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QUICK REFERENCE GUIDE:

MANAGING TO ENSURE FAIR OUTCOMES FOR ELECTRICAL CONTRACTORS FOR OUT-OF-SEQUENCE WORK & SCHEDULE COMPRESSION

Commissioned by ELECTRI International.
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ELECTRI INTERNATIONAL
Research and Education for the Electrical Construction Industry

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Introduction

Consider the electrification of transportation infrastructure, proliferation of smart building technology, and millions of square feet of under-construction data centers. Has there ever been a time in which electrical contractors were in such high demand? Electrical contractors are the backbone of construction projects, spanning from the installation of temporary power service to the final inspections of life safety systems. As the percentage of the total project cost associated with electric scope increases, the need for trusted and competent electrical contractors grows in parallel.

Electrical contractors recognize that current market conditions are stressing their production capacity. These same contractors also face business challenges at the project level, thereby impeding their ability to succeed. Electrical contractors are pushed to complete projects of greater complexity within aggressive—often unrealistic—time frames. They report that conditions including out-of-sequence work and schedule compression often result in significant schedule changes. Electrical contractors must balance the goal of maintaining strong working relationships with general contractors and owner clients while at the same time obtaining fair compensation to recuperate for the cost of schedule changes.

Harnessing the experiences and insights of more than 150 electrical professionals, this research provides electrical contractors with helpful insights regarding out-of-sequence work and schedule compression. The report outlines proactive management tools electrical contractors can use to manage schedule changes and to obtain fair compensation when changes occur.

A proactive and diligent electrical contractor, prepared with the processes and tools to manage schedule change, offers great value to the whole project, including the general and other trade contractors. By working together, the collective project team can reduce schedule changes and the financial detriments these changes cause, thereby benefiting all stakeholders.



Recommendations

This research aggregates and shares the project experiences and management practices of more than 150 electrical contracting professionals so others may benefit in their own work. Some of the key recommendations are drawn from the following factors.

- One cause of out-of-sequence work and schedule compression is the lack of pre-construction planning. A pre-construction planning process should involve coordination with the general contractor and schedule input from the electrical contractor.
- Scope changes greatly increase the probability of out-of-sequence work and schedule compression. Often, non-electrical scope changes may have a ripple effect on the electrical contractor.
- At the very beginning of a project, electrical contractors should identify time sensitive long-lead materials and equipment procurement risks. Delivery dates for critical materials or equipment, whether provided by the EC or by others, need to be calculated. Delivery dates for equipment to be furnished by the owner or others should be specified in the electrical subcontract, along with pre-agreed-upon remedy for missed dates.
- Electrical contractors should institute a reliable system of daily record-keeping that documents occurrences of out-of-sequence work and schedule compression. The daily report should include notes on causes and timely photographs.
- In the likely occurrence that the electrical contractor is financially negatively impacted by schedule change, it is paramount that the EC has timely and formally communicated the notice of change and properly documented the related cost and time impacts.
- Construction projects are best managed by collaborative stakeholders who are willing to communicate persistently and coordinate effectively with all trade contractors throughout the duration of the work.

Investigation

The research team conducted three in-person workshops and one on-line research session, involving 37 electrical contracting professionals. In addition, the research team collected on-line surveys completed by more than 120 electrical professionals.

Table 1. Summary of Research Workshops

Workshop Location	Date	Number of Participants	Host	Method
Phoenix, AZ, USA	08-24-23	9	Arizona NECA	In person
Hamilton, Ontario, CA	10-30-23	8	ECA, Hamilton	In person
Atlanta, GA, USA	12-04-23	14	Georgia NECA	In person
Remote Session	02-02-24	6	Oregon-Columbia NECA	Online

By probing industry experts regarding the causes and solutions for out-of-sequence work and schedule compression, the research results provide electrical contractor project teams with recommendations and practical tools to build positive working relationships while also achieving fair financial compensation.

Out-of-Sequence Work

Out of sequence work is defined as the execution of project activities in a non-optimal fashion that deviates from the most efficient or most logical plan for production. It arises due to various factors such as incomplete preceding work, material delays, and/or client changes. A schedule change can occur because of directed changes or unexpected disruptions in the workflow. Any departure from planned sequences disrupts the inherent orderliness of project progression, impacting production which then ripples through the rest of the project.

As a result, electrical contractors often incur additional costs associated with demobilization and remobilization because the resources and/or crews may need to be rearranged to accommodate the change in flow. Additionally, the efficiency gained by maintaining continuous production is lost. This can lead to potential delays, inefficient workflow, and increased costs in completing the project. **Table 2** (page 8) summarizes the causes of out-of-sequence work reported by the electrical contracting professionals participating in this project.



Schedule Compression

Schedule compression is a project management strategy to complete a project or task within a shorter timeframe than originally planned. It compels the same amount of work to be completed in a reduced amount of time. While perhaps advantageous in the ability to make up lost time caused by others, schedule compression often results in activity durations below the most cost-effective timeframe, unbudgeted overtime, inefficient craft stacking, and additional field supervision.

Schedule compression typically requires additional resources such as more personnel, longer working hours, or increased effort from existing team members. In any combination of these conditions, productivity often suffers due to the pressure of the compressed schedule, potentially leading to compromised quality or increased risk of errors.

Causes and Responses

The researchers asked electrical contractors to provide the causes of out-of-sequence work and schedule compression as separate issues. Top answers are provided in the ranked order of responses in Table 2 below. The causes are nearly identical yet are reported in a different order of prevalence on current construction projects.

Table 2: Causes of Out-of-Sequence Work and Schedule Compression in Ranked Order

Causes of Out-of-Sequence Work	Causes of Schedule Compression
1. Delayed by Other Trades	1. Delayed by Other Trades
2. Poor Upfront Planning in General for the Project/ Unrealistic Master Schedule	2. Late Delivery/Procurement of Equipment/Delayed Submittals
3. Late Delivery/Procurement of Equipment/ Delayed Submittals	3. Inadequate Trade Coordination
4. Scope Changes/ Incomplete Design	4. Poor Upfront Planning in General for the Project/ Unrealistic Master Schedule
5. Inadequate Trade Coordination	5. Inadequate Resources of Skilled Labor

Table 3 provides a response for each of the primary causes for out-of-sequence work and schedule compression. The third column proposes management tools that address each cause.

Table 3: Responses and Solutions to Address the Causes of Out-of-Sequence Work and Schedule Compression

Cause	Response	Tools
Delayed by Other Trades	• Understand capabilities of adjacent trade contractors • For long term planning, communicate craft needs, standard working hours, and dates of completion of preceding work • For short term planning, have clear communication and commitment by preceding trades of what work needs to be completed to support the planned flow from trade to trade • Communicate clearly with general contractor when commitments are missed by predecessor trades	1. Field tickets to document directed change in sequencing 2. Template communications to communicate delayed predecessor work 3. Use of constraint logs to communicate needed completions of predecessor activities 4. Template notices on regular cadence of completed and incomplete predecessor work; over communicate with e-mail courtesy copy 5. Develop standards for photographs of completed and incomplete predecessor work 6. Track commitments vs. actual (reverse poor trends before it becomes unrealistic to recover)

Cause	Response	Tools
Late Delivery / Procurement of Equipment / Delayed Submittals	• Communicate clearly with general contractor when commitments are missed by predecessor trades • Communicate needed review and approval times for submittals, perhaps document all in subcontract • Identify long-lead items at most risk for delivery delays • Obtain firm commitments upfront from suppliers • Develop plans for storage/payment for expedited high-risk equipment • Detail expectations and roles/ responsibilities for owner-furnished equipment	1. Template contract language/table for submittal reviews, specifically for the most critical long-lead items 2. Keep a procurement risk log to identify items with the longest procurement time, a procurement "hot list" 3. Create template language regarding payment, storage, insurance issues for stored materials 4. Detail delivery milestones and pre-agreed-upon remedy/actions for missed delivery dates by owners or others
Inadequate Trade Coordination	• Communicate expectations for quality trade coordination and documentation • Recommend methods for effective trade communication at the foreperson level, e.g. pull planning • Recommend documentation from coordination meetings to measure planned vs. actual completions	1. List proposed expectations for electrical contractor coordination with the general contractor, e.g. weekly coordination meetings with published minutes, experienced leader for meetings, etc. 2. Employ a measurement of construction using Planned Percent Complete (PPC) tracking a. Validate metrics to track progress b. Compare progress achieved on similar scopes in historical examples
Poor Upfront Planning in General for the Project / Unrealistic Master Schedule	• Conduct an in-house review of the master schedule as provided by the general contractor, e.g., what craft count, working hours, level of coordination, etc. are necessary to achieve the plan • Understand what level of involvement and influence trade contractors will have in establishing the master schedule	1. Create a template for communication expectations for upfront planning 2. Use a checklist of pre-bid and pre-award discussion points with general contractor 3. Consider lost productivity when extensive overtime and/or night shift are anticipated. 4. Document key predecessor milestones necessary to maintain electrical contractor's flow of work

Cause	Response	Tools
Inadequate Resources of Skilled Labor	• Craft a resource-loaded schedule to visualize the craft count needed to meet the master or contract-required schedule • Communicate allocation of craft resources available for any specific project	1. Use resource-loaded CPM schedules 2. Create template language regarding general contractor ability to mandate certain number of electrical craft. 3. Commit to a specific craft curve, with some reasonable margin
Scope Changes / Incomplete Design	• Ask for contract time extension when the proposed scope changes will push the schedule beyond available craft resources • Demonstrate the impact of the change in the current contract schedule	1. Utilize a contract review checklist regarding changes 2. Utilize a checklist to evaluate the quality and completeness of the bid documents



Guidebook of Practical Tools

The Guidebook provided with this report is a collection of practical tools. The tools are presented in template formatting so electrical contractors can modify and customize them for their unique needs and purposes. The template communications and tools developed from this research are an aggregation of more than 15 tools shared by seven NECA-member electrical contractors.

A. Templates: Communications

1. TEMPLATE: NOTICE TO GC—Change in Work
2. TEMPLATE: NOTICE TO GC—Missed Completions by Others
3. TEMPLATE: Field Reports to Office/Project Management
4. TEMPLATE: Weekly Proactive Progress Updates to GC
5. TEMPLATE: Field Schedule Directive
6. TEMPLATE: Field Ticket
7. TEMPLATE: Notification to GC of Schedule Compression or Out-Of-Sequence Work

B. Templates: Checklists / Meeting Agendas

8. CHECKLIST: Non-Legal Bidding Considerations for a Potential Project
9. CHECKLIST: Sub-Contract Legal Terms Review—Schedule Related Items
10. AGENDA: Proposal/Bid Review Meeting With GC
11. AGENDA: Transfer of Project From Office to Field Management

C. Templates: Production and Schedule Management Tools

12. TEMPLATE: Constraint & Impact Logs
13. GUIDELINES: Documentation for Legal Recovery
14. TEMPLATE: Craft Resource Plan
15. TEMPLATE: Out-of-Sequence Work Documentation
16. TEMPLATE: Prove Productivity Loss Due to Schedule Delay and/or Disruption

D. Other Reference Guidance

17. REFERENCE: Trip Wire Provisions Watch List
18. REFERENCE: Links to ELECTRI International Related Materials
19. REFERENCE: Cited Technical Articles

About the Authors



Timothy C. Becker, Ph.D., P.E.. Dr. Timothy Becker serves as Programs Chair and Eminent Scholar at Arizona State University's Del E. Webb School of Construction, one of the first and most highly-regarded construction management programs in the U.S. In this role, he teaches, conducts research, and manages the school's impressive roster of outreach and service activities.

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