

False Precision and the Illusion of Accuracy.



Why do project disasters continue when so much effort has been put into avoiding them?

Abstract

Project executives face an overwhelming amount of information today, as contractors generate very detailed estimates and schedules. Meanwhile, owners have installed inordinately detailed verification processes that expand on the information. The sheer volume of detail and analysis (i.e., precision) gives both owners and contractors a false sense of confidence in the accuracy of their estimates and schedules. Beyond this sense of accuracy, estimators and schedulers tend towards over-optimism regarding the quality of their work. However, in reality, at the level where the information is generated and analyzed, the estimating factors cannot be verified – they can only be tested in summation. Further, actual performance data frequently does not match the estimate, due to differences in contracting strategy, making comparison difficult.

With management assuming (and wanting to believe in) the precision and accuracy of information, far too frequently decisions are made that result in optimistic cost estimates and impossible schedules. Valiant attempts to meet these unrealistic schedules then compound cost overruns, result in operations issues, and/or require sustaining capital due to false declarations of completion.

In our Independent Value Assurance work, we see perceived precision in estimates and schedules generate a false sense of accuracy far too routinely. Our 2014 Annual Perspective shares key metrics that have helped our clients avoid false precision in their projects – and can hopefully help your projects as well.



Project software has provided the industry with detail and precision... but not accuracy

With the aid of powerful computing software, cost quantification and schedule activities can be developed at a very detailed level based on volumetric estimating systems and parametric models. The level of detail is almost entirely based on very detailed material quantities. Using the generated quantifications requires estimation factors that are more detailed than the level of information available from actual construction performance metrics. Considerable time is spent on determining the multiplier of 1.0 for US Gulf Coast productivity with little real ability to test what the base of 1.0 represents against actual performance. Work-hours are normally a key consideration in contingency and risk, but contingency and risk are expressed in currency terms and rarely considered as contingency and risk-adjusted work-hours. Work-hours set schedule durations and, without contingency and risk adjustment, give false confidence in durations.

Case in point

We reviewed a project with a 12,000-activity work-hour-loaded schedule. It appeared quite impressive in its level of detail. The project team had done a risk analysis and the probabilistic results indicated a three-week slip from the deterministic date. We extracted roughly 100 key dependency activities from the 12,000 schedule activities, and created our own time-risk logic model. Using our model and our view of ranging, we arrived at a probabilistic date eighteen months later than the deterministic date. The project is now complete and our date missed the actual completion date by two weeks.

We used high-level project overview performance metrics to gauge possible progress, along with a logic model that hard-connected the key schedule dependencies. The schedule was unrealistic at inception based on project overview performance metrics, yet the client was convinced it was possible because of the level of detail. The eighteen-month difference was caused by the combination of declining performance (due to increasing difficulty) and failing to consider risked work-hours. We have seen many similar cases dealing with cost estimates where the overview was not based on real performance data, but rationalized as factual due to the level of detail.

Average construction progress flat lines at 0.7% per week for large capital projects

Westney has tracked the average physical construction progress per week (from first foundations to mechanical completion) against total project size (measured in total site direct work-hours) for 35 years, with a database of several hundred projects. As project size (or at least direct work-hours) increases, it is clear that the ability to achieve progress flat lines at

about 0.7% per week for projects that require 10 million work-hours and above. The range of actual outcomes or scatter (denoted by the dotted lines in Figure 1, below) is only wide on relatively small projects. The progress also seems to be mostly independent of whether or not the work-hours are productive – i.e. cheaper, less productive work-hours in developing countries get the same result as more productive work-hours in developed countries. The range of outcomes is small for projects at or above 10 million work-hours, ranging from about 0.57% average per week at worst, to 0.734% average per week at best.

There are only three projects above 0.7% average per week. The best we have seen was a 0.734% average per week, and that was a 16 million work-hour project built 30 years ago.

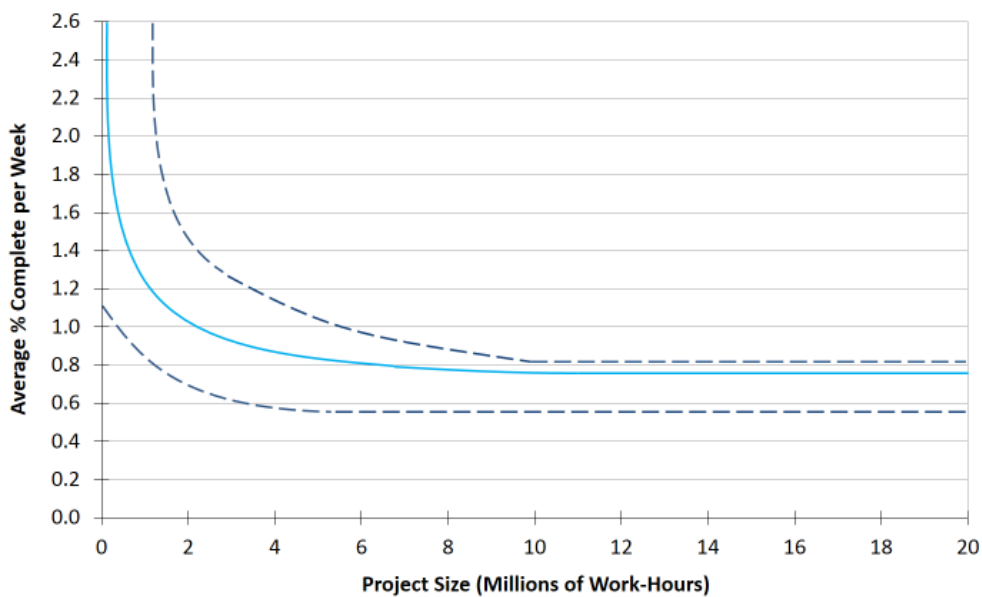


Figure 1: Historical Completion Rates vs. Project Size (200+ Projects)
From Start of Foundations to Mechanical Completion

Successful projects focus on the sweet spot in the construction progress profile

Another check on what is possible is the understanding of the profile of construction progress. We see many projects where planning indicates multiple weeks of about 0.9% weekly progress (or better) productivity, continuously improving up to project completion. The reality is that the only real chance for improvement is in the 20% to 80% range of the project duration (see Figure 2, below). The first 20% is very constrained, due to available open work faces and design information. The last 20% is constrained by work face access, the difficulty of the remaining tasks, and a shift to systems completion.

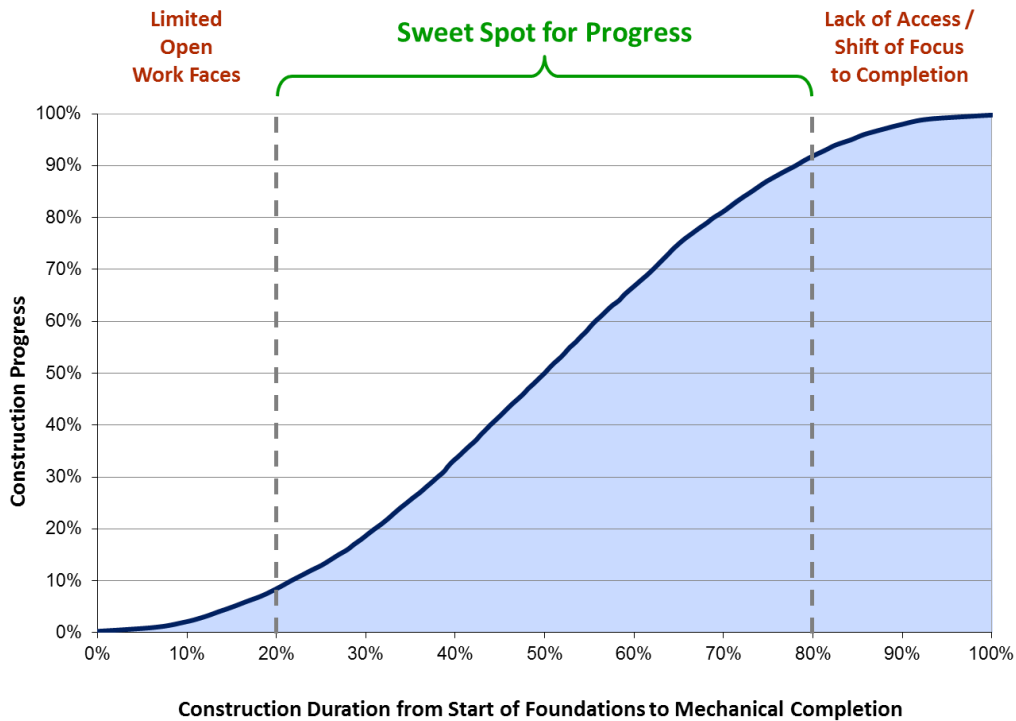


Figure 2: Construction Progress Profile

Successful projects and contractors focus on the 20% to 80% “sweet spot” of the construction progress profile. Their strategy is to assure progress by making sure the design information, materials, and equipment are available in each discipline (or craft), in order to achieve the rate of installation to meet scheduled progress. Resources are matched to available work, not necessarily to the schedule. We find many projects, especially owner-directed ones, solely trying to work the schedule in this period, as opposed to working the design information, materials, and resources available to achieve the rate. This always results in poor productivity.

Project overview performance metrics for the US Gulf Coast

In order to improve industry knowledge and project planning, Westney will annually share our high-level view of key metrics from the US Gulf Coast, which can serve as the basis for your own project overview analysis.

Work-Hours Expectations for 2014

Category	Unit	Achievable Work-Hours per Unit		
		Lower Temp / Lower Pressure / Less Corrosive / Low Equip Count Projects	Higher Temp / Higher Pressure / More Corrosive / Elevated / High Equip Count Projects	Recently Observed Projects
Engineering & Home Office Construction	Piece of Major Equipment	2,000	3,500 ⁽¹⁾	1,900 to 4,400 ⁽¹⁾
Concrete ⁽²⁾	Cubic Yard	12	16	12 to 24
Structural Steel ⁽³⁾	Ton	35	45	30 to 81
Pipe ⁽³⁾	Center Line Linear Foot	2.2	3.2	2.5 to 7.6
Electrical ⁽³⁾	Linear Foot	0.25	0.30	0.23 to 0.45
Instruments ⁽³⁾	Each	25	35	35 to 40

(1) Excludes LNG which is much higher at ~8,000 hours per piece of major equipment

(2) Inclusive of area paving

(3) Scaffolding and clean-up in a general site account

Cost Expectations for 2014

2014 Expectations All-in Contractors Rates	Low Rate ⁽¹⁾	Fair Price ⁽²⁾
Engineering and Home Office Construction – Houston (Ex. Travel and Accommodation)	\$75	\$140
Engineering and Home Office Construction – High Value Center (Ex. Co-located Project Supervision and T&A)	\$42	\$45
Construction	\$85	\$100 ⁽³⁾

(1) Low Rate represents services provided for no risk, generally continuous work or project hiring and minimal functional support

(2) Fair Price represents contractors taking risks and maintaining resources for supervision continuity, functional support, skills advancement, and risk management

(3) 50 hour work week basis

Westney has developed proprietary tools that have successfully helped clients combat false precision

Decades of industry experience have enabled Westney to define the key issues that lead to predictable cost and schedule outcomes. We have consolidated these issues into 42 predictability factors, which form the basis of our proprietary Predictability Calibration® diagnostic. This tool provides clients with an independent verification of the likelihood of project success, along with detailed, actionable recommendations that will improve project predictability and performance.

Westney is also able to provide clients with an experience-driven, top-down, independent view of the projected cost, schedule, and work-hours for a project using our Risk Resolution® methodology. We independently value the project's key risks and benefits in a "straw man" to assure that all risks (no matter how sensitive) are considered. Our independent view combats false precision and rationalized optimism, and provides clients with a risk-adjusted interpretation of key project metrics.

Our diagnostics are forward-looking and project-specific. The outputs are based on several industry experts' knowledge and insight into the specific project's technical/commercial issues, location, contracting strategy, team, and risk factors – not just a benchmark of previous projects that may or may not be relevant to the unique challenges and environment of the project being evaluated.

The industry's ability to generate false precision greatly exceeds its ability to generate meaningful and accurate estimates. Organizational biases such as false precision and rationalized optimism further complicate the issue. While there is no cure-all for cost and schedule over-runs, conducting well-informed project overview analysis on the front-end of a project is the best place to start.

If you would like to discuss the contents of our 2014 Annual Perspective, or hear more about the type of work that we do, please give us a call at (713) 861-0800 or email us at info@westney.com.