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SEPTEMBER/OCTOBER 2018

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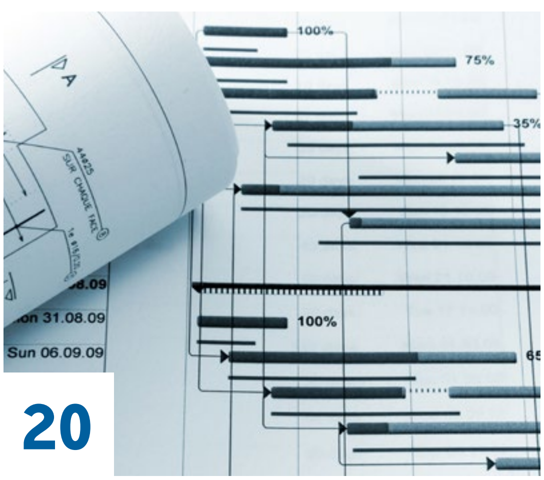

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AACE Launches **Call for Nominations**

BY **CHARITY A. QUICK**, MBA CIA CCT, EXECUTIVE DIRECTOR/CEO

AACE International has launched the annual call for members to apply for open positions on the Association Board of Directors and to serve on the Membership Board as a Regional Director. We are looking for leaders interested in furthering our mission and to help lead the Association. There are seven open positions: President Elect, Vice President Administration, Director Region 3, Director Region 5, Director Region 6, Director Region 8 and Director Region 10. The President-Elect and Vice President Administration will serve on the Board of Directors and the Executive Committee. The Regional Directors will serve on the Membership Board.

Interested parties should complete the online nomination form. You can self-nominate or nominate another person. All nominations will be submitted to the Nominating Committee for review. The Nominating Committee is charged with developing a slate of candidates to be put forward to the membership. Please go here to self-nominate, nominate another person, read position descriptions, etc.: https://www.tfaforms.com/418232

There are substantial benefits to serving as a volunteer leader within AACE which include:

- Playing a key role in shaping the profession
- Enhancing the value AACE brings to membership and the community
- Exchanging ideas and networking with other volunteer leaders

The Nominating Committee has identified desired attributes that will be part of the selection process. Applicants should possess:

- Demonstrated leadership and involvement with AACE
- Recognized leader in the cost engineering community
- Relevant expertise in the disciplines of organizational management
- Positive leadership attributes, emotional intelligence, ability to collaborate effectively and engage in debate when needed
- Commitment to participate in 2-3 board meetings per year plus several virtual meetings
- Visionary and strategic thinker with an ability to influence

The Nominating Committee will present its slate of candidates to the AACE membership no later than November 15. The membership has the option to add other nominations by presenting, no later than Dec. 15, a petition signed by 20 members in good standing. Voting in the online election will open on February 1, 2019 and close at 4 p.m. eastern US time on March 15, 2019. Elected candidates will take office at the 2019 AACE International Conference & Expo.

Make a Nomination

Click this banner to self-nominate, nominate another person, or read position descriptions.

All nominations will be submitted to the Nominating Committee for review. Voting will take place in early 2019.

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Identifying and Predicting **Labor Availability in the Construction Industry**

BY **DR. NOUR BOUHOU; ANTHONY GONZALES;** AND **DR. MARCELO AZAMBUJA**

ABSTRACT

We have all heard the stories; "I can't find enough electricians to finish my job" or "there are not enough skilled concrete workers to finish on time." The lack of available and qualified labor on a project is not only a recent headline but has historically occurred on numerous occasions. Multiple construction organizations have claimed recurring shortages of construction labor in the U.S. in the past three decades. These organizations emphasized the criticality of understanding the implications of the shortages in the workforce on construction projects. However, firms have relied on published assessments based on cognitive approaches (i.e., employer skill, job vacancy surveys, etc.) instead of empirical information to determine the magnitude of these shortages. This article focuses on how to properly identify, quantify, and predict labor availability; and dispel misconceptions inherent within the construction industry. This article was first presented as PM.2639 at the 2017 AACE International Annual Meeting.

INTRODUCTION/BACKGROUND

The U.S. construction industry spending grew by 6% in 2016 compared to 2015, with more than 1,172 billion dollars spent in October 2016 [13]. Of the 6,685,000 employees in an industry that remains heavily labor intensive, more than five (5) million U.S. construction workers occupy production and nonsupervisory functions [12]. Although multiple research studies claim that the U.S. construction industry has been undergoing a labor shortage crisis [7, 9, 10, 15], more than 404,000 construction workers are unemployed, and the construction job openings have been in constant decline since July 2016 [2]. The Associated General Contractors (AGC) conducted a workforce survey in 2016 and concluded that the industry's workforce challenge is primarily a craft worker shortage. In 2016, roughly 69% of the construction firms had difficulty finding labor, specifically carpenters, electricians, roofers, plumbers, and concrete workers [2]. The AGC survey also showed that 12% of the respondents reported an increase in injuries and illnesses because of worker shortage. Also, the Construction Industry Institute's (CII) research team analyzed past construction projects that experienced craft shortages. In accordance with CII's study, 75% of the contractors suffered from labor shortages that were reflected in schedule delays and cost overruns. CII's research study showed that for projects experiencing moderate to severe staff shortages, the average increase in costs was 17.3%, schedules were extended by 22.4%, and the recordable injury rate rose to 0.94 from 0.26 per 200,000 workhours for a fully staffed project. Therefore, it is essential to proactively identify labor shortage conditions in the construction industry as it impacts, with different degrees of magnitude, the project costs, schedule, and safety.

Construction professionals and researchers often identify a labor shortage condition based on two main types of data sources; perceptions of labor shortage, and market condition metrics. The industry perceptions of labor shortage are often represented by employer skill surveys and job vacancy surveys. For example, based on the AGC national survey, 69% of contractors have difficulty finding labor, which could indicate that a labor shortage condition may have occurred in 2016. However, these surveys do not accurately depict the actual labor market condition. First, the surveys are solely based on employers' perceptions of a shortage in the labor force. Also, the surveys do not specify a metric that quantifies the market workforce, which resulted in the key facts contracting the available data. And, because labor market policies are often based on labor market trends, it is essential that policymakers have an accurate assessment of the labor market condition; and accurately identify and predict labor shortage conditions.

This article provides an empirical analysis of the current and predicted labor market trends. It introduces and uses the *labor availability* metric to properly identify, quantify, and predict labor availability in the U.S., dispelling misconceptions inherent within the industry.

The Theory of Labor Shortage

There is no universal definition for labor shortage. However, labor shortage is generally defined as a market disequilibrium between supply and demand, in which the number of workers demanded exceeds the supply available and willing to work at a prevailing wage and for a sustained period [3]. Labor shortage conditions in the construction industry are driven by multiple factors, including the increase in the demand for labor, decrease in the supply of labor, restrictions on prices of labor (i.e., wages), qualifications mismatch, movement to higher paying industries or markets (i.e., oil and gas), geographic trends and retirement ages, etc. [6]. Economists have also provided static and dynamic definitions of labor shortage conditions that explain why wages do not simply need to increase to eliminate labor shortage conditions.

THE STATIC MODEL OF LABOR SHORTAGE

Labor shortage condition is statically defined as the market condition in which the employer demand for labor is greater than the supply of workers. Figure 1 illustrates the supply and demand curves representing a static labor shortage condition. This static model, as shown in Figure 1, does not allow for a possibility that a labor shortage can be sustained in the long run, because market forces could eliminate a shortage. In Figure 1, at market equilibrium, the wage is equal to W_e, and the quantity of workers willing to work at that wage W_e is equal to the quantity of labor that employers wish to hire Q_e. If the market wage becomes W_o instead of W_e; then, the quantity of workers willing to work for that wage is Q_s. However, employers would like to hire a quantity of workers Q_d at that wage rate Q_s. Therefore, the difference between Q_d and Q_s is the amount of labor shortage.

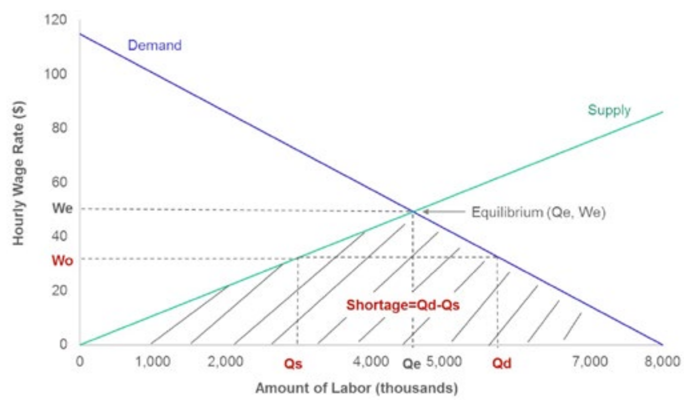

FIGURE 1 Supply/Demand Curves Representation of Static Labor Shortage

This model does not allow for a long-term labor shortage because competitive market forces lead to an increased wage rate, thereby resulting in more workers willing to work for the increased wage and less workers demanded by employers.

THE DYNAMIC MODEL OF LABOR SHORTAGE

The static model of labor shortage does not account for a dynamic labor market. Blank and Stigler (1959) suggested a dynamic market condition that occurs when the supply of workers increases less rapidly than the number demanded at the salaries paid [4]. Furthermore, Arrow and Capron (1959) defined labor shortage as a shift to the right of the demand curve (dashed demand line) caused by an increase in the demand for workers [1]. A shortage occurs under this condition if the wage remains at W_e, employers want to hire Q_1 workers, and only Q_e workers are available at W_e. As a result, the amount of labor shortage is estimated as $(Q_1–Q_e)$, and the new market equilibrium is represented by the point (Q_2, W_2). See Figure 2.

However, the definitions are conceptual, and the identification of labor shortage conditions would require developing labor supply and demand curves for each respective trade in the applicable market. The development of these curves is cumbersome, time consuming, and expensive. As a result, a reasonable measurement should be used to identify a market that experiences a labor shortage condition.

Construction professionals often identify a labor shortage condition based on two main types of data sources; perceptions of labor shortage, and market condition metrics.

The industry perceptions of labor shortage are often represented by employer skill surveys and job vacancy surveys. However, these surveys do not accurately depict the actual labor market condition. First, the surveys

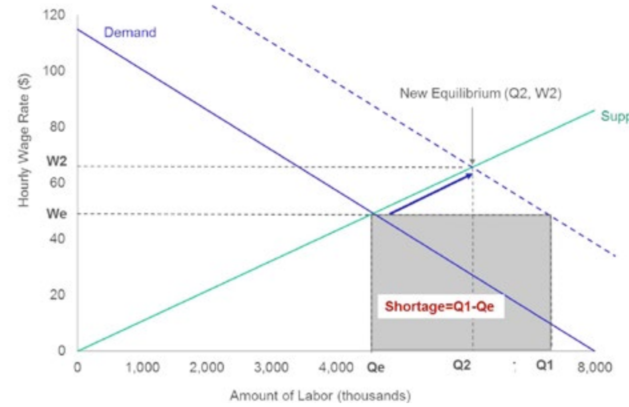

FIGURE 2 Supply/Demand Curves Representation of Dynamic Labor Shortage

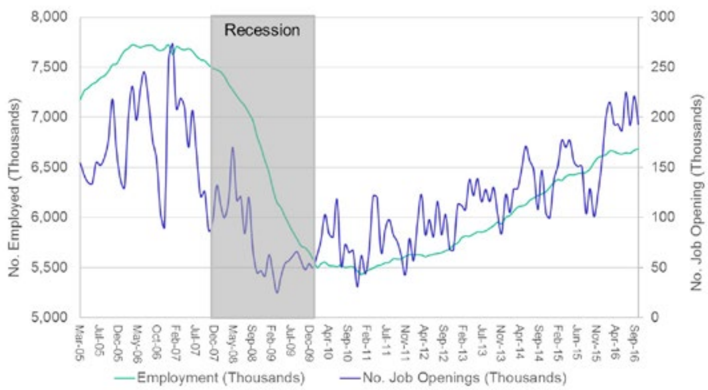

FIGURE 3 National Employment vs. Job Openings

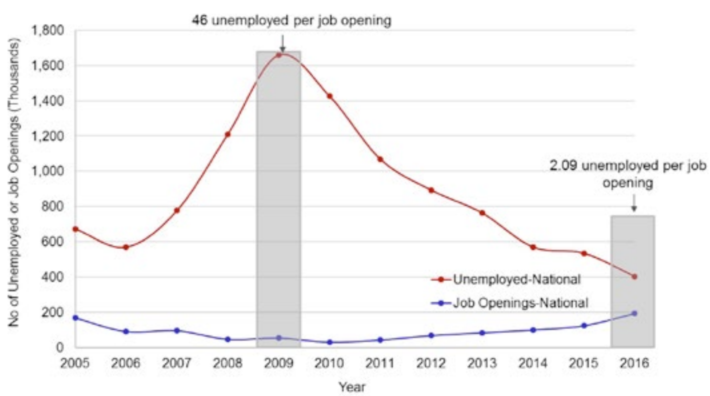

FIGURE 4 National Unemployed vs. Job Openings

Category	Variable	Range
Time	Month	January 2005 to October 2016
Construction Workforce	Employment (in thousands) Unemployment Rate Job Openings (in thousands)	Mean = 6,466, σ=794.4 Mean = 11%, σ=5.3% Mean = 123.4, σ=54.2
Earnings for Production and Nonsupervisory Workforce	Hourly Earnings ($/hr.)	Mean = 24, σ=1.95
Cost	Cost of Construction Index (base year = 1913) Cost of Living (base 1982-1984)	Mean = 8,731, σ=799.5 Mean = 220.5, σ=14.1
Demographic Factors	US Population Growth (% per year) Women in Construction (thousands) Working Age Population (thousands)	Mean = 0.87%, σ=0.15% Mean =943, σ=131.1 Mean = 198,185, σ=3,852

TABLE 1 Summary Statistics of the Explanatory Variables Used in the Analysis
(σ corresponds to the data sample standard deviation)

are solely based on employers' perceptions of a shortage in the labor force. Furthermore, the surveys do not provide detailed information regarding the efforts each employer undertook to secure additional workers. Also, the surveys do not specify a metric that quantifies the market workforce. Instead, the results tend to be an average of the employer perceptions for the labor market.

The market condition should be described using supply and demand matrices, help-wanting advertising, and market indicators. Market indicators include employment levels, unemployment rates, wages, job openings, replacement demand (separation, labor attrition, etc.), training expenditures, levels of immigration, and vacancy rates.

Predicting Labor Shortage Conditions Using the "Labor Availability" Metric

DEFINITION OF THE LABOR AVAILABILITY METRIC

The authors define *labor availability* (Y) as the metric that determines whether unemployed workers have trouble finding a job opening in a given market. It is the ratio between the number of unemployed workers and the number of job openings for a specific trade and location. See Equation 1.

$$Y = Labor\ Availability = \frac{Number\ of\ Unemployed\ People}{Number\ of\ Job\ Openings}$$

EQUATION 1

For example, if there are 100 unemployed concrete workers and 500 concrete job openings in location A; then, the Labor Availability is equal to 0.2. A labor availability metric equal to 0.2 means there are 5 concrete job openings for each unemployed concrete worker in location A. In this case, there is a labor shortage condition in the concrete market in location A. However, if there are 500 unemployed concrete workers and 100 concrete job openings in location B; then, the labor availability metric is equal to 5. A labor availability metric equal to 5 means there are 5 unemployed concrete workers for each unemployed concrete worker in location B. In this case, the concrete market in location B does not experience a labor shortage condition.

STUDY SAMPLE

The data set used in this study was mainly obtained from the U.S. Bureau of Labor Statistics, U.S. Census, and U.S. Bureau of Economic Analysis. Table 1 summarizes the explanatory variables used in the analysis.

Figures 3-7 capture the construction trends on the national level and in the State of Texas.

Figure 3 indicates that employment from 2010 to 2016 increased by 19% since the recession on a national level. It also shows the number of job openings in construction increased by 300% over the same time since the recession.

As of July 2016, the national unemployment and job opening data (Figure 4) identified 99,000 more unemployed than construction job openings nationally. The number of unemployed per job opening in construction was equal to 1.46 (by July 2016), which indicates that for each job opening, there are more than one available unemployed construction worker to fill in the position. As a result, it is less unlikely that the construction market experienced a labor shortage condition in 2015 and up to July 2016 on a national level [11].

However, the labor availability statistics for specific states tend to be different from the national levels. For example, in Texas, there were 45,752 more construction job openings than unemployed in July 2016. The number of unemployed people in Texas per construction job opening was equal to 0.42 in 2016 (Figure 5), which indicates there are roughly 2.38 construction job openings for each unemployed person in Texas (i.e. $2.38 = {}^{1}/_{0.42}$). Therefore, it is more likely that the number of construction job openings per unemployed construction worker is smaller than 0.42, because the construction unemployment rates in Texas are typically lower in the construction industry. These results suggest the construction industry in Texas is more likely to have experienced a labor shortage condition up to July 2016.

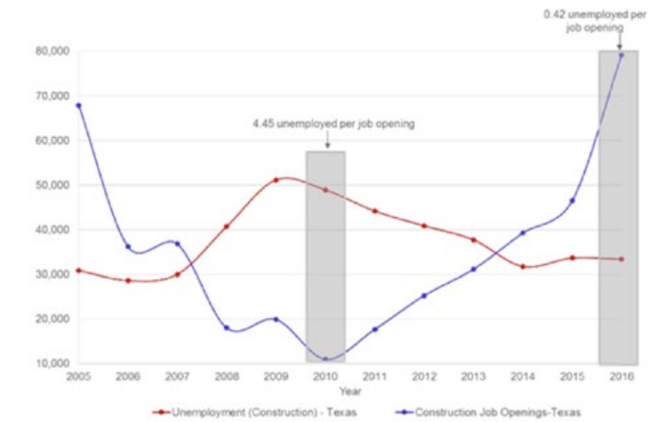

FIGURE 5 Texas Unemployed Construction Workers vs. Construction Job Openings

Figure 6 compares the national construction trends to Texas and shows the number of unemployed per construction job opening is equal to 4.31 nationally, as opposed to 0.72 in Texas in 2015. These results further demonstrate that it is very unlikely that the national construction industry experienced a labor shortage condition in 2015; whereas, the construction industry in Texas possibly did. Figure 6 also shows that the number of unemployed per construction job openings by July 2016 decreased from 4.31 to 1.46 on the national level (i.e., decreased by 66%), and from 0.72 to 0.42 in Texas (i.e., decreased by 42%), compared to 2015.

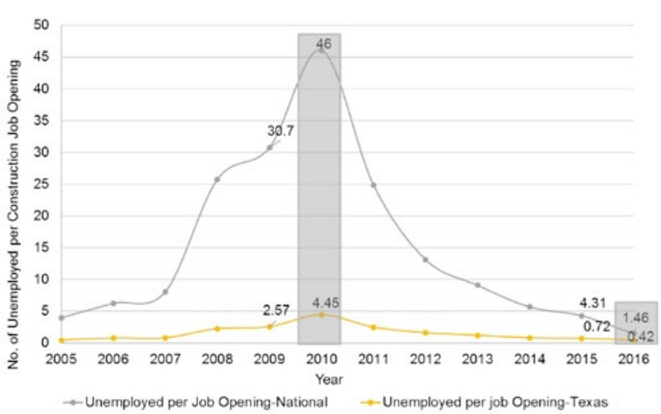

FIGURE 6 Total Unemployed per Construction Job Opening; National vs. Texas

The AGC 2016 workforce survey results for the State of Texas indicated that 72% of the companies that participated in the survey had trouble filling carpenters and electricians; and 67% had troubles filling concrete work positions, drywall installers, pipe layers, and plumbers. Figure 7 is an interactive map that shows the variation of the number of unemployed people per construction job opening in multiple metropolitan areas in Texas and could help better identify the Texas regions that experienced labor shortage conditions in July 2016. Figure 7 indicates that cities in southern Texas (i.e., MacAllen and Brownsville) have more available workers than the larger metropolitan areas in Texas (e.g., Austin, Houston, Dallas, and San Antonio, etc.).

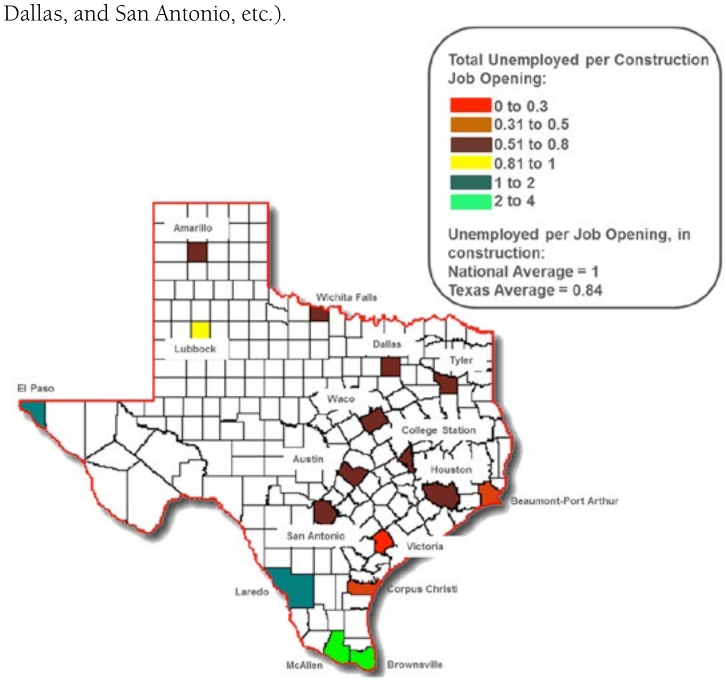

FIGURE 7 Unemployed Per Construction Job Opening in Texas Metropolitan Areas (July 2016)

MODEL SPECIFICATION AND PREDICTION RESULTS

The authors built seven multiple linear regression (MLR) models to examine the impact of each of the seven explanatory variables in Table 1 on labor availability. Each model tests the statistical significance of the seven explanatory variables. The general multiple linear regression model specification is shown in Equation 2.

$$\log(Y_t) = \beta_0 + \beta_1 t + \beta_2 t^2 + \beta_3 Wage_t + \beta_4 CCI_t + \beta_5 CPI_t + \beta_6 \%P_t + \beta_7 W_t + \beta_8 WA_t + \varepsilon_t$$

EQUATION 2

Where:

Y_t represents the monthly Labor Availability (i.e., number of unemployed per job opening)

β_j (j from 0 to 8) are the regression coefficient estimates

t represents the year

$Wage_t$ represents the hourly wage rate (in U.S. dollars) for production and nonsupervisory workers at time t

CCI_t represents the construction cost index at time t, with 1913 being the base year (i.e., 1913 CCI=100)

CPI_t represents the consumer price index (or cost of living) at time t, with 1984 as the base year (i.e., 1984 CPI=100)

$\%P$ represents the U.S. population growth percentage compared to t-1

W_t represents the number of women in construction at time t

WA_t represents the working age population (between 15 and 64 years)

ε_t represents the error terms

The general General linear Linear model Model (GLM) process was used as a preliminary step to select the predictors that explain the most variability in labor availability (see Equation 1). The selected variables cannot all be included in the model because of the sample size restriction and data availability. However, the resulting output provides some intuition for factors contributing to fluctuations of labor availability.

Table 2 demonstrates that demographic characteristics of the labor force, in addition to time variance, explain most of the variation in labor availability. When considered in isolation, the construction cost index explains a moderate degree of variability, with an adjusted coefficient of determination R^2 equal to 3.4%.

The GLM results also demonstrate that a one dollar ($1) increase in the wage rate increases the Labor Availability by 2.8%. However, the wage rate variable does not have a significant effect on labor availability (R^2=0.00389). See Table 2.

The GLM results and stepwise regression were used to screen for predictors to be included in the several regression models, dropping statistically insignificant predictors and those that negligibly explain variability in labor availability.

Table 3 shows model results of a multiple linear regression model. The corresponding model is shown in Equation 3:

Explanatory variables	Coefficient	p-value	R^2	% change in Labor Availability for 1 unit increase in X variable
Year (t)	-0.01393	0.515	0.003077	-1.38 %
Year 2 (Transformed to Year²)	-0.06198	< .0001	0.5766	-6.01%
Wage	0.02761	0.461	0.00389	2.8%
Construction Cost Index	0.0001931	0.038	0.034	0.0193%
Consumer Price Index	-0.001492	0.7736	0.000602	-0.149%
US Population Growth	-1.0212	0.0408	0.02293	-64%
Women in Construction	-0.0030168	0.002	0.0607	-0.301%
Working Age Population	0.0109	0.057	0.0287	0.007%

TABLE 2 General Linear Model (GLM) for Model Selection
$\log(Y_t) = \beta_0 + \beta_1 X_t + \varepsilon_t$, where β_0, β_1 represents the model coefficients, X_t the explanatory variables, and ε_t the error terms, and Y_t the response variable (Labor Availability)

Explanatory variable	Coefficient estimate	p-value	% change in Labor Availability for 1 unit increase in X variable
Constant (bo)	-183800	<0.0001	-
Year (t)	182.9	<0.0001	-
Year 2 (Transformed to Year²)	-0.0455	<0.0001	-4.45%
Wage	1.6540	<0.0001	423%
Consumer Price Index	-0.1235	<0.0001	-12%
U.S. Population Growth	0.5789	0.0122	58%
Working Age Population	-0.0004	<0.0001	-0.036%

TABLE 3 Regression Multiple Linear Model for Labor Availability

$$\log(Y_t) = \beta_0 + \beta_1 t + \beta_2 t^2 + \beta_3 Wage_t + \beta_4 CPI_t + \beta_5 \%P_t + \beta_6 WA_t + \varepsilon_t$$

EQUATION 3

The regression coefficient estimate for each variable indicates the percentage change in labor availability with a one-unit increase in the variable of interest, keeping all the other variables constant. For instance, a one dollar ($1) increase in the hourly wage increases labor availability by 423%, thereby demonstrating the wage has a significant impact on the occurrence of a labor shortage condition in the construction industry. A one-unit increase in the consumer price index decreases labor availability by 12%. The increased population growth in the U.S. has a considerable influence on labor availability, at almost 78%. This regression model coefficient of determination R^2 is equal to 85%. This means that 85% of the variance in the labor availability is predictable from the independent variables listed in Table 3.

LABOR SHORTAGE CONDITION PREDICTIONS FOR THE NEXT 5 YEARS

The multiple regression model described in Equation 3 was used to predict U.S. labor availability in construction for the next five years, from 2016 to 2020. The hourly wage estimates for the study period of 2016 to 2020 were predicted using the multiple linear regression model shown in Equation 4.

$$Wage_t = \beta_0 + \beta_1 CPI_t + \varepsilon_t$$

EQUATION 4

Equation 5 shows the coefficient estimates from the multiple regression model described in Equation 4.

$$\widehat{Wage}_t = b_0 + b_1 CPI_t$$

EQUATION 5

Where:

$\widehat{Wage}_t$ represents the estimated hourly wage for time *t*

b_0 = -6.56

b_1 = 0.133

The labor availability estimates for the years 2016 to 2020 were obtained using Equation 6.

$$\hat{Y}_t = \exp(b_0 + b_1 t + b_2 t^2 + b_3 \widehat{Wage}_t + b_4 CPI_t + b_5 \%P_t + b_6 WA_t)$$

EQUATION 6

Where:

$\hat{Y}_t$ represents the estimated labor availability at time *t*

t represents time, from 2016 to 2020

b_j (j from 0 to 6) are regression coefficient estimates from Table 3

Table 4 describes the predicted U.S. labor availability in the construction industry from 2016 to 2020.

Year	Labor Availability
2016	2.11
2017	1.38
2018	0.86
2019	0.48
2020	0.24

TABLE 4 Labor Availability Predictions from 2016 to 2020 (see Equation 6)

Table 4 shows the labor availability predictions for the construction industry, from 2016 to 2020, as of July 2016, on the national level. Table 4 indicates the national labor availability for construction was predicted to be roughly 2.11 by the end of 2016. These results mean the model in Equation 3 predicted there would be 2.11 unemployed construction workers for each construction job opening by the end of 2016, which suggests that a labor shortage condition was unlikely to occur in the construction industry. The authors used the U.S. Bureau of Labor Statics data to validate the prediction results in Table 4. The authors found that the actual labor availability in October 2016 was equal to 2.09, which only represents a 1% error compared to the labor availability prediction as of July 2016. The difference of only 1% could be caused by other externalities driving the construction industry, and that could accelerate the occurrence of labor shortage conditions in the near future.

These findings validate that the prediction model described by Equation 3 is valid and provides a reasonable prediction of labor availability in the short term. However, results in Table 4 show that the construction labor availability is predicted to be roughly 0.86 by the end of 2018, thereby indicating the construction industry is predicted to endure a labor shortage condition on a national U.S. level.

GENERAL FRAMEWORK FOR LABOR SHORTAGE CONDITION IDENTIFICATION

As defined in previous sections of this article, labor availability can be an appropriate metric to quantify and identify labor shortage conditions. However, the ability to effectively estimate labor availability for a given market, in a given space and time, depends on the available and accurate data. The following steps represent a general framework that could help define and identify labor shortage conditions in the construction industry.

1. Define the study space and time variables:
   - The region and city perceived to experience a labor shortage condition
   - The timeframe or period when the labor shortage condition was observed
2. Determine if labor shortage condition exists in the construction industry:
   - Estimate the labor availability.
   - Determine if the construction market is under a labor shortage condition at the regional level, i.e., if labor availability < 1.
3. Define the specific trade suspected to encounter a labor shortage condition (e.g. carpenters, concrete workers, construction managers, etc.).
4. Contact the state labor commission, union halls, and local construction organizations for labor market data.
   - Employment market trends
   - Unemployment rates for the specific trade
   - Number of job openings for the specific trade
   - Conference Board for data on help wanted online/job advertising
5. Re-estimate labor availability for the specific trade, in the determined space, and time conditions
   - If labor availability < 1; then, the construction labor market for the specific trade is undergoing a labor shortage condition

ADDRESS LABOR SHORTAGE CONDITIONS

After identifying and/or predicting a labor shortage condition in the construction industry, construction professionals should proactively engage the necessary efforts to address it. The following is a list of example efforts that could enable employers to partially alleviate the repercussions of labor shortage conditions.

Contract Language–Contractors should modify their contract language to include escalation, force majeure clauses, and better-drafted labor-related contract provisions. For example, a contractor could claim that a labor shortage condition can be qualified as a force majeure if the contractor demonstrates that the lack of labor availability made work performance impracticable [8]. However, this demonstration could require an analysis of the following:

- The contract and bid documents.
- The foreseeability of the labor shortage condition.
- The extent and severity of the labor shortage condition.
- The extent and severity of the hardship caused by the labor shortage condition.
- Whether an appropriate labor supply was a mutual assumption in the contract, or not.
- Whether a notice of the labor shortage condition was sent promptly to the owner.

Labor and Material Costs Adjustments–Contractors should include reasonable assumptions for labor and material costs in the bid period.

Workforce Training–Companies should develop workers' cross-training programs to create a diversified workforce. Establishing an apprenticeship program, for occupations that do not require a college degree, is a potential training method through onsite or classroom training. In some cases, employers are not required to pay for the training as courses can be partially or fully funded by federal programs, including the Workforce Investment Act (WIA), state training programs, or educational institutions [14].

Workforce Stability–Impacted companies should create programs to develop and maintain workforce stability and improve working conditions. These programs could include tenure recognition programs, training programs to deal with stress related to the occupation, workers' involvement in the company operations. Companies can also use bonuses, overtime opportunities, loyalty rewards, and promotions as incentives to retain their workforce [5].

Higher Wages and Benefits–Based on the supply and demand curve analysis described in the previous sections, increasing wages can improve labor availability in a particular occupation. However, in extreme cases, if the supply of workers is inelastic for a certain period (i.e., not responsive to wage changes), increased wages would not lead to any changes in the number of qualified workers. Improving employees' fringe benefits can also attract more employees. In some cases, employers are usually able to reduce their vacancy rates by improving their fringe benefits rather than increasing wages by a similar amount [3].

Regional Labor Sourcing–Supply and demand for labor varies across each state and nationally. Contractors experiencing reduced labor availability in a specific market should source subcontractors and workers in areas where a labor shortage condition is not occurring. Contractors can pre-fabricate portions of the project in areas where a labor shortage condition is not occurring or compensate workers to relocate to the project site.

Re-engage at the Student Level–The construction industry must re-engage at the student level. By re-establishing and better educating students about vocational-technical schools and construction industry trade education, the industry may be able to attract the high school students that are still deciding what they want to do after school.

Change Perceptions of the Construction Worker and the Construction Industry [5, 11]–The respect that the skilled worker once held must be regained. Owners, employers and contractors must celebrate the work that the skilled laborer provides and recognize how they help to keep the economy moving forward.

Conclusion

Many construction professionals have claimed the construction industry has been experiencing labor shortages in the past three decades. However, labor shortage is a noneconomic term that cannot be quantified and is often misused to describe labor availability challenges. Labor availability is an economic metric that can be used to identify and quantify a labor shortage condition in the construction industry. Our analysis of the construction employment trends suggests there are no current labor availability concerns on the U.S. national level for the construction industry based on the labor availability measurements. However, it appears that certain parts of Texas experienced a lack of labor availability in 2015. Labor shortage conditions have substantial impacts on construction projects, including increased costs, project delays, productivity loss, safety and deliverable quality issues, increase claims and litigation cases, etc. Therefore, it is highly beneficial to forecast the occurrence of labor shortage conditions using the labor availability metric and proactively address the potential labor availability issues by adding labor availability clauses and provisions in the contract, including escalation clauses and force majeure provisions. This analysis could also support decision makers on bidding opportunities and resource planning.

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