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S Curve Forecasting: Creating Visibility

By Pete Gallagher

A construction company faces three primary visibility challenges in predicting the timing of job margin: understanding how work backlog translates into margin, determining if a project is behind in dollars, and having forward visibility into how gross margin will end up for the year.

To help businesses overcome these obstacles, S curve forecasting is a powerful tool that provides margin visibility, timing, and control. This article explores the concepts of S curve forecasting, provides real-life examples that illustrate the concepts, and discusses the benefits and features to look for in an S curve solution.



A POWERFUL TOOL FOR MARGIN VISIBILITY, TIMING & CONTROL

S curves are named as such because monthly project cost and revenue tend to be low (flat) in the early stages of a project, steepen during the middle as costs increase, and flatten again at the end. This flat, steep, flat shape manifests as an "S."

S curve tools provide the ability to plot a project's planned cost, revenue, and margin compared to the actual costs/revenue using a monthly or milestone-based schedule format.

More complex, longer duration projects will typically use the milestone format to provide more granularity and better accuracy. S curves provide powerful visualization capabilities, coupled with the ability to make dynamic adjustments to dates, percent complete, and cost/revenue, while seeing the results instantly for better visibility of project timing required to achieve financial performance.

Real-Life Example: The Construction of a Shopping Mall

To better understand the importance of S curve forecasting, let's consider a

real-life example. A construction company has been contracted to build a shopping mall. The project has a budget of \$50 million and is expected to take 24 months to complete. The company's project manager (PM) needs to ensure that the project schedule and budget stay on track. They decide to use S curve forecasting to monitor the project's progress and make informed decisions based on the data.

S Curve Forecasting in Action

The PM sets up a milestone-based S curve for the shopping mall project,

Exhibit 1: S Curve: Planned Billings vs. Costs

S curve showing planned billings vs. cost by month.

Charting margin by month can help predict cash flow shortages so that action can be taken as early as possible.

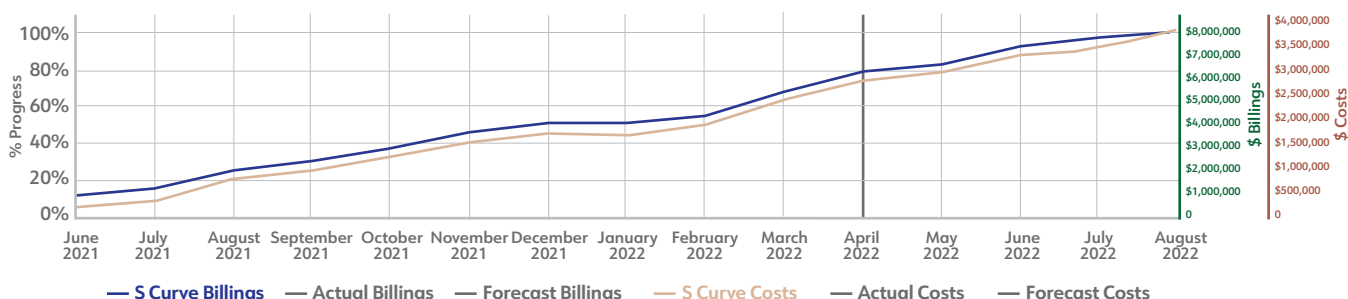


Exhibit 2: S Curve Schedule Using Milestones

	Day	Time %	Description	Billed %	Milestone Billed %	Cost Complete %	Milestone Cost Complete %
1	0	0.0%	Project Start	0.0%	0.0%	0.0%	0.0%
2	7	1.9%	Site Work: Clearing & Construction Road	7.0%	7.0%	2.0%	2.0%
3	22	6.0%	Formwork	11.0%	4.0%	6.0%	4.0%
4	37	10.1%	Foundation Slab	15.0%	4.0%	10.0%	4.0%
5	55	15.1%	Framing: Walls/Subfloor	20.0%	5.0%	15.0%	5.0%
6	66	18.1%	Framing: Roof	23.0%	3.0%	18.0%	3.0%
7	73	20.0%	Framing: Wall & Roof Sheathing	25.0%	2.0%	20.0%	2.0%
8	80	21.9%	Cornice & Facia	27.0%	2.0%	22.0%	2.0%
9	91	24.9%	Windows	30.0%	3.0%	25.0%	3.0%
10	99	27.1%	Underground Utilities	32.0%	2.0%	27.0%	2.0%
11	117	32.1%	HVAC Rough	37.0%	5.0%	32.0%	5.0%
12	128	35.1%	Exterior Doors	40.0%	3.0%	35.0%	3.0%
13	139	38.1%	Exterior Painting	43.0%	3.0%	38.0%	3.0%
14	146	40.0%	Plumbing	45.0%	2.0%	40.0%	2.0%
15	164	44.9%	Electrical Rough In	50.0%	5.0%	45.0%	5.0%

breaking down the project into various phases, such as site preparation, foundation, structural work, and finishing. Each phase is associated with specific costs, revenues, and scheduled completion dates. As the project progresses, the PM uses the S curve to visualize the project's planned cost, revenue, and margin vs. actuals, allowing them to make necessary adjustments and predict future outcomes.

Integrating S Curve Forecasting With Key Systems

In this example, the construction company integrates its S curve forecasting tool with its accounting and forecasting systems. This integration ensures that labor, material, equipment, and other costs are automatically synchronized with the S curve actuals by month and milestone. Additionally, weekly or monthly PM forecasts can be synced to update projected costs, hours, and units of completion. This integration not only increases accuracy, but it also eliminates the need for costly data reentry.

Complete Visibility of Project Margin Timing

With the S curve forecasting tool in place, the construction company gains complete visibility of the timing over the shopping mall project's margins. They can easily identify future cash flow constraint points and make data-driven decisions to maintain better project financial control.

TRACKING MILESTONES FOR DEEPER INSIGHT

Milestone-based S curves are more detailed than simple monthly S curves. Breaking down an S curve project cost and revenue into phases (milestone activities) provides a greater degree of accuracy for more complex projects. This helps ensure milestone events are accurately accounted for and billed as cost events happen.

Milestone S Curve Benefits

- Detailed project view provides a better alignment between cost, revenue, and schedule.

- The ability to associate milestone events with the proper billing month.

- Templates can be used to speed up the setup of new S curve milestone schedules.

- The milestone event day/month can automatically populate using project duration days.

- Ability to link to Gantt schedules to populate S curve templates.

Milestone-based S curves offer numerous benefits that can help construction companies better manage their projects. These benefits allow for more precise project management, ultimately leading to improved outcomes and greater profitability.

Better Alignment Between Cost, Revenue & Schedule

By breaking down a project into distinct milestone activities, PMs can more effectively monitor progress and make necessary adjustments. For example, if a construction project has separate milestones for foundation work, framing, and roofing, PMs can identify cost overruns or delays in each phase and take corrective action promptly.

Accurate Billing & Cash Flow Management

Associating milestone events with the proper billing month ensures that invoices accurately reflect the work completed during that period. This helps maintain a healthy cash flow for the business. For instance, if a project milestone, such as completing the foundation, is associated with a specific billing month, the company can invoice the client accordingly and maintain a steady stream of revenue.

Efficient Setup of New S Curve Milestone Schedules

Using templates can significantly speed up the process of setting up new milestone schedules for similar projects. For example, if a construction company frequently builds apartment complexes, it can use a predefined template with common milestones like site preparation,

S Curve Implementation Tips

- Keep it simple. Overcomplication creates barriers to implementation and discourages adoption. Accountants love to analyze, ponder the "what-if," and see different assumption scenarios; however, PMs don't.

- Step one is the milestone schedule. Once defined, keep the total job costs and total billings as one line each. The PM then maintains only two lines of detail per job.

- After success at the total costs and total billings level, then move on to the next level of detail which is a more detailed breakout of the billings. This may be at the contract item level or other performance point grouping of those contract items.

- The next level of breakdown is S curve costs. Most S curve systems allow job costs to be broken down and maintained at the cost type level.

- S curves make sense for project types over 12 months and for project types that are repeated by a contractor. The ultimate benefit on the S curve setup and maintenance time requires a couple iterations.

- Milestones can be simple. Without the benefit of costs history, the draw schedule may provide the best milestone starting point for new project types.

- S curves forecast costs and billings over the time horizon based on defined milestone incurred and billed percentages. With minor changes to the assumptions, a more precise cash flow can be generated.

structural work, and finishing to quickly create a new project schedule.

Automatic Population of Milestone Event Days & Months

By autopopulating milestone event days and months based on the project's overall duration, PMs can save time. For instance, if a project is scheduled to take 12 months and has evenly distributed milestones, then the system can automatically calculate the expected completion dates for each milestone. If the project end date is changed, then the remaining period S curve milestone amounts and completion dates are recalculated and prorated over additional time.

Seamless Integration With Gantt Schedules

The ability to link milestone-based S curves to Gantt schedules allows PMs to visualize the project's overall timeline alongside its financial performance. This integration can help identify bottlenecks, potential delays, and areas where resources may need to be reallocated.

INTEGRATION WITH KEY SYSTEMS: BRINGING IT ALL TOGETHER

For construction CFOs and PMs, selecting an S curve forecasting solution that integrates with key systems like accounting and forecasting is essential. This

integration not only increases accuracy, but it also eliminates the need for costly duplicate data entry, ultimately saving time and resources.

- **Job Cost Accounting (ERP) system:** Automatically synchronizes labor, material, equipment, and other costs to update S curve actuals by month and milestone.

- **PM forecast:** Weekly and monthly PM forecasts can be synced to update projected cost, hours, and units of completion.

Traditionally, these source systems provide information at a point in time (e.g., cost to date, forecasted cost at completion, cost to complete). S curve exposes this data over a time horizon.

THE RESULT: COMPLETE VISIBILITY & CONTROL OVER PROJECT MARGINS

Effective S curve forecasting requires some effort to set up and maintain. Each month the amount of billings and costs incurred will be different from the S curve calculated amounts. Those differences must be allocated over the remaining months, further refining future visibility.

The benefits far outweigh the costs. A properly maintained S curve schedule provides real-time visibility into remaining

durations, billings, costs, and margins in easy-to-use dashboards. This helps identify future cash flow constraint points and provides better project financial control.

EVALUATING S CURVE SOLUTIONS: IMPORTANT FEATURES

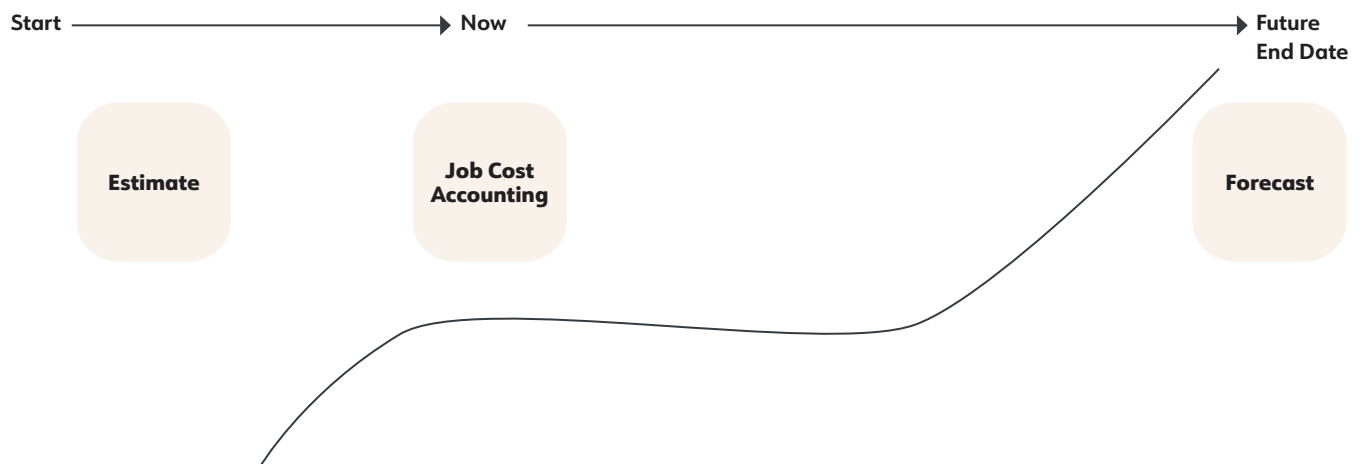
Building on the basics of S curve forecasting, the following key features can greatly enhance the power and usability of your solution:

1. **Seamless integration with Job Cost Accounting (ERP) systems:** Choose an S curve solution that automatically synchronizes labor, material, equipment, and other costs to update actuals by month and milestone. This feature ensures that your financial data is always current and accurate, allowing for better project management and decision-making.

2. **Compatibility with PM forecasts:** A robust S curve solution should sync with weekly or monthly PM forecasts, updating projected costs, hours, and units of completion. This helps PMs stay on top of their projects' financial performance and make informed decisions.

3. **Monthly or milestone-based S curve forecasting:** Opt for a solution that accommodates both simple and complex

Exhibit 3: S Curve Data Visibility Over Entire Project Timeline



S Curve Forecasting: Creating Visibility

projects, offering flexibility in how you manage your construction business.

4. S curve templates: To streamline project setup, look for a solution that offers S curve templates for different kinds of projects (e.g., schools, hospitals). These templates can be copied and customized to suit new projects with similar milestones, saving valuable time and effort.

5. Auto load S curve from historical jobs: With a powerful S curve solution, you should be able to create an S curve based on completed projects, leveraging past data to inform future decision-making.

6. Auto allocation feature: Find a solution that can automatically spread remaining contract revenue, cost, and days back to specific milestone durations based on historical percentages. Ensure that auto-generated data can be overridden to adapt to unique project conditions when necessary.

7. Accounting and forecasting integration: Choose a solution that integrates seamlessly with your existing accounting and PM forecasting systems, eliminating dual entry, and increasing accuracy.

8. Build S curve information at the cost type level: Choose a solution that enables you to build actual and forecasted costs at the cost type level (e.g., labor, materials, equipment). This granular approach provides more accurate financial data and improved project management capabilities.

By selecting an S curve forecasting solution that offers these key features, construction CFOs and PMs can gain complete visibility and control over project margins. As a result, you'll be better equipped to identify future cash flow constraints, optimize resource allocation, and improve the overall financial performance of a project.

OTHER OPTIONS FOR S CURVES

S curve forecasting can also be done in a

Exhibit 4: Timed Cash Flow Forecasting

S Curve Milestones	Total Value	Jobs to Date	Remaining	Timed Values	To Spread	May 21	June 21	July 21	August 21	September 21	October 21
Days	564	450	114			409	430	464	498	529	563
Time	100.0%	79.8%	20.2%			72.6%	76.4%	82.5%	88.5%	94.0%	100.0%
Billings	100.0%	82.0%	18.0%			10.0%	4.0%	8.0%	2.0%	6.0%	2.0%
Cost	100.0%	77.0%	23.0%			10.0%	4.0%	8.0%	4.0%	4.0%	7.0%
Contract Items/ Groups											
All Contract Items	228,040	68,412	159,628	159,628	0 □	0	0	70,946	17,736	53,209	17,736
Total Contract Value/Billings	228,040	68,412	159,628	159,628	0	0	0	70,946	17,736	53,209	17,736
Less: Cost (Forecast/JTD)	186,181	88,422	97,759	96,120	1,639 ■	4,090	2,180	250,000	22,729	22,729	25,662
Equipment (38.48%)	71,651	68,972	2,679	11,570	(8,891) □	4,090	2,180	9,621	623	623	703
Labor (45.77%)	85,218	3,837	81,381	70,648	10,734 □	0	0	11,443	18,921	18,921	21,363
Material (11.84%)	22,053	8,782	13,271	12,616	655 □	0	0	2,961	3,085	3,085	3,484
Other (3.9%)	7,259	6,831	427	1,286	(858) □	0	0	975	99	99	112
Gross Profit	41,859	(20,010)	61,869	63,508	(1,639)	(4,090)	(2,180)	45,946	(4,992)	30,480	(7,925)

company's project scheduling software. However, a full-time cost engineer is needed to break down accounting costs back into detailed work breakdown structure (WBS) tasks and a full-time schedule update resource to maintain it. This article outlines a solution for most of the contractors that don't have that luxury.

Challenges with scheduling software include:

- Scheduling level WBS structures and tasks are more detailed than cost code/phase breakdowns in accounting job cost.
- Taking job costs from the accounting systems and mapping it back to the detailed WBS is often impossible.
- Integration with the source data is critical and few "integrations" available to map accounting job cost back to the scheduling software. Again, there is significant low-value time spent to rekey and reconcile the data before a PM can analyze the data; integrations let construction financial professionals focus on analysis.

CONCLUSION

Job cost accounting systems provide the current state of job costs to date and billings to date. Job forecasts provide the vision of final cost at completion based on insights of project management. Critically, S curves leverage those factors over a time horizon to show a true windshield view of project financial health — displaying both the journey *and* the destination.

Be aware, S curves are a game of horse-shoes, not darts. Start the S curve process at a high level, because too much detail will choke the process, delaying constraint identification and limiting time to respond. Used effectively, milestone-based S curve analysis provides a powerful tool for construction companies to gain deeper insight into their projects' and overall company financial performance. **BP**

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Forecasting Considerations

Work Backlog Conversion

It can be difficult to determine how work backlog will convert into actual margins. For example, having a larger backlog than usual might seem positive, but if significant projects don't start until later, then the backlog might not cover the company's overhead in the short term.

Let's assume you have millions of dollars in work backlog but limited visibility on how it will unfold. If you normally have \$20 million of work backlog (approved contract value minus work billed to date) and now have \$25 million, then you might feel pretty good. However, if two jobs have signed contracts totaling \$10 million and they don't start until the middle of next year, is the backlog adequate to cover your monthly overhead three months from now? Forecasting how work backlog turns into margin is important.

Schedule vs. Financial Progress

While a project may have a schedule, it can be challenging to determine if it's behind in monetary terms. A project might be a few days behind schedule, but the real concern is whether the project is behind in earned value, which could require more significant adjustments than merely making up a few days on the schedule.

Let's say your project has a schedule but it's hard to determine if you are behind in dollars. If a PM indicates they are a few days behind on the schedule, it may sound okay. However, if an S curve forecasts a spend of \$4 million by now and you've only spent \$3 million, then you are behind in earned value. A more impactful discussion with a PM is how to make up \$1 million of earned value vs. making up a few days on the schedule.

Forward Visibility of Gross Margin

Without forward visibility into annual gross margin, it's hard to identify the additional work required to meet budget targets. A company may need help comparing the margin generated from ongoing work with yearly budgeted gross margin, providing better insights into the necessary workload to achieve the budget.

Consider if you lack insight into your annual gross margin, making it difficult to strategize for the future. If yearly budgeted gross margin is \$5 million and you have \$3 million in gross margin generated from ongoing work, then S curve forecasting can help identify the timing required for an additional \$2 million worth of projects to meet your budget target. This numerical comparison provides a clearer understanding of the necessary workload to achieve your financial goals.