

A Study of the Supply and Demand for Construction Education Graduates

**David Bilbo, PhD, CPC,
Courtney Collins, MSCM,
Mohamad Waseem, MSCM &
Richard Burt, PhD, MRICS**
Texas A&M University,
College Station, Texas

This research study analyzes programs, at accredited four-year universities nationwide, which produce construction graduates. A construction program strives to educate their students and prepare them for construction management, as opposed to architecture, business and/or engineering programs. In this study, 64 accredited construction education programs were identified, and sent surveys. The number of “construction graduates” who were produced by the university construction programs were then quantified. The study also surveyed 551 construction companies across the United States, who hired construction graduates, in order to quantify the demand for construction graduates. The study then compared the supply and demand figures. In 2005, findings from the accredited universities indicated a production level of approximately 3596 construction graduates per year. The industry survey indicated a demand for approximately 7877 construction graduates per year. The study finds that the supply deficit is being filled by other types of college graduates, most notably graduates from civil engineering, and business degree programs. The intent of the study is to provide a representation of the current production level of, and the demand for construction graduates, for the purpose of comparing supply and demand. The results of the survey data indicate an increasing demand for construction education graduates. Additionally, the survey data reveals the supply of construction graduates is not currently meeting the demands of the construction industry, nor will it be meeting future industry demands.

Keywords: construction graduates, construction programs, construction industry, supply, demand

Introduction

The construction industry has, for several years, been one of the largest industries in the United States. Over the course of the last few years, the construction industry has continued to grow steadily. According to the U.S. Department of Labor and Statistics (2006), current employment statistics estimates show total annual average construction employment rising from 5,274,000 in 1995 to a high of 6,964,000 in 2004, surpassing the previous high achieved in 2001. Due to this continued growth, and construction processes become increasingly complex the industry has placed a growing importance upon accredited construction education programs to supply bright and motivated individuals (U.S. Department of Labor, Bureau of Labor Statistics, 2006). As the importance of the supply from construction education programs increases, so does the necessity to measure and evaluate industry needs (the demand for construction graduates) and the educational program production (the supply of construction education graduates). However, the research that has been done to quantify the supply and demand for construction graduates in recent years is very limited. To address this problem, the Department of Construction Science at Texas A&M University has been actively involved in research to develop credible information

on both the supply and demand for construction graduates. This study is a replication study of the similar research conducted by Bilbo, Fetters, Burt and Avant in 2000. It involved the survey of 54 accredited construction programs in the U.S. and over 700 companies which consistently hire graduates from the surveyed construction education programs. The results suggested a widening gap in the supply and demand of construction graduates for the near and long-term future, given the continuation of current market growth and production levels of accredited construction programs.

Research Objectives

The following are the research objectives that are examined in this study:

- Identify the supply and demand for construction graduates in the construction industry from 2000-2010.
- Develop a predictive model for supply and demand through the year 2010.
- Identify the companies that hire construction graduates from accredited universities.

Methodology

The purpose of conducting the research for this study was to analyze the supply and demand for construction education graduates from 2000-2010. In order to analyze and collect this data, surveys were sent and collected from the supply (universities) and demand (construction companies) sources.

University Survey

In order to analyze the supply for construction graduates, accredited construction education programs throughout the United States were surveyed. To facilitate the gathering of data for the construction education supply, mail-out surveys were sent to all American Council for Construction Education (ACCE) accredited construction education programs, selected Accreditation Board for Engineering and Technology (ABET) programs, and selected National Association of Industrial Technology (NAIT) programs. The ABET and NAIT programs that were selected to be surveyed had to meet certain standards. In order to ensure the selected ABET programs were producing a “construction graduate,” that was the close equivalent to a construction graduate of an ACCE program, the selection criteria was as follows: the identified ABET programs were those in the engineering field that best matched the ACCE programs by preparing and educating students for a career in the construction industry, rather than engineering. When the original study was conducted in 2000, 48 universities were surveyed and their data was analyzed (Bilbo *et al*, 2000). This study surveyed 64 universities, as the number of accredited construction education programs has increased in the past seven years.

Employer Survey

Data collected from the employer “needs assessment” survey was a two-part process. Initial contacts were made to survey the companies on the list of employers from the original study

conducted by Bilbo *et al* (2000). The original list of companies was surveyed first, and was part one of data collection for the demand element of this research. Data was collected from chief executive officers and/or presidents of construction companies. The heads of human relations were also recipients of the survey, depending upon the departmental structure of the company or directions of the company president.

In order to obtain a list of companies that most regularly recruit from universities, each accredited university was asked to identify these companies. In the survey, it was made clear that construction companies of all size and volume were relevant, as long as they recruited from the construction program on a regular basis. Once companies were identified by the universities, each company was subsequently surveyed.

Data Analysis and Results

University Survey Findings

A total of 64 universities with construction education programs accredited by either ABET, ACCE, NAIT, and in some cases two of the three, were surveyed. Of the 64 universities surveyed, 57 responded. Out of the 57 universities that participated in this research study, 46 (81%) reported that their supply of new construction graduates was not meeting the demands of the recruiting companies. Of these universities, almost all of them revealed in the survey that they could place, in most cases, two to three times more students were they available. Only 11 of the universities (19%) stated they were meeting the demands of the construction companies. Although, as revealed by 81% of the universities, their supply of construction graduates are not meeting the demands of the recruiting companies, even more significant is that only 58% (33 out of 57) of the universities have plans to increase the size of their programs. Most common reasons that were given for not increasing the program included: money and budget issues (lack of available funds), fierce competition amongst programs within the university (for example, business, architecture, engineering) and lack of faculty to teach.

Employer Survey Findings

A total of 203 responses were received to the employer survey from either an executive or human relations manager of a company. The 203 responses represents a 37% response rate. In the survey, each employer was asked to identify both the size (by volume) of the company, as well as the type of service that their company supplies. This information can be utilized by the reader to see the hiring trends of companies, based on size and the service provided. For the purposes of this study, the companies are classified as follows:

- *Large companies*-A company whose volume exceeds 50 million dollars of business annually
- *Medium companies*-A company whose volume is between 25 to 50 million dollars of business annually
- *Small companies*-A company whose volume is less than 25 million dollars of business annually

The greatest percentage (70%) of companies that hire construction graduates are large companies. The small-sized companies that responded make up 17%, while the medium-sized companies make up only 13%. In this research study, it was discovered that large companies hire the greatest number of construction graduates. However, given the fact that 70% of the hiring companies on the employer list are “large,” this finding is not surprising. Reported in the original study, was the fact that while the large companies predicted large short-term increases in new hires, the hiring trend flattens when the large companies predict long-term hires. Bilbo *et al* (2000) states that this “may indicate large companies do not believe they can sustain the recent growth in hiring”. However, the results of the current replication study do not indicate this same trend is occurring again. Conversely, small, medium, and large companies predicted not only sustained, but increasing growth in hiring.

Services Provided by Hiring Companies

When the companies were asked to disclose what type of service their company provided, they were given the following options from which to choose: commercial construction, industrial construction, heavy/highway construction, residential construction, financial services, consulting, construction management, architectural/engineering, or they could select “other.” Figure 1 shows the services provided by the surveyed companies. The category of “Other” were those replies that had three or fewer responses and included the following: design-build, real-estate development, manufacturing, public works, electrical, heavy/civil and government building, maintenance construction of county roads, marine construction, nursing homes and modified wood-frame construction, specialty contractor-mechanical and HVAC, and utility. Although there was an option to specify “financial services” on the survey, there were zero respondents that indicated this option.

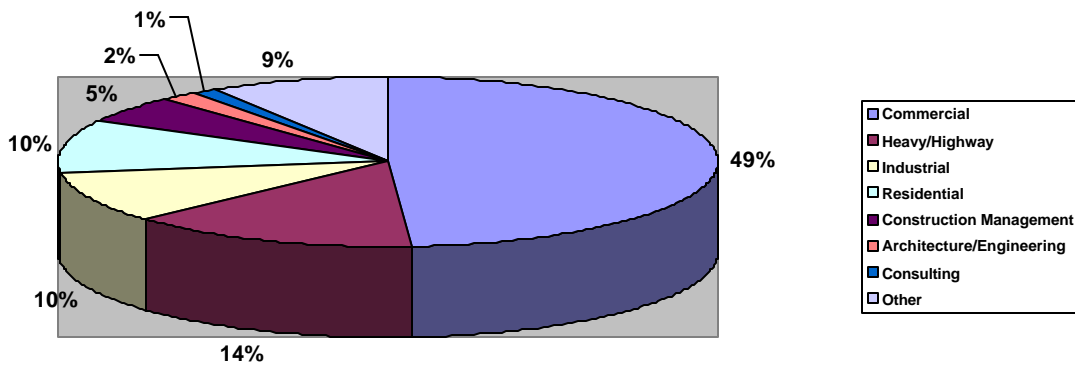


Figure 1: Services Provided by Employers

In this study, the employer’s were asked to state from what, if there were any, types of programs (business, technology, architecture, engineering, etc.) do they recruit from to fill the remaining vacancies within their company. The data from the employer surveys reveals that 44% of the

companies are filling their supply deficit for construction graduates from other programs at four-year universities. According to the responses given on the employer survey, the most common programs from which companies seek out employees are engineering and business programs.

Of the companies that responded to the survey, 26% reported their company recruits from engineering programs, as well as construction education programs. Business programs followed closely behind as 21% of all the companies that responded reported that their company hired graduates from business education programs, as well as construction education programs.

Supply of Construction Graduates

Data analyzed from the survey indicate that 3596 construction graduates, as defined by this study, were produced in 2005. Of these students, 3272 (91%) received a bachelors degree and 324 (9%) received a master's degree. However, the reader must keep in mind that of the 64 universities that were surveyed, 57 actually responded, making the response rate 89% for the university surveys. Therefore, taking this response rate into account, the annual supply totals were multiplied by 1.12 (1/0.89), which gives us the final supply number for construction graduates of 3596.

When the original study was conducted in 2000, 54 universities were surveyed, and 48 responded, making the response rate 89% for the university surveys. It was reported that the survey indicated 2350 construction graduates were produced. Of these 2179 students (93% of) received a bachelor's degree and 171 students (7%) received a master's degree (Bilbo *et al*, 2000). This represents an increase in the supply of construction graduates of 1,246 (53%) from 2000 to the year 2005. However, it is interesting to note that the overall ratio of students earning a bachelor's degree compared to a master's degree is nearly the same, seven years later. In 2000, 93 students out of 100 earned a bachelor's degree, while only 7 out of 100 earned a master's degree. In 2005, 91 students out of 100 earned a bachelor's degree, while only 9 out of 100 earned a master's degree.

Predicting Supply and Demand

For this research study, the data for the supply and demand of construction graduates was predicted into the future. By taking the factored numbers given by the universities and construction companies, the researcher was able to perform a statistical analysis using linear regression. The researcher used a simple linear regression equation in order to predict the supply of and demand for the number of construction graduates (based on the calendar year). The regression model was defined as follows:

$$\text{Number of Construction Graduates} = b_0 + b_1\text{Year} + e$$

The dependent variable was the number of construction graduates. The independent variable (b_1) was the number of years from the first year surveyed (the first year surveyed was calendar year 2000). The hypothesis is that the demand for or supply of construction graduates varies annually. The results of the General Linear Model procedure for supply regression are shown in Table 1 below. The r-square value (the coefficient of determinant), was .955. This means that

approximately 95.5% of the change in the number of construction graduates is explained by change in time. Essentially, this r-square value indicates that the regression model is a good predictor of the supply of construction graduates, withstanding the steady growth of the industry remaining constant.

Table 1

<i>Results of General Linear Model Procedure for Supply Regression</i>					
Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Model	1	451329.7	451329.673	84.901	.001 ^a
Error	4	21263.924	5315.981		
Total	5				
R-square					.995

Table 2, lists the actual number of construction graduates as reported by the accredited construction programs. The years from 2006 to 2010, under the heading “Survey Data,” are the short-term predictions (reported by the programs) of the supply of construction graduates. The numbers under the headings “Predicted (In Regression)” and “Prediction Intervals” were generated by taking the actual numbers given by the universities and performing statistical analysis using the SPSS program.

Table 2

<i>Supply of Construction Graduates 2000-2010</i>				
Year	Survey Data	Predicted (In Regression)	Prediction Intervals	
			<i>Lower 95%</i>	<i>Upper 95%</i>
2000	2843	2874	2634	3115
2001	2935	2991	2757	3224
2002	3008	3107	2880	3334
2003	3359	3223	3000	3445
2004	3436	3339	3119	3559
2005	3596	3455	3236	3674
2006	3493	3571	3351	3791
2007	3624	3687	3464	3910
2008	3736	3803	3576	4030
2009	3911	3919	3687	4152
2010	4062	4035	3795	4276

This projected supply trend is a linear regression model based only on actual university estimates from the years 2000-2010. Figure 2 is a graphical representation of the supply of construction graduates from the years 2000-2010.

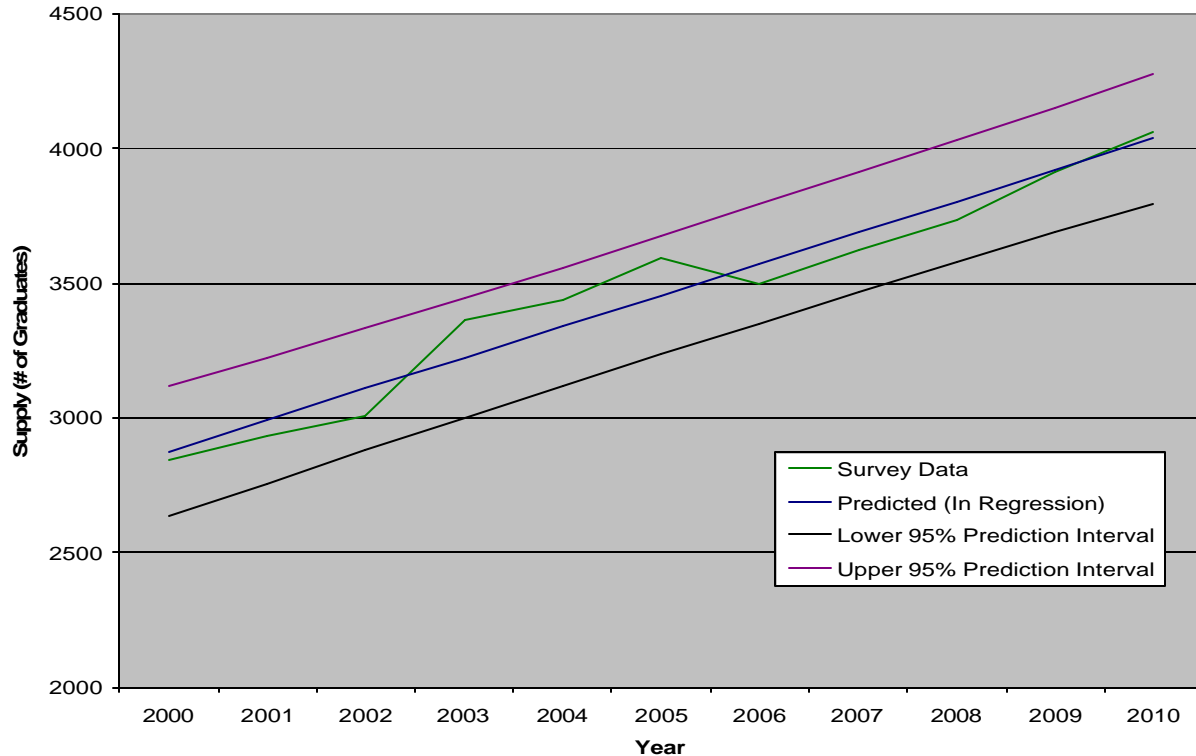


Figure 2: Predicted Supply of Graduates 2000-2010

Construction Graduate Demand

Respondents reported the actual number of construction graduates they hired in the years 2000 through 2005. They were then asked to predict how many construction graduates they would hire in 2006 through 2010. Figure 6 shows a graphical representation of the actual reported hiring quantity data that was collected from the industry surveys. In Figure 6, the actual survey data numbers (of graduates that were hired) are shown from the years 2000 through 2005. These numbers represent the actual numbers of new construction graduates that were reported hired from the employer list. However, of the 551 companies that were surveyed, 203 actually responded, making the response rate 37% for the employer surveys. Therefore, taking this response rate into account, the annual demand totals were multiplied by 2.7 (1/0.37), which gives us the final demand numbers for construction graduates. After 2005, the graph continues from the years 2006 through 2010. These numbers represent the predicted number of future hires, the respondents from the employer list predict, and are considered short-term predictions. The results of the General Linear Model procedure for demand regression are shown in Table 3 below. The r-square value was .965. Again, this r-square value indicates that the regression model is a good predictor of the demand for construction graduates, withstanding the steady growth of the industry remaining constant.

Table 3

<i>Results of General Linear Model Procedure for Demand Regression</i>					
Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Model	1	62530728	62530728.145	245.804	.000 ^a

Error	9	2289531.5	254392.388
Total	10		
R-square			
.965			

Table 4, below, shows the actual numbers of the demand for construction graduates and, Figure 3 below, graphically depicts those numbers. Although the “Survey Data” results have produced the actual demand for construction graduates from 2000-2005, the respondents were only able to predict the future demand from 2006-2010.

Table 4

<i>Demand of Construction Graduates 2000-2010</i>				
Year	Predicted (In Regression)	Survey Data	Prediction Intervals	
			<i>Lower 95%</i>	<i>Upper 95%</i>
2000	4094	3949	2784	5404
2001	4848	4796	3580	6117
2002	5602	5727	4367	6838
2003	6356	6129	5145	7568
2004	7110	6715	5914	8307
2005	7864	7877	6672	9056
2006	8618	9087	7421	9815
2007	9372	10570	8161	10584
2008	10126	10020	8890	11362
2009	10880	10457	9611	12149
2010	11634	11182	10324	12944

In Table 4, the annual construction graduate demand totals are clearly set out. Included are the numbers from the survey data, predicted (in regression), lower 95% prediction interval, and upper 95% prediction intervals. These numbers, excluding those falling under the heading “Survey Data,” were generated by taking the actual numbers given by the construction companies and performing statistical analysis using the SPSS program.

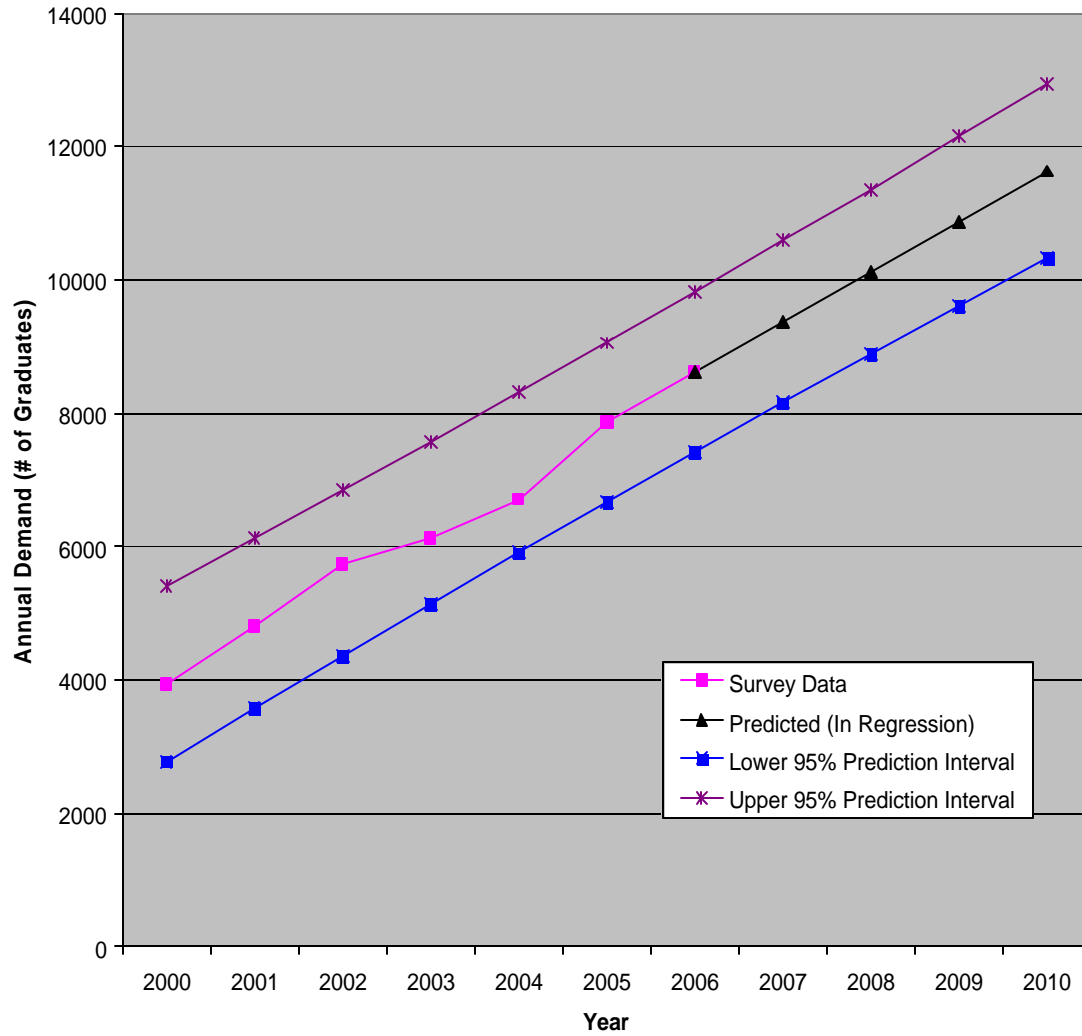


Figure 3: Reported Hiring Trend

This projected hiring trend data is a linear projection based on actual company estimates from the years 2000-2010. Figure 4 shown below is a graphical representation of the supply and demand for construction graduates from 2000-2010.

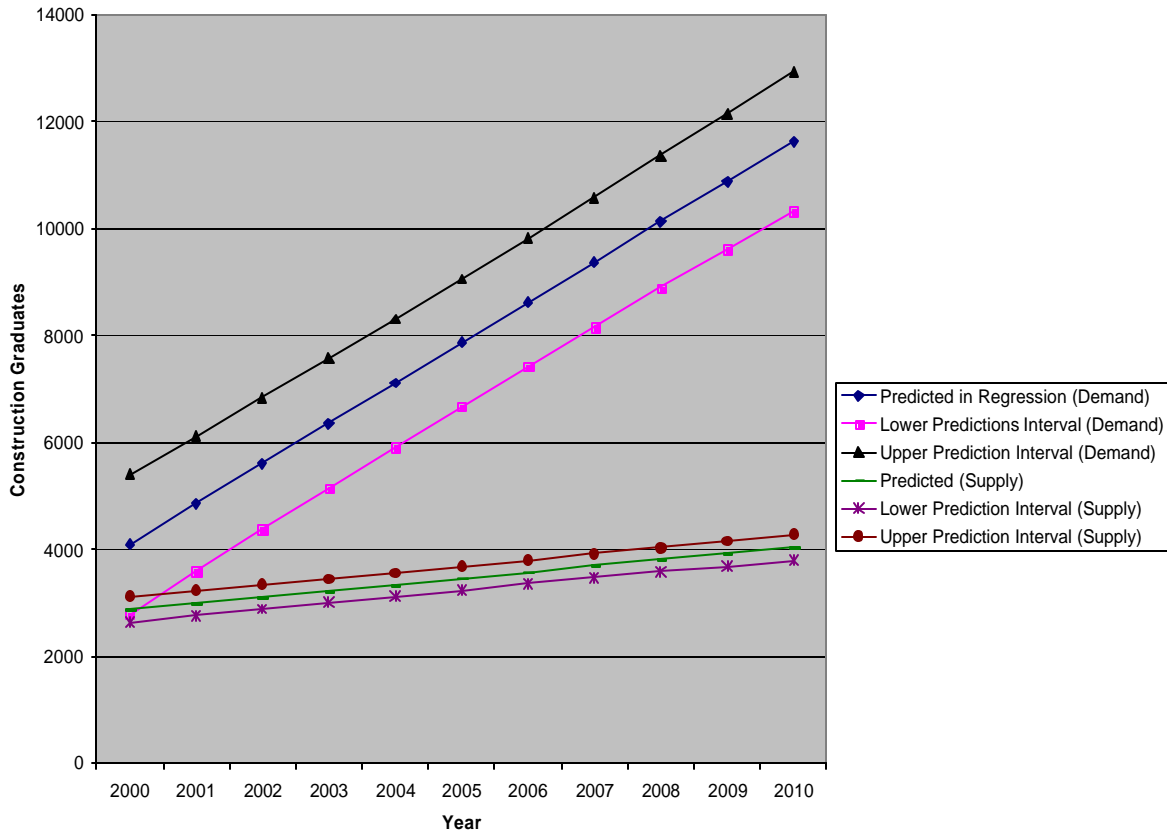


Figure 4: Upper and Lower Predictions-Supply and Demand for Construction Graduates 2000-2010

Conclusions

Construction Graduate Supply

This study concludes that approximately 3596 construction graduates were produced by ACCE accredited construction programs and the selected ABET and NAIT accredited programs in 2005. The supply of construction graduates in 2005 has increased 53% from the supply of construction graduates in 2000 (from 2350 to 3596). However, the supply of construction graduates is still not meeting the demands of the construction industry.

Construction Graduate Demand

This study concludes that approximately 7877 construction graduates per year are being demanded by construction companies that regularly recruit from the accredited construction programs. This should be tempered with the knowledge that the conclusions to this survey are based upon a response rate of 37%. The majority (70%) of the demand for construction graduates is stimulated by those companies whose volume is 50 million dollars annually or greater. The hiring trend for these large companies indicates current rapid growth, and indicates a continued

growth in the future provided the market maintains the need or grows. The atypically non-conservative approach to long-term hiring trends indicates the industry is optimistic about the future. In the past, as well as currently, demand has exceeded supply. Construction employers have been forced to fill this gap from other sources. When the supply of construction education graduates has been exhausted, recruiting companies most often turn to engineering programs, followed very closely by business programs. However, the industry predicting and stating the needs it has for the short-term and long-term future without its usual conservatism is essential for the demands to ever be heard, and subsequently met.

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