

Comparing the Structure and Curricula of Canadian Construction Management Bachelor Degree Programs

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Canadian undergraduate bachelor degree programs in construction management are offered solely by community colleges, with there being four such programs in existence. The null hypothesis “Canadian construction management bachelor degree programs are similar to each other and equivalent to American construction management bachelor degree programs in terms of structure and curriculum” is tested. This is done by extracting data of the curricula of these programs from their public websites and reformatting it according to the ACCE curriculum category requirements. It is found that there are more similarities than differences in the curricula of these programs and none of them fully satisfy the ACCE’s curriculum requirements. In this regard, the null hypothesis is proven to be partially correct. Of the four programs, the Red River College program appears to be closest in terms of equivalency to standard American programs. In terms of the strengths and weaknesses of Canada’s undergraduate construction management education system, its weaknesses are more obvious and easier to discern. Significant weaknesses include that these programs are not internationally accredited, and there appears to be limited academic progression in Canada for holders of credentials from these programs.

Key Words: ACCE, Bachelor Degree, Canada, Community College, Curriculum, Construction Management

Introduction

The Canadian construction industry is faced with a demographic problem of retiring construction workers and a projected shortfall of new workers entering the industry (Calgary Beacon 2011). In an attempt to deal with this demographic issue, some Canadian provinces have granted charters to various community colleges to award undergraduate bachelor degrees in construction management. Undergraduate construction management bachelor degree programs are widespread and common in America, where during the 1970s the construction management profession became popular (Knutson et al. 2009). Canada’s lag behind America with respect to undergraduate construction management degree programs does not mean that the construction management profession is not widely recognized in Canada. In Canada, construction managers are usually individuals who have worked their way up the ranks and have many years of practical experience. The emergence of Canadian construction management bachelor degree programs is a clear indication of a departure from the status-quo, and is meant to counter the effects of the construction industry’s inability to attract highly capable and innovative professionals. Although Canadian construction management bachelor degree programs are in their infancy, it is expected that the structure and curricula of these newly established programs will be similar. It is also expected that Canadian construction management bachelor degree programs will be equivalent to American construction management bachelor degree programs, given the many similarities in the structure and operation of the American and Canadian construction industries, as well as the identicalness of the construction management profession between the two countries. To-date, there have been no formal research studies done to verify the aforementioned. In fact, the most recent research study on construction education in Canada was done by Hass et al. (2007) focusing on the history and renaissance of construction engineering and management in Canada, a study that was done before the establishment of most of Canada’s construction management bachelor degree programs. In this regard, the goal of this study is to determine whether the structure and curricula of Canadian construction management bachelor degree programs are similar, and whether these programs are equivalent to American construction management bachelor degree programs. The objectives of this study are: 1) to compare the program pathways and curricula of Canadian construction management bachelor degree programs to identify differences and similarities, 2) to compare the curricula of Canadian construction management bachelor degree programs with the standard curriculum adopted by most

American construction management bachelor degree programs to determine if Canadian programs are equivalent to American programs, and 3) to comment on the general strengths and weaknesses of the Canadian undergraduate construction management education system. It is expected that the findings of this research study will provide an understanding of issues related to the structure and curricula of Canadian construction management bachelor degree programs, and will serve as an impetus for more detailed research studies focusing on promoting the growth and evolution of Canadian undergraduate construction management education.

Null Hypothesis

Canadian construction management bachelor degree programs are similar to each other and equivalent to American construction management bachelor degree programs in terms of structure and curriculum.

Background: Canadian Postsecondary Institutions offering Construction Management Bachelor Degrees

In Canada, there are no bachelor degrees in construction engineering and management. There are, however, bachelor degrees in construction management offered solely by community colleges. In this regard, there are currently four community colleges offering bachelor degree programs in construction management, these being British Columbia Institute of Technology (BCIT), Southern Alberta Institute of Technology (SAIT), Red River College (RRC), and George Brown College (GBC). General information associated with these institutions is summarized in Table 1. Of the four colleges, SAIT is the oldest, having been established in 1916 as the Provincial Institute of Technology and Art (SAIT 2013A). George Brown College is the most recently established institution, having been created by the Ontario Provincial Government in 1967. George Brown College offers seven bachelor degrees while SAIT offers two bachelor degrees. The oldest construction management bachelor degree program is BCIT's program, which was established in 1998 and confers a Bachelor of Technology (B.Tech) in Construction Management. The second program to be established was George Brown's program in 2006, which confers a Bachelor of Applied Technology (BAT) in Construction Science and Management. The Bachelor of Technology in Construction Management from Red River College was the third program to be established, coming into being in 2010. The most recent program is SAIT's Bachelor of Science (B.Sc.) in Construction Project Management, which was established in 2011. Of the four community colleges, George Brown College has the most degree programs (7 in number) while SAIT offers the least (2 in number).

Table 3: General information on Canadian institutions offering bachelor's degrees in construction management

Institution	Year Established	No. of Degrees Offered	Construction Management Degree	Year Construction Management Degree First Offered
BCIT	1960 ^A	4 ^B	B.Tech. Construction Management ^C	1998 ^D
SAIT	1916 ^E	2 ^F	B.Sc. Construction Project Management ^F	2011 ^G
Red River College	Mid 1930s ^H	3 ^{I,J,K}	B.Tech. Construction Management ^K	2010 ^L
George Brown College	1967 ^M	7 ^N	BAT Construction Science and Management ^O	2006

Sources: ^A(BCIT, 2013A), ^B(BCIT, 2011), ^C(BCIT, 2013B), ^E(SAIT, 2013A), ^F(SAIT, 2013B), ^G(Gilbert, 2011), ^H(Red River College, 2013A), ^I(Red River College, 2013B), ^J(Red River College, 2013C), ^K(Red River College, 2013D), ^L(Red River College, 2013E), ^M(George Brown College, 2013A), ^N(George Brown College, 2013B), ^O(George Brown College, 2013C)

To date, the four programs have been successfully accredited by the Canadian Institute of Quantity Surveyors (BCIT 2013B, SAIT 2013C, Red River College 2013D, George Brown College 2013C). George Brown's program has also been accredited by the Chartered Institute of Building (CIOB) and graduates receive thirty credits toward Gold Seal Certification offered by the Canadian Construction Association (CCA) (George Brown College 2013C). In addition, SAIT is currently pursuing accreditation from the Project Management Institute - Global Accreditation Centre (PMI-GAC) (SAIT 2013C). At the time of this study it was unclear as to the progress SAIT has made with respect to this accreditation.

Method

The method used to implement this study consisted of four steps. Firstly, information on the curriculum and structure of the four Canadian construction management bachelor degree programs was collected by mining the websites of the four programs to extract data with respect to matriculation requirements, courses offered, course outlines, credit hours required, and course prerequisites. Secondly, the curriculum associated with each program was reorganized into a common format according to the curriculum category requirements outlined by the American Council for Construction Education (ACCE) “Standards and Criteria for Accreditation of Postsecondary Construction Education Degree Programs”. This reorganization was done based on the curriculum category descriptions provided by the ACCE and through the use of information provided in publicly available course descriptions and course outlines. Thirdly, for each program, a typical sequence of courses was developed respecting the rules of prerequisites and credit hour requirements. Fourthly, credit hours associated with the typical sequences of courses of the four programs were compared with each other and with the ACCE minimum credit hour requirements. In this way, the four Canadian programs were compared with each other and with the standard curriculum of most American programs, based on the level of learning and training of a typical student registered in each program.

It should be noted that the ACCE’s curriculum category requirements was used as the comparison framework because most American undergraduate construction management education programs, as well as programs in Australia and China, have sought accreditation from the ACCE. In this regard, the ACCE curriculum category requirements reflect the standard curriculum adopted by most American construction management bachelor degree programs. By using the ACCE curriculum category requirements as the comparison framework, the four Canadian programs were compared with each other using a set of common criteria and overcame differences in the way courses were categorized by each program.

Results and Discussion

Comparison of Canadian Construction Management Bachelor Degree Program Pathways

The bachelor degrees offered by Red River College, George Brown College, and SAIT are “from scratch” bachelor degree programs, i.e. students can register as first-year students and complete the necessary coursework over a period of four years. For all four programs there is some flexibility in their admission requirements. In general, the three “from scratch” programs require the successful completion of a high school diploma along with specified minimum grades in certain subjects (SAIT 2013D, Red River College 2013F, George Brown College 2013C). All four programs are structured according to the semester system.

Figure 1 is a schematic showing the program pathway associated with Red River’s program. There are four exit points, where after the first year; students can exit with a civil engineering technician certificate. At the ending of years two and three, students can exit with a construction technician certificate and a construction technology diploma, respectively. At the end of the fourth year, students graduate with a B.Tech in construction management.

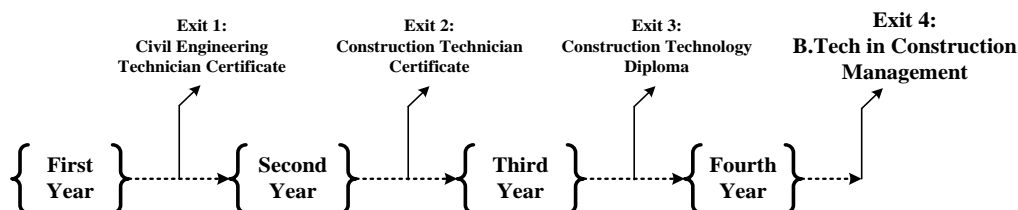


Figure 8: Schematic showing Red River College's B.Tech in Construction Management program pathway (source: Red River College (2012))

While both SAIT and George Brown college have “from scratch” programs similar to Red River’s, they do not award other credentials to students who exit before the successful completion of the fourth year. Based on this, Red River’s B.Tech program appears to be more versatile than the SAIT and George Brown programs.

BCIT’s program is a diploma to degree program, with four admission pathways that are highlighted by the schematic shown in Figure 2. Pathway A is the most common and requires the completion of a Dip. Tech in Architecture or a B.Tech in Architecture and two years of construction work experience, with a minimum of six months of work experience directly preceding the date of application to the program. Pathway B is for students who would have completed a university degree in any discipline. These students are required to have a minimum of four years of construction work experience. Pathway C is for students who have completed just two years of a university program. These students are required to successfully complete a set of prescribed construction bridging courses. Pathway D is for trades’ personnel, such as journeymen. These students are required to complete high school, have passes in Math and English, and successfully complete a set of prescribed construction bridging courses. Students who have entered the program through the four pathways must successfully complete 61.5 semester credit hours of coursework before they can graduate with a B.Tech in Construction Management.

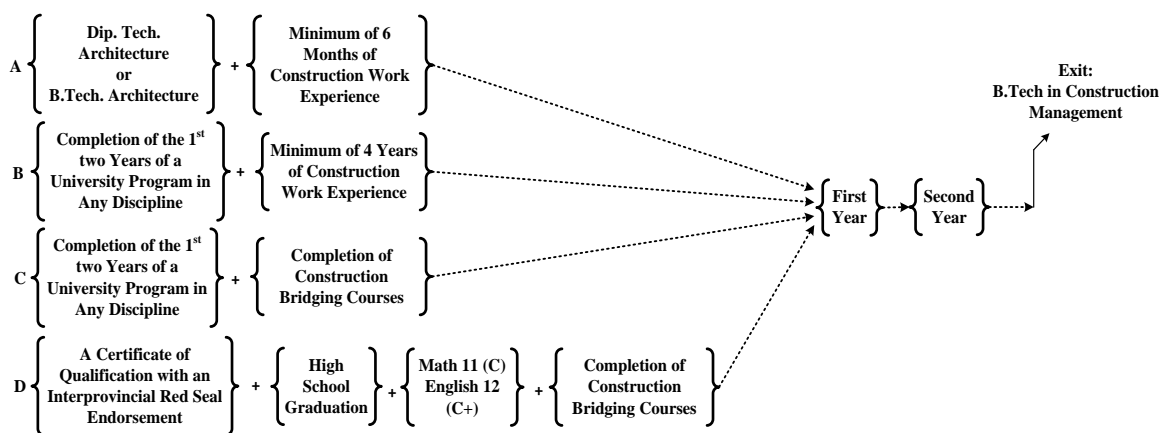


Figure 9: A schematic showing the four program pathways of BCIT's B.Tech in construction management (source: BCIT, 2013C)

Comparison of Curricula of Canadian Construction Management Bachelor Degree Programs according to the ACCE Curriculum Category Requirements

The ACCE structures undergraduate construction management education according to five curriculum categories. These curriculum categories and their concomitant minimum semester credit hour requirements are: “general education” (15 semester credit hours), “mathematics and science” (15 semester credit hours), “business and management” (18 semester credit hours), “construction science” (20 semester credit hours), and “construction” (20 semester credit hours). While the minimum total semester credit hours associated with the five curriculum categories is 98, a minimum of 120 semester credit hours is required for ACCE accreditation (ACCE 2013B).

Figure 3 is a comparison of total credit hours, i.e. core + elective courses, associated with the four programs according to the ACCE’s five curriculum categories. Also shown are the ACCE minimum required semester credit hours for the five curriculum categories. The numbers at the top of the bars represent core course credit hours for each ACCE curriculum category that a typical student registered in each program must complete in order to graduate. The numbers at the bottom of the bars represent elective course credit hours a typical student is likely to complete based on courses offered and rules of prerequisites associated with each program. It is observed that for the George Brown program, ACCE’s curriculum credit hour requirements are satisfied for general education, construction science, and construction curriculum categories. For Red River College’s program, ACCE’s curriculum credit hour requirements are satisfied for science and mathematics, business and management, construction science, and construction curriculum categories. For BCIT’s program, ACCE’s curriculum credit hour requirements are satisfied for science and mathematics, construction science, and construction curriculum categories. For SAIT’s

program, ACCE's curriculum credit hour requirements are satisfied for science and mathematics, construction science, and construction curriculum categories. Based on the aforementioned, Canadian programs are similar to each other in that they do not completely satisfy the ACCE's curriculum category credit hour requirements. It appears that of the four Canadian programs, the Red River College program has the greatest similarity to standard American construction management bachelor degree programs, based on the extent to which it has satisfied the ACCE's curriculum category credit hour requirements. A second similarity between the Canadian programs is observed in terms of the elective courses that are offered. It is observed that none of the four Canadian programs offer elective courses for all five of the curriculum categories. All four programs, however, appear to offer elective courses in the business and management curriculum category. A third similarity between the Canadian programs is observed in terms of their emphasis. It seems that the four Canadian programs place significantly more emphasis on construction science and construction courses. At George Brown College, construction science and construction courses account for approximately 66% of the program's credit hours. At Red River College, these two categories of courses account for approximately 67% of its program's credit hours, while at BCIT and SAIT, they account for approximately 75% and 70%, respectively.

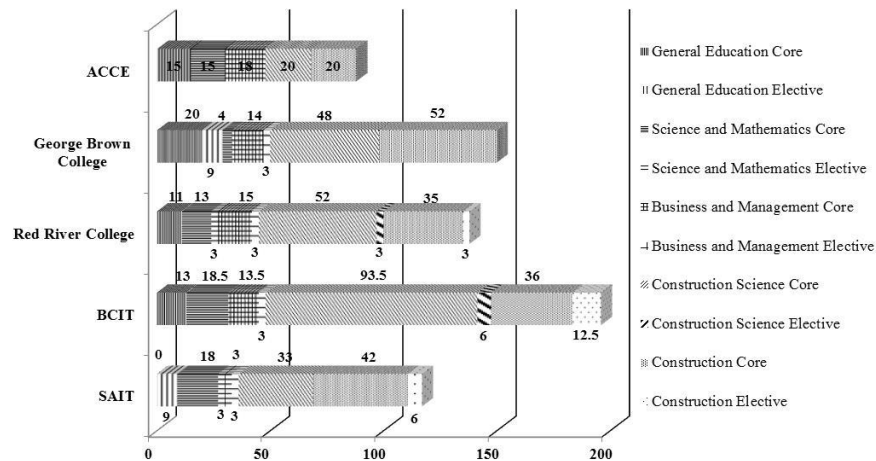


Figure 10: A comparison of total credit hours in terms of core and elective courses that a typical student will complete for each program

Figure 4 is a comparison of the general structure of the curricula of the four programs with respect to core courses, elective courses, and co-op/industry internships, based on number of program credit hours. Of the four programs, BCIT's program requires the completion of the most credit hours (207), while SAIT's program requires completion of the least amount (123). The amount of total program credit hours is an obvious difference between the four programs and is attributed to differences in type of credential awarded by the programs. This difference in total program credit hours reflects that there is disparity with respect to coursework requirements. Of the three "from scratch" programs, students enrolled in Red River's program have greater credit hour completion requirements (171 credit hours) than students enrolled in the SAIT (123 credit hours) and George Brown College (157 credit hours) programs. At first glance, it appears that the implication of this is that students enrolled in the Red River College program will have more contact hours of classroom education in comparison to students enrolled in the SAIT and George Brown College programs. This is, however, disproven by a closer observation which reveals that actual contact hours of classroom education, i.e. core + elective credit hours, is greatest for George Brown College (140+12=152), followed by Red River College (132+12=144), then SAIT (99+21=120). If it is assumed that courses are worth an average of three credit hours, then the difference between George Brown College and SAIT in terms of courses is at least ten courses, a noteworthy difference in course load between the two programs.

Figure 5 is a comparison of the general structure of curricula of the four programs based on percentage of program credit hours. This comparison highlights the contribution of core courses, elective courses, and co-op/industry internship to the curricula of the four programs. It is observed that BCIT and George Brown College are similar in their reliance on core courses, which account for approximately 89% of each program's curriculum. SAIT's program has the greatest reliance on elective courses, while the Red River College has the greatest reliance on co-op/industry internship. The implication of these observations is, firstly, the BCIT and George Brown College

programs focus more on the core knowledge and skills required of a construction manager, and place less emphasis on specialized knowledge and skills, which would be covered in elective courses. Secondly, the Red River College program utilizes experiential learning to a greater extent than the other programs, with this form of learning being achieved through mandatory co-op/industry internships.

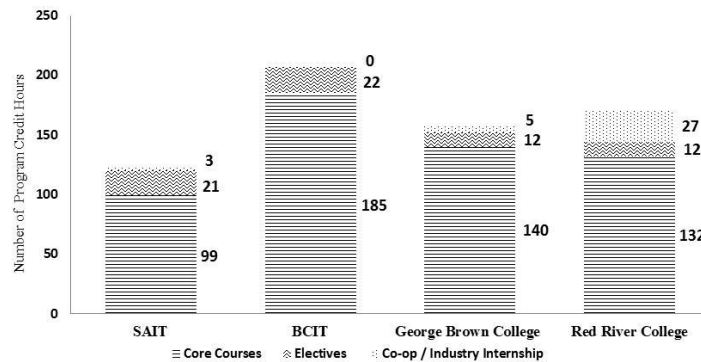


Figure 11: A comparison of the general structure of curricula of the four programs based on number of program credit hours

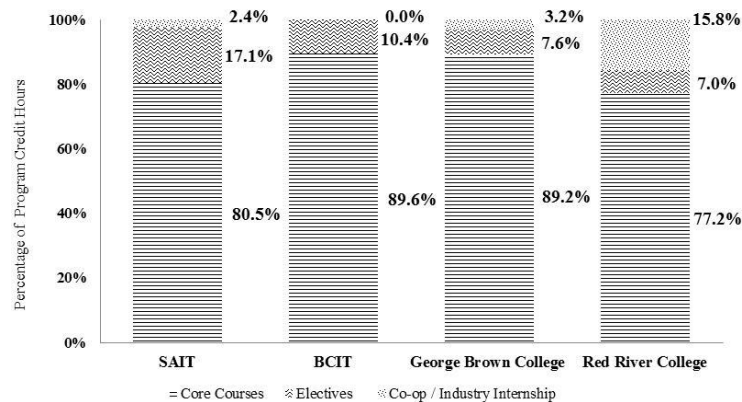


Figure 12: A comparison of the general structure of curricula of the four programs based on percentage of program credit hours

Commentary on Perceived Strengths and Weaknesses of the Canadian Undergraduate Construction Management Education System

There are three easily discernible general weaknesses associated with the Canadian undergraduate construction management education system. To begin with, Canada's four bachelor degree programs collectively award three different types of credentials, which is likely to have the effect of making it difficult for students to easily transfer between programs. This is mainly due to the different curriculum structures, i.e. while three of the four programs require completion of co-op/industry internship, the durations and expectations are different between programs in this regard. Based on this, there is a need for a central body to regulate undergraduate construction management education in Canada. The second general weakness associated with Canada's undergraduate construction management education system is its bachelor degree programs are not officially recognized beyond Canada. To date, none of the four bachelor degree programs have received any international accreditation, which makes it unclear whether students can transfer to American programs, and whether graduates will be able to gain employment in the American construction industry as construction managers. While it may be argued that the purpose of Canadian construction management bachelor degree programs is to satisfy the needs of the Canadian construction industry, it will be prudent to provide graduates with the ability to function overseas given the globalized nature of construction. The third general weakness associated with Canada's undergraduate construction management education system is there appears to be no further progression for graduates of these degrees with respect to Canadian Masters degrees in construction management. While these degrees do require the completion of some engineering courses (classified as

belonging to the “construction science” curriculum category), curriculum credit hours in this regard are too low for admission to Canadian Masters’ programs in Construction Management, which are part of graduate civil engineering degree programs. Also, in Canada there are no graduate programs in technology, such as Masters of Technology or Doctor of Technology. In this regard, holders of Canadian undergraduate bachelor degrees in construction management appear to be limited to postgraduate studies in business and management, or will have to seek admission to American Master’s programs in construction management.

When looked at collectively, the general strengths of Canada’s undergraduate construction management education are not easily discernible. Some construction educators and education policy makers may argue that a variety of different degree types is a strength associated with the overall system. It is however, the author’s opinion that the use of different credentials between institutions is a sign of the immaturity of Canada’s undergraduate construction management education system. It should be noted that there are specific strengths associated with each degree program. For instance, the requirement of co-op/industry internship is a strength that leads to graduates that are familiar with the operation of the construction industry, and will therefore require less on-the-job training.

Conclusion and Recommendations

A comparison of program pathways and curricula of Canada’s four construction management bachelor degree programs reveals that there are three general similarities between these programs which include: similar admission requirements, similar accreditation and lack of internationally recognized accreditation, and similarity in terms of failure to fully satisfy ACCE curriculum credit hour requirements. There are three general differences between these programs, which include: differences in the type of credential awarded, differences in program credit hours, and differences in the structure of curricula with respect to core courses, electives, and co-op/industry internship. Based on the aforementioned, the null hypothesis is partially correct, i.e. Canadian construction management bachelor degree programs are similar to each other to an extent, but are not equivalent to American construction management bachelor degree programs based on ACCE curriculum requirements. Of the four programs, the Red River College program is most similar to American programs while SAIT’s program is the least, based on satisfying the ACCE curriculum requirements. With respect to perceived strengths and weaknesses of Canada’s undergraduate construction management education system, it appears that there are more obvious weaknesses than strengths. A significant weakness is the lack of international accreditation which will have the effect of reducing the international mobility of graduates of these programs. Weaknesses associated with this research study include sourcing data about the curricula of the construction management bachelor programs from program websites, which were assumed to be accurate and current. In addition, it was assumed that most American programs follow strict adherence in terms of satisfying the ACCE’s curriculum requirements. Based on the aforementioned, future work associated with this area of research include: 1) implementing a more detailed study to compare the curricula of American and Canadian construction management bachelor degree programs, 2) investigating the possibility of linking undergraduate bachelor degree programs in construction management with existing Canadian graduate programs in construction engineering and management; and 3) investigating the impact of Canada’s construction management bachelor degree programs on the productivity and performance of the Canadian construction industry.

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