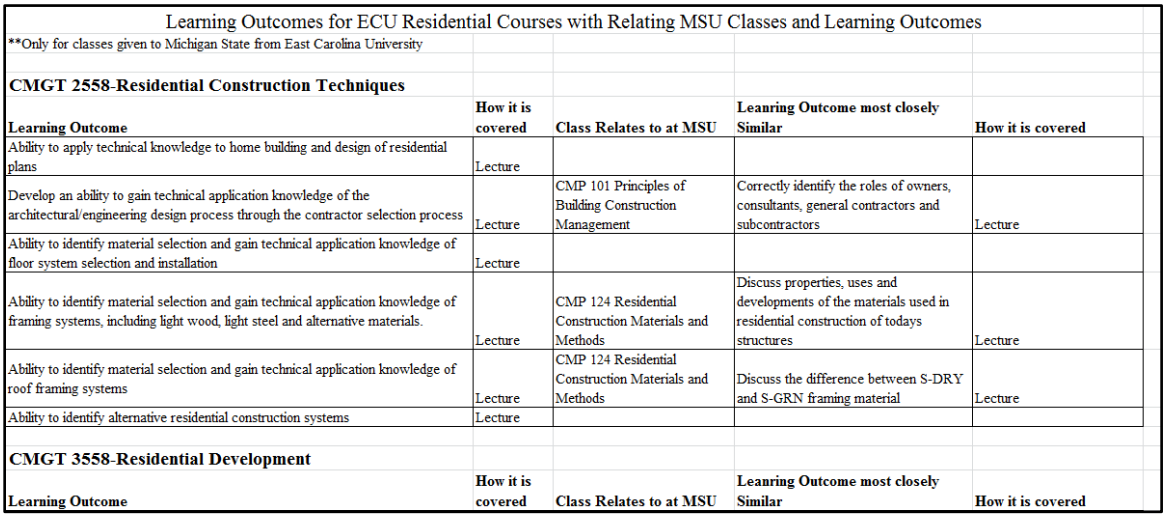
CMGT 2400/2401 Building Systems and Codes-Formerly CMGT 2660, 2661

Interpretation of structural and interior and exterior finishing systems in residential and commercial buildings. Introduces major building codes, materials and industry standards, and utilization of manufacturers' catalogs.

CMGT 2600 Construction Documents and Analysis-Formerly CMGT 3100

Practical exercises in reading and evaluating plans for construction projects to discern project design

Figure 4: Screenshot of Description of Each Course in NAHB Gold Standard Curriculum (East Carolina University Construction Management Program)



Learning Outcomes for ECU Residential Courses with Relating MSU Classes and Learning Outcomes

**Only for classes given to Michigan State from East Carolina University

CMGT 2558-Residential Construction Techniques

Learning Outcome	How it is covered	Class Relates to at MSU	Leanring Outcome most closely Similar	How it is covered
Ability to apply technical knowledge to home building and design of residential plans	Lecture			
Develop an ability to gain technical application knowledge of the architectural/engineering design process through the contractor selection process	Lecture	CMP 101 Principles of Building Construction Management	Correctly identify the roles of owners, consultants, general contractors and subcontractors	Lecture
Ability to identify material selection and gain technical application knowledge of floor system selection and installation	Lecture			
Ability to identify material selection and gain technical application knowledge of framing systems, including light wood, light steel and alternative materials.	Lecture	CMP 124 Residential Construction Materials and Methods	Discuss properties, uses and developments of the materials used in residential construction of todays structures	Lecture
Ability to identify material selection and gain technical application knowledge of roof framing systems	Lecture	CMP 124 Residential Construction Materials and Methods	Discuss the difference between S-DRY and S-GRN framing material	Lecture
Ability to identify alternative residential construction systems	Lecture			

CMGT 3558-Residential Development

Learning Outcome	How it is covered	Class Relates to at MSU	Leanring Outcome most closely Similar	How it is covered

Figure 5: Screenshot of the Learning Outcomes from East Carolina's Syllabi with MSU Classes

3.1.3 NAHB Residential Gold Standard Review Process

The NAHB Gold Standard Resources are found on the East Carolina University website. The resources we looked at were the Learning Outcomes and Model Course Flow Chart because these were the only working links. The URL to find this information is http://www.ecu.edu/cs-tecs/construction/National-Housing-Endowment.cfm.

The Learning Outcomes Link brought a viewer to a list of Learning Outcomes defined as the Gold Standard for a Residential Construction Curriculum. A complete list of all the learning outcomes can be found in Appendix O.

Using the information from this list of Learning Outcomes, a chart was made showing when the learning outcomes were covered in each Michigan State and East Carolina Class. The chart can be found in Appendix P. A screenshot is shown below in Figure 5.

NAHB Gold Standard-Learning Outcomes for a Residential Construction

1. Overview and History-Introduction to the Construction Industry

Learning Outcome	MSU Class Covered in	How it is covered	ECU Class Covered in
Differentiate the Different Construction Types Based on FMI	CMP 101	Lecture	CMGT 2200
Differentiate the percentage of total annual construction based on construction type	CMP 101	Lecture	CMGT 2200
Differentiate the different occupancy types based on the IBC	CMP 211	Lecture	CMGT 2400
Identify Construction Projects by the Construction Sector	CMP 101	Lecture	CMGT 2200
Explain the Role of General Contractors vs. Subcontractors in the construction process	CMP 101	Lecture	CMGT 2200
Identify Construction organizations that represent an ethical approach to practice	All CMP Courses	Lecture	CMGT 2200
Explain the Role of Ethics in the sustainable construction	CMP 385 and 423	Lecture	N/A
Identify Sustainability Concerns within the construction industry	CMP 385 and 423	Lecture	N/A

2. Techniques-Construction and Civil Materials, Soils, Foundations, Land Development

Learning Outcome	MSU Class Covered In	How it is covered	ECU Class Covered in
Explain the principles of materials and systems specification and design.	CMP 315	Lecture	CMGT 3150
Explain basic construction terms related to construction materials.	CMP 124	Lecture	CMGT 2210
Compare and select major construction materials according to their properties, uses, limitations, care, storage, and installation equipment.	CMP 124	Lecture	CMGT 2210
Critique alternate material use.	CMP 124	Lecture	CMGT 2210
Demonstrate use of construction materials in a laboratory setting.	CMP 124	Lecture	N/A
Identify the resource cycle of materials for construction.	N/A		N/A
Discuss construction material manufacturing, testing, safety, environmental & lifecycle			

Figure 6: Screen Shot of NAHB Gold Standard-Learning Outcomes for Residential Construction with Michigan State Classes and East Carolina Classes.

The second link on the page was the Model Course Flow Template. This is shown in Figure 6: Model Course Flowchart below.

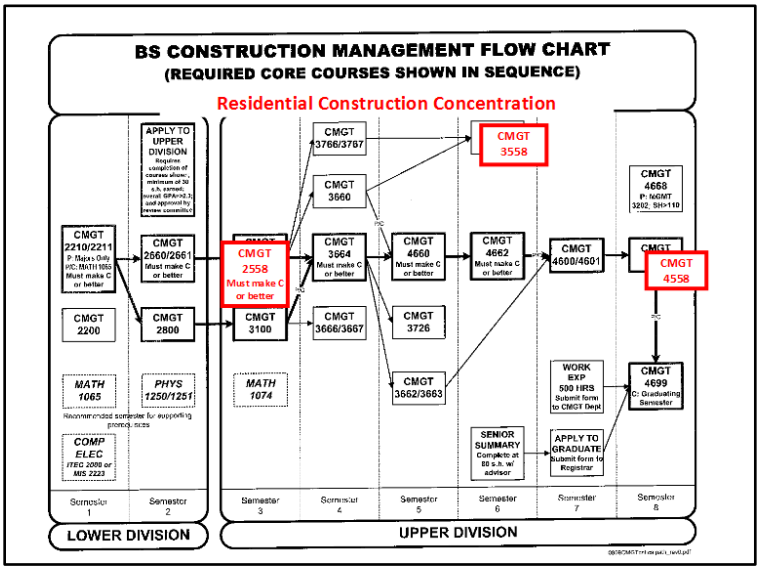


Figure 7: Model Course Flowchart for Classes at East Carolina University

This chart shows when each class is taken each semester. A similar chart was also made with Michigan State classes and then one with both East Carolina classes and Michigan State classes. Finally an overlapping chart was made with the similar classes at Michigan State and East Carolina. These similar classes were determined by course description taken from each University Websites. Below in Figure 7 and Figure 8 the similarities are shown for both Michigan State and East Carolina University classes. The flow charts can be found in the Appendix M and N.

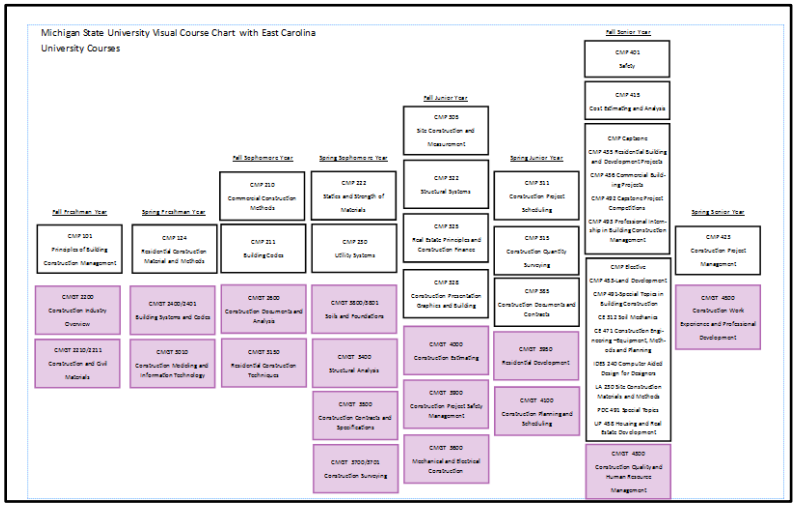


Figure 8: Screenshot of both ECU Courses and MSU courses taken each semester

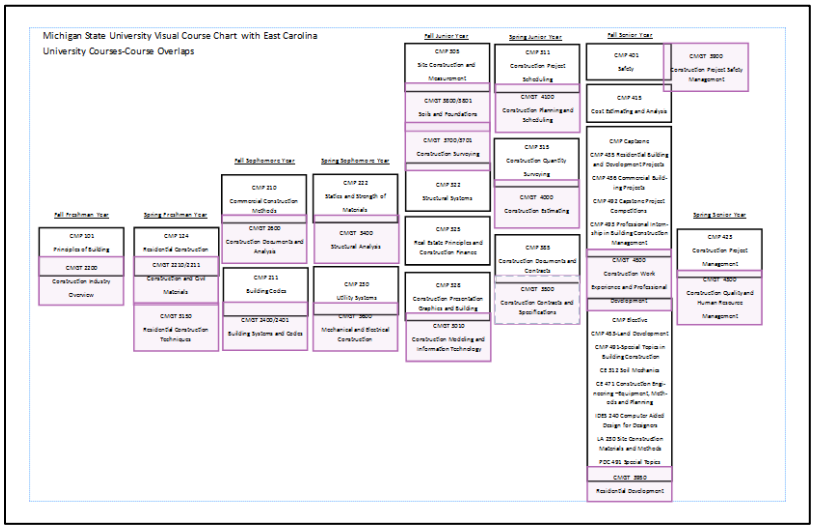


Figure 9: Screenshot of overlapping Michigan State courses and East Carolina courses

3.2 Residential Competition Team Reviews and Processes

The 2013 Michigan State Competition Team finished 1st place in the Residential Construction Competition. The 2013 Michigan State team was interviewed. The interviews asked questions about the team's preparations and what led to their success in hopes to determine what helped the team place 1st and what could be done so there is continued success. The team members were interviewed along with the coach. For the

remaining past five years, the top finishers at the residential competition were also reviewed. This included visiting the websites of each team.

3.2.1 Michigan State Competition Team Process

The following students participated in interviews from the Michigan State Competition Team: Billy Palazzo, Byron Hester, Alex Montague, Mike Damico and Josh Pittsley. The Coach, Ken Gottschalk was also interviewed. All interviews were conducted via email in March. Interview notes can be found in Appendix Y-EE.

The questions asked to the competition team were:

1. What was the number one factor that contributed to our greatest success?
2. If we could have had something to make us more successful what would it be?
3. What preparation helped us in presenting?
4. If you could change something about the class, what would it be?
5. What classes/experiences contributed to our success?

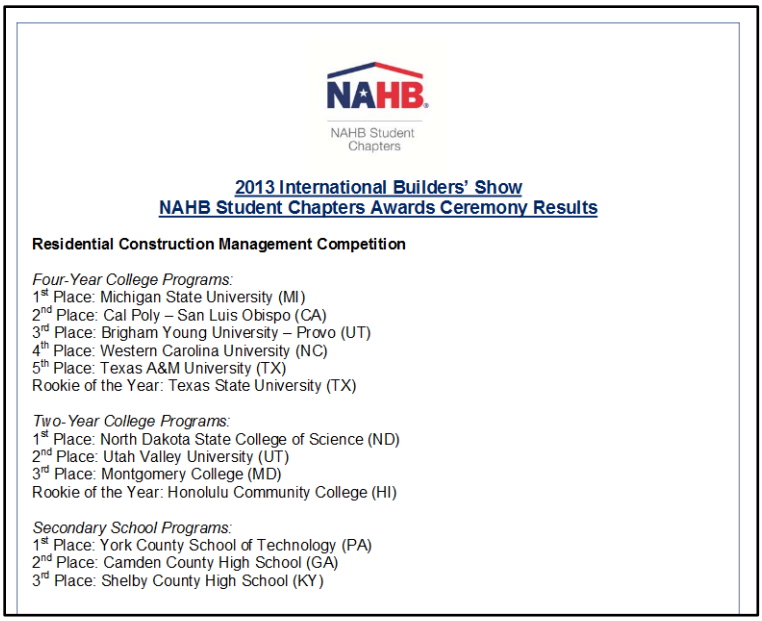
The questions asked to the Competition Team Coach Ken Gottschalk were:

1. What made this team different from last year's team?
2. What do you think contributed to this team's success? Was it the preparations? Resources?
3. What do you think would make this team or past year teams more successful?
4. As the coach, what do you think you would need to make the team more successful?
5. What would draw more students to be on the team?
6. What areas do you wish students had more knowledge in from classes?

3.2.2 Benchmark Programs Process

The NAHB keeps records of the top finishers for the Residential Competition on their website. The past 5 years top finishers were reviewed and found that the top placing schools at the NAHB Residential Competition 4 year College Programs are: Brigham Young University, Texas A&M, California Polytechnic State University, and Middle Tennessee University. This was based on how many times they were in the top 5 and these schools were most frequently ranked among them. This information was gathered from Page Browning, the Director of Academic Services for NAHB Student Chapters. She directed us to the website containing this information. The URL for this website is:
http://www.nahb.org/generich.aspx?sectionID=771&generichContentID=92934

The links on the webpage, for the past five years, would lead a viewer to the results from the year selected. In addition to 1^{st}-5^{th} place for the four year college competition, it also includes 1^{st}-3^{rd} place for two year colleges, 1^{st}-3^{rd} for secondary school programs, Outstanding Educator Award, Distinguished Service Award and Outstanding Students Awards. Results from the 2013 International Builders' Show NAHB Student Chapters Awards Ceremony are shown in Figure 9.



NAHB Student Chapters

2013 International Builders' Show
NAHB Student Chapters Awards Ceremony Results

Residential Construction Management Competition

Four-Year College Programs:
1st Place: Michigan State University (MI)
2nd Place: Cal Poly – San Luis Obispo (CA)
3rd Place: Brigham Young University – Provo (UT)
4th Place: Western Carolina University (NC)
5th Place: Texas A&M University (TX)
Rookie of the Year: Texas State University (TX)

Two-Year College Programs:
1st Place: North Dakota State College of Science (ND)
2nd Place: Utah Valley University (UT)
3rd Place: Montgomery College (MD)
Rookie of the Year: Honolulu Community College (HI)

Secondary School Programs:
1st Place: York County School of Technology (PA)
2nd Place: Camden County High School (GA)
3rd Place: Shelby County High School (KY)

Figure 10: Screenshot of the Results 2013 International Builders' Show NAHB Student Chapters Awards Ceremony Results

Brigham Young University, Texas A&M, California Polytechnic State University and Middle Tennessee's University's websites were all visited to gain information about their competition teams.

Brigham Young University competition website, Figure 10, had information about their competition teams, what categories they compete in, and how to prepare. The URL for this website is: http://cm.byu.edu/?q=competitions

Figure 11: Screenshot of the Competitions Page on the Brigham Young website

Texas A&M's website, shown in Figure 11, had information about their student organizations and competition team. The URL for this website is: http://cosc.arch.tamu.edu/people/student-groups/

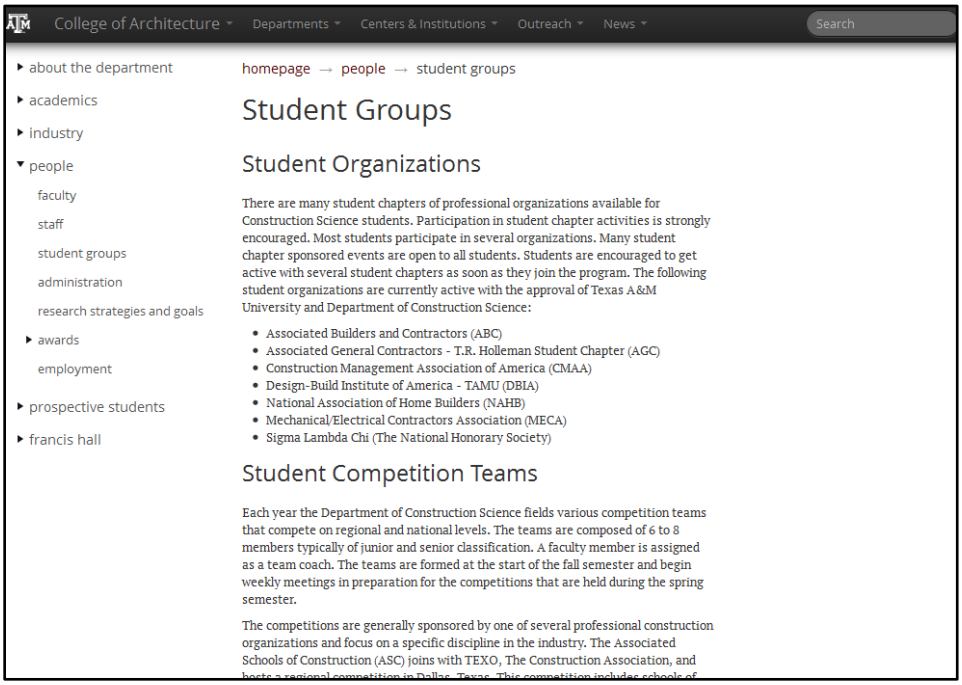


Figure 12: Screenshot of the Competition Team Texas A&M website

California Polytechnic State University had information about how to apply to be on the team shown on Figure 12 and a link to the application on their website, Figure 13. The application can be found in the Appendix. The URL for this website is http://www.construction.calpoly.edu/content/competitions-and-awards/index

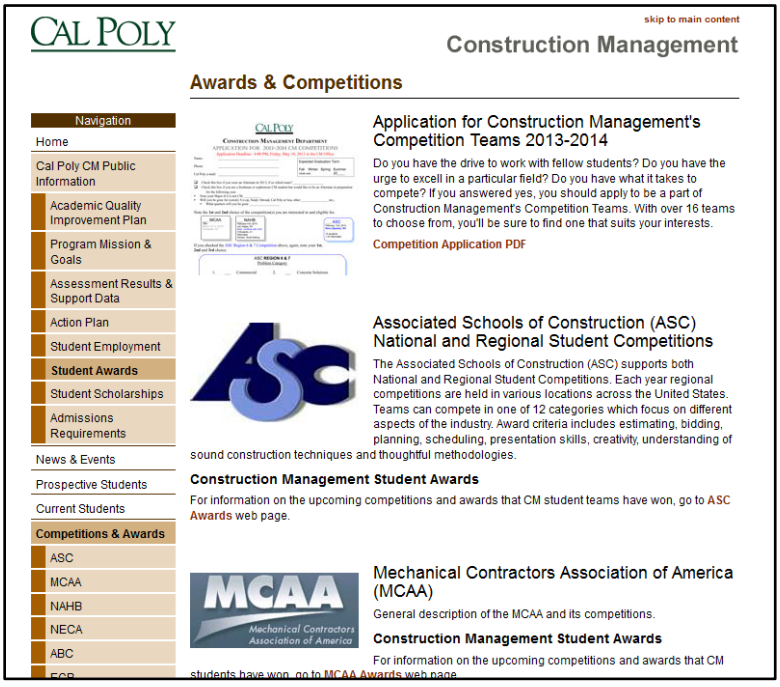
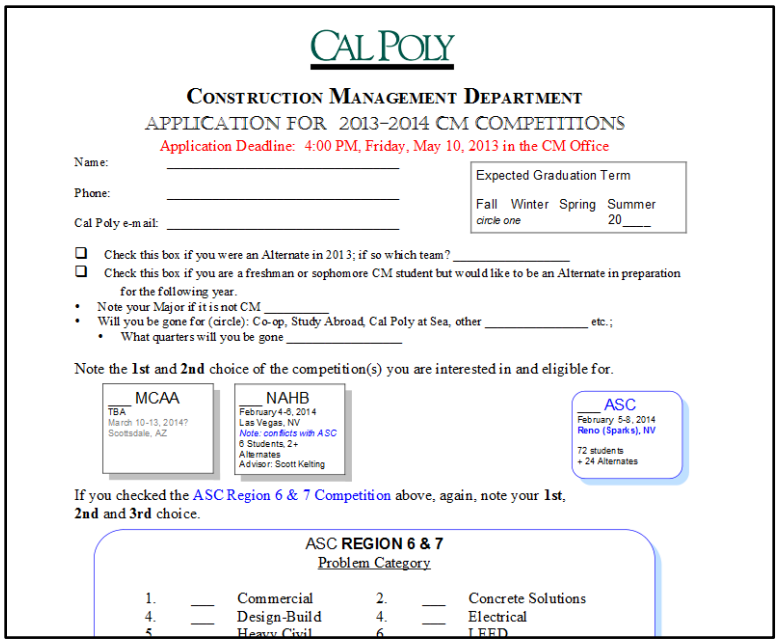


Figure 12: Screenshot of Competition Team at California Polytechnic State University



CAL POLY

CONSTRUCTION MANAGEMENT DEPARTMENT

APPLICATION FOR 2013-2014 CM COMPETITIONS

Application Deadline: 4:00 PM, Friday, May 10, 2013 in the CM Office

Name: _____

Phone: _____

Cal Poly e-mail: _____

Expected Graduation Term

Fall Winter Spring Summer

circle one 20____

☐ Check this box if you were an Alternate in 2013; if so which team? _____

☐ Check this box if you are a freshman or sophomore CM student but would like to be an Alternate in preparation for the following year.

- Note your Major if it is not CM _____
- Will you be gone for (circle): Co-op, Study Abroad, Cal Poly at Sea, other _____ etc.;
  - What quarters will you be gone _____

Note the **1st** and **2nd** choice of the competition(s) you are interested in and eligible for.

___ MCAA
TBA
March 10-13, 2014?
Scottsdale, AZ

___ NAHB
February 4-8, 2014
Las Vegas, NV
Note: conflicts with ASC
6 Students, 2+ Alternates
Advisor: Scott Kelting

___ ASC
February 5-8, 2014
Reno (Sparks), NV
72 students + 24 Alternates

If you checked the ASC Region 6 & 7 Competition above, again, note your **1st**, **2nd** and **3rd** choice.

ASC **REGION 6 & 7**
Problem Category

1.	___	Commercial	2.	___	Concrete Solutions
4.	___	Design-Build	4.	___	Electrical
5		Heavy Civil	6		LEED

Figure 13: Screenshot of the Cal Poly Competition Team Application.

Middle Tennessee University offers a class to be on their Competition Team. Their website had information about this class shown in Figure 14. The URL for their website is:
http://www.mtsu.edu/construction/marathon.php

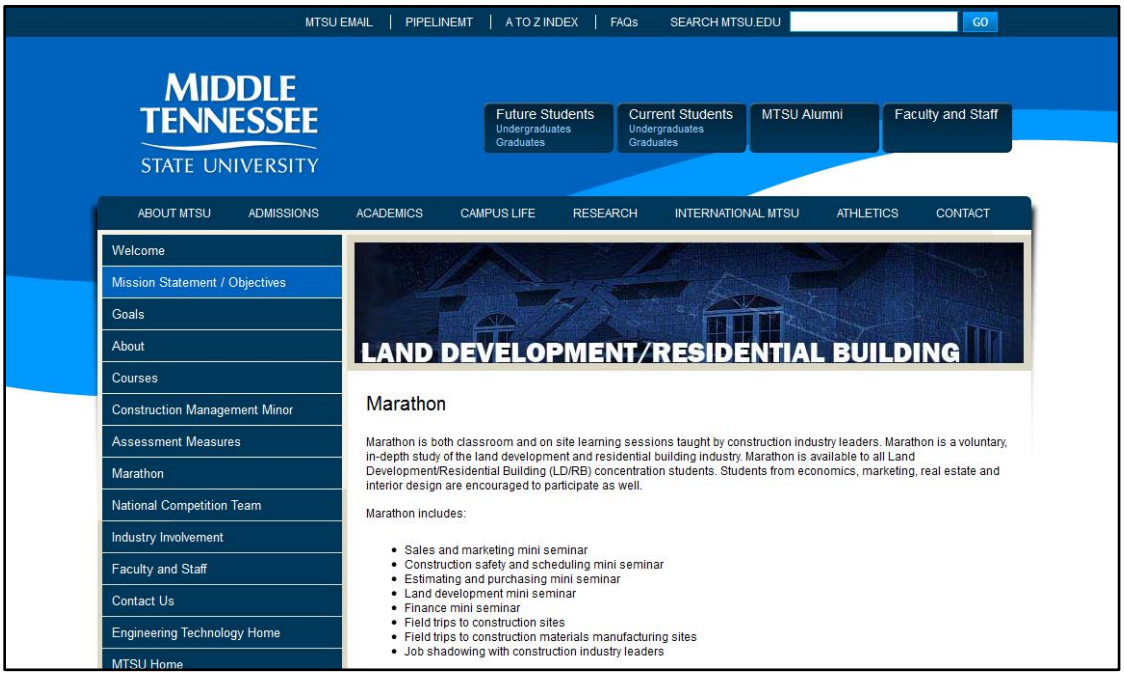


Figure 14: Screenshot of Middle Tennessee Marathon Website

3.3 NAHB Student Chapter Process for Michigan State University Student Builders and Contractors Association

The president of Michigan State's Student Builders and Contractors Association was interviewed to review what the organization had planned for the semester.

3.4 National Housing Endowment Residential Construction Related Scholarships Nationwide Process

The scholarships that the National Housing Endowment offers were also reviewed from the National Housing Endowment website, Figure 15, and included in this report's appendixes. The URL to find this information is: http://www.nationalhousingendowment.org/category.aspx?sectionID=1717&channelID=1407

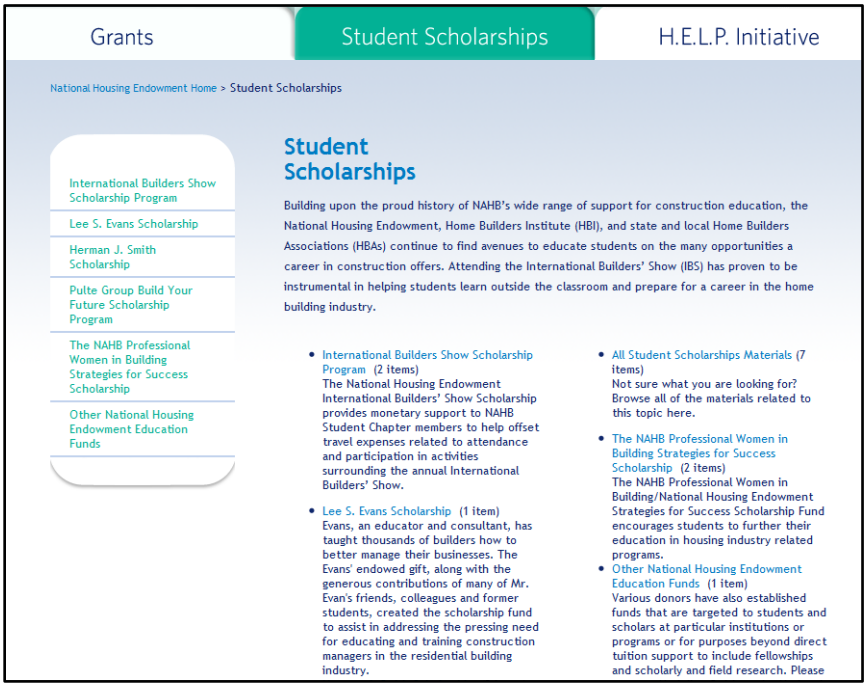


Figure 15: Screenshot of Student Scholarships offered by National Housing Endowment Website

4. Curriculum Review for Residential Construction Programs

4.1 Michigan State Construction Management Program: Residential Focus

4.1.1 Information Gathered from Michigan State Syllabus Review

The information gathered from the Michigan State Syllabus Review, was how the Learning Objectives are covered. A complete chart can be found in the Appendix B showing how each class is covered. The chart shows that most learning outcomes are covered by lecture, projects, labs and site visit. All the entry level Construction Management Courses only cover each class's learning outcomes by lecture. Utility Systems (CMP 230) does show examples of mechanical, electrical, and plumbing (MEP) drawings in the lectures. Site Construction and Measurement (CMP 305) is the first class to cover the learning outcomes with something besides lecture. The class offers a lab where students practice and learn material hands on. Scheduling (CMP

311) covers all learning outcomes in lab, students work on computers using Primavera P3 software. Real Estate Principles and Construction Finance (CMP 325) has many homework assignments for students to practice calculations. This class is covered by lecture and then projects. Construction Surveying and Cost Estimating Analysis (CMP 315 and 415) covers learning outcomes in labs with projects. This includes hands on work and work with computer programs. Students are given the opportunity to work with their own set of plans and specifications. Land Development (CMP 453) incorporates student research through case studies and article reviews. The summer Safety Class (CMP 401) is the only course that provides a site visit.

4.1.2 Michigan State Faculty Interview Results

The following Michigan State faculty members were interviewed: Professor Metoyer, Professor Streng, and Professor Welch. Each interviewee discussed the classes taught; how residential construction was covered in their courses; and if there was anything else that could be added to incorporate more residential, not only in their classes but program as a whole.

Professor Metoyer was interviewed on February 8th at 9:00am. Professor Streng was interviewed on February 8th at 10:30am. Professor Welch was interviewed on February 1st at 9:00am. The interview notes are below. All complete interview notes are included in the Appendices.

The professors all agrees that they would like the ability to take more field trips. Most classes are only 50 minutes, making it almost impossible to take students somewhere and have them back in time. Field trips provide an opportunity for students to view construction practices they are learning about. The professors would also like more time to be allotted for residential speakers. However, the professors note they already have so much to cover and there is no room to add speakers during class time, unless speakers could come outside normal class sessions. The professors have had trouble finding a complete set of Residential Plans and Specifications in order to teach the estimating class. Most prints are missing important information and require students to make too many assumptions and are not good teaching tools. A complete set of plans and specifications could be used in Construction Quantity Surveying (CMP 315). The students currently use a commercial project in the area.

The professors believe that most students gravitate toward commercial construction because of the ability to get an internship. Many commercial companies come to career fair and make company presentations. The professors all agree that more students would pursue a residential career if there were more opportunities for internships. It is required for all students to complete an internship or participate in a capstone course; therefore, most students choose commercial construction positions to help fulfill the requirement.

4.2 East Carolina University Construction Management Program: Residential Focus

4.2.1 Information Gathered from East Carolina University Syllabus Review

Erich Connell, Director of Residential Construction at East Carolina University sent Michigan State three syllabi to review. The syllabi he gave to review were: Residential Construction Techniques (CMGT 2558); Residential Development (CMGT 3558); and Residential Project Management (CMGT 4558). In addition, all other East Carolina Construction Management classes were reviewed. Since there were not syllabi for every class, the course description was looked at instead. The learning outcomes for each of these classes listed above were reviewed and were matched to the most similar class at Michigan State. The chart also shows

what Michigan State class learning outcomes was most similar. If there was no syllabus and no learning outcomes, it was based on course description.

All the classes sent to us by East Carolina cover their classes by lecture.

Table 5: Related Courses between East Carolina and Michigan State below shows what Michigan State University Course is most closely related the each East Carolina University Course.

Table 5: Related Courses between East Carolina and Michigan State

Related Courses	
East Carolina University Course	Michigan State University Course
CMGT 22000	CMP 101
CMGT 2210/2211	CMP 124, 210
CMGT 2400/2401	CMP 211
CMGT 2600	CMP 210
CMGT 3010	CMP 328
CMGT 3150	CMP 124
CMGT 3400	CMP 222, 322
CMGT 3500	CMP 385
CMGT 3800	CMP 305
CMGT 3700	CMP 305
CMGT 4000	CMP 315, 415
CMGT 3600	CMP 230
CMGT 3950	CMP 453
CMGT 3900	CMP 315, 401
CMGT 4100	CMP 411
CMGT 4300	CMP 423
CMGT 4500	CMP 493

After reviewing the syllabi and course descriptions, the following conclusions were made. Residential Construction Techniques (CMGT 2558) is most similar to CMP 124. Residential Development CMGT 3558) is a mixture of almost all Michigan State Construction Management classes but most of the learning outcomes relate to Real Estate Principles and Construction Finance (CMP 325). Real Estate Principles and Construction Finance had no learning out comes covered by the Gold Standard. Residential Project Management (CMGT 4558) is similar to the Competition team but Michigan State Competition team does not have an organized lecture. The class is used more as a work period at Michigan State. The classes at Michigan State that had similarities to the classes at East Carolina cover the material by not only lecture but projects, and labs. All the East Carolina schools covered these classes by lecture.

The learning outcomes from East Carolina University that did not match to a course at Michigan State and therefore had no learning outcome either were:

- Ability to apply technical knowledge to home building and design of residential plans
- Ability to identify material selection and gain technical application knowledge of floor system selection and installation
- Ability to identify alternative residential construction systems
- List interior space planning concepts

- Recognizing residential design concepts
- Identify sustainability of green home and LEED
- Identify residential marketing strategies
- Identify residential sales strategies

In total, there were 24 learning outcomes from the syllabi. Eight of the learning outcomes could not be matched at a class at Michigan State University.

4.3 NAHB Residential Gold Standard Review

4.3.1 Information Gathered from Learning Outcome Review

East Carolina University was given a HELP Grant by the NAHB and developed a Gold Standard Curriculum Resources for Residential Construction. The website is found at: http://www.ecu.edu/cs-tecs/construction/National-Housing-Endowment.cfm . The only working links on their website, shown on Figure 16, were the Learning Outcomes and Model Course Flow Template. The working links are in red boxes below. The information from these links can be found in the Appendices. A chart was made showing all the Learning Outcomes that the Gold Standard requires. The Michigan State and East Carolina classes that covered each Gold Standard Learning Outcome were also included. This decision was made based on the learning outcomes in Michigan State's Syllabi and East Carolina's course description. The Learning Outcomes from the Gold Standard that Michigan State does not cover are listed in the Table 6: Learning Outcomes from NAHB Gold Standard not covered in Michigan State Courses below.

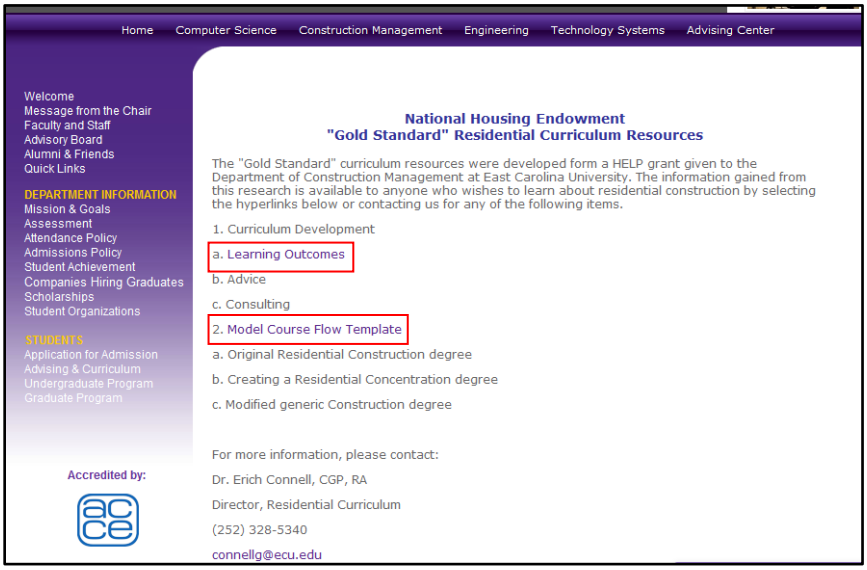


Figure 16: Screenshot of the Gold Standard Curriculum Resources Provided by East Carolina University

Table 6: Learning Outcomes from NAHB Gold Standard not covered in Michigan State Courses

Learning Outcomes from NAHB Gold Standard not covered in MSU Courses
Identify the resource cycle of materials for construction.
Identify space planning alternatives for residential interiors.
Articulate the concepts of sustainable development.
Differentiate the different structural systems involved in construction.
Identify and discuss framing techniques for building construction.
Discuss the ethics of contracting and construction management.
Discuss and plan for common construction techniques for interior/exterior finish systems.
Create building plans and details of a building design that incorporate a variety of building components and building systems.
Calculate building dimensions, design building components, analyze placement of components, and create final projects of student designed buildings.
Create AutoCAD and Sketch-Up projects encompassing basic construction document criteria.
Demonstrate team engagement and prepare CAD and class presentations based on team projects
Utilize correct terminology for construction systems when developing CAD drawings.
Analyze objects and create 2D and 3D projects in both hand drawn & CAD processes.
Utilize CAD software to analyze buildings and their systems.
Identify industry standards for sheet development, detailing, note placement and construction document systems of materials and systems identification.
Identify potential problems in construction drawings and communicate with the designer.
Create MEP schematic drawings using hand sketch and CAD drawings, derived from information obtained in the lab and on-site project visits.
Update a project schedule based on actual performance.
Articulate resource use for a construction project and incorporate the information in a schedule.
Prepare quality control checklist based on construction specifications, standards, and codes.
Coordinate in-process inspections and material delivery with project schedule.
Explain historical human resource management theories and current practices. Discuss the characteristic elements of compensation and benefits plans.

Plan and conduct personnel recruiting, placing, and training.
Analyze and Conduct a safety audit of a construction site.

Of the possible 146 Gold Standard Learning Outcomes, 26 of them were not covered by Michigan State. The Michigan State courses with the most learning outcomes on the NAHB Gold Standard are Construction Project Management (CMP 423). It had 22 learning outcomes. Site Construction and Measurement (CMP 305) had 17 learning outcomes and Residential Construction Materials and Methods (CMP 124) had 14 learning outcomes. The current NAHB Gold Standard Learning Outcomes that Michigan State covers are covered by an even mixture of lectures, projects, and hands on labs.

East Carolina University's course descriptions were also reviewed and compared to the Gold Standard Learning Outcomes. Based on course description, 45 of the learning outcomes were not covered.

4.4 Feedback to Gold Standard and NAHB

Real Estate and Construction Principles (CMP 325) are currently not learning outcomes in the Gold Standard. Real Estate and Construction Principles provides students an understanding of financial methods, instruments utilized in construction, rehabilitation, development and purchase of real estate.

Material that was on the nonworking links needs to be added. These are curriculum development, advice, counseling, original construction degree, creating a residential construction degree, and modified generic construction degree.

5. Residential Competition Teams Review

5.1 Information Gathered from Michigan State Competition Team Interviews

Michigan State provides a class for students to take that will count as their capstone or elective requirement. There is no information found on the School of Planning Design and Construction website about the competition team or taking the class. Information about the class can be found on the Michigan State Schedule of Courses website, under the search for courses tab. Figures 17 & 18 below show screen shots of this. The URL to gain this information is: https://schedule.msu.edu/searchResults.asp#SearchResults .

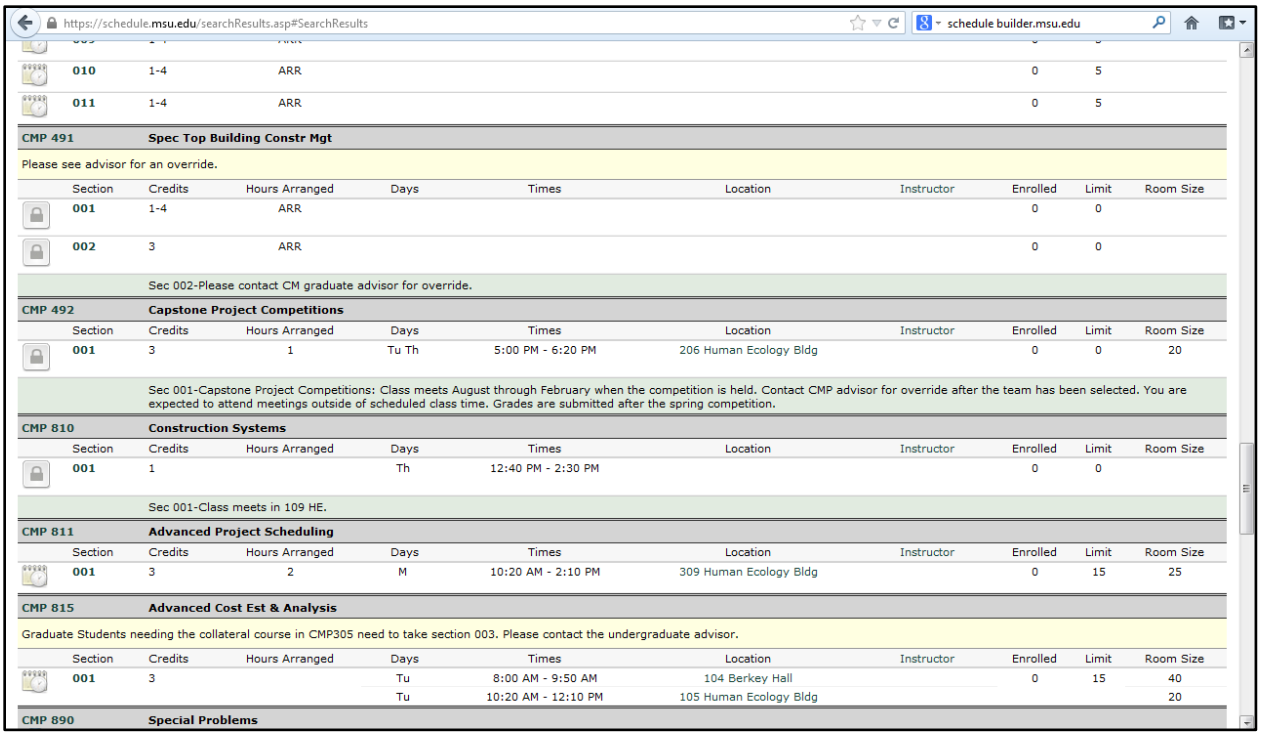


Figure 17: Screen Shot from the Schedule of Courses webpage

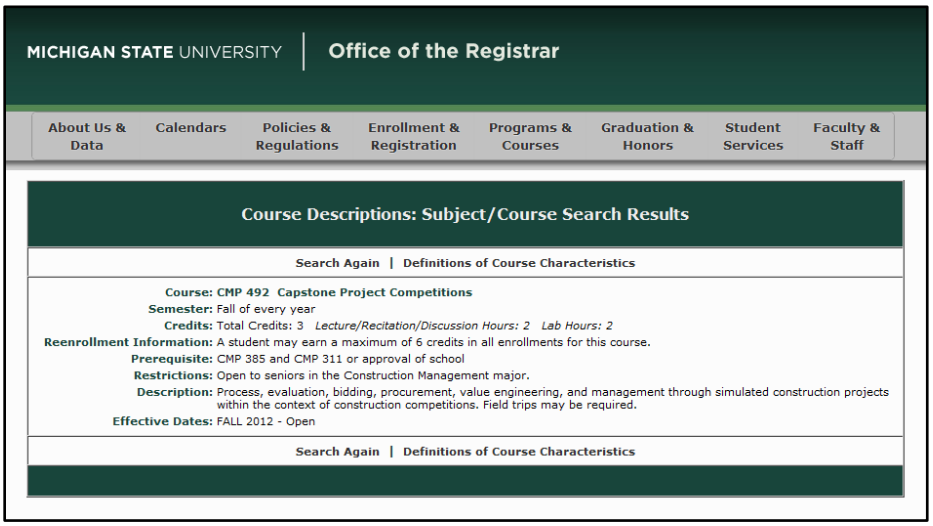


Figure 18: Screen Shot of the Course Description webpage

Michigan State's competition team was interviewed to help determine what made the team successful and their preparation process.

Many things contributed to the success of the first place finish of the Michigan State Residential Team this past year. The students on the team all agreed that the teams' greatest efforts came from their ability to work well together and shared the common goal of winning a National Championship. Everyone stayed very dedicated throughout the entire preparation of the proposal and worked well together. Everyone was clear on the common goal and on the same page. Students knew of each other's strengths and weaknesses and knew

when and were not afraid to pick up others slack. Josh Pittsley believes the 80/20 Rule applied to this year's team, which says that 80% of the work was done by 20% of the people. And the other 80% of the people only contributed about 20% of the finished product. Since the members of the team were aware of this and dedicated, the lack of contribution from some members did not bring the team down as a whole. Students also felt that the ability to visit the site helped them gain valuable information from local developers, and realtors in the area. This information could not be gained without visiting the site resulting in an advantage over the other teams. This included ideas for how they designed the project and the site layout. An employee from Mayberry Homes was one of the many industry speakers that came to our class. The team members felt the feedback the industry professionals helped give them understanding from real life experience.

In order to improve the team and make future teams more successful, all members of the 2013 team agreed that more time was needed to develop a better proposal. The team could not start preparing until mid-October after the Commercial Competition. Unfortunately toward the end of the project, the team felt they were cramming and could not create the best proposal possible. The amount of work on the project was not foreseeable until the project was well underway. On top of the amount of work for other classes, students became frustrated and stressed and saw the class as a burden versus an opportunity. The team members put in many long hours towards the end of the semester. A work room is very critical for the team's success. In the final hours of preparation, the team could not afford to be fighting over space with other students. Also in order to improve the final hours of the project, a better way to gather and bring the information is needed. A lot of time was wasted trying to format correctly. All laptops should be equipped with Adobe Acrobat Pro. Additional support from the faculty would be beneficial. Michigan State is fortunate enough to have some very knowledgeable professors. Their knowledge and assistance would be greatly appreciated.

The presentation required lots of practice. Professor Streng met with team members outside of class prior to the presentation to practice public speaking. Professor Streng filmed each student speaking and led multiple public speaking exercises. The team found these exercises very helpful. Practicing the presentation many times made sure that each speaker had their part memorized and was comfortable, making it easier to speak in front of others. The team had industry professionals also come in a listen to the presentation to critique and give ideas on how to be more confident.

In order to improve the team for future success, team members would like to either have more time or more students to distribute the workload more evenly. For example, have 12 students and have 6 students participate in the commercial competition and then a different 6 on the residential competition. Another option would be to compete in one competition. This would allow more time to prepare for the Residential competition. The criteria for the selection of the team need to be more selective. The advising department needs to prepare students for the amount of work and commitment that this class requires. Also if events, such as the career fair, were not planned as the same time as the competition, it would give team members a chance to participate in both.

For the members of the team that had internships, those individuals felt that this experience helped them the most in their preparation and success. All the Construction Management classes, helped prepare students but the estimating, scheduling, and project management classes were most often looked over while preparing the proposal. Students on the competition team should be required to take Project Management (CMP 423) concurrently in order to understand the cash flow analysis. Estimating is currently offered at the same time as

the competition class and required to be taken concurrently. Real Estate and Construction Principals also helped with the financial part of the project.

Ken Gottschalk, an employee at the Physical Plant was the coach for the 2013 1st Place Competition Team. Ken believed that this team was different from last year because the students took ownership of the project and were all committed to the goal of winning and becoming National Champions. All the students worked very well together. This past year more speakers from the industry were brought in. This gave the students an opinion from experienced professionals. The work was also divided based on students interest, in the past the work was divided to challenge students in areas where they were not that proficient or comfortable in. By dividing the topics to students that found each topic interesting, it made them an expert on the topic and allowed them to use what they had previously learned or experienced. Unfortunately students did not improve in areas they were not as familiar with. Some of the students also visited the site; this gave the students a better understanding of the local environment and customs of the population. This especially helped determine the demographics of the site and to provide insight of what the customers would want in their homes. In order for any competition team to be successful, preparation, ability, and wanting to learn is key. Students must not be afraid to ask questions of other students, the coach or of guest speakers when they came in.

Ken currently does not think he needs any additional resources. The school has been very supportive in preparing the students. The team is very appreciative of this. The classes do an excellent job at preparing students but if there was an area for students to improve it would be in communication and public speaking. Students need to be more confident in speaking with industry professionals.

In order to draw more students to the team, there needs to be more marketing. The class maximum is 12 students where 6 participate in each competition. This year we had 9 students. Ken believes offering more competitions and more opportunities for students to compete would bring more students into the class. This would put a strain on the students and resources, however.

Copies of all interviews can be found in the appendix.

5.2 Information Gathered from Benchmark Programs Competition Teams

The most successful competition teams in the last five years are Brigham Young University, Texas A&M, California Polytechnical University, and Middle Tennessee. These competition teams were reviewed based on their university website.

5.2.1 Information Gathered from Brigham Young University

Students at Brigham Young University must apply to a team at the end of the winter term and the next year, the fall term is spent preparing. These competition teams are viewed as extra curricular activities not classes. The competitions Brigham Young participates in are: NAHB, ASC, CM Challenge, and Rocky Mountain Design/Build. The link to this information is: http://cm.byu.edu/?q=competitions

5.2.2 Information Gathered from Texas A&M

Texas A&M also does not have a class for the competition team but it is viewed as an extra curricular activity. Teams are formed at the beginning of the semester and have weekly meetings. A faculty member is the coach. The link to find more infromation is: http://cosc.arch.tamu.edu/people/student-groups/

5.2.3 Information Gathered from California Polytechnical University

Cal Poly also only offers the teams as an extra curricular. Interested students must fill out an application the spring prior to the competitions. The teams are only open to juniors and seniors. The link to find more information is: http://www.construction.calpoly.edu/content/competitions-and-awards/index

5.2.4 Information Gathered from Middle Tennesse State University

Students at Middle Tennesse State Univeristy must be enrolled in Marathon in order to be eligible for the competition team. Marathon is voluntary and uses both classroom and on site learning sessions taught by construction industry leaders. Marathon is available to all Land Development/Residential Building (LD/RB) concentration students. Students from economics, marketing, real estate, and interior design are allowed to participate as well. Marathon includes:

- Sales and marketing mini seminar
- Construction safety and scheduling mini seminar
- Estimating and purchasing mini seminar
- Land development mini seminar
- Finance mini seminar
- Field trips to construction sites
- Field trips to construction materials manufacturing sites
- Job shadowing with construction industry leaders

The link to find more information is: http://www.mtsu.edu/construction/marathon.php

6. NAHB Student Chapter Review at Michigan State Student Builders and Contractors Association

6.1 Information Gathered from NAHB Student Chapter Review at Michigan State Student Builders and Contractors Association

Grant Malone is the Fall 2012-Spring 2013 President of the Student Builders and Contractors Association at Michigan State University. Grant was interviewed to learn what the student organization has planned and has done this semester. Grant was interviewed on February 15th at 12:00pm.

The activities relating to residential the student organization has planned this semester are one speaker. The student organization would like to have more speakers speak about land development and entrepreneurship. Students in the organization would also like to have an Alumni panel with lessons learned about MSU CM Program and Residential Construction.

7. National Housing Endowment Residential Construction Related Scholarships Nationwide Review

The following Scholarships were found on the National Housing Endowment Website: http://www.nationalhousingendowment.org/category.aspx?sectionID=1717&channelID=1407 shown on Table 7 below.

Table 7: National Housing Endowment website list of scholarships

Scholarships offered by National Housing Endowment			
Scholarship	**URL to find Scholarship**	**Who can Apply**	**Due Date**
Lee S. Evans Scholarship	http://www.nationalhousingendowment.org/reference_list.aspx?sectionID=1737&channelID=1407		No Due Date Found
Herman J. Smith Scholarship	http://www.nationalhousingendowment.org/reference_list.aspx?sectionID=1738&channelID=1407	Undergraduates preparing for careers in Residential Construction. Preference is given to students in Texas	May 3rd 2013
Pulte Group Build Your Future Scholarship Program	http://www.nationalhousingendowment.org/reference_list.aspx?sectionID=1739&channelID=1407	Students pursuing career in building industry	March 8th 2013
The NAHB Professional Women in Building Strategies for Success Scholarship	http://www.nationalhousingendowment.org/reference_list.aspx?sectionID=1740&channelID=1407	Full time student, pursuing a career in a building related course of study	March 15th 2013
Dale & Bea Stuard/National Housing Endowment Educational Fund		Any student but special interest given to those in California	No Due Date
National Housing Endowment/Richard Sexton Scholarship Recipients		Students at Birmingham Southern College in Alabama	

Lee S. Evans Scholarship

Lee S. Evans and his wife, Virginia, established the Lee S. Evans/National Housing Endowment Scholarship in 1990. Evans, an educator and consultant, has taught thousands of builders how to better manage their businesses. The Evans' endowed gift, along with the generous contributions of many of Mr. Evan's friends, colleagues and former students, created the scholarship fund to assist in addressing the pressing need for educating and training construction managers in the residential building industry. The Evan's vision to establish a permanent source of scholarship funding to assist promising students entering the field of residential construction management, has helped students nationwide achieve their career goals.

No application or due date found

Herman J. Smith Scholarship

Herman J. Smith, a builder and developer in Tarrant County, Texas, and surrounding areas held numerous leadership positions in state and local home builder associations and as President of the National Association of Home Builders during his long career. He was inducted into the National Association of Home Builders' Housing Hall of Fame in 1987. His philanthropic contributions throughout the years benefited his church, his community, his industry, and his peers. His dedicated leadership and his exemplary life will remain as an inspiration to all those lives he touched during his lifetime. In keeping with his favorite motto, "always leave the woodpile higher than you found it," this scholarship fund commemorates an outstanding Texas and housing icon, Herman J. Smith.

Due May 3, 2013

Pulte Group Build Your Future Scholarship Program

Pulte Group established the Pulte Group/National Housing Endowment Build Your Future Scholarship in 1999. These scholarships provide tuition assistance to undergraduate students pursuing careers in the building industry. The scholarship fund was created to assist in addressing the pressing need for educating and training managers in the building industry. The vision and mission of this program is to establish a permanent source of scholarship funding to help students nationwide achieve their career goals.

Due March 8, 2013

The NAHB Professional Women in Building Strategies for Success Scholarship

The NAHB Professional Women in Building Strategies for Success Scholarship Fund encourages students to further their education in housing industry related programs. It was initiated in 2001 by NAHB Professional Women in Building Past National President Deborah Ferland and Austin Ferland and is supported through the generosity of Professional Women in Building members, individuals, and corporations.

Up to $2,000 can be awarded to a full time student pursuing education in a building-related course of study, such as construction management, construction technology, civil engineering, architecture, design, or any of the trade specialties at the college or university they attend. The scholarship award may be used to pay tuition, fees, and/or books.

Due March 15, 2013

Dale & Bea Stuard/National Housing Endowment Educational Fund

This fund provides financial assistance to qualified young individuals who are active students or trainees in educational programs designed to prepare them for careers in the housing industry.
Applicants must either be a graduating high school student or presently enrolled in an academically-recognized construction program.

Special emphasis may be given to programs or individuals located in the state of California and to individuals who, due to family or financial circumstances, are unlikely to have educational opportunities beyond high school or equivalent career technical training.
This fund is administered by the Building Industry Association of Orange County.

No due date or application found

National Housing Endowment/Richard Sexton Scholarship Recipients

This scholarship was founded in 1989 in memory of Richard Sexton, a builder from Alabama.
Over $61,000 has been awarded to support housing research and scholarships at university housing centers throughout the state of Alabama and at Sexton's alma mater, Birmingham Southern College.

No due date or application found.

8. Conclusions

The proud history of Michigan State University's Construction Management Program, has found its richness through both commercial and residential construction. Through the successful award of the National Association of Home Builders - Homebuilding Education Leadership Program 2013 grant our program will continue to seek was in which we can produce high quality professionals for the residential industry. This report presents our current strategies aimed to improve the residential construction. To this end, we have thoroughly examined the NAHB Gold Standard Curriculum Resources for Residential Construction across other universities; evaluated our student residential competition team formation, strategies, and lessons learned; and collected feedback from both faculty and students on program improvements. In addition, our report explores the numerous scholarship opportunities available for residential construction undergraduate and graduate students. It is our aim that these strategies, and findings, will be utilized to display our commitment to graduate qualified Construction Managers equipped with necessary tools to successfully enter the residential construction industry. In the light of this report, the following action items are produced to achieve our report goals:

- Embed up-to-date residential construction documents and site visits in a variety of courses to enrich the residential construction focus of MSU's CM curriculum. HELP 2013 industry advisory board members agreed to support MSU's CM program with this goal. HELP 2013 project team will facilitate the access of MSU faculty to these construction documents and site visits;
- Continuously monitor and improve our learning outcomes across the curriculum;
- Provide feedback to NAHB's Gold Standard Curriculum and online resources based on the outcomes of this report;

- Ensure repeating competition team success, carry the lessons learned as presented in this report to the coming years; and engage the competition team with the residential advisory members at the beginning of the residential competition preparations to facilitate brainstorming sessions;
- Facilitate faculty members' active engagement with the NAHB student chapter at MSU, bring residential industry speakers to student chapter events to inspire students in entrepreneurship in residential construction, and bring CM students to local Home Building Association events to strengthen student-industry ties; and
- Publicize NAHB's scholarship activities via student chapter, SPDC website, advising offices, and other school resources to encourage student involvement.

9. References

Brigham Young University - Construction Management (BYU). (2013). *Undergraduate: Competition*, April 22, 2013 from http://cm.byu.edu/?q=competitions

California Polytechnic University - Construction Management (Cal Poly). (2013). *Student Awards*, April 22, 2013 from http://www.construction.calpoly.edu/content/competitions-and-awards/index

East Carolina University - Department of Construction Management (ECU). (2013). *National Housing Endowment "Gold Standard" Residential Curriculum Resources*, April 22, 2013 from http://www.ecu.edu/cs-tecs/construction/National-Housing-Endowment.cfm

East Carolina University - Department of Construction Management (ECU). (2013). *Advising and Curriculum*, April 22, 2013 from http://www.ecu.edu/cs-tecs/construction/advising_curriculum.cfm

National Association of Home Builders (NAHB). (2013). *NAHB Student Chapters Awards Ceremony Results*, April 22, 2013 from http://www.nahb.org/generic.aspx?sectionID=1320&genericContentID=92934

Michigan State University - Office of the Registrar (MSU). (2013). *Academic Programs - Undergraduate Degree: Construction Management*, April 22, 2013 from http://www.reg.msu.edu/AcademicPrograms/ProgramDetail.asp?Program=5257

Michigan State University - Office of the Registrar (MSU). (2013). *Course Descriptions: Subject/Course Search Results*, April 22, 2013 from http://www.reg.msu.edu/Courses/Request.asp

Michigan State University - School of Planning, Design, and Construction (MSU). (2013). *Scholarships*, April 22, 2013 from http://www.spdc.msu.edu/student_services/scholarships

Michigan State University - School of Planning, Design, and Construction (MSU). (2013).*Undergraduate Degree: Construction Management - Bachelor of Science*, April 22, 2013 from http://www.spdc.msu.edu/student_services/undergraduate

Michigan State University - School of Planning, Design, and Construction (MSU). (2013). *Student Organization*, April 22, 2013from http://www.spdc.msu.edu/student_services/student_organizations

Middle Tennessee State University - Construction Management (MTSU). (2013). *Land Development/Residential Building*, April 22, 2013 from http://www.mtsu.edu/construction/marathon.php

National Consortium of Housing Research Centers (2013). *Current Research*, April 22, 1013 from http://www.housingresearch.net/currentresearch.html

National Housing Endowment (2013). *Student Scholarships*, April 22, 2013 from http://www.nationalhousingendowment.org/category.aspx?sectionID=1717&channelID=1407

Texas A&M University - Construction Science (2013). *Student Groups - Student Competition Teams*, April 22, 2013 from http://cosc.arch.tamu.edu/people/student-groups/

10. Appendices

10.1 Appendix A: Summary of Michigan State Construction Management Courses

The program is designed to provide a student with a background in managerial, technological, economic, social, political, and environmental aspects of residential and commercial construction. A systems approach is used and includes project management, construction science, land acquisition and development, real estate, finance, management, and marketing. Career opportunities include supervisory and managerial employment within commercial and residential contracting, land development, and real estate organizations; material distribution systems; financial institutions; and governmental agencies.

CMP 101 Principles of Building Construction Management (2 credits)

Historical developments, current issues and trends in commercial and residential construction industries.

CMP 124 Residential Construction Materials and Methods (3 credits)

Properties of construction materials and their application in residential construction.

CMP 210 Commercial Construction Methods (3 credits)

Commercial construction: principles, materials, assemblies, and commercial blueprints.
CMP 211 Building Codes (3 credits)

Construction codes: structural, mechanical, electrical, and plumbing. Building safety and accessibility.

CMP 222 Statics and Strengths of Materials (3 credits)

Equilibrium of forces. Free body diagrams. Force components. Bending moments. Stress and strain. Mechanical properties of materials. Beams and trusses. Computer applications. Indeterminate structures.

CMP 230 Utility Systems (4 credits)

Heating, cooling, ventilating, electrical, gas, lighting, water, waste water, telecommunications, fire protection, safety, security, and sound control systems in residential and commercial construction. Applicable codes.

CMP 305 Site Construction and Measurement (3 credits)

Site construction methods, materials and equipment for buildings, soil, foundation, erosion, and storm water. Layout, leveling, surveying, and underground utilities.

CMP 311 Construction Project Scheduling (3 credits)

Basic construction project scheduling procedures. Work breakdown structure, critical path method, and scheduling logic. Activity durations, status reports, resource allocation, and control.

CMP 315 Construction Quantity Surveying (3 credits)

Measurement of quantities for construction projects. Work breakdown structure. Industry standards.

CMP 322 Structural Systems (3 credits)

Structural design using wood, steel and concrete. Beams, columns, footings, and foundation walls. Loading, soils.

CMP 325 Real Estate Principles and Construction Finance (4 credits)

Financial methods and instruments utilized in construction, rehabilitation, development, and purchase of real estate. Terms, contracts, valuation, brokerage, taxation, risk, and interest rate analysis.

CMP 328 Construction Presentation Graphics and Building Information Modeling (2 credits)

Graphic communication methods used in construction organizations. Use of Building Information Modeling software.

CMP 385 Construction Documents and Contracts (3 credits)

Construction contracts for commercial and residential projects. Contract procedures, bidding, changes, substitutions. Specifications. Insurance, bonding, claims, disputes, and payments. Responsibilities of owners and contractors.

CMP 401 Construction Safety Management (3 credits)

Construction safety with Occupational Safety and Health Administration (OSHA) emphasis. General safety and health provisions, records, and safety management programs. Personnel protection and life saving equipment. Economic impact of safety program.

CMP 415 Cost Estimating and Analysis (3 credits)

Estimation of construction project costs: direct and indirect, labor, material, and equipment. Overhead and profit. Bidding. Computer-based estimating.

CMP 423 Construction Project Management (3 credits)

Construction management principles and practices. Project planning and controls.

CE 312 Soil Mechanics (4 credits)

Engineering properties of soil and their measurement. Effective-stress concept. Permeability and seepage. Compaction. Consolidation, shear strength, and stress-strain behavior.

CE 471 Construction Engineering - Equipment, Methods and Planning (3 credits)

Engineering and construction fundamentals of earthwork operations, moving of materials, concrete construction, formwork, false work, and other temporary structures. Relationship to a construction project's constructability, cost, and schedule.

CMP 453 Land Development (3 credits)

Methods and practices of land development, market research, financial feasibility, land use regulations, legal documentation, and site analysis and design. Case studies.

CMP 491 Special Topics in Building Construction Management (3 credits)

Topics such as computer methods in building construction management, construction technology, solar energy, special land use codes, or new technology management.

IDES 240 Computer-Aided Design for Designers (3 credits)

Introduction to computer-aided design applications.

LA 230 Site Construction Materials and Methods (3 credits)

Landscape architectural elements and principles of grading, drainage, construction materials and methods.

PDC 491 Special Topics (3 credits)

Selected topics that integrate content across construction management, interior design, landscape architecture and urban and regional planning.

UP 458 Housing and Real Estate Development (3 credits)

Real estate development process from idea inception to asset management. Finance, organization, design and implementation. Housing, social impacts, and public sector involvement.

CMP 435 Residential Building and Development Projects (3 credits)

Development of a residential project and business plan.

CMP 436 Commercial Building Projects (3 credits)

Evaluation, procurement, and management of commercial building projects.

CMP 492 Capstone Project Competitions (3 credits)

Process, evaluation, bidding, procurement, value engineering, and management through simulated construction projects within the context of construction competitions. Field trips may be required.

CMP 493 Professional Internship in Building Construction Management (3 credits)

Supervised professional experiences in agencies and businesses related to a student's major field of study.

10.2 Appendix B: Learning Outcomes for MSU Residential Courses

Learning Outcomes for MSU Residential Courses

CMP 101-Principles of Building Construction Management

Learning Outcome	How it is covered
List Contractor Types	Lecture
Differentiate between residential, commercial, industrial, institutional, and mixed-use projects	Lecture
Define union and non-union contractors	Lecture
Identify the steps required to obtain an accurate estimate	Lecture
Correctly identify the roles of owners, consultants, general contractors and subcontractors	Lecture
Distinguish between lump sum, cost-plus-fee, guaranteed maximum price and unit price contracts	Lecture
Identify the various stages of a project from design through post construction	Lecture
Identify successful construction processes	Lecture
Identify many ADA requirements and where they apply	Lecture
Differentiate between ethical and unethical behavior	Lecture

CMP 124-Residential Construction Materials and Methods

Learning Outcome	How it is covered
Discuss properties, uses and developments of the materials used in residential construction of today's structures	Lecture
Discuss the difference between S-DRY and S-GRN framing material	Lecture
Explain functional difference between housewrap and vapor barrier	Lecture
List 5 Cement Types	Lecture
Lists and discuss the different types of Masonry Types	Lecture

CMP 211-Building Codes

Learning Outcome	How it is covered
Competencies required to navigate, review and interpret the International Residential and Building Code	Lecture
Students will develop an understanding of the process and goals of construction code regulation	Lecture
Students will develop an understanding of the working relationship between the project manager and the building official	Lecture

Students will demonstrate competency in the terminology associated with Construction Codes and Code Enforcement	Lecture

CMP 222-Statics and Strength of Material

Learning Outcome	How it is covered
Calculate forces, reactions, force components, moments and couples	Lecture
Calculate stress and strain	Lecture
Calculate the average stresses that occur in members and joints of simple structures	Lecture
Understand how beams behave under loading	Lecture
Do all of the calculations related to beam analysis	Lecture
Understand the design of beams	Lecture
Understand the load distribution on buildings	Lecture
Understand the construction loads and operations on structures	Lecture

CMP 230-Utility Systems

Learning Outcome	How it is covered
Calculate Heat Loss of a structure	Lecture
Calculate Heat Gain of a structure	Lecture
Calculate the cost of heating a structure with readily available fuels	Lecture
Calculate the cost of cooling a structure	Lecture
Compute ventilation air requirements for healthy IAQ	Lecture
Compute voltage drop	Lecture
Use Ohm's law to compute a missing variable	Lecture
Compute the monthly cost of electricity for a home	Lecture
Size water piping systems	Lecture
Size duct systems	Lecture
Identify the various types of heating and cooling systems	Lecture
Identify unethical and ethical behavior	Lecture
Identify components of MEP drawings and list their functions	Drawings
Identify which parts of building meet energy star requirements	Lecture
Identify the advantages and disadvantages of 6 alternative energy sources	Lecture

CMP 305-Site Construction and Measurement

Learning Outcome	How it is covered
Discuss the basic functions of the site supervisor and site responsibilities	Lecture
Explain trenching equipment and safety equipment necessary for safe trenching practices	Lecture
List the main three types of soil erosion and erosion control methods	Lecture

Demonstrate proper set-up and use of site leveling (straight-line) equipment	Lab
List the factors that cause frost heave and how to control frost heave	Lecture
Read and discuss site and topographic maps	Lab
List two classification tests that are used to determine the range of particle sizes	Lecture and Lab

CMP 315-Construction Quantity Survey

Learning Outcome	How it is covered
Read and interpret (explain) construction documents (material description-quality) and construction drawings	Lecture and Lab
Calculate the quantity of construction materials needed for a given construction project (CSI divisions 3-9, 2 and 31-32)	Lecture and Lab

CMP 311-Scheduling

Learning Outcome	How it is covered
Determine durations of common building construction activities	Lab
Assess progress and status to pre-establish project milestones	Lab
Track resource utilization and cash flow on projects	Lab
Monitor timing and budgetary overruns	Lab
Perform what-if-scenarios and make decisions on construction progress	Lab
Understanding of master project scheduling concepts and labor saving computer applications employed in construction to both develop and communicate work schedules. Students shall demonstrate knowledge relating to construction sequence for wood, and steel construction	Lab
Students will demonstrate the ability to use arrow and node networks, basic overlapping networks, project controls, least cost scheduling and lean construction	Lab

CMP 322-Structural Systems

Learning Outcome	How it is covered
Understanding of loads and forces on buildings	Lecture
Construction loads and operations on structures	Lecture
Procedures used to design structural elements for buildings by applying principles of physics, statics and mechanics to the design of beams, columns, and foundations	Lecture
Basic structural design procedures for wood, steel and concrete structural systems	Lecture

CMP 325-Real Estate Principles and Construction Finance

Learning Outcome	How it is covered
Determine the unknown financial variable in return/investment problems-interest rate (i), present value (PV), future value (FV), number of periods (N), and payments (PMT)	Lecture, Homework Problems
Determine whether leverage is positive or negative	Lecture
List Property Rights	Lecture
Read and understand a mortgage, sales agreement, title insurance policy	Lecture
Calculate Loan Balance at any point in time	Lecture, Homework Problems
Select the real estate investment yielding the lowest risk, highest return	Lecture, Homework Problems
List those items important to establishing real estate value	Lecture
Establish income (investment) property values	Lecture
Define Secondary Mortgage Market	Lecture
Identify the characteristics of FHA, VA, HUD, Fannie Mae, and Freddie Mac	Lecture
Determine whether to purchase or lease real estate	Lecture, Homework Problems
Enumerate the differences between land development and project development	Lecture
Calculate flows into the future for investment properties	Lecture, Homework Problems
Calculate returns on investment before and after taxes	Lecture, Homework Problems
List the advantages and disadvantages of various forms of real estate ownership	Lecture
Differentiate between ethical and unethical actions	Lecture

CMP 401-Construction Safety Management

Learning Outcome	How it is covered
Discuss policies and safety regulations developed by OSHA	Lecture, Site Visit
Plan for proper safety procedures and to analyze the potential hazard on the job site	Lecture, Site Visit
Discuss proper welded frame scaffold erection standards as required by OSHA	Lecture
Discuss and explain proper ladder set-up procedures as required by OSHA standards	Lecture

CMP 415-Cost Estimating and Analysis

Learning Outcome	How it is covered
Prepare a cost estimate for a construction project based on scientific methods and procedures	Lecture, Lab, Projects
Understand principles of basic estimating, general requirements and bid preparation and review process as well as bid ethics	Lecture, Lab, Projects
Use computer software to prepare an estimate for residential/commercial projects	Lab
Appraise bid strategies, explain bid efficiency, judge engineering economy, describe and correlate job costing and construction cost accounting	Lab, Lecture, Projects
Form construction crews and predict their productivities and explain how productivity affects the project cost data	Lab, Lecture, Projects

CMP 435-Residential Building Projects

Learning Outcome	How it is covered
Create a comprehensive interactive understanding of the development of residential construction projects through a well-considered proposal as well as a practice execution	Project

CMP 423-Construction Project Management

Learning Outcome	How it is covered
Become familiar with the overall concepts of construction project management	Lecture
Understand project organization and start up	Lecture, project
Introduced to computer based project administration	Lecture, lab
Learn project control techniques related to time and cost	Lecture, project

CMP 453-Land Development

Learning Outcome	How it is covered
Evaluate Development Project Feasibility	Lecture
Perform basic Development Site Analysis	Lecture
Explain the Brownfield Redevelopment Process	Lecture
Explain Infill Redevelopment	Lecture
Explain Urban Renewal and its major problems	Lecture
Understand the goals of municipal Planning and Zoning	Case Study
Explain the Municipal Site Planning Process	Lecture
Explain the differences and advantages of Subdivision vs Site Condos	Lecture
Perform a basic Market analysis	Lecture
Identify the Target market for a development project	Lecture
Develop a basic Marketing Plan for a development project	Lecture

Demonstrate understand of Zoning Regulations, and Model Codes and Development Fees	Case Study
Analyze Engineering Feasibility Analysis of a Development	Lecture
Explain the basic Environmental Regulations imposed on development	Lecture
Explain Environmental Site Assessments	Lecture
Describe Historic and Archaeological Assessment	Case Study
Perform a basic Market Analysis and Economic Feasibility	Lecture
Explain the basic municipal Rezoning Process	Case Study
Demonstrate understand of Ethics issues related to Land Development	Lecture

10.3 Appendix B: Interview Notes - Professor A

Interview Notes

CMP 101

- Most examples used are residential
- Feels he cannot use too many residential because he is trying to convert non CM to CM majors. The economy is so bad that many people have negative views about residential
- Uses PowerPoint
- Would like to do field trips but there are too many people, not enough time.
    - He has thought about putting together an extra credit option that would be available 3 or 4 times a semester

CMP 230

- Starts class with a lot of residential examples-HVAC
- Uses lecture and PowerPoint
- Focuses on energy code compliance with residential specs, determining if applies to residential energy code

CMP 325

- Uses lots of residential examples
- Wishes he could have a homebuilder give a guest lecture about how they handle financing on a residential project

CMP 411

- Students will schedule a residential house
- Learn how to use software in lab, lab is now using P6
- Lectures using PowerPoint
- This class is very theoretical-need to know how to apply software to: residential, commercial or infrastructure
- He would like to add another residential scheduling assignment with either HW or project

Residential Capstone

- Set up company-LLC, etc.
- Picking lot, picking structure
- All residential or mixed use
- Lectured-based on the phases they should be completing (business form, marketing)
    - Have people come in for area of expertise and from other departments

Overall Program Notes

- Need more residential internships-problem-builders cannot afford to pay and students cannot afford unpaid

- Need help from NAHB? Get more participation in career fair or presentations in the evening

10.4 Appendix C: Interview Notes - Professor B

Interview Notes

CMP 210

- Nothing

CMP 211Building Codes

- 50% residential
- Lectures with many residential stories and examples-200 terms
- Could add an outside speaker but would be afraid it would be too boring

CMP 435 Residential Capstone

- Modeled similar to comp team
- Mixed use in Byron Michigan
- Went to Byron and met with officials, took pictures
- Made plans for commercial, residential
- Made estimate and schedule
- Will present book to officials
- Would really like the university to pay to have books made not only for students but officials in Byron
- No formal lectures, go over what working on-it is a work period
- Streng sees himself as more of a consultant
- Requires students to make a schedule of work throughout the semester

CMP 453 Land Development

- 75% residential
- Goes over everything until the shovel is put into the ground
- Political process: agencies have impact, jurisdiction, demographics, developing project meets needs of local community
- Speak on Residential development
- Lectures
- Group discussion
- Would like to take a field trip but in the past not enough interest, hard to take students away for a full day

Notes for Program

- After economy picks up, have a residential vs. commercial track
    - Not enough resources, need more interest

10.5 Appendix D: Interview Notes - Professor C

Interview Notes

CMP 124

All Residential

Would like to do a site visit and thinks it would be beneficial but not enough time

Used to be involved in Habitat but not anymore

CMP 305 and 315

Very hard to find good residential specs to teach from

Sell the concepts

- Concrete
- Brick
- Wood-makes up own residential take off for that, also does the same for roofing

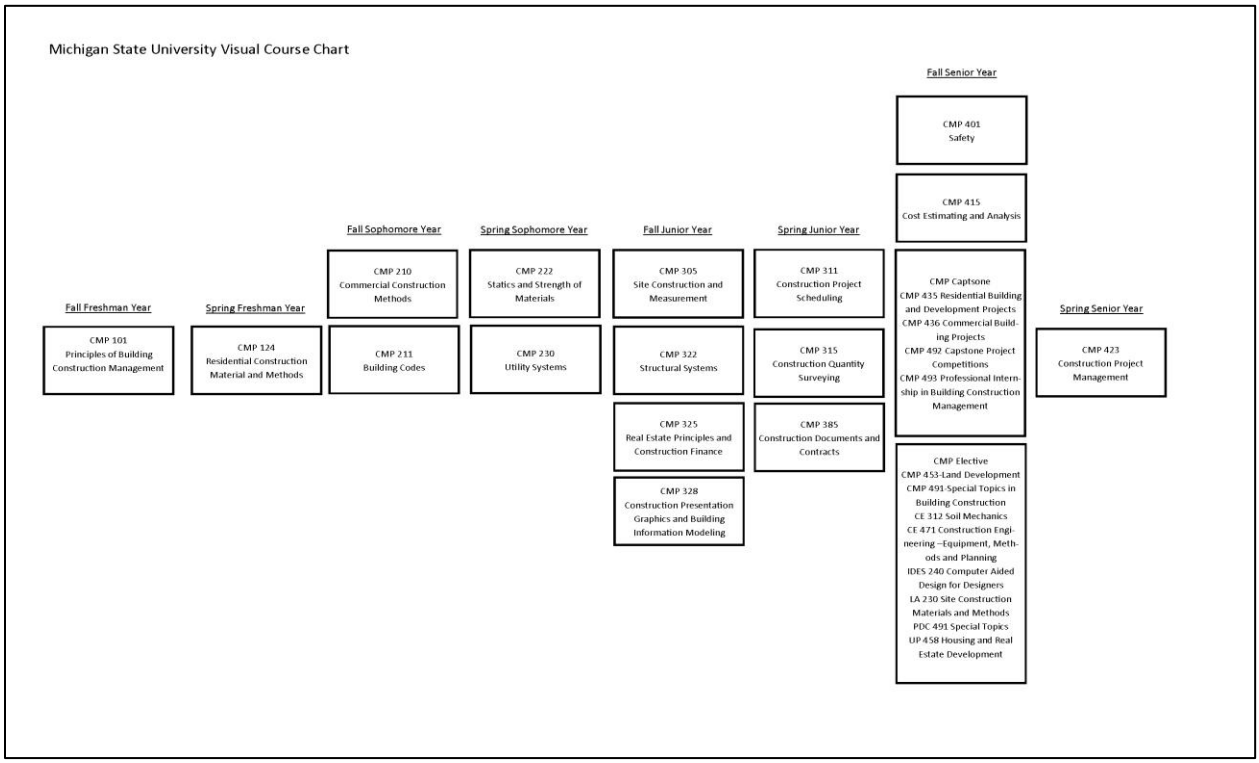
CMP 401

Both residential and commercial (50/50)

Uses lots of residential pictures and examples

Does site visit only in summer-not a lot companies allow

10.6 Appendix E: Michigan State University Visual Course Chart



10.7 Appendix F: Descriptions of East Carolina University Construction Management Courses

CMGT 22000 Construction Industry Overview

History and the role of construction management within residential, commercial, and heavy industries.

CMGT 2210/2211 Construction and Civil Materials

Introduction to construction materials with an emphasis on the physical characteristics, properties, and significance of the materials to the industry.

CMGT 2400/2401 Building Systems and Codes-Formerly CMGT 2660, 2661

Interpretation of structural and interior and exterior finishing systems in residential and commercial buildings. Introduces major building codes, materials and industry standards, and utilization of manufacturers' catalogs.

CMGT 2600 Construction Documents and Analysis-Formerly CMGT 3100

Practical exercises in reading and evaluating plans for construction projects to discern project design, construction materials, and construction placement techniques.

CMGT 3010 Construction Modeling and Information Technology-Formerly CMGT 2800

Graphical expression of construction and architectural elements through use of 3D and Building Information Modeling (BIM) software including construction document organization and preparation, and specifications.

CMGT 3150 Residential Construction Techniques-Formerly CMGT 2558

Selection criteria and graphical interpretation of materials and techniques of residential buildings. Considers performance, code requirements, maintainability, and cost benefit aspects related to the different sectors of residential construction.

CMGT 3400 Structural Analysis-Formerly CMGT 3660

Introduces statics, strength of materials, and structural analysis as related to stability of building's structural components. Topics include building loads resulting in compressive and tensile forces in columns, beams, and trusses; strength of components to resist such loads; analysis of components under varying load conditions; and basic design considerations of common temporary construction structures such as formwork, bracing of vertical elements, rigging for lifts, and retaining walls.

CMGT 3500 Construction Contracts and Specifications-Formerly CMGT 3664

Practices and principles in use of contract documents and specifications as they apply to construction project. Emphasis on relationship to construction process and project management.

CMGT 3800/3801 Soils and Foundations-Formerly CMGT 3766, 3767

Fundamentals of soil mechanics as related to soil classification and construction of earthwork and foundations.

CMGT 3700/3701 Construction Surveying-Formerly CMGT 3666, 3667

Construction aspects of surveying with field and classroom exercises in use of transit, level, tape, and related surveying equipment. Problems and exercises in traverse closure and pipeline, grading, street, curve, and building layout.

CMGT 4000 Construction Estimating-Formerly CMGT 4660

Procedures to quantify materials, labor, and equipment for construction. Emphasis on classification of work, quantity survey techniques, cost estimating and understanding of schedule of values with coordination to construction documents.

CMGT 3900 Construction Project Safety Management (3) Formerly CMGT 3726

Use of safety management as a company profit center with focus on estimating and scheduling of required safety standards as they impact CSI divisions. Includes safety control strategies based on training, programs, and culture.

CMGT 3600 Mechanical and Electrical Construction (3) Formerly CMGT 3662, 3663

Study of mechanical, electrical, and plumbing systems, applicable codes, and effect on the construction process. Coordination with various construction document formats and media.

CMGT 3950 Residential Development-Formerly CMGT 3558

Introduction to the selection criteria for land development, planning principles, codes and regulations, and design approaches for residential construction of small to large units.

CMGT 4100 Construction Planning and Scheduling-Formerly CMGT 4662

Applies planning and scheduling techniques to construction projects. Emphasis on bar charts, critical path method (CPM), cost allocation, schedule updating, cash flow, and resource scheduling with coordination to construction documents.

CMGT 4300 Construction Quality and Human Resource Management-Formerly CMGT 4600, 4601

Issues in construction quality and human resource management incorporating safety methods, utilizing group and individual relationships among construction personnel to comply with laws and regulations.

CMGT 4500 Construction Work Experience and Professional Development-Formerly CMGT 4699

Minimum of 500 documented hours of construction work with state licensed general contractor, subcontractor, construction management company, or other approved employment. Students must pay a fee and sit for the Americhan Institute of Constructors Level I Certification exam during the last semester before graduating.

10.8 Appendix H: CMGT 2558 Residential Construction Techniques Syllabus East Carolina University

(Exchanges with CMGT 2664 in flow chart)

CMGT 2558 Residential Construction Techniques

Fall 2010

SECTION 00x: Tuesday & Thursday, 9:30-10:45AM – Rawl xxx

Instructor: Dr. Prof. xxxxxxx,		
Office: 3xx Rawl	Phone: 252-328-xxxx	Email: xxx@ecu.edu
Office hours: 8:00 am – 9:15 am Monday - Friday		
Blackboard Course Website: http://ecu.blackboard.com		
ECU Emergency Hotline: 328-0062	**ECU Email Help: 328-6866 (www.ecu.edu/6866)**	
East Carolina University seeks to comply fully with the Americhans with Disabilities Act (ADA). Students requesting accommodations based on a disability must be registered with the Department for Disability Support Services located in Slay 138 (252) 737-1016 (Voice/TTY).		

COURSE DESCRIPTION: 3 Credit Hours: (100% Lecture)

This course will cover the selection criteria and graphical interpretation of materials and techniques for residential construction. Content will consider performance, code requirements, maintainability, and cost benefit aspects related to the different sectors of residential construction..

SECTION 00x meets: Tuesday & Thursday, 9:30-10:45AM – SZ 242

LEARNING OUTCOMES:

UNIT ONE:

1. Ability to apply technical knowledge to home building and design of residential plans
2. Develop an ability to gain technical application knowledge of the architectural/engineering design process through the contractor selection process.

UNIT TWO:

3. Ability to identify material selection and gain technical application knowledge of floor system selection and installation.
4. Ability to identify material selection and gain technical application knowledge of framing systems, including light wood, light steel and alternative materials.

UNIT THREE:

5. Ability to identify material selection and gain technical application knowledge of roof framing systems.

UNIT FOUR:

6. Ability to identify alternative residential construction systems.

PREREQUISITES:

CMGT 2200 (Minimum grade C): Introduction to Construction
CMGT 2210 (Minimum grade C): Construction and Civil Materials
CMGT 2800 (Minimum grade C): Foundations of Construction

Be aware that students who do not have the required prerequisites will be **automatically dropped** from the course at any point in the semester.

FINAL EXAM:

(Per ECU policy - this assigned timeslot CANNOT be changed)
Section 002 (Tues/Thurs) **xxxx,xxxx,xxxx: 8:00 -10:30AM**

REQUIRED TEXTBOOK:

Allen, Edward & Rob Thallon (2006). Fundamentals of Residential Construction (2nd ed.).
New York: John Wiley & Sons, Inc.

COURSE GRADING:

The final grade will be determined from these four categories:

Test 1	15%
Test 2	15%
Test 3	15%
Test 4	15%
Final Exam	40%
Total	100%

This Course is a **"C Wall" Course.**

ASSIGNMENTS

It is REQUIRED all assignments be prepared with word processing, spreadsheet or similar computer based software. Late work will be reviewed but not graded.

Test will be given based on the content of the course presentations and required reading and assignments given over the course of the semester. Assignments must be turned in on time or no credit will be given.

The final exam (is comprehensive and covers pertinent information addressed during the semester.

E-MAIL AND COMMUNICATIONS

All e-mails will be sent to your university e-mail address. It is required per university policy that you check your university email regularly. If you correspond with me by e-mail, begin the subject line with CMGT 2658 and last name. Be sure that your name is included on any attachments and in your email correspondence.

ATTENDANCE POLICY:

Active student participation is expected in all construction management courses. To support this objective, attendance is paramount for academic success and reinforces the value of student-faculty and student-student interactions. Therefore,

students must attend a minimum of 75% of course meetings to earn credit for any construction management course, regardless of any other grading criteria.

Attendance and punctuality is required in all Construction Management courses but no grade is given for attendance or punctuality. Instead, absences, late arrivals, and early departures have a significant negative impact on your grade. Course work missed by absence, late arrival, or early departure will be recorded as a zero.

Student attendance will be recorded for all scheduled course meetings including the first and last week of classes. Excused absences are only those documented as "university excused" by the Office of the Provost. Refer to the official ECU catalog for definition of university excused absences. It is the student's responsibility to contact the Office of the Provost to inquire about and secure documentation of university excused absences. Without such documentation, absences will not be excused. In all cases, the student should notify his or her instructor by email as soon as they realize they will be absent. Official university notification must be received within ten (10) days of an absence or it will not be accepted.

PRINCIPLE OF ACADEMIC INTEGRITY:

Academic integrity is expected of every East Carolina University student. Academic honor is the responsibility of the students and faculty of East Carolina University.

Academic Integrity Violations:

Academically violating the Honor Code consists of the following:

- Cheating - Unauthorized aid or assistance or the giving or receiving of unfair advantage on any form of academic work.
- Plagiarism - Copying the language, structure, ideas, and/or thoughts of another and adopting same as one's original work.
- Falsification - Statement of any untruth, either spoken or written, regarding any circumstances relative to academic work.
- Attempts - Attempting any act which if completed would constitute an academic integrity violation as defined herein.

Student Observation of Suspected Violation:

A student or group of students knowing of circumstances in which an academic violation of the Honor Code may have occurred or is likely to occur is encouraged to bring this knowledge to the attention of the responsible faculty member, or to the dean or department chairperson, or to the attention of a member of the University Academic Integrity Board.

COURSE ETHICS:

Cheating is a serious offense. Students are expected to finish independently all work turned in for credit, including homework, projects and exams. Copying and sharing files between students or other forms of cheating results in BOTH students receiving a zero for the course and BOTH students will have their cases reviewed for further disciplinary actions. You should not underestimate your instructor’s ability to discover any wrong doing of this kind.

CLASS PARTICIPATION:

The success of the course and its value is dependent on the involvement and participation of each individual. Students are encouraged and expected to ask questions or share information during class time relative to the course topic. Such discussion will be accommodated as long as adequate class time remains to cover the subject matter required.

Everyone should actively participate in the project activity as well. No “free-ride” is allowed. The individual grades are subject to a **peer review** process at the end of the semester.

AMERICHAN DISABILITIES ACT:

East Carolina University seeks to comply fully with the Americhans with Disabilities Act (ADA). Students requesting accommodations based on a disability must be registered with the Department for Disability Support Services located in Slay 138 ((252) 737-1016 (Voice/TTY).

10.9 Appendix G: East Carolina University Curriculum Course Proposal Form CMGT 3558

Undergraduate University Curriculum Committee

Course Proposal Form for Courses Numbered 0001 – 4999

(Faculty Senate Resolution #8-16, March 2008)

Guidelines for submission may be accessed via the web at:

www.ecu.edu/cs-acad/fsonline/cu/curriculum.cfm.

Note: Before completing this form, please carefully read the accompanying instructions.

1. **Course Prefix and Number:** **CMGT 3558**

2. **Date:** **February 26, 2010**

3. **Requested Action** (check only **one** box)**:**

X	**New Course**			
	Revision of Active Course			
	Unbanking of a Banked Course			
	Renumbering of Existing Course from:	#	**to**	#

4. **Justification for new course, revision, unbanking, or renumbering:**

Based on the recommendation of the CMGT Advisory Board, approval of the faculty and research conducted for the National Association of Home Builders a Gold Standard Residential concentration was developed. The residential concentration will be under the BS in Construction Management degree. This course is one of the designated classes needed in the concentration.

5. **Course description exactly as it should appear in the next catalog:**

3558. Residential Development (3) (F,S) P: CMGT 2558, Minimum overall GPA of 2.0; minimum grade of C in CMGT 2558. Selection criteria for land development, planning principles, codes and regulations, and design approaches for residential construction of small to large units.

6. If this is a course revision, briefly describe the requested change:

7. Page Number from current undergraduate catalog: **351**

8. The Writing Across the Curriculum Committee must approve Writing Intensive (WI) Credit for all courses prior to their consideration by the UCC. If WI credit is requested, has this course been approved for Writing Intensive (WI) credit (yes/no)?
If Yes, will all sections be Writing Intensive (yes/no)? **No**

9. The Academic Standards Committee must approve Foundations Curriculum Credit for all courses prior to their consideration by the UCC. If FC credit has been approved by the ASC, then check the appropriate box (check at most one):

	English (EN)			**Science (SC)**
	Humanities (HU)			**Social Science (SO)**
	Fine Arts (FA)			**Mathematics (MA)**
	Health (HL)			**Exercise (EX)**

10. Course Credit:

Lecture Hours	**3**	Weekly	**or**		Per Term	Credit Hours	**3**	**s.h.**
Lab		Weekly	**or**		Per Term	Credit Hours		**s.h.**
Studio		Weekly	**or**		Per Term	Credit Hours		**s.h.**
Practicum		Weekly	**or**		Per Term	Credit Hours		**s.h.**
Internship		Weekly	**or**		Per Term	Credit Hours		**s.h.**
Other (e.g., independent study):								

Total Credit Hours	**3**	**s.h.**

11. Anticipated yearly student enrollment: **30**

12. Affected Degrees or Academic Programs:

Degree(s)/Course(s)	Catalog Page	Change in Degree Hours

13. Overlapping or Duplication with Affected Units or Programs:

X	**Not Applicable**
	Applicable (Notification and/or Response from Units Attached)

14. Approval by the Council for Teacher Education (required for courses affecting teacher education programs):

X	**Not Applicable**
	Applicable (CTE has given their approval)

15. Instructional Format: please identify the appropriate instructional format(s):

X	**Lecture**		**Internship**
	Lab		**Studio**
	Student Teaching		**Clinical**
	Correspondence		**Honors**
	Seminar		**Colloquia**
	Practica		**Other**

16. Statements of Support:

	Current staff is adequate

X	**Additional Staff is needed** (describe needs in the box below)**:**
	One faculty member is needed (see letter of support attachment)

X	**Current facilities are adequate**
	Additional Facilities are needed (describe needs in the box below)**:**

X	**Initial library resources are adequate**
	Initial resources are needed (in the box below, give a brief explanation and estimate for cost of acquisition of required resources)**:**

X	**Unit computer resources are adequate**	
	Additional unit computer resources are needed (in the box below, give a brief explanation and an estimate for the cost of acquisition)**:**	
X	**ITCS Resources are not needed**	
	Following ITCS resources are needed (put a check beside each need)**:**	
		Mainframe computer system
		Statistical services
		Network connections
		Computer lab for students
	Describe any computer or networking requirements of this program that are not currently fully supported for existing programs (Includes use of classroom, laboratory, or other facilities that are not currently used in the capacity being requested)**.**	
	Approval from the Director of ITCS attached	

17. Syllabus – please insert course syllabus below. <u>Do not submit course syllabus as a separate file.</u> You must include (a) the name of the textbook chosen for the course, (b) the course objectives, (c) the course content outline, and (d) the course assignments and grading plan.

CMGT 3558 – Residential Development

TEXTS:

1. *Be a Successful Residential Land Developer,* R. Dodge Woodson, McGraw-Hill, 2004.
2. *Land Developer's Checklists and Forms*, R. Dodge Woodson, McGraw-Hill, 2004.
3. *Home Sales Financing Handbook*, Tom Richey, BuilderBooks, 2008.

OBJECTIVES: Upon completion of the course students should be able to:

- Define Land Acquisition Concepts + Real Estate
- Identify Land planning design principles + Equipment use
- Classify Residential foundation types + Equipment Use
- Compare residential types
- Compare interior space planning concepts
- Compare residential design scheme options
- Determine the appropriate Residential Code for differing contexts.
- Identify Regulations and impact fees for residential construction.
- Analyze different applications of Real Estate Law
- Evaluate sustainability concepts of Green Home and LEED standards
- Evaluating criteria of Energy Star Rating Systems for residential products.
- Appraise a Residential Safety plan

COURSE CONTENT:

- Overview of Land Development
- Land Design
- Land Planning Process
- Land Construction Equipment
- Land Values
- Due Diligence
- Planning Units
- Unit Design
- Interior Design Options
- Sustainable Developments
- Marketing
- Sales

- Residential Real Estate Principles + Concepts

COURSE GRADING:

100 - 90 = A
89 - 80 = B
79 - 70 = C
69 - 60 = D
Below 60 = F

Grades will be determined based on four exams and a final examination.

Grading Component		%
Unit 1		15%
Unit 2		15%
Unit 3		15%
Unit 4		15%
Final Exam		40%
Final Grade		100%

10.10 Appendix J: East Carolina University Curriculum Course Proposal Form CMGT 4558

Undergraduate University Curriculum Committee

Course Proposal Form for Courses Numbered 0001 – 4999

(Faculty Senate Resolution #8-16, March 2008)

Guidelines for submission may be accessed via the web at:

www.ecu.edu/cs-acad/fsonline/cu/curriculum.cfm.

Note: Before completing this form, please carefully read the accompanying instructions.

1. **Course Prefix and Number:** **CMGT 4558**

2. **Date:** **February 26, 2010**

3. **Requested Action** (check only **one** box)**:**

X	**New Course**			
	Revision of Active Course			
	Unbanking of a Banked Course			
	Renumbering of Existing Course from:	#	**to**	#

4. **Justification for new course, revision, unbanking, or renumbering:**

Based on the recommendation of the CMGT Advisory Board, approval of the faculty and research conducted for the National Association of Home Builders a Gold Standard Residential concentration was developed. The residential concentration will be under the BS in Construction Management degree. This course is one of the designated classes needed in the concentration.

5. **Course description exactly as it should appear in the next catalog:**

4558. Residential Capstone (3) (F,S) P: CMGT 3558, Minimum overall GPA of 2.0; minimum grade of C in CMGT 3558, 3662, 3664, 4660, 4662. Integrates multiple aspects of the residential construction management process through the use of technical and human resources utilizing Construction Documents for the course.

6. If this is a course revision, briefly describe the requested change:

7. Page Number from current undergraduate catalog: **352**

8. The Writing Across the Curriculum Committee must approve Writing Intensive (WI) Credit for all courses prior to their consideration by the UCC. If WI credit is requested, has this course been approved for Writing Intensive (WI) credit (yes/no)?
If yes, will all sections be Writing Intensive (yes/no)? **No**

9. The Academic Standards Committee must approve Foundations Curriculum Credit for all courses prior to their consideration by the UCC. If FC credit has been approved by the ASC, then check the appropriate box (check at most one):

	English (EN)			**Science (SC)**
	Humanities (HU)			**Social Science (SO)**
	Fine Arts (FA)			**Mathematics (MA)**
	Health (HL)			**Exercise (EX)**

10. Course Credit:

Lecture Hours	**3**	Weekly	**or**		Per Term	Credit Hours	**3**	**s.h.**
Lab		Weekly	**or**		Per Term	Credit Hours		**s.h.**
Studio		Weekly	**or**		Per Term	Credit Hours		**s.h.**
Practicum		Weekly	**or**		Per Term	Credit Hours		**s.h.**
Internship		Weekly	**or**		Per Term	Credit Hours		**s.h.**
Other (e.g., independent study):								

Total Credit Hours	**3**	**s.h.**

11. Anticipated yearly student enrollment: **30**

12. Affected Degrees or Academic Programs:

Degree(s)/Course(s)	Catalog Page	Change in Degree Hours

13. Overlapping or Duplication with Affected Units or Programs:

X	**Not Applicable**
	Applicable (Notification and/or Response from Units Attached)

14. Approval by the Council for Teacher Education (required for courses affecting teacher education programs):

X	**Not Applicable**
	Applicable (CTE has given their approval)

15. Instructional Format: please identify the appropriate instructional format(s):

X	**Lecture**		**Internship**
	Lab		**Studio**
	Student Teaching		**Clinical**
	Correspondence		**Honors**
	Seminar		**Colloquia**
	Practica		**Other**

16. Statements of Support:

	Current staff is adequate

X	**Additional Staff is needed** (describe needs in the box below)**:**
	One faculty member is needed (see letter of support attachment)

X	**Current facilities are adequate**
	Additional Facilities are needed (describe needs in the box below)**:**

X	**Initial library resources are adequate**
	Initial resources are needed (in the box below, give a brief explanation and estimate for cost of acquisition of required resources)**:**

X	**Unit computer resources are adequate**	
	Additional unit computer resources are needed (in the box below, give a brief explanation and an estimate for the cost of acquisition)**:**	
X	**ITCS Resources are not needed**	
	Following ITCS resources are needed (put a check beside each need)**:**	
		Mainframe computer system
		Statistical services
		Network connections
		Computer lab for students
	Describe any computer or networking requirements of this program that are not currently fully supported for existing programs (Includes use of classroom, laboratory, or other facilities that are not currently used in the capacity being requested)**.**	
	Approval from the Director of ITCS attached	

17. Syllabus – please insert course syllabus below. <u>Do not submit course syllabus as a separate file.</u> You must include (a) the name of the textbook chosen for the course, (b) the course objectives, (c) the course content outline, and (d) the course assignments and grading plan.

CMGT 4558 - Residential Capstone

TEXT:

1. *Managing the Construction Process,* Frederichk E. Gould, Pearson Prentice Hall, 2005.
2. *Home Builder Contracts & Construction Management Forms*, NAHB BuilderBooks, 2006.

OBJECTIVES: Upon completion of the course students should be able to:

- Differentiate Project Management Strategies for Residential Construction.
- Differentiate Residential Marketing Strategies.
- Compare Residential Sales Strategies.
- Evaluate Residential Estimating Controls Strategies.
- Evaluate Residential Scheduling Strategies.
- Evaluate Residential Project Control Strategies.

COURSE CONTENT:

- Project Management Process
- Standards of Practice;
- Single Family
- Multifamily
- Large Scale Production
- Alternatives Delivery Approaches
- Cost Estimating for Residential Developments
- Scheduling for Residential Developments
- Residential Safety
- Residential
- Quality Control for Residential
- Closeout Practices for Residential

GRADING PLAN:

100 - 90 = A
89 - 80 = B
79 - 70 = C
69 - 60 = D
Below 60 = F

Grades will be determined based on four exams and a final examination.

Grading Component		%
Unit 1		15%
Unit 2		15%
Unit 3		15%
Unit 4		15%
2Final Exam		40%
Final Grade		100%

10.11 Appendix K: Construction Management Courses at East Carolina (NAHB Gold Standard Curriculum)

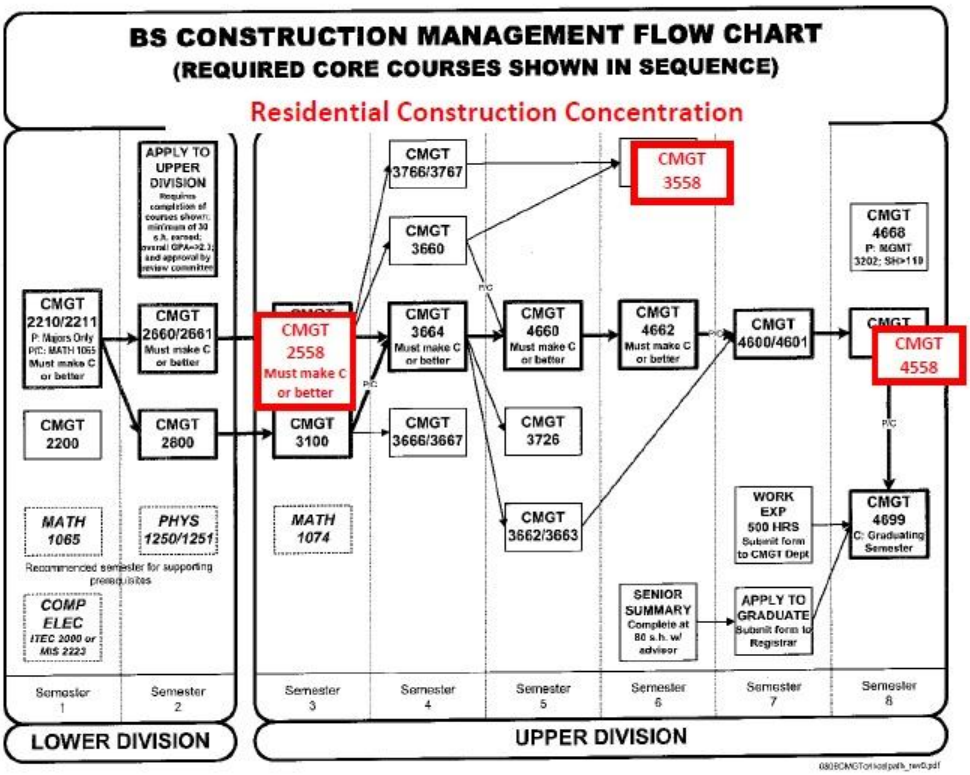
The MSU courses closely related to the ECU courses

East Carolina University Course	Michigan State University Course
CMGT 22000	CMP 101
CMGT 2210/2211	CMP 124, 210
CMGT 2400/2401	CMP 211
CMGT 2600	CMP 210
CMGT 3010	CMP 328
CMGT 3150	CMP 124
CMGT 3400	CMP 222, 322
CMGT 3500	CMP 385
CMGT 3800	CMP 305
CMGT 3700	CMP 305
CMGT 4000	CMP 315, 415
CMGT 3600	CMP 230
CMGT 3950	CMP 453
CMGT 3900	CMP 315, 401
CMGT 4100	CMP 411
CMGT 4300	CMP 423
CMGT 4500	CMP 493

CMP Courses that do not match: CMP 325

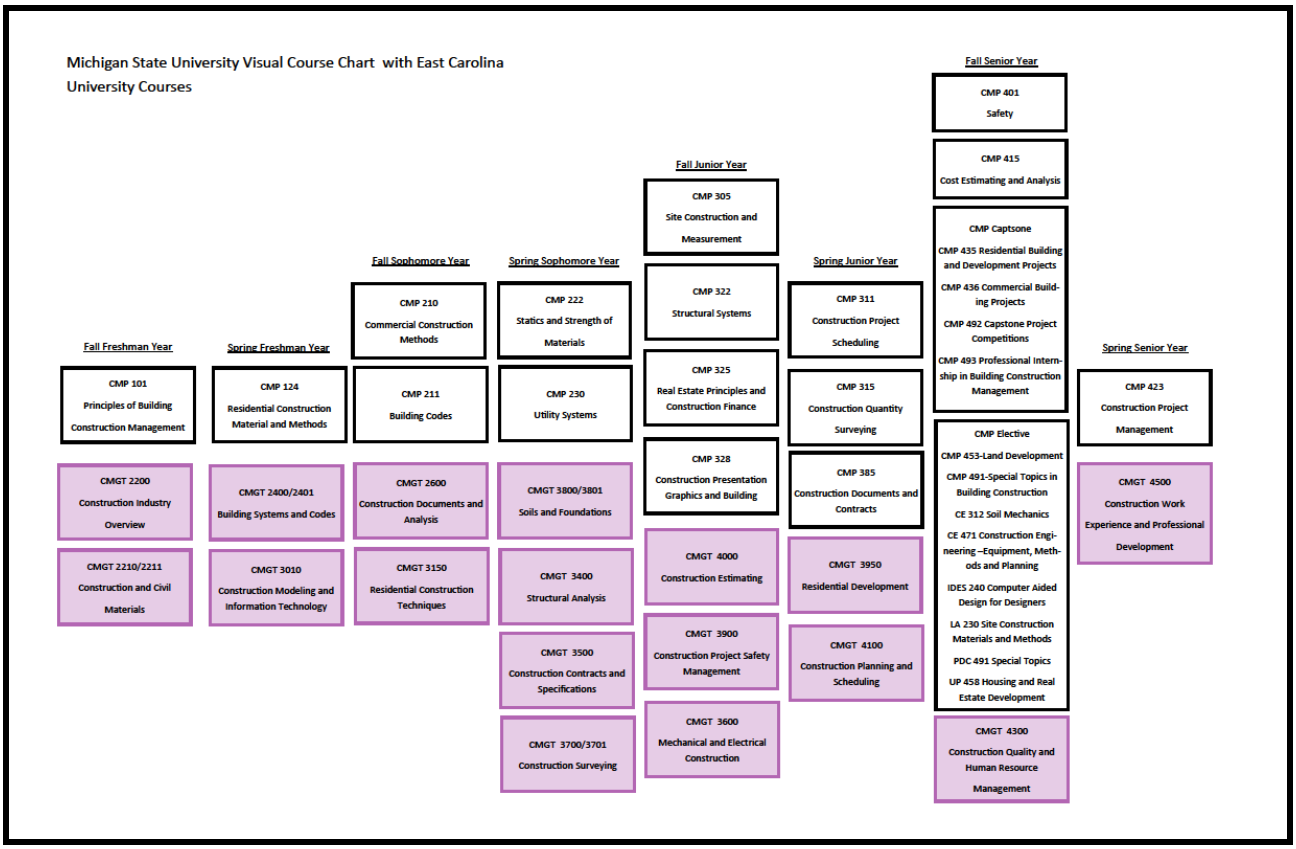
CMP Course that matches that is not required: CMP 453

10.12 Appendix H: East Carolina University Course Flow Chart

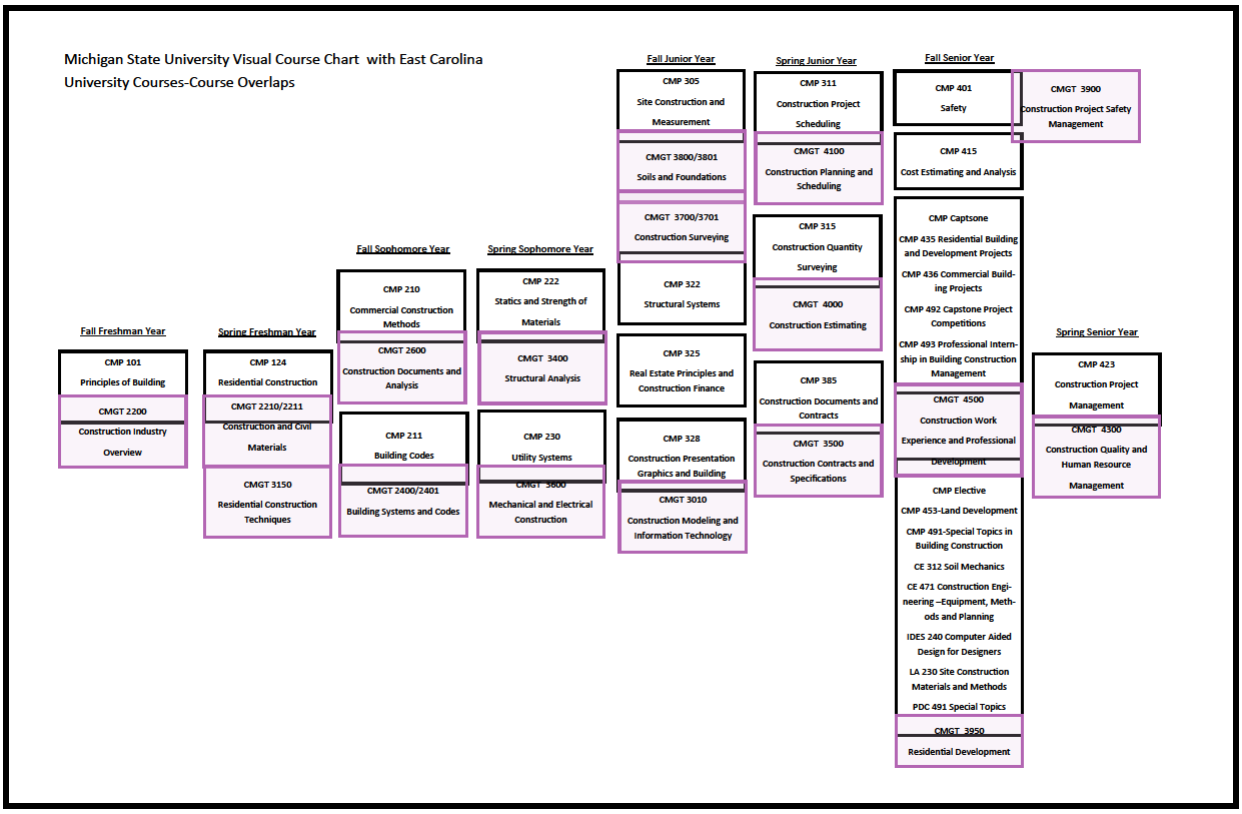


For further information contact: Dr. Erich Connell, connellg@ecu.edu, (252) 328-5340 Associate Professor, Director of Residential Curriculum
Department of Construction Management - East Carolina University

10.13 Appendix I: Michigan State University Course Flow Chart Comparison with East Carolina University



10.14 Appendix N: Michigan State University Course Chart Overlap Comparison with East Carolina University



10.15 Appendix O: Michigan State University Learning Outcomes Comparison with East Carolina University

Learning Outcomes for ECU Residential Courses with Relating MSU Classes and Learning Outcomes				
**Only for classes given to Michigan State from East Carolina University				
CMGT 2558-Residential Construction Techniques				
Learning Outcome	**How it is covered**	**Class Relates to at MSU**	**Learning Outcome most closely Similar**	**How it is covered**
Ability to apply technical knowledge to home building and design of residential plans	Lecture			
Develop an ability to gain technical application knowledge of the architectural/engineering design process through the contractor selection process	Lecture	CMP 101 Principles of Building Construction Management	Correctly identify the roles of owners, consultants, general contractors and subcontractors	Lecture
Ability to identify material selection and gain technical application knowledge of floor system selection and installation	Lecture			
Ability to identify material selection and gain technical application knowledge of framing systems, including light wood, light steel and alternative materials.	Lecture	CMP 124 Residential Construction Materials and Methods	Discuss properties, uses and developments of the materials used in residential construction of todays structures	Lecture
Ability to identify material selection and gain technical application knowledge of roof framing systems	Lecture	CMP 124 Residential Construction Materials and Methods	Discuss the difference between S-DRY and S-GRN framing material	Lecture
Ability to identify alternative residential construction systems	Lecture			
CMGT 3558-Residential Development				
Learning Outcome	**How it is covered**	**Class Relates to at MSU**	**Learning Outcome most closely Similar**	**How it is covered**
Identify land acquisition concepts and real estate	Lecture	CMP 453 Land Development		Lecture
Identify land planning design principles and equipment use	Lecture	CMP 305 Site Construction and Measurement	Read and Discuss site and topographic maps	Lecture and Lab
Identification of residential foundation types and equipment use	Lecture	CMP 124 Residential Construction Materials and Methods	Discuss properties, uses and developments of the materials used in residential construction of today's structures	Lecture
Identification of residential types	Lecture	CMP 101 Principles of Building	Differentiate between residential, commercial, industrial,	Lecture

		Construction Management	institutional, and mixed-use projects	
List interior space planning concepts	Lecture			
Recognizing residential design concepts	Lecture			
Determining the different residential codes need under differing conditions	Lecture	CMP 211 Building Codes	Competencies required to navigate, review and interpret the International Residential and Building Code	Lecture
Identifying regulations and impact fees for residential construction	Lecture	CMP 325 Real Estate Principles and Construction Finance	List those items important to establishing real estate value	Lecture
Real estate law	Lecture	CMP 325 Real Estate Principles and Construction Finance	All of CMP 325	Lecture
Identify sustainability of green home and LEED	Lecture			
Identifying the criteria that satisfy energy star rating systems for residential products	Lecture	CMP 230 Utility Systems	Identify which parts of building meet energy star requirements	Lecture
Residential safety	Lecture	CMP 401 Safety	All of CMP 401	Lecture, Guest Speakers
CMGT 4558-Residential Project Management-Capstone				
Learning Outcome	**How it is covered**	**Class Relates to at MSU**	**Learning Outcome most closely Similar**	**How it is covered**
Identify project management strategies for residential construction	Lecture	CMP 101 Principles of Building Construction Management	Correctly identify the roles of owners, consultants, general contractors and subcontractors	Lecture
Identify residential marketing strategies	Lecture			
Identify residential sales strategies	Lecture			
Identify residential estimating and controls strategies	Lecture	CMP 415 Cost Estimating and Analysis	Prepare a cost estimate for a construction project based on scientific methods and procedures	Lecture, Lab and Project
Identify residential scheduling strategies	Lecture	CMP 311 Scheduling	determine durations of common building construction activities	Lecture, Lab and Project
Identify residential project control strategies	Lecture	CMP 423 Construction Project Management	learn project control techniques related to time and cost	Lecture and Project

10.16 Appendix P: NAHB Gold Standard - Learning Outcomes for a Residential Construction Curriculum

NAHB Gold Standard - Learning Outcomes for a Residential Construction Curriculum

1. OVERVIEW and HISTORY

- **Introduction to the Construction Industry**
- Differentiate the different construction types based on FMI.
- Differentiate the percentage of total annual construction based on construction type.
- Differentiate the different occupancy types based on the IBC. Identify construction projects by the construction sector.
- Explain the role of General Contractors vs. Subcontractors in the construction process.
- Compare career opportunities in the construction industry.
- Identify construction organizations that represent an ethical approach to practice.
- Explain the role of ethics in the sustainable construction.
- Identifying sustainability concerns within the construction industry.

2. TECHNIQUES

- **Construction and Civil Materials, Soils, Foundations, Land Development**
- Explain the principles of materials and systems specification and design. Explain basic construction terms related to construction materials.
- Compare and select major construction materials according to their properties, uses, limitations, care, storage, and installation equipment.
- Critique alternate material use.
- Demonstrate use of construction materials in a laboratory setting. Identify the resource cycle of materials for construction.
- Discuss construction material manufacturing, testing, safety, environmental & lifecycle cost.
- Demonstrate proper, ethical conduct.
- Read and interpret soil reports in the context of construction management.
- Recognize unforeseeable underground conditions for both horizontal and vertical construction.
- Discover a developing problem involving soil conditions, gauge the seriousness of the problem, and decide when to get help from a soil professional.
- Manage excavations and fill operations in a safe and economical manner.
- Compare and select installation methods of foundations, fill placement and excavation.

- Control erosion and 'flooding' on construction site.
- Anticipate problems and seek solutions related to slope stability and erosion.
- Communicate with owner’s representatives, engineers, and other project participants.
- Explain how stresses develop, pass through, and dissipate in a soil mass.
- Explain the practices of land acquisition and planning design Compare and select types of residential housing.
- Identify space planning alternatives for residential interiors.
- Explain and critique design schemes and their correlation to residential building codes.
- Read and interpret regulations and their impacts on residential development.
- Articulate the concepts of sustainable development.
- **Building Design, Components, Structural Systems + Finishes**
- Explain home design, development, and construction processes.
- Compare and select construction materials used in geographically different residential construction regions.
- Manage and coordinate selection and installation of floor, framing, and roof systems, including light wood, light steel, and alternative materials.
- Explain and compare alternative residential construction systems.
- Discuss standard building structural systems.
- Identify building codes related to common buildings and structures.
- Analyze architectural plans to demonstrate knowledge of a building structure.
- Differentiate the different structural systems involved in construction.
- Identify and discuss framing techniques for building construction.
- Identify the different roof systems for respective construction types.
- Analyze and discuss proper material selections and explain their application to building interior/exterior finish systems.
- Identify and discuss techniques for masonry and concrete construction.
- Discuss the ethics of contracting and construction management.
- Compare and select interior/exterior finish systems according to their functions, cost, and features.
- Discuss and plan for common construction techniques for interior/exterior finish systems.
- Discuss impact of project changes on Owner and Designer requested changes, and the impact on Contractor's scheduling. Change Orders and their importance to the Contractor are also discussed.
- Discuss the impact of the project on the existing land zoning. Students shall observe zoning change process by attending a local Planning and Zoning Commission meeting.
- Discuss bidding practice, determining fair market pricing, and subcontractor selection process with emphasis on avoiding bid shopping and bid rigging.

3. CONSTRUCTION DOCUMENTS

- **AutoCAD**

- Create building plans and details of a building design that incorporate a variety of building components and building systems.
- Calculate building dimensions, design building components, analyze placement of components, and create final projects of student designed buildings.
- Create AutoCAD and Sketch-Up projects encompassing basic construction document criteria.
- Demonstrate team engagement and prepare CAD and class presentations based on team projects.
- Discuss and explain the consequences of ethical construction practices.
- Utilize correct terminology for construction systems when developing CAD drawings.
- Analyze objects and create 2D and 3D projects in both hand drawn & CAD processes.
- Utilize CAD software to analyze buildings and their systems.

- **Drawings: Civil, Structural, Architectural, Mechanical, Electrical and Plumbing (MEP)**

- Read and analyze architectural, civil, structural and mechanical/electrical/plumbing MEP drawings, and construction specifications, for construction instructions, bidding, and cost estimating.
- Identify and interpret drawing symbols, materials, notes, and nomenclature of construction documents.
- Identify industry standards for sheet development, detailing, note placement and construction document systems of materials and systems identification.
- Interpret the organization of construction documents and locate information within the construction document for project management communications.
- Select construction methods and procedures according to the construction documents and discuss details in terms of constructability.
- Identify potential problems in construction drawings and communicate with the designer.
- Prepare site/ construction sketches and preliminary quantity takeoff.
- Discuss the principles of potable water and wastewater distribution and collection systems, and their considerations for the proposed project
- Discuss the principles of MEP systems and how the principles are incorporated into the design and the building of the Project; specifically, terminology and practice associated with mechanical, plumbing and electrical systems.
- Read and interpret MEP drawings and symbols.
- Identify MEP systems and their locations in residential construction and explain their applications.
- Identify MEP systems and their locations in commercial construction and explain their applications
- Analyze drawings and specifications to determine location and size of MEP feeds and tie-ins.
- Create MEP schematic drawings using hand sketch and CAD drawings, derived from information obtained in the lab and on-site project visits.
- Interpret MEP codes with respect to construction types.

- **Specifications and Contracts**

- Delineate relationship of construction contract to specifications to delineate relationship to the construction project.
- Discuss construction traditions, practices, and principles of construction law.
- Compare and select project delivery systems including traditional, Design Build, CM, etc.
- Explain bidding requirements and processes as well as other selection processes for construction professional.
- Review and analyze construction contract and specifications. Compare and use standard contract and specification forms. Explain the nature of claims and the dispute resolution process. Demonstrate knowledge of the ethics involved in bidding and negotiation. Discuss the ethics of the Change Order process

4. ENGINEERING

- **Surveying**

- Explain importance of surveying in construction.
- Perform horizontal and vertical measurements using surveying equipment. Prepare and calculate correction for leveling and traverse field notes.
- Demonstrate proper surveying staking techniques including placement and identification.
- Identify resources required to perform various construction surveys.
- Explain and discuss the impact of surveying on construction cost and schedule. Explain GPS applications in surveying.
- Calculate earth volumes based on topographic maps.

- **Structural Analysis**

- Accurately construct free body diagram for concurrent and non-concurrent force systems including rigging cables, trusses, beams.
- Express and mathematically solve equilibrium equations to identify external loading applied to components.
- Determine a component's centroid and moment of inertia and calculate stress and strain resulting from loading.
- Analyze the location of reinforcing in concrete beams and explain the function of stirrups play in beams, and describe the necessity of formwork bracing.

5. QUANTITIES

- **Construction Cost**

- Demonstrate the ability to conduct a takeoff for a construction project.
- Perform quantity takeoff with appropriate techniques and units. Obtain pricing information for materials, labor and equipment.
- Identify factors that influence construction productivity on project cost.

- Demonstrate competent use of estimating software for quantity takeoff and pricing.
- Compare and apply bidding strategies to maximize the chance of winning bid.
- List the factors that explain the importance of ethics during the bid process.
- Identify units of weight, square footage and volume through material take-offs for existing construction projects, roof coverings, wall coverings, floor coverings.
- Explain the importance and role of scheduling and planning in construction management.
- Prepare a preliminary construction bid package with estimate summary, and Schedule of Values.
- **Planning and Scheduling**
- Identify common activity types for both building construction.
- Develop a bar chart and precedence diagram manually and with a computer program.
- Perform critical path calculations based on a precedence diagram. Create a bar chart schedule manually and using a computer program. Create a precedence diagram manually and using a computer program. Develop a linear schedule based on quantity of work and production rate.
- Update a project schedule based on actual performance.
- Demonstrate the most efficient way to accelerate a developed schedule.
- Articulate resource use for a construction project and incorporate the information in a schedule.
- Perform cash flow analysis based on schedule and cost estimate and examine its influence on the financial health of a project.
- Perform earned value analysis of a construction project.

6. MANAGEMENT

- **Project Capstone/Synthesis**
- Explain project organization and common practices of managing construction processes.
- Discuss roles and responsibilities of construction manager.
- Develop and maintain essential project control documents for cost, time, quality, and safety.
- Demonstrate the allocation and control of construction resources.
- Assess the impact of project changes during the construction process.
- Create presentations with professional quality.
- **Building Quality**
- Explain the structure and functions of a quality control system.
- Review and analyze construction documents for risk assessment.
- Conduct project control and prepare documentation for cost, schedule, procurement, logistics and material handling.
- Perform and document quality control/testing for building system.
- Prepare quality control checklist based on construction specifications, standards, and codes.

- Coordinate in-process inspections and material delivery with project schedule.
- Create controls for estimating, scheduling, documentation, and purchasing, logistics and material handling.

- **Equipment**

- Compile criteria and calculate productivity for common construction equipment.
- Explain and discuss the organization, procedures and record keeping of preventive maintenance.
- Analyze economics and compare the options of buying, leasing, and replacing heavy equipment, and factors associated with depreciation, overhead and operating costs.
- Demonstrate competent use of computer software for equipment management.
- Compare and select appropriate equipment for common construction activities.

- **Human Resources**

- Explain historical human resource management theories and current practices. Discuss the characteristic elements of compensation and benefits plans. Plan and conduct personnel recruiting, placing, and training.
- Analyze and discuss collective bargaining, labor relations and legal contexts of human resource management.
- Explain an ethical code of human resource management conduct.

- **Safety**

- Articulate the impact of safety on overall project objectives.
- List awareness criteria for personal safety in construction.
- Analyze and Conduct a safety audit of a construction site.
- Create a safety program for a construction company.
- Demonstrate use of the 29CFR1926 OSHA Standards.
- Analyze construction site safety violation and cite the OSHA standards violated.
- Explain the criteria for being a safety construction professional.

- **Work Experience**

- Utilize campus resources available to aid in job placement.
- Compare and evaluate career paths and opportunities.

For further information contact:

Dr. Erich Connell, connellg@ecu.edu, (252) 328-5340
Associate Professor, Director of Residential Curriculum
Department of Construction Management

10.17 Appendix Q: NAHB Gold Standard-Learning Outcomes for a Residential Construction Curriculum Course Content Comparison

NAHB Gold Standard-Learning Outcomes for a Residential Construction Curriculum

1. Overview and History-Introduction to the Construction Industry

Learning Outcome	MSU Class Covered in	How it is covered	ECU Class Covered in
Differentiate the Different Construction Types Based on FMI	CMP 101	Lecture	CMGT 2200
Differentiate the percentage of total annual construction based on construction type	CMP 101	Lecture	CMGT 2200
Differentiate the different occupancy types based on the IBC	CMP 211	Lecture	CMGT 2400
Identify Construction Projects by the Construction Sector	CMP 101	Lecture	CMGT 2200
Explain the Role of General Contractors vs. Subcontractors in the construction process	CMP 101	Lecture	CMGT 2200
Identify Construction organizations that represent an ethical approach to practice	All CMP Courses	Lecture	CMGT 2200
Explain the Role of Ethics in the sustainable construction	CMP 385 and 423	Lecture	N/A
Identify Sustainability Concerns within the construction industry	CMP 385 and 423	Lecture	N/A

2. Techniques-Construction and Civil Materials, Soils, Foundations, Land Development

Learning Outcome	MSU Class Covered In	How it is covered	ECU Class Covered in
Explain the principles of materials and systems specification and design.	CMP 315	Lecture	CMGT 3150
Explain basic construction terms related to construction materials.	CMP 124	Lecture	CMGT 2210
Compare and select major construction materials according to their properties, uses, limitations, care, storage, and installation equipment.	CMP 124	Lecture	CMGT 2210
Critique alternate material use.	CMP 124	Lecture	CMGT 2210
Demonstrate use of construction materials in a laboratory setting.	CMP 124	Lecture	N/A
Identify the resource cycle of materials for construction.	N/A		N/A
Discuss construction material manufacturing, testing, safety, environmental & lifecycle cost.	CMP 124	Lecture	CMGT 2210
Demonstrate proper, ethical conduct.	N/A		N/A
Read and interpret soil reports in the context of construction management.	CMP 305	Lab	CMGT 3800
Recognize unforeseeable underground conditions for both horizontal and vertical construction.	CMP 305	Lecture	CMGT 3800
Discover a developing problem involving soil conditions, gauge the seriousness of the problem, and decide when to get help from a soil professional.	CMP 305	Lecture	CMGT 3800
Manage excavations and fill operations in a safe and economical manner.	CMP 305	Lecture	CMGT 3800
Compare and select installation methods of foundations, fill placement and excavation.	CMP 305	Lecture	CMGT 3800
Control erosion and 'flooding' on construction site.	CMP 305	Lecture	CMGT 3800
Anticipate problems and seek solutions related to slope stability and erosion.	CMP 305	Lecture	CMGT 3800

Communicate with owner's representatives, engineers, and other project participants.	CMP 385	Lecture	N/A
Explain how stresses develop, pass through, and dissipate in a soil mass.	CMP 305	Lecture	CMGT 3400
Explain the practices of land acquisition and planning design	CMP 453	Lecture	CMGT 3950
Compare and select types of residential housing.	CMP 453	Lecture	CMGT 3950
Identify space planning alternatives for residential interiors.	N/A		CMGT 3150
Explain and critique design schemes and their correlation to residential building codes.	CMP 211	Lecture	CMGT 3150
Read and interpret regulations and their impacts on residential development.	CMP 453	Lecture	CMGT 3150
Articulate the concepts of sustainable development.	N/A		N/A
Explain home design, development, and construction processes.	CMP 124	Lecture	CMGT 3950
Compare and select construction materials used in geographically different residential construction regions.	CMP 124	Lecture	CMGT 2200
Manage and coordinate selection and installation of floor, framing, and roof systems, including light wood, light steel, and alternative materials.	CMP 124	Lecture	CMGT 3150
Explain and compare alternative residential construction systems.	CMP 124	Lecture	CMGT 3150
Discuss standard building structural systems.	CMP 210	Lecture	CMGT 3400
Identify building codes related to common buildings and structures.	CMP 211	Lecture	CMGT 2400
Analyze architectural plans to demonstrate knowledge of a building structure.	CMP 315	Lab	CMGT 3010
Differentiate the different structural systems involved in construction.	N/A		CMGT 3400
Identify and discuss framing techniques for building construction.	N/A		N/A
Identify the different roof systems for respective construction types.	CMP 124	Lecture	CMGT 2210
Analyze and discuss proper material selections and explain their application to building interior/exterior finish systems.	CMP 124	Lecture	CMGT 2210
Identify and discuss techniques for masonry and concrete construction.	CMP 124	Lecture	CMGT 2210
Discuss the ethics of contracting and construction management.	N/A		N/A
Compare and select interior/exterior finish systems according to their functions, cost, and features.	CMP 124	Lecture	CMGT 3150
Discuss and plan for common construction techniques for interior/exterior finish systems.	N/A		CMGT 3150
Discuss impact of project changes on Owner and Designer requested changes, and the impact on Contractor's scheduling. Change Orders and their importance to the Contractor are also discussed.	CMP 385	Lecture	CMGT 4300
Discuss the impact of the project on the existing land zoning. Students shall observe zoning change process by attending a local Planning and Zoning Commission meeting.	CMP 453	Lecture	CMGT 3950
Discuss bidding practice, determining fair market pricing, and subcontractor selection process with emphasis on avoiding bid shopping and bid rigging.	CMP 415	Lecture	CMGT 4000

3. Construction Documents-AutoCad, Drawings, Specifications and Contracts

Learning Outcomes	MSU Class Covered In	How it is Covered	ECU Class Covered in
Create building plans and details of a building design that incorporate a variety of building components and building systems.	N/A		CMGT 3010
Calculate building dimensions, design building components, analyze placement of components, and create final projects of student designed buildings.	N/A		CMGT 3010
Create AutoCAD and Sketch-Up projects encompassing basic construction document criteria.	N/A		CMGT 3010
Demonstrate team engagement and prepare CAD and class presentations based on team projects	N/A		CMGT 3010
Discuss and explain the consequences of ethical construction practices.	All Classes		
Utilize correct terminology for construction systems when developing CAD drawings.	N/A		CMGT 3010
Analyze objects and create 2D and 3D projects in both hand drawn & CAD processes.	N/A		CMGT 3010
Utilize CAD software to analyze buildings and their systems.	N/A		CMGT 3010
Read and analyze architectural, civil, structural and mechanical/electrical/plumbing MEP drawings, and construction specifications, for construction instructions, bidding, and cost estimating.	CMP 230	Lecture	CMGT 3600
Identify and interpret drawing symbols, materials, notes, and nomenclature of construction documents.	CMP 315	Lab	CMGT 2600
Identify industry standards for sheet development, detailing, note placement and construction document systems of materials and systems identification.	N/A		CMGT 2600
Interpret the organization of construction documents and locate information within the construction document for project management communications.	CMP 315	Lab	CMGT 2600
Select construction methods and procedures according to the construction documents and discuss details in terms of constructability.	CMP 415	Lab	CMGT 2600
Identify potential problems in construction drawings and communicate with the designer.	N/A		CMGT 2600
Prepare site/ construction sketches and preliminary quantity takeoff.	CMP 315	Lab	CMGT 4000
Discuss the principles of potable water and wastewater distribution and collection systems, and their considerations for the proposed project	CMP 305	Lecture	CMGT 3800
Discuss the principles of MEP systems and how the principles are incorporated into the design and the building of the Project; specifically, terminology and practice associated with mechanical, plumbing and electrical systems.	CMP 230	Lecture	CMGT 3600
Read and interpret MEP drawings and symbols.	CMP 230	Lecture	CMGT 3600
Identify MEP systems and their locations in residential construction and explain their applications.	CMP 230	Lecture	CMGT 3600
Identify MEP systems and their locations in commercial construction and explain their applications	CMP 230	Lecture	CMGT 3600
Analyze drawings and specifications to determine location and size of MEP feeds and tie-ins.	CMP 230	Lecture	CMGT 3600
Create MEP schematic drawings using hand sketch and CAD drawings, derived from information obtained in the lab and on-site project visits.	N/A		CMGT 3600
Interpret MEP codes with respect to construction types.	CMP 211	Lecture	CMGT 3600
Delineate relationship of construction contract to specifications to delineate relationship to the construction project.	CMP 385	Lecture	CMGT 3500
Discuss construction traditions, practices, and principles of construction law.	CMP 385	Lecture	N/A
Compare and select project delivery systems including traditional, Design Build, CM, etc.	CMP 385	Lecture	N/A
Explain bidding requirements and processes as well as other selection processes for construction professional.	CMP 415	Lecture	CMGT 4000
Review and analyze construction contract and specifications.	CMP 385	Lecture	CMGT 3500
Compare and use standard contract and specification forms.	CMP 385	Lecture	N/A
Explain the nature of claims and the dispute resolution process.	CMP 385	Lecture	N/A
Demonstrate knowledge of the ethics involved in bidding and negotiation.	CMP 385	Lecture	N/A
Discuss the ethics of the Change Order process	CMP 415	Lecture	N/A

4. Engineering-Surveying, Structural Analysis

Learning Outcome	MSU Class Covered In	How it is covered	ECU Class Covered in
Explain importance of surveying in construction.	CMP 305	Lecture	CMGT 3700
Perform horizontal and vertical measurements using surveying equipment.	CMP 305	Lab	CMGT 3700
Prepare and calculate correction for leveling and traverse field notes.	CMP 305	Lab	CMGT 3700
Demonstrate proper surveying staking techniques including placement and identification.	CMP 305	Lab	CMGT 3700
Identify resources required to perform various construction surveys.	CMP 305	Lab	CMGT 3700
Explain and discuss the impact of surveying on construction cost and schedule.	CMP 305	Lecture	CMGT 4000
Explain GPS applications in surveying.	CMP 305	Lecture	CMGT 3700
Calculate earth volumes based on topographic maps.	CMP 305	Lab	CMGT 3700
Accurately construct free body diagram for concurrent and non-concurrent force systems including rigging cables, trusses, beams.	CMP 222	Lecture	CMGT 3400
Express and mathematically solve equilibrium equations to identify external loading applied to components.	CMP 222	Lecture	N/A
Determine a component's centroid and moment of inertia and calculate stress and strain resulting from loading.	CMP 222	Lecture	CMGT 3400

Analyze the location of reinforcing in concrete beams and explain the function of stirrups play in beams, and describe the necessity of formwork bracing.	CMP 222	Lecture	CMGT 3400

5. Quantities-Construction Cost, Planning and Scheduling,

Learning Outcome	MSU Class Covered In	How it is covered	ECU Class Covered in
Demonstrate the ability to conduct a takeoff for a construction project.	CMP 315	Lab	CMGT 4000
Perform quantity takeoff with appropriate techniques and units.	CMP 315	Lab	CMGT 4000
Obtain pricing information for materials, labor and equipment.	CMP 415	Lab	CMGT 4000
Identify factors that influence construction productivity on project cost.	CMP 415	Lecture	CMGT 4000
Demonstrate competent use of estimating software for quantity takeoff and pricing.	CMP 415	Lab	N/A
Compare and apply bidding strategies to maximize the chance of winning bid.	CMP 415	Lab	N/A
List the factors that explain the importance of ethics during the bid process.	CMP 415	Lecture	N/A
Identify units of weight, square footage and volume through material take-offs for existing construction projects, roof coverings, wall coverings, floor coverings.	CMP 315	Lab	CMGT 4000
Explain the importance and role of scheduling and planning in construction management.	CMP 311	Lecture	CMGT 4100
Prepare a preliminary construction bid package with estimate summary, and Schedule of Values.	CMP 423	Lab	N/A
Identify common activity types for both building construction.	CMP 311	Lecture	CMGT 4100
Develop a bar chart and precedence diagram manually and with a computer program.	CMP 311	Lecture	CMGT 4100
Perform critical path calculations based on a precedence diagram.	CMP 311	Lecture	CMGT 4100
Create a bar chart schedule manually and using a computer program.	CMP 311	Lab	CMGT 4100
Create a precedence diagram manually and using a computer program.	CMP 311	Lab	CMGT 4100
Develop a linear schedule based on quantity of work and production rate.	CMP 423	Project	CMGT 4100
Update a project schedule based on actual performance.	N/A		N/A
Demonstrate the most efficient way to accelerate a developed schedule.	CMP 423	Project	CMGT 4100
Articulate resource use for a construction project and incorporate the information in a schedule.	N/A		CMGT 4100
Perform cash flow analysis based on schedule and cost estimate and examine its influence on the financial health of a project.	CMP 423	Project	N/A
Perform earned value analysis of a construction project.	CMP 423	Project	N/A

6. Management-Project Capstone/Synthesis, Building Quality, Equipment, Human Resources, Safety, Work Experience

Learning Outcome	MSU Class Covered In	How it is covered	ECU Class Covered in
Explain project organization and common practices of managing construction processes.	CMP 423	Lecture	N/A
Discuss roles and responsibilities of construction manager.	CMP 423	Lecture	N/A
Develop and maintain essential project control documents for cost, time, quality, and safety.	CMP 423	Lecture	N/A
Demonstrate the allocation and control of construction resources.	CMP 423	Project	N/A
Assess the impact of project changes during the construction process.	CMP 423	Lecture	N/A
Create presentations with professional quality.	CMP 423	Lecture	N/A
Explain the structure and functions of a quality control system.	CMP 423	Lecture	N/A
Review and analyze construction documents for risk assessment.	CMP 423	Lecture	N/A
Conduct project control and prepare documentation for cost, schedule, procurement, logistics and material handling.	CMP 423	Lab	N/A
Perform and document quality control/testing for building system.	CMP 423	Lab	CMGT 4300
Prepare quality control checklist based on construction specifications, standards, and codes.	N/A		N/A
Coordinate in-process inspections and material delivery with project schedule.	N/A		N/A
Create controls for estimating, scheduling, documentation, and purchasing, logistics and material handling.	CMP 423	Lecture	N/A
Compile criteria and calculate productivity for common construction equipment.	CMP 423	Project	N/A
Explain and discuss the organization, procedures and record keeping of preventive maintenance.	CMP 423	Lecture	N/A
Analyze economics and compare the options of buying, leasing, and replacing heavy equipment, and factors associated with depreciation, overhead and operating costs.	CMP 423	Lecture	N/A
Demonstrate competent use of computer software for equipment management.	CMP 423	Lab	N/A
Compare and select appropriate equipment for common construction activities.	CMP 124	Lecture	N/A
Explain historical human resource management theories and current practices.	N/A		CMGT 4300
Discuss the characteristic elements of compensation and benefits plans.	N/A		CMGT 4300
Plan and conduct personnel recruiting, placing, and training.	N/A		CMGT 4300
Analyze and discuss collective bargaining, labor relations and legal contexts of human resource management.	CMP 385	Lecture	N/A
Explain an ethical code of human resource management conduct.	All CMP Classes	Lecture	CMGT 4300
Articulate the impact of safety on overall project objectives.	CMP 401	Lecture	CMGT 3900
List awareness criteria for personal safety in construction.	CMP 401	Lecture	CMGT 3900
Analyze and Conduct a safety audit of a construction site.	N/A		N/A
Create a safety program for a construction company.	CMP 401	Lecture	CMGT 3900
Demonstrate use of the 29CFR1926 OSHA Standards.	CMP 401	Lecture	CMGT 3900
Analyze construction site safety violation and cite the OSHA standards violated.	CMP 401	Lecture	CMGT 3900
Explain the criteria for being a safety construction professional.	CMP 401	Lecture	CMGT 3900
Utilize campus resources available to aid in job placement.	Career Fair		N/A
Compare and evaluate career paths and opportunities.	Career Fair		N/A

10.18 Appendix R: Learning Outcomes from NAHB Gold Standard not covered in MSU Courses

Learning Outcomes from NAHB Gold Standard not covered in MSU Courses
Identify the resource cycle of materials for construction.
Identify space planning alternatives for residential interiors.
Articulate the concepts of sustainable development.
Differentiate the different structural systems involved in construction.
Identify and discuss framing techniques for building construction.
Discuss the ethics of contracting and construction management.
Discuss and plan for common construction techniques for interior/exterior finish systems.
Create building plans and details of a building design that incorporate a variety of building components and building systems.
Calculate building dimensions, design building components, analyze placement of components, and create final projects of student designed buildings.
Create AutoCAD and Sketch-Up projects encompassing basic construction document criteria.
Demonstrate team engagement and prepare CAD and class presentations based on team projects
Utilize correct terminology for construction systems when developing CAD drawings.
Analyze objects and create 2D and 3D projects in both hand drawn & CAD processes.
Utilize CAD software to analyze buildings and their systems.
Identify industry standards for sheet development, detailing, note placement and construction document systems of materials and systems identification.
Identify potential problems in construction drawings and communicate with the designer.
Create MEP schematic drawings using hand sketch and CAD drawings, derived from information obtained in the lab and on-site project visits.
Update a project schedule based on actual performance.
Articulate resource use for a construction project and incorporate the information in a schedule.
Prepare quality control checklist based on construction specifications, standards, and codes.
Coordinate in-process inspections and material delivery with project schedule.
Explain historical human resource management theories and current practices.
Discuss the characteristic elements of compensation and benefits plans.

10.19 Appendix S: Michigan State Classes with most Residential Focus Base on NAHB Gold Standard

Michigan State Classes with most Residential Focus Based on NAHB Gold Standard

*All Totals gathered from NAHB Gold Standard Learning Outcomes for a Residential Construction Curriculum

Course	Number of Learning Outcomes
All CMP Courses	3
CMP 101	4
CMP 124	14
CMP 210	1
CMP 211	7
CMP 222	4
CMP 230	6
CMP 305	17
CMP 315	8
CMP 385	10
CMP 415	9
CMP 423	22
CMP 453	4
Not covered	26

10.20 Appendix T: NAHB Student Chapter Awards Ceremony Results 2009

2009 International Builders' Show
NAHB Student Chapters Awards Ceremony Results

Distinguished Service Award
Delmar Cengage Learning

Outstanding Student Chapter Awards
1st Place: Delgado Community College, New Orleans, LA
2nd Place: Southeast Community College, Milford, NE
3rd Place: University of Nebraska-Lincoln, Lincoln, NE

Outstanding Educator Awards
Outstanding Junior Faculty:
Russ Peterson, Texas A&M University
Outstanding Educator, Two-Year Programs:
Barney Kahn, Pennsylvania College of Technology
Outstanding Educator, Four-Year Programs:
Patrick Pannell, South Dakota State University

Residential Construction Management Competitions
Secondary School Programs:
1st Place: Juneau Douglas High School, Juneau, AK
2nd Place: McPherson High School, McPherson, KS
3rd Place: Forbes Road CTC, Monroeville, PA
Rookie-of-the-Year: Forbes Road CTC, Monroeville, PA

Two-Year Programs:
1st Place: Brigham Young University-Idaho, Rexburg, ID
2nd Place: Pennsylvania College of Technology, Williamsport, PA
3rd Place: Purdue University North Central, Westville, IN
Rookie-of-the-Year: John A. Logan College, Carterville, IL

Four-Year Programs:
1st Place: Brigham Young University, Provo, UT
2nd Place: Middle Tennessee State University, Murfreesboro, TN
3rd Place: California Polytechnic State University, San Luis Obispo, CA
4th Place: Appalachian State University, Boone, NC
5th Place: Texas A&M University, College Station, TX
Rookie-of-the-Year: Appalachian State University, Boone, NC

10.21 Appendix U: NAHB Student Chapter Awards Ceremony Results 2010

NAHB Student Chapters

2010 International Builders' Show
NAHB Student Chapters Awards Ceremony Results

Outstanding Student Chapter
Sponsored by NCHI, the Leading Suppliers of NAHB

1st Place: Texas A&M University, College Station, TX
2nd Place: Killingly High School, Danielson, CT
3rd Place: Southeast Community College, Milford, NE

Outstanding Educator
Sponsored by Delmar Cengage Learning

Outstanding Junior Faculty:
Scott Kelting, Cal Poly San Luis Obispo, CA
Outstanding Educator
Bonnie Beland, Killingly High School, Danielson, CT

Residential Construction Management Competition

Secondary School Programs:
1st Place: McPherson High School (McPherson, KS)
2nd Place: Cumberland Perry AVTS (Mechanicsburg, PA)
3rd Place: Killingly High School (Chaplin, CT)

Two-Year Programs:
1st Place: Utah Valley University (Orem, UT)
2nd Place: Dunwoody College of Technology (Minneapolis, MN)
3rd Place: Brigham Young University-Idaho (Rexburg, ID)

Four-Year Programs:
1st Place: Brigham Young University – Provo (UT)
2nd Place: University of Denver (CO)
3rd Place: Pittsburg State University (KS)
4th Place: Michigan State University (MI)
5th Place: Texas A&M University (TX)
Rookie-of-the-Year: Pittsburg State University (KS)

10.22 Appendix V: NAHB Student Chapter Awards Ceremony Results 2011

NAHB Student Chapters

2011 International Builders' Show
NAHB Student Chapters Awards Ceremony Results

Outstanding Student Chapter
Sponsored by NCHI, the Leading Suppliers of NAHB
1st Place: Southeast Community College, Milford, NE
2nd Place: Delgado Community College, New Orleans, LA
3rd Place: Killingly High School, Danielson, CT

Outstanding Educator
Sponsored by Delmar Cengage Learning
Joseph "Joe" Karpinski, Kent State University, OH

Residential Construction Management Competition
Four-Year College Programs:
1st Place: Cal Poly – San Luis Obispo (CA)
2nd Place: Middle Tennessee State University (TN)
3rd Place: Brigham Young University – Provo (UT)
4th Place: University of Florida (FL)
5th Place: Western Carolina University (NC)
Rookie of the Year: Central Washington University (WA)
Two-Year College Programs:
1st Place: Pennsylvania College of Technology (PA)
2nd Place: Brigham Young University – Idaho (ID)
3rd Place: North Dakota State College of Science (ND)
Rookie of the Year: Tarrant County College Southeast (TX)
Secondary School Programs:
1st Place: Cumberland Perry AVTS (PA)
2nd Place: Camden County High School (GA)
3rd Place: Shelby County High School (KY)
Rookie of the Year: Shelby County High School (KY)

Distinguished Service Award
In Memoriam, Joe Powell, Las Vegas, NV

10.23 Appendix W: NAHB Student Chapter Awards Ceremony Results 2012

NAHB Student Chapters

2012 International Builders' Show
NAHB Student Chapters Awards Ceremony Results

Outstanding Student Chapters
Sponsored by The Leading Suppliers Council of NAHB
1st Place: Delgado Community College (LA)
2nd Place: Killingly High School (CT)

Outstanding Educators
Sponsored by Delmar Cengage Learning
Outstanding Educator Award
Patrick Huish, Brigham Young University-Idaho (ID)
Outstanding Junior Faculty Award
Aaron Kliethermes, Linn State Technical College (MO)

Residential Construction Management Competition
Four-Year College Programs:
1st Place: Middle Tennessee State University (TN)
2nd Place: Cal Poly – San Luis Obispo (CA)
3rd Place: Brigham Young University – Provo (UT)
4th Place: University of Denver (CO)
5th Place: University of Florida (FL)

Two-Year College Programs:
1st Place: Jefferson State Community College (AL)
2nd Place: Montgomery College (MD)
3rd Place: Northcentral Technical College (WI)
Rookie of the Year: Linn State Technical College (MO)

Secondary School Programs:
1st Place: York County School of Technology (PA)
2nd Place: Cumberland Perry AVTS (PA)
3rd Place: Marion County High School (KY)
Rookie of the Year: Upper Cape Technical School (MA)

Distinguished Service Award
Fred Humphreys, retired, President and CEO, Home Builders Institute

10.24 Appendix X: NAHB Student Chapter Awards Ceremony Results 2013

NAHB Student Chapters

2013 International Builders' Show
NAHB Student Chapters Awards Ceremony Results

Residential Construction Management Competition

Four-Year College Programs:
1st Place: Michigan State University (MI)
2nd Place: Cal Poly – San Luis Obispo (CA)
3rd Place: Brigham Young University – Provo (UT)
4th Place: Western Carolina University (NC)
5th Place: Texas A&M University (TX)
Rookie of the Year: Texas State University (TX)

Two-Year College Programs:
1st Place: North Dakota State College of Science (ND)
2nd Place: Utah Valley University (UT)
3rd Place: Montgomery College (MD)
Rookie of the Year: Honolulu Community College (HI)

Secondary School Programs:
1st Place: York County School of Technology (PA)
2nd Place: Camden County High School (GA)
3rd Place: Shelby County High School (KY)

Outstanding Educator Award
Orlando Bagcal, Tarrant County College Southeast (TX)

Distinguished Service Award
Calculated Industries

Outstanding Student Awards
Appalachian State University: Laura McCree
BYU-Idaho: Taylor Hunt
BYU-Provo: Dakoda John
Cal Poly San Luis Obispo: Jennifer Gallegos
California State University Long Beach: David Glover
Camden County High School: Evan Jenkins
Cont'd on Page 2

10.25 Appendix Y: Cal Poly University Application for 2013-2014 CM Competitions

CAL POLY

CONSTRUCTION MANAGEMENT DEPARTMENT

APPLICATION FOR 2013-2014 CM COMPETITIONS

Application Deadline: 4:00 PM, Friday, May 10, 2013 in the CM Office

Name: _____

Phone: _____

Cal Poly e-mail: _____

Expected Graduation Term

Fall Winter Spring Summer
circle one 20____

- ☐ Check this box if you were an Alternate in 2013; if so which team? _____
- ☐ Check this box if you are a freshman or sophomore CM student but would like to be an Alternate in preparation for the following year.
- Note your Major if it is not CM _____
- Will you be gone for (circle): Co-op, Study Abroad, Cal Poly at Sea, other _____ etc.;
  - What quarters will you be gone _____

Note the **1st** and **2nd** choice of the competition(s) you are interested in and eligible for.

___ MCAA
TBA
March 10-13, 2014?
Scottsdale, AZ

___ NAHB
February 4-6, 2014
Las Vegas, NV
Note: conflicts with ASC
6 Students, 2+ Alternates
Advisor: Scott Kelting

___ ASC
February 5-8, 2014
Reno (Sparks), NV
72 students
+ 24 Alternates

If you checked the ASC Region 6 & 7 Competition above, again, note your **1st**, **2nd** and **3rd** choice.

ASC **REGION 6 & 7**
Problem Category

1.	___	Commercial	2.	___	Concrete Solutions
4.	___	Design-Build	4.	___	Electrical
5.	___	Heavy Civil	6.	___	LEED
7.	___	Marine	8.	___	Mechanical
9.	___	Mixed Use	10.	___	Preconstruction
11.	___	Risk Management	12.	___	VDC (BIM)

Briefly identify your most recent internship or co-op detailed in your résumé or one you have this summer.

Company	Project Type	Duties	Months

Attach a current copy of your **Résumé** and **CM flowchart** with highlights showing the courses you've completed or are enrolled in this Spring.
Your are ineligible to be on a team if you are on AP Fall and/or Winter

10.26 Appendix Z: Interview Questions - Student A Comp Team

Interview Questions

1. What was the number one factor that contributed to our greatest success?

The number one factor was that we created a plan very early on and everyone was on the same page of what we planned to do with the parcel of land we were given.

2. If we could have had something to make us more successful what would it be?

More time would have helped more than anything which means there need to be more students in the class to help. This class is seen as a burden by most students not as an opportunity. The school should change that reputation and promote the competition team.

3. What preparation helped us in presenting?

Dr. Streng helped a lot in the beginning by making us aware of what we do or don't do when presenting. Most importantly, we practiced our speech parts a million times.

4. If you could change something about the class, what would it be?

I think that we need more students and that students should be on one team only and assisting in the preparation for the team they are not on.

5. What classes/experiences contributed to our success?

For me, my internship helped extremely for the commercial competition. A lot of the guest speakers were great to hear from as well because they gave us a level of expertise we wouldn't have otherwise. All of my CMP classes especially scheduling and estimating were very useful in this competition.

10.27 Appendix AA: Interview Questions - Student B Comp Team

Interview Questions

1. What was the number one factor that contributed to our greatest success?

Our team camaraderie and commitment to presenting a quality finished work.

2. If we could have had something to make us more successful what would it be?

It would have been a great help if the location of the site was geographically closer.

3. What preparation helped us in presenting?

I feel that the initial first formal presentation in front of several contractors helped us work out the kinks and improve our presentation. Also, the polishing we did before the final presentation.

4. If you could change something about the class, what would it be?

We need to start preparing for the Residential competition earlier so there is more time to prepare for the many challenges the project presents, at least a month earlier.

5. What classes/experiences contributed to our success?

Project management which helped with figuring out the cash flows for the project and interactive revit course.

10.28 Appendix BB: Interview Questions - Student C Comp Team

Interview Questions

1. What was the number one factor that contributed to our greatest success?

The number one factor that contributed to our success was the ability we had to meet with many people in the industry to get feedback on our project while it was in the works. Having Mayberry Homes and other professionals come talk to us and review our proposal really helped us get a leg up on the competition.

2. If we could have had something to make us more successful what would it be?

I feel that this project is very time dependent. Since we did not begin working on the residential competition project until after the commercial one had ended in mid October, we did not get to put forth as much time towards this project as we had initially anticipated.

3. What preparation helped us in presenting?

When it came to presenting, the fact that we had a presentation style that stood out from the rest really set us apart. We had practiced our presentation countless times to the point where most had their part memorized and everyone knows the more you are comfortable with the subject you're talking about, the easier it is to speak in front of many people.

4. If you could change something about the class, what would it be?

If I could change something about the class it would be to spur more interest so that there are more students working on it rather than having some of the same students participate in both competitions. Although, being one of the students that had the privilege to compete in both was quite an honor and an amazing experience.

5. What classes/experiences contributed to our success?

I feel the number one class that contributed to the team's success was CMP 423 and CMP 415. These two classes really brought together the project management aspect and the estimation/scheduling side of things in order for us to master the material we were presenting.

10.29 Appendix CC: Interview Questions - Student D Comp Team

Interview Questions

1. What was the number one factor that contributed to our greatest success?
   a. **I would say the dedication of the core team members. Additionally their ability to pick up the slack of the weaker members. I think the 80/20 rule definitely applied this year, which says 80% of the work was done by 20% of the available workers. And the other 80% of the people only contributed about 20% of the end product. The statistics might not be exact but you get the general idea.**

2. If we could have had something to make us more successful what would it be?
   a. **We could have used some help in regards to establishing an efficient way to organize our information and how to collectively bring everything that we had worked on individually into one final finished product. Exactly what that tool is, I am not sure. That might be a good research project for the faculty. A lot of time was spend making all the pages and information align, which became very tedious and time consuming.**
   b. **If I remember the commercial competition correctly I believe that we struggled greatly with putting the proposal together at the final hours. One tool that I was astonished that we didn't have on the laptops was Adobe Acrobat Pro. I would consider this a must have for next year.**
   c. **Having a work room for the competition team was huge. The members of this team put in long hours and need a place to work as a team where they are not fighting over space and computers with other students. A team work room is a must for continued success.**
   d. **Additional support from the faculty. We have a bunch of very knowledgeable professors who are always talking about the competition team but not once did I see any one of them come in to our work sessions and offer support.**

3. What preparation helped us in presenting?
   a. **A huge factor in our success was having a lot of meetings with people in the industry. Some of the ideas that Mayberry Homes shared with us such as coving, help to make us stand out. The industry professionals always have had to stay ahead of the curve so they help to bring in fresh ideas that we may not receive from the facility within.**

4. If you could change something about the class, what would it be?
   a. **I would not put the students through two competitions. The burden of having to complete the commercial competition which results in getting a late start on the residential competition was almost too much. The best bet is to have enough students to have two teams for each, a keep them separated for the most part, or just focus on one competition as a whole. The commercial and residential capstone classes work on only one project for the semester so I do not see the need to have the competition team complete two projects. I honestly feel that the construction management department under realizes the amount of work that it takes to prepare and compete at these competitions.**
   b. **I would also make the criteria much more selective for the students are a part of the competition team. I was under the impression that the competition team was that way. When the advising**

department signs student up for the competition they need to be clear about the amount of dedication, teamwork and workload. And they students need to be clearly dedicated to the cause because you will not be doing the team any good if there is a student or two who does not want to put in the work like the rest of the team.

5. What classes/experiences contributed to our success?
    a. **I would say that there wasn't one, or even a hand full of, classroom experiences that lead to our success. We study construction management and I think an accumulation of all our classroom experience helped. Since our program is not very heavily focused on residential construction I do not think we were very well educated for the residential competition. Most everyone relied on their past experiences.**

10.30 Appendix DD: Interview Questions - Student E Comp Team

Interview Questions

1. What was the number one factor that contributed to our greatest success?

After the competition the number one factor that contributed to our success would have been our ability to have a site visit. This is because we were able to gain valuable information from local developers and realtors in the area other teams could not get. This included our ideas for how our homes would be designed and our site layout.

2. If we could have had something to make us more successful what would it be?

The only specific factor that would have helped us create a better proposal would have been having more time. We started to cram near the end of our project and needed an earlier start because we did not foresee how much effort we needed to put in.

3. What preparation helped us in presenting?

When preparing our presentation we had industry professionals come in and listen to our preliminary presentation. They were able to critique us and give us ideas to be more confident when presenting in front of the judges. Also, practicing over and over while in Vegas before the actual presentation.

4. If you could change something about the class, what would it be?

If I could change something about the class it would be having our other class schedules and CM events scheduled at better times around the class itself. Part of this was our own faults for procrastinating. Although it was tough to prepare to the first competition during the career fair and then the second during exam week.

5. What classes/experiences contributed to our success?

The classes that most contributed to our success would have been CMP 423, CMP 415 and part of CMP 325 for the financial part of our final project proposal.

10.31 Appendix EE: Interview Questions - Comp Team Coach

Interview Questions

1. What made this team different from last year's team?

Leadership and the ability to work together for the common goal. The student took ownership.

2. What do you think contributed to this team's success? Was it the preparations? Resources?

Having people from industry was very beneficial. More speakers were brought in this year than past years. The large project was divided according to personal interest. Years past students were challenged to work in areas they were not comfortable or familiar with. Engaging more industry people while attending the site visit allowed the students to better understand the local environment and customs, as well as design ideas relative to the area.

3. What do you think would make this team or past year teams more successful?

Preparation and being comfortable to ask questions both in class and with guest speakers. Communication from the students is key to the real world.

4. As the coach, what do you think you would need to make the team more successful?

The School has been very supportive and allowed us to prepare adequately. Resources have been available and the teams are very appreciative.

5. What would draw more students to be on the team?

Getting the word out and marketing. Currently there are only 2 competitions we compete in, Commercial & Residential. Each allows for a maximum of 6 students for a total of 12 students per semester. Any more than that and we have students that don't get to actually compete. One thing we could do is open the class up to include additional competitions. This could put a strain on resources/other but could be an area for improvement/expansion.

6. What areas do you wish students had more knowledge in from classes?

The professors in the Program do an excellent job preparing the students. Communication is the biggest area for improvement. Students need to be able to talk confidently with industry people.

10.32 Appendix FF: Interview Questions - Student Builders and Contractors Association

SBCA Interview

Questions for SBCA

President

1. What activities do you have planned for the semester?

a. **Internship expectations day**
b. **Tutoring for 222-University asked to do this**
c. **Mining Safety Speaker**
d. **LA distinguished Speaker**
e. **Fundraising**

2. Any activities that relating to residential?

a. **Currently have a lead on one speaker**

3. If you could have any additional support what would it be?

a. **Funding, access to alumni, help getting more underclassman get involved**

4. Regarding residential, what do you think would be most beneficial and of most interest to students?

a. **Residential speakers? –but would like more hands on speakers**
b. **Land developers and residential process? –Entrepreneurship-owners or an alumni panel**
c. **Company presentations?**
d. **Help in gaining internship opportunities-struggle with Robin, she does not want companies coming to SBCA meetings.**
e. **Anything else you thought of?**

Question from Faculty

Feedback on residential internships-do you know anyone that has had one?

Adam Oliver last summer got an email from Robin and applied with information given in email. Company was in Michigan.