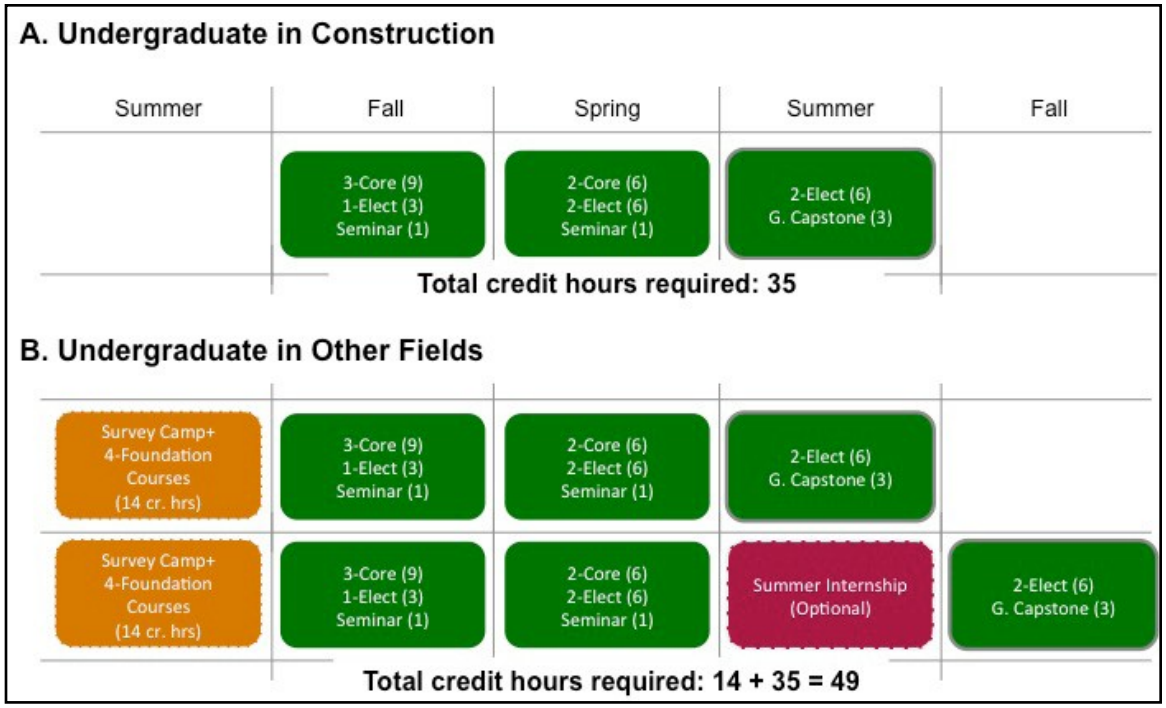
PROGRAM ASSESSMENT REPORT - 2019

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 8 – 20 in any given academic year. The enrollment data of the last five years is shown below:

Year	2015-16	2016-17	2017-18	2018-19	2019-2020
Enrollment	16	14	12	12	15

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 of foundation (i.e. levelling) 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 shown 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.

Part A: Defining Student Learning Outcomes (SLOs)

1. Specificity of Outcomes

Program Vision

The vision of the Master of Building Construction (MBC) program is to prepare 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 be able to analyze processes involved in construction project development. ***Student 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. ***Student 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	Classify 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 develop effective digital, oral, and written communication skills. ***Student 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	Establish 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. ***Student 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. Comprehensiveness of the 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 from October 2013 to April 2014. Minor revisions were made in March 2017 and May 2018 to refine the verb usage for some outcomes as suggested by the reviewers. 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 in line 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 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 is accessible to all faculty and staff members.

Students

The enrolled students are provided a copy of the program vision, learning objectives and learning outcomes document in their orientation meeting with the Graduate Program Chair. This meeting is 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 provided to the graduate students again to collect their feedback on each learning outcome.

4. Curriculum Map

Overview

The next table presents a mapped overview of student learning outcomes (SLOs) and the program curriculum. The table includes all foundation and core courses. The elective courses are excluded because students have a choice to choose a variety of electives from Building Construction or other related disciplines. Following abbreviations are used in the table.

- I: Course(s) where a particular SLO is first introduced
- M: Courses(s) where a particular SLO is mastered
- R: Courses(s) where a particular SLO is reinforced
- A: Courses(s) where a particular SLO is assessed

Courses with asterisk (*) are foundation courses which are taken by students with a non-construction undergraduate degree. These courses are offered a semester before the start of the program. The full course titles are available in Appendix A.

Learning Objective 1									
Courses	**Student Learning Outcomes (SLOs)**								
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
BSCI 6970-001:Estimating*	I			I		I			
BSCI 6970-003:Surveying*									
BSCI 7100-002:Structures*									
BSCI 7100-003:Info Tech*									
BSCI 7100-004:PM/Scheduling*	I			I	I	I			I
BSCI 7020:Intg Bldg Process-I	MA	IMA	IMA	MA	MA	MA	IMA	IMA	IMA
BSCI 7030:Construction IT									
BSCI 7040:Intg Bldg Process-II	R	R	R	R	R	R	R	R	R
BSCI 7050:Executive Issues	R	R	R	R	R	R	R	R	R
BSCI 7060:Research Methods									
BSCI 7950:Graduate Seminar						R	R	R	
BSCI 7980:Graduate Capstone									

Learning Objective 2														
Courses	**Student Learning Outcomes (SLOs)**													
	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	2.11	2.12	2.13	2.14
BSCI 6970-001:Estimating*			I	I	I				I				I	
BSCI 6970-003:Surveying*														
BSCI 7100-002:Structures*								IM						
BSCI 7100-003:Info Tech*														

BSCI 7100-004:PM/Scheduling*	I		I						I	I	I	I		I
BSCI 7020:Intg Bldg Process-I												I		I
BSCI 7030:Construction IT						I								
BSCI 7040:Intg Bldg Process-II	MA	IMA	MA	MA	MA	MA	IMA	RA	MA	MA	MA	MA	MA	MA
BSCI 7050:Executive Issues		R	R	R	R	R	R		R	R	R	R	R	R
BSCI 7060: Research Methods														
BSCI 7950: Graduate Seminar							R	R	R				R	R
BSCI 7980: Graduate Capstone														

Learning Objective 3

Courses	**Student Learning Outcomes (SLOs)**						
	3.1	3.2	3.3	3.4	3.5	3.6	3.7
BSCI 6970-001:Estimating*							
BSCI 6970-003:Surveying*	I						
BSCI 7100-002:Structures*							
BSCI 7100-003:Info Tech*	I	I					
BSCI 7100-004:PM/Scheduling*							
BSCI 7020:Intg Bldg Process-I	R	R	I	I	I	I	I
BSCI 7030:Construction IT	M	M	M	M		R	
BSCI 7040:Intg Bldg Process-II	M	R	R	R	R	R	M
BSCI 7050:Executive Issues	R	R	R	R	M	M	R
BSCI 7060:Research Methods	R	R					M
BSCI 7950:Graduate Seminar	R	R			R	R	R
BSCI 7980:Graduate Capstone	RA	RA	RA	RA	RA	RA	RA

Learning Objective 4

Courses	**Student Learning Outcomes (SLOs)**						
	4.1	4.2	4.3	4.4	4.5	4.6	4.7
BSCI 6970-001:Estimating*							
BSCI 6970-003:Surveying*							
BSCI 7100-002:Structures*							
BSCI 7100-003:Info Tech*							
BSCI 7100-004:PM/Scheduling*							
BSCI 7020:Intg Bldg Process-I	I	I	I	I	I	I	I
BSCI 7030:Construction IT		I					
BSCI 7040:Intg Bldg Process-II	I	R	I	I	I	R	I
BSCI 7050:Executive Issues	M	M	M	M	M	M	M
BSCI 7060:Research Methods	M	M	M	R	R	R	R
BSCI 7950:Graduate Seminar						R	R

BSCI 7980:Graduate Capstone	RA	RA	RA	RA	RA	RA	RA

Part B: Methodology

5. Outcome-Measure Alignment for SLOs Assessment

The following table depicts the alignment between Student Learning Outcomes (SLOs) and required measures (i.e courses/experiences) used for assessment.

Learning Objective	Learning Outcomes	Course/Experience for Assessment	Description
#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 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 of the project is based on both group and individual performance. The SLOs assessment is conducted by the course instructor for individual students.
#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 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 Experience: Written Report and Presentation	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 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	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

		Research Report	(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.

6. & 7. <u>Measures (Direct or Indirect) and Data Collection Process</u>

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 # (SLOs #)	**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. Evaluations range is as follows: Excellent (5), Good (4), Fair (3), Poor (2), and Very Poor (1). <u>Performance measurement criteria</u>: At least 70% of the students will receive "Good" or better evaluation (4.00 or higher) and mean evaluation score for each SLO shall be 3.50 or above. Any SLO evaluation that falls below this threshold for two consecutive years will be reviewed by the graduate faculty.
	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 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 learning outcome. <u>Performance measurement criteria</u>: Mean evaluation score for each learning outcome shall be 3.5 or above. Any learning outcome evaluation that falls below this threshold for two consecutive years will be reviewed by the graduate faculty.
	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 requirements. In addition, the graduate program chair meet with the graduating students in small groups to get their feedback and suggestions for improvement. Performance measurement criteria: Mean evaluation score for each learning outcome should be 3.5 or above. Any learning outcome evaluation that falls below this threshold for two consecutive years will be reviewed by the graduate faculty.
#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. Performance measurement criteria: Same as LO#1 (direct assessment).
	Faculty Assessment of Students	Indirect	The faculty members are asked to fill out a survey to determine if the student has met the 14 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 learning outcome. Performance measurement criteria: Same as LO#1 (indirect assessment #1).
	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 #2. In addition, the graduate program chair meets with graduating students in small groups to get their feedback and suggestions for improvement. Performance measurement criteria: Same as LO#1 (indirect assessment #2).
#3 (3.1 – 3.7)	Review of Capstone	Direct	BSCI 7980: Capstone Project is a required course

	Report and Presentation for BSCI 7980: Capstone Project		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. Performance measurement criteria: Same as LO#1 (direct assessment).
	Faculty Assessment of Students	Indirect	The faculty members are asked to fill out a survey to determine if the student has met the 7 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 learning outcome. Performance measurement criteria: Same as LO#1 (indirect assessment #1).
	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 #3. In addition, the graduate program chair meets with graduating students in small groups to get their feedback and suggestions for improvement. Performance measurement criteria: Same as LO#1 (indirect assessment #2).
#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. Performance measurement criteria: Same as LO#1 (direct assessment).
	Faculty Assessment of Students	Indirect	The faculty members are asked to fill out a survey to determine if the student has met the 7 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 learning outcome. Performance measurement criteria: Same as LO#1 (indirect assessment #1).
	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 #4. In addition, the graduate program chair meets with graduating students in small groups to get their feedback and suggestions for improvement. Performance measurement criteria: Same as LO#1 (indirect assessment #2).

Part C: Results

The most recent data was collected and analyzed from Fall 2017 to Summer 2018 (2017-18 Cohort). In a cohort of 12, 11 students graduated in the summer 2018 semester and data is reported for these graduating students only. The data from last two years assessment reports (2016-17 and 2015-16 Cohorts) is also presented for comparison purposes.

The interpretation of the behavior anchors that are used in the evaluation rubrics of all SLOs is follows:

Behavior Anchor	Score	Description

Excellent	5	Demonstrates a thorough understanding of context and purpose of the assigned task and focuses on all elements of the work. Al required information included and well organized.
Good	4	Demonstrates a good understanding of context and purpose of the assigned task and focuses on all elements of the work. Minor errors and omissions.
Fair	3	Demonstrates an adequate understanding of context and purpose of the assigned task and focuses on all elements of the work. A few major errors and omissions.
Poor	2	Demonstrates some understanding of context and purpose of the assigned task and focuses on all elements of the work. Several major errors and omissions.
Very Poor	1	Demonstrates minimal understanding of context and purpose of the assigned task and focuses on all elements of the work. Little required information addressed.

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

Assessment Method #1 (Direct): Review of Project Development Portfolio

Reported Results

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

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.
	Cohort	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 (SLO# 1.1,1.2, 1.3)	**2017-18** (Size: 11)	**11**	**0**	**0**	**0**	**0**	**5.00**[1]	**0.00**
	2016-17 (Size: 11)	4	4	3	0	0	4.10	0.83
	2015-16 (Size: 15)	9	6	0	0	0	4.60	0.51
Student identifies methods of project funding, equity, and capital and their impact on construction (SLO# 1.4)	**2017-18**	**1**	**10**	**0**	**0**	**0**	**4.09**	**0.289**
	2016-17	0	11	0	0	0	4.00	0.00
	2015-16	10	5	0	0	0	4.67	0.49
Student prepares final pro forma, including reefined and detailed construction costs, operating costs and income (SLO# 1.6, 1.7)	**2017-18**	**0**	**11**	**0**	**0**	**0**	**4.00**	**0.00**
	2016-17	4	7	0	0	0	4.36	0.51
	2015-16	10	5	0	0	0	4.67	0.49
Student is able to evaluate project risks and creates a risk management plan (SLO# 1.8)	**2017-18**	**4**	**7**	**0**	**0**	**0**	**4.36**	**0.492**
	2016-17	2	7	2	0	0	4.00	0.63
	2015-16	13	2	0	0	0	4.87	0.35

Student developed a conceptual construction cost estimate sufficient to complete a project, including design costs (SLO# 1.5, 1.7)	**2017-18**	**0**	**11**	**0**	**0**	**0**	**4.00**	**0.00**
	2016-17	7	3	1	0	0	4.54	0.69
	2015-16	11	4	0	0	0	4.73	0.46
Student prepares and presents a workable project development plan to the owner (SLO# 1.9)	**2017-18**	**4**	**7**	**0**	**0**	**0**	**4.36**	**0.492**
	2016-17	8	0	0	3	0	4.18	1.21
	2015-16	11	4	0	0	0	4.73	0.46

[1] Text and numbers in **Bold** represents the current year data (i.e. 2017-18)

Interpreting Results

Current Cohort (2017-18)

Overall, the results are very satisfactory and exceeds the minimum performance criteria outlined in the previous section. On a scale of 1 to 5 (with 1 represents very poor performance and 5 represents excellent performance) the weighted mean scores range from 4.00 to 5.00 which are above the threshold value of 3.50. For all SLOs, 70% or more students received a score of 4.00 or higher. This indicates that the students performed well in all SLOs and there is no particular area of concern.

Comparison with the Last Two Years Data (2017-18 v. 2016-17 and 2015-16)

On average, the mean scores of the three SLOs are slightly dropped. These SLOs are 1.5: Develop the project execution plan, 1.6: Evaluate project delivery options, and 1.7: Produce constructability reviews and value studies. The SLOs 1.4 and 1.8 that received the lowest scores last year show moderate improvement.

Communicating Results

The results are shared with the graduate program faculty group that teaches courses related to SLOs 1.1-1.9. A discussion with the course instructor (BSCI 7020) revealed that the main reason for the SLOs 1.5-1.7 mean score drop is non-inclusion of a key task by all students in the final project report. It was merely a result of misinterpretation of project deliverables by all students and will be fixed next year by inclusion of clearer project submission guidelines. Since mean scores of SLOs 1.4 and 1.8 show some improvement, the course instructors will continue to improve course contents by adding latest key information, more case studies and practical examples. No major change in the curriculum/course contents is recommended in the 2019 Quality Improvement meeting held on May 3.

Assessment Method #2 (In-direct): 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 be able to analyze processes involved in construction project development.		Faculty Assessment 5: Strongly Agree 4: Agree 3: Neutral 2: Disagree 1: Strongly Disagree					
Student Learning Outcomes		2015-16 (15)		2016-17 (11)		**2017-18 (11)**	
Upon graduation, Graduates of the Master of Building Construction program will be able to:		Mean	S.D.	Mean	S.D.	**Mean**	**S.D.**
1.1	Analyze the roles of stakeholders in a construction	4.17	0.67	3.96	0.71	**4.30[1]**	**0.65**

	project						
1.2	Develop organization strategy and strategic management plan	4.49	0.53	4.27	0.56	**4.62**	**0.51**
1.3	Apply a basic project portfolio management system	4.17	0.67	3.96	0.71	**4.30**	**0.65**
1.4	Define project scope and financing alternatives	4.65	0.44	4.42	0.47	**4.51**	**0.43**
1.5	Develop the project execution plan	4.05	0.69	3.97	0.73	**4.17**	**0.67**
1.6	Evaluate project delivery options	4.49	0.53	4.27	0.56	**4.62**	**0.51**
1.7	Produce constructability reviews and value studies	4.17	0.67	4.13	0.71	**4.30**	**0.65**
1.8	Evaluate project risks and create a risk management plan	4.65	0.44	4.28	0.47	**4.60**	**0.43**
1.9	Create plans to manage human resources, equipment and materials at jobsites	4.05	0.69	3.85	0.73	**4.17**	**0.67**

[1] Text and numbers in **Bold** represents the current year data (i.e. 2017-18)

Interpreting Results

The mean faculty scores of all 9 SLOs range from 4.17 to 4.62 which indicates that the faculty in general have agreed that the students have met these learning outcomes. All scores are higher than the threshold score of 3.50. Most of the mean scores are higher as compared to the last two years' data including SLOs 1.5-1.7 where direct assessment results showed a slight dip. As discussed earlier, this dip was due to misinterpretation of project deliverables by all students and not related to their knowledge gain and/or retention.

Communicating Results

The results are shared with the graduate program faculty group that teaches courses related to SLOs 1.1-1.9. The faculty assessment results are mostly in agreement with the direct assessment results. As mentioned in the previous section, no major improvements in the course contents are planned for the next year but direct and indirect scores will be closely monitored and if any downward trend is noticed then a detailed discussion will be made in the quality improvement meeting.

Assessment Method #3 (Indirect): 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 be able to analyze processes involved in construction project development.		Students Assessment 5: Strongly Agree 4: Agree 3: Neutral 2: Disagree 1: Strongly Disagree					
Student Learning Outcomes		2015-16 (15)		2016-17 (11)		**2017-18**	
Upon graduation, Graduates of the Master of Building Construction program will be able to:		Mean	S.D.	Mean	S.D.	**Mean**	**S.D.**
1.1	Analyze the roles of stakeholders in a construction project	4.60	0.53	4.23	0.56	**4.44**[1]	**0.53**
1.2	Develop organization strategy and strategic management plan	4.46	0.42	4.73	0.39	**4.96**	**0.37**
1.3	Apply a basic project portfolio management system	4.08	0.54	3.75	0.57	**4.32**	**0.54**
1.4	Define project scope and financing alternatives	4.60	0.36	4.14	0.38	**4.35**	**0.36**
1.5	Develop the project execution plan	4.31	0.43	4.57	0.40	**4.80**	**0.38**
1.6	Evaluate project delivery options	3.96	0.73	4.20	0.64	**4.41**	**0.60**
1.7	Produce constructability reviews and value studies	4.31	0.43	4.22	0.48	**4.43**	**0.46**
1.8	Evaluate project risks and create a risk management plan	4.05	0.52	3.73	0.59	**4.28**	**0.56**
1.9	Create plans to manage human resources, equipment and materials at jobsites	3.96	0.73	3.84	0.77	**4.04**	**0.73**

[1] Text and numbers in **Bold** represents the current year data (i.e. 2017-18)

Interpreting Results

Of the 9 SLOs, the mean scores range from 4.04 to 4.96 which are above the threshold score of 3.50. Most of the mean scores are higher than the mean scores of the last two years, which is in line with the direct and indirect measure results of this year. No significant drop in the mean score of any SLO is recorded which indicates that the suggested course improvements in the last three assessment cycles worked very well.

Communicating Results

The results are shared with the graduate program faculty group that teaches courses related with SLOs 1.1-1.9. The students' assessment results are mostly in agreement (or show improvement) with the assessment methods #1 and #2 results. No major improvements in the course contents is planned in the next year but all SLOs direct and indirect mean scores will be closely monitored. In addition, standard templates will be provided for final project submission so that the students do not miss out any important information in their submissions.

Learning Objective #2: Mastery of Construction Project Management Skills

Assessment Method #1 (Direct): Review of Project Management Portfolio

Reported Results

The grading rubric used for assessment along with weighted 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.
	Cohort	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)	**2017-18** (Size: 11)	**6**	**4**	**1**	**0**	**0**	**4.46**[1]	**0.69**
	2016-17 (size: 11)	9	2	0	0	0	4.82	0.33
	2015-16 (size: 15)	5	10	0	0	0	4.33	0.49
Student is able to develop a project organization chart and accurately defines the role and scope of the project team members (LO# 2.2)	**2017-18**	**7**	**4**	**0**	**0**	**0**	**4.64**	**0.51**
	2016-17	11	0	0	0	0	5.00	0.00
	2015-16	6	9	0	0	0	4.40	0.51
Student prepares a realistic project schedule and assigns appropriate resources to different tasks (LO #2.2, 2.3, 2.10)	**2017-18**	**4**	**7**	**0**	**0**	**0**	**4.36**	**0.51**
	2016-17	3	5	3	0	0	4.00	0.78
	2015-16	5	10	0	0	0	4.33	0.49
Student develops site utilization, safety and quality management plans for the project (LO# 2.6, 2.8)	**2017-18**	**9**	**2**	**0**	**0**	**0**	**4.82**	**0.41**
	2016-17	2	3	5	1	0	3.55[2]	0.87
	2015-16	5	10	0	0	0	4.33	0.49
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)	**2017-18**	**4**	**4**	**3**	**0**	**0**	**4.09**	**0.87**
	2016-17	4	4	3	0	0	4.09	0.87
	2015-16	4	10	1	0	0	4.20	0.46
Student is able to complete project close-out activities and prepares an executive summary (LO# 2.2, 2.13, 2.14)	**2017-18**	**4**	**7**	**0**	**0**	**0**	**4.36**	**0.51**
	2016-17	7	4	0	0	0	4.64	0.51
	2015-16	5	9	1	0	0	4.27	0.59

[1] Text and numbers in **Bold** represents the current year data (2017-18); [2] Numbers in Red text indicate the SLO mean score below or close to 3.50.

Interpreting Results

Current Cohort (2017-18)

The results as a whole are very satisfactory and exceeds the minimum performance criteria. On a scale of 1 to 5 (with 1 represents very poor performance and 5 represents excellent performance) the weighted mean scores range from 4.09 to 4.82. The lowest mean score of 4.09 is associated with the SLOs 2.2, 2.3, 2.11 and 2.12. However, for all SLOs, 70% or more students received a score of 4.00 or higher which is well above the threshold score of 3.50.

Comparison with Last Two Years Data (2017-18 v. 2016-17 and 2015-16)

A mixed trend is observed in the mean scores comparison with the last two years. The mean scores of some areas are increased and some are decreased however on average this increase/decrease in mean scores is within ±0.25 points and hence can be considered as normal. The mean score of SLOs 2.6 and 2.8 is increased from 3.55 (2016-17) to 4.82 (2017-18) which is very satisfactory and clearly indicates that the improvements suggested last year and implemented during this year worked very well. No improvement in the SLOs 2.2,2.3,2.11 and 2.12 score are recorded.

Communicating Results

The results are shared with the graduate program faculty group that teaches courses related with SLOs 2.1-2.14. In addition, the results were also discussed during the Quality Improvement meeting held in Spring 2019. Although there is no specific area of concern, the following action plan is developed for continuous improvement: (1) Coverage of "cash flow analysis" will be further increased in the course since the SLO associated with this topic did not show any improvement as compared to the last year; (2) Additional industry examples related to cash flow examples will be provided to the students via guest lectures.

Assessment Method #2 (Indirect): 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.		Faculty Assessment 5: Strongly Agree 4: Agree 3: Neutral 2: Disagree 1: Strongly Disagree					
Student Learning Outcomes		2015-16 (15)		2016-17 (11)		**2017-18 (11)**	
Upon graduation, Graduates of the Master of Building Construction program will be able to:		Mean	S.D.	Mean	S.D.	**Mean**	**S.D.**
2.1	Establish project priorities and create a Work Breakdown structure	3.97	0.67	4.02	0.75	**4.30**	**0.67**
2.2	Identify construction best practices and apply them to the project	4.49	0.53	4.54	0.51	**4.86**	**0.82**
2.3	Produce project cost, schedule and resource allocation plans	4.09	0.59	4.13	0.82	**4.42**	**0.74**
2.4	Prepare project bid and detailed construction documents	4.31	0.46	4.34	0.84	**4.64**	**0.76**
2.5	Analyze subcontractor bid scope statement	3.54	0.81	3.64[2]	0.94	**4.15**	**0.94**
2.6	Assess the jobsite safety program	3.97	0.67	3.70	0.86	**4.39**	**0.77**
2.7	Organize Green Building activities	3.97	0.67	3.97	0.71	**3.69**	**0.64**
2.8	Analyze buildings for their compliance with structural requirements (i.e. strength, stiffness, stability)	4.09	0.61	4.05	0.93	**4.34**	**0.84**
2.9	Analyze building systems and equipment	4.09	0.59	3.94	0.80	**4.22**	**0.72**
2.10	Understand direct-hire construction craft worker issues (i.e. hiring, training, promoting and retaining workers)	4.21	0.41	4.16	0.86	**4.33**	**0.77**
2.11	Analyze labor reports, schedule acceleration and resource leveling	4.09	0.59	3.98	0.88	**4.06**	**0.79**
2.12	Develop procedures to measure project progress and performance	4.49	0.32	4.62	0.68	**4.94**	**0.47**
2.13	Evaluate project submittal documents	4.09	0.61	4.33	0.70	**4.63**	**0.63**
2.14	Analyze financial, legal and contractual issues	3.97	0.67	4.07	0.82	**4.35**	**0.74**

[1] Text and numbers in **Bold** represents the current year data (i.e. 2017-18)

[2] Numbers in Red text indicate the sub-SLO score below or close to threshold score of 3.50.

Interpreting Results

The mean faculty scores of the 14 learning outcomes range from 3.69 to 4.94 which indicates that the faculty in general agreed that the students have met these learning outcomes. Most of these scores are moderately improved from last year except the SLO 2.7 which received the lowest score in the last three years. This reduction in mean score is consistent with the direct assessment results of this SLO. In the past years, students took a graduate elective on Green Buildings along with the BSCI 7040 course that provides them fundamental knowledge about the Green Buildings. This year that elective course was not offered and coverage of this topic in other courses was minimal. The SLO #2.5 “"Analyze subcontractor bid scope statement" which received the lowest score in the last two years now show reasonable improvement.

Communicating Results

The results are shared with the graduate program faculty group that teaches courses related to SLOs 2.1-2.14. The following improvement plan is developed: (1) An elective on Green Buildings will be offered in the Spring 2020 semester. If that elective could not be offered due to non-availability of the qualified faculty then the fundamental topics will be included in the graduate seminar class. Industry speakers will be invited to deliver

related lectures; (2) The coverage of the topic, "Subcontractor bid scope statement" in the BSCI 7040: Integrated Building Process-II course will be further expanded. Guest lectures on this topic from construction industry professionals will also be arranged in the BSCI 7950: Graduate Seminar class.

Assessment Method #3 (In-direct): 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.		Students Assessment 5: Strongly Agree 4: Agree 3: Neutral 2: Disagree 1: Strongly Disagree					
Student Learning Outcomes		2015-16 (15)		2016-17 (11)		**2017-18 (11)**	
Upon graduation, Graduates of the Master of Building Construction program will be able to:		Mean	S.D.	Mean	S.D.	**Mean**	**S.D.**
2.1	Establish project priorities and create a Work Breakdown structure	4.15	0.74	4.28	0.82	**4.49**[1]	**0.75**
2.2	Identify construction best practices and apply them to the project	4.10	0.79	4.25	1.02	**4.47**	**0.94**
2.3	Produce project cost, schedule and resource allocation plans	4.32	0.65	4.42	0.90	**4.64**	**0.83**
2.4	Prepare project bid and detailed construction documents	3.91	0.81	4.05	1.14	**4.25**	**1.05**
2.5	Analyze subcontractor bid scope statement	3.71	0.86	3.79[2]	1.12	**4.05**	**1.03**
2.6	Assess the jobsite safety program	4.15	0.73	3.98	0.91	**4.49**	**0.84**
2.7	Organize Green Building activities	4.15	0.73	4.23	0.78	**3.80**[2]	**0.71**
2.8	Analyze buildings for their compliance with structural requirements (i.e. strength, stiffness, stability)	3.91	0.81	3.89	0.98	**3.97**	**0.90**
2.9	Analyze building systems and equipment	3.80	0.84	3.89	0.96	**4.08**	**0.88**
2.10	Understand direct-hire construction craft worker issues (i.e. hiring, training, promoting and retaining workers)	4.10	0.79	4.15	1.07	**4.35**	**0.99**
2.11	Analyze labor reports, schedule acceleration and resource leveling	4.10	0.79	4.15	1.03	**4.35**	**0.95**
2.12	Develop procedures to measure project progress and performance	4.00	0.95	4.25	0.98	**4.47**	**0.90**
2.13	Evaluate project submittal documents	4.15	0.74	4.28	0.75	**4.49**	**0.69**
2.14	Analyze financial, legal and contractual issues	4.32	0.65	4.42	0.86	**4.64**	**0.79**

[1] Text and numbers in **Bold** represents the current year data (i.e. 2016-17)

[2] Numbers in Red text indicate the sub-SLO score below or close to threshold score of 3.50.

Interpreting Results

Of the 14 learning outcomes evaluated in 2017-18, the mean scores range from 3.80 to 4.64. In line with the faculty evaluation, the students also gave minimum scores to the following learning outcome, "2.7: Organize Green Building Activities". A comparison from last year indicates that all mean scores are slightly-to-moderately increased except the mean scores for learning outcome 2.7 which is lower this year.

Communicating Results

The results are shared with the graduate program faculty group that teaches courses related to SLOs 2.1-2.14. As mentioned in the previous section, the elective on "Green Buildings" will be re-offered in the Spring semester. If that plan does not work due to non-availability of qualified faculty then two to three guest lectures on this topic will be arranged in the BSCI 7950: Graduate Seminar class.

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

Assessment Method #1 (Direct): Review of Capstone Report and Presentation

Reported Results

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

A. BSCI7980: Capstone Project - Grading Rubric for Capstone Report

Goal/Expectations	Students' Performance (Sample size = 11)							
	Grade and number of students earned it						Weighted Mean Score	S.D.
	Cohort	Excellent (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)		
Student is able to organize information clearly and logically in and within chapters (LO# 3.1, 3.3, 3.4, 3.5, 3.7)	**2017-18** (Size: 11)	**8**	**3**	**0**	**0**	**0**	**4.73[1]**	**0.44**
	2016-17 (size: 11)	6	4	1	0	0	4.46	0.69
	2015-16 (size: 15)	11	4	1	0	0	4.63	0.62
Student is able to maintain coherence and scholarly tone throughout the capstone report (LO# 3.1, 3.3)	**2017-18**	**8**	**3**	**0**	**0**	**0**	**4.73**	**0.44**
	2016-17	8	0	3	0	0	4.46	0.93
	2015-16	10	5	1	0	0	4.56	0.63
Student employs a writing style that is clear, consistent, and readable (LO# 3.1)	**2017-18**	**7**	**3**	**1**	**0**	**0**	**4.55**	**0.65**
	2016-17	6	3	1	1	0	4.27	1.01
	2015-16	9	4	2	0	0	4.47	0.73
Student strictly follows the capstone report writing guidelines (LO# 3.1)	**2017-18**	**11**	**0**	**0**	**0**	**0**	**5.00**	**0.00**
	2016-17	10	1	0	0	0	4.91	0.28
	2015-16	7	7	1	0	0	4.40	0.62
Student is able to use correct syntax and grammar (LO 3.1)	**2017-18**	**7**	**4**	**0**	**0**	**0**	**4.64**	**0.48**
	2016-17	7	3	1	0	0	4.55	0.67
	2015-16	5	7	3	0	0	4.13	0.72

B. BSCI7980: Capstone Project - Grading Rubric for Capstone Presentation

Goal/Expectations	Students' Performance (Sample size = 11)							
	Grade and number of students earned it						Weighted Mean Score	S.D.
	Cohort	Excellent (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)		
Student is able to organize information clearly and logically throughout the presentation (LO# 3.1, 3.6, 3.7)	**2017-18 (Size: 11)**	**8**	**3**	**0**	**0**	**0**	**4.73[1]**	**0.40**
	2016-17 (size: 11)	8	2	1	0	0	4.63[1]	0.67
	2015-16 (size: 15)	12	3	0	0	0	4.80	0.41
Student presents technically sound and scientifically correct information (LO 3.1, 3.6)	**2017-18**	**9**	**2**	**0**	**0**	**0**	**4.82**	**0.43**
	2016-17	8	3	0	0	0	4.73	0.47
	2015-16	5	8	2	0	0	4.20	0.70
Student demonstrates best usage of the multimedia resources for the presentation (LO# 3.1, 3.2)	**2017-18**	**10**	**1**	**0**	**0**	**0**	**4.91**	**0.28**
	2016-17	9	1	1	0	0	4.73	0.65
	2015-16	9	5	1	0	0	4.53	0.64
Student manages the presentation time effectively (LO# 3.1)	**2017-18**	**10**	**1**	**0**	**0**	**0**	**4.91**	**0.28**
	2016-17	10	1	0	0	0	4.91	0.30
	2015-16	11	4	0	0	0	4.73	0.46
Student is able to satisfactorily answer the questions of the audience (LO# 3.1)	**2017-18**	**9**	**2**	**0**	**0**	**0**	**4.82**	**0.38**
	2016-17	7	3	0	1	0	4.45	0.29
	2015-16	10	4	1	0	0	4.60	0.63

[1] Text and numbers in **Bold** represents the current year data (i.e. 2017-18)

Interpreting Results

For the written research report, the overall results are very satisfactory and well above the threshold score of 3.50. More than 90% students earned a score of 4.00 or higher in all goals. The weighted mean scores of 2017-18 are also highest when compared to the last two years. The least score is received by the technical writing category which indicates that students may need little more help in technical writing. For the oral presentations, the overall results are excellent and well above the threshold score of 3.50. More than 90% students earned a score of 4.00 or higher in all goals. The mean scores of all goals are higher than the last two years.

Communicating Results

The results are shared with the graduate program faculty who have supervised capstones in the last three years. A quality improvement meeting was held on May 3, 2019 to review and discuss the results and develop a plan for improvement, if needed. In 2017, the graduate program committee recommended mandatory summer

residency for graduate students that plan to complete the capstone in the same semester. It was determined that this decision proved to be fruitful and resulted in better faculty-student interaction throughout the semester. The faculty decided to continue this practice. Lectures on improving written communication skills that were added in the BSCI 7950: Graduate Seminar class proved to be very beneficial. In addition to the in-house measures, students will be continuously encouraged to regularly consult the Office of University Writing to improve their technical writing and presentation skills.

Assessment Method #2 (In-direct): 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 develop effective digital, oral, and written communication skills.		Faculty Assessment 5: Strongly Agree 4: Agree 3: Neutral 2: Disagree 1: Strongly Disagree					
Student Learning Outcomes		2015-16 (15)		2016-17 (11)		**2017-18 (11)**	
Upon graduation, Graduates of the Master of Building Construction program will be able to:		Mean	S.D.	Mean	S.D.	**Mean**	**S.D.**
3.1	Apply written, oral and visual means to communicate effectively in diverse settings	4.32	0.64	4.72	0.67	**4.81**[1]	**0.65**
3.2	Employ technology as an effective communication, visualization and management tool	4.51	0.73	4.82	0.52	**4.91**	**0.56**
3.3	Formulate resolutions to difficult issues creatively by employing multiple systems and tools	4.61	0.53	4.87	0.63	**4.96**	**0.51**
3.4	Solve conflicts by personal communication	4.05	0.82	4.18	0.67	**4.36**	**0.74**
3.5	Demonstrate the ability to negotiate construction issues	4.12	0.74	4.61	0.71	**4.70**	**0.69**
3.6	Operate effectively in business meetings	4.67	0.69	4.93	0.31	**4.94**	**0.68**
3.7	Prepare project proposals and technical reports	4.32	0.35	4.46	0.56	**4.54**	**0.65**

[1] Text and numbers in **Bold** represents the current year data (i.e. 2017-18)

Interpreting Results

The mean faculty scores of the 7 learning outcomes range from 4.36 to 4.94 which indicates that the faculty in general agreed that the students have met these learning outcomes. A comparison with the last two years' mean scores shows a continuous improvement. The lowest score is given to the SLO #3.4 "Solve conflicts by personal communication". The same SLO received the lowest scores in the last two years. This year's score for this SLO is higher than the last two years' scores but still lowest among all learning outcomes scores.

Communicating Results

The results are shared with the graduate program faculty individually and in the quality improvement meeting. The survey findings indicate that the SLO 3.4 "Solve conflicts by personal communication" is still an area of concern. Since some improvement is recorded this year so the faculty decided to continue the last year's strategies, i.e. to cover this topic in depth in the following courses, BSCI 7050: Executive Issues in Construction, and BSCI 7100: Construction Law. In addition, guest lectures by industry professionals will continue to be offered 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 develop effective digital, oral, and written communication skills.		Students Assessment 5: Strongly Agree 4: Agree 3: Neutral 2: Disagree 1: Strongly Disagree					
Student Learning Outcomes		2015-16 (15)		2016-17 (11)		**2017-18 (11)**	
Upon graduation, Graduates of the Master of Building Construction program will be able to:		Mean	S.D.	Mean	S.D.	**Mean**	**S.D.**
3.1	Apply written, oral and visual means to communicate effectively in diverse settings	4.21	0.63	4.51	0.56	**4.60**	**0.54**
3.2	Employ technology as an effective communication, visualization and management tool	4.65	0.52	4.80	0.61	**4.90**	**0.59**
3.3	Formulate resolutions to difficult issues creatively by employing multiple systems and tools	4.32	0.82	4.45	0.78	**4.52**	**0.76**
3.4	Solve conflicts by personal communication	4.17	0.63	4.55	0.57	**4.64**	**0.56**
3.5	Demonstrate the ability to negotiate construction issues	4.05	0.87	4.29	0.81	**4.38**	**0.78**
3.6	Operate effectively in business meetings	4.05	0.87	4.29	0.81	**4.42**	**0.74**
3.7	Prepare project proposals and technical reports	4.75	0.76	4.90	0.72	**4.94**	**0.70**

[1] Text and numbers in **Bold** represents the current year data (i.e. 2017-18)

Interpreting Results

Of the 7 learning outcomes, the mean scores for 2017-18 range from 4.38 to 4.94 which indicates that most students have agreed that these learning outcomes have been successfully met. All mean scores are moderately higher than the last two years' scores. The learning outcomes 3.5 and 3.6 received the lowest scores in all years. This suggests that more work is needed to improve students learning in these two learning outcomes.

Communicating Results

The results are shared with the graduate program faculty group. Last year, two guest lectures on the topic "Successfully Operating Business Meetings" were organized in the BSCI 7950: Graduate Seminar course. It was decided to keep these lectures in the course and further strengthen them by providing additional reading and video material to the students.

Learning Objective #4: Ability to Conduct Independent Research

Assessment Method #1 (Direct): Review of Final Research Report for 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

Goal/Expectations	Students' Performance (Sample size = 11)							
	Grade and number of students earned it						Weighted Mean Score	S.D.
	Cohort	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)	**2017-18 (Size: 11)**	**8**	**3**	**0**	**0**	**0**	**4.73[1]**	**0.44**
	2016-17 (size: 11)	6	4	1	0	0	4.45[1]	0.69
	2015-16 (size: 15)	6	8	1	0	0	4.33	0.62
Produce a comprehensive literature review of the problem domain (LO# 4.3)	**2017-18**	**10**	**1**	**0**	**0**	**0**	**4.91**	**0.27**
	2016-17	8	2	1	0	0	4.63	0.67
	2015-16	4	10	1	0	0	4.20	0.56
Employ systematic procedures to find out the answers of the research questions (LO# 4.2, 4.3)	**2017-18**	**9**	**1**	**1**	**0**	**0**	**4.73**	**0.60**
	2016-17	7	3	1	0	0	4.54	0.69
	2015-16	8	6	1	0	0	4.47	0.64
Collect and analyze the data and report main findings (LO# 4.4, 4.5, 4.7)	**2017-18**	**8**	**2**	**1**	**0**	**0**	**4.64**	**0.63**
	2016-17	5	4	2	0	0	4.27	0.79
	2015-16	10	4	1	0	0	4.60	0.63
Develop conclusions based on the data analysis and propose suitable recommendations (LO# 4.4, 4.6, 4.7)	**2017-18**	8	**2**	**1**	**0**	**0**	**4.64**	**0.63**
	2016-17	8	3	0	0	0	4.73	0.48
	2015-16	10	4	1	0	0	4.60	0.63

[1] Text and numbers in **Bold** represents the current year data (i.e. 2017-18)

Interpreting Results

The overall results are extremely satisfactory. The evaluation matrix shows the weighted mean scores above 4.00 in all categories which are well above the threshold score of 3.50. A comparison with the last two years' data show that all mean scores are either improved or in close proximity (±0.10). The mean score for the following goal "Collect and analyze the data and report main findings" which was lowest last year is increased

by half mean point and now highest as compared to the last two years.

Communicating Results

The results are shared with the graduate program faculty group who have supervised capstones in the last three years. The group noted that the mean score of the following goal "Collect and analyze the data and report main findings (SLO #4.4, 4.5, 4.7)"is significantly improved. This indicates that the strategies recommended last year worked very well. The group decided to keep implementing these strategies (i.e. earlier literature review submission and IRB approval) in the coming years.

Assessment Method #2 (In-direct): 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					
Student Learning Outcomes		2015-16 (15)		2016-17 (11)		**2017-18 (11)**	
Upon graduation, Graduates of the Master of Building Construction program will be able to:		Mean	S.D.	Mean	S.D.	**Mean**	**S.D.**
4.1	Rationally analyze an on- or off-site construction problem	4.32	0.61	4.50	0.55	**4.59**[1]	**0.53**
4.2	Apply systematic procedures to identify the major issues	4.37	0.63	4.36	0.65	**4.41**	**0.63**
4.3	Select possible solutions within or outside the organization	4.11	0.91	4.22	0.85	**4.31**	**0.83**
4.4	Develop, implement and evaluate the best solution	4.11	0.89	4.14	0.77	**4.22**	**0.75**
4.5	Validate research findings	4.32	0.84	4.33	0.65	**4.41**	**0.63**
4.6	Write a report to document the entire process for knowledge management	4.47	0.74	4.49	0.73	**4.53**	**0.64**
4.7	Apply code of ethical principles and procedures throughout the research process	4.23	0.65	4.45	0.55	**4.54**	**0.54**

[1] Text and numbers in **Bold** represents the current year data (i.e. 2016-17)

Interpreting Results

The mean faculty scores of the 7 learning outcomes range from 4.22 to 4.59 which are above the threshold score of 3.50. The scores indicates that the faculty in general agreed that the students have met these learning outcomes. All scores are slightly better than the last two years' scores. Learning outcome #4.4 still received the lowest score. This outcome also received the lowest score in the last two years. The main reason is the shortest time available for capstone research (i.e. one semester) which is not enough for some students to develop and evaluate the best solution for their research problem.

Communicating Results

The results are shared with the graduate program faculty group. The faculty found that construction industry involvement and feedback in the capstone project in the last two years significantly helped students to select and develop the best solution to their research problem. It was decided to continue this practice by arranging guest lectures of construction industry professionals on potential research topics in the BSCI 7950: Graduate Seminar course. In addition, more effort would be put to find out industry mentors that can provide appropriate feedback to the students at each stage of their research.

Assessment Method #3 (In-direct): 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					
Student Learning Outcomes		2015-16 (15)		2016-17 (11)		**2017-18 (11)**	
Upon graduation, Graduates of the Master of Building Construction program will be able to:		Mean	S.D.	Mean	S.D.	**Mean**	**S.D.**
4.1	Rationally analyze an on- or off-site construction problem	4.63	0.47	4.68	0.47	**4.77**	**0.45**
4.2	Apply systematic procedures to identify the major issues	4.41	0.75	4.65	0.66	**4.74**	**0.64**
4.3	Select possible solutions within or outside the organization	4.53	0.59	4.68	0.52	**4.77**	**0.50**
4.4	Develop, implement and evaluate the best solution	4.21	0.43	4.24	0.37	**4.32**	**0.36**
4.5	Validate research findings	4.05	0.89	4.46	0.72	**4.55**	**0.70**
4.6	Write a report to document the entire process for knowledge management	4.90	0.21	4.95	0.29	**4.97**	**0.17**
4.7	Apply code of ethical principles and procedures throughout the research process	4.71	0.47	4.90	0.47	**5.00**	**0.00**

[1] Text and numbers in **Bold** represents the current year data (i.e. 2016-17)

Interpreting Results

Of the 7 learning outcomes, the lowest mean response score on a 5 point scale is 4.32 for the learning outcome 4.4 "Develop, implement and evaluate the best solution". The learning outcome was also found to be the weakest in the faculty assessment results. In the exit interview, same as last year, 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 group. To improve the outcome of learning outcome 4.4, it was decided to closely involve the construction industry in the capstone research process. This year, more effort would be put to find out industry mentors that can provide appropriate feedback to the students at each stage of their research. Action on this strategy was initiated in the Fall 2016 semester and will be strengthened in the coming year.

Part D: Use of Results

Purposeful Reflection and Action Plan

The assessment results are shared and discussed with the graduate faculty in three ways:

1. Individual faculty members that teach a course(s) where assessment of a specific learning objective and related learning outcomes is made.

2. Small group of faculty members that teach courses related with a particular learning objective (courses where various learning outcomes are either introduced or mastered or reinforced or assessed).

3. Quality improvement meeting at the end of the academic year to review the final assessment results and develop quality improvement plan for the next academic year. In the quality improvement meeting all faculty members were invited to review results and participate in the discussion. This year, the quality improvement meeting was held on May 3, 2019. Sixteen out of eighteen faculty members attended the meeting.

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

During the exit interviews conducted in the last three years, students offered several suggestions for overall program improvement. These suggestions were thoroughly discussed in the program improvement meeting conducted on May 4, 2018 and decisions were taken to address students' concerns and to improve the program delivery. The following table reports the actions taken on these decisions (since these decisions/actions are not related to a particular SLO hence they are listed here).

Decision	**Implementation Status**
The foundation (or levelling) course BSCI 7100:004 Foundations IV, Project Scheduling which is currently offered in the second mini-semester of summer will be offered in the full summer semester w.e.f. Summer 2019.	Decision implemented. BSCI 7100:004 is now a full summer course.
A free 10-hours construction safety camp will be organized at the end of the summer semester to introduce students to OSHA 10-hours safety training and better prepare them to ensure safety at the jobsites.	The safety camp was organized for graduate students at the end of the Summer 2018 semester. A similar camp will be offered in Summer 2019.
BSCI 7020: Integrated Building Process-1 and BSCI 7040: Integrated Building Process-2 courses will be renamed and their offering semesters will be swapped w.e.f. 2019.	The following titles are proposed for these courses: BSCI 7020: Construction Project Development BSCI 7040: Construction Project Management Necessary paperwork for renaming these courses will be submitted in Fall 2019.
Faculty will share possible capstone topics with the students in the summer semester so that they have enough time available to brainstorm all topics and choose the best one.	Faculty available in the summer are now discussing their proposed capstone topics with the students during the summer classes.

In addition, the following decisions are taken during this year Quality Improvement Meeting and will be implemented within this year.

1. Same construction project will be used in all foundation courses offered during the Summer semester so that students can learn various aspects of construction project management by working on the same project in different classes.

2. Members of the Industry Advisory Board will be invited in a seminar class to share their research interests with the students and serve as their industry mentors. The first seminar of this series is planned in early Fall 2019.

Action of these decisions will be reported in the 2019-2020 assessment report.

Appendix A – List of Master of Building Construction Courses

Foundations Courses* (for undergraduates with non-construction degrees)		**Credit Hours**
BSCI 6970-1	Special Problems in Construction – Surveying	2
BSCI 6970-3	Foundations I - Estimating	3
BSCI 7100-02	Foundations II – Building and Temporary Structures	3
BSCI 7100-03	Foundations III - Information Technology	3
BSCI 7100-04	Foundations IV - Project Management / Scheduling	3

First Semester - 13 Credits		
BSCI 7020	Integrated Building Processes I	3
BSCI 7030	Construction Information Management	3
BSCI 7060	Research Methods in Building Science	3
BSCI 7950	Graduate Seminar I	1
BSCI 7xxx	Graduate Elective (Varies)*	3

Second Semester - 13 Credits		
BSCI 7040	Integrated Building Processes II	3
BSCI 7050	Executive Issues in Construction	3
BSCI 7950	Graduate Seminar II	1
BSCI 7xxx	Graduate Elective (Varies)*	3
BSCI 7xxx	Graduate Elective (Varies)*	3

Third Semester - 9 Credits		
BSCI 7xxx	Graduate Elective*	3
BSCI 7xxx	Graduate Elective*	3
BSCI 7980	Capstone Project	3

* The following courses are offered as construction electives: Labor and Productivity Issues, Construction Safety, Building Great Structures, Sustainable Construction, Global Construction, Multicultural Issues in Construction, Planning and Decision Making in Construction, Lean Construction, Advanced Information Technology for Construction.