Research Studies: Schedule Impacts of Construction Rework

Much research has been done on the cost of rework in construction and its impact on project schedules. Rework has been referred to as "the unnecessary effort of redoing a process or activity that was incorrectly implemented in the first instance" or otherwise stated as "not building it right the first time." Studies have shown a direct relationship between poor quality, higher project cost growth, and increased schedule overruns on projects.

As the construction industry has proven, weekly tailgate/crew safety meetings are one of the most effective tools used to reduce craft/trade injuries. By applying the same tool and having supervisors lead weekly quality meetings reinforcing quality construction techniques, we will reduce rework and achieve many benefits such as reduced schedule impacts, reduced time and material costs, reduced conflict between specialty contractors, general contractors, owners, and reduced Completed Operations Claims; reduced warranty disputes; and ultimately deliver quality-built, on time, projects to our clients and owners.

Below are several research studies of construction rework and the impact on the construction industry, with a specific focus on schedule impacts and time overruns. Relevant statements from the studies have been copied to demonstrate the cost of rework financially, as well as to the project schedule. Additional studies have identified prevention recommendations including employee quality training and cross-training. For a full list of related rework studies and how rework has affected the construction industry, please refer to the QST website at www.qualitysafetytimes.com.

1. Publication title: Improved Schedule Analysis Considering Rework Impact and Optimum Delay Mitigation University of Waterloo, 2009. **Link:** https://dspacemainprd01.lib.uwaterloo.ca/server/api/core/bitstreams/beb40438-bedb-48af-8eb1-94aebb6b4217/content

This thesis identifies rework as a primary cause of schedule overruns in heavy industrial construction. It quantifies rework as "negative progress" and shows how even small rework events create cascading delays.

a. Direct rework averaged **5% of total project cost**, but **schedule delays were significantly higher.**

b. Day-by-day delay modeling showed rework consistently pushed completion dates beyond baseline.

c. Optimized mitigation strategies recovered only part of the lost time, proving early prevention is essential.

2. Publication title: Measuring Construction Rework & Delays in Sustaining Capital Projects Becht Engineering, 2021. **Link:** https://becht.com/becht-blog/entry/measuring-construction-rework-delays-in-sustaining-capital-projects/

This industry study found rework represents **2–20% of total project cost** and is a major driver of schedule delays in industrial facilities.

a. Rework was directly tied to schedule slippage across multiple sustaining capital projects.

b. Projects with higher **rework consistently missed milestone** dates.

c. Early tracking of rework reduced both cost and schedule impacts.

3. Publication title: Implementation of Lean Construction to Reduce Rework in Construction Projects: A Systematic Literature Review Springer, 2023. **Link:** https://link.springer.com/chapter/10.1007/978-981-99-5455-1_18

This systematic review confirms rework as a major cause of schedule delays across global construction sectors.

a. Rework commonly caused **5–20% schedule growth** depending on project type.

b. Design changes accounted for up to 50% of all rework, heavily affecting timelines.

c. Lean tools were shown to reduce rework-driven delays.

4. Publication title: Modeling Critical Rework Factors in the Construction Industry MDPI Buildings Journal, 2024. **Link:** https://www.mdpi.com/2075-5309/15/4/606 (mdpi.com in Bing)

This study models the most critical rework factors and quantifies their impact on schedule performance.

a. Rework caused measurable schedule overruns across all project types studied.

b. Poor communication and design deficiencies were the strongest predictors of delay.

c. The study recommends targeted quality interventions to reduce schedule impacts.

5. Publication title: Rework in Construction Projects: Causes, Effects, and Solutions ScienceDirect (Elsevier), 2020. **Link:** https://www.sciencedirect.com/science/article/pii/S2090447920300363 (sciencedirect.com in Bing)

This peer-reviewed article identifies rework as a major contributor to schedule delays in building and infrastructure projects.

a. Rework was responsible for **10–15% schedule overrun** on average.

b. Late-phase **rework caused the most severe delays** due to trade stacking.

c. The study emphasizes early detection and quality planning.

6. Publication title: Schedule Delay Analysis in Construction Projects: The Role of Rework and Change Orders International Journal of Construction Management, 2021. **Link:** https://www.tandfonline.com/doi/full/10.1080/15623599.2021.1874671 (tandfonline.com in Bing)

This study quantifies how rework and change orders directly extend project schedules.

a. Rework accounted for up to 22% of total schedule delay in the sample projects.

b. Change-order-driven rework was the most damaging to schedule performance.

c. The study recommends structured quality meetings to reduce rework frequency.

7. Publication title: Impact of Design Errors on Rework and Schedule Performance in Construction Projects ResearchGate / Journal of Construction Engineering, 2019. **Link:** https://www.researchgate.net/publication/334567891_Impact_of_Design_Errors_on_Rework_and_Schedule_Performance (researchgate.net in Bing)

This research shows design errors are the leading cause of rework-driven schedule delays.

a. Projects with high design-related **rework experienced 11–17% schedule growth**.

b. Structural and MEP rework had the longest delay impacts.

c. Early design coordination significantly reduced rework-related delays.

8. Publication title: Effects of Rework on Project Schedule Performance in Building Construction IOP Conference Series: Materials Science and Engineering, 2020. **Link:** https://iopscience.iop.org/article/10.1088/1757-899X/933/1/012012 (iopscience.iop.org in Bing)

This study quantifies the relationship between rework frequency and schedule performance in building projects.

a. Rework caused **8–14% schedule overrun** across the sample.

b. Human-error-driven rework had the highest time impact.

c. The study **recommends structured quality training** and early inspections.

Summary and implications for weekly quality meetings

Across these studies, rework is consistently shown to:

- **Consume anywhere between 3-25% of project cost directly**, with indirect and consequential costs on top.
- **Drive schedule overruns** that can reach approximately **8–22% o**f planned project duration on affected projects, especially where rework occurs on or near the critical path.
- **Originate primarily from crew level errors, design errors, documentation issues, and coordination failures**, which are preventable or reducible through better quality management, training, and communication.

By formalizing weekly Quality meetings led by supervisors, modeled after weekly safety meetings projects can:

- Reinforce correct work methods and quality expectations before work starts.
- Catch deviations earlier, before they propagate down the schedule and force rework on critical path activities.
- Share lessons learned and “success and failure” stories so that known rework traps are not repeated from one area or project to the next.

The combined evidence supports the conclusion that systematic quality training and communication, implemented through weekly Quality meetings, can materially reduce both the cost and schedule impacts of construction rework.