AUBURN UNIVERSITY

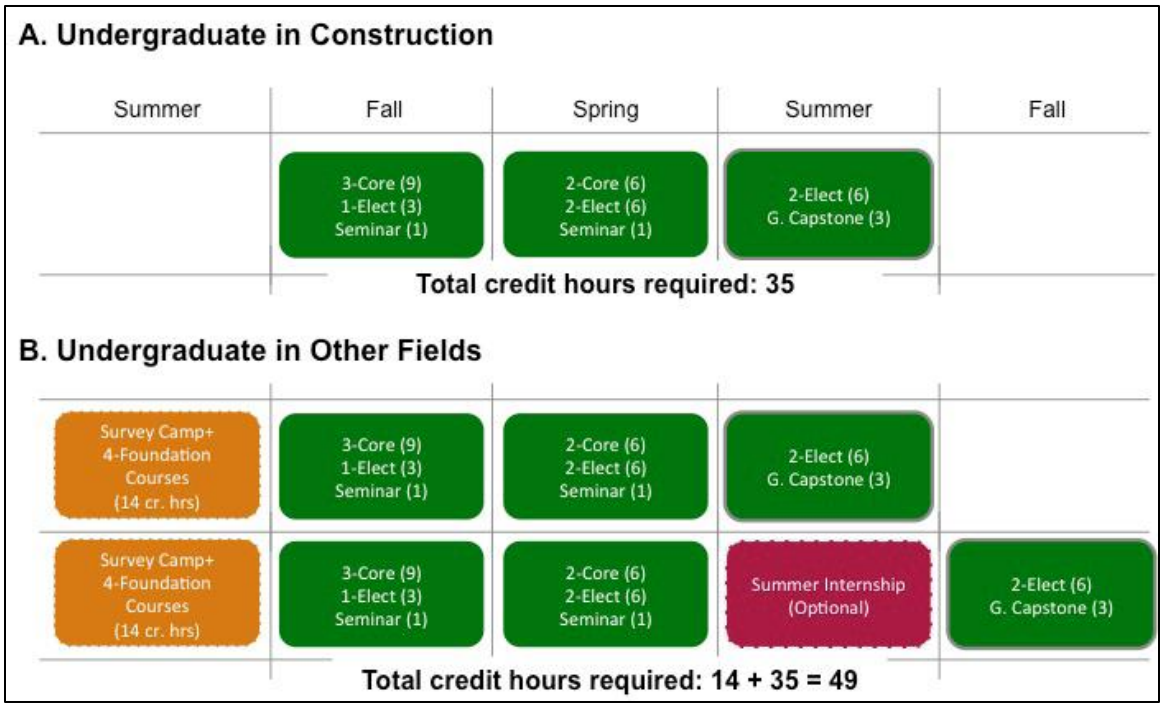
PROGRAM ASSESSMENT REPORT

MASTER OF BUILDING CONSTRUCTION

The Master of Building Construction (MBC) is a non-thesis based graduate program which requires a minimum of 35 credit hours to complete. The program has been enrolling students since fall of 1993. The average number of students in the MBC program has been approximately 12 during the past 10 years and has varied from 5 – 20 in any given academic year. The enrollment data of the last five years is shown below:

Year	2012-13	2013-14	2014-15	2015-16	2016-17
Enrollment	5	12	17	16	18

The graduate construction programs are not required to be accredited by the American Council for Construction Education (ACCE). The MBC program is designed to be completed in one calendar year (3 semesters) by students who hold an accredited undergraduate degree in construction. Those students who enter the program with a degree in a non-construction discipline (including civil engineering or architecture) are required to take an additional 14 credit hours foundation courses. The foundation courses are offered in the summer semester only. This increases the total time to complete the degree to 16 months (4 semesters).. The curriculum plan of the MBC program is graphically depicted below:



The MBC program does not offer any formal options/tracks. The program is offered on-campus. It is important to note that the McWhorter School of Building Science offers three graduate certificates in construction management via distance education. Each certificate is a 12 credit-hour graduate program. Students completing all three certificate programs and a graduate capstone course can earn a Master of Building Construction (MBC) degree. The distance education program is administered and assessed separately. Hence the scope of this report is limited to on-campus program only.

Student Learning Outcomes

1. Specificity of Outcomes

Program Vision

The vision of the Master of Building Construction (MBC) program at Auburn is to build construction industry leaders through engaged learning, active collaboration with industry, and entrepreneurial creativity.

Learning Objectives and Outcomes

Five learning objectives have been defined to realize the program vision. The learning objectives and their relationship to the individual learning outcomes are set out below:

Learning Objective #1 Students graduating with a Master's degree in Building Construction will demonstrate proficiency in processes involved in construction project development. ***Learning Outcomes:***	
Upon graduation, Graduates of the Master of Building Construction program will be able to:	
1.1	Analyze the roles of stakeholders in a construction project
1.2	Develop organization strategy and strategic management plan
1.3	Apply a basic project portfolio management system
1.4	Define project scope and financing alternatives
1.5	Develop the project execution plan
1.6	Evaluate project delivery options
1.7	Produce constructability reviews and value studies
1.8	Evaluate project risks and create a risk management plan
1.9	Create plans to manage human resources, equipment and materials at jobsites

Learning Objective #2 Students graduating with a Master's degree in Building Construction will show evidence of mastery of project management skills required for national and international construction projects. ***Learning Outcomes:***	
Upon graduation, Graduates of the Master of Building Construction program will be able to:	
2.1	Establish project priorities and create a Work Breakdown structure
2.2	Identify construction best practices and apply them to the project
2.3	Produce project cost, schedule and resource allocation plans
2.4	Prepare project bid and detailed construction documents
2.5	Analyze subcontractor bid scope statement
2.6	Assess the jobsite safety program
2.7	Organize Green Building activities
2.8	Analyze buildings for their compliance with structural requirements (i.e. strength, stiffness, stability)
2.9	Analyze building systems and equipment
2.10	Understand direct-hire construction craft worker issues (i.e. hiring, training, promoting and retaining workers)
2.11	Analyze labor reports, schedule acceleration and resource leveling

2.12	Develop procedures to measure project progress and performance
2.13	Evaluate project submittal documents
2.14	Analyze financial, legal and contractual issues

Learning Objective #3

Students graduating with a Master's degree in Building Construction will demonstrate effective digital, oral, and written communication skills.

Learning Outcomes:

Upon graduation, Graduates of the Master of Building Construction program will be able to:	
3.1	Apply written, oral and visual means to communicate effectively in diverse settings
3.2	Employ technology as an effective communication, visualization and management tool
3.3	Formulate resolutions to difficult issues creatively by employing multiple systems and tools
3.4	Solve conflicts by personal communication
3.5	Demonstrate the ability to negotiate construction issues
3.6	Operate effectively in business meetings
3.7	Prepare project proposals and technical reports

Learning Objective #4

Students graduating with a Master's degree in Building Construction will be able to independently research a problem important for the construction industry and systematically develop its solution while displaying the highest standards of ethical conduct.

Learning Outcomes:

Upon graduation, Graduates of the Master of Building Construction program will be able to:	
4.1	Rationally analyze an on- or off-site construction problem
4.2	Apply systematic procedures to identify the major issues
4.3	Select possible solutions within or outside the organization
4.4	Develop, implement and evaluate the best solution
4.5	Measure system performance and any intended problem(s)
4.6	Write a report to document the entire process for knowledge management
4.7	Apply code of ethical principles and procedures throughout the research process

2. Comprehensive Outcomes

The program vision, learning objectives and subsequent learning outcomes are created by the Building Construction graduate faculty group (8 members) through a series of brain storming sessions and consensus meetings held between October 2013 to April 2014. Though the MBC program is non-accredited but accreditation guidelines developed by the American Council for Construction Education (ACCE), USA and Royal Institute of Charted Surveyors (RICS), UK for graduate construction (or built environment) programs were consulted. The aim was to develop learning objectives and outcomes inline with the potential accreditation standards so that it would be easy to seek an accreditation in the future.

3. Communicating Outcomes

Faculty

The Building Construction graduate faculty was directly involved in the development of program vision, learning objectives, and learning outcomes. A copy of this document is typically provided to newly hired faculty and adjunct faculty members during the orientation week or beginning of their academic semester.

The document is also available on the School's shared drive which can be accessed by all faculty and staff members.

Students

The enrolled students are provided a copy of program vision, learning objectives and learning outcomes document in their orientation meeting with the Graduate Program Chair. This meeting is typically held in the beginning of the first semester of the program. Students are also introduced about the program assessment methods used by the graduate faculty and the program chair. In their final semester, the same document is again provided to the graduate students to get their feedback on each learning outcome.

Curriculum Map

The following table depicts the alignment between student learning outcomes and required courses/experiences.

Learning Objective	Learning Outcomes	Course/Experience	Remarks
#1	1.1 – 1.9	Course: BSCI 7020: Integrated Building Process-I Experience: Final Project	The BSCI 7020: Integrated Building Process-I is a required (core) course and is offered in the first semester of the program. The course involves a final project that is completed by the students in small groups (2-3 members per group). The final project covers all 9 sub-learning outcomes. A construction project development proposal is provided to the students at the beginning of the course. The students mimic the role of a project manager and complete various tasks typically involved in the construction project development process. A report is required at the completion of each task for review and feedback. Towards the end of the course, each group submits a project development portfolio to a "hypothetical" client. The final assessment is typically performed by the course instructor, sometimes with the help of an industry representative. The final assessment is based on both group and individual performance.
#2	2.1 – 2.14	Course: BSCI 7040: Integrated Building Process-II Experience: Project Portfolio	The BSCI 7040: Integrated Building Process-II is a required course and is offered in the penultimate semester. A specific construction project is assigned to a student at the beginning of the course. Construction drawings and specifications are provided. The student mimics the role of a construction project manager and completes various tasks typically involved in the construction process. A report is required at the completion of each task for review and feedback. Towards the end of the course, the student submits a project portfolio (containing revised reports) for final assessment and feedback. The project portfolio covers all 14 sub-learning outcomes. The final assessment is typically performed by the course instructor. Other faculty members and industry representatives may be invited based on the discretion of the instructor.
#3	3.1 – 3.7	Course: BSCI 7980: Graduate Capstone	BSCI 7980: Capstone Project is a required course for all building construction graduate students in the last semester of their progress towards the degree. The course deliverables include a written

		Experience: Written Report and Presentation	research report and an oral presentation. These deliverable are evaluated by a committee consisting of a major professor and 2 or 3 committee members.
#4	4.1 – 4.7	Course: BSCI 7980: Graduate Capstone Experience: Final Research Report	BSCI 7980: Capstone Project is a required course for all building construction graduate students in the last semester of their progress towards the degree. In this course students complete an independent piece of scholarly research work. Each student identifies a problem (or an existing issue) in the construction industry and proposes a solution using systematic research design. The final deliverable (a research report) is evaluated by a committee consisting of a major professor and 2 or 3 committee members.

Measurement

The table shown below provides the following information: (1) Outcome-Measure Alignment; (2) Type of Measure (Direct or Indirect); and (3) Data collection process. The grading rubrics, survey and exit interview questions as indicated below are available in the "Results" section.

Outcome – Measure Alignment		**Direct/Indirect Measure**	**Data Collection Process**
Learning Objective/Outcomes	**Description of the Assessment Measure**		
#1 (1.1 – 1.9)	Final Project Portfolio for BSCI 7020: Integrated Building Process-I	Direct	The final project is completed by the students in small groups. Towards the end of the course, each group submits a project development portfolio to a "hypothetical" client. The final assessment is typically performed by the course instructor, sometimes with the help of an industry representative. The final assessment is based on both group and individual performance. A grading rubric is used by the instructor (and/or industry representative) for project portfolio assessment.
	Faculty Assessment of Students	Indirect	The graduate faculty members are asked to fill out a survey to determine if each student has met the 9 sub-learning outcomes at the end of the program. They are asked to show their level of agreement or disagreement (on a scale of 1 to 5, with 1 represents Strongly Disagreed while 5 represents Strongly Agreed) if the graduating student has met each sub-learning outcome.
	Student's Exit Survey and Interview	Indirect	An Exit Survey is sent to the graduating students. Students are asked how strongly they agree (on a five point scale with 5 representing the strongest level of agreement) they have met the Master of Building Construction program Learning objective #1. In addition the graduate program

			chair meet with the graduating students in small groups to get their feedback and suggestions for improvement.
#2 (2.1 – 2.14)	Project Management Portfolio for BSCI 7040: Integrated Building Process-II	Direct	A specific construction project is assigned to a student at the beginning of the course. The student mimics the role of a construction project manager and completes various tasks typically involved in the construction process. A report is required at the completion of each task for review and feedback. Towards the end of the course, the student submits a project portfolio (containing revised reports) for final assessment and feedback. The final assessment is typically performed by the course instructor using a grading rubric. Other faculty members and industry representatives may be invited based on the discretion of the instructor.
	Faculty Assessment of Students	Indirect	The faculty members are asked to fill out a survey to determine if the student has met the 14 sub-learning outcomes at the end of the program. They are asked to show their level of agreement or disagreement (on a scale of 1 to 5, with 1 represents Strongly Disagreed while 5 represents Strongly Agreed) if the graduating student has met each sub-learning outcome.
	Student's Exit Survey and Interview	Indirect	An Exit Survey is sent to the graduating students. Students are asked how strongly they agree (on a five point scale with 5 representing the strongest level of agreement) they have met the Master of Building Construction program Learning objective #1. In addition the graduate program chair meet with the graduating students in small groups to get their feedback and suggestions for improvement.
#3 (3.1 – 3.7)	Review of Capstone Report and Presentation for BSCI 7980: Capstone Project	Direct	BSCI 7980: Capstone Project is a required course for all building construction graduate students in the last semester of their progress towards the degree. The course deliverables include a written research report and an oral presentation. These deliverables are evaluated by a committee consisting of a major professor and 2 or 3 committee members using a 5-items grading rubric for each deliverable.
	Faculty Assessment of Students	Indirect	The faculty members are asked to fill out a survey to determine if the student has met the 7 sub-learning outcomes at the end of the program. They are asked to show their level of agreement or disagreement (on a scale of 1 to 5, with 1

			represents Strongly Disagreed while 5 represents Strongly Agreed) if the graduating student has met each sub-learning outcome.
	Student's Exit Survey and Interview	Indirect	An Exit Survey is sent to the graduating students. Students are asked how strongly they agree (on a five point scale with 5 representing the strongest level of agreement) they have met the Master of Building Construction program Learning objective #1. In addition the graduate program chair meet with the graduating students in small groups to get their feedback and suggestions for improvement.
#4 (4.1 – 4.7)	Review of Final Research Report in BSCI 7980: Capstone Project	Direct	BSCI 7980: Capstone Project is a required course for all building construction graduate students in the last semester of their progress towards the degree. In this course students complete an independent piece of scholarly research work. Each student identifies a problem (or an existing issue) in the construction industry and proposes a solution using systematic research design. The final deliverable (a research report) is evaluated by a committee consisting of a major professor and 2 or 3 committee members using a 6-items grading rubric that measures students' abilities to: 1. Rationally analyze a construction problem and develop research questions and scope. 2. Produce a comprehensive literature review of the problem domain. 3. Employ systematic procedures to find out the answers of the research questions. 4. Collect and analyze the data and report main findings. 5. Develop conclusions based on the data analysis and propose suitable recommendations. 6. Write a research report to document the entire process.
	Faculty Assessment of Students	Indirect	The faculty members are asked to fill out a survey to determine if the student has met the 7 sub-learning outcomes at the end of the program. They are asked to show their level of agreement or disagreement (on a scale of 1 to 5, with 1 represents Strongly Disagreed while 5 represents Strongly Agreed) if the graduating student has met each sub-learning outcome.
	Student's Exit Survey and Interview	Indirect	An Exit Survey is sent to the graduating students. Students are asked how strongly they agree (on a five point scale with 5 representing the strongest

			level of agreement) they have met the Master of Building Construction program Learning objective #1. In addition the graduate program chair meet with the graduating students in small groups to get their feedback and suggestions for improvement.

Results

The program assessment results for data collected between Fall 2014 to Summer 2015 (2014-15 Cohort) are shown in the following sections. In a cohort of 17, 11 students graduated in the summer 2015 semester and data is reported for these graduating students only.

Learning Objective #1: Proficiency in Processes involved in Construction Project Development

Assessment Method #1: Review of Project Development Portfolio for BSCI 7020: Integrated Building Process -I

Reported Results

The grading rubric used for assessment along with the mean scores and standard deviation is shown below:

BSCI7020: Construction Project Development Portfolio - Grading Rubric with Results

Goal/Expectations	Students' Performance (Sample size = 11)						
	Grade and number of students earned it					Weighted Mean Score	S.D.
	Excellent (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)		
Student rationally analyzes the project concept, supporting market data, and proposes an effective site analysis and usage plan (LO# 1.1,1.2, 1.3)	8	2	1	0	0	4.64	0.67
Student identifies methods of project funding, equity, and capital and their impact on construction (LO# 1.4)	7	2	2	0	0	4.45	0.82
Student prepares final pro forma, including refined and detailed construction costs, operating costs and income (LO# 1.6, 1.7)	6	4	0	1	0	4.36	0.92
Student is able to	4	3	2	2	0	3.82	1.17

evaluate project risks and creates a risk management plan (LO# 1.8)							
Student prepares cash flow projections for construction and operations phases (LO# 1.5, 1.7)	4	5	1	1	0	4.09	0.94
Student prepares and presents a workable project development plan to the owner (LO# 1.9)	8	2	1	0	0	4.64	0.67

Interpreting Results

Overall, the results are very satisfactory. On a scale of 1 to 5 (with 1 represents Very poor performance and 5 represents Excellent performance) the weighted mean score ranges between 3.82 to 4.64. The following item receives the minimum mean score "Student is able to evaluate project risks and creates a risk management plan". Two areas of improvement were identified as follows: (1) More in-depth coverage of the topic, risk analysis and management, is needed in this course (BSCI 7020) as well as in the program; (2) Students should be exposed to various risk evaluation and management methods.

Communicating Results

The results are shared with the graduate program faculty. The following improvements have been made: (1) The scope of the topic "risk analysis" is expanded in the course BSCI 7020: Integrated Building Process-1; (2) Guest lectures on Risk Management by the construction industry professionals are introduced in the BSCI 7950: Graduate seminar class; and (3) A new elective BSCI 6460: Planning and Decision-Making in Construction has been introduced in the program. This elective provides in-depth coverage of the risk management process.

Assessment Method #2: Faculty Assessment of Students in Program Learning Outcome #1

Reported Results

The faculty assessment results are shown below:

Learning Outcome #1 Students graduating with a Master's degree in Building Construction will demonstrate proficiency in processes involved in construction project development. Sub-Learning Outcomes		Faculty Assessment 5: Strongly Agree 4: Agree 3: Neutral 2: Disagree 1: Strongly Disagree	
		Mean	S.D.
Upon graduation, Graduates of the Master of Building Construction program will be able to:			
1.1	Analyze the roles of stakeholders in a construction project	3.87	0.90
1.2	Develop organization strategy and strategic management plan	4.37	1.02
1.3	Apply a basic project portfolio management system	3.38	0.90
1.4	Define project scope and financing alternatives	4.10	1.28
1.5	Develop the project execution plan	3.87	0.62
1.6	Evaluate project delivery options	3.78	0.90

1.7	Produce constructability reviews and value studies	3.63	0.87
1.8	Evaluate project risks and create a risk management plan	3.33	1.03
1.9	Create plans to manage human resources, equipment and materials at jobsites	3.74	0.89

Interpreting Results

The mean faculty scores of the 9 sub-learning outcomes range between 3.33 to 4.37 which indicates that the faculty in general have agreed that the students have met these sub-learning outcomes. These mean scores are slightly lower as compared to year 2013-14. The lowest mean score (3.33) is given to the sub-leaning outcome #1.8 "Evaluate project risks and create a risk management plan". The threshold score was set as 3.50. The mean scores of other outcomes are above 3.50.

Communicating Results

The results are shared with the graduate program faculty. The faculty assessment results are in agreement with the assessment method #1 results. The action plan for improvement is already provided in assessment method #1.

Assessment Method #3: Student's Exit Survey and Interview

Reported Results

The students' exit survey results are shown below:

Learning Outcome #1 Students graduating with a Master's degree in Building Construction will demonstrate proficiency in processes involved in construction project development. Sub-Learning Outcomes		Students Assessment 5: Strongly Agree 4: Agree 3: Neutral 2: Disagree 1: Strongly Disagree	
		Mean	S.D.
Upon graduation, Graduates of the Master of Building Construction program will be able to:			
1.1	Analyze the roles of stakeholders in a construction project	4.00	0.93
1.2	Develop organization strategy and strategic management plan	3.88	1.21
1.3	Apply a basic project portfolio management system	3.55	0.93
1.4	Define project scope and financing alternatives	4.00	1.16
1.5	Develop the project execution plan	3.75	0.63
1.6	Evaluate project delivery options	3.63	0.89
1.7	Produce constructability reviews and value studies	3.75	0.74
1.8	Evaluate project risks and create a risk management plan	3.00	1.01
1.9	Create plans to manage human resources, equipment and materials at jobsites	3.75	0.93

Interpreting Results

Of the 9 sub-learning outcomes, the mean scores range between 3.00 to 4.00. The following sub-learning outcome received the minimum mean scores LO# 1.8: "Evaluate project risks and create a risk management plan". The mean scores of the remaining LOs are above the threshold value of 3.50.

Communicating Results

The results are shared with the graduate program faculty. The students assessment results are in agreement with the assessment method #1 and #2 results. The action plan for improvement is already provided in assessment method #1.

Learning Objective #2: Mastery of Construction Project Management Skills

Assessment Method #1: Review of Project Management Portfolio for BSCI 7040: Integrated Building Process-II

Reported Results

The grading rubric used for assessment along with the mean scores and standard deviation is shown below:

Goal/Expectations	Students' Performance (Sample size = 11)						
	Grade and number of students earned it					Weighted Mean Score	S.D.
	Excellent (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)		
Student is able to fully understand the project drawings and specifications and prepares a project analysis report (LO# 2.1, 2.2, 2.4, 2.5, 2.7, 2.9, 2.14)	6	3	2	0	0	4.36	0.81
Student is able to develop a project organization chart and accurately defines the role and scope of the project team members (LO# 2.2)	8	3	0	0	0	4.73	0.47
Student prepares a realistic project schedule and assigns appropriate resources to different tasks (LO #2.2, 2.3, 2.10)	3	4	2	2	0	3.73	1.10
Student develops site utilization, safety and quality management plans for the project (LO# 2.2, 2.6, 2.8)	4	4	3	0	0	4.09	0.83
Student is able to perform cash flow projections, change orders management, and prepares monthly pay requests (LO# 2.2, 2.3, 2.11, 2.12)	7	2	2	0	0	4.45	0.82
Student is able to complete project close-out activities and prepares an executive summary (LO# 2.2, 2.13, 2.14)	8	2	1	0	0	4.64	0.67

Interpreting Results

Overall, the results are very satisfactory. On a scale of 1 to 5 (with 1 represents Very poor performance and 5 represents Excellent performance) the weighted mean score ranges between 3.73 to 4.68. The following item receives the minimum mean score "Student prepares a realistic project schedule and assigns appropriate resources to different tasks". Two sets of weaknesses are identified: (1) Students need more instructions on preparing complex project schedules with multiple constraints; (2) More exposure to the project scheduling software is required.

Communicating Results

The results are shared with the graduate program faculty. The topic "Complex Projects Scheduling" is given more coverage in the first semester foundation course "BSCI 7100: Project Management/Scheduling". More realistic examples and case studies are included in the BSCI 7100 (Project Management/Scheduling) and BSCI 7040 (Integrated Building Process-II) courses. The project scheduling software (Primavera P6) is now formerly taught in the BSCI 7030: Construction Information Management course.

Assessment Method #2: Faculty Assessment of Students in Program Learning Outcome #2

Reported Results

The faculty assessment results are shown below:

Learning Outcome #2 Students graduating with a Master's degree in Building Construction will show evidence of mastery of project management skills required for national and international construction projects. Sub-Learning Outcomes		Faculty Assessment 5: Strongly Agree 4: Agree 3: Neutral 2: Disagree 1: Strongly Disagree	
		Mean	S.D.
Upon graduation, Graduates of the Master of Building Construction program will be able to:			
2.1	Establish project priorities and create a Work Breakdown structure	3.68	0.75
2.2	Identify construction best practices and apply them to the project	4.16	1.20
2.3	Produce project cost, schedule and resource allocation plans	3.78	0.98
2.4	Prepare project bid and detailed construction documents	3.95	1.14
2.5	Analyze subcontractor bid scope statement	3.22	1.17
2.6	Assess the jobsite safety program	3.84	0.96
2.7	Organize Green Building activities	3.59	0.69
2.8	Analyze buildings for their compliance with structural requirements (i.e. strength, stiffness, stability)	3.63	1.17
2.9	Analyze building systems and equipment	3.42	0.94
2.10	Understand direct-hire construction craft worker issues (i.e. hiring, training, promoting and retaining workers)	3.72	1.22
2.11	Analyze labor reports, schedule acceleration and resource leveling	3.50	1.08
2.12	Develop procedures to measure project progress and performance	4.31	0.97
2.13	Evaluate project submittal documents	4.16	0.72
2.14	Analyze financial, legal and contractual issues	3.78	0.90

Interpreting Results

The mean faculty scores of the 14 sub-learning outcomes range between 3.22 to 4.31 which indicates that the faculty in general have agreed that the students have met these sub-learning outcomes. The lowest score is given to the sub-leaning outcome #2.5 "Analyze subcontractor bid scope statement". The sub-learning outcomes #2.9 "Analyze building systems and equipment" and #2.11"Analyze labor reports, schedule acceleration and resource leveling" also received mean scores below 3.50.

Communicating Results

The results are shared with the graduate program faculty. As a result, (1) More coverage is now given to the topic "Analyze subcontractor bid scope statement" in the BSCI 7040: Integrated Building Process-II course. Two guest lectures on this topic are also arranged in the BSCI 7950: Graduate Seminar class; (2) More exercises and case studies are added in the BSCI 7100-002: Building Structures and BSCI 7100-006: Sustainable Construction courses to provide in-depth knowledge about Building Systems and Green Building Activities to the students.

Assessment Method #3: Student's Exit Survey and Interview

Reported Results

The students' exit survey results are shown below:

Learning Outcome #2 Students graduating with a Master's degree in Building Construction will show evidence of mastery of project management skills required for national and international construction projects. Sub-Learning Outcomes		Students Assessment 5: Strongly Agree 4: Agree 3: Neutral 2: Disagree 1: Strongly Disagree	
		Mean	S.D.
Upon graduation, Graduates of the Master of Building Construction program will be able to:			
2.1	Establish project priorities and create a Work Breakdown structure	4.00	0.82
2.2	Identify construction best practices and apply them to the project	4.00	1.15
2.3	Produce project cost, schedule and resource allocation plans	4.10	1.07
2.4	Prepare project bid and detailed construction documents	3.80	1.36
2.5	Analyze subcontractor bid scope statement	3.50	1.27
2.6	Assess the jobsite safety program	4.00	1.00
2.7	Organize Green Building activities	3.90	0.75
2.8	Analyze buildings for their compliance with structural requirements (i.e. strength, stiffness, stability)	3.30	1.06
2.9	Analyze building systems and equipment	3.60	0.98
2.10	Understand direct-hire construction craft worker issues (i.e. hiring, training, promoting and retaining workers)	3.80	1.25
2.11	Analyze labor reports, schedule acceleration and resource leveling	3.80	1.17
2.12	Develop procedures to measure project progress and performance	4.10	0.92
2.13	Evaluate project submittal documents	4.00	0.69
2.14	Analyze financial, legal and contractual issues	4.10	0.98

Interpreting Results

Of the 14 sub-learning outcomes evaluated in 2013-14, the mean scores range between 3.30 to 4.10. The following sub-learning outcomes received the minimum mean scores, 2.5: "Analyze subcontractor bid scope statement" and 2.8 "Analyze buildings for their compliance with structural requirements".

Communicating Results

The results are shared with the graduate program faculty. As a result, (1) More coverage is now given to the topic "Analyze subcontractor bid scope statement" in the BSCI 7040: Integrated Building Process-II course. Two guest lectures on this topic are also arranged in the BSCI 7950: Graduate Seminar class; (2) More exercises and case studies are added in the BSCI 7100-002: Building Structures course to provide in-depth knowledge about Building Systems to the students.

Learning Objective #3: Effective Digital, Oral, and Written Communication Skills

Assessment Method #1: Review of Capstone Report and Presentation for BSCI 7980: Capstone Project

Reported Results

The grading rubric used for assessment along with the mean scores and standard deviation is shown below:

BSCI7980: Capstone Project - Grading Rubric for Capstone Report

Goal/Expectations	Students' Performance (Sample size = 11)						
	Excellent (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)	Weighted Mean Score	S.D.
Student is able to organize information clearly and logically in and within chapters (LO# 3.1, 3.3, 3.4, 3.5, 3.7)	7	4	0	0	0	4.64	0.50
Student is able to maintain coherence and scholarly tone throughout the capstone report (LO# 3.1, 3.3)	8	1	2	0	0	4.55	0.82
Student employs a writing style that is clear, consistent, and readable (LO# 3.1)	5	4	1	1	0	4.18	0.98
Student strictly follows the capstone report writing guidelines (LO# 3.1)	10	1	0	0	0	4.91	1.29
Student is able to use correct syntax and grammar (LO 3.1)	8	3	0	0	0	4.73	0.47

BSCI7980: Capstone Project - Grading Rubric for Capstone Presentation

Goal/Expectations	Students' Performance (Sample size = 11)						
	Excellent (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)	Weighted Mean Score	S.D.
Student is able to organize information clearly and logically throughout the presentation (LO# 3.1, 3.6, 3.7)	9	2	0	0	0	4.82	0.40
Student presents technically sound and scientifically correct information (LO 3.1, 3.6)	7	3	1	0	0	4.55	0.69
Student demonstrates best usage of the multimedia resources	10	1	0	0	0	4.91	0.30

for the presentation (LO# 3.1, 3.2)							
Student manages the presentation time effectively (LO# 3.1)	11	0	0	0	0	5.00	0.00
Student is able to satisfactorily answer the questions of the audience (LO# 3.1)	7	4	0	0	0	4.64	0.50

Interpreting Results

For the written research report, the overall results are very satisfactory. The evaluation matrix shows weight mean scores above 4.50 in 4 out of 5 categories. The area that shows some concerns is technical writing. For the oral presentations, the overall results are excellent. All faculty were very pleased by the excellent presentation skills of the students.

Communicating Results

The results are shared with the graduate program faculty. Students are encouraged to regularly consult the Office of University Writing to improve their technical writing skills. The final capstone project report is now required to be reviewed by a university writing consultant. Lectures on improving written communication skills are added in the BSCI 7950: Graduate Seminar class.

Assessment Method #2: Faculty Assessment of Students in Program Learning Outcome #3

Reported Results

The faculty assessment results are shown below:

Learning Outcome #3 Students graduating with a Master's degree (MBC) in Building Construction will demonstrate effective digital, oral, and written communication skills. Sub-Learning Outcomes		Faculty Assessment 5: Strongly Agree 4: Agree 3: Neutral 2: Disagree 1: Strongly Disagree	
		Mean	S.D.
Upon graduation, Graduates of the Master of Building Construction program will be able to:			
3.1	Apply written, oral and visual means to communicate effectively in diverse settings	4.67	0.78
3.2	Employ technology as an effective communication, visualization and management tool	4.67	1.63
3.3	Formulate resolutions to difficult issues creatively by employing multiple systems and tools	4.67	0.79
3.4	Solve conflicts by personal communication	3.92	0.58
3.5	Demonstrate the ability to negotiate construction issues	4.67	0.76
3.6	Operate effectively in business meetings	4.92	0.79
3.7	Prepare project proposals and technical reports	4.17	0.41

Interpreting Results

The mean faculty scores of the 7 sub-learning outcomes range between 3.92 to 4.67 which indicates that the faculty in general have agreed that the students have met these sub-learning outcomes. The lowest score is given to the sub-leaning outcome #3.4 "Solve conflicts by personal communication".

Communicating Results

The results are shared with the graduate program faculty. The survey findings indicate that the sub-learning outcome 3.4 "Solve conflicts by personal communication" is an area of concern. To improve students' abilities in communication and conflict resolution, this topic is now covered in depth in the following courses, BSCI 7050: Executive Issues in Construction, and BSCI 7100: Construction Law. In addition, 1-2 guest lectures by industry professionals are added in the BSCI 7950: Graduate Seminar class.

Assessment Method #3: Student's Exit Survey and Interview

Reported Results

The students' exit survey results are shown below:

Learning Outcome #3 Students graduating with a Master's degree (MBC) in Building Construction will demonstrate effective digital, oral, and written communication skills. Sub-Learning Outcomes		Students Assessment 5: Strongly Agree 4: Agree 3: Neutral 2: Disagree 1: Strongly Disagree	
		Mean	S.D.
Upon graduation, Graduates of the Master of Building Construction program will be able to:			
3.1	Apply written, oral and visual means to communicate effectively in diverse settings	4.38	0.55
3.2	Employ technology as an effective communication, visualization and management tool	4.50	0.76
3.3	Formulate resolutions to difficult issues creatively by employing multiple systems and tools	4.13	0.83
3.4	Solve conflicts by personal communication	4.50	0.58
3.5	Demonstrate the ability to negotiate construction issues	4.13	0.83
3.6	Operate effectively in business meetings	4.13	0.83
3.7	Prepare project proposals and technical reports	4.75	0.76

Interpreting Results

Of the 7 sub-learning outcomes, the mean scores range between 4.13 to 4.75 which indicates most students have agreed that these learning outcome have been successfully met. During the exit interviews, 3 students indicated their weakness to operate effectively in the business meetings (sub-learning outcome 3.6) and suggested to invite industry professionals to give 1 to 2 guest lectures on this topic.

Communicating Results

The results are shared with the graduate program faculty. Two guest lectures on the topic "Successfully Operating Business Meetings" are organized in the BSCI 7950: Graduate Seminar course. The guest speakers were senior management personnel (e.g. VP or Senior Project Manager) from the large construction firms. In addition, short videos on this topic are provided to the students for watching in their free time.

Learning Objective #4: Ability to Conduct Independent Research

Assessment Method #1: Review of Final Research Report in BSCI 7980: Capstone Project

Reported Results

The grading rubric used for assessment along with the mean scores and standard deviation is shown below:

BSCI7980: Capstone Project Grading Rubric

Learning Outcome	Students' Performance Score (Sample size: 11)					Weighted Mean Score	S.D.
	Excellent (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)		
Rationally analyze a construction problem and develop research questions and scope (LO# 4.1)	5	5	1	0	0	4.36	0.67
Produce a comprehensive literature review of the problem domain (LO# 4.3)	9	2	0	0	0	4.82	0.40
Employ systematic procedures to find out the answers of the research questions (LO# 4.2, 4.3)	7	3	1	0	0	4.55	0.69
Collect and analyze the data and report main findings (LO#4.4, 4.5, 4.7)	5	3	3	0	0	4.18	0.87
Develop conclusions based on the data analysis and propose suitable recommendations (LO# 4.4, 4.6, 4.7)	8	3	0	0	0	4.73	0.47

Interpreting Results

The overall results are very satisfactory. The evaluation matrix shows weight mean scores above 4.50 in 3 out of 5 categories while no score is below 4.0.

Communicating Results

The results are shared with the graduate program faculty. Though the descriptive statistics suggest that overall the building construction students are doing well in the capstone project, the faculty saw room for improvement in learning outcomes 1 (developing research problem) and 4 (data collection and analysis).

For learning outcome 4.1, 5 (45.5%) students were rated Excellent, 5 (45.5%) were rated Good, and 1 student (9%) was rated Fair. The faculty suggested following strategies for improvement: (1) More instructions would be given in the BSCI 7060: Research Methods in Building Science course regarding the identification and development of research problem; (2) Appropriate guest lectures from the industry professionals will be organized in the BSCI 7950: Graduate Seminar course to familiarize students with the recent construction issues and construction industry perspective. Action on these strategies is initiated from Fall 2015 semester.

For learning outcome 4.4, 5 (46%) students were rated Excellent, 3 (27%) were rated Good, and 3 students (27%) were rated Fair. One of the main reasons for low performance was identified as small time frame for data collection and analysis. The low performing students obtained their IRB approvals very late and did not devote substantial time to this task. To address this issue, the IRB approval is now a prerequisite for enrollment in the capstone course. Students would be required to apply and obtain the IRB approval in their

penultimate semester.

Assessment Method #2: Faculty Assessment of Students in Program Learning Outcome #4

Reported Results

The faculty assessment results are shown below:

Learning Outcome #4 Students graduating with a Master's degree in Building Construction will be able to independently research a problem important for the construction industry and systematically develop its solution while displaying the highest standards of ethical conduct.		Faculty Assessment 5: Strongly Agree 4: Agree 3: Neutral 2: Disagree 1: Strongly Disagree	
Sub-Learning Outcomes		Mean Score	S.D.
Upon graduation, Graduates of the Master of Building Construction program will be able to:			
4.1	Rationally analyze an on- or off-site construction problem	4.50	0.55
4.2	Apply systematic procedures to identify the major issues	4.17	0.75
4.3	Select possible solutions within or outside the organization	4.17	0.89
4.4	Develop, implement and evaluate the best solution	4.00	0.75
4.5	Validate research findings	4.17	0.52
4.6	Write a report to document the entire process for knowledge management	4.33	0.82
4.7	Apply code of ethical principles and procedures throughout the research process	4.50	0.52

Interpreting Results

The mean faculty scores of the 7 sub-learning outcomes range between 4.00 to 4.50 which indicates that the faculty in general have agreed that the students have met these sub-learning outcomes. The lowest score is given to the sub-leaning outcome #4.4 "Develop, implement and evaluate the best solution".

Communicating Results

The results are shared with the graduate program faculty. The faculty decided that more construction industry involvement and feedback in the capstone project would help students to develop the best solution to their research problem. To do so, guest lectures on potential research topics would be organized in the BSCI 7950: Graduate Seminar course. In addition, efforts would be made to find out industry mentors that can provide appropriate feedback to the students in each stage of their research. Action on these strategies is initiated from the Fall 2015 semester.

Assessment Method #3: Student's Exit Survey and Interview

Reported Results

The students' exit survey results are shown below:

Learning Outcome #4 Students graduating with a Master's degree in Building Construction will be able to independently research a problem important for the construction industry and systematically develop its solution while displaying the highest standards of ethical conduct.		Students Assessment 5: Strongly Agree 4: Agree 3: Neutral 2: Disagree 1: Strongly Disagree	
Sub-Learning Outcomes		Mean Score	S.D.
Upon graduation, Graduates of the Master of Building Construction program will be able to:			
4.1	Rationally analyze an on- or off-site construction problem	4.55	0.52
4.2	Apply systematic procedures to identify the major issues	4.70	0.65
4.3	Select possible solutions within or outside the organization	4.65	0.51

4.4	Develop, implement and evaluate the best solution	4.10	0.36
4.5	Validate research findings	4.70	0.65
4.6	Write a report to document the entire process for knowledge management	4.85	0.40
4.7	Apply code of ethical principles and procedures throughout the research process	4.90	0.52

Interpreting Results

Of the 7 sub-learning outcomes, the lowest mean response score on a 5 point scale is 4.10 for the sub-learning outcome 4.4 "Develop, implement and evaluate the best solution". It is important to note that the faculty also gave lowest scores for this sub-learning outcome. The reason for low score is identified as limited construction industry involvement in the capstone project. The students indicated that more construction industry involvement and feedback would help them to develop the best solution to their research problem.

Communicating Results

The results are shared with the graduate program faculty. To increase the construction industry involvement in the capstone project, guest lectures on potential research topics would be organized in the BSCI 7950: Graduate Seminar course. In addition, efforts would be made to find out industry mentors that can provide appropriate feedback to the students in each stage of their research. Action on these strategies is already initiated from the Fall 2015 semester.

Use of Results

Purposeful Reflection and Action Plan

The assessment results are shared with the graduate faculty in two ways:

1. Individual faculty members that typically teach a course(s) that is directly used in the assessment process.
2. Small group of faculty members that typically teach core courses of the MBC curriculum.

The weaknesses identified through the assessment process are thoroughly discussed with the faculty and action plans are developed by the Graduate Program Chair. The details of these action plans for each learning objective are already provided in the "Communicating Results" sections.

During the preparation of this assessment report, we noticed that this process should be more structured and well documented. Hence we plan to hold "Quality Improvement Meetings" in the future with full graduate faculty group to review both future assessment results as well as monitor the effectiveness of changes made in the curriculum. The first of this kind of meeting will be held in late October once this assessment review results will be available.