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ABSTRACT

The internet and various print media offer a variety of ordinal ranking systems for colleges and universities. These rankings are readily available to everyone and offer a simplistic way to differentiate universities. However, these publications make little to no attempt to inform the end-user of the criteria by which the schools are ranked, or how the criteria are weighted, and the rank is developed. The goal of any rating system should be to accurately and transparently disseminate information to a designated end-user while avoiding the simplistic winner and loser paradigm. The term rating rather than ranking has been selected intentionally, to illustrate the comparative excellence of each program, not to simply name one as the best and others as less excellent. This document takes the first step to achieve this goal.

This research set out to create a framework for rating academic construction programs. The body of this work has taken the initial step to collect the criteria which will be considered for the rating framework. During the planning stages of this project, the research team identified three main objectives to be fulfilled. The first objective was to formalize the method of collecting the criteria that should be considered when measuring the excellence of academic construction programs. The second objective was to collect the criteria from three proposed sources: current research literature, a focus group of educators from Associated Schools of Construction (ASC) member schools, and one on one interviews with professors who held an administrative position for their respective department. The findings outline 87 criteria extracted from the sources. Finally, the third goal was to objectively create a consensus concerning the criteria and assign weights to these criteria. This document does not attempt to conduct a functional rating using the selected criteria based on the limited scope and resources of this research.

Through a modified Delphi method, a panel of experts has formed a consensus concerning which criteria should be considered and has assigned relative weights to the suggested criteria. The findings have been aligned with the conclusion and shown to either support or contradict other studies. The criteria limitations outlined in the conclusion portions of this document, arise from a time constraint. Suggestions for future research outline the next step required to create a rating system which accurately and transparently disseminate information to a designated end-user while avoiding the simplistic winner and loser paradigm.

TABLE OF CONTENTS

List of Tables and Figures

Tables

Figures

1.0 Introduction

The modern post-secondary academic landscape offers an incredibly diverse range of institutions. The task of choosing one of these institutions to further one's education may become daunting with the seemingly endless choices. It is widely written that schools have three basic objectives, which must be intertwined to create the schools' stated direction – research: the construction of knowledge; education: the dissemination of knowledge; and service: the use of knowledge. These three objectives have been and will continue to be divided and subdivided into specialized bodies of knowledge which force institutions of higher education to choose where to focus talent and resources. This pattern of choice is ultimately what differentiates one university from another.

When selecting which school to attend, students choose from a variety of universities that vary in size, expense, location, and a multitude of other unique factors. Attwood (2009) found, public perception of a university mainly hinges upon the academic reputation of that university. However, it is possible that the institution that is the best fit for a student may diverge rapidly from the basic public perception of a university. Theoretically, students should choose to attend a certain college or university based on what drives that institution. If a student aspires to be a doctor, they would most likely choose a university which has a top tier medical school. It follows that universities, which compete for these students, have a vested interest in being considered top tier. A plausible symbiotic relationship is developed here, in that, schools and potential students want a mutually beneficial exchange of information. Commonly, this is done through a ranking system.

To explore the ranking and rating systems of construction programs, this research began with a literature review using a snowball approach. The literature review examined several ranking methods commonly found on various online platforms and concluded with a discussion of two academic publications on ranking construction programs. An overview and explanation of each ranking system has been accompanied by current academic critiques. The method portion of this paper states the research objective and then outlines methods used for data collection, survey development, and subsequent analysis. Due to the extensive nature of rating systems this research only seeks to build a framework for selecting criteria and then assigns a value to the

selected criteria. This document concludes with suggestions for future directions of the current research study.

1.1 Overarching Research Questions

Ranking systems are ubiquitous on the internet and claim to be legitimate measures of university excellence. According to Marginson (2007), ranking systems like the US News and World Report are very simple, easy to understand, and incredibly convenient. Although the academic debate on the effectiveness of ranking universities is fraught with controversy (Dill & Soo, 2005, Lazaridas, 2009, Lukeman et al., 2010), it seems they are here to stay, and for institutions of higher education, they are inescapable. This observation offers a research opportunity. Rather than reject ranking as a practice, academia could benefit from a rating system. An ideal rating would accurately and transparently disseminate information to a designated end-user while avoiding the simplistic winner and loser paradigm. The term rating, rather than ranking, has been selected intentionally, to illustrate the comparative excellence of each program, not to simply name one as the best and others as less excellent.

1.2 Initial Research into Rankings

The initial searches for construction program ranking systems revealed several possible issues with those found on the internet. These sites are available using any common search engine and are readily available to the general public. Using one common website: www.collegechoice.com, a problem arose when a comparison between the 2017 ranking and the 2018 rankings was made. Below, Table 1 contains one of the website's top five picks from 2017 to 2018. There is no overlap, which would indicate either a large drop in the excellence of those 2017 top five programs, or a large improvement of the 2018 top five programs. Upon further investigation into the methodology of this particular ranking, the website cites five criteria used to create the rankings: affordability, quality, reputation, satisfaction, and value. The definitions which accompany these criteria could be interpreted many ways and do not attempt to mathematically explain the analysis of how schools are scored. Evidently, Indiana State University experienced a sharp decline in all five categories from one year to the next.

Table 1: Top five universities from 2017 and 2018 as per www.collegechoice.com

	2017	2018 Rank		2018
1	Indiana State University	Dropped to # 21	**1**	California State University - Sacramento
2	Everglades University	Not Ranked	**2**	Arizona State University - Tempe
3	Rowan University	Not Ranked	**3**	Purdue University
4	National American University	Not Ranked	**4**	Central Connecticut State University
5	National University	Dropped to # 12	**5**	New York University

These rankings offer little to no transparency when it comes to university movement within the ranking. An end-user is unable to see what caused the sharp assent or decline, and therefore may find themselves unable to make an informed decision about a university based on these rankings.

1.3 Terms and Vocabulary

It is useful at this point to define *end-user* and *stakeholder*, two terms which will be used throughout this document. A "stakeholder" is someone who has a vested interest in being viewed favourably by the rating system. Stakeholders would include university faculty, current students, alumni, and industry partners. According to Atkinson et al. (1997), "a stakeholder is an individual or group, inside or outside the company that has a stake in or can influence the organizations performance." Comparatively, an "end-user" is someone who employs the rating system as an analytical tool for choosing a university. End-users would include prospective students and parents, employers seeking talent, and faculty looking for a change. These terms will be explored in further detail and focused on stakeholders and end-users related to construction education later in this work.

Additionally, the terms *rating* and *ranking* are two terms which should be distinguished. In this document, the term ranking is used to describe a list that indicates the relative standing of an institution in a number series. By nature, ordinal ranking places more value on those institutions which rank closer to one and less value on those ranked further from one. This is commonly done through comparison. Whereas a rating refers to the evaluation of an institution through its attributes. While a ranking can be derived from this rating, it is not the intention of this research to describe one university as best and the others as less excellent.

1.4 Conclusion

Selecting a university to attend is a pivotal event in a person's life and can be a very difficult choice with many far-reaching implications. Students may begin this search with online ranking systems, often eliminating potential universities based on where they fall on the ranking. A superficial look into these ranking systems revealed large movement by universities in the rank order from year to year. Furthermore, based on the explanations of the ranking methodology, it is difficult to explain the considerable movement, leaving the end user uninformed about institutional weaknesses or strength. The research creates a strategy for constructing a rating framework that transparently disseminates information to a designated end-user. The first phase includes a critical review of the current literature regarding ranking programs. The second phase involves criteria collection and evaluation, and finally a consensus and raw score is built around the selected criteria. The research culminates with the development of a proposed system to rate construction programs that has been developed with a review of the literature, and a multi-faceted, integrated research design using opinions of various construction program leadership.

2.0 Literature Review

Since WWII, construction as a discipline in academia has steadily grown to fill the industry need for competent construction professionals to handle the growing complexity of modern construction. The number of construction programs in the United States has topped two hundred with just over ninety schools accredited by the American Council for Construction Education (ACCE). The ACCE and the Accreditation Board of Engineering and Technology (ABET) were created out of the industry demand for quality assurance. Both the ACCE and the ABET have dedicated standards of excellence schools are required to fulfill before accreditation and membership, respectively, are granted. These standards or criteria used for accreditation outline what these bodies believe should be taught during a student's tenure. Furthermore, the ACCE and the ABET conduct regular assessments of universities which hold accreditation. These criteria are outlined as required curriculum standards and programs must be able to prove through direct and indirect assessment these standards are being taught. For example, the ACCE outlines the required student learning outcomes (SLOs) and programs must track and publish data concerning these outcomes. Initially, this resembles a tool of comparison. However, there is no commonality among universities concerning how these outcomes are measured. While accreditation data is important, it does not provide an end-user an analytical tool to aid in the school comparison process.

2.1 Current Ranking Models

The oldest and perhaps the most recognizable ranking system is US News and World Report (USNWR) (www.usnews.com/best-colleges/rankings/national-universities). An annual university rank is published on the USNWR website and is subsequently included in a historical volume. This ranking system uses yearly data points produced by the Integrated Post-Secondary Data System (IPEDS), as well as, several qualitative measures that were selected by a pool of designated experts. The rank criteria are defined and explained on the website. Furthermore, the formula used to establish the rankings use quantitative and qualitative measures, which have been proposed as reliable metrics for academic quality by education experts (US News and College Ranking report 2019). The USNWR attempts to be transparent and offers a framework for distinguishing universities by placing them in an ordinal rank.

A more exacting search for construction program rankings produced a variety of rankings. The large majority were designed by private, for profit commercial websites. The majority of these sites formulate the rankings in the same manner. Below, Table 2 outlines which websites were visited during the initial research for this project.

Table 2- Initial website searches

Ranking Organization	Website	Date Visited	Date Visited	Date Visited
US News and World Report	https://www.usnews.com/	9/9/2018	10/19/2018	12/1/2018
College Factual	https://www.collegefactual.com/	9/9/2018	10/19/2018	12/1/2018
College Raptor	https://www.collegeraptor.com/	9/9/2018	10/19/2018	12/1/2018
Affordable Schools	https://affordableschools.net/	9/9/2018	10/19/2018	12/1/2018
Niche	https://www.niche.com/k12/rankings/	9/9/2018	10/19/2018	12/1/2018
College Choice	https://www.collegechoice.net/	9/9/2018	10/19/2018	12/1/2018

Dubbed as "ambiguous additive systems" by Toffallis in 2011, these systems are easily found on the web using common search engines. For many prospective students, they are a precursory method for most when engaging in an initial college research. The methods to produce the rankings among those rankings found on the web are fairly similar. According to Toffallis (2011), assorted measures are combined to generate and overall score using an additive method. In many cases, these measures must first be normalized to make them comparable prior to the calculation of a cumulative score. As a popular example, the website College Factual, www.collegefactual.com, offers a 2020 ranking of the "Top Construction Management Colleges in the US." The websites methodology section lists five criteria: graduate earning, major focus, related major concentration, accreditation, and overall school quality. These five criteria are scored, and those scores are added to produce a combined additive score. The schools are subsequently ranked based on the additive score, with 1st place going to the school with the highest additive score. Similar to a sports ranking, the school in first place would presumably be better equipped to produce successful students.

2.2 Critique of Ubiquitous Ranking Model

According to Silver and Fischer-Baum of ABC Sports (2015), ranking systems for sports, which utilize the Elo rating (named after the method's inventor, Arpad Elo), are highly dependable. This dependability has generated a generally favorable attitude toward rankings, and that attitude is being leveraged by many online ranking websites. The ease of access, immediacy, and clarity of these types of ranking systems may be attractive to prospective students. However, simplicity and convenience may be detrimental to an unbiased comprehensive look at a university. Marginson (2007) points out, "The powerful clarity of league tables of universities conceals a whole array of methodological problems and anomalies." The objective of these university ranking systems is to assign a relative rank to the 'university as a whole.' As Van Dyke (2005) asserts, many rankings systems profess to 'evaluate universities as a whole', and in doing so they depend on arbitrary weightings of the different elements, which cover different aspects of quality or performance. Usher and Savino (2006) also point out, that many other legitimate indicators or combinations of indicators may exist, but this observation is commonly sidestepped for convenience. Comparing the overall excellence of a university neglects and even skews the individual program excellence of a university. In fact, a survey published by Frank and Cook (1995) illustrated a "halo effect" when students ranked the Princeton Law School as a top 10 law school. Whereas, Princeton does not have a law school. Additionally, this inconsistency was uncovered, specifically concerning construction programs. During a precursory search of these ranking systems, the University of Oklahoma (OU) was ranked second in a poll which ranked the top 15 "Online Construction Management Degrees" by Affordable Colleges Online. However, OU does not have an online CM degree. Therefore, judging the excellence of a construction program based on the excellence of the entire university may be inadequate for the purposes of program improvement.

In general, all additive ranking systems suffer from the same basic inadequacies. There is no formal attempt to define what constitutes educational quality. As Usher and Savino (2006) observed, different ranking systems are tasked with establishing the particular notions of what constitutes educational excellence, however these norms may differ greatly based on what drives a particular ranking system. This claim by the researchers was not aimed at these particular additive ranking systems but remains true for all additive systems across the board. A research-

oriented university will certainly rank differently than a teaching-focused university and in turn prevent an end-user from making a direct and commensurate comparison.

2.3 Current Construction Program Ranking Model

The second ranking methodology, "The World Class Model for Construction Programs" that is available for construction programs is also additive by nature but seeks to be much more precise. Construction academics and industry professionals have been pursuing the idea of ranking construction programs since the early 2000s. Badger and Smith (2006) described efforts by the Engineering Record News (ENR) and numerous construction academics to create a theoretical "world class" construction program that would act as a yardstick by which all other construction programs could compare themselves. It was anticipated the ranking would not only raise public awareness of academic programs, but it would also allow programs to benchmark themselves against other programs and in turn improve program performance and outcomes. The world-class model was based on the following seven factors:

- Professional Faculty- Program faculty members are evaluated by their academic credentials, ability to educate future leaders and the quality and quantity of research they undertake.
- Quality Students and Committed Alumni- Graduating students and alumni should demonstrate high levels of success and commit significant personal and corporate funds to their home universities.
- School- World Class- Schools need to cultivate their academic reputation. This is done through organizational position, securing endowments and developing internal and external alliances.
- State and Institutional Support- Schools should demonstrate exceptional institutional support, not only in the form of funding, but also the promotion of faculty within the university and the autonomy to make strategic decisions concerning the program.
- International Engagement- Global industry partnerships, formalized relationships and joint degrees should be established worldwide by top universities.
- Social Embeddedness- Programs should seek to serve the needs of the local communities as well as the larger national and international communities. These programs should proactively offer solutions concerning current and future issues.

- Interdisciplinary- Connections and formalized relationships with other academic disciplines should be created and maintained, to strengthen the overall academic foundation of the program.

Based in part on these seven criteria, Badger and Smith (2006) then went on to propose a strawman ranking system. Similar to the Engineering News Record (ENR) efforts, Badger and Smith felt, universities that participate in a ranking process will have greater access to data which may facilitate growth as an academic program. This proposed ranking system breaks the programs into five distinct groups based on enrollment class size, faculty numbers, and research funding. Each program would then be evaluated on nine categories that were assigned relative weights.

- Peer ranking [250 points]
- Faculty [150 points]
- Students [150 points]
- Funding [100 points]
- Industry Support [100 points]
- Programs [100 points]
- Facilities [50 points]
- Globalism [50 points]
- Alumni [50 points].

Each category was broken down even further to explain the specific metrics that allow programs to earn points. Once all categories have been scored, a simple summation of category scores would reveal the overall score. A program that earned 1000 points would earn the label of world-class. Before critiquing the research, it needs to be pointed out that the stated objective of the Badger and Smith paper was to start an academic debate on the method and criteria for ranking construction programs. Rather than exploring what constitutes a world class construction program, the authors offered this research as an explanation of a world class construction program. According to Robson (1993), this position requires that several research design and research method issues be addressed.

2.4 Shortcoming of Current Ranking Model

By nature, the purpose of the Badger and Smith (2006) research is largely exploratory. It aimed to establish the model “world class” construction program by its respective attributes but made

no attempt to gather any information. There is not a problem with exploring what constitutes a "world class" program, much like making a suggestion about what constitutes a world class program. However, because the authors chose to explain or lay out the exact framework of what constitutes a "world class" program the study neglected to follow traditional research strategies. The explanatory research strategy employed by the Badger and Smith study required some type of data collection.

The "world class" rating seeks to explain the relative value of a construction program in terms of comparison. Selecting which criteria should be evaluated was a very important step and should have followed a traditional research strategy of experiment, survey, or case study (Robson 1993). The researchers self-selected the criteria within the categories. These criteria were their own personal opinions on what constitutes a world class construction program. There was extensive explanation of each criteria, but there was little to no empirical or theoretical justification. Even with all the experience these academics may have had to offer, an inherent and obvious bias was created. In practical terms the authors created a sample of what two large research driven universities consider to be desirable criteria. According to Robson (1993), the individual opinion is not where research finds the value, it is the generalized opinion drawn from the generalized population. Efforts should have been made to retrieve the general opinion of a meaningful representation of the construction community. A survey could have served the purpose of the authors and would presumably offer outcomes very similar to the already proposed criteria. This simple step would have offered internal and external validity, while avoiding bias. Moreover, a survey and accompanying Likert scale offers opportunity to objectively calculate the category weights as well.

The methodology used for the strawman poll required that each category be assigned a weight based on its relative importance to the overall metric. The authors do not offer an empirical or theoretical justification for category weights. With no justification, the weights may be considered as arbitrary, which undermines ranking validity and reliability due to construct validity errors (Robson 1993). Secondly, the proposed methodology for ranking these schools relies on a variety of quantitative and qualitative measures. These measures, while good, would

require tremendous effort to collect and normalize. Schools may not even be willing to reveal much of the information required by the proposed framework.

In response to the Smith and Badger (2006) work, Williamson and Burt (2007) published a ranking of "C-Schools" using the Associated Schools of Construction (ASC) publication as a metric. This response critiqued the strawman ranking system by pointing out the lack of points assigned to research. The researchers assert that research publication within construction academia is one of the most "visible indicators" of research activity and can be easily quantified for measurement purposes. The paper goes on to offer a method of ranking programs by statistically analyzing the research production of program faculty. The authors limited the sample population to the publications of the ASC members. This work was intended to be an addition to the academic debate of ranking construction schools but does not address several fundamental research design issues. Both Smith and Badger (2006) and Williamson and Burt (2007) are included in this research moving forward, as they are the valued opinions of construction academics and represent the initial efforts for rating construction programs.

2.5 Conclusions

It is important to note the overall lack of research literature concerning the mechanisms of rankings. Although there is ample literature written to critique the current ranking systems, there is little research which attempts to pursue and grow the endeavour. This observation alters the original research design, of converting an already existing and valid ranking system to meet the needs of construction program ranking

The review of the literature and common ranking systems has revealed several issues. While online rankings are readily available and straight forward, there is a lack of transparency concerning how the ranking actually scores each program and what sort of value is placed on each criterion in the ranking. Efforts to create a ranking or rating system in construction academia offered many insights and have influenced this research. However, the lack of adherence to a proper research strategy raises the question of bias. The researcher's home institution could potentially influence the way in which the criteria are written or weighed. Furthermore, it is impossible to discern if the ranking is equally objective for all rated schools, or

if some of the selected and weighted criteria would naturally tip the rating in favour of certain institutions.

While the literature search has exposed gaps in the theory and practice of ranking university and college programs, there is an observable common goal. Each of the ranking or rating systems seeks to reveal the excellence of programs, and then disseminate that information in a readily accessible and clear way.

3.0 Research Goals

The process of creating a working model for rating construction programs presents a daunting challenge. ***The central goal of this research is to create a rating system that accurately and transparently disseminates information to a designated end-user while avoiding the simplistic winner and loser paradigm.*** In order to properly address the current ranking deficiencies and create a practical and useful ranking system, several precursory steps need to be taken. Below are listed the challenges of the initial research objective.

1. End-users need to be selected prior to entering data or criteria into the framework. Due to the nature of rating systems, the end-user must be designated to allow the criteria to be properly weighted. Disparate end-users will value criteria differently.
2. An objective method to select which criteria to consider, when rating construction programs, will eliminate the possibility of researcher bias. Depending on the stakeholder and the end-user, opinions on which criteria to select have been seen to vary widely.

3.1 End Users

A common criticism of ranking systems is a lack of regard for the end-user (UNESCO 2013). Depending on who the end-user is, the weight of what criteria is important and how important they are varies. "[University ranking systems] are generally deficient in responding to different needs of the users in terms of specialized rankings across regions, fields, or subjects with objective measures of research and teaching criteria" (Olcay & Bulu 2017). Interactive tables have been proposed to theoretically solve this problem, but no meaningful framework has been designed. Throughout this study it became clear, if the rating system is to be meaningful, it needed to be highly targeted with clearly identified stakeholders and end-users. The scope of this research focuses specifically on rating construction programs through the lens of university faculty. This lens offers a unique challenge, in that, faculty are both stakeholders and end-users in the rating system. With this in mind, an assumption was made. Faculty (Professors, Deans, Program Directors) have a vested interest in improving their university by way of improving their academic program. Improving an academic program happens by identifying deficiencies and then creating solutions to address the problems. The framework for the proposed rating system attempts to allow university faculty and administrators to identify possible program deficiencies through a comparison of value ranked criteria.

Parent or Student

Understandably the most common end-user of a collegiate ranking is a parent or student doing initial research into schools. The motivations of this particular end-user may offer differences in micro motivations, but ultimately this end user is looking at which school is going to ensure the future success of the student. This parent/student end-user may be looking at location and cost to benefit ratios to assess the value of a school.

Industry

Insight into which schools are producing the best construction practitioners is valuable to companies that are attempting to keep up with industry demands. The process of acquiring new talent for the industry is risky and schools can offer evidence of a potential candidate's efficacy. A ranking system could act as a guide in selecting which students to hire. Unlike the parent/student end-user, the industry would be far less interested in the cost of tuition.

Academic

This end user is twofold. Ideally, academic end-users are actively trying to make their programs better. Knowing where they rank among other similar institutions allows them to benchmark themselves against others. Continual improvement is encouraged through comparison, and in turn produces a better student. The second fold concerning this end-user is the academic looking to make a change in academic institutions. He or she may be looking at salaries, retention rates, and research funding.

3.2 Context for Research Direction

Although there is need to create a framework for all intended end-users, the scope of that undertaking is much larger than this study. The end-user in this research is limited to academics in construction academia, to allow for purposive sampling, and the development of a rating system with a high degree of internal validity. This end-user has extensive knowledge concerning measuring the excellence of construction programs. The following research model required extensive contact with these end-users, and because this research is still theoretical, academics were likely be the most willing subjects.

3.3 Research Objectives

As previously stated, the overarching research goal is to create a rating system that accurately and transparently disseminates information to a designated end-user, construction academics, while avoiding the simplistic winner and loser paradigm. This goal requires several initial steps to avoid the pitfalls that delegitimize the currently available ranking systems. The following research objectives were established to guide this study and begin the process of creating a usable rating system:

- Compile a comprehensive list of criteria for measuring the excellence of construction programs, as suggested by three distinct sources.
- Evaluate those collected criteria to ascertain the practicality and applicability for rating construction programs.
- Build a consensus among a panel of experts concerning which criteria should be considered when rating a construction program.

3.4 Conclusion

This section explained and deconstructed the overarching research goal, by defining the end-users and outlining the research objectives. Fundamentally, end-users complicate ranking and rating research, because individual end-users may differ on what attributes they deem important when ranking the excellence of a construction program. The section above defines each end-user for reference later in the study and justifies the need to choose an end-user prior to developing the research methods. Finally, the research objectives outline what this study set out to achieve. These objectives will be expanded later in this document. Furthermore, measures are assigned to each of the research objectives in order to assess the relative success of the research.

4.0 Research Methodology

This research set out to take the first step in creating an empirically and theoretically sound framework for rating construction programs through a proper research design. This idea drove the methods of data collection, data analysis and in turn criteria selection. Once the criteria were selected, a survey was developed and distributed among construction academics to assist in assessing the relative importance of each criteria. Theoretically, a framework can now be constructed utilizing the weights of each criteria to rate construction programs.

The first objective was to select what criteria should be considered when rating a construction program. The next objective was to create a consensus among academics concerning these criteria, to ensure validity for this research. Finally, it was determined a relative weight for each of the established criteria was needed in order to identify and establish a relative importance for each criterion.

4.1 Literature Review

The current market-place for entry level students interested in construction education is vast and full of variety. Analogous to the construction industry itself, the academic discipline of construction can be divided again and again into highly specialized areas of study. The industry itself commonly recognizes differences in the types of construction. Residential construction can vary from commercial and institutional, while industrial and heavy civil construction are completely unique categories. Institutions of higher education are then tasked with teaching the skills required to be successful in this incredibly heterogeneous industry. Specialization is inevitable. Furthermore, within these categories or types of construction, the skill sets required of a project manager may be different than the skill set required of a superintendent.

> *As can be noticed, construction management programs can be found in schools of construction, engineering, science, built environment, technology, business and management. Degree titles can be construction management, construction science, construction, construction engineering, and construction engineering technology to name the most common* (Farooqui & Ahmed 2009).

This diversity may be an extension of the industry itself. Academic programs are evolving to meet the ever-changing needs of the industry, which leaves little to no time for the standardization of construction education. In contrast, this diversity represents a challenge to the

industry because companies cannot rely on all graduates being given the same skill sets and may be forced to invest in further educating new employees. It follows, that companies would then be interested in knowing which institutions were producing the most capable and career ready students. This brief summary of the heterogeneity of construction programs is important, because it represents a road block to this research, but also points out the need for such research.

4.2 Criteria and Accreditation Requirements

While there are many obvious differences between programs, there is also significant and meaningful overlap among construction programs. Fundamentally, the responsibility of every program is the same, to provide the construction industry with competent and capable construction professionals. The nuance of how to accomplish this task is where we see the divergence. At the basic curriculum level, most, if not all programs are the same. Both accrediting bodies, the American Council for Construction Education (ACCE) and the Accreditation Board for Engineering and Technology (ABET), require close adherence to certain curricula, and ensure specific learning outcomes through various forms of direct or indirect assessment. Despite the differences in language between the two accrediting bodies, there are more similarities than differences between the two accrediting bodies.

Furthermore, both the ACCE and ABET require some form of industry involvement with the school. "Accrediting bodies for post-secondary education construction programs, the American Board of Engineering Technology (ABET) and the American Council on Construction Education (ACCE), require a formal linkage between industry and programs preparing students to enter the construction or construction-related industries" (Hynds and Smith 2001). Predominantly this is done through and industry advisory council (IAC). The driving purpose behind these councils is to academia is meeting the needs of the industry.

4.3 Phase 1 -Developing the Model

During the planning stages of this project three main objectives were identified. The first objective was to formalize the method of collecting the criteria that should be considered when measuring the excellence of construction programs. The second objective was to collect the criteria from three proposed sources: current research literature, a focus group of educators from ASC member schools, and one on one interviews with professors who held an administrative

position for their respective department. Finally, the third objective was to assign weights to these criteria in an unbiased fashion.

Due to the subjective nature of this research, and the inherently qualitative methods needed to achieve these objectives, extensive consideration for how to deal with certain obstacles was needed. Consistent review in the process allowed the research to remain free of the pitfalls common to this type of research. The following sections are organized chronologically.

4.4 Collecting Criteria for Consideration

The survey, as a traditional research strategy, requires collecting information from an appropriate research population using a set of prearranged standardized procedures. This qualitative data collection involved a source sample set which varies in institutional size, motivation, and program type to avoid the pitfalls of institutional bias. This method of investigation follows a multi-modal systematic design process. This research design employed data triangulation and data saturation. Three different sources were explored and analyzed to identify overlapping criteria deemed to be important. The collection of possible criteria involved the following three sources:

4.4.1 Research Literature

The first source was a preliminary review of the research on ranking construction programs to gather all previously proposed criteria and create a running list. The author included all criteria proposed by Smith and Badger (2006). Using a snowball approach, the search was expanded to academic literature concerning education-ranking systems used to rank engineering, business and medical schools. Criteria was included based on relevancy to construction programs. More than 50 scholarly publications were identified and reviewed. Using the ASCE Library, Google Scholar, and the Web of Science databases to search, the terms “ranking universities”, “rating universities”, and “rankings for engineering programs” respectively returned an impractical number of articles. The articles were filtered for relevance to the research objective. Ultimately, ten articles were chosen from which criteria was extracted. The majority of the articles were critiques, rather than explanations of the ranking systems. Only the Badger and Smith (2006) and the Williamson and Burt (2007) studies had any real substantive work on what criteria should be and is used when ranking universities or individual programs

within a university. The criteria extracted from these literature sources are reviewed in the findings section of this document.

4.4.2 Focus Group

The second source was construction academics employed at schools which are members of the ASC. On October 5th, 2018, at the annual ASC Region 5 Educators Conference in Dallas, Texas, an hour-long focus group discussion was held to hear ideas from university faculty. An invitation for the conference was offered to all faculty and administration of the 17 Region 5 ASC member schools. Each school has approximately eight to fifteen faculty which were invited. Thus, the proposed population of this source was greater than 140. From this population a sample was created from the faculty which attended the conference. The sample size was 21 which is an appropriate representation of the Region 5 ASC member schools. During this focus group notes were transcribed detailing each participant's discussion points and are compiled in the findings section. While this discussion was fruitful, the group spent considerable time discussing the legitimacy of such rankings, with a wide range of opinions being offered. Although this is considered a convenience sample, the sample group was comprised of faculty from construction programs which are considered very diverse. Ultimately, it was assumed this type of diversity would add to the overall validity and reliability of this research. The eleven participating schools represented an array of program sizes (faculty and student numbers), ages, geographic locations, tuition amounts, and many other factors.

4.4.3 Interviews

The final source was from a broader national sample of construction faculty. Interviews were held with experienced construction faculty from a variety of universities across the nation to avoid a regional bias. The sample is considered a convenience sample. The faculty which volunteered their time and expertise are colleagues of the mentor panel which is overseeing this research. This sample type was chosen due to time and commitment constraints common to collegiate academics. According to Adler and Ziglio (1996), selecting participants as experts for this type of study is very important. The selection process should ensure participants have:

- Extensive knowledge and experience with the issues under investigation
- A capacity and willingness to participate
- Sufficient time to participate in the study
- Effective communication skills

During the fall of 2018, approximately 18 emails were sent out soliciting help with this project, 15 of which positively responded. Over the course of the next six months a total of 12 interviews were held with the respective professors. All interviewees held at least a Ph.D. in a related field and were in some form involved as an administrator for their programs. The identities of these individuals have been kept confidential.

4.5 Developing the Interview Questions

There are several guiding principles that shaped the construction of the interview questions. The first was an understanding of who was being interviewed. These academics are extremely busy and were gracious enough to help with this research. The questions needed to be straight and to the point while allowing the interviewee as much latitude as they needed to deliver the suggestions. The next guiding principle stemmed from a need to avoid leading the participant. This research design seeks to avoid as much bias as possible and these questions were written with this in mind. The final guiding principle was opportunity. There are two questions which get to the substance of the interview. The first question comes early, and the second comes late. This method deviates from the classic frontloaded interview model but does so for opportunity. The hope was that after the initial question was answered we would circle back to the question in a different form later in the interview, to see if we had missed anything.

After the initial draft of questions was reviewed, several changes were made to the wording of questions, and several questions were eliminated to remain conscious of the participant's time. The interviewer also took the liberty of asking follow-up questions to the interviewee if clarification or further explanation was needed. The conversations were very informative and produced many interesting criteria. The interview questions that were used may be found in appendix B.

4.6 Phase 2 - Extracting and Eliminating the Criteria

During the initial efforts of criteria collection, a running list of criteria for each source was created for record keeping purposes and to allow comparison of criteria across all sources. In general, the lists were simple descriptive lists which used as much verbatim language from the source as possible. The focus group and interviews required the moderator and interviewer to record notes by hand, as participants were informed that they would not be recorded using an audio device. Audio recording was beyond the scope of this study, which was proposed to and accepted by the IRB at the University of Oklahoma. Transcribing an interview by hand may be seen as having the observational bias of the moderator, however it should be noted efforts were made to avoid this pitfall. The following rules were observed for each of the interviews and the focus group as per Robson (1993):

- When transcribing interviews and the ASC focus group session, every effort was taken to transcribe suggested criteria verbatim to accurately depict to the participants true meaning.
- During the interviews, leading or suggesting possible criteria was avoided. When clarification of proposed criteria was required, clarifying questions avoided verbiage which may have implanted an interpretation.
- Immediately following the interview, the transcripts were revisited to rectify any gaps in the material. Only concrete terms which can be recalled as a part of the interview were included.
- Possible personal interpretations, feelings, ideas and additions which were present in the transcript were either eliminated or denoted.
- When the interviews were revisited, all material, which was considered ambiguous and did not produce a clear and concise criterion, was eliminated.

These steps were taken in order to establish a concrete research method to collect these criteria, a shortcoming of the Badger and Smith (2006) study. Transcripts of both the focus group, and interviews can be found in Appendix C. Once the lists were compiled, a comparison of the criteria was required to find areas of overlap and eliminate criteria repetition.

There was extensive overlap of suggested criteria between the sources. Consolidating the collected criteria was performed using a well-defined and previously established method. The scissor and sort method was chosen to initially code and eventually consolidate the lists of criteria. The scissor and sort method, "… is sometimes called the cut and paste method, is a quick and cost effective method for analyzing a transcript of a focus group discussion" (Stewart & Shamdasani 2015). The first step involves the review of the transcript to identify those sections which are pertinent to the research questions. There were many opportunities to glean information from the transcripts, but most criteria were extracted from two questions:

- How do you measure the excellence of your program? What are the steps in this process?
- What criteria do you believe should be included when evaluating a construction program?

These two questions saw high levels of overlap concerning the answers and produced almost all interview proposed criteria. The next step in the scissor and sort technique requires all material be "cut out and sorted, so that all material relevant to a particular topic can be placed together." Once these materials had been sorted by topic, topic titles were chosen for organizational purposes. The following topic titles were chosen to sort the criteria into broader categories for organizational and clarity purposes: ***Students, Faculty, Funding, University/Department, & Curriculum/Classroom.*** Within these broad categories, criteria that were extracted from the sources were listed. It should be noted at this point in the research, all criteria were listed regardless of repetition to ensure meticulous attention to all suggested criteria. Therefore, with the high levels of repetition some content analysis was required to consolidate repetitive content.

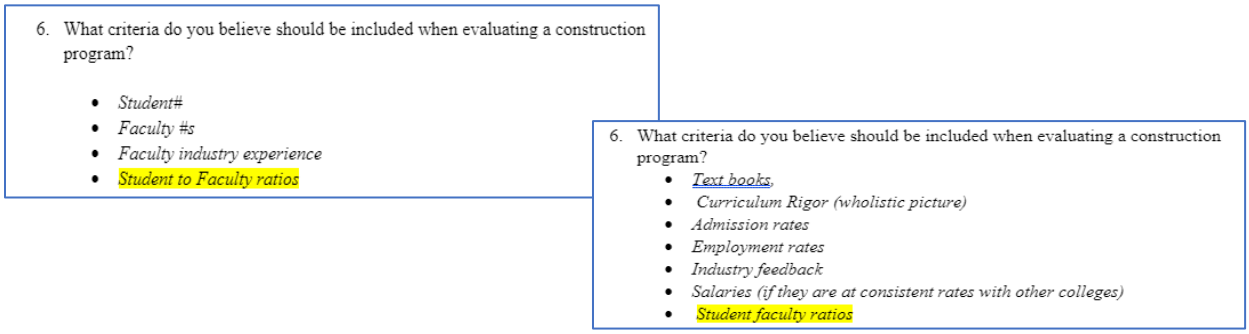

Figure 1: Example of repetitive content in an interview transcript

As suggested by Stewart and Shamdasani (2015), a simple semantic content analysis was employed. This requires the transcribed content to be examined for the frequency of certain descriptors. Descriptors are then analyzed for content and content units were then be created. For example, the criterion "faculty to student ratios" can be found overwhelmingly in all sources. However, the phrase "faculty to student ratio" may not have been employed, alternatively the phrase, "students per faculty member" may have been used, which produces an obvious overlap. In cases such as this, these terms were grouped together under the established content unit. However, if there was not a clear overlap, or certain terms left the suggested criterion ambiguous, the criterion was not grouped together. In appendix D a complete list of all suggested criteria can be found grouped by topic title. From the three sources, more than 200 suggestions were noted and consolidated into the 76 criteria seen in Table 3.

Table 3: Complete list of consolidated criteria

Students	**Faculty**	**Funding**	**University/Department**	**Curriculum/Classroom**
Student to Faculty Ratio	Degree Types of Faculty (Top Terminal)	Faculty Compensation	Program Title	Type of Degree
AIC Exam Participation and Outcomes	Years of Industry Experience	Size of Endowments	Program Structure (Stand alone or housed in a larger school)	ACCE/ABET Accreditation
Program Student Selectivity	% of Full time Faculty	Scale of Research Grants (Amount) *	Academic Reputation	Specialization (Industrial, Heavy Civil etc.)
Retention Rate	Class Load	Longevity of Research Grants (Amount)	Institutional Support for Program	Available Technology and Tools
Diversity (Rates of Underrepresented Students)	Faculty Satisfaction	Scholarships Available	Classification of Instructional Program (CIP) Code	Continual Curriculum Innovation
Student Satisfaction	Faculty Recognition	Industry Support	Program Size*	Hands on Labs/Experiences*
Student Recognition	Fund Raising Responsibility	Alumni Giving Rate	Program Age	Reputation within the Industry (Feedback and Adaptation)
Internship Programs and Opportunities	Faculty/Course Evaluations*		Program Growth	Rigor and Breadth of Curriculum
Alumni Prestige (Company Leadership and Ownership)	Continuing Education Requirements/Completion		Community Outreach	Service Learning Opportunities

Average Grades Given	Conference Proceedings Publications		University Focus (Research, Teaching)	Capstone Offerings and Requirements
Student Employment Placement Rates	Journal Publications		Active Industry Advisory Board	Internship Oversight
Average Starting Salaries after Graduation	Service to Community		Qualitative Comments on Accreditation Reports	Modernized Facilities
% of Student Participation in Competition Teams	Quality of Faculty***		Job fair Opportunities (Student attendance, Company Attendance, Company Diversity)	Available Space for Growth
Study Abroad Opportunities (Cultural Immersion)	% of Adjunct Faculty		Cost to Benefit Ratio (Tuition and fees vs value of school)	Post Graduate Offerings (Masters PhD)
Student Competition Outcomes	Faculty Credentials***		Parent Perception	% Online
Diversity of Employment Position Types	Professional Organization Activity			
Student Completion Time Tables	Research Productivity and Implementation by the Industry			
Pre and Post Internship Feedback from Industry	Engagement with ASC			
	Direct Availability to Students			
	Faculty Experience in Pedagogical Areas			

The Likert survey was developed but determined to be overly burdensome and time-consuming than was practical for participants. The original survey was more than eight pages long and could not reasonably be completed by participants in a timely manner. Furthermore, the criteria were vague and further explanation through basic definition was needed. This preliminary eight pages would have been three to four times more if all necessary information was added. It was obvious the survey needed to be condensed to ensure high levels of participation in the survey. Professors, most with an administrative role at their universities, seemed exceptionally well equipped to determine what criteria would be appropriate when measuring the excellence of a construction program. The challenge we face with this type of participant is availability or a

general time constraint. Moreover, as will be discussed later in this work, the participants were asked to participate multiple times in the study. Thus, it was determined the list of 76 criteria needed to be narrowed if possible. The time burden placed on participating professors was deemed to be too great and would lead to a marked lack of participation. In turn, this would diminish the reliability of the research. To mitigate this issue several questions were identified that established the basis for further narrowing the list of criteria.

1. Specifically, how measurable are these criteria, and what sort of effort would go into collecting the data form the measurement?
2. Were the criteria mentioned by all the sources? Are they important to all sources or just one?
3. How many times were the criteria mentioned in the one on one interviews?

The author decided to eliminate criteria based on three hinge points, measurability, triangulation, and saturation.

4.6.1 Measurability

"There are, admittedly, major differences in the style between many of those who do studies producing qualitative data, and those whose studies produce quantitative data" (Robson 1993). This project falls firmly inside the mixed method category. His research has attempted to create a qualitative study (the excellence of construction programs) based on quantitative measures. Ideally, each measure in the rating system is based on a quantifiable metric. Obviously, some criteria are far more quantifiable than others. For example, if defined properly, "retention rate" is clearly measurable. While the nuance in "continual curriculum improvement" makes measuring this criterion much more subjective. Ultimately, measurement levels were created, high, medium, and low to allow a score to be assigned to each criterion. To achieve a score of "high" a criterion needed to be universally reported, definable, public information. To achieve a score of "medium" a criterion would be internally reported requiring self-survey techniques, subjective in nature, and largely absent of hard data. To achieve a score of "low" a criterion would have no current reporting practices, completely subjective measures required, no appropriate way to compare discovered differences. Table 4 illustrates how measurability scores were assigned.

Table 4: Scoring metrics for assigning measurability

Measurability		
High- 3 pts	Medium- 2pts	Low-1pt
Universally reported, definable, public information	Internally reported requiring self-survey techniques, Subjective in nature, and largely absent of hard data	No current reporting practices, completely subjective measures required, no appropriate way to compare discovered differences.

4.6.2 Triangulation

To exhaust the various sources of criteria selection, multiple methods of data collection were employed. Commonly this is referred to as "permitted triangulation" (Denzin 1988). In this research, and in the work of Denzin (1988) the idea of "where it is" has been adapted to reveal how important it is to the three separate sources. All three sources are basically addressing the same research question, what criteria should be considered when measuring the excellence of a construction program? Therefore, it follows that we would be interested if all three sources agreed on certain criteria. Congruent to measurability, the levels of high, medium, and low were created and defined to allow a score to be assigned to each criterion. There was an obvious parallel between how many sources cited the criterion, and how many points it would receive.

Table 5: Scoring metrics for assigning triangulation

Triangulation		
High-3 pts	Medium 2-pts	Low-1pt
Mentioned in all three sources: Literature, Focus Group, and Interviews	Mentioned in two sources: Literature, Focus Group, and Interviews	Mentioned in only one source: Literature, Focus Group, and Interviews

4.6.3 Saturation

The source which produced the highest number of criteria was the one on one interviews with the professors. It is predictable because these participants have a vested interest and are, in most cases, responsible for the excellence of their respective programs. It would follow they are best equipped to offer suggestions as to what criteria were important. The original pool of interviewees was 12. Consequently, the levels of high, medium and low were created by dividing

the group of 12 into thirds. High saturation was assigned if 9-12 participants had voiced the criterion. Medium saturation was assigned if 5-8 participants mentioned the criteria, while low was assigned if 1-4 participants suggested the criterion. Table 6 illustrates the saturation scores.

Table 6: Scoring metrics for assigning saturation

Saturation		
High- 3pts	Medium- 2pts	Low- 1pt
If 12 to 9 participants mentioned this during the one on one interviews	If 8 to 5 participants mentioned this during the one on one interviews	If 4 to 1 participants mentioned this during the one on one interviews

Each criterion was considered and assigned a score in this elimination framework. Finally, a summation of the scores for an individual criterion then produced an overall score for the criterion. If a criterion had a cumulative score lower than 6 it was eliminated from consideration. Figure 2 illustrates the cumulative scores from several criteria, in an attempt to show a brief representation of the elimination portion of this research. The full table may be found in appendix D.

Proposed Criteria	Literature	ASC Focus Group	Interviews	Measurability	Triangulation	Saturation	Score
Students							
Student to Faculty Ratio	✓	✓	✓	High	High	High (10)	9
AIC Exam Participation and Outcomes	✓	✓	✓	High	High	Low (2)	7
Program Student Selectivity	✓		✓	High	Medium	Medium (6)	7
Retention Rate	✓		✓	High	Medium	High (10)	8
Diversity (Rates of Underrepresented Students)	✓		✓	High	Medium	High (10)	8
Student Satisfaction	✓	✓	✓	Low	High	High (10)	7
Student Recognition	✓	✓	✓	Low	High	Low (2)	5
Internship Programs and Opportunities	✓		✓	Low	Medium	High (9)	6
Alumni Prestige (Company Leadership and Ownership)	✓		✓	Low	Medium	Low (1)	4
Average Grades Given			✓	Medium	Low	Low (1)	4
Student Employment Placement Rates		✓	✓	High	Medium	High (12)	8
Average Starting Salaries after Graduation			✓	Medium	Low	Low (2)	4
% of Student Participation in Competition Teams			✓	High	Low	Medium (6)	6
Study Abroad Opportunities (Cultural Immersion)			✓	Low	Medium	Low (2)	4
Student Competition Outcomes			✓	High	Low	Low (2)	5
Diversity of Employment Position Types		✓	✓	Medium	Medium	Low (1)	5
Student Program Completion Time Tables			✓	High	Low	Low (1)	5
Pre and Post Internship Feedback from Industry			✓	High	Low	Low (1)	5

Figure 2: Cumulative score table

The complete table further explains the elimination or difficulty inherent to the criteria. It must be noted here that the elimination of these criteria poses a major limitation to this research. Theoretically, all criteria should be objectively measured and weighed into the rating of a construction program. However, as Robson (1993) points out, "real world" studies have inherent constraints and researchers must remain sensible concerning time and resources, when considering research goals. Looking at the professional staff writers, data analysts, and project managers employed by the US News and World Report, it becomes obvious that including all suggested criteria and developing metrics for each would be vastly beyond the scope of this work.

4.7 Phase 3 - Delphi Technique

The research design of this project required a comprehensive collection of as many criteria, from every appropriate academic source possible. This type of snowball data collection is unstructured and consequently many of the criteria were nuanced and open to interpretation. The possible pitfalls of this data collection exist in the interpretation (observer error) while transcribing as a moderator or interviewer. Personal and institutional bias was a concern when verbiage for the proposed criteria was created. This concern led to the selection of a modified Delphi Method to ensure there was an external approval of the suggested criteria. The modified Delphi Method became phase three of the research.

Created by Norman Dalkey in the 1950s, the Delphi method was initially used to explore opinions concerning munitions output in the US. Dalkey used seven experts, and through iteration developed a consensus within those expert opinions. The classic Delphi according to Row and Wright (1999) is characterized by four distinct features:

- **Anonymity of Delphi participants** allows the participants to freely express their opinions without undue social pressures to conform from others in the group. Decisions are evaluated on their merit, rather than who has proposed the idea.
- **Iteration** allows the participants to refine their views in light of the progress of the group's work from round to round.

- **Controlled feedback** informs the participants of the other participant's perspectives and provides the opportunity for Delphi participants to clarify or change their views.
- **Statistical aggregation of group response** allows for a quantitative analysis and interpretation of data.

The Delphi technique is particularly adept at solving complex problems by virtue of its flexibility. A quick precursory database search of the Delphi technique uncovers its extensive use by academics (Skulmoski, Hartman & Krahn 2007). The Delphi essentially allows researchers to facilitate group problem solving by structuring and informing the communication process. This method has been employed to facilitate qualitative forecasting (Rowe & Wright 1999), applied to program planning and administration (Delbeg, Van de Ven & Gustafson 1975), as well as when incomplete knowledge about a problem exists (Adler and Ziglio 1996). In each of these studies, the Delphi method was adapted to fit the unique needs of the study, while adhering to rigorous research methods. In this research the Delphi was modified to only include the quantified data or mean scores for each criterion.

This research resembles the work of Adler and Ziglio (1999) that leveraged the subjective judgements of a panel of experts. This panel was selected for their expertise in developing the excellence of their academic programs and is also representative of the larger pool of construction programs across the United Sates. This assertion ultimately allows a generalization to be applied to the research outcome. The Delphi technique was employed to form a consensus concerning three important factors, which lends validity to the rating system in the future.

1. The panel needed to establish agreement on which criteria would be considered for the rating system.
2. The panel needed to approve the proposed definition for each criterion. These two objectives were accomplished in the initial survey, and the exact methods utilized to accomplish this will be discussed in later sections.

3. A generalized consensus of the relative weights of each accepted criterion needed to be established. Methods and formulas to accomplish this objective is outlined in later sections.

The flexibility of the Delphi technique aided in accomplishing these goals. Following the technique's iterative design, feedback from both the focus group and interviews was included as part of the surveys. Figure 3 (below) illustrates the basic format for the Delphi technique.

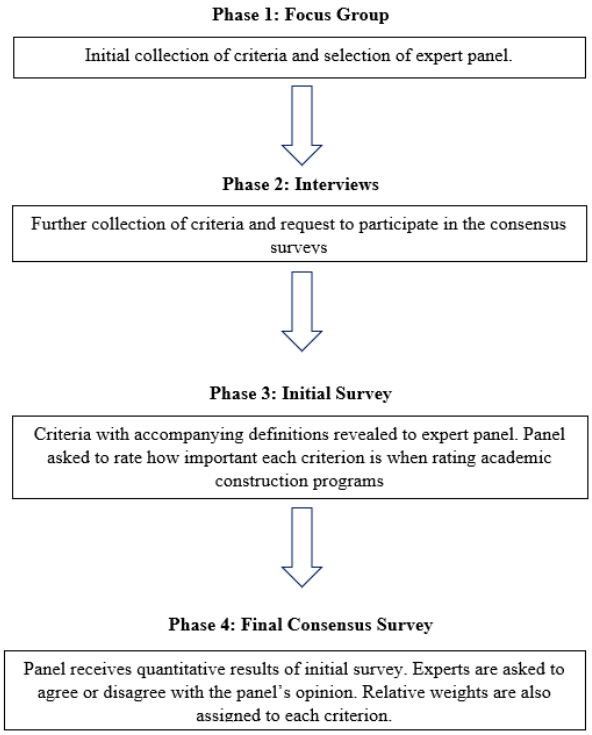

Figure 3: Basic Delphi format

The Delphi method heavily relies on the expertise of the respondents. The internal validity of this method comes specifically from this expertise and it is important to outline the experts as they were used in this study. Chosen mainly based on their position, requests to participate came from members of the OU CNS faculty. Only colleagues that were considered experts in construction academia were asked to participate. Table 7 contains the relative information on the subject matter experts (SME).

Table 7: Position and years of experience of the SMEs

	Current Position	Years of Experience	Industry Experience
Respondent 1	Senior Professor & Program Director	16.5	30
Respondent 2	Professor and Department Chair	25	6
Respondent 3	Associate Professor & Program Chair	13	8
Respondent 4	Professor and Department Chair	19	5
Respondent 5	Associate Professor & Program Chair	31	8
Respondent 6	Associate Professor & Department Chair	14	3
Respondent 7	Professor and Program Director	21	20
Respondent 8	Associate Professor & Program Chair	31	10

4.8 Developing the First Round of Delphi Survey

Addressing a research objective with a survey can present many obstacles which need to be navigated to ensure the research goals are properly addressed. The initial collection of criteria produced many disparate criteria. The criteria were then consolidated using the scissor and sort method. The initial interpretation of the criteria was distilled down to 76 criteria, which can be found in appendix D. Along with accompanying survey explanation and Likert scales, the criteria comprised eight pages of survey. Through investigation of measurability, triangulation, and saturation, the elimination process further distilled the list down to 31 criteria. It was then further reduced to eliminate certain criteria based on the fundamental subjectivity of the criteria. For example, “Type of Degree” was innately charged with subjectivity. It was agreed that there would be no practical way to objectively measure one degree type as better than another. Therefore, criteria which suffered from this highly subjective nature were eliminated from consideration.

While the scissor and sort method used to consolidate the criteria was needed to narrow down the collected criteria, it produced overly vague condensed versions of the criteria. These abbreviated versions of the criteria were well suited to act as the idea placeholders during discussions and for organizational purposes, but these broad categorical titles needed to be better defined. Thus,

definitions were written for the 21 criteria that were considered. Many of these definitions were simply duplications of definitions commonly used by university institutional research and review departments and did not need to be further defined.

The initial survey began with two self-reporting questions, which were used to draw reportable background information on the panel participants.

- How many years have you worked in academia?
- Prior to your current academic position, how many years did you work in the construction industry?

These two questions were reported in the findings section of this work and establishes credibility for the panel of experts. The third block was used as instructions for the remaining blocks. The initial survey needed to quantify the relative opinions of the committee towards a particular criterion. This relative opinion was reported back to the panel prior to the second round of surveys. A 0-6 Likert scale was chosen as the reporting measure. A score of 0 represented the opinion that the criteria did not belong in the rating system, while a score of 6 represented the opinion that the criteria must be included in the rating system. The criteria were presented in a broad categorical format, which was bolded. The broad bolded criteria were followed by a more exacting and explanatory definition as written and critiqued during the development of the survey. The 0-6-point Likert scale accompanied the first two elements, and the question block concludes with a comments space. This comments space was inserted to solicit feedback for the definitions. As was previously stated, the second goal of the initial survey was for the panel to approve the proposed definitions for the criteria. Appendix E contains instruction and example question blocks used for the survey.

4.9 Developing the Second Round of Delphi Survey

Once the initial survey window closed, the individual answers were sorted, and the data was compiled. Several objectives were reaffirmed, and research parameters were adjusted to accommodate the data collected. By research design, the Delphi technique requires all data be revealed to the expert panel. This assertion gives additional direction to the second survey. An online survey platform was used to issue and track both surveys. After lengthy consideration of

what was useful to the panel, it was decided simply including a mean and standard deviation was optimal.

After the data was revealed to the panel, the survey needed to capture individual approval of the accepted or rejected criteria. The Likert scale was 0-6, thus the consensus for elimination was set at the midway point, three. Any criteria whose mean score was less than three is eliminated by the panel, where as any criteria whose mean score was equal to or greater than three would be accepted.

Ultimately, this parameter was set to establish a consensus among the panel of experts to ascertain whether a certain criterion should be considered when rating the excellence of a construction program. The first block of the survey was instruction concerning the next matrix table.

The first matrix table was set up as a bipolar table, in which the respondents could agree or disagree with the panel's opinion. The first section of the table was reserved for those criteria which had been accepted, and the second section included those criteria that had been rejected. In order to reveal the panel's general opinion, mean scores and standard deviation were listed with each criterion. Additionally, two more matrix tables were added to collect supplementary information concerning the suggested criteria.

First, it was observed that even though relative weights could be assigned to criteria based on the initial survey mean scores, those scores would not differentiate numerically between criteria to allow proper weights to be assigned. Therefore, it was determined a new 10-point Likert scale would need to be added to ensure weights were properly assigned. The directions for this table asked respondents to assume that all criteria would be accepted.

Additionally, a third matrix table was added inquiring which criteria were currently being tracked by the respondents' home university. This matrix table gathered data which will evaluate the availability of the data on each criterion.

4.10 Conclusion

The research methods proposed in this section were developed to objectively establish the criteria that should be considered when measuring the excellence of a construction programs.

The first phase entailed the research method development and collecting the criteria as proposed by three distinct sources. Once the criteria were selected, the study entered the extracting and eliminating criteria phase. Phase two consisted grouping and organizing the criteria, and then determining what criteria was practical. The criteria were evaluated in terms of measurability, triangulation and saturation, to determine the applicability of each criteria. The three evaluative terms were scored on a 1-3 point scale. A cumulative score was then assigned to each criterion. To eliminate superfluous criteria a parameter was set, and only those criteria that scored above a six were then considered for the first Delphi survey.

The final phase in the research method established reliability for this study. Following the Delphi method, a panel of eight experts was asked to score the importance of each criteria using a Likert scale. The data was compiled once the survey was returned, and the results were analysed so a consensus could be built. The second survey revealed the results of the first survey, and asked the panel to come to an agreement of what criteria should be considered when measuring the excellence of construction programs.

5.0 Findings

The findings of this research will be covered in four broad sections, 1) the collected criteria, 2) extraction and elimination of criteria, 3) initial survey, and finally, 4) the secondary survey. These four categories of findings are based, in part, on the process of data collection. Each subsection will be listed within the broader section to allow for continuity of the findings.

5.1 Collected Criteria

The snowball approach to the literature review, revealed several articles which were rich with criteria, but an overall dearth of academic work on ranking academic programs. This may be the case because many ranking systems are published for profit and therefore proprietary. It would not be in the organizations best interest to publish those methods used to rank schools, because imitation sites may publish rankings using those same methods. Nonetheless, the Badger and Smith (2006) article covered the majority of the criteria found by the literature review.

Literature Review

The primary source for the criteria that was captured by the literature review was that of the Badger and Smith's article. The list was categorized and defined. Furthermore, this comprehensive list of criteria was focused specifically on rating construction programs. It was also written with many of the same objectives of this research, which made it extremely fruitful. While the nine other articles which were used offered ranking critiques, they did not specifically mention or propose criteria. Only through anecdotal elements could possible criteria be gleaned. The following table (Table 8) contains the 37 criteria found in the literature search.

Table 8: Literature search criteria

Students	***Faculty***	***Funding***	***University and Department***	***Curriculum and Classroom***
Student to Faculty Ratio	Degree Types of Faculty (Top Terminal)	Faculty Compensation	Program Title	Type of Degree
AIC Exam Participation and Outcomes	Years of Industry Experience	Size of Endowments	Program Structure (Stand alone or housed in a larger school)	ACCE/ABET Accreditation

Students	*Faculty*	*Funding*	*University and Department*	*Curriculum and Classroom*
Program Student Selectivity	% of Full time Faculty	Scale of Research Grants (Amount)	Academic Reputation	Specialization (Industrial, Heavy Civil etc.)
Retention Rate	Class Load	Longevity of Research Grants (Amount)	Institutional (University) Support for Program	Available Technology and Tools
Diversity (Rates of Underrepresented Students)	Faculty Satisfaction	Scholarships Available from an External Source		Continual Curriculum Innovation
Student Satisfaction	Faculty Recognition	Scholarships Available		
Student Recognition	Fund Raising Responsibility	Industry Support		
Internship Programs and Opportunities	Faculty/Course Evaluations	Alumni Giving Rate		
Alumni Prestige (Company Leadership and Ownership)	Continuing Education Requirements/Completion			
	Conference Proceedings Publications			
	Journal Publications			

Focus Group

The focus group occurred early in the research process, during the fall 2018 ASC Educators' Conference. The 21 participating professors represented eleven universities from across the southern United States. The focus group was slated to occur toward the end of the final conference session. After the topic was introduced, the immediate response of the participants was to debate the usefulness and accuracy of university rankings in general. A member of the focus group pointed out that, "because of location and industry demand, my university focuses on highway heavy civil construction. How do you compare my school to one specializing in commercial construction?" Once the group was verbally guided beyond this debate, participant

began to suggest criteria. As each new criterion was offered, discussions of how the criteria should be measured, what the exact definition should be, and the criteria's potential to benefit or punish various schools ensued. One participant offered, "You need to look at what schools offer, the types of tools they are given." Thus, the criteria "skills acquired" was added to the list of suggested criteria. The table below (table 9) contains all criteria suggested by the focus group.

Table 9: Focus group criteria

Students	***Faculty***	***Funding***	***University and Department***	***Curriculum and Classroom***
Student to Faculty Ratio	Degree Types of Faculty (Top Terminal)	Size of Endowments		Type of Degree
AIC Exam Participation and Outcomes	Years of Industry Experience	Scale of Research Grants (Amount)		Specialization (Industrial, Heavy Civil etc.)
Student Satisfaction	Faculty Recognition	Longevity of Research Grants (Amount)		Available Technology and Tools
Student Recognition	Fund Raising Responsibility	Scholarships Available from an External Source		Continual Curriculum Innovation
Student Employment Placement Rates				Reputation within the Industry (Feedback and Adaptation)
Diversity of Employment Position Types				Skills Acquired

Interviews

By far the most fruitful source for criteria was the one on one interviews. Each interview was scheduled to be approximately 30 minutes, however the conversations commonly extended well beyond an hour. Each interviewee was sent the interview questions prior to the interview, and all interviews were conducted by phone. The participants were selected by their general willingness to participate in this project and because of their direct involvement with the administration of their respective programs. Each interview produced unique results and the transcripts from each interview are found in appendix C. Similar to the focus group the participants voiced reservations about ranking as a common practice. When asked if they thought a rating system would be useful, one participants response was particularly salient, "Many people are against it. Educators are a community, if you introduce a ranking system it becomes a competition. People

are no longer willing to share and work together to improve as a whole." Regardless of these feelings the interview participants were very cooperative and forthright. These interviews were, in fact, so comprehensive and thorough, that no other source would have been necessary, as all criteria from other sources can be identified in the interviews. The table below (table 10) contains all criteria suggested by the interview participants.

Table 10: Interview criteria

Students	***Faculty***	***Funding***	***University and Department***	***Curriculum and Classroom***
Student to Faculty Ratio	Degree Types of Faculty (Top Terminal)	Faculty Compensation	Program Title	Type of Degree
AIC Exam Participation and Outcomes	Years of Industry Experience	Size of Endowments	Program Structure (Stand alone or housed in a larger school)	ACCE/ABET Accreditation
Program Student Selectivity	% of Full time Faculty	Scale of Research Grants (Amount)	Academic Reputation	Specialization (Industrial, Heavy Civil etc.)
Retention Rate	Class Load	Longevity of Research Grants (Amount)	Institutional (University) Support for Program	Available Technology and Tools
Diversity (Rates of Underrepresented Students)	Faculty Satisfaction	Scholarships Available from an External Source	Classification of Instructional Program (CIP) Code	Continual Curriculum Innovation
Student Satisfaction	Faculty Recognition	Scholarships Available	Program Size	Hands on Labs/Experiences
Student Recognition	Fund Raising Responsibility	Industry Support	Program Age	Reputation within the Industry (Feedback and Adaptation)
Internship Programs and Opportunities	Faculty/Course Evaluations	Alumni Giving Rate	Program Growth	Rigor and Breadth of Curriculum
Alumni Prestige (Company Leadership and Ownership)	Continuing Education Requirements/Completion		Community Outreach	Service Learning Opportunities
Average Grades Given	Conference Proceedings Publications		University Focus (Research, Teaching)	Capstone Offerings and Requirements
Student Employment Placement Rates	Journal Publications		Active Industry Advisory Board	Internship Oversight

Average Starting Salaries after Graduation	Service to Community	Qualitative Comments on Accreditation Reports	Modernized Facilities
% of Student Participation in Competition Teams	Quality of Faculty***	Job fair Opportunities (Student attendance, Company Attendance, Company Diversity)	Available Space for Growth
Study Abroad Opportunities (Cultural Immersion)	% of Adjunct Faculty	Cost to Benefit Ratio (Tuition and fees vs value of school)	Post Graduate Offerings (Masters PhD)
Student Competition Outcomes	Faculty Credentials***	Parent Perception	% Online
Diversity of Employment Position Types	Professional Organization Activity		
Student Program Completion Time Tables	Research Productivity and Implementation by the Industry		
Pre and Post Internship Feedback from Industry	Engagement with ASC		
	Direct Availability to Students		
	Faculty Experience in Pedagogical Areas		

5.2 Extracting and Eliminating Criteria

The three sources combined to produce well over 200 disparate criteria. The scissor and sort method consolidated the criteria into 76 different criteria. These criteria were sorted into five different sections. The first section, students, contains 18 criteria. Table 11 presents the criteria and denotes three things:

- The first three columns following the "Proposed Criteria" column are the criteria's origination locations from which they were extracted.
- The next three columns are the scoring columns used to eliminate criteria from consideration.
- Finally, a cumulative score is listed. All included criteria are highlighted in green.

Table 11: Scoring table for the student category

Proposed Criteria	Literature	ASC Focus Group	Interviews	Measurability	Triangulation	Saturation	Score
Students							
Student to Faculty Ratio	X		X	High	High	High (10)	9
AIC Exam Participation and Outcomes	X	X	X	High	High	Low (2)	7
Program Student Selectivity	X	X	X	High	Medium	Medium (6)	7
Retention Rate	X		X	High	Medium	High (10)	8
Diversity (Rates of Underrepresented Students)	X		X	High	Medium	High (10)	8
Student Satisfaction	X	X	X	Low	High	High (10)	7
Student Recognition	X	X	X	Low	High	Low (2)	5
Internship Programs and Opportunities	X		X	Low	Medium	High (9)	6
Alumni Prestige (Company Leadership and Ownership)	X		X	Low	Medium	Low (1)	4
Average Grades Given			X	Medium	Low	Low (1)	4
Student Employment Placement Rates		X	X	High	Medium	High (12)	8

Average Starting Salaries after Graduation			X	Medium	Low	Low (2)	4
% of Student Participation in Competition Teams			X	High	Low	Medium (6)	6
Study Abroad Opportunities (Cultural Immersion)			X	Low	Medium	Low (2)	4
Student Competition Outcomes			X	High	Low	Low (2)	5
Diversity of Employment Position Types		X	X	Medium	Medium	Low (1)	5
Student Program Completion Time Tables			X	High	Low	Low (1)	5
Pre and Post Internship Feedback from Industry			X	High	Low	Low (1)	5

Table 12 contains criteria related to university faculty and the teachers and staff entrusted to facilitate program success. The twenty criteria in the faculty category presented several problems from a measurability standpoint. As can be seen by the saturation numbers, the focus of the interview participants was central to the student. One of the first interview participants, put it very clearly, “Primarily we are a teaching faculty, so we measure excellence by ascertaining how well students are doing through an exit survey. Would they recommend this university to a friend, if they would it means they are getting a good experience, so basically the student perspective is very important.” This theme was present throughout all of the interviews, and student success/learning was almost universally mentioned as the “most important” criteria. Although there were more proposed criteria for the faculty category, the sources mentioned them less often.

Table 12: Scoring table for faculty category

Proposed Criteria	Literature	ASC Focus Group	Interviews	Measurability	Triangulation	Saturation	Score
Faculty							
Degree Types of Faculty (Terminal)	X	X	X	Medium	High	Low (3)	6
Years of Industry Experience	X	X	X	Medium	High	High (9)	8
% of Full time Faculty	X		X	High	Medium	Medium (6)	7
Class Load	X		X	Medium	Medium	Low (1)	5
Faculty Satisfaction	X		X	Low	Medium	Low (2)	4
Faculty Recognition	X	X	X	Medium	High	Medium (6)	7
Fund Raising Responsibility	X	X	X	Medium	High	Low (1)	6
Faculty/Course Evaluations*	X		X	Low	Medium	Medium (8)	5
Continuing Education Requirements-Completion	X		X	Medium	Medium	Low (2)	5
Conference Proceedings Publications	X		X	High	Medium	Medium (7)	7
Journal Publications	X		X	High	Medium	Medium (7)	7
Service to Community			X	Low	Low	Low (4)	3
Quality of Faculty			X	Low	Low	Medium (6)	4
% of Adjunct Faculty			X	High	Low	Medium (6)	6
Faculty Credentials			X	High	Low	Low (3)	5

Professional Organization Activity			X	Low	Low	Low (1)	3
Research Productivity and Implementation by the Industry			X	Medium	Low	Low (1)	4
Engagement with ASC			X	Medium	Low	Low (1)	4
Professional Organization Activity			X	Low	Low	Low (1)	3
Research Productivity and Implementation by the Industry			X	Medium	Low	Low (1)	4
Engagement with ASC			X	Medium	Low	Low (1)	4
Direct Availability to Students			X	Low	Low	Low (1)	3
Faculty Experience in Pedagogical Areas			X	Medium	Low	Low (1)	4

The funding category focuses on the monetary metrics of programs and universities and contains eight criteria. Every criterion was offered by at least two sources, indicating the importance of these funding criteria. However, during the focus group and the interviews, participants made it clear that this was a contentious subject and would favor certain well-funded schools over others. It was mentioned numerous times that money plays a role but can be meaningless when comes to the quality of the education offered. More than one of the participants expressed strong reservations against including funding as a criterion for measuring excellence.

Table 13: Scoring table for funding category

Proposed Criteria	Literature	ASC Focus Group	Interviews	Measurability	Triangulation	Saturation	Score
Funding							
Faculty Compensation	X		X	Medium	Medium	Low (4)	5
Size of Endowments	X	X	X	High	High	Low (3)	7
Scale of Research Grants (Amount)	X	X	X	High	High	Low (2)	7
Longevity of Research Grants (Amount)	X	X	X	High	High	Low (1)	7
Scholarships Available from an External Source	X	X	X	High	High	Low (1)	7
Scholarships Available	X		X	High	Medium	Low (2)	6
Industry Support	X		X	Medium	Medium	High (9)	7
Alumni Giving Rate	X		X	Medium	Medium	Low (1)	5

The university/department category encompasses all those attributes which are considered at the university or department level. Many of these criteria are currently tracked internally by respective universities, but the methods of tracking may differ greatly. The majority of these criteria were offered by the interview participants, presumably because these individuals are involved with their university at the executive level and have insight into the limitations of programs at a department level. While discussing the department structure at this participant's university, they offered, "Programs suffer from what I call the "identity crisis. They are housed in different colleges, Business, Architecture, Engineering, Design etc. but we all serve the construction industry. Endowments are needed. Construction programs don't belong in

colleges, they should stand alone." As table 14 indicates, many of these criteria were not included, due to low levels of triangulation and saturation.

Table 14: Scoring table for university/department category

Proposed Criteria	Literature	ASC Focus Group	Interviews	Measurability	Triangulation	Saturation	Score
University or Department							
Program Title	X		X	Medium	Medium	Low (1)	5
Program Structure (Stand alone or housed in a larger school)	X		X	Medium	Medium	Low (3)	5
Academic Reputation	X		X	Medium	Medium	Medium (5)	6
Institutional (University) Support for Program	X		X	Medium	Medium	Low (2)	5
Classification of Instructional Program (CIP) Code			X	Medium	Low	Low (3)	4
Program Size			X	Medium	Low	Low (2)	4
Program Age			X	High	Low	Low (2)	5
Program Growth			X	High	Low	Medium (6)	6
Community Outreach			X	Low	Low	Low (1)	3
University Focus (Research, Teaching)			X	High	Low	Low (1)	5
Active Industry Advisory Board			X	High	Low	High (10)	7
Qualitative Comments on			X	Low	Low	Low (1)	3

Accreditation Reports							
Job fair Opportunities (Student attendance, Company Attendance, Company Diversity)			X	High	Low	Medium (5)	6
Cost to Benefit Ratio (Tuition and fees vs value of school)			X	Medium	Low	Low (1)	4
Parent Perception			X	Low	Low	Low (2)	3

Finally, the curriculum/classroom category pertains to the actual dissemination of knowledge to the students and contained 15 of the 76 criteria. While many of these criteria have obvious influence over the quality of an education. As one interview participant explained, "The industry is poised to change completely, and we are on the front edge to see that. We are well placed to help facilitate and even lead the change within the industry." This obviously points to a need for continuous curriculum review and innovation. However, it was observed that these criteria suffer from a lack of measurability, and without properly developed metrics and ample resources these criteria may be deeply flawed. As indicated by table 15, only 4 of the 15 criteria were included.

Table 15: Scoring table for the curriculum/classroom category

Proposed Criteria	**Literature**	**ASC Focus Group**	**Interviews**	**Measurability**	**Triangulation**	**Saturation**	**Score**
Curriculum/ Classroom							
Type of Degree	X	X	X	Medium	High	Low (2)	6
ACCE/ABET Accreditation	X		X	High	Medium	High (11)	8

Specialization (Industrial, Heavy Civil etc.)	X	X	X	Medium	High	Low (3)	6
Available Technology and Tools	X	X	X	Low	High	Low (2)	5
Continual Curriculum Innovation	X	X	X	Low	High	Medium (7)	6
Hands on Labs/Experiences			X	Medium	Low	Medium (6)	5
Reputation within the Industry (Feedback and Adaptation)		X	X	Low	Medium	Medium (5)	5
Rigor and Breadth of Curriculum			X	Low	Low	Low (4)	3
Service Learning Opportunities			X	Low	Low	Low (4)	3
Capstone Offerings and Requirements			X	Low	Low	Low (1)	3
Internship Oversight			X	Low	Low	Low (1)	3
Modernized Facilities			X	Low	Low	Low (1)	3
Available Space for Growth			X	Low	Low	Low (2)	3
Post Graduate Offerings (Masters PhD)			X	High	Low	Low (4)	5
% Online			X	Medium	Low	Low (2)	4
Type of Degree			X	Medium	High	Low (2)	6

5.3 Responses from First Round of Delphi Survey

The initial survey was distributed just after the 2019 spring semester ended and took approximately four weeks to be returned. Of the twelve surveys sent, eight were completed and returned. The first objective of the initial survey was to compile years of cumulative industry and academic experience of the participants. The eight participants combined have spent a total of 170 years in academia and prior to their employment in academia, a total of 90 years in the construction industry. The second objective of the initial survey was to measure the general opinion of the included criteria and get feedback on the criteria's proposed definitions. To quantify the general opinion, the mean was calculated and included. The standard deviation was also calculated to show the spread or deviation from the mean. The relative importance or weight of the criteria in comparison to the other criteria was calculated by dividing the mean by the total max score a criterion could receive. As was mentioned previously, any criteria whose mean score was less than three is eliminated by the panel, where as any criteria whose mean score was equal to or greater than three would be accepted. Below, Table 16 contains all data revealed to the participants on the second survey.

Table 16: First Delphi survey results

Criteria ****Included Criteria***	***Mean***	***Std Deviation***	***Relative Importance***
1. Student Employment Placement Rates	5.75	.43	**0.96**
2. Years of Industry Experience	5.25	.66	**0.88**
3. ACCE/ABET Accreditation	5.25	.83	**0.88**
4. Industry Support	5.13	.6	**0.86**
5. Student to Faculty Ratio	5	1	**0.83**
6. % of Full time Faculty	5	.5	**0.83**
7. Scholarships Available	4.63	.86	**0.77**
8. Continual Curriculum Innovation	4.63	.86	**0.77**
9. Retention Rate	4.5	1.32	**0.75**
10. Faculty Recognition	4.25	.66	**0.71**
11. % of Student Participation in Competition Teams	4.13	.93	**0.69**
12. Diversity (Rates of Underrepresented Students)	3.88	1.27	**0.65**
13. Size of Endowments	3.88	1.62	**0.65**
14. Program Student Selectivity	3.75	1.39	**0.63**

15. Degree Types of Faculty (Top Terminal)	3.75	1.56	**0.63**
16. Conference Proceeding Publications	3.5	.87	**0.58**
17. AIC Exam Participation and Outcomes	3	1.8	**0.5**
18. Journal Publications	3	1.41	**0.5**
******Not Included***			
19. Scale of Research Grants (Amount) *	2.5	1.58	**0.42**
20. Program Growth	2.38	2.23	**0.40**
21. Longevity of Research Grants (Amount)	2.13	1.62	**0.36**

5.4 Responses from Second Round of Delphi Survey

The second round of surveys was released after the start of the 2019 fall semester, 65 days after the initial survey closed. Again, the questionnaire was sent to the same 12 participants, but it was important this round that the original eight which had responded to the first survey responded to the second survey. All eight surveys were completed and returned within four weeks.

The consensus rate was established by asking respondents if they agree or disagree with the panel's opinion to include or not include the criteria when measuring the excellence of construction programs. For example, 100% of respondents agreed that "ACCE/ABET accreditation" should be considered when rating construction programs, while only 63% of respondents believed "scholarships available" should be considered.

The Likert average was established by asking respondents to rate each criterion on a 10-point scale. At which point, the scores were averaged across the eight responses. One of the primary objectives for the second survey was to develop a relative weight for each criterion, which could then be included in a rating or scoring system. To do so, a raw score was calculated by again dividing the Likert mean score by the maximum possible score. Then the raw score was multiplied by the total number of sample participants to calculate the relative weight of importance. The coefficient of variance as well as the standard deviation were included to demonstrate the levels of relative agreement concerning each criterion. A relatively low value for these measures would indicate high levels of agreement among the panel, whereas high values indicates low levels of agreement. Table 17 contains those results.

Table 17: Consensus results

Criteria	*Consensus Rate*	*Mean*	*Coefficient of Variance*	*Standard Deviation*
Consensus Built				
1. Student Employment Placement Rates	**88%**	**8.38**	**0.07**	**.43**
2. Years of Industry Experience	**100%**	**8.00**	**0.13**	**.66**
3. ACCE/ABET Accreditation	**100%**	**9.13**	**0.16**	**.83**
4. Industry Support	**100%**	**8.88**	**0.12**	**.6**
5. Student to Faculty Ratio	**100%**	**8.13**	**0.20**	**1**
6. % of Full time Faculty	**100%**	**8.50**	**0.10**	**.5**
9. Retention Rate	**100%**	**7.75**	.29	**1.32**
8. Continual Curriculum Innovation	**88%**	**7.88**	.19	**.86**
15. Degree Types of Faculty (Top Terminal)	**88%**	**7.13**	.42	**1.56**
10. Faculty Recognition	**75%**	6.50	.16	**.66**
14. Program Student Selectivity	**75%**	**7.25**	**.37**	**1.39**
Consensus Questionable				
7. Scholarships Available	**63%**	**6.63**	**.19**	**.86**
12. Diversity (Rates of Underrepresented Students)	**63%**	**6.88**	**.33**	**1.27**
13. Size of Endowments	**63%**	**5.63**	**.42**	**1.62**
16. Conference Proceeding Publications	**63%**	**5.75**	**.25**	**.87**
17. AIC Exam Participation and Outcomes	**63%**	**6.00**	**.42**	**1.8**
Consensus Not Built				
11. % of Student Participation in Competition Teams	**50%**	**5.75**	**.23**	**.93**
18. Journal Publications	**50%**	**5.50**	**.47**	**1.41**
Consensus Built to Eliminate				
19. Scale of Research Grants (Amount) *	**88%**	**2.5**	**.36**	**1.58**

20. Program Growth	**88%**	**2.38**	**.94**	**2.23**
21. Longevity of Research Grants (Amount)	**88%**	**2.13**	**.75**	**1.62**

5.5 Currently Tracked Criteria

In addition to forming consensus among the 11 criteria, the second survey solicited information about which criteria are currently tracked by each respective university. Furthermore, respondents were asked what information was publicly available. This data will allow future research to determine the scope of properly collected all the data required for the rating system. Table 18 contains the results of this question matrix.

Table 18: Currently Tracked Criteria

Criteria	**Tracked by Respondent's University**	**Publicly Available**
Student Employment Placement Rates	100.00%	50.00%
Faculty Years of Industry Experience	75.00%	25.00%
ACCE/ABET Accreditation	87.50%	87.50%
Industry Support	100.00%	37.50%
Student to Faculty Ratio	87.50%	37.50%
% of Full time Faculty	87.50%	12.50%
Scholarships Available	100.00%	62.50%
Continual Curriculum Innovation	75.00%	12.50%
Retention Rate	75.00%	0.00%
Faculty Recognition	50.00%	0.00%
% of Student Participation in Competition Teams	62.50%	12.50%
Diversity (Rates of Underrepresented Students)	87.50%	50.00%
Size of Endowments	62.50%	25.00%
Program Student Selectivity	75.00%	25.00%
Degree Types of Faculty (Terminal)	50.00%	25.00%

Conference Proceeding Publications	62.50%	12.50%
AIC Exam Participation and Outcomes	62.50%	12.50%
Journal Publications	62.50%	0.00%
Scale of Research Grants (Amount)	50.00%	12.50%
Program Growth	87.50%	25.00%
Longevity of Research Grants	50.00%	12.50%

6.0 Conclusions

As established in the second chapter, the central research objective was to create a rating system which accurately and transparently disseminates information to a designated end-user while avoiding the simplistic winner and loser paradigm. This research objective ultimately proved to be outside the scope of this study and has yet to be completed. However, this study did take the initial steps toward completing the central research objective. The study was developed in three distinct phases. The first phase established through a review of relevant literature what criteria should be considered when measuring the excellence of a construction program. In the second phase, the criteria were analysed and defined for clarity and measurability. Finally, the third phase sought the relative opinion of a panel of experts concerning those criteria, to establish a consensus in the academic community.

As the research objective of this project suggests, as an academic, it is very tempting to reject these ranking systems. However, this ignores the obvious. The general public is using these ranking systems to aid in the college selection process. It would be short sighted of academics to wash our hands of the opaque industry of ranking. Reflecting on the interviews, it is easy to see there are many passionate academics who are working diligently to build their respective programs, produce smart, capable, industry ready students, and continually improve their craft. A malleable, end-user oriented, transparent ranking system would monumentally aid in their mission.

The difficulty in this endeavor is twofold. First, as this research indicates, it is difficult to find consensus among the end-users on what criteria is important. As an end-user, academics may present a unique challenge because they are directly involved in the production of university excellence. Nonetheless, the findings suggest it is difficult to produce a generalized score without manipulating the criteria to suit the individual needs of the end user. A task which would be overly time consuming and arduous. This assertion is supported by a 2007 Washington Post article by Michele Tolela Myers, President of Sarah Lawrence University, who explains that in the absence of real data, these ranking companies will invent data. When Sarah Lawrence University dropped the SAT score for admissions consideration, US News and World Report, began inserting arbitrary SAT averages one standard deviation below the average SAT scores of

their peer group. Instead of taking the time to adjust the criteria scores the company simply fictionalized them. Secondly, addressing the subjectivity of certain criteria by creating an objective measure may be impractical. For example, the "rigor and breadth of curriculum" is possible to measure, but someone would need to go to great lengths to produce an objective measure and in turn a scoring metric. While it would be very illuminating, it would not be very realistic.

Interestingly, contrary to the consensus findings, early iterations of this study fell in lock step with the Badger and Smith (2006) study. After searching the three sources and consolidating the criteria, the list which was generated had high levels of overlap with Badger and Smith's "World Class" evaluation. This study produced 76 extracted criteria, while the Badger and Smith study produce approximately 40 broad criteria. The similarities in criteria and category are unmistakable. Early in this study it looked like Badger and Smith would prove to be correct in their attempt to explain what constitutes a "world class construction program". However, at that stage in the study, no parameters had been set to assess criteria for measurability and practicality.

While examining the criteria for whether they could be reasonably and practically measured, it was recognized that collecting quantifiable data on certain criteria would be unrealistic. Furthermore, some data that was readily available was influenced by factors beyond the control of the school. For example, financial support from the industry can easily be skewed by market factors. The southern regions have shown more recent growth, and as a consequence, universities in the south may enjoy an unearned advantage in a rating. The nuance in criteria and the concept of a fair playing field probably are major reasons for the reluctance of academics to include certain criteria.

Inductively, this research does offer some evidence to the validity of the Badger and Smith (2006), but also draws its own conclusions that depart from the premise set forth by Badger and Smith. Initially, it was easy to see evidence that almost all criteria are valid to assorted stakeholders. This observation supports the recommendations of Badger and Smith. However, upon further investigation and analysis of the criteria, this study offers a much more narrow view of which criteria should be considered. This is due to the participants' inability to agree on what

criteria should be considered. Understandably, finding common ground for a construction program rating system is difficult due to the innumerable motivations of the stakeholders.

Nevertheless, the possible benefits of creating a transparent rating system are very real. The academics which were interviewed for this research almost unanimously believed a rating system would be beneficial, if it was appropriately developed and ratings were transparently generated. Thus, these eleven criteria represent common ground for academics concerning rating the excellence of construction programs, and using their relative weights of importance, should populate the forthcoming cumulative scoring system.

Phase One

The literature search, the focus group, and the interviews recommended over 200 criteria that should be considered when measuring the excellence of construction programs. This finding supports the 2013, United Nations Educational, Scientific and Cultural Organization (UNESCO) published report, which points to a general inadequacy of measurable criteria, and "narrow range and scope of measures". Additionally, the UNESCO (2013) report identified a fundamental limitation citing the inability of these ranking systems to properly compare data concerning key indicators of performance. Indeed, the ubiquitous internet ranking systems, including the US News and World Report ranking, only cited on average 6 metrics which were used to establish the rank order. Furthermore, those metrics were not explained, and no attempt was made to publish the exact methodologies. This leaves the end-user of the ranking unable to gauge the trustworthiness of the ranking or amend the conclusions for their own purposes.

Phase Two

Analysis of the suggested criteria was required to discover overlap, inconsistencies, and the general subjectivity of the criteria. The coding and analysis of the literature, focus group notes, and interview transcripts consolidated the more than 200 criteria down to 76 criteria, which were then divided into five categories. These findings covered all criteria suggested by the Badger and Smith report (2006) and further proposed 41 new criteria which should be considered. The findings produced by this phase suggested that end-users wanted a more comprehensive ranking system. Similarly, numerous research studies (Redden 2013, Kaplan 2011) critique the current

university ranking tables as only being able to measure a small slice of university academic performance. This critique is astute but operates under the assumption of unlimited resources. Objectively compiling the data on all 76 metrics for this rating system may require unrealistic resource requirements.

The second stage in phase two eliminated many of the criteria. This process was necessary to navigate the time constraints of the participants and assess the overall subjectivity and measurability of the suggested criteria. The criteria were evaluated on the measurability, saturation and triangulation of each criteria during the collection and analysis phases. The criteria were further reduced from 76 criteria to 21 criteria. These findings are contradictory to the critiques mentioned in the Kapland (2011) and Redden (2013) studies and are covered in the limitations section of this research.

Phase Three

The Delphi method was employed to develop a consensus among the panel of experts concerning what criteria should be considered when measuring the excellence of construction programs. The goal of the Delphi method was to establish legitimacy for the study in academia and establish a framework for others to expand upon this research. As UNESCO Assistant Director-General for Education Doctor Qian Tang writes, "it is vital that those compiling them make perfectly clear what criteria they are using to devise them, how they have weighted these criteria, and why they made these choices." Additionally, the idea of ranking legitimacy is discussed at length by Marope and Wells (2013) in the UNESCO publication, *Ranking and Accountability in Higher Education: Use and Misuse*. As the article suggests, no matter how much they expand the base of indicators considered in their methodologies, they can never exhaustively cover the full range of the universities' functions and activities, "by their very nature indicators are selective and not exhaustive." This aligns with the decision to use the panel of experts to "select such criteria."

Through this research design a consensus was built around 11 criteria to provide a basis for rating construction programs. Perhaps more importantly, the framework created in this work, while extensive, can be replicated considering any number variables to produce a specific desired outcome. During the literature review, it became apparent there was a disconnect between the

public's opinion and dependence on ranking systems for institutions of higher education and the accuracy and reliability of those same rankings. The clarity of the rank order which is published by the internet ranking systems is very misleading, and the general public's dependence on those ranking systems is very misguided. Moreover, according to Mr. Douglass Bennet, President at Earlham College (2007), these rankings distract from the real issues of access and quality and misguide university administration when trying to improve academically. This research set out to solve these difficulties through a rigorous research method, and through validation from academics external to this research. Ultimately, the research objectives of this study were fulfilled, and hopefully the findings will illuminate why many of the current ranking systems are deficient.

The third phase of the study built a consensus around 11 criteria as outlined in the findings section of this document. The majority of those criteria fell into the students and faculty categories. It follows that the panel of professors reached consensus concerning criteria which were human based. After all, modern teaching theory espouses the importance of building person to person relationships within the teacher learner paradigm (Fraser & Walberg 2005). During the interviews, conversations commonly revolved around the student, while the other criteria were simply offered as a means of improving the dissemination of knowledge to those students. This observation can also be made of the Badger and Smith (2006) strawman poll, which created an entire section on students, but then weaves students into every other category. A second trend that can be found in the 11 criteria is the significant role played by the industry. Construction education as an academic discipline is highly intertwined with the industry it serves. Research shows the importance of industry involvement when programs create targeted competencies within curricula (Ahn, Annie, & Kwon 2012). All 12 interviews cited some form of industry review panel that is responsible for periodically giving feedback to the program. Predictably, four of the 11 criteria have some relation to the industry.

In contrast to the findings, this research originally assumed consensus would be formed around many more criteria. This follows the idea that the more criteria that were assessed the more accurate and reliable rating would be. The initial 76 criteria was narrowed to 21 when the research analyzed the criteria for measurability, saturation, and triangulation. At this point, it was

assumed all criteria which were included would be accepted by the panel. However, this was not the case. Even within a homogeneous group of end-users, consensus about what should be measured could only be reached on just over half the criteria. This observation also falls in direct contradiction to the majority of ranking systems critiques. These critiques report insufficient measures (Marginson 2007, Dill & Soo 2005, Van Dyke 2003) and an overly simplified classification system (UNESCO 2013). Complexity within the ranking and rating paradigm makes this contradiction difficult to explain. The only conclusion which can safely be drawn is that to create a meaningful rating system, end-users would need to be offered the ability to pick and choose the criteria which are utilized in the rating methodology. Even though efforts were taken to build a consensus, the value of this research may be found in ascertaining which criteria is measurable, collecting the appropriate data on those criteria, and then allowing the end-user to insert those measures into a framework which will produce a rating for all appropriate universities.

Another explanation for the inability to build consensus around more than 11 criteria is the panel's acute recognition of why certain criteria may not provide an accurate depiction of a program. For example, the criteria which had the highest Likert score on the first round of Delphi survey, did not achieve 100% consensus. This particular criterion, student employment placement rates, may seem like an essential metric for rating the excellence of construction programs. However, according to one interview participant, this measure may be unfair based on the market demand for new hires. The market in California may be much more saturated than the market in Texas, and while there may be no difference in the quality of education there is less opportunity in California. It follows that this criterion may be misleading to end-users because it is in some way market dependent rather than program dependent. If applied generally to all the collected criteria, this observation may offer insight into why the panel members were hesitant to accept more criteria.

Finally, through the practice of creating a ranking system, it has become obvious how the practice of rankings is beset with pitfalls. Opinions about what criteria should be considered and how to weight those criteria range extensively. Criteria can be inherently flawed. In many cases, important indicators of university or program excellence are entirely subjective, and may result

in an objective measure that stemmed from something resembling a movie review. These observations may not be consequential on their own, but when you couple this with the idea that deans and donors are making decision based in part on the current available ranking systems, it becomes imperative that this research move forward.

6.1 Limitations

This research offered the opportunity to review several research questions. First, comparing such diverse programs presented a research challenge, if the rating is to be recognized as legitimate. Throughout this research, it became obvious experts in the field of construction education were very wary of comparing certain schools to one another. Constructing a rigid framework that is based on set indicators of excellence may reveal some schools as less excellent than others. The false negative outcome could pose threats to the validity/reliability of this research.

Secondly, many of the potential criteria which should be considered when rating a construction program are highly subjective. These measures become a problem in several ways. First, creating a metric to assess certain highly subjective criterion becomes overly burdensome and time-consuming for the purposes of this research. For example, the depth and breadth of curriculum may seem like a very important metric, but when considering how to quantify such a criterion, it becomes clear this would probably be a self-reporting measure riddled with inherent bias. Additionally, if the metrics to assess these subjective criteria were created, the process of collecting such data, again becomes overly burdensome and time consuming. Therefore, this research must realistically navigate the suggested criteria, by taking into account metric creation and collection constraints.

As with most types of qualitative descriptive research, the findings are subjective. During the collection of criteria, the growing number of criteria became overwhelming, but the confidence that the rating would be comprehensive was unquestionable. As the committee began to investigate the proposed criteria, it was recognized that many of the criteria were not objectively measurable. Elimination of the criteria proceeded under this pretense, and before long became

narrow and uncomprehensive. The problem is a lack of resources and time to properly develop the methods to measure many of these criteria. Using quantifiable measures which are currently publicly available, may not create a meaningful rating. The idea is to add measures or criteria to create differentiation among the programs. However, due to resource constraints we eliminated almost 75% of the suggested criteria. The reader may view this set of criteria as a watered-down version.

As a primary research objective, collecting the criteria as suggested by the three identified sources was performed by transcribing interviews and the focus group in real time. While a method to avoid moderator bias was followed, it is nearly impossible not to interpret certain answers through the lens of personal experience. As a graduate student, the author's lens is that of a student. Thus, when a professor mentioned diversity as a criterion, the author assumed it was the diversity of the student body, when in fact, it was the diversity of the faculty. Although, with the help of the research committee, the author wrote the definitions of the criteria, they need clarification. This assertion could easily fall under the future direction section, but the author thought it was appropriate to add here, because this was something that should have been addressed early in the process. Continuity for the criteria was necessary for the research process. If the definitions are manipulated subsequent to the release of the initial survey, the study becomes vulnerable to institutional bias. Therefore, the definition for the suggested criteria should have come from the original source.

Furthermore, when the definitions are written, it would benefit the stakeholders to understand the methods by which the criteria will be measured. These methods should be included in the definitions to allow end-users to correctly assign the relative weight of importance. Although this shortcoming was outside the original research objectives of the study, more extensively defining the measures would have allowed for preliminary case studies to be explored.

The modified Delphi method also represents a limitation to this study. Traditionally, all feedback from the initial rounds of Delphi is submitted to the panel of experts. The panel is then able to see the subjective responses of the other experts, and in turn an individual expert is exposed to the expertise of the whole panel. This exposure may lead to a greater understanding and more

informed answers by the individual respondents. This studies research strategy dictated the surveys be stream lined as much as possible out of respect for the time constraints of the respondents. It may have been beneficial to include all respondent feedback.

6.2 Significance of Study

There is a real problem with the current ranking paradigm. Generally, the public regards them as reliable, but they are not (UNESCO 2013). Anecdotal evidence exists of shortcuts and careless arbitrary decisions made by those responsible for the production of current ranking models (Myers 2007). This research represents work to rectify this problem. The symbiotic relationship offered by rankings is undeniable. Schools benefit greatly from a high rank. That type of positive exposure can lead to many benefits. In conjunction with schools, prospective students can gather very clear and accessible information without having to sift through the endless cache of information regarding universities. The problem with the current models is a lack of transparency and malleability. Support for a clear and well-developed rating system is strong. As one participant articulated, "It would be a recruiting tool for the entire CNS community. It would be the power of an outside expert. It would also cure some of our curiosity."

While this research lacks a definitive mathematical model for the rating system, it represents the first step required to create a reliable and legitimate rating system. The methods conceived in this work can also be applied to the other end-users to generate the criteria appropriate for that specific group. Once the mathematical model is created the criteria can be shuffled and reweighted to produce a rating which a specific end-user finds engaging.

6.3 Future Directions

The next logical steps for this research have been suggested in the limitations section. First, the definitions which were created for the criteria should be expanded and clarified. It may be necessary to solicit feedback from the academic community, as simply writing these definitions may not be appropriate. Additionally, the metrics for measurement need to be defined for each criterion. Several criteria such as "continual curriculum improvement" and "faculty recognition" may pose a unique challenge. It may be difficult to quantify these criteria, which makes it

necessary to complete before the next steps. If these measures cannot be quantified, they will need to be eliminated from consideration.

The next logical step is to create a mathematical model for the rating system. Each criterion should receive its own score based on its unique measuring metric. That score should then receive a weight for what it is worth in the larger framework and then a summative rating should be produced. It is my recommendation to list all individual criteria scores with the overall rating to allow end-users to make their own subjective judgments. This research generalized the findings, and then applied them to the framework. It is not the intention of this work to devalue the individual opinion over the whole, but rather to show on average what the panel believes.

Finally, the need to eliminated criteria represents a weakness in the framework. It would benefit the overall quality of the rating to include many more measures. An exhaustive list, while not practical, would produce a much more meaningful and potent rating. Hopefully, many more iterations of this framework will be generated, and each time several more criteria will be defined, and measurement metrics will be created. The result would theoretically allow the end-user to choose the 25 criteria most influential to them and a then a personal rating could be produced.

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Appendix A

Students	Definition
Student to Faculty Ratio	Ratio of FTE equivalent divided by the total number of students in the program
AIC Exam Participation and Outcomes	An average of both the % of student body participation and an overall percentage of passing scores
Program Student Selectivity	Requirements that are published for admissions into the program, and a yearly average of accepted student ACT/SAT and GPA
Retention Rate	Rate of yearly student retention through graduation (subdivided by gender, and ethnicity
Diversity (Rates of Underrepresented Students)	Reported rates of minority genders and ethnicities
Student Satisfaction	Measure must be created. It is necessary to review the common practices of obtaining this information, and perhaps create a common measure that all programs would adopt.
Internship Programs and Opportunities	Total number of students who participate in an internship divided by the total student body
Student Employment Placement Rates	% of graduates who successfully enter the industry upon graduation
% of Student Participation in Competition Teams	Total number of students who compete (competitors and reserves) divided by the total student body which is eligible to compete

Faculty	Definition
Degree Types of Faculty (Top Terminal)	% of faculty with the top terminal degree in their field (PhD) divided by the total number of faculty on staff
Years of Industry Experience	Sum of faculty years in the industry
% of Full time Faculty	Faculty which are FTE divided by total number of faculty

Faculty Recognition	Need help on this one. (Total number of awards ?? Should this include grants, or just be a set of predetermined awards commonly recognized in academia?)
Conference Proceedings Publications	Number of yearly publications in recognized conference proceedings
Journal Publications	Number of yearly publications in recognized journals

Funding	**Definition**
Size of Endowments	Total amount of endowment and amount of yearly allocation from the endowment
Scale of Research Grants (Amount) *	Total yearly amount of grant money by department (reported from the previous year)
Longevity of Research Grants (Amount)	Number of recurring grants and number of years they will recur
Scholarships Available	% of students receiving grants and total amount awarded each year
Industry Support	Total amount of money awarded to the program directly from industry partners. Includes but is not limited to direct grants, tail gates, competition team support, job fair fees etc.

University/Department	**Definition**
Program Growth	Metric to compare % growth or decline of total number of students

Curriculum/Classroom	**Definition**
Type of Degree	This might only be used to allow users to filter the data. It may not be appropriate to give value to certain titles, while devaluing others
ACCE/ABET Accreditation	Determination of if and which accrediting body the university is a part, and the date of upcoming accreditation review
Continual Curriculum Innovation	Difficult to measure, but could be looked at through the lens of industry innovation. When BIM is implemented in the industry, how long did it take the university to hire a BIM professional?

Appendix B

Questions

1. What is your current position at the university?

2. What is the highest degree you have received, and from which university did you receive it?

3. How do you measure the excellence of your program? What are the steps in this process?

4. Are you currently using or familiar with any rating or ranking system for construction programs? If yes, what is the name of the system, and for what purpose do you utilize it?

5. Do you believe a rating system would be useful to you and/or your academic program and how would you use it?

6. What criteria do you believe should be included when evaluating a construction program?

7. Do you feel any of these criteria could be considered "more or most important"?

8. Are there any criteria that should NOT be considered in measuring programs?

9. Are there other programs, or aspects of programs familiar to you, which you consider to be a model in construction higher education?

10. What are those programs and what do they do well?

11. Currently construction programs are extremely diverse concerning identifying characteristics, such as, degree type offered, academic focus (research, teaching) industry specialization, etc. What are some of the unifying characteristics of academic construction programs?

Appendix C

Questions

1. What is your current position at the university?
[redacted]

2. What is the highest degree you have received, and from which university did you receive it?

I have a PhD in Civil Engineering from [redacted]

3. How do you measure the excellence of your program? What are the steps in this process?

This will be different depending on what university you are talking about and what their focus is. We are a research-intensive university.

Our first focus is on student achievement. Measuring student performance in the classroom through grades and production, then we measure student achievement through employment rates, and finally from industry input.

Faculty achievement-

- *Teaching- evaluations, average grades given, exit surveys with graduating seniors*
- *Research- $ for funded research at least $100,000, Publication rate- 2 per year in high quality publications*
- *Recognition/Outreach – Service to the community, industry, and university*

4. Are you currently using or familiar with any rating or ranking system for construction programs? If yes, what is the name of the system, and for what purpose do you utilize it?

None

5. Do you believe a rating system would be useful to you and/or your academic program and how would you use it?

Yes, for comparing or benchmarking our program, and in-turn making improvements.

6. What criteria do you believe should be included when evaluating a construction program?

These are the same as the criteria for measuring excellence as listed above.

7. Do you feel any of these criteria could be considered “more or most important”?

Accountability and accreditation

8. Are there any criteria that should NOT be considered in measuring programs?
Hands on labs

9. Are there other programs, or aspects of programs familiar to you, which you consider to be a model in construction higher education?

University of Florida College of Design Construction and Planning
They are endowed from an external source to the university.

10. What are those programs and what do they do well?
They have an independent school devoted to construction, which is not overshadowed by architecture or engineering. This offers credibility to the school. Construction schools need to have a separate department name to offer autonomy. They also have a good balance of program offerings and specializations with a good mix of faculty.

11. Currently construction programs are extremely diverse concerning identifying characteristics, such as, degree type offered, academic focus (research, teaching) industry specialization, etc. What are some of the unifying characteristics of academic construction programs?

How faculty is evaluated- Similar
Admittance #s
GPA requirements

Questions

1. What is your current position at the university?

[redacted]

2. What is the highest degree you have received, and from which university did you receive it?

PhD Civil Engineering from [redacted]

3. How do you measure the excellence of your program? What are the steps in this process?

Well, first we look at student learning objectives. Are the goals of the SOLs being met? We review student grades when assessing these SOLSs. Are the students merely passing or are they earning high grades? We look at faculty evaluations, graduation rates, whether the students are graduating in 5 and 6 years. Student retention rates are also important. If students can graduate in 4 years or not, and if they are sticking with the program. Program learning objects are reviewed and assessed. We also look at some industry questionnaires to employers.

4. Are you currently using or familiar with any rating or ranking system for construction programs? If yes, what is the name of the system, and for what purpose do you utilize it?

Us News and World Report, ABC Construction Executive, College Factual. However, they only rank programs which respond to the survey, so they are not very accurate.

5. Do you believe a rating system would be useful to you and/or your academic program and how would you use it?

Yes, to accurately look at certain aspects of programs to which we want to compare or aspire.

6. What criteria do you believe should be included when evaluating a construction program?

- *Text books,*
- *Curriculum Rigor (wholistic picture)*
- *Admission rates*
- *Employment rates*
- *Industry feedback*
- *Salaries (if they are at consistent rates with other colleges)*
- *Student faculty ratios*
- *Permanent faculty vs adjunct faculty*
- *Faculty available for students*
- *Quality of faculty*
- *Number of students*
- *Requirements to be in programs*

7. Do you feel any of these criteria could be considered "more or most important"?
   Construction programs offer a professional degree, thus when a person enters the program the expectation when the graduate is to be gainfully employed, if we fulfill that, we are fulfilling the most important aspect of our programs. Everything else falls in line, if we are rigorous and stay in line with what the industry needs then they will get jobs.

8. Are there any criteria that should NOT be considered in measuring programs?
   Student evaluations are not very accurate. Many times, students evaluate a professor and score highly because they are easy.

9. Are there other programs, or aspects of programs familiar to you, which you consider to be a model in construction higher education?
   The 4-5 schools that really put construction as a degree program on the map are doing a good job. University of Florida, Clemson, VT, Auburn, Texas A&M They have the history, they are continually producing quality students. ECU has evolved into good program. We have 600 undergrads, 12 full time professors. Each program has strengths and weaknesses strong support from industry, and they are well funded.

10. What are those programs and what do they do well?
    See above

11. Currently construction programs are extremely diverse concerning identifying characteristics, such as, degree type offered, academic focus (research, teaching) industry specialization, etc. What are some of the unifying characteristics of academic construction programs?
    ACCE- if a program is accredited then they are following the curriculum, some programs offer residential, industrial, etc. Our industries biggest employers are commercial and residential, so most programs cater to them. The bulk of students, end up in residential and commercial. Programs suffer from what I call the "identity crisis." They are housed in different colleges, business, arch, engineering, design etc., but we all serve the construction industry. Endowments are needed. CNS programs don't belong in colleges, they should stand alone.

Questions

1. What is your current position at the university?

[redacted]

2. What is the highest degree you have received, and from which university did you receive it?

PhD in Education from [redacted]

3. How do you measure the excellence of your program? What are the steps in this process?

Our university requires assessment program outcomes. We compile yearly records of exams for the university. We also follow industry opinions closely, student opinions, etc. We are collecting data all the time. We look at how much involvement we have in engagement learning opportunities like competition teams, and other activities outside the normal classroom. We offer an outdoor field lab, which allows 100% of students to participate in some Service Learning project before they graduate. We look at the success of our active learning classroom. Industry feedback is also very valuable for inputting of tech knowledge.

4. Are you currently using or familiar with any rating or ranking system for construction programs? If yes, what is the name of the system, and for what purpose do you utilize it?

I am familiar with a couple, but the problem is that most are a function of CIP code classification of instructional programs. Older programs like ours rank by SIP code in Architectual Engineering, so we get compared to all sorts of engineering schools.

5. Do you believe a rating system would be useful to you and/or your academic program and how would you use it?

I am not convinced for something like this to be useful. If it were somehow done effectively, it could motivate change for programs, identify best practices, and allow research on what other programs are doing.

6. What criteria do you believe should be included when evaluating a construction program?

- *Professor Industry Experience*
- *Engaged learning*
- *Comp Teams*
- *Capstone*
- *Service Learning etc,*
- *Engagement with industry, industry feedback*
- *Internship completion*
- *Study abroad, cultural immersion*
- *Accreditation*

- *Faculty with professional credentials*
- *How do faculty remain current?*
- *How do programs remain current with professional practices?*
- *Being active with professional organizations, field and office*
- *Disseminating research*

7. Do you feel any of these criteria could be considered "more or most important"?
   Accreditation, Engaged Learning,

8. Are there any criteria that should NOT be considered in measuring programs?
   Size

9. Are there other programs, or aspects of programs familiar to you, which you consider to be a model in construction higher education?
   Colorado State, Texas A&M-Facilities, Cal Poly- Field Lab, University of Florida-Research

10. What are those programs and what do they do well?
    See above

11. Currently construction programs are extremely diverse concerning identifying characteristics, such as, degree type offered, academic focus (research, teaching) industry specialization, etc. What are some of the unifying characteristics of academic construction programs?

    Producing graduates for the construction industry

Questions

1. What is your current position at the university?

[redacted]

2. What is the highest degree you have received, and from which university did you receive it?

PHD [redacted]

3. How do you measure the excellence of your program? What are the steps in this process?

First, we look at our accreditation. How do we assess 1. Growth of program, which is the number of students enrolled compared to graduation (retention rates) 2. Employment rates of grads. Then we review senior exit surveys, industry surveys , graduate alumni survey, etc. We also require our studenst to take the AIC Level 1 CNS cert., which allows us to compare to others around nation. We also use regional and national ASC competitions. The do we have any AGC outstanding Sigma Lamda Chi Awards etc. Then we look at student involvement in our Service Learning Projects. How much outreach do we have going into the community?

4. Are you currently using or familiar with any rating or ranking system for construction programs? If yes, what is the name of the system, and for what purpose do you utilize it?

Not really. The problem is what defines what is good?

5. Do you believe a rating system would be useful to you and/or your academic program and how would you use it?

6. What criteria do you believe should be included when evaluating a construction program?

- *What school are you under (program structure)?*
- *Age of program*
- *Student to faculty ratio*
- *Competitions*
- *Industry Support*
- *AIC Exam*
- *Size*
- *Focus*
- *Varied Specialization*
- *Service-Learning Component*

- *Opportunities for Student involvement*
- *Faculty Industry Experience*

7. Do you feel any of these criteria could be considered "more or most important"?
   Size, Offering, Ratio

8. Are there any criteria that should NOT be considered in measuring programs?
   Grant Money

9. Are there other programs, or aspects of programs familiar to you, which you consider to be a model in construction higher education?

   Cal Poly- Graduates are ready to take on roles that use high tech methodologies and are ready to go immediately participate in the indusrty
   Boise State- ready to go to work, basics, hands-on, management at the field level leadership Construction processes knowledge
   University of Oklahoma and Auburn based on their industry support

10. What are those programs and what do they do well?
    See above

11. Currently construction programs are extremely diverse concerning identifying characteristics, such as, degree type offered, academic focus (research, teaching) industry specialization, etc. What are some of the unifying characteristics of academic construction programs?

    AGC student Chapter- Volunteering

Questions

1. What is your current position at the university?

[redacted]

2. What is the highest degree you have received, and from which university did you receive it?

PHD in Civil Engineering from [redacted]

3. How do you measure the excellence of your program? What are the steps in this process?

Primarily Teaching faculty, so we measure excellence by ascertaining how well students are doing through an exit survey. Would they recommend to friend, if they would it means they are getting a good experience, so basically the student perspective is very important.

Employers Coop institutions also have access to the students during our 3 different mandatory 6-month programs. The feedback from these coop employers gives us a sense of the effectiveness of our curriculum.

We also look at retention within program. Are we keeping the freshman or transfer students that are enrolling in the program?

Our advisory council or executive council, meets every two months, is made up of approximately 22 industry professionals and are able to give feedback on curriculum content. Some of these are alumni who can give us an inside perspective.

Industry Committee or "friends of the program" meet twice a year and also offer an industry perspective on the excellence of our students.

4. Are you currently using or familiar with any rating or ranking system for construction programs? If yes, what is the name of the system, and for what purpose do you utilize it?

No ranking program

Teaching to the test

5. Do you believe a rating system would be useful to you and/or your academic program and how would you use it?

It would be a recruiting tool for the entire CNS community. Recruiting this is what we bring to the table. It would be the power of an outside expert. It would also cure some of our curiosity. what are they doing elsewhere- curiosity.

6. What criteria do you believe should be included when evaluating a construction program?

- *Student#*
- *Faculty #s*
- *Faculty industry experience*
- *Student to Faculty ratios*
- *Placement rate in the industry -when we are lean vs healthy*
- *Salaries widely varied*
- *Research productivity*
- *Kinds of research*
- *Stability*
- *Facilities- integrate tech into curriculum*
- *Breadth of curriculum*
- *student satisfaction- town hall every quarter, zoom experience with curriculum, focus groups*
- *Masters program?*
- *Online?*

7. Do you feel any of these criteria could be considered "more or most important"?
Curriculum Student satisfaction Industry feedback

8. Are there any criteria that should NOT be considered in measuring programs?
Separation

9. Are there other programs, or aspects of programs familiar to you, which you consider to be a model in construction higher education?

Virginia Tech- integrated curriculum
Cal Poly- curriculum
Auburn-
Colorado State #s
Boise State- Hands on Labs Lab facility teaching
Arizona State- Sustainability

10. What are those programs and what do they do well?
See above

11. Currently construction programs are extremely diverse concerning identifying characteristics, such as, degree type offered, academic focus (research, teaching) industry specialization, etc. What are some of the unifying characteristics of academic construction programs?
Curriculum Undergraduate program

Questions

1. What is your current position at the university?
   [redacted]

2. What is the highest degree you have received, and from which university did you receive it?

   PHD from [redacted]

3. How do you measure the excellence of your program? What are the steps in this process?
   2 Parts Feedback from industry. Good feedback about students and their knowledge comes from the industry but it is only anecdotal. We also assess learning outcomes in the classroom. Within each course, what each student does on learning outcomes and obviously the documentation of the ACCE 20 competency outcomes, but it is more than that for some professors. Exams, oral presentations, written communication skills allow professors to gauge student outcomes. Also feedback from students, but within perspective.
   Deans want us to bring in grants, but what I value as an educator might focus more on the classroom and students.
   What does the industry say? We are trying to meet the needs of the industry. CNS as a professional degree program, we focus on students graduating and immediately participating in the industry.

4. Are you currently using or familiar with any rating or ranking system for construction programs? If yes, what is the name of the system, and for what purpose do you utilize it?
   We are not using one
   I have spent 15-16 years of listening to discussions about ranking systems and there is R1 research institution

5. Do you believe a rating system would be useful to you and/or your academic program and how would you use it?

   Not sure it would be useful, but I am afraid that it will be required. ASC is very much like the construction industry -fragmented We are all over the board, CNS is also fragmented Consensus is tough for construction. Might need to be a Pass/Fail type of system.

6. What criteria do you believe should be included when evaluating a construction program?
    - *Industry perspective on graduate competency,*
    - *Research Dollars,*
    - *Engagement with ASC*
    - *Grants,*
    - *Placement rates,*
    - *Internships opportunities,*
    - *50 students per year, Class size,*
    - *Faculty numbers*
    - *Teaching focus,*
    - *Qualitative research,*
    - *Evaluating peer reviewed*
    - *research publications applied research, not theory,*
    - *Student contact time with RA or faculty members,*
    - *Industry experience for faculty,*
    - *Staying Current to the Industry,*
    - *Curriculum Updates, Technology*

7. Do you feel any of these criteria could be considered "more or most important"?

   Industry perception of faculty and students, Industry satisfaction,

8. Are there any criteria that should NOT be considered in measuring programs?

   Everything should be included, because it is a departmental issue,

9. Are there other programs, or aspects of programs familiar to you, which you consider to be a model in construction higher education?

   For the last 10 years, it has been Auburn

10. What are those programs and what do they do well?

    High emphasis on bringing industry experience into the classroom. Applied research is ongoing. They are engaged nationally and internationally with the industry and educational bodies. They are seeing high levels of student success in competitions. Might be bringing in grant money, but that is not a focus.

11. Currently construction programs are extremely diverse concerning identifying characteristics, such as, degree type offered, academic focus (research, teaching) industry specialization, etc. What are some of the unifying characteristics of academic construction programs?

I believe I can participate in a Delphi Study.

Questions

1. What is your current position at the university?

[redacted]

2. What is the highest degree you have received, and from which university did you receive it?

PhD of civil engineering with a concentration in CNS content from [redacted]

3. How do you measure the excellence of your program? What are the steps in this process?

We want to prepare students for the job market. Internships are crucial to this process. We offer two days of undergrad classes to allow students to work in the industry during their down time. I am continually being a career advisor, and keeping the students under a sort of career surveillance. We have biannual career days in the spring and fall, with between 50 -60 students attending. We focus on a progressive curriculum, so students are able to work during week, and then practice what they learn in class in the field. The student experience is very important. We want to know how many students transfer from community colleges, do we have a strong network of community colleges, are students building resumes, can they find jobs, do we have stability in numbers, are the students receiving the best service.

4. Are you currently using or familiar with any rating or ranking system for construction programs? If yes, what is the name of the system, and for what purpose do you utilize it?

No

5. Do you believe a rating system would be useful to you and/or your academic program and how would you use it?

Yes, it would be useful for promotion of program, publicity nation-wide, convincing students to come to the university. Ultimately, recruiting.

6. What criteria do you believe should be included when evaluating a construction program?

- *Student opportunity to get hands on experience during education*
- *Ability to apply what you learn in class in the field.*
- *Internships opportunity,*
- *strong placement program,*
- *program is accredited,*
- *academic side is evaluated by external source,*
- *placement of student after graduation*
- *Retention rates*
- *quality of students,*

- *nationwide opportunities, international?*
- *Ratio of students to faculty,*
- *level of attention to undergraduate students,*
- *quality of professor,*
- *how much face to face contact with professor*
- *efforts to place and monitor students in internships,*
- *curriculum requirements, management,*
- *does a program have a master's program? Access different parts of society*

7. Do you feel any of these criteria could be considered "more or most important"?
   Internships, hands on experience

8. Are there any criteria that should NOT be considered in measuring programs?
   Size of the program,

9. Are there other programs, or aspects of programs familiar to you, which you consider to be a model in construction higher education?

   Chico State puts on competitions. They are well managed, on a national stage, and students involved with all sorts of companies.
   It is a good service for students and industry, opportunity by putting on reno competition.
   They have unique attributes, faculty are involved in accreditation ACCE, impressive involvement.

10. What are those programs and what do they do well?
    See above

11. Currently construction programs are extremely diverse concerning identifying characteristics, such as, degree type offered, academic focus (research, teaching) industry specialization, etc. What are some of the unifying characteristics of academic construction programs?

Questions

1. What is your current position at the university?

2. What is the highest degree you have received, and from which university did you receive it?

   PhD of Education from

3. How do you measure the excellence of your program? What are the steps in this process?

   The main way is accreditation. ACCE- Being able to successfully become or remain accredited. We listen to anecdotal industry feedback through formal and informal industry conversation. We look at highering rates, reputation, fundraising, # of students, retention rates, AIC exam, student performance in capstone We have over 8 years of data on many of these measures. We also have a formal industry advisory board which is 20 people, called and active board. This group must be active. Industry sponsors, evening seminar, once a week, where we can receive feedback.

4. Are you currently using or familiar with any rating or ranking system for construction programs? If yes, what is the name of the system, and for what purpose do you utilize it?

   I am familiar with the ubiquitous rankings on internet, but they are not formally used.

5. Do you believe a rating system would be useful to you and/or your academic program and how would you use it?

   If valid, yes. We could use it for marketing, attracting faculty and students, internally making a case for resources at the university. It would also tell us where we stand among or peers.

6. What criteria do you believe should be included when evaluating a construction program?

- *External industry evaluation*
- *Accreditation*
- *qualitative comments on accreditation internal reports*
- *strengths and weakness in the report*
- *grad rates, retention rates, 1st yr to 2nd yr,*
- *reputation among other schools through perhaps a survey*
- *polling of peers schools could be problematic*
- *student experiences from exit surveys*
- *Availability of extracurriculars*
- *access to resources*

- *Innovations*
- *student to faculty ratio*
- *intimacy # of classes*
- *full time faculty*
- *measures of faculty itself*
- *industry experience of faculty*
- *Experience in pedagogical areas*

7. Do you feel any of these criteria could be considered "more or most important"?
   Accreditation, almost every program is. It is an external evaluation.
   AIC exam scores, which is and objective measure.

8. Are there any criteria that should NOT be considered in measuring programs?
   Things that don't apply to the program, popularity

9. Are there other programs, or aspects of programs familiar to you, which you consider to be a model in construction higher education?

10. What are those programs and what do they do well?

11. Currently construction programs are extremely diverse concerning identifying characteristics, such as, degree type offered, academic focus (research, teaching) industry specialization, etc. What are some of the unifying characteristics of academic construction programs?

Questions

1. What is your current position at the university?
[redacted].

2. What is the highest degree you have received, and from which university did you receive it?

PhD in Architecture [redacted]

3. How do you measure the excellence of your program? What are the steps in this process?

We have three goals. What we are trying to do is measure students coming into program, student experience while in the program, and then transitioning out. Measures we use: Student enrollment, # of students in the program, retention rates, rates of underrepresented students. The students' academic ability through ACT scores as well as a formula for measuring the GPA of students entering our program. The second goal is providing students with an enriching educational experience- Measured through student participation in service learning. We also use exit survey data. We will compare with university data, and track participation in study abroad student exchanges,competition teams, and participation numbers for internship or coop programs. Third, we strive to advise, prepare and ensure entry level positions into the industry. We are able to track these things through the career office. We look at number of submitted resumes, how many companies come in and present to students, what sort of assistance, career fair numbers, students and companies. We track diversity of companies, residential, commercial ect., along with placement for students. Then we track the diversity of positions precon, super, PM, etc.

4. Are you currently using or familiar with any rating or ranking system for construction programs? If yes, what is the name of the system, and for what purpose do you utilize it?

Not very well defined, Publicly we are grouped by the CIP Code for Architectual engineering. So, we don't use it.

5. Do you believe a rating system would be useful to you and/or your academic program and how would you use it?

Many people are against it. Educators are a community, if you introduce a ranking system it becomes a competition. People are no longer willing to share and work together to improve as a whole.

6. What criteria do you believe should be included when evaluating a construction program?

- *Research and publications are important*
- *ASC & ACCE Accreditation*
- *Faculty participation the in conventions,*

7. Do you feel any of these criteria could be considered "more or most important"?

8. Are there any criteria that should NOT be considered in measuring programs?
   If you weight things objectively, then you may use everything. Small and large programs are going to value different things.

9. Are there other programs, or aspects of programs familiar to you, which you consider to be a model in construction higher education?
   Our peer group, Purdue, VT, Florida, Texas A&M, Arizona State , Colorado St, OU Architecture and construction are working together.

10. What are those programs and what do they do well?
    Colo State HS Summer camp for Females

11. Currently construction programs are extremely diverse concerning identifying characteristics, such as, degree type offered, academic focus (research, teaching) industry specialization, etc. What are some of the unifying characteristics of academic construction programs?
    Information that is publicly available, ASC

Questions

1. What is your current position at the university?

[redacted]

2. What is the highest degree you have received, and from which university did you receive it?

PhD in Civil Engineering [redacted]

3. How do you measure the excellence of your program? What are the steps in this process?

Generally, we try to track and improve on:

- *Job Placement*
- *Starting Salaries*
- *Student enrollment*
- *Student competitions*
- *Research and research publications*
- *Industry support, advisory participation,*
- *4-5 year student completion rate,*
- *retention rates,*
- *Accreditation, ACCE*

Not tracked in program but looked at are, student engagement, track # hrs student groups are doing things,

4. Are you currently using or familiar with any rating or ranking system for construction programs? If yes, what is the name of the system, and for what purpose do you utilize it?

Best Value CNS Program We could probably publish on social media. Parents saw one of these polls one time. It would speak to program success when parenst and students are doing research

5. Do you believe a rating system would be useful to you and/or your academic program and how would you use it?

Marketing tool for perspective of students. There is value, but I am torn if it places us well then yes. It also allows us to see where we need to improve,

6. What criteria do you believe should be included when evaluating a construction program?

- *Hands on Learning,*
- *Lab Space,*
- *Accreditation,*
- *Job placement,*
- *Salary,*
- *student success after graduation,*

- *tuition and fees, value of school, (cost to benefit ratio)*
- *student to teacher ratios,*
- *research publications,*
- *$ for research,*
- *employer feedback,*
- *company recruitment,*
- *industry satisfaction,*
- *Ratio of full time vs adjunct,*
- *Students satisfaction,*
- *20 learning objectives,*
- *History of program,*
- *Perception of programs by other programs,*
- *Size,*
- *Endowment, money tied to program, scholarships*

7. Do you feel any of these criteria could be considered "more or most important"?
   Student Success, are they getting jobs, good jobs, proud of programs, company support, recruiting, cost to benefit ratio,

8. Are there any criteria that should NOT be considered in measuring programs?

9. Are there other programs, or aspects of programs familiar to you, which you consider to be a model in construction higher education?
   Aspirational programs, University of Florida, Auburn. They are ensuring student experience in school and success after school. Learning environment, field trips, hands on learning, Cal Poly, Big Company Base,

10. What are those programs and what do they do well?

11. Currently construction programs are extremely diverse concerning identifying characteristics, such as, degree type offered, academic focus (research, teaching) industry specialization, etc. What are some of the unifying characteristics of academic construction programs?
    Everything is related to the built environment. Basically- what it is we do, getting things done, accomplishment, practical based, less theory, planning and logistics, experiences, internships, people in the program deal with lots of people.

Questions

1. What is your current position at the university?

[redacted]

2. What is the highest degree you have received, and from which university did you receive it? How many years have you been in academia?

PHD [redacted]

Many directors are not required to be full professors and may hurt the programs. May be more painful to the university. Leadership challenges may lead young unseasoned professors to go through growing pains which then could lead to angry and exhausted leadership.

3. How do you measure the excellence of your program? What are the steps in this process?

- *Industry feedback mechanism*
- *Job placement*
- *Industry involvement derivative of funding for research, scholarships etc.*
- *Recently our university has increased pressure for recruitment. We were tasked with growing, which was a university focus We grew from 230 5 yrs. Ago to more than 500 currently.*
- *Quality of the student, if parents are seeing us a viable option to send students to then we see the growth.*
- *Accreditation**
- *Student competitions**
- *Rating and evaluating i.e. CollegeFactual.com*
- *Curriculum changing- Critical pieces for the future industry driven*
- *Technology innovation*

**Minor*

4. Are you currently using or familiar with any rating or ranking system for construction programs? If yes, what is the name of the system, and for what purpose do you utilize it?

Communication -Media, we need to look at weights and metrics to better understand ow the numbers are derived. Real estate school was able to leverage a greater allocation of resources after showing them to administration. Basically, an external source to argue for resources.

Peer Review- Research 1 university. Carnegie Melon Classification We compare ourselves to these schools to see if we are comparable on basic metrics like salary, ratio, etc.

5. Do you believe a rating system would be useful to you and/or your academic program and how would you use it?

We could take that to our administration. Policy changes would be possible if our university policies were in contradiction to how we are ranked.

6. What criteria do you believe should be included when evaluating a construction program?

Classification or designations should be created to allow a direct comparison of similar universities. Compare apples to apples.

Salaries, ratio, teaching evaluations, metrics to measure teacher excellent, social mission, involvement, etc.

Faculty Load- in 4 units= 2 teaching, 1 research, 1 service. Full teaching load of 4 units would resemble a 4 class 240 student load.

7. Do you feel any of these criteria could be considered "more or most important"?

Student Learning Quality of education Excellence of teaching
Work that is being done at a university is worth paying for.

8. Are there any criteria that should NOT be considered in measuring programs?

Dollars in grants – Amounts, rather it should be if external groups are willing to pay for the research that is being done. Internal grants should not play a role.

9. Are there other programs, or aspects of programs familiar to you, which you consider to be a model in construction higher education?

We look at our cohort of Carnegie Melon Research 1 Institutions to compare. Purdue has caught our attention lately.

10. What are those programs and what do they do well?

They are good at engaging with industry, they have a global view of industry problems Their model is working well because they are not bound by what happened 20

years ago, changes in curriculum are immediate and research based. Integrating current research curriculum changes.

11. Currently construction programs are extremely diverse concerning identifying characteristics, such as, degree type offered, academic focus (research, teaching) industry specialization, etc. What are some of the unifying characteristics of academic construction programs?

Experienced based, student focused, tacit, industry is poised to change completely, front edge to see that. Well placed to help facilitate and even lead the change within the industry. We are all responsible for producing the professionals within the construction industry.

12. Would you be willing to participate in a Delphi survey later this spring? Should be a quick survey which you can complete in 10 minutes or less. I am trying to create a consensus among educators.

I will be happy to participate.

Questions

1. What is your current position at the university?
[redacted].

2. What is the highest degree you have received, and from which university did you receive it?

Doctorate of Higher Education in Construction [redacted]

3. How do you measure the excellence of your program? What are the steps in this process?

The main way we measure excellence is industry feedback. The most concrete measure of that is if our graduates are obtaining jobs. Secondly, the feedback we receive from potential employers before and after internships. Students are also able to give feedback about proficiency and deficiency. We also look at grades, student end-products and student achievements. OSU also has an industry advisory board with 40 industry professionals.

4. Are you currently using or familiar with any rating or ranking system for construction programs? If yes, what is the name of the system, and for what purpose do you utilize it?

The ENR (Engineering News and Research Magazine) attempted a ranking system back in 2001-2003. We do not use one currently.

5. Do you believe a rating system would be useful to you and/or your academic program and how would you use it?

The short answer is no. Ranking systems are inherently full of bias and there are too many variables to make a meaningful ranking. A compilation or list of schools and their attributes, accreditation types, size, program duration, faculty to student ratios etc. would be useful to compare.

6. What criteria do you believe should be included when evaluating a construction program?

• *Faculty #s*	• *% Online*
• *Student #s*	• *% Placement*
• *College you are in*	• *Required internships?*
• *Structure of program*	• *Focus of degree*
• *Accreditation*	• *Options for alternative focus*
• *Course offerings*	• *Faculty wages*
• *Masters and PhD Programs*	•
•	•

7. Do you feel any of these criteria could be considered "more or most important"?

Accreditation

8. Are there any criteria that should NOT be considered in measuring programs?
Every criteria is bound to be valuable to someone

9. Are there other programs, or aspects of programs familiar to you, which you consider to be a model in construction higher education?
We tend to look at the industry as our model. They will tell us what curriculum changes need to be made.

10. What are those programs and what do they do well?

11. Currently construction programs are extremely diverse concerning identifying characteristics, such as, degree type offered, academic focus (research, teaching) industry specialization, etc. What are some of the unifying characteristics of academic construction programs?

• *4yr and 2 yr programs*	• *Industry specialization*
• *Accreditation*	• *Part of parent college*
• *Wages*	• *Micro level subjects Estimating & Scheduling*
• *# of Faculty*	•

Appendix D

Proposed Criteria	Literature	ASC Focus Group	Interviews	Measurability	Triangulation	Saturation	Score
Students							
Student to Faculty Ratio	✓	✓	✓	High	High	High (10)	9
AIC Exam Participation and Outcomes	✓	✓	✓	High	High	Low (2)	7
Program Student Selectivity	✓		✓	High	Medium	Medium (6)	7
Retention Rate	✓		✓	High	Medium	High (10)	8
Diversity (Rates of Underrepresented Students)	✓		✓	High	Medium	High (10)	8
Student Satisfaction	✓	✓	✓	Low	High	High (10)	7
Student Recognition	✓	✓	✓	Low	High	Low (2)	5
Internship Programs and Opportunities	✓		✓	Low	Medium	High (9)	6
Alumni Prestige (Company Leadership and Ownership)	✓		✓	Low	Medium	Low (1)	4
Average Grades Given			✓	Medium	Low	Low (1)	4
Student Employment Placement Rates		✓	✓	High	Medium	High (12)	8
Average Starting Salaries after Graduation			✓	Medium	Low	Low (2)	4
% of Student Participation in Competition Teams			✓	High	Low	Medium (6)	6
Study Abroad Opportunities (Cultural Immersion)			✓	Low	Medium	Low (2)	4
Student Competition Outcomes			✓	High	Low	Low (2)	5
Diversity of Employment Position Types		✓	✓	Medium	Medium	Low (1)	5
Student Program Completion Time Tables			✓	High	Low	Low (1)	5
Pre and Post Internship Feedback from Industry			✓	High	Low	Low (1)	5
Proposed Criteria	Literature	ASC Focus Group	Interviews	Measurability	Triangulation	Saturation	Score
Faculty							
Degree Types of Faculty (Top Terminal)	✓	✓	✓	Medium	High	Low (3)	6
Years of Industry Experience	✓	✓	✓	Medium	High	High (9)	8
% of Full time Faculty	✓		✓	High	Medium	Medium (6)	7
Class Load	✓		✓	Medium	Medium	Low (1)	5
Faculty Satisfaction	✓		✓	Low	Medium	Low (2)	4
Faculty Recognition	✓	✓	✓	Medium	High	Medium (6)	7
Fund Raising Responsibility	✓	✓	✓	Medium	High	Low (1)	6
Faculty/Course Evaluations*	✓		✓	Low	Medium	Medium (8)	5
Continuing Education Requirements/Completion	✓		✓	Medium	Medium	Low (2)	5
Conference Proceedings Publications	✓		✓	High	Medium	Medium (7)	7
Journal Publications	✓		✓	High	Medium	Medium (7)	7
Service to Community			✓	Low	Low	Low (4)	3
Quality of Faculty***			✓	Low	Low	Medium (6)	4
% of Adjunct Faculty			✓	High	Low	Medium (6)	6
Faculty Credentials***			✓	High	Low	Low (3)	5
Professional Organization Activity			✓	Low	Low	Low (1)	3
Research Productivity and Implementation by the Industry			✓	Medium	Low	Low (1)	4
Engagement with ASC			✓	Medium	Low	Low (1)	4
Direct Availability to Students			✓	Low	Low	Low (1)	3
Faculty Experience in Pedagogical Areas			✓	Medium	Low	Low (1)	4

Proposed Criteria	Literature	ASC Focus Group	Interviews	Measurability	Triangulation	Saturation	Score
Funding							
Faculty Compensation	✓		✓	Medium	Medium	Low (4)	5
Size of Endowments	✓	✓	✓	High	High	Low (3)	7
Scale of Research Grants (Amount) *	✓	✓	✓	High	High	Low (2)	7
Longevity of Research Grants (Amount)	✓	✓	✓	High	High	Low (1)	7
Scholarships Available from an External Source	✓	✓	✓	High	High	Low (1)	7
Scholarships Available	✓		✓	High	Medium	Low (2)	6
Industry Support	✓		✓	Medium	Medium	High (9)	7
Alumni Giving Rate	✓		✓	Medium	Medium	Low (1)	5
Proposed Criteria	Literature	ASC Focus Group	Interviews	Measurability	Triangulation	Saturation	Score
University/Department							
Program Title	✓		✓	Medium	Medium	Low (1)	5
Program Structure (Stand alone or housed in a larger school)	✓		✓	Medium	Medium	Low (3)	5
Academic Reputation	✓		✓	Medium	Medium	Medium (5)	6
Institutional (University) Support for Program	✓		✓	Medium	Medium	Low (2)	5
Classification of Instructional Program (CIP) Code			✓	Medium	Low	Low (3)	4
Program Size*			✓	Medium	Low	Low (2)	4
Program Age			✓	High	Low	Low (2)	5
Program Growth			✓	High	Low	Medium (6)	6
Community Outreach			✓	Low	Low	Low (1)	3
University Focus (Research, Teaching)			✓	High	Low	Low (1)	5
Active Industry Advisory Board			✓	High	Low	High (10)	7
Qualitative Comments on Accreditation Reports			✓	Low	Low	Low (1)	3
Job fair Opportunities (Student attendance, Company Attendance, Company Diversity)			✓	High	Low	Medium (5)	6
Cost to Benefit Ratio (Tuition and fees vs value of school)			✓	Medium	Low	Low (1)	4
Parent Perception			✓	Low	Low	Low (2)	3
Proposed Criteria	Literature	ASC Focus Group	Interviews	Measurability	Triangulation	Saturation	Score
Curriculum/Classroom							
Type of Degree	✓	✓	✓	Medium	High	Low (2)	6
ACCE/ABET Accreditation	✓		✓	High	Medium	High (11)	8
Specialization (Industrial, Heavy Civil etc.)	✓	✓	✓	Medium	High	Low (3)	6
Available Technology and Tools	✓	✓	✓	Low	High	Low (2)	5
Continual Curriculum Innovation	✓	✓	✓	Low	High	Medium (7)	6
Hands on Labs/Experiences*			✓	Medium	Low	Medium (6)	5
Reputation within the Industry (Feedback and Adaptation)		✓	✓	Low	Medium	Medium (5)	5
Rigor and Breadth of Curriculum			✓	Low	Low	Low (4)	3
Service Learning Opportunities			✓	Low	Low	Low (4)	3
Capstone Offerings and Requirements			✓	Low	Low	Low (1)	3
Internship Oversight			✓	Low	Low	Low (1)	3
Modernized Facilities			✓	Low	Low	Low (1)	3
Available Space for Growth			✓	Low	Low	Low (2)	3
Post Graduate Offerings (Masters PhD)			✓	High	Low	Low (4)	5
% Online			✓	Medium	Low	Low (2)	4

Appendix E

The following is a list of possible criteria that will be used rate construction programs within higher education.

Using the accompanying Likert scale, please rate each criteria (0 = not important and 6 = absolutely essential) based on how important each criteria is when rating the excellence of a construction program.

Each criteria is followed by a definition. These definitions were created to clarify the criteria. **If you feel further clarification is needed or you disagree with some or all of the definition, please feel free to include comments in the space provided following each criteria.**

Student to Faculty Ratio

Ratio of the total number of students in the program divided by the number of FTE faculty

	0	1	2	3	4	5	6
Likert Scale	○	○	○	○	○	○	○

Comments

AIC Exam Participation and Outcomes

An average of both the % of student body participation and an overall percentage of passing scores

	0	1	2	3	4	5	6
Likert Scale	○	○	○	○	○	○	○

Comments

Program Student Selectivity

Requirements that are published for admissions into the program, and a yearly average of accepted student ACT/SAT and GPA (some programs may simply use the standard requirements for acceptance into the university). Additionally, "gate" requirements for upper level students will be considered.

	0	1	2	3	4	5	6
Likert Scale							

Comments

Retention Rate

% of students retained through graduation

	0	1	2	3	4	5	6
Likert Scale							

Comments

Diversity (Rates of Underrepresented Students)

Ratio of underrepresented students divided by total number of students in the program

	0	1	2	3	4	5	6
Likert Scale							

Comments

AIC Exam Participation and Outcomes

An average of both the % of student body participation and an overall percentage of passing scores

	0	1	2	3	4	5	6
Likert Scale	○	○	○	○	○	○	○

Comments

Program Student Selectivity

Requirements that are published for admissions into the program, and a yearly average of accepted student ACT/SAT and GPA (some programs may simply use the standard requirements for acceptance into the university). Additionally, "gate" requirements for upper level students will be considered.

	0	1	2	3	4	5	6
Likert Scale	○	○	○	○	○	○	◉

Comments

Retention Rate

% of students retained through graduation

	0	1	2	3	4	5	6
Likert Scale	○	○	○	○	○	○	◉

Comments

Student Employment Placement Rates

% of graduates who successfully enter the industry upon graduation

	0	1	2	3	4	5	6
Likert Scale							

Comments

% of Students who "Participate" in Competitions

Total number of students who compete (competitors and reserves) divided by the total student body which is eligible to compete

	0	1	2	3	4	5	6
Likert Scale							

Comments

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Comments