



To Improve Safety, Improve Project Definition

Can improving construction safety be as simple as improving project definition at the early stages of the project lifecycle? Capital projects that are well prepared at the front-end have better construction safety results. Project teams, including the business sponsors, should focus on the application of best practices during front-end planning—the project definition phase. Proper project definition not only drives better project cost and schedule results, but improves construction safety. That is, project safety performance and project outcomes go together because *all* aspects of a project benefit from good planning and excellent execution.

The injury rate in construction is higher compared to many other industry sectors. In 2015, 937 workers in the U.S. construction industry died from work-related injuries and illnesses. Approximately 116,000 more suffered a DART injury case.¹ The U.S. construction industry had a recordable incident rate of 3.5 per 200,000 hours and a DART² incident rate of 2.0 per 200,000 hours.³ Given the size of the construction industry, these rates represent extremely high numbers of injured workers. And despite the overall trend showing improvement in the industry, that improvement unfortunately is primarily in the less severe categories of injuries or illnesses. In fact, the industry's fatality and DART incident rates have shown little improvement over the last several years.

Best Practice Number One: Project Definition

What can be done? The single best practice with the most leverage is achieving the appropriate level of project definition during the early development phase of a project, especially before starting project execution. Better levels of project definition prior to project authorization and the start of detailed engineering are strongly correlated with better safety performance during the construction phase.

One element in particular leads to better safety: **a formal, documented, and approved project execution plan**. Such a plan will outline a project execution strategy as well as specify team staffing and a master project schedule. The plan also will include environmental, health, and safety (EH&S) plans and construction safety plans.

In addition to the formal and approved project execution plan, a well-defined project will contain a **complete basic engineering package** that includes issued-for-design (IFD) piping and instrumentation diagrams (P&IDs) for the entire project scope, health and safety (HAZOP) reviews on the IFD P&IDs, and a bottom-up cost estimate that serves as a cold-eye check that all the deliverables required are complete. Importantly, this engineering package should be reviewed by the operations and maintenance staff.

¹ Bureau of Labor Statistics, Fatal Occupational Injuries by Industry and Event or Exposure, All United States, 2015.

² DART (days away, restricted, or transferred)

³ Bureau of Labor Statistics, Employer-Reported Workplace Injuries and Illnesses – 2015, USDL-16-2056, 27 October, 2016.

Other Best Practices

Another best practice correlated with better safety results is **forming an integrated project team to manage the project definition phase**. Projects developed by teams that include all key functional representation have better safety results in the construction phase. Integrated teams are teams that include active representation from the functional groups associated with a capital project: business, operations and maintenance, EH&S, procurement, engineering and design, and construction management. Too often, the project teams that lead the definition phase of capital projects lack representation from one or more of these areas. The result is often late input, which in turn could lead to changes in scope, in design, in cost and schedule targets, or even in overall project objectives.

Also, projects that **plan and implement a robust project controls program** have better construction safety results. A comprehensive project controls program includes several important practices. The project cost estimate should be developed to a level of detail that makes it possible to function as a basis for project cost controls during execution. The cost estimate should be validated using an objective basis for comparison with actual industry performance to ensure that the targets are competitive yet not unachievable. The project team must include a project controls professional during both the project definition phase and the execution phase. During execution, project progress must be measured using physical progressing of actual deliverables and not based on estimated percent complete, hours spent, or costs incurred. Finally, a comprehensive project controls program includes a process for archiving project cost and schedule results for use in future projects.

Apply Best Practices

Best practices during the front-end that drive improved project cost and schedule outcomes will mean better construction safety performance. Projects developed by fully integrated project teams that achieve the appropriate level of definition prior to authorization are less likely to have disruptive late changes, excessive cost growth or schedule slip, or major turnover in team members. A project that is fully defined and is then executed under control simply is less likely to have serious safety problems once in the field.

Too many construction workers suffer work related injuries or illnesses on the job site. Project owners, contractors, and teams should strive to apply well-established project definition best practices not only because it will mean better safety results, but because applying those best practices will result in better cost and schedule performance.

What's Next?

This is the first in a series of NAC white papers linking better safety outcomes to best practices in project delivery. The next paper will address best practices in execution that help drive better safety results. The third paper will look into lessons learned programs that help organizations improve safety performance on future projects. The final paper will discuss organizational leadership practices that support the safety culture.

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