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An Analysis of the Contractor's Project Performance based on Field Performance Rating

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Abstract
Project schedules are affected by several factors, and contractor's project performance is one of them. In many cases, contractors develop a schedule that is not accurate enough to represent work sequencing. Besides, their project delivery methods create plenty of challenges to track and monitor project progress. This paper illustrates the project performance of contractors based on seven different factors obtained from the contractor's field performance rating by one State Highway Agency (SHA). The purpose of this study is to analyze the field performances of the nineteen contractors that delivered thirty public transportation projects during the last three years in one state. The authors collected the contractor's project performance reports from one SHA. The performance reports summarize the overall contractor's performance throughout the project. This study contributes to the body of knowledge by identifying areas of improvement of the contractor's performance based on the analysis of performance reports. The study also presents recommendations to the contractors to improve future transportation projects.

Keywords
Project Performance, Schedule Delay, Public Transportation Projects.

1. Introduction

Contractor’s project performance depends on the overall field performance rating during the construction period. Contractors are responsible for the overall success of construction projects, including achieving cost, schedule, quality, and safety goals (Russell et al., 1997). The traditional pre-qualification or contractor selection, common in the construction industry, includes weighting specific criteria such as financial stability, experience, completed projects, achieved quality, and key personnel (Yasamis et al., 2012). Combining a contractor's quality performance assessment with a contractor's technical and economic performance assessment provides a better understanding of the contractor's overall capabilities (Yasamis et al., 2012). Clients often focus on stakeholder satisfaction and needs, but contractors aim to minimize project costs and duration (Bryde & Robinson, 2005). In practice, the definition of project performance is often based on the client's needs (Chan & Chan, 2004). Going by previous studies undertaken by researchers, it was found that various types of criteria are considered in evaluating the construction project performance (Idrus et al., 2011). However, there is no standardized approach or guideline for determining the performance of construction projects (Idrus et al., 2011). The primary purpose of this study is to analyze the contractor's overall performance based on seven different factors adopted by one SHA during the construction period. The data collection is mainly from one SHA in the USA and the nature of these thirty projects represent multiple types of work including new construction, maintenance and rehabilitation. This paper aims to identify the strengths and weaknesses of several contractors to complete the project from the SHA's perspective. Finally, the study presents a list of recommendations to improve the project delivery process.

2. Literature Review

Project performance determines the desired outcome through feedback and evaluation of the contractor’s key personnel and field performance. Previous studies have determined the criteria to measure the contractor's project performance, including several factors such as cost, time, quality, client satisfaction, user expectation, friendliness of environment, health and safety, and quality of workmanship (Songer & Molenaar, 1997; Lim & Mohamme, 1999, Indus et al. 2011, and Chan, 2004). Other factors included labor dependency, project management, resource availability, flexibility.

Similarly, studies by Yasamis-Speroni et al. (2012) and Bryde et al. (2005) used factors such as quality, team integration, scope, schedule, procurement, risk, and owner satisfaction to evaluate the performance of construction projects effectively. In addition, Ng et al. (2002) developed a dynamic e-reporting system that evaluates the contractor's performance based on financial stability, work progress, quality, safety, resources, management capabilities, communication, cooperation, integrity, and claims, and contractual disputes.

On the other hand the study of Hashem et al. (2018) determined the contractor's project performance from the statistical analysis of the project delivery method, competency trust, organizational trust, and relational trust (Hashem et al. 2018). Based on the literature review, several studies had different evaluation criteria regarding contractor performance. However, all these factors are based on cost, schedule, quality, and owner satisfaction. Thus, this research will also use similar performance criteria to determine areas of strength and weaknesses regarding contractor's performance. Performance criteria was established by SHA which was the scope of work of the researchers.

3. Research Methodology

The authors conducted the research in two phases. The first phase is the data collection, and the second phase is the data analysis. The data collection is mainly from one SHA in the USA. The data analysis is qualitatively analyzing the project performance reports for thirty public transportation projects. The qualitative analysis resulted in identifying problems that affect project performances. Finally, a list of recommendations is presented to overcome common problems discovered in the project performance reports.

3. 1 Data Collection

The research team collected the daily work report, baseline schedules, and contractor's field performance reports from one SHA. The field performance reports evaluate the contractor's performance based on the pursuit of the work, conformance with contract specification, traffic control and mobility, and timely and complete submittal of documents. The performance report also includes an evaluation of cooperation with the SHA personnel, property owners, utility, mitigating cost and schedule delay, and superintendence of the project.

The authors sorted out thirty different projects out of forty-nine delivered by nineteen different contractors in the last three years. Then, these projects were evaluated based on baseline schedules, daily work reports, and construction reports. The projects' types of work ranged from new construction to maintenance and rehabilitation. These projects included a variety of activities such as crushing and stockpiling crushed surfacing material, fencing, median cable barrier, draining, milling plant mix, lane rental, bent cap replacement, drilled shaft foundations, installing signs, rockfall mitigation, pavement markings, and bituminous pavement surfacing, bridge rehabilitation, and miscellaneous works. The total value of the thirty projects was approximately $107.4 million. The range of the total amount of the thirty projects was $243,387.00 to $1,103622.00.

3.2 Data Analysis

The authors analyzed the contractor's project performances through seven different factors listed in Table 1. For each evaluation criterion, the authors went through the performance reports and summarized the weaknesses or deficiencies identified by the SHA. The analysis was done by analyzing the language used in the field performance rating. The SHA assigns a rating for each factor of the seven factors and a written description for each criterion met or unmet. The authors used the written description on the field performance report the determine the challenges faced by contractors. Upon completion of the project, contractors got an opportunity from the SHA to review the performance report for accuracy. Contractors can achieve the maximum rating by satisfying all the criteria described by the SHA.

The first criterion is the pursuit of the work, which refers to pursuing the work with sufficiently trained labor, materials, and equipment. The assessment included the skill level of the workforce, the condition of equipment to accomplish the job, and active progress on critical path items each day following the approval of the baseline schedule.

The second criterion evaluated by the SHA is conformance to contract specifications, plans, materials quality, temporary and final products, and services. This also included supplemental specifications, notification clauses, special provisions, dispute resolution processes, federal, state, and local laws. The third criterion evaluated by the SHA was the effective use of worksite traffic control maintainer to monitor and correct traffic control deficiencies. This criterion also rewards the initiative to identify and fix traffic control and mobility concerns regardless of timing.

The fourth criterion is the evaluation of timely submittal of documents in an accurate manner, including all required information and details to prevent withholding pay estimates in work. This also includes documents originating from suppliers and subcontractors. The fifth criterion is to evaluate the level of coordination between contractors and SHA personnel responsible for administering the contract and inspecting the completed work. The sixth criterion is the contractor's ability to mitigate schedule delays and cost overrun. Finally, the SHA evaluates the superintendent's performance based on the initiative and management of all aspects of the projects. After evaluating all items, the maximum rating attainable would be 100 points.

4. Results and Discussion

A significant difference was observed after analyzing the field performances of the thirty projects and nineteen different contractors. Table 1 provides the overall project performances based on seven different factors. The names of the projects were given acronyms A_n, where n is a value between 1 and 30. Generally speaking, the total point data were more spread out, whereas cooperation with the SHA personnel was more consistent. In addition, inferior performances were noticed in the pursuit of the work, traffic control and mobility, and timely and complete submittal of documents factors. The following subsections discuss the challenges faced by contractors for each factor.

Table 1. Contractor's Project Performance Report

	Performance	Average	Maximum	Minimum	Standard Deviation	Median	Mode
1	Pursuit of the Work	14.93	20	0	5.8	14	20
2	Conformance with contract specification (plans and quality control excluding traffic control)	15.23	19	5	4.02	14	19
3	Traffic Control and Mobility	13.2	16	0	3.64	13	16
4	Timely and Complete Submittal of Documents	12.1	15	0	4.34	15	15
5	Cooperation with the SHA Personnel, Property Owners and Utility Companies	11.2	12	8	1.24	12	12
6	Mitigate Cost and Time Overrun	7.47	8	4	1.48	8	8
7	Superintendence of Project	8.57	10	3	2.33	10	10
8	Total points	83.53	100	50	13.14	84.5	100

4.1 Contractors Project Performance

The contractor's project performances showed that the maximum field performance rating was 100 out of 100, whereas the lowest was 50 (see Figure 1). Out of the thirty projects, around 13% achieved full credit, and more than 50% obtained more than 80% overall score. Approximately 17% of projects scored between 70 to 79, and the rest, 20%, were below 70. The name of the contractors was given acronyms X_n where n is a value between 1 and 19. Contractor X_1 completed four projects which were A_1, A_4, A_7, and A_{15}. Contractor X_2 did projects A_3 and A_{21} whereas, contractor X_3 completed projects A_{12}, A_{18}, and A_{20}. Projects A_8, A_9, A_{14}, A_{28}, and A_{29} were completed by contractor X_4, and contractor X_5 completed A_{23} and A_{24} projects. Although the last and first projects' scores of the contractor X_1 were the same (92), the middle two projects' performances were 84 and 78, respectively. X_1 contractor's cooperation with the SHA personnel, property owners, and utility companies was consistent in all four projects. Still, there were ups and downs in other factors. In the case of contractor X_2, they achieved 20 points less in their last project (80) than the previous one (100). X_2 contractor failed to complete the project before the deadline, and they obtained only 3 out of

20 in the pursuit of the work factor. Contractor X_3 got full credit from the three projects (see Figure 1). Contractor X_3 was consistent in all three projects. On the other hand contractor X_4, gradually improved from the oldest (67) project to the latest (97). However, 80% improvement (50 to 90) was noticed regarding contractor X_5's overall project performance from the previous project to the recent one.

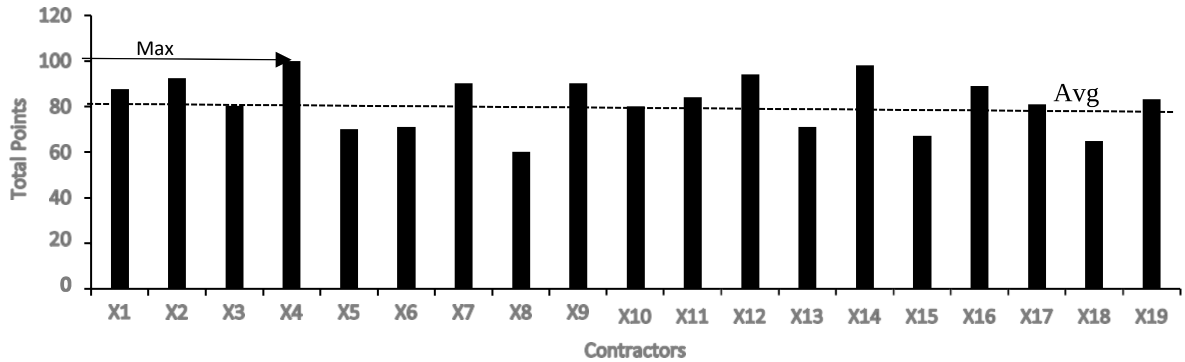

Fig. 1. Contractors Project Performance

4.2 Pursuit of the work

Figure 2 shows the scores earned for all 30 projects regarding the contractor's pursuit of work. Around 46% of the total projects did well and finished physical work and the punch list items before the stipulated completion date. The contractor of project A_1 was active in getting the work done through the project's duration but had several unskilled crew members. The SHA charged liquidated damages to project A_3 for ten days for a total of $19,250 for failure to complete all work before the completion date. Projects A_4 and A_7 met all critical dates outlined in the special provision for construction requirements. The contractor of project A_9 missed a few critical dates, and their crew members were unskilled. In the case of project A_{10}, there was no superintendent on the site, and there were no regular meetings. Due to weather and other projects, they did not complete punch list items within ten working days as stipulated by contract. The contractor of projects A15 and A23 worked with a minimal crew, and they could not complete the punch list items on time.

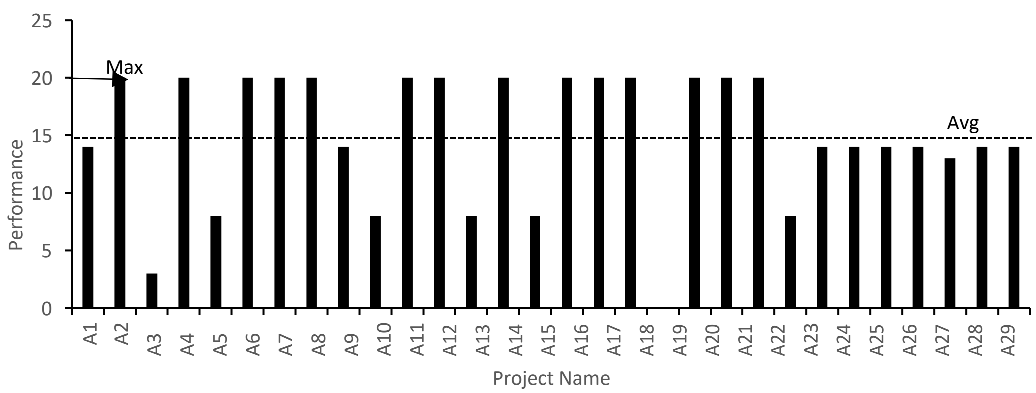

Fig. 2. Pursuit of the Work

Unfortunately, Project A19 failed to meet the previous target due to being 35 days behind the completion date. The superintendent of project A24 had difficulty scheduling equipment and labor to keep the project on schedule. Materials and some truck parts were difficult to get due to COVID-19 for project A26. Finally, projects A27 and A30 had some quality issues with concrete finishing.

4.3 Conformance with contract specification (plans and quality control excluding traffic control)

There were no quality control issues for 36% of projects, whereas 27% of contractors worked hard to complete the project according to the plans and specifications (Figure 3). However, there were minor quality issues on some of the completed work. During removal, there was damage to existing items that had to be replaced at no additional cost to the SHA. Contractor A_2 had issues with both gradations and densities of the materials used for the subbase. The projects A_6 and A_{11} had multiple days when concrete was not conforming with specification, and the SHA had to reject numerous loads. Because of the excellent communication and quality work, SHA received a great finished product of project A_7. The contractor of project A_{10} reworked the crushed base many times to get some sections accepted by the SHA.

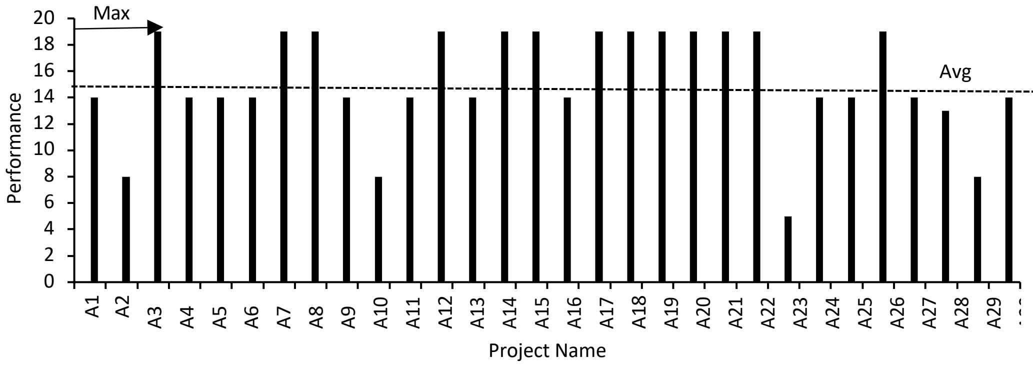

Fig. 3. Conformance with contract specification (plans and quality control excluding traffic control)

4.4 Traffic Control and Mobility

In total, 40% of projects obtained full credit ensuring all traffic controls were adequately set up and maintained throughout the job. Figure 3 shows the scores for traffic control and mobility for each project. In the case of projects A_2 and A_7, there were a lot of issues with traffic control. The contractor did not submit diaries concerning the temporary traffic signals to the SHA on time. The work of project A_4 started without proper traffic control in place. The SHA had to direct around 16% of contractors multiple times to take corrective actions on the traffic control. Unfortunately, the performance of project A_8 was not acceptable due to the unavailability of the traffic maintainer, a faulty device, or lack of proper setup of the traffic control on multiple occasions. Inappropriate traffic control was setup a couple of times in projects A_9 and A_{28}. On the other hand, there was a long-term temporary traffic control issue in project A_{13}. Traffic control of projects A_{16}, A_{25} and A_{29}, was placed and performed satisfactorily with minimal SHAdirection. The traffic control subcontractor of project A_{23} was charged for liquidated damages on several issues.

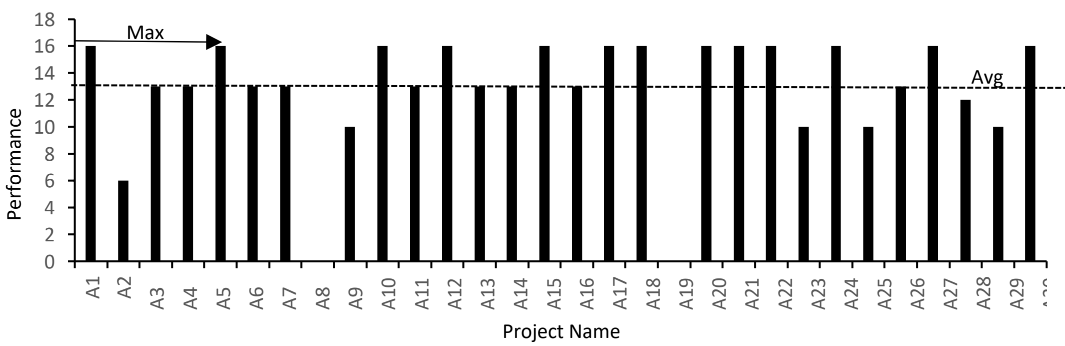

Fig. 4. Traffic Control and Mobility

4.5 Cooperation with SHA Personnel, Property Owners and Utility Companies

Most of the projects (70% of the thirty projects) achieved full credit communicating with the SHA and other parties involved with the project (see Figure 4). The contractor of project A_2 worked with landowners and took care of their concerns, such as dust control and restoration of their plan site. Some items and topics of project A_5 were not always clearly communicated to the SHA. The contractor of projects A_6 and A_{11} had a complaint from a member of the traveling public and wanted corrective action. The contractor of project A_{10} worked well with the SHA but had some conflicts with landowners regarding installing mailboxes and fence material. The contractor cooperated with onsite SHA personnel of project A_{16}, and they should improve communication regarding communicating work schedules and changes with more advanced notice. Coordination of project A_{25} was acceptable, but improvements were made to notify SHA when plans had changed. The contractor A_{27} cooperated well with all, but they could not deliver the project as stipulated in the schedule.

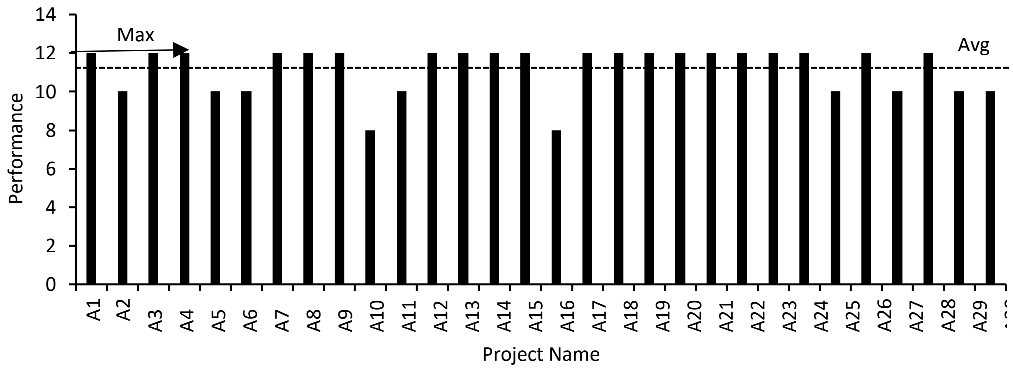

Fig. 5. Cooperation with SHA Personnel, Property Owners and Utility Companies

4.6 Timely and Complete Submittal of Documents

Contractors did not delay submitting documents of 63% of projects (see Figure 4). Project A_1 struggled to get the necessary information to the SHA. Overall, Contractor of the project A_2 did well with certification and documentation. There were only a few instances where the SHA had to ask for certifications or testing results several times. Project A_5 had averaged an approximately nine calendar day delay in processing the monthly estimate due to not submitting documents in a timely fashion. The contractor of project A_7 always submitted the work schedules and payrolls timely, but the contractor did not get full credit because of inaccurate submittals. Due to missing certificates, the authority had to withhold payment on a couple of items of project A_9. There were delays to the submitted documentation of projects A_{17} and A_{29}. The SHA did not receive most of the schedules of the project A_{27} in time, and the contractor was too late to notify the SHA, adequately helping out with an inspection.

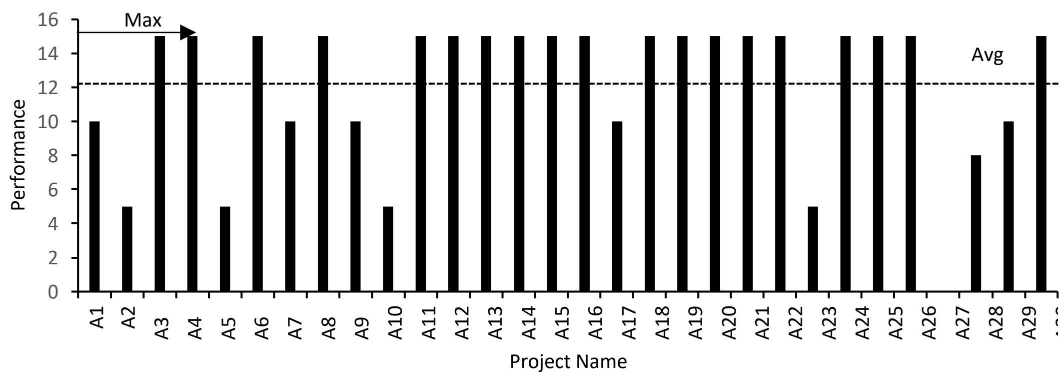

Fig. 6. Timely and Complete Submittal of Documents

4.7 Mitigate Cost and Time Overrun

The contractors worked diligently to avoid time overruns for 60% of projects (see Figure 5). Contractors of projects A_1 and A_{22} worked to prevent additional charges but required changes to the requests for additional funds. The SHA had to remind them that they needed specific bid items for change orders on multiple occasions. The contractor of project A_2 completed their work on time, despite several challenges such as the availability of the personnel due to COVID-19. Project A_3 was in overtime, and the contractor worked diligently to reduce the number of overtime charges on this project. The SHA provided proper documentation for project A_4 change orders. There had been no change orders on project A_5. Still, the contractor could not hit some critical dates due to repairs to out-of-specification items. The contractor of projects A_{10} and A_{15} did not have a superintendent on site. Project A_{10} had a foreman, and the contractor of Project A_{15} worked with a minimal crew. For these reasons, they were not able to complete the project timely. Project A_{19} did not document information accurately when asking for more time or additional money. When the SHA requested additional information from project A_{23}, it was not provided in a timely manner.

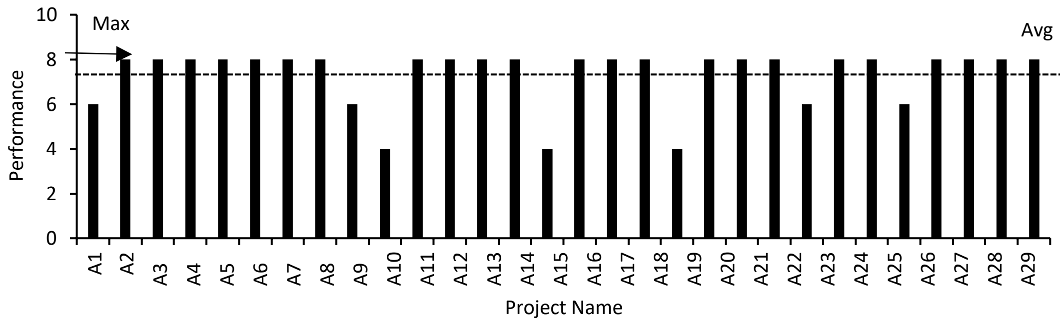

Fig. 7. Mitigate Cost and Time Overrun

4.8 Superintendence of Project

Superintendents were always available for 70% of the projects and were knowledgeable of completing the work (see Figure 5). Several superintendents were assigned to project A_1, and some of them were more organized and better understood the schedule, plans, and specifications. That being said, they were always available for collaboration and could work through difficulties on the project. Although superintendents were present in project A_8, the constant change of superintendents towards the project's closeout phase created poor communication with the SHA personnel. The contractor of project A_{10} had a person on site that was a go-between the office manager and the field activities. All things that need a decision on the field need to be run by someone in the office. However, the onsite superintendent of the project had little knowledge of the specification and plans. Communication was lacking when it came to notifying the resident engineer office of the schedule of project A_{30}. In the case of project A_{29}, the superintendent was routinely available and executed the direction of the engineer. The superintendent of project A_{22} was not available on the site rather than via phone. As a result, projects A_8, A_{10}, A_{22}, A_{29}, and A_{30} had delays in completing the projects in time.

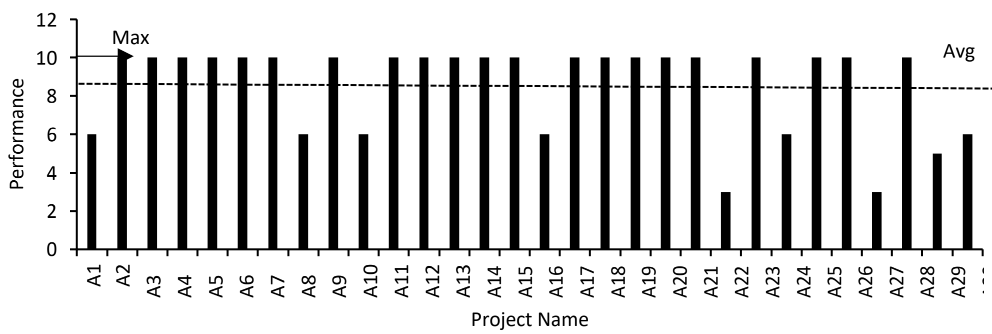

Fig. 8. Superintendence of Project

5. Conclusions and Recommendations

The paper presents the overall field performances of 30 different transportation projects delivered by 19 contractors in one state. There were issues related to the project performance of the contractors regarding the pursuit of work, traffic control and mobility, and timely and complete submittal of documents. The main weaknesses were failure to meet schedule requirements, lack of traffic maintainer and proper set up of the traffic control devices, using faulty traffic control devices, and failure to submit proper schedule documentation to notify the SHA with delays. Most contractors exhibited effective communication with SHA and mitigating cost and time overrun. COVID-19 has played a vital role in project performances for the past two years. Due to the pandemic, most contractors faced a scarcity of materials and personnel.

The primary recommendations for future projects are discussed as follows. (1) The contractor should not assign unskilled crew members to projects because hiring unskilled labor was a common comment in the project performance report. (2) Baseline schedules should be developed and used for the project control and not just to satisfy contract requirements. In some projects, the baseline schedule was merely a list of activities with no clear and logical sequence between activities. Also, some schedules had activities with unrealistic durations (i.e., more than 60 days). The SHA agency should enforce minimum requirements regarding baseline schedules and project updates. (3) Contractors should submit acceptable daily work reports and schedule updates of the project in a timely fashion. (4) The SHA should require a revised baseline schedule with every approved change order to estimate schedule slippage accurately. However, this will not provide its full potential until the SHA requires minimum standards for developing baseline schedules. (5) The SHA should require a dynamic logistics and site layout plan that outlines the project phases when applicable. Damage to completed work was observed and noted in the performance reports. This could be improved by requiring contractors to have mobilization and logistics plans, which can help improve and maintain good communication with the SHA personnel and project stakeholders. (6) The contractor has to submit diaries concerning traffic control to the SHA on time. Many performance reports indicated that contractors lacked timely submission of diaries and work reports. (7) SHA should require a communication management plan for all projects involving public stakeholders and utility companies. This would force contractors to plan for communication and coordination issues with different project stakeholders. There was one case in which a contractor changed the location of a drilled shaft without notifying the SHA. This would have been avoided with a proper project communication management plan. (8) Finally, the SHA should require a staffing management plan to help contractors plan for superintendents, labor availability, and requirements. It is evident from the analysis that some projects had labor and personnel issues due to COVID-19 and poor planning. The challenges and recommendations discussed in this paper are limited to 30 projects from one SHA. It may be difficult to genralize this research's findings and recommendations across other SHAs. Further research should be conducted on projects from different SHAs to identify common challenges and recommendations to improve contractors' performance.

References

Bryde, D. J., & Robinson, L. (2005). Client versus contractor perspectives on project success criteria. *International Journal of project management*, *23*(8), 622-629. https://doi.org/10.1016/j.ijproman.2005.05.003

Chan, A. P., Chan, D. W., Chiang, Y. H., Tang, B. S., Chan, E. H., & Ho, K. S. (2004). Exploring critical success factors for partnering in construction projects. *Journal of construction engineering and management*, *130*(2),188-198. https://doi.org/10.1061/(ASCE)0733-9364(2004)130:2(188)

Hashem M. Mehany, M. S., Bashettiyavar, G., Esmaeili, B., & Gad, G. (2018). Claims and project performance between traditional and alternative project delivery methods. Journal of Legal Affairs and Dispute Resolutionin Engineering and Construction, 10(3), 04518017.
https://doi-org.libproxy.uwyo.edu/10.1061/(ASCE)LA.1943-4170.0000266

Idrus, A., Sodangi, M., & Husin, M. H. (2011). Prioritizing project performance criteria within client perspective. *Research Journal of Applied Sciences, Engineering and Technology*, *3*(10), 1142-1151. http://www.maxwellsci.com/print/rjaset/v3-1142-1151.pdf

Lim, C. S., & Mohamed, M. Z. (1999). Criteria of project success: an exploratory re-examination. *International journal of project management*, *17*(4), 243-248. https://doi.org/10.1016/S0263-7863(98)00040-4

Ng, S. T., Palaneeswaran, E., & Kumaraswamy, M. M. (2002). A dynamic e-Reporting system for contractor's performance appraisal. *Advances in Engineering software*, *33*(6), 339-349. https://doi.org/10.1016/S0965-9978(02)00042-X

Russell, J. S., Jaselskis, E. J., & Lawrence, S. P. (1997). Continuous assessment of project performance. *Journal of construction engineering and management*, *123*(1), 64-71.
https://doi.org/10.1061/(ASCE)0733-9364(1997)123:1(64)

Songer, A. D., & Molenaar, K. R. (1997). Project characteristics for successful public-sector design-build. *Journal of construction engineering and management*, *123*(1), 34-40.
https://doi.org/10.1061/(ASCE)0733-9364(1997)123:1(34)

Yasamis-Speroni, F., Lee, D. E., & Arditi, D. (2012). Evaluating the quality performance of pavementcontractors. *Journal of Construction Engineering and Management*, *138*(10), 1114-1124. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000539