TCM.2535

Portfolio Scheduling – How to Achieve Success and What Does Success Look Like?

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Abstract—Initiated, implemented and maintained properly, portfolio scheduling can provide invaluable information to its users. This paper will provide examples of some of the benefits that portfolio scheduling can achieve. The paper will also discuss the implementation of some of the key processes required to ensure success in the development of a portfolio scheduling system. Some of the key components to the development of successful portfolio scheduling systems are establishment of criteria for portfolio governance, engagement of the project stakeholders; uniformity in the project schedules; quality of scheduling; and effective dashboards, tables, and reports that deliver useful data to the end user in an easily discernible manner. Use of a portfolio scheduling system enables the management to strategically prioritize which projects best meet the organization's goals, plan for contingencies, and calculate risk at the portfolio level. The goal is to provide insightful and actionable information to the executive management responsible for managing a complex and seemingly disparate portfolio of projects. The authors have drawn upon their experience working for a large electric utility and a government agency with a multi-billion dollar per year work program.

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Introduction

Properly setting up portfolio scheduling will benefit enterprise programs by providing invaluable information to its users. The authors will discuss the implementation of key processes required to ensure success in the development of a portfolio scheduling system. Key components for developing successful portfolio scheduling systems are engagement of the project stakeholders; uniformity in the project schedules; quality of scheduling; and effective dashboards, tables, and reports that deliver useful data to the end user in an easily discernible manner. The intent of this paper is to provide insight into portfolio scheduling from experience in working in a real world capital improvement program for a large electric utility and government agency with a multi-billion dollar per year work program.

For clarity, we have included definitions of Portfolio and Portfolio Management from both the Project Management Institute (PMI) [1] and AACE International (AACE) [2] below:

1. **Portfolio:**
   a. PMI - A collection of projects, programs and other work that is grouped together to facilitate the effective management of work to meet strategic business objectives. The projects or programs of the portfolio may not necessarily be interdependent or directly related.
   b. AACE - An array of assets—projects, programs, or other valuable and often revenue-producing items—that are grouped for management convenience or strategic purpose. When strategically combined, the portfolio assets serve to create synergies among and otherwise complement one-another.
2. **Portfolio Management:**
   a. PMI - The centralized management of one or more portfolios, which includes identifying, prioritizing, authorizing, managing, and controlling projects, programs, and other related work, in order to achieve specific strategic business objectives.
   b. AACE - Direction and oversight of an array of assets grouped together for strategic purpose or convenience. In total cost management (TCM), this is considered an aspect of strategic asset management (SAM).

Key Benefits to Portfolio Scheduling

The direction of this paper will discuss the use of portfolio scheduling for the construction industry. Some of the key benefits are as follows:

- Enables prioritization of projects based on operational and financial goals
- Enables coordination between and amongst projects
- Enables performance measurement for teams supporting projects
- Enables estimation of required personnel, equipment, and cash flow requirements, required to support annual or capital work effort of the portfolio.

- Provides a high level view of individual project performance and overall portfolio performance
- Provides a historical view of similar projects, and the ability to benchmark future projects
- Provides insight into systemic issues or irregularities in project delivery

Enables prioritization of projects based on operational and financial goals

Viewing all of the projects at once enables the management to strategically prioritize which projects best meet the organization's goals, plan for contingencies, and calculate risk at the portfolio level. This is to be followed by monitoring the portfolio risk and applying the contingencies.

Enables Coordination between projects

- **Modeling of inter-project dependencies, logical ties between projects** – In a portfolio, logical ties can connect the work activities in multiple projects. In this way the effect of progress or lack of progress on preceding projects extends to subsequent projects.
- **Resource demand** – Assuming that the projects are resource-loaded, a project portfolio provides an efficient way of managing people, money, and equipment.

Enables performance measurement for teams supporting projects

- **Scorecard Milestones** – Scorecard milestones compare predicted deadline dates with actual status. This manner of reporting is very appealing to both schedulers and other stakeholders involved with contracts, design, licensing and permitting, management, etc. This paper will show an example of how a dashboard can depict scorecard milestone performance.
- **Cost** – Accounting programs provide great detail on budgets, actual costs, contract commitments, and estimated cost at completion. The portfolio schedules, if cost-loaded, provide useful insight into how planned/actual cost compares with the early and late spending plan, as well as a view of the forecasted cost for each project and the entire portfolio.

Enables estimation of required personnel or equipment to support yearly work effort

Resource loading is one method of estimating staffing requirements. Resource loading is very helpful in customizing assessment of resource requirements across a portfolio of projects. This assessment could examine all resources across a portfolio of projects or be filtered to view only a particular resource. Resource loading in a portfolio environment enables the identification of available resources, areas where resources requirement exceed current resources (staffing or equipment), prioritization of resources and a number of other benefits.

Assigning coding to activities where particular resources are required in the project schedules is another means of displaying resource requirements. Coding activities allows readers of the schedule to determine when a particular resource will be required. For example, a design department that commonly reviews drawing submittals from design consultants would benefit by knowing the timing of the design submittals and their review periods. Providing a field (place) in the schedule to estimate the work effort (drawing count) during the design review periods enables a better forecast of staffing requirements. A dashboard can deliver this information to the engineering managers as they prepare to staff their work assignments on an ongoing basis. [1].

Provides a high level view of individual project performance

Portfolio scheduling enables the organization to view all projects at a high level to evaluate the health of the portfolio at a glance. This provides managers with a means to quickly identify problem areas of their portfolio. (See Exhibit 6 in this paper, which shows a dashboard of the cost forecast for the portfolio as an example of a high level report.)

Provides a historical view of similar projects

The project portfolio provides a history of project performance that enables the planning of future projects. The assignment of project codes is critical to enabling an easy filtering of project criteria to locate similar projects from the portfolio. Linking the scope documents or project execution plans to each of the individual projects is very helpful in understanding the basis of the project durations and costs. Failure to provide this level of detail may render the schedule useless for future planning. As an example, an electrical transformer replacement project at a substation may typically take a year to accomplish; however, if there were delays due to permitting issues, real estate acquisition, increased scope, or other conditions, project completion may take as long as three years. Understanding project conditions is essential to attain accuracy in planning future work.

Provides insight into systemic issues or irregularities in project delivery

The ability to see a preponderance of project data over time, coupled with a phased/gated approach, allows for trending of project performance within a given portfolio. Trends can be categorized over time, allowing for vision and understanding of systemic or themed delivery issues. For example, analysis over a multi-year portfolio could suggest that a well-intended process for review and approval generally takes twice as long as anticipated; on an individual basis this could often be brushed aside as a one-off delay, but when viewed holistically, the commonality of occurrence becomes obvious.

Development of the Portfolio

Key components to the development of successful portfolio scheduling systems are establishing criteria for portfolio governance, uniformity in the project schedules, engagement of the project stakeholders, and quality of scheduling.

Establishing criteria for Portfolio Governance

This includes the establishment of the criteria for the projects that make up the portfolio, the means of evaluating which of the projects are the most critical to the success of the portfolio, guidance for determination of portfolio risk, and contingency guidance.

Uniformity of the Project Schedule

In order to gain the most benefit out of the project portfolio, there needs to be consistency in all project schedules. The best way to control the consistency of the project schedules is to develop a schedule template endorsed by each of the stakeholder groups. It is also extremely helpful to develop written scheduling guidelines that establishes the structure, coding, and other guidelines for the use of the schedule template. Scheduling portfolios typically involve the services of multiple schedulers. Without clear scheduling guidelines, it is nearly impossible to maintain schedule consistency among project schedules. These guidelines also include the establishment of the processes for change management, updating cycle, and schedule reviews with stakeholder, etc.

All processes in the management of the portfolio should have guidelines. Examples of some of the other guidelines would include; cost engineering guidelines, database administrator guidelines, portfolio management guidelines, etc.

Figure 1 below shows an example of a table of contents for project schedulers.

Guide to Project Schedule Management

Project Management Office

Figure 1 – Scheduling Guidelines

Engagement of the Stakeholder Groups

The engagement of the stakeholder is critical to the success of effective portfolio level scheduling. It is important for the implementer to see how the individual stakeholder groups are currently managing their work while determining the goals for each of the stakeholder groups; understanding each stakeholder's group's goals is critical. In many environments, the goals of the stakeholder are at odds with the project management team's goals. For example, a design department might consider the efficient use of their people, the cost of design, or the end cost of construction as more important goals than the timely completion of the project.

It might also be possible that scheduling is not currently part of the stakeholder's management process. Determining the correct level of detail and reporting methods that will assist the stakeholder in achieving their goals, as well as project goals, is critical to achieving stakeholder engagement and project success. The section related to the development of the schedule template will further discuss this topic.

Quality of Scheduling

Generally, multiple schedulers working in the same schedule database perform portfolio scheduling. As such, there needs to be a way to assess how well the entire group is providing

quality schedules that not only work as individual project schedules, but also are uniform in structure with the proper coding, work breakdown structure, and other features of the schedule template. Problems with quality require multiple means to identify and control the following attributes:

1. **Project scope** – Validation of project scope is the most difficult to verify, as it requires the reviewer to be familiar with details of the project. In an environment where multiple projects are assigned to each scheduler, it is advisable to have a manager select and review a representative schedule from each scheduler on a monthly basis, using the scope documents and status reports to determine if the schedule adequately covers the project scope and current status. At the same time, the scheduling manager should verify the feasibility of the critical path. The use of schedule analytic software may also enhance this review**.**

2. **Project schedule consistency of the work breakdown structure, coding, summary activities, resource loading assignment, etc. with the schedule template** – Analysis of the schedule's work breakdown structure is best reviewed in the scheduling software's work breakdown screen. The verification of proper coding assignments involves reviewing the dashboards or layouts where codes are present to ensure that the user is viewing correct information. Verifying correct coding assignments can be difficult to check unless the errors in the code assignments are obviously incorrect. Having code assignments that do not change from the schedule template have a higher probability of being correct than those that have to be modified by the scheduler.

3. **General schedule technical quality: high float, activities starting or finishing on the data date, large variances in schedule details between updates, activities missing predecessors or successors** – It is advisable to monitor these types of errors on a weekly basis using an extract of the data to track and report the number of each scheduler's errors in the portfolio. This process will aid the scheduler by quickly identifying the technical issues so they can be resolved quickly. It is also possible to provide a log of the problem area per week of each type and keep a running log of each of the issues.

In order to ensure that scheduling team produces quality schedules throughout the portfolio, it is recommended that the PMO and scheduling managers employ all three types of quality reviews.

Development of the Schedule Template

The development of the base schedule templates is a critical task in the success of portfolio scheduling. A good schedule template provides the critical sequencing of the work process for each of the key stakeholders. The schedule template also needs to include key interface points between stakeholders. Every project is unique, but the standard processes and interface points will be consistent through the portfolio. Good schedule templates are so critical to the success of portfolio scheduling that the organization must allow time in the setup of a portfolio scheduling environment for a mandatory pilot testing of the schedule template. The

development of the schedule template will use many of the same steps as detailed in the schedule development phase.

Schedule Development from the Schedule Template

Project schedules are one of the main portfolio components, whether they are part of a program or managed individually. Hence, the design and development steps to create project schedules need to ensure reliable inputs and outputs during the process of balancing a portfolio. Typically, as part of the schedule design step, program and project managers will identify the type of project, schedule level of detail, key stakeholders, project scope of work and required outputs (e.g., WBS and project/activity codes). However, many schedulers ignore the schedule design step and choose to start right into schedule development [2]. A portfolio would communicate and report Level 1 to Level 3 schedules, irrespective of whether they are Class 5 or Class 1 schedules; according to AACE's schedule classification system, schedule levels establish the level of detail required for communication, while schedule classes define the project and engineering definition required for schedule development [3].

The schedule development step follows the schedule design step and includes the identification of the schedule layouts, activities, milestones, activity durations, control accounts, interfaces, resources, calendars and constraints. While the schedule template will help to streamline the planning and scheduling processes, it will need the input and constant verification from the program and project managers to make sure that schedules accurately reflect the project scope.

The project management within a portfolio should pay particular attention to the key stakeholders' needs, especially to those that have the most control, urgency and power over the strategic objectives of the organization; these key stakeholders include the organization's executives, portfolio managers, regional managers, operations managers, director of engineering, director of construction, human resources and finance department executives. There has to be a constant and direct communication between these high level stakeholders and project level staff. Some of the goals are to help stakeholders manage their expectations related to demand, selection, planning and reporting. Enabling stakeholders to work within their current processes can be an effective strategy to gain adoption, as long as the project goals are met. The schedule template must contain the activities that are actually performed and can easily be updated.

Interactive Planning Sessions (IPS)

The engagement of the stakeholder is critical to project success. The development of the schedule is the time to determine the goals, activities, and the sequences that best represent the work of each stakeholder. The authors have found that many of the stakeholders are

unmotivated to engage in the schedule development process without understanding how it would benefit their particular group, not just the project as a whole.

One of the tools that addresses this issue is the IPS, which is a collaborative process performed in a meeting with key project team members, and aims to facilitate stakeholders buy-in, improve communication, develop an integrated execution schedule, identify potential interface issues and uncover risks [4]. The performing Organization should implement IPS only on prioritized projects to avoid over allocating its project management resources; the project prioritization is usually based on project size, dependencies, funding, risk to the organization, market demand, and return on investment. When there are hundreds of projects within a portfolio, the portfolio and program managers should identify the 20% of projects. The success of any IPS relies in planning ahead of time, usually three to four weeks in advance, and in addressing the following points:

- Familiarize the internal and external key stakeholders with the IPS process; the number of key stakeholders should be limited to those that have authority and control over the strategic business decisions.
- Define the number of IPS; depending on the size of the project, there would be two to three sessions.
- Outline the goals, milestones, issues and concerns, available resources, constraints, portfolio components, market conditions, verified stakeholders tolerances to cost/time and risk, funds allocation, and potential dependencies between projects in the same portfolio or other portfolios.
- Identify the tools (i.e., software, reports, post-it notes, plans) that would be used during the IPS; digital tools have the advantage of providing instant feedback to the audience; they also minimize data interpretation errors that would commonly occur when an individual, working in isolation, has to create the schedule with the data collected.
- Identify an IPS facilitator, usually the portfolio manager, program manager or IPS expert.

At the onset of the IPS meeting, the facilitator should encourage active participation and open communication from all participants. The attendees of the IPS should follow these steps:

- Develop basic Work Breakdown Structures based on typical project phasing and identification of critical stakeholders; the resulting output of an initial IPS is a high level schedule ranging from Class 5 to Class 3 that shows the agreed time frames for the major phases of the project.
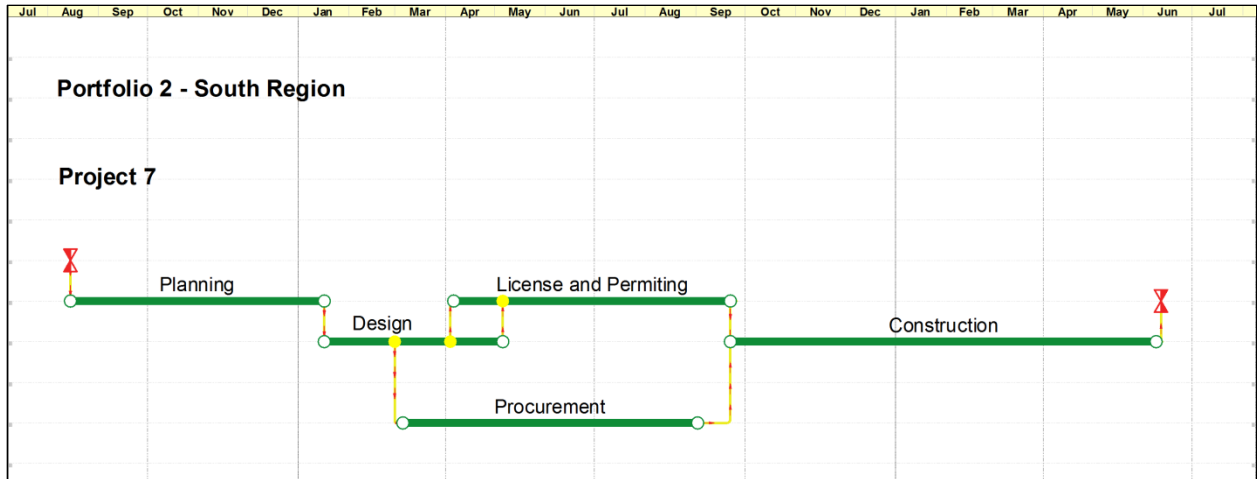
Figure 2 – Project Work Breakdown Structure

- Determine interface points with other stakeholders; there should be a commitment from each participant to achieve the agreed upon dates.
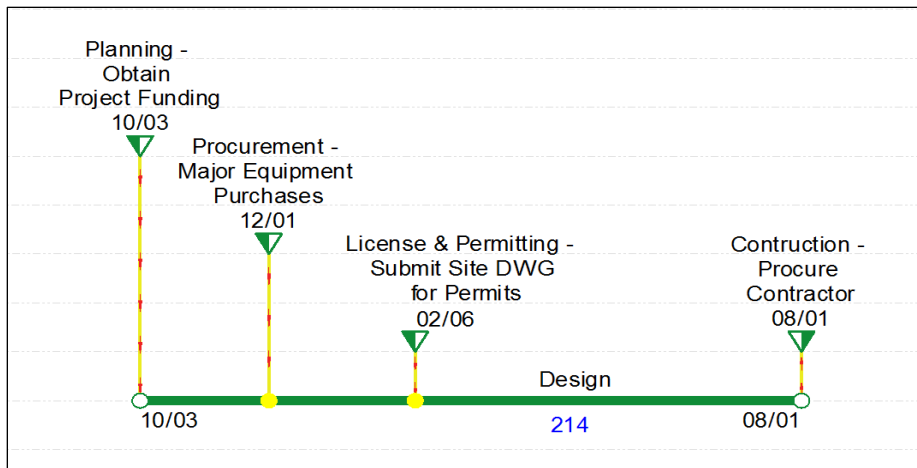

Figure 3 – Stakeholder Interface Points

- Determine actual activities that best represent the stakeholders' work process. Note that these activities need to be measurable and actually performed, not just a part of written guidelines.
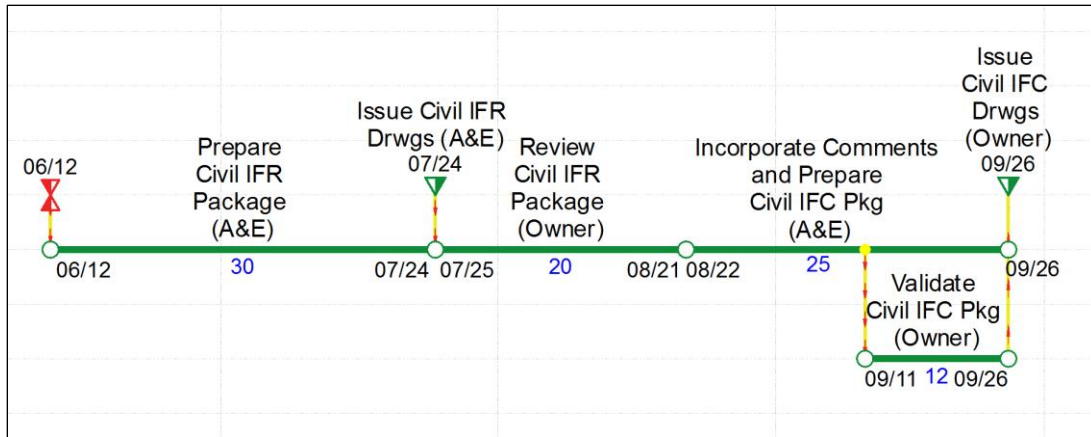
Figure 4 – Stakeholder Work Process to Review Design Documents

Depending on the performing organization and the project definition, the project schedule would be a Class 5 to Class 3 schedule that includes the first agreed-upon network with activities, constraints, critical and near-critical paths, and milestones dates. After the IPS, additional iterations will follow with the goal of optimizing the available resources and committed funds for the fiscal year; creating what-if scenarios is common when factoring in market conditions and operational considerations.

The quality of the schedule is of paramount importance. Quality procedures include the calculation of schedule metrics and their comparison with industry norms [5], along with conformance with the scope of work and schedule guidelines. Additionally, qualitative and quantitative analyses would support the identification of systemic and project-specific risks, and would provide insight as to the suggested time contingency needed to account for potential delays and/or potential time savings opportunities. The next step is for the program and project manager to set the project schedule baseline once all stakeholders endorse the schedule; the authors suggest distributing a baseline scope narrative so that members involved in the baseline approval know the assumptions, constraints and requirements from each group.

Use of Dashboards

The authors found that the use of custom dashboards, graphs or reports best communicated the results of the portfolio schedule. The following is an example of some possible improvements to standard schedule reporting methods. This reporting can use multiple data sources besides the scheduling software to create the dashboards. For example, the project detail reporting dashboard incorporates information from safety reporting, change order status and some of the other non-schedule related from sources other than the scheduling software.

Cost Matrix – Actual vs Planned Cost Comparison

This table allows the user to select from all projects, or a selected group of projects, or a single project and determine how the actual or current forecast of the cost compares to the cost plan from the beginning of the year. This is very helpful information in modifying the spending plan during the year, if the progress exceeds the planned budget or does not keep up with obligated expenditures.
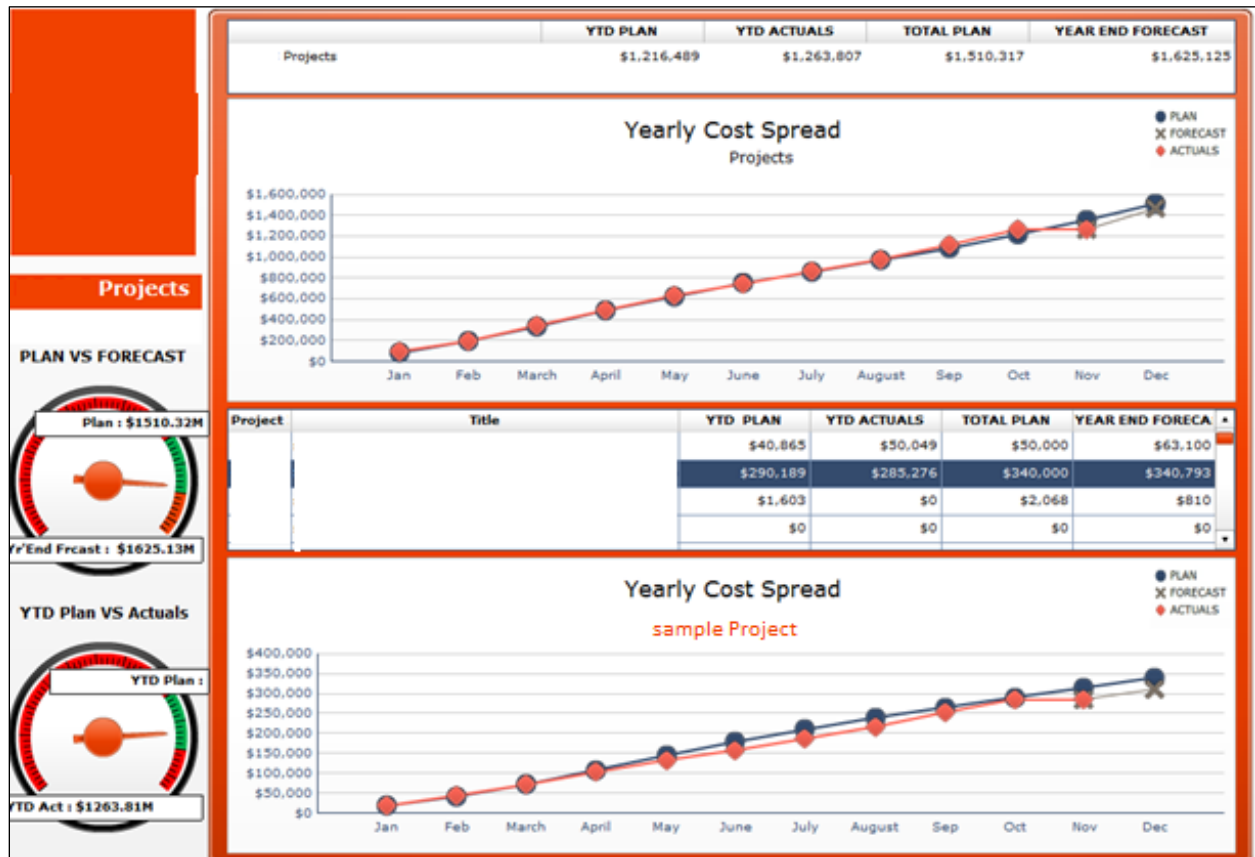

Figure 5 – Actual versus Planned Cost Comparison Dashboard (version 1)

Another option to this display appears in Figure 6 on the following page.

Figure 6 – Actual versus Planned Cost Comparison Dashboard (version 2)

Contracts Award Dashboard – Comparison of Planned Dates vs Current Forecast or Actual Dates

In the authors' experience, one of the areas of the schedule that has been of great interest to the stakeholders has been employment of scorecard milestones. Scorecard milestones are a means of measurement used to determine if a stakeholder group is achieving the completion of time objectives within committed deadlines. As an example, the dashboard below was used by a client's contracts department, enabling them to anticipate their future commitments.

Figure 7 – Contract Award Dashboard

Project Status Report Dashboard – Quick update on project details regarding the project status

This dashboard provides the user with written highlights on any project in the portfolio. This dashboard highlights project risk, lists major issues, and provides milestone and in-service status updates.

Figure 8 – Project Status Dashboard

Major Project Status Report Dashboard

On larger projects it is common practice to periodically issue a major project status report. Automation of this report through extracting data from the scheduling software and other project management tools provides a single source of the project information, leading to greater consistency and accuracy. Figure 9 is an example of a customized automated report based on a client's reporting criteria. The report below shows the status of all major elements of the project, such as funding, budgeting, scheduling, licensing and permitting, engineering, procurement, and construction.
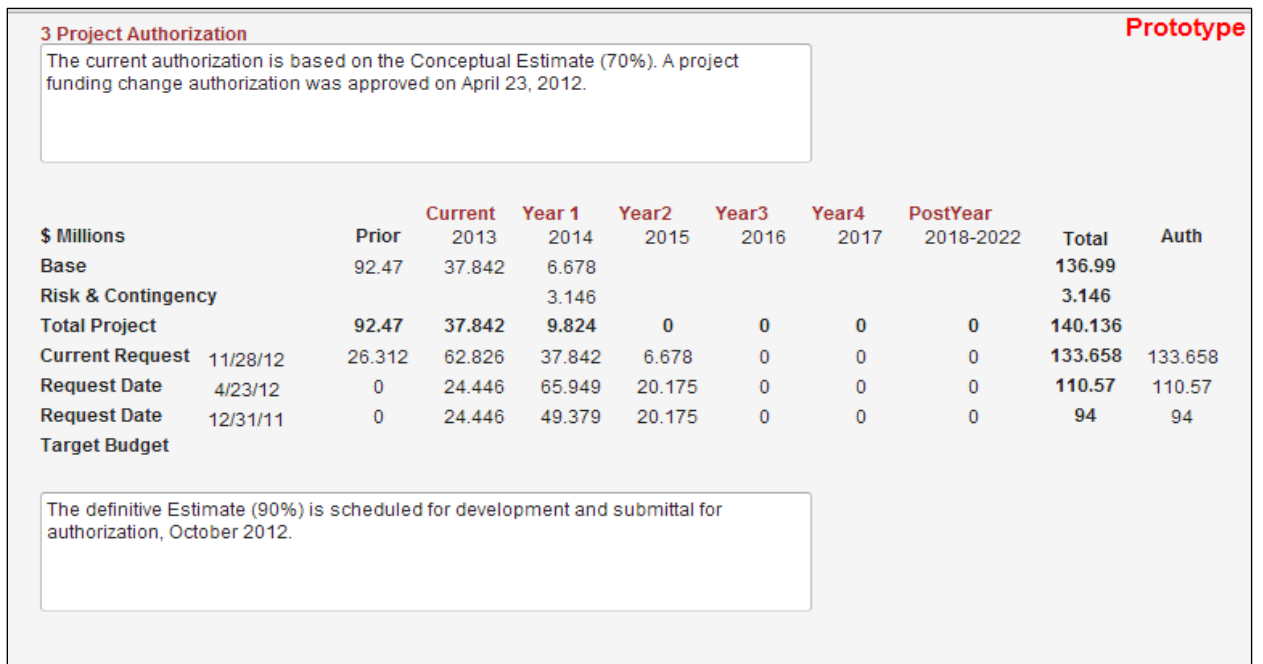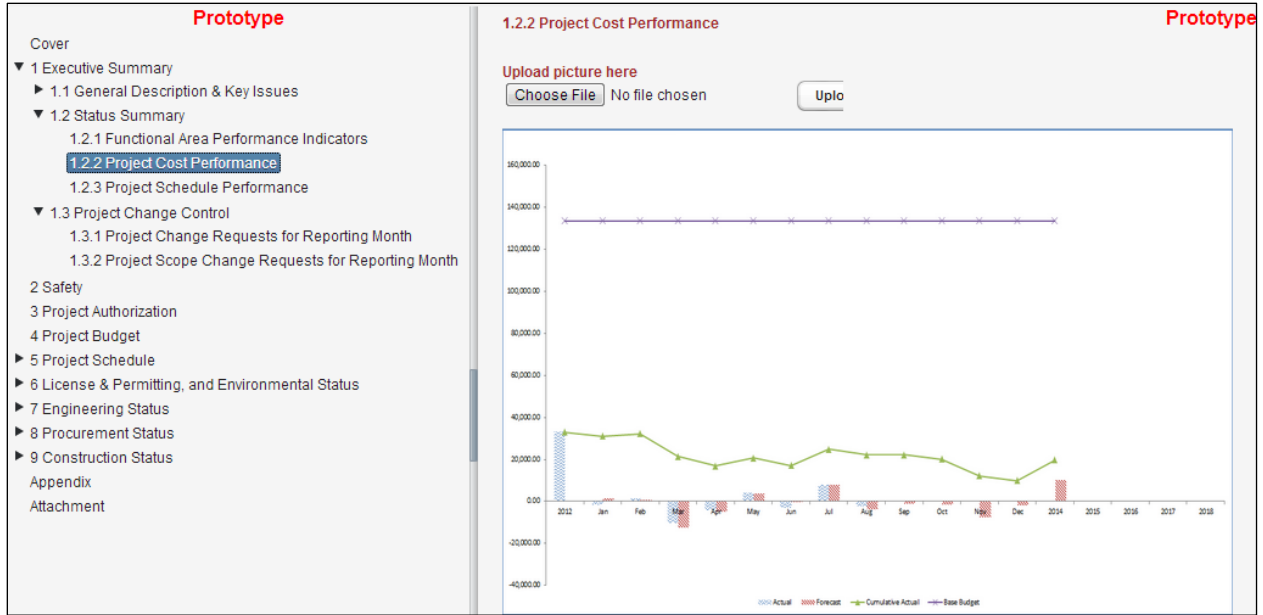
3 Project Authorization

The current authorization is based on the Conceptual Estimate (70%). A project funding change authorization was approved on April 23, 2012.

$ Millions		Prior	Current 2013	Year 1 2014	Year2 2015	Year3 2016	Year4 2017	PostYear 2018-2022	Total	Auth
Base		92.47	37.842	6.678					136.99	
Risk & Contingency				3.146					3.146	
Total Project		92.47	37.842	9.824	0	0	0	0	140.136	
Current Request	11/28/12	26.312	62.826	37.842	6.678	0	0	0	133.658	133.658
Request Date	4/23/12	0	24.446	65.949	20.175	0	0	0	110.57	110.57
Request Date	12/31/11	0	24.446	49.379	20.175	0	0	0	94	94
Target Budget										

The definitive Estimate (90%) is scheduled for development and submittal for authorization, October 2012.

Figure 9 – Major Project Status Dashboard

Touch Point Dashboard

When working on utility upgrades with an electrical transmission utility company, the project controls team needs to be aware of all of the current active projects during the planning phase of future projects. The client calls this report the "TouchPoint" report. This benefits the planning team by helping to coordinate the timing of the work and to ensure that there are no conflicts in the project work scopes. The dashboard below identifies current projects where work is taking place at the same electrical substations as a future project. This dashboard also

provides the current planned in-service date for the work at each station. The information provided by this dashboard is useful not only at the individual project level but can also be used in planning performed by area managers and stakeholders.

TouchPoint Report - Current Projects at Station	
Project Name	In-Service Date
Adam Station	
Adam's Station Transformer Upgrade Project	18-Mar-19
N.E. Transmission Line Upgrade Project	21-Jun-20
Smith Station	
N.E. Transmission Line Upgrade Project	19-May-19
Cap Bank Improvement Project	21-Nov-20

Figure 10 – TouchPoint Report Dashboard

Conclusion

Establishing a single scheduling database to manage a portfolio of projects provides a multitude of benefits to the user: Enables prioritization of projects based on operational and financial goals, easy coordination between projects, performance measurement, projection of staffing needs, a high-level view of the entire portfolio, and the historical basis to plan future work. Use of a portfolio scheduling system enables the management to strategically prioritize which projects best meet the organization's goals, plan for contingencies, and calculate risk at the portfolio level. Key components of the development of successful portfolio scheduling systems are uniformity in the project schedules, engagement of the project stakeholders, and quality of scheduling. The authors have discussed that in some cases, all stakeholders do not fully appreciate the value of portfolio scheduling. However, when portfolio scheduling is properly undertaken and thereby produces accurate, insightful and actionable reporting, its value is self-evident. The authors have shown several examples of effective dashboards, including tables and reports that deliver useful data to the end user in a more easily discernible manner. This information is useful not only at the individual project level but can also be used in planning performed by area managers and stakeholders.

Success in portfolio scheduling depends on good communication with the key stakeholders in the setup of the schedule template. The implementer of a portfolio scheduling initiative must be able to engage with the stakeholders to establish a schedule that provides benefit to each of the stakeholder groups in accomplishing their work, while at the same time supplying consistent interface points with other groups. Having an implementer that is familiar with the clients particular business function is essential. Knowledge of scheduling systems alone will not achieve a successful implementation.

Once the working schedule template is established, success is dependent upon the development and maintenance of all of the schedules in the portfolio. This requires the development of a scheduling reference manual that establishes the structure, coding, and other guidelines for the use of the schedule template. The employment of multiple criteria to measure schedule quality will aid the achievement of this goal. Project schedules must adequately represent the project scope; have similar work breakdown structures, similar activity descriptions, and consistent coding; and use good schedule practice. Failure to do so leads to problems in data quality of the portfolio.

Finally, one must consider the means of communicating this scheduling data. The use of custom dashboards, graphs or reports is often the best way to communicate and interpret scheduling data. Stakeholder groups have preferred these as improvements over standard schedule reporting methods. It cannot be overemphasized that industry knowledge on the part of the implementer is critical to the successful development of effective dashboards.

Portfolio scheduling, performed correctly, is a very effective means of managing multiple projects in an organization. A qualified implementation team having experience in a particular industry is essential to successfully establish and maintain best practices in portfolio scheduling.

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