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COVID-19 Impact to Construction Activity Durations on Department of Defense (DoD) Projects

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The COVID-19 virus ravaged the United States population and economy. In March 2020 almost every state went into a self-mandated lockdown. States began reopening in May and June of 2020 with different safety protocols and restrictions in place. Most Department of Defense (DoD) construction sites were considered essential, therefore did not have to shut down. To keep their personnel safe, contractors quickly began adopting additional safety measures as recommended by the Centers for Disease Control and Prevention (CDC). One of the most widely used safety measures was social distancing or staying 6 ft away from other individuals. This paper summarizes the impacts of COVID related delays on construction activities based on survey data. Results indicate that several issues caused construction delays including labor shortage, social distancing, COVID-19 protocols and material supply delays. The data also showed that delays were noticed in all aspects of construction including concrete, MEP, masonry and finishes.

Key Words: COVID-19, Social Distancing, Construction Schedules, DoD

Introduction and background

Since January 2020, the Coronavirus pandemic has caused devastating effects on the world's population and economies. Most states in the U.S. went into statewide lockdowns with different degrees of restrictions beginning in March, 2020. By the end of March, over half the U.S. population was under stay at home orders (Perper et al., 2020). Once states decided to start reopening in May and June of 2020, most instituted new protocols and guidelines to slow the spread of the coronavirus. These guidelines typically included wearing masks, washing hands frequently, and socially distancing whenever possible.

The pandemic has affected every employment sector in some way, including the construction industry. If construction workers are followings protocols set forth by the Centers for Disease Control and Prevention (CDC, 2020), then it stands to reason that construction activities may take longer than

normal to complete. Most Department of Defense (DoD) construction sites were considered essential and could remain open during the shutdown, however, strict rules were put in place to reduce the likelihood the virus could spread on the job site. The Occupational Safety and Health Agency (OSHA) has distributed guidance to assist in implementing new safe practices in the workplace. In addition to the measures self-implemented by construction companies, OSHA calls for the following measures on jobsites: workers to wear gloves and masks over their nose and mouth; limit the workers that come into physical contact with each other; teach workers proper respiratory etiquette (i.e. cover the mouth and nose while coughing); workers clean their tools and equipment after use with Environmental Protection Agency (EPA) approved cleaning agents; and keeping meetings among a gathering of workers as short as possible (OSHA, 2020). Many companies also increased the number of handwashing stations for workers to periodically wash their hands to reduce the spread of the virus (Goodman, 2020). Despite of all these measures, studies have shown that construction activities resulted in increased infection rates and hospitalization in the workforce (Pasco et al., 2020).

Materials manufacturing also slowed due to the shutdown. Shipments were delayed due to a drop in supply and a heavily burdened shipping industry. It is suspected that social distancing, sanitation guidelines, and material delays have adversely affected the entire construction industry, including DoD construction projects. Social distancing and not having workers work in close proximity or limiting the number of workers in a given area will add time to project schedules and that should be expected by owners and contractors (Goodman, 2020). Early results from studies looking at the overall impact of COVID-19 on the construction industry seem to indicate moderate disruptions to operations in all phases of construction (Ogunnusi et al., 2020). The pandemic has forced companies to explore ways to incorporate prefabrication methods on projects (Gamil & Alhagar, 2020). The matter is further exasperated by the poor implementation and monitoring of various regulatory guidelines on project sites in the construction industry (Amoh & Simpeh, 2020).

In May 2020, the Associated General Contractors (AGC) of America surveyed 800 companies regarding the impacts of COVID-19 on their companies. The results showed that 30% had projects delayed due to government order, 37% were stopped due to owner requests related to the pandemic, and 67% of companies have had a project delayed or canceled due to funding issues since March (AGC, 2020). A United States Chamber of Commerce study showed that 87% of surveyed contractors are experiencing some type of delay to their projects that is contributed to the COVID-19 pandemic (Cates & Swanek, 2020). The study by Cates & Swanek (2020) also showed that contractors saw immediate revenue decrease and new business dropped because of the pandemic. The extent of the impacts of COVID-19 on construction schedules is the topic of this research.

Research objective and methodology

Most of the literature found was focused on the overall impact of COVID-19 on the construction industry. Little or no literature discussed how specific activities on construction projects were impacted due to social distancing guidelines. Furthermore, no research was conducted that focused on impact of COVID-19 on US DoD construction projects. The research aim for this study was to determine the impact of COVID-19 on DoD construction schedules. The authors sought to examine this through an anonymous survey administered online to contractors and USACE / Naval Facilities (NAVFAC) construction personnel. Potential participants were encouraged to forward the survey to their peers and sub-contractors to produce a more robust data set. The survey was conducted in a 2-week period in early October.

The questionnaire included forty (40) questions total, of which six (6) questions sought information on the demographic of the respondent, sixteen (16) questions on COVID-19 cases on their project, if prime contractor staff was enforcing social distancing and if workers were adhering to new safety rules to include social distancing. Next, the questionnaire had nine (9) questions that pertained to which trades and activities were taking longer due to COVID-19 impacts and social distancing. Lastly, an open-ended question was provided for respondents to provide additional feedback on how the construction industry has changed due to the pandemic. Sixty-eight responses were recorded for the questionnaire.

Results and discussion

The survey was completed by 68 respondents, representing a wide variety of positions within the construction industry and a broad distribution of company size, as shown in table 1. Project managers and company executives, who are generally most involved in project scheduling, represent most of the respondents, accounting for over 54% of the data. Remaining respondents included superintendents (8.8%), quality control managers (8.8%), site safety and health officers (4.4%), foremen (4.4%), and “other” (19.1%). Most of the respondents were working on projects in the Military Construction (MILCON) programs (53.7%) and Sustainment, Restoration and Modernization (SRM) programs (32.8%). MILCON projects are new construction projects with a contract value greater than \$6 Million. SRM is typically operations and maintenance projects with much smaller contract values than MILCON. The remaining responses fell into the categories of dredging, civil works, or other.

Table 1

Demographics by Role of Survey Participants and Number of Employees in their Organizations

Role	#	%	Number of Employees	#	%
	1			1	
Project Manager	9	27.94%	1-25	3	19.12%
				2	
Superintendent	6	8.82%	26-50	8	41.18%
Quality Control Manager	6	8.82%	51-75	7	10.29%
Safety Officer	3	4.41%	76-100	4	5.88%
				1	
Foreman	3	4.41%	101 and Over	6	23.53%
	1			6	
Executive	8	26.47%	Total	8	
	1				
Other	3	19.12%			
	6				
Total	8				

Survey results indicate that 47% respondents saw their projects shut down during the pandemic and 47% had to seek a time extension due to the pandemic. Just under 50% indicated they had not had any positive COVID-19 cases on their project site and only 20% had experienced a cluster outbreak, meaning they had five or more related positive cases with one trade or trades that work very closely together. Survey results indicate that 100% of the projects represented established one or more new safety measure after the initial outbreak.

Figure 1 shows the resulting safety measures adopted on projects in response to the pandemic. Mask wearing was implemented by 81.5%, sanitation stations were installed by 72.3%, 63.1% have implemented temperature checks, and 95.4% indicated that social distancing measures were implemented. If social distancing guidelines are implemented, it stands to reason that certain construction activities that require multiple workers to be in proximity, such as lifting of a heavy object, would be impacted. Questions in this survey further explored this idea to better understand schedule impacts.

Survey takers were asked to gauge which trades were impacted most by the COVID-19 pandemic: concrete, masonry, mechanical, electrical, plumbing, finishes, thermal protection, site work, or other. If the respondent chose “other” they were given a text box to further specify their response. Respondents could choose as many trades as applicable. Figure 2 shows the results of the survey responses to this question.

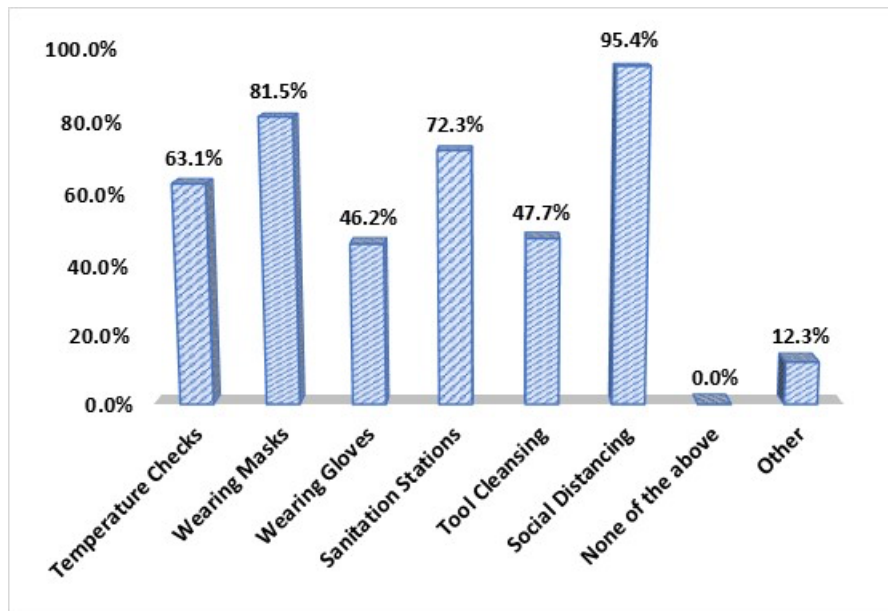


Figure 1: New safety measures implemented in response to COVID-19 (68 responses)

The survey then asked which activities within each of the previously identified trades were taking longer than normal due to COVID-19. Respondents were able to choose as many activities as they felt were applicable within each category. Respondents were also given a choice of “No Knowledge.” Results where respondents identified areas for each category that was delayed are categorized and presented. Figures 3 through 8 show the results of the survey responses to this set of questions for the top 6 trades which were identified above as mechanical, electrical, concrete, finishes, masonry, and plumbing.

Figure 3 shows the responses for specific tasks that were deemed delayed for concrete and masonry. 25 respondents indicated some type of delay for concrete related activities. Of these 25 respondents, more than 50% respondents indicated that ‘Concrete Finishing’ (52%), ‘Layout’ (64%) and ‘Slab Pours’ (68%) were delayed. More than 70% indicated that ‘Footing Pours’ (72%) and ‘Rebar Installation’ (72%) were delayed.

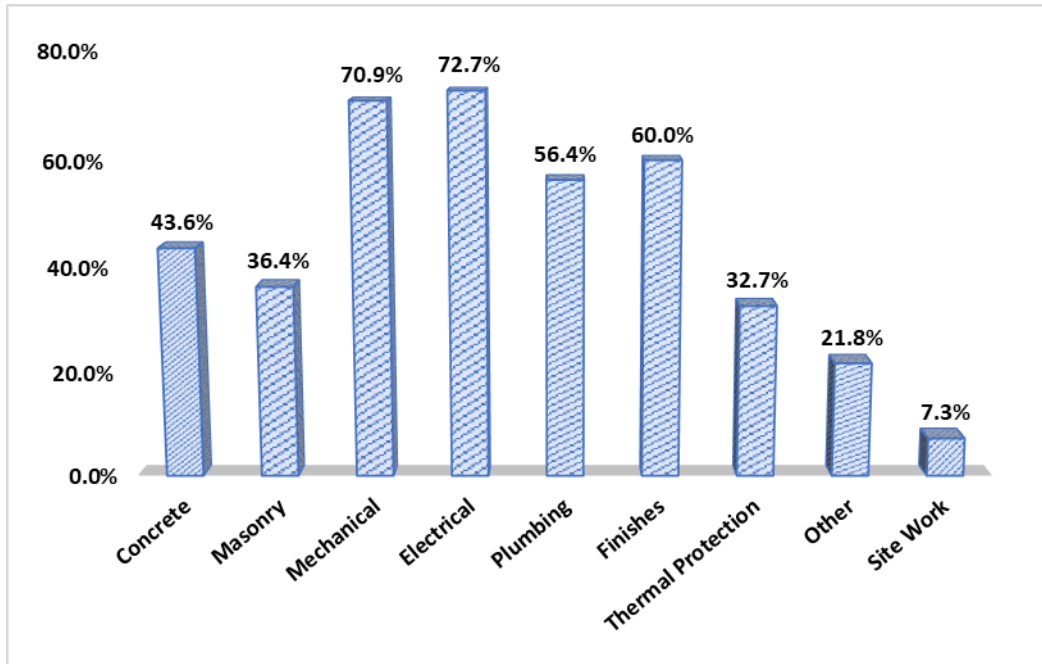


Figure 2: Trades taking longer due to COVID-19 impacts (68 responses)

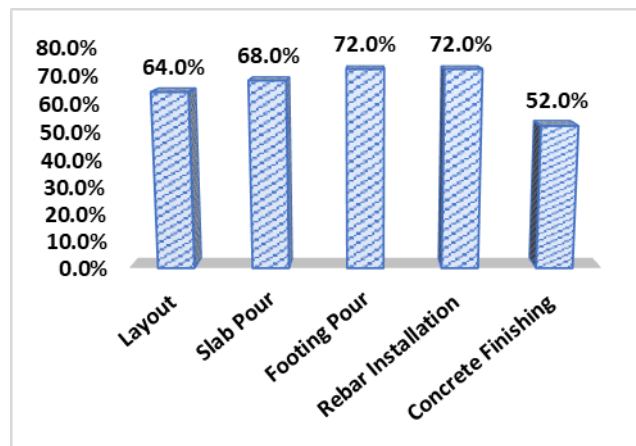


Figure 3: Pandemic caused delays in concrete activities (25 responses)

22 respondents indicated delays in Masonry related activities, as shown in Figure 4. More than 50% of the respondents indicated delays in ‘Layout’ (54.5%) and ‘Brick Installation’ (68.2%). ‘CMU Installation’ (77.3%) and ‘Grouting’ (77.3%) were shown to have more than 70% of the respondents indicating delays.

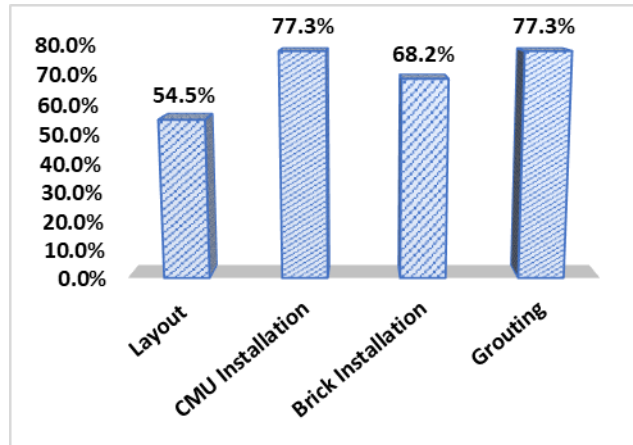


Figure 4: Delays in masonry activities due to COVID-19 (22 responses)

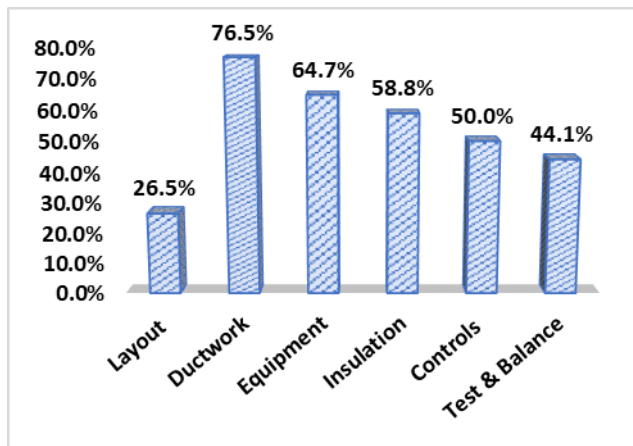


Figure 5: Delays in mechanical related tasks due to COVID-19 (34 responses)

Of the 34 responses indicating delays for mechanical trades, ‘Ductwork Installation’ (76.5%) was the task identified as most affected by COVID-19, as shown in Figure 5. Other tasks delayed include ‘Equipment Installation’ (64.7%), ‘Insulation’ (58.8%), ‘Controls’ (50%), ‘Test & Balance’ (44.1%), and ‘Layout’ (26.5%).

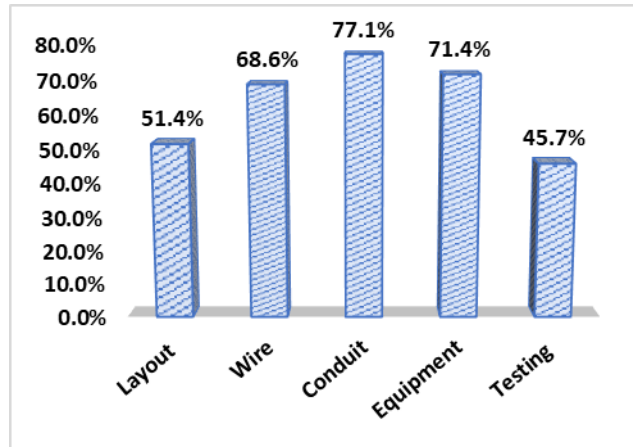


Figure 6: COVID-19 pandemic related delays for electrical trades (35 responses)

35 respondents indicated delays in electrical trade related activities, as shown in Figure 6. ‘Conduit Installation’ (77.1%) and ‘Equipment Installation’ (71.4%) were the tasks identified as delayed by more than 70% of these 35 respondents. Other electrical related tasks delayed include ‘Pulling Wire’ (68.7%), ‘Layout’ (51.4%) and ‘Testing’ (45.7%).

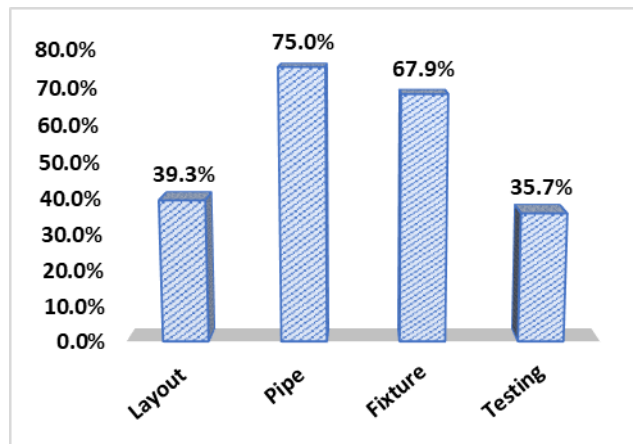


Figure 7: Plumbing related delays due to the pandemic (28 responses)

28 respondents indicated delays in plumbing related activities, as shown in Figure 7. Most of these 28 respondents indicated that ‘Pipe Installation’ (75%) was delayed. Other activities indicated as delayed were ‘Fixture Installation’ (67.9%), ‘Layout’ (39.3%) and ‘Testing’ (35.7%).

Finishes were also indicated as delayed by 30 of the 68 respondents, as shown in Figure 8. The majority of these 30 respondents indicated that ‘Paint’ (70%) as being delayed the most. Other tasks delayed were ‘Casework Installation’ (56.7%), ‘Molding’ (50%), ‘Flooring’ (50%) and ‘Layout’ (33.3%).

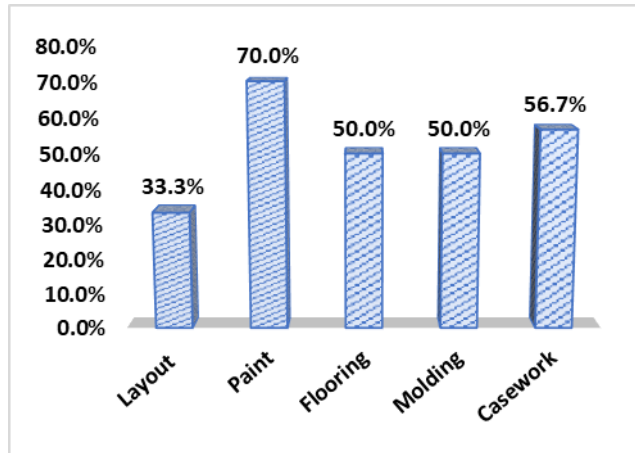


Figure 8: Delays in finishes related tasks due to COVID-19 (30 responses)

The last survey question was open ended and asked for specific example(s) of how the construction industry has changed due to the COVID-19 pandemic. The biggest issue identified among the responses to this open-ended question was material delivery times, accounting for 19 responses. As one respondent mentioned, *“Slowed down and can't get the materials need due to factory shutdowns”*. In general there was some trepidation among all field personnel for catching the COVID virus, as indicated by one respondent *“I believe some of us, including myself, are very concerned about COVID-19 while others do not understand the risk of catching the virus”*. The overall sentiment seemed to indicate that social distancing is having an impact on construction schedules, as shown by one comment *“We have had to implement social distancing and require face masks on site. I have noticed during the hotter months that subcontractors and labor personnel are having to take more frequent breaks to go outside and remove their masks for fresh air. We have had to also reduce the number of onsite personnel to achieve social distancing, and make sure trades have separate areas to work. With the reduced personnel and requiring trades work in different areas the construction process has slowed down impacting schedules and overhead”*.

Other areas identified in the verbal responses to the open-ended question were crew/workforce limitations (4), rising prices (5), labor costs due to longer activity durations (4), safety protocols affecting productivity (5), anxiety of workers (4). A few of them also indicated no impacts (3).

Conclusions and Recommendations

The results of the questionnaire are a strong indication that construction activities are being delayed on DoD projects due to pandemic related safety and social distancing protocols. This delay in executing specific tasks is likely to lead to schedule delays for the overall project. The results to open-ended question that asked respondents about how the industry has changed due to the pandemic indicated, most of them are seeing material supply and delivery delays on projects. The comments also indicate field personnel are concerned for their own health and welfare during the COVID-19 pandemic.

The impact of the coronavirus on the construction industry is a new topic with very little research published to date. The delay in the manufacturing processes should be researched in further detail. The extent of the impact of material delays on project schedule is not yet fully known. It is also

unclear how contractors are dealing with material delays and their impact on the construction schedule. Research should be conducted regarding the impact of these schedule delays in terms of both time and cost for the project. Additionally, this research should be extended to non-DoD projects, to determine the impacts to construction beyond the public sector.

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