Post-Disaster Labor Force Issues:
What Practitioners Need to Understand About Labor Availability and the Impacts of Natural Disasters

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Abstract:

A natural disaster can both create new labor force issues and augment existing ones. Using history and case studies, this plenary will provide an overview of how to properly identify, quantify, and predict labor availability; and dispel misconceptions inherent within the construction industry. By evaluating the historical impact of severe weather conditions on labor availability, in addition to the impacts that natural disasters can have on labor availability, the paper will discuss preventative and restorative measures that can be used by lawyers and construction professionals when those impacts threaten or are encountered.

I. The Sky is Falling, the Sky is Falling!

Chicken Little: The sky is falling! The sky is falling! The sky is falling! …
Goosey Loosey: It is like War of the Worlds outside.
Chicken Little, Walt Disney films, released November 4, 2005

“Construction requires men, machines and materials. … Labor, particularly skilled labor, is perhaps the most critical component in any construction project.”

A. A Storm Is Brewing.

The U.S. labor shortage is reaching a critical point.3

Grappling with an acute labor shortage, the construction industry is being forced to get creative.4

As Hurricanes Maria and Jose approach, construction industry still suffering from a labor shortage.5

Construction worker shortages tops sector concerns in 2019.6

The headlines are not subtle – the construction industry is in dire need of field labor, and skilled craft labor in particular. The Associated General Contractors of America published survey results from over 2,500 contractors confirming this sentiment is more than mere media blitz. In August 2018, 80% of contractors reported difficulty finding qualified craft workers.7 In an unfortunate juxtaposition, that group represents the largest category of employees needed to keep
up with current demand, with 76% of reporting employers indicating they need to hire additional craft personnel. Further, nearly half of reporting contractors rated the well trained/skilled craft labor in their area as poor.

A variety of factors contributed to the apparent labor shortage, including:

1. Mass exodus of construction employees from the construction industry following the 2008-2009 recession, often referred to as the “Great Recession.” Indeed, from 2005-2010, the number of construction workers in the United States shrunk from 11.197 million to 9.077 million. Construction work vanished during the Great Recession, and although work in the industry has more than recovered, the over 2 million workers who left have not returned.

2. United States immigration policy, especially in the current political climate, has resulted in increased scrutiny of immigrant workers, fewer available immigrant workers, and more frequent enforcement and harsher sanctions levied for immigration violations. Indeed, the total number of immigrant workers has declined or stayed roughly the same since reaching its peak in 2007. The obviously implication: the available workforce for many construction labor jobs has not increased proportionate to the amount of available work, especially in markets with large immigration populations.

3. Lower unemployment rates indicate there are more available jobs than there are employees to fill them. Recent statistics indicate that, across industry, there is only one employee available for one open job. This does not account for the skill required to perform the job, which means that there is an insufficient skilled workforce to fill the available jobs.
4. Younger workers more often opt for four-year degrees and pursue white collar work as opposed to blue collar work. The result is an aging field labor work force with no backfill as the current generation begins to retire. According to a recent survey by the National Association of Home Builders, only 3% of survey respondents ages 18-25 selected a career field in construction.14

5. Similarly, males ages 18-25, typically the target age demographic for construction field workers, are disproportionately affected by the opioid crisis.15 Increased drug screening programs make it difficult to hire workers in this age range, especially in areas of the country that have been particularly hit hard by the opioid crisis.

B. Surveying the Damage.

As a result of these shortages, contractors report that they are putting higher prices into bids or contracts, and projects take longer and cost more than anticipated.16 Further, 80% of responding contractors indicated that the skilled labor shortage is having an impact on worker and jobsite safety.17 In fact, in a 2018 Q3 report published by the USG Corp. and U.S. Chamber of Commerce Commercial Construction Index 6, 58% of reporting contractors believe lack of skilled workers is the primary cause of increased safety risk on construction job sites.18 There is increased litigation and claims resulting from schedule disruption and delays.19 And while currently there is no reported data to confirm, those in the construction industry speculate that with the decreased skilled workforce and increased workload, construction defect claims will increase.

II. The Sky May Not Actually Be Falling

Surveys may not accurately depict the severity or magnitude of the actual labor market condition. Therefore, practitioners need to understand how to identify, quantify, and substantiate labor shortage conditions to implement preventative and restorative measures in the event a natural
disaster occurs. Labor availability is a simple problem of supply and demand. An increase in demand for labor would require a similar supply increase in the same market. However, if the demand was greater than the supply of labor in a market, a project may be experiencing a labor shortage condition. A labor shortage condition is generally defined as a market disequilibrium between supply and demand, in which the number of laborers demanded exceeds the supply available and willing to work at a prevailing wage and for a sustained period. Main drivers of labor shortage conditions include 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, retirement ages, and the occurrence of natural disasters. Accordingly, to determine if a project is experiencing a labor shortage condition one would need to quantify labor demand, supply, and wages for a given project and market.

Often, a project manager or executive is tempted to increase wages to eliminate a labor shortage condition. However, as demonstrated below, increasing wages may not eliminate or mitigate a labor shortage condition over the long term. Economists have provided static and dynamic definitions of labor shortage conditions to demonstrate why increasing wages may not eliminate labor shortage conditions.

A. The Static Model of a Labor Shortage Condition

In the static model, a labor shortage condition is defined as a market condition in which the employer demand for labor is greater than the supply of workers. As a wage rate increases, more workers are willing to enter an occupation and current workers are generally willing to stay. Market equilibrium occurs when the quantity of workers willing to work at a wage (We) is equal to the quantity of workers needed by employers (Qe). However, if the quantity of workers (Qs) willing to work for a lower wage (Wo) is less than the quantity needed by employers (Qd), then a
labor shortage condition is occurring. In other words, if employers would like to hire a quantity of workers (Q_d) at a set wage (W_o), but the workers available at that wage (Q_s) is a lesser quantity, than a labor shortage condition is occurring. Therefore, the difference between Q_d and Q_s is the amount of labor shortage under a static model. Figure 1 depicts the occurrence of a labor shortage condition under the static model.

![Figure 1 – Supply/Demand Curves representation of static labor shortage](image)

However, 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.

**B. The Dynamic Model of Labor Shortage**

In the dynamic model, labor shortage is defined as a dynamic market condition that occurs when the supply of workers increases less rapidly than the number demanded at the salaries paid. Arrow and Capron define labor shortage as a shift to the right of the demand curve caused by an increase in the demand for workers. Under this condition, a shortage occurs if the wage remains
at \( W_e \), employers want to hire \( Q_1 \) workers, and only \( Q_e \) workers are available at the wage \( W_e \). 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 \((Q_2, W_2)\). *Figure 2* depicts the situation when a labor shortage condition occurs under the dynamic model.

![Supply and Demand Curves representation of dynamic labor shortage](image)

*Figure 2* – *Supply and Demand Curves representation of dynamic labor shortage*

Accordingly, static and dynamic models help practitioners understand why wages do not simply need to increase to eliminate labor shortage conditions. However, the development of supply and demand curves are cumbersome and time consuming. Therefore, an introduction of a labor availability metric as a reasonable measure that can help identify and quantify labor shortage conditions often proves more useful when analyzing labor shortage in a specific circumstance.

**C. Labor Availability Metric**

“Labor Availability” \((Y)\) is defined as the metric that determines whether or not unemployed workers have trouble finding a job opening in a given market.\(^{22}\) It is the ratio between
the number of unemployed workers and the number of job openings for a specific trade and location.

\[ Y = \text{Labor Availability} = \frac{\text{Number of Unemployed People}}{\text{Number of Job Openings}} \]

*Equation 1 – Labor Availability*

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 that equals 0.2 means there are five 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 is equal to 5. A Labor Availability that equals 5 means there are five 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.

**D. Labor Availability Trends in Construction**

Labor Availability in construction has substantially fluctuated in the past ten years. A review of historical employment data in the U.S. demonstrates that employment increased by 30% since the recession on a national level, from 2010 to 2018. The number of job openings in construction increased by 415% over the same time since the Great Recession. In addition, as of November 2018, the national unemployment and job opening data identified 19,000 more unemployed than construction job openings nationally. The number of unemployed per job opening in construction was equal to 1.07 (in November 2018). This indicates that for each job opening in the month of November, there was one available unemployed construction worker to fill the position. *Figure 3* depicts the construction employment trends on the national level.
Nationally, the number of unemployed per construction job opening was equal to 22.6 in 2010 and changed to 1.6 in 2018, a 93% decrease. Figure 4 depicts the historical Labor Availability in construction on the national level.

*Figure 3 – National Employment vs. Job Openings*\(^{23}\)

*Figure 4 – Total unemployed per construction job opening on the national level*
While it appears that Labor Availability has decreased at the national level, a review at the state level is required. Labor Availability statistics for specific states tend to be different from the national levels. For example, in Texas, there were 25,858 more construction job openings than unemployed construction workers in November 2018. The number of unemployed construction workers in Texas per construction job opening was equal to 0.5 in 2018, which indicates there are roughly 2 construction job openings for each unemployed construction worker in Texas (i.e., \(2=1/0.5\)). These results suggest the construction industry in Texas is more likely to have experienced labor shortage conditions from 2016 through November 2018. *Figure 5* depicts the historical Labor Availability in construction in Texas.

![Figure 5 – Total unemployed per construction job opening in Texas](image)

III. Impact of Severe Weather Conditions and Natural Disasters on Labor Availability

Labor Availability in construction has been considerably decreasing since the Great Recession, both nationally and locally. Even prior to the devastation of California's fires and Hurricanes Harvey and Irma, states like Texas and California have further suffered from acute
shortages in construction workers, especially in the past three years. Unfortunately, natural disasters that struck the U.S. have heavily contributed in plunging the construction industry into deeper labor shortages.

In 2012, Hurricanes Isaac and Sandy resulted in extensive damages across several northeastern states and southeastern states due to high wind and coastal storm surge. Sandy's impact on major population centers caused widespread interruption to critical water and electrical services and caused multiple deaths and over 73 billion dollars in damages. More recently, in 2017, Hurricanes Maria, Irma, and Harvey resulted in over 270 billion dollars in financial losses. Hurricane Harvey, particularly, caused over 127 billion dollars in widespread damage across Texas. Harvey's devastation was aggravated by extreme rainfall producing historic flooding across Houston and surrounding areas, resulting in massive flooding that displaced over 30,000 people and damaged or destroyed over 200,000 homes and businesses. With these massive and destructive natural disasters, affected buildings needed to be restored and rebuilt which resulted in an increased demand on construction workers in markets that already were suffering from labor shortage conditions. *Figures 6 and 7* illustrate the magnitude of financial losses resulting from natural disasters on the national level and in Texas.
To further assess the impact of natural disasters on Labor Availability, a correlation study was performed using historical Labor Availability and several natural disaster types. The correlation study demonstrates that Labor Availability is inversely correlated to wildfires and
flooding, indicating that wildfires and flooding are likely to result in Labor Availability issues in the construction marker. Figure 8 is an illustration of the correlation between Labor Availability in construction, nationally, and natural disaster types.

![Figure 8 - Illustrative graphic of the correlation between Labor Availability in construction and natural disasters. Positive correlations are displayed in Figure 8 in blue and negative correlations in red color. Color intensity and the size of the circle are proportional to the correlation coefficients.](image)

IV. The Sky Has Fallen … and Busted the Schedule/Budget: Available Legal Remedies

“Only in unusual circumstances may the contractor look to another, such as the owner, to absolve it of the responsibility to provide sufficient skilled labor to accomplish the work.”

Labor shortage resulting from a weather event arguably presents such “unusual circumstance” allowing contractor to shift the costs resulting from a labor shortage to the owner. Although there are a few statutory remedies available in public works contracts that allow for an increase in price resulting from extended labor shortages, the primary mechanism in place to allow for such shift is the force majeure clause of the construction agreement.
A. **No Reading Between the Lines.**

A standard force majeure clause typically includes protections against labor strikes or other acts of a labor union, floods, earthquakes, acts of God, and acts of war. Could the argument be made that a weather event that results in a decreased skilled labor pool fall within that definition, even if not explicitly stated? It could, but it would likely fail. Indeed, courts are reticent to extend a force majeure clause beyond the explicit language contained in the governing contract.

For instance, in *S&B/Bibb Hines PB 3 Joint Venture v. Progress Energy Florida, Inc.*, 365 Fed. Appx. 202 (11th Cir. 2010), the Eleventh Circuit Court of Appeals analyzed whether a contractor could use a force majeure clause to recover additional labor and material costs when construction was delayed and completing the work on schedule became much more expensive following several natural disasters. Specifically, four hurricanes struck the jobsite at issue during construction.\(^{27}\) As a result of the hurricanes, the construction labor market decreased, resulting in insufficient skilled labor available to complete construction.\(^{28}\) After construction was complete, the contractor filed suit against the owner seeking roughly $40 million above the contract price, including, in part, costs for increased, and unforeseen, labor costs due to the shortage.\(^{29}\)

The Eleventh Circuit found that the fixed price contract negotiated between the parties “foreclosed any recovery of additional compensation beyond the contract price.”\(^{30}\) However, in support of its right to recover the additional costs, the contractor relied on the construction contract’s force majeure clause.\(^{31}\) That force majeure clause included “adverse weather” and “labor disturbances”\(^{32}\) as qualified events, but only allowed for an extension of time under the contract, **not costs**, providing “in no event shall Contractor be entitled to any increased costs, such as additional compensation, or damages of any type resulting from such Force Majeure delays.”\(^{33}\)
The opinion does not address whether the labor shortage constitutes a force majeure event, so it appears there was no dispute on this issue at the Eleventh Circuit. However, the contractor argued that, although the plain language of the contract provides that its only remedy following a force majeure event is to seek additional time, the contract should be read to include an implicit “obligation on [the part of the owner] to compensate [contractor] for any costs it incurs in responding to a Force Majeure event.” The Eleventh Circuit rejected this reading. Indeed, the court held:

No natural reading of the contracted language gives rise to an interpretation that [contractor’s] contractual obligation to mitigate costs in the event of a Force Majeure delay implicitly requires [owner] to reimburse it for non-delay costs. To read into the parties’ contract such an obligation would nullify, not harmonize, multiple contract provisions. Furthermore, it would subvert the entire purpose of a fixed price contract to allow [contractor] to recover additional labor and material costs when the benefit of a fixed price contract is to protect against price increases, labor shortages, material shortages, and the like. In contracting for the fixed price construction job, “the parties thoroughly addressed and allocated the risks” inherent in the project and [contractor] could have increased its prices to reflect the risks it was assuming.

The contractor’s exclusive remedy following the hurricanes was to seek additional time. Based on this holding, the contractor may have been better off seeking an extension of time to complete the work, thereby not incurring additional labor costs due to the shortage, and finished the project after the original completion date. It is unclear whether this would have been a cost-saving option – perhaps material cost increases were the majority of the claim and would have existed regardless of when the project was completed. However, when facing a similar situation, contractors (at least those within the Eleventh Circuit) may consider requesting additional time under a force majeure clause rather than finishing the job on time because, unless the contract explicitly allows for
additional compensation for increased costs following a force majeure, such costs will not be permitted.

**B. What You Know and When You Knew it Matters.**

Even if a force majeure clause allows for the recovery of costs in addition to an increase in performance time, proper notice must be given before a party will be granted additional time or money to complete the performance of the contract. Although outside the construction industry, *Aquila v. C.W. Mining*, 45 F.3d 1258 (10th Cir. 2008), provides an excellent example of the notice required to invoke a force majeure provision on the basis of a labor shortage. In *Aquila*, C.W. Mining (“CWM”), a mining cooperative, could not meet its shipment obligations pursuant to its contract with Aquila, a utility provider. 39 CWM’s performance was affected by a labor strike that resulted in labor shortage and geological issues in several of its mines. 40 While Aquila had knowledge of some of the geological issues, CWM only provided written notice that it was invoking the force majeure clause due to the labor shortage caused by the strike. 41

Aquila filed suit to recover its losses stemming from CWM’s breach and cancellation of the contract between the parties. 42 After a bench trial, the district court awarded Aquila $24 million. CWM appealed, arguing that the labor dispute and geological events constituted force majeure events and excused its performance of the contract. 43 In an opinion written by now Supreme Court Justice Neil Gorsuch, the Tenth Circuit Court of Appeals disagreed, and affirmed the district court.

First, the Tenth Circuit held that the evidence supported a finding that the delays were not caused by the labor shortage. 44 For instance, witness testimony indicated that the mines were not safe or otherwise available to be mined (i.e., there was nowhere for miners to work even if they were not on strike). 45 Further, CWM only advertised for three open positions during that time

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The Court reasoned it was unlikely that a labor shortage of three could warrant disruption of CWM’s performance under the contract. Accordingly, there was sufficient evidence that the mine’s geological issues, not the labor disruption, were the primary and independent cause of CWM’s inability to perform under the contract.

While the geological issue may have sufficed as a qualifying force majeure event, CWM did not describe the mining issues as having such an impact until the litigation began. Indeed, CWM “downplayed its geological problems and represented that they would be overcome shortly.” At trial, CWM argued that Aquila had “actual notice” of the geological issues with the mines, which substituted for written notice required by the contract. The Tenth Circuit also rejected this argument, finding:

[to be sure, Aquila had notice that CWM was experiencing geological problems. But, the district court expressly found that Aquila did not have actual notice that CWM considered its geological problems a force majeure event … Classifying an event as a force majeure has powerful ramifications – at the very least, receiving notice that that an event is considered a force majeure allows a party to evaluate the validity of a claimed force majeure event and permits it to make other arrangement to mitigate its damages if it suspect the event is serious and will persist.

The holding implies that, had CWM provided adequate notice under the contract invoking force majeure for both the labor dispute and the geological issues, the clause could have excused its performance. However, absent such explicit written notice, CWM could not claim that its failure to perform was a force majeure event resulting from geological issues in the mine. The takeaway here is to be explicitly clear when invoking a force majeure clause, and include all events that could constitute a force majeure. Similarly, be prepared to provide sufficient evidence that the circumstances alleged actually contributed to or resulted in the delay or increased cost. The evidence in Aquila failed to show the labor shortage affected CWM’s ability to perform, proving fatal to its force majeure defense.
C. **We’re Going to Trial!**

In addition to strict construction and proper notice, the cases interpreting force majeure are very factually intensive. So much so, that it is unlikely these cases will be resolved on summary judgment and is more likely they will be decided by some trier of fact, whether it be arbitrator, judge or jury. This fact should be considered when determining how to resolve a dispute involving a force majeure event. If the case goes to litigation or arbitration, the parties should be prepared to go the full distance of the matter through trial.\textsuperscript{52}

V. **Handling the Labor Shortage in the Construction Industry**

With severe weather conditions and natural disasters, labor shortage conditions are further accelerated and result in decreased worker productivity and safety, increased construction defects, slippage to project schedule, and increase in costs and claims. Construction professionals are therefore required to implement preventive measures to alleviate the impacts of labor shortage conditions, by better planning their project, modifying the contract language, and including cost, schedule, and risk adjustments. Restorative measures can also be implemented to mitigate labor shortage conditions, including trade unions, cross-training, workforce stability, labor sourcing, student outreach, perception change, immigration initiatives, and increased benefits.

A. **Contract Language**

Contractors should modify their contract language to include escalation, force majeure clauses, and better-drafted labor-related contract provisions. Applying the lessons learned from the cases above, with the right contract language and compliance with applicable notice requirements, a contractor could successfully claim that a labor shortage condition qualifies as a force majeure event if the contractor demonstrates that the lack of qualified labor available made work
performance impracticable. However, this demonstration could require an analysis of the following:

1) the contract and bid documents;
2) the foreseeability of the labor shortage condition;
3) the extent and severity of the labor shortage condition;
4) the extent and severity of the hardship caused by the labor shortage condition;
5) whether an appropriate labor supply was a mutual assumption in the contract; and
6) whether a notice of the labor shortage condition was sent promptly to the owner.

Contractors should also include reasonable assumptions for labor and material costs in their bids and proposals.

The following provision is an example describing the impact of labor shortage on project delays and liquidated damages;

*Shortage of Supply: Contractor shall promptly notify the Owner of any occurrence of which it becomes aware that it expects will result in a likely labor shortage, whether due to a force majeure or otherwise, or prevent Contractor from performing work in conformity with the project schedule set forth in the contract documents. In this case, Contractor shall include in such notice its best estimate of the duration of the delay, the reasons for the delay, and whether the reason impacts the project critical activities.*

**B. Cost and Schedule Adjustments**

Adjustment multipliers can be used to develop reasonable baseline schedules and cost estimates, accounting for labor shortage risks in the market, as described in the following table.
<table>
<thead>
<tr>
<th>Craft Labor Staffing Difficulty</th>
<th>OHSA Number of Recordable Incident Cases per 200,000 Work Hours</th>
<th>Average Cost Change (%) (95% Confidence Interval)</th>
<th>Average Schedule Change (%) (95% Confidence Interval)</th>
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<tbody>
<tr>
<td>Moderate/Severe</td>
<td>0.94 (0, 2.84)</td>
<td>17.3% (8.4%, 26.2%)</td>
<td>22.5% (11.5%, 33.4%)</td>
</tr>
<tr>
<td>Slight</td>
<td>0.43 (0, 1.72)</td>
<td>3.2% (−0.9%, 7.3%)</td>
<td>12.8% (7.7%, 17.9%)</td>
</tr>
<tr>
<td>No Difficulty</td>
<td>0.26 (0, 1.25)</td>
<td>−6.2% (−10.7%, −1.8%)</td>
<td>6.4% (1%, 11.8%)</td>
</tr>
</tbody>
</table>

Source: CII Implementation Resource 318-2 “Is There a Demographic Craft Labor Cliff That Will Affect Project Performance?”

C. Workforce Training

Companies should develop 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.

D. 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, or programs encouraging involvement in company operations. Companies can also use bonuses, overtime opportunities, loyalty rewards, and promotions as incentives to retain their workforces.

E. Higher Wages and Benefits

Based on the supply and demand curve analysis described in the previous sections, increasing wages may improve Labor Availability in a particular occupation, but generally not for a long period of time. 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.

**F. 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.

**G. 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.

**H. Change Perceptions of the Construction Worker and the Construction Industry**

The respect that the skilled worker once held must be regained. Owners, employers, and contractors must celebrate the work that skilled laborers provide and recognize how they help to keep the economy moving forward.

**I. General Framework for Labor Shortage Condition Identification**

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

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<tbody>
<tr>
<td>1. Define the study space and time variables:</td>
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<tr>
<td>▪ The region and city perceived to experience a labor shortage condition</td>
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<tr>
<td>▪ The timeframe or period when the labor shortage condition was observed</td>
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<tr>
<td>2. Determine if labor shortage condition exists in the construction industry:</td>
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</tr>
<tr>
<td>▪ Estimate the Labor Availability.</td>
<td></td>
</tr>
<tr>
<td>▪ Determine if the construction market is under a labor shortage condition at the regional level (i.e., if Labor Availability &lt; 1).</td>
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<tr>
<td>3. Define the specific trade suspected to encounter a labor shortage condition (e.g., carpenters, concrete workers, construction managers, etc.).</td>
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<tr>
<td>4. Contact the state labor commission, union halls, and local construction organizations for labor market data.</td>
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<tr>
<td>▪ Employment market trends</td>
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<tr>
<td>▪ Unemployment rates for the specific trade</td>
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<tr>
<td>▪ Number of job openings for the specific trade</td>
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<tr>
<td>▪ Data on help wanted online/job advertising</td>
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<tr>
<td>5. Re-estimate the Labor Availability for the specific trade, in the determined space, and time conditions</td>
<td></td>
</tr>
<tr>
<td>▪ If Labor Availability &lt; 1, the construction labor market for the specific trade is undergoing a labor shortage condition</td>
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VI. What We Can Expect Through 2020

Using statistical modeling techniques, a multiple linear regression (MLR) model was updated to examine the impact of multiple explanatory variables on Labor Availability, including time, wage, construction cost index, consumer price index, the U.S. population growth percentage, working age population, and number of women in construction. The MLR model tests the statistical significance of the explanatory variables. After examining the statistical significance of the explanatory variables, a final MLR model was selected to explain the variation in Labor Availability using historical data. The final MLR model described the changes in Labor Availability as a function of time, hourly wages, consumer price index, U.S. population growth, and working age population. This final MLR model was used to predict Labor Availability in construction, on the national level, through 2020. The model results indicate that Labor Availability was predicted to be roughly 1.01 by the end of 2018, 0.57 by the end of 2019, and 0.3 by the end of 2020. Date obtained from the U.S. Bureau of Labor Statistics was used to validate the model prediction results. The actual Labor Availability in November 2018 was equal to 1.07 and the predicted Labor Availability, using the final MLR model, is equal to 1.01 for 2018, which only represents a 6% error. This 6% difference could be a result of externalities and weather conditions that drive the construction industry and accelerate the occurrence of labor shortage conditions in the future. The 6% error also validated that the final MLR model provides a reasonable prediction of the Labor Availability in the short term. However, as depicted by the model results, construction Labor Availability is predicted to be roughly 0.57 by the end of 2019, indicating that Labor Availability will continue to worsen on national level. Considering potential market externalities and potential severe weather conditions and natural disasters, the actual Labor Availability might decrease much faster than predicted in the next two years. Construction
professionals are therefore highly encouraged to start proactively implementing the recommended preventive measure outlined above.

1 Nour Bouhou, PhD with Spire Consulting Group, LLC contributed to this paper.
8 Id.
9 Id.
14 Rose Quin, Young Adults & the Construction Trades National Association of Home Builders: Eye on Housing April 19, 2017 http://eyeonhousing.org/2017/04/young-adults-the-construction-trades/
15 National Institute of Health; National Institute on Drug Abuse: Opioids https://www.drugabuse.gov/drugs-abuse/opioids Last Visited March 29, 2019
25 Bruner & O’Connor Construction Law §7:82 (June 2018).
26 See e.g. 48 C.F.R. § 16.203-2 (2019).
28 Id.
29 Id.
30 Id. at 204.
31 Id. at fn.2.
32 Id. at 204.
33 Id.
34 Id. at 205.
35 Id. at 205-06.
36 Id. at 206.
37 Id. at fn. 4.
38 Aquila v. C.W. Mining, 45 F.3d 1258, 1260 (10th Cir. 2008).
40 Id. at 1261.
41 Id. at 1261-62.
42 Id. at 1262.
43 Id.
44 Id. at 1263.
45 Id.
46 Id.
47 Id.
48 Id. at 1264.
49 Id. at 1262.
50 Id. at 1265.
51 Id. at 1266-67
52 See also Shenango Inc. v. Massey Coal Sales Co., 2009 WL 2901296 (W.D. Pa. September 10, 2009) (coal mining company permitted to argue force majeure arising from labor shortage at trial because sufficient expert and corporate witness testimony indicating that there was insufficient labor to complete mining at the available mines).
53 MLR updated by Dr. Nour Bouhou based on 2017 paper authored by Nour Bouhou, PhD, Anthony Gonzales & Marcelo Azambuja, PhD. Identifying and Predicting Labor Availability in the Construction Industry. 2017 AACE International Annual Meeting.