Pandemics and Construction Productivity: Quantifying the Impact
# Pandemics and Construction Productivity: Quantifying the Impact

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Executive Summary

Overview

A pandemic can have far reaching impacts on the U.S. economy. Companies in once successful industries across the United States have felt the immediate impact of the current pandemic in the most devastating of ways. Many companies have come to a complete and total shutdown that has displaced over 25 million Americans from their jobs since March 2020. Other industries like the healthcare and medical research fields have seen excessive stress placed on them in terms of resources and equipment, but also on the personal lives of the professionals that are administering these services. These are truly unprecedented times that were unforeseen just six months ago.

The government has tried to do its part to care for the unemployed, the small businesses and even some large industries that have been most noticeably impacted by the government directed shutdowns and forced isolations of our population. The CARES Act has gone a long way to help to start bridging the gap from today toward recovery but it is not enough and cannot be the end of the support to corporations across this country.

Caught in the middle ground and left out of these often-discussed areas of our society and business owners are the essential operations that have been asked to remain working during this pandemic. These industries are traditionally known to provide food, basic human necessities or some service that our government has deemed to be critical to the wellbeing of our citizens or to keep our economy moving in some way that prevents a total collapse of our infrastructure. The construction industry is one of those essential industries that has continued to deliver its services to both private owners and government agencies alike. It has done so while adapting to and adhering to a continuously updated and changing set of recommendations from our health, state and federal government officials. During this time of essential operation, our workforce continues to receive their paychecks, union pension and health funds are contributed to and not drawn from, and our building owners receive their buildings per the schedule that they have asked for it to be completed. These are all positives for the economy. However, the unintended consequence of being deemed essential and working under these new mandates has fallen directly at the feet of the corporations who employ this workforce.

Most of these construction companies work on fixed price contracts and have limited if any financial relief per the terms of their owner agreements. So, the added costs and inefficiencies of being an essential business are directly taken from the corporate profits. Without financial aid from our government, this industry too will suffer from the impact of this pandemic, but it will look different than the early impact on the people and industries that our legislative branch has tried to save in the pandemic. It could be months or in some cases a few years from the start of this pandemic where you will see the failures of construction companies because they have no clear channel for equitable adjustment and have been contractually mandated to continue operations. The new normal that is being created from our health and social modifications resulting from this pandemic are being shown early in the construction industry so Congress should take note as to what the potential financial or profitability ripple looks like as we start to reopen America.
Construction sites are usually vibrant micro-communities that thrive on fast paced teamwork and require the precision of large numbers of men and women working together in tight spaces. They all play their parts working together to erect massive buildings. Nearly every activity on a job site takes more than 1 person to complete so the rule of social distancing creates a nearly impossible challenge. Hundreds of men and women line up daily to have their temperatures scanned prior to beginning work. They ride in elevators to and from their work areas in one-third the capacity that they once did so that they create space from each other. This takes up hours that were spent productively installing construction materials and are instead now spent simply getting to the work area. Every activity is spaced at six-foot distances. Safety toolbox talks, stretch and flex programs and daily meetings are all impacted as communication and coordination of activities has diminished at job sites. Each site has created their own version of shelter in place habits that have slowed down the industry to reduce the potential spread of this virus while continuing to work.

The construction industry thrives on challenge and innovation and will continually improve to safely delivery products to owners. In time, we will adjust to this new normal and price the work of our contracts appropriately. However, in the near term the financial burden of the social restrictions on this industry may be so great that many companies will not survive to compete in the future.

Preliminary Findings

Early measurements of the impact of this pandemic suggest that construction productivity has been impacted by nearly 20%. A rule of thumb for self-performing contractors is that a 10% impact on productivity results in a 100% impact on profitability. As such, contractors need to seriously consider the impact of this study on their profitability and seek equitable adjustments that adequately compensate them for the impact.

This study is divided into three distinct sections:

- Part I - Pandemic Mitigation Tracking
- Part II - Productivity Benchmarking
- Part III - Business and Project Impacts

Pandemic Mitigation specifically quantifies hours associated with preventative measures such as training, health screenings, cleaning and disinfecting, job site access and administration instituted to minimize exposure.

Productivity Benchmarking specifically quantifies the reduction in direct work productivity related to social distancing rules, staggered shifts, reduced crew sizes, increased personal protective equipment requirements and related job site regulations.

Business and Project Impacts specifically quantifies ancillary impacts experienced by most contractors who participated in this study.

The following is a description of each of the three distinct sections.
Part I - Pandemic Mitigation Tracking
Data collected to date suggests that 7% of labor hours are lost on pandemic mitigation activities based on a random sampling of over 75,000 labor hours. It is reasonable to expect that if crews were not spending 7% of their available productive time working on pandemic mitigation, they would be putting work in place.

Contractors should prepare and submit change order requests to seek compensation for the impact of pandemic mitigation and prevention efforts instituted on their projects. Pandemic mitigation was never contemplated at the time of pricing a project and represents an unforeseen cost. Contained within this study is a change order calculator for contractors.

Part II - Productivity Benchmarking
The data indicates a 12.4% overall average impact on Vertical Construction productivity as a result of a pandemic. It is important to note that this impact is additive to the 7% loss experienced as a result of mitigation tracking. Based on the current data, we are seeing 50 to 60 minutes of lost productivity per day per employee 8-hour work period.

The study clearly illustrates the need to file change orders to recover losses on out-of-scope work and losses in productivity. The current pandemic also demonstrates the necessity of implementing proper productivity controls. Contractors with accurate labor and productivity tracking systems are far better positioned to manage the crisis than those without. NECA will be conducting an outreach program as a follow up to this study to help educate contractors on the how and why of effective job cost control systems.

Part III – Business and Project Impacts
To be provided by Mark Federle.
Part I - Pandemic Mitigation Tracking

Objective
The objective of Pandemic Mitigation Tracking is to quantify lost productivity directly associated with jobsite pandemic mitigation requirements such as training, health screenings, cleaning and disinfecting, job site access and administration instituted to minimize exposure.

Data Collection and Methodology
Researchers provided participants with an application for iOS and Android smartphones and tablets to collect hours from projects daily. A Microsoft Excel based worksheet for participants with bulk daily time data provided an additional data collection option. Data collection began on April 15th, 2020 and continues at the time of writing.

A single data point for this research represents time reported to five standardized time codes, per project, per day. Standard definitions for each time code normalize the data across the range of participants in the sample. The time codes are:

- 100 - Total Hours Worked
- 200 - Hours lost to COVID Safety and Training
- 201 - Hours lost to COVID Distancing and Jobsite Access
- 202 - Hours lost to COVID Cleaning and Disinfection
- 203 - Hours lost to COVID Administration.

Detailed definition of types of activities per time code are available in Appendix ‘A’.

Definitions of activities for each time code category were drawn from:

- Local, State and Federal government guidelines for social distancing.
- OSHA’s ‘Guidance on Preparing Workplaces for COVID-19’.
- OSHA’s ‘Interim Enforcement Response Plan for Coronavirus Disease 2019.’
- Firsthand accounts provided by contractors.

Participants were provided instruction for using the data collection tools via a combination of methods:

- Webinar (live and recorded)
- PDF Instruction Manual
- Instructions and FAQ embedded in both data collection tools
- Direct access via phone, text or email to the researchers for questions and technical support

Sample size and geographic coverage were reviewed daily using a heat map linked to the sample data set.
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The analysis of the data collected centers around a single question: Is it reasonable to expect that the percent of labor hours, on average, that a contractor loses on jobsite pandemic mitigation requirements are hours not available to produce work at estimated rates of production and/or rates of production as defined in resources such as NECA’s Manual of Labor Units 2019-2020?

Sample Set
As shown in Figure 1, the sample data collected was geographically distributed across the United States and Ontario, Canada and contained many major markets.

![Figure 1: State Distribution of Mitigation Data.](image)

Figure 2 shows the “heat map” distribution and relative number of samples from each geographic location.

![Figure 2: Concentration Heatmap of Sample Set Data Areas.](image)
Figure 3 provides a table depicting the breakdown of hours collected and task coded to mitigation related activities:

<table>
<thead>
<tr>
<th></th>
<th>Total Hours</th>
<th>% of Total Hours</th>
<th>% of Mitigation Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Hours Available</td>
<td>77,205</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitigation Safety &amp; Training</td>
<td>1,598</td>
<td>2.1%</td>
<td>29.6%</td>
</tr>
<tr>
<td>Mitigation Distancing &amp; Access Rules</td>
<td>1,865</td>
<td>2.4%</td>
<td>34.6%</td>
</tr>
<tr>
<td>Mitigation Cleaning &amp; Disinfecting</td>
<td>1,400</td>
<td>1.8%</td>
<td>25.9%</td>
</tr>
<tr>
<td>Mitigation Administration</td>
<td>532</td>
<td>0.7%</td>
<td>9.9%</td>
</tr>
<tr>
<td><strong>Total Mitigation Hours</strong></td>
<td><strong>5,394</strong></td>
<td><strong>7.0%</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

*Figure 3: Hours by Task Code for Mitigation Activities*

*Figure 4: Mitigation Hours as a Percent of Total Hours by Week*
Summary Findings

On average, electrical contractors experience a 7% loss of production due to pandemic mitigation activities each day. Approximately 60% of the loss is due to the combined effects of distancing, access, cleaning and disinfection activities. During an active pandemic these are activities that crews manage throughout each day.

Thirty percent (30%) of the loss is due to pandemic specific safety and training meetings, toolbox talks, orientations, medical screenings, personal protective equipment fitting and training, etc. that occur on more periodic basis.

Ten percent (10%) of lost time occurs due to pandemic related administration such as additional paperwork, managing suspected cases and additional work coordination due to increased complexity in managing workflow. These activities are typically managed by onsite supervision.

In general, it should not be required for contractors to itemize the loss of 7% into sub-categories as all categories require management on active projects during a pandemic. Federal distancing guidelines, OSHA requirements, and the resulting general contractor and subcontractor safety plans apply to most projects regardless of region or type. For example, the following existing standards are referenced by OSHA as applicable in times of pandemic and apply to all projects across the country:

- 29 CFR § 1904, Recording and Reporting Occupational Injuries and Illness.
- 29 CFR § 1910.133, Eye and Face protection.
- 29 CFR § 1910.1020, Access to Employee Exposure and Medical Records.
- Section 5(a)(1), General Duty Clause of the OSH Act.

It is possible that local, state, owner driven, or contractor specific mitigation requirements could affect the degree and complexity required to comply with mitigation requirements. In such cases contractors should use the 7% loss as a baseline from which modifications specific to their situation are made. Factors to consider are provided in the section entitled “Roadmap” below.

Is the situation improving with time? It is too early to tell. It is reasonable to expect that early uncertainty surrounding the necessity and degree of mitigation requirements will ease as the specific disease is better understood and enforcement agencies more clearly define requirements. It is also reasonable to expect that contractors will improve their ability to cope with mitigation requirements as time goes on provided they know what to expect. Until then, contractors should consider several factors to assess the degree of impact they will experience that will modify the current average including:

- GC/CM/Owner Site Specific Safety Plans
- GC/CM Site Logistics Plans
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- Quality of work coordination
- Local, State, or other modifiers to Federal Guidelines

With the number of hours and projects sampled, 7% is a solid calculation of the current average loss experienced daily by contractors across the country with a margin of error of plus or minus 1%.

Roadmap

Contractors should utilize the average loss in productivity in the following scenarios:

- Use the average provided and the calculator provided as backup to prepare change orders requesting relief for lost time managing pandemic mitigation requirements.
- Use the average provided as a multiplier on active project to forecast financial projections, schedule impact, and resource availability.
- Use the average provided as a multiplier for estimating projects that will require pandemic mitigation factors as projects re-open and for future projects assuming prolonged mitigation requirements.

Factors that should be considered as modifications to the baseline average include, but are not limited to:

- Detailed knowledge of federal, OSHA, and CDC applicable guidelines and directives.
- Local and state modifiers or additions to federal, OSHA, and CDC guidelines and directives.
- Availability and clarity of owner, GC/CM project specific safety plans.
- Project specific characteristics that influence social distancing & logistics.
- Relationship with the GC/CM.

It should be noted that some traditional methods of schedule acceleration, such as additional manpower or overtime, are either not possible due to the nature of pandemic mitigation guidelines and directives or will compound the effects of activities such as waiting for access to work areas or gaining access to trailers for medical screenings, to name a few.

Contractors should look to their local NECA Chapters for news and information regarding additional training and education as well as updates to the data provided.
Part II - Productivity Benchmarking

Objective

The aim of the Productivity Benchmarking had three parts:

1. To measure electrical contractor companies’ pre- and post-pandemic direct work productivity
2. To measure the impacted tasks by market segment, project/job type and geographic area
3. Provide analysis, summary findings and a roadmap to operationalize the results

In order to achieve the objective, a model was established to normalize data and provide a consistent and structured manner to collect and analyze the productivity data. More specifically:

- Researchers documented specific tasks designed by an ELECTRI-designated task force – this enabled us to collect percent completed and hours for common tasks across companies by market segment
- Constructed a formalized data gathering process from multiple electrical contracting companies across the US
- Defined specific critical dates that impacted contractor productivity (i.e. – Shelter in place orders)
- Measured, tracked, mapped and analyzed the data provided by contractors
- Built analytics models to generate insights into data and summarized the results
- Utilized a double-blind methodology with only Maxim Consulting knowing which contractor’s data is aggregated in the results to ensure confidentiality
- Provided contractors that participated in the study an individualized profile of their results versus the national numbers to further assist in quantification
Data Collection and Methodology

The Collection Process
The data collection process involved the generation of large amounts of data from contractors providing the information in a formalized template.

For each data point, we collected the following information from contractors:

- Market Segment
- Project ID
- Project/Job Name
- Project/Job Type
- Location City
- Location State
- Contact Person
- Contact Person Phone
- Week Start Date
- Week Date
- Task Code
- Percent Complete
- Hours
- Week of Data Collection

Contractors were provided with a specific selection of options for the Project/Job Type based on the federal government’s establishment of essential projects:

- Chemical
- Commercial Facilities
- Communications
- Critical Manufacturing
- Dams
- Defense Industrial Base
- Emergency Services
- Energy
- Financial Services
- Food and Agriculture
- Government Facilities
- Healthcare and Public Health
- Information Technology
- Nuclear Reactors, Materials, and Waste
- Transportation Systems
- Water and Wastewater Systems
• Other (in the case where a specific state had a departure from the federal list)

We provided the contractors with specific selection options for the Market Segment:

• Vertical Construction (high rise, mid-rise, commercial, healthcare, etc.)
• Horizontal Construction (traffic signalization, streets and bridges, agriculture, etc.)
• Line Construction (power transmission and distribution, substations, etc.)
• Systems only Construction (i.e. – fire alarm, low voltage, etc.)
• Maintenance (facility maintenance, etc.)

Data was normalized by providing the contractors with specific definition for the Task Codes associated with each Market Segment:

<table>
<thead>
<tr>
<th>Market Segment</th>
<th>Task Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical</td>
<td>In Slab</td>
<td>Branch Distribution Raceways (power, lighting, equipment), BAS Raceways, Feeder/Power Distribution Raceways. Life Safety &amp; Communication Raceways, if acceptable.</td>
</tr>
<tr>
<td>Vertical</td>
<td>In Wall Rough In</td>
<td>The “In The Wall” Portion of the Raceway That Needs to Be Concealed in a Wall for Switches, Receptacles, Communication, Life Safety, BAS Devices, any Miscellaneous Equipment That Needs a Wall Rough In.</td>
</tr>
<tr>
<td>Vertical</td>
<td>Wire Pulling</td>
<td>Wire &amp; Cable Installations for all Systems Below Slab or Overhead. Feeder Wire, Branch Power, Branch Lighting and Equipment Wire, Life Safety, Communications, and BAS Cabling.</td>
</tr>
<tr>
<td>Vertical</td>
<td>Electric &amp; Equipment Rooms</td>
<td>Switchboards, Panelboards, Electrical Switching Devices, VFD’s, Mechanical Equipment Connections (HVAC, Plumbing, Process, etc.)</td>
</tr>
<tr>
<td>Horizontal</td>
<td>Traffic Signals</td>
<td>Below Grade Work, Set Poles &amp; Equipment, Wiring.</td>
</tr>
<tr>
<td>Horizontal</td>
<td>Street Lighting</td>
<td>Below Grade Work, Set Poles &amp; Luminaires, Wiring.</td>
</tr>
<tr>
<td>Horizontal</td>
<td>Interconnect</td>
<td>Below Grade Work, Below Grade Wiring, Overhead Work (if applicable).</td>
</tr>
<tr>
<td>Line Construction</td>
<td>Mobilization/Demobilization</td>
<td>Mobilization/Demobilization of equipment, tooling and manpower to project. Includes warehouse support, trucking, on-boarding and establishment of laydown/office areas.</td>
</tr>
<tr>
<td>Line Construction</td>
<td>Drilling/Pole Setting</td>
<td>Drilling of pole holes including caisson foundations, setting of wood/steel poles, plump/backfill of pole, torqueing of bolts on steel monopoles.</td>
</tr>
<tr>
<td>Market Segment</td>
<td>Task Code</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Line Construction</td>
<td>Framing</td>
<td>All framing of the poles including cross arms, insulators, attachment plates, grounding, riser material, equipment (cutouts, reclosers, transformers, cap banks, switches, etc.).</td>
</tr>
<tr>
<td>Line Construction</td>
<td>Anchors/Guys</td>
<td>Installation of anchor types and associated guying between the pole and anchor.</td>
</tr>
<tr>
<td>Line Construction</td>
<td>Wire Stringing</td>
<td>All tasks involved with the installation of wire including pulling ropes, pulling wire, clipping in and dead ending wire, and splicing.</td>
</tr>
<tr>
<td>Line Construction</td>
<td>Transfers</td>
<td>Moving wire or equipment from old pole to new pole (typical for distribution work)</td>
</tr>
<tr>
<td>Line Construction</td>
<td>Removals</td>
<td>Removal of any poles, framing, anchors/guys, wire, etc.</td>
</tr>
<tr>
<td>Systems</td>
<td>General Pathways</td>
<td>When included in our SOW this details cable tray (outside of TR’s), sleeves, cable supports, etc.</td>
</tr>
<tr>
<td>Systems</td>
<td>ER/TR Buildout</td>
<td>Telecommunication room buildout includes ladder tray, racks, cabinets, patch panels, fiber panels, UPS/PDU’s, and grounding associated with ER/TR’s.</td>
</tr>
<tr>
<td>Systems</td>
<td>Horizontal Cabling</td>
<td>Includes category cabling to work area outlets. Depending on scope this can also include other systems type cable. Depending on project size the technical systems (AV, sound masking, paging, fire alarm, nurse call, etc.) would constitute a separate cost code.</td>
</tr>
<tr>
<td>Systems</td>
<td>Backbone Cabling</td>
<td>Includes copper, fiber, and coax type backbone cable between main ER and all associated TR’s.</td>
</tr>
<tr>
<td>Systems</td>
<td>Horizontal Cable Termination &amp; Testing</td>
<td>Includes terminating and testing both headend and station end cabling. This also can be broken out by floor, area, etc. depending on project size with separate cost codes for each. Also includes face plates and labeling.</td>
</tr>
<tr>
<td>Systems</td>
<td>Backbone Cable Termination &amp; Testing</td>
<td>Includes termination and testing of all backbone cabling. This also can be broken out by floor, area, etc. depending on project size. Also includes patch panel labeling.</td>
</tr>
</tbody>
</table>
Sample Set
The data collected for Vertical construction was normalized into seven distinct task types:

- Underground
- In Slab
- Overhead Rough In
- In Wall Rough In
- Wire Pulling
- Trim
- Electric & Equipment Rooms

As shown in Figure 5 the sample data collected was geographically distributed across the country and contained many major markets.

Figure 5: State Distribution of Productivity Data.
Figure 6 shows the “heat map” distribution and relative number of samples from each geographic location.

*Figure 6: Concentration Heatmap of Sample Set Data Areas of United States.*

*Figure 7: Vertical Construction Productivity Against Events*
Figure 8: Vertical Construction Productivity by Project/Job Against Events
Summary Findings

Our study indicates a 12.4% overall average impact on Vertical Construction productivity as a result of a pandemic. Based on the current data, we are seeing 50 to 60 minutes of lost productivity per day per employee 8-hour work period.

Roadmap

The companies that have trended lower in the productivity losses have established, organized and trained their teams with new pandemic mitigation processes and procedures. Additionally, they have monitored and shifted work activities to accommodate required distance working between team members.

The baseline impact of 12.4% is substantial. Contractors should utilize this information to properly price an equitable adjustment utilizing the calculator provided and this study as backup for the impact.
Part III - Business Impact of a Pandemic

To be provided by Mark Federle.
### Appendix A: Pandemic Mitigation Tracking Data Collection Definitions & Tools

#### Figure 9: Pandemic Mitigation App Data Collection Tool

<table>
<thead>
<tr>
<th>Cost Code</th>
<th>Cost Code Name</th>
<th>Example activities in cost code</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Total Crew Hours Worked</td>
<td>Sum of all labor hours worked on your project for the day.</td>
</tr>
<tr>
<td>200</td>
<td>COVID Safety &amp; Training</td>
<td>Any/all forms of time lost due to COVID specific safety huddles, orientations, respirator training &amp; fitting, equipment handling, air flow equipment maintenance, sneeze shielding, etc.</td>
</tr>
<tr>
<td>201</td>
<td>COVID Distancing &amp; Access Rules</td>
<td>Any/all forms of time lost due to site logistics, waiting to access work areas, waiting on medical screening, extra distance walking to lunch tents, additional coordination or reworking due to inaccessible work areas, etc.</td>
</tr>
<tr>
<td>202</td>
<td>COVID Cleaning &amp; Disinfecting</td>
<td>Any/ all forms of time lost due to COVID related cleaning, disinfection, personal hygiene, filter management, disposal, etc.</td>
</tr>
<tr>
<td>203</td>
<td>COVID Administration</td>
<td>Any/ all forms of time lost due to COVID related administration, paperwork, management of suspect or positive cases, additional work coordination meetings, etc.</td>
</tr>
</tbody>
</table>

#### Figure 10: Pandemic Mitigation App Activity Definitions
Appendix B: Double-Blind Productivity Benchmark Participant Survey

The research study utilized a double-blind methodology to observe pre- and post-pandemic construction productivity impacted by behavioral interventions. Blinding or masking refers to the withholding of information regarding treatment allocation from one or more participants in the research study. It is an essential methodological feature of studies that help maximize the validity of the research results.