



Construction CPM Conference

“Reflections on Planning & Scheduling”

By

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Planning & Scheduling

- ▣ The key to successful projects is effective project controls
- ▣ Effective project controls comes from a structured approach to developing the planning culture
 - Adoption of industry best practices
 - Recruiting, training, mentoring personnel
 - Maintaining state of the art competencies at all levels



Importance of Project Planning



- ❑ Project planning is necessary to establish systems and procedures to ensure adequate project controls are in place
- ❑ Good project controls require benchmarks in the form of baseline schedule, cost budget, scope, risk, and quality
- ❑ Without good planning, no one on the team has thought out all the steps necessary to succeed
- ❑ Without good planning including risk assessment, surprises occur throughout the project encouraging crisis management



Empirical Study Results Planning Value

- ❑ Paper: “*Project Scheduling Enhancements for Avoiding Litigation*”, by Dr. Anamaria Popescu, PE, Dr. James T. O’Connor, and Dr. John D. Borcharding, 2002 AACEi International Transactions
- ❑ Study surveyed use of eight functional improvements in scheduling: resource loading, team development of the baseline schedule, weather delay analysis, subcontractor-specific analysis, concurrent delay analysis, turnaround document application, near-critical analysis, and coding structure development.
- ❑ Three of these are planning efforts: resource loading, team development of the baseline schedule, coding structure development
- ❑ Turnaround document application relates to a planning effort when the project schedule predicts late completion, showing delays



Empirical Study Results Planning Value



- Conclusions:
 - “The functional improvements, team development of the baseline schedule, and the development of the turnaround document are the most significant in reducing delay claims.”
 - Team development of baseline schedule ranked #1 in reducing delay claims



Success Factors for Projects

- From “*Scheduling Practice & Project Success*” by Dr. Andrew Griffith
- Study identifying characteristics of schedules that correlated with better project performance (success)
 - Integration of all project phases into a single schedule
 - Application of Critical Path Method (CPM) scheduling
 - Resource-loading of project schedule
 - Detailed review of schedule by project team



Success Factors for Projects

- Integration of all project phases into a single schedule
 - Includes full scope of work
 - Allows for planning for interfaces between project phases (pre-design, design, procurement, construction, post-construction)
 - Limited use of constraints
 - Better cost performance & less schedule slip



Success Factors for Projects

- Application of Critical Path Method (CPM) scheduling
 - Forces team to break down project into discrete activities, estimate durations, identify & review sequencing
 - Network is permitted to calculate accurately, providing better tool with reasonable Critical Path and float values
 - Unrelated to project size
 - Better cost performance & less schedule slip



Success Factors for Projects

- Resource-loading of project schedule
 - Helps to ensure alignment between cost & schedule
 - Allows evaluation of peak labor
 - Focuses the team on critical resources
 - Better cost performance & less schedule slip



Success Factors for Projects

- ▣ Detailed review of schedule by project team
 - Provides a check on accuracy
 - Allows functional leaders to verify that means & methods are represented in the schedule
 - Supports buy-in by project team
 - Demonstrated less cost growth



Success Factors for Projects

- ▣ Lessons Learned
 - Benchmark schedule development
 - Schedule definition developed early in project when ability to influence outcome is greatest
 - Allocate resources to develop & use an integrated project schedule
 - Proper planning and scheduling are worth the investment since they contribute to project success



Reasons for Time and Cost Overruns



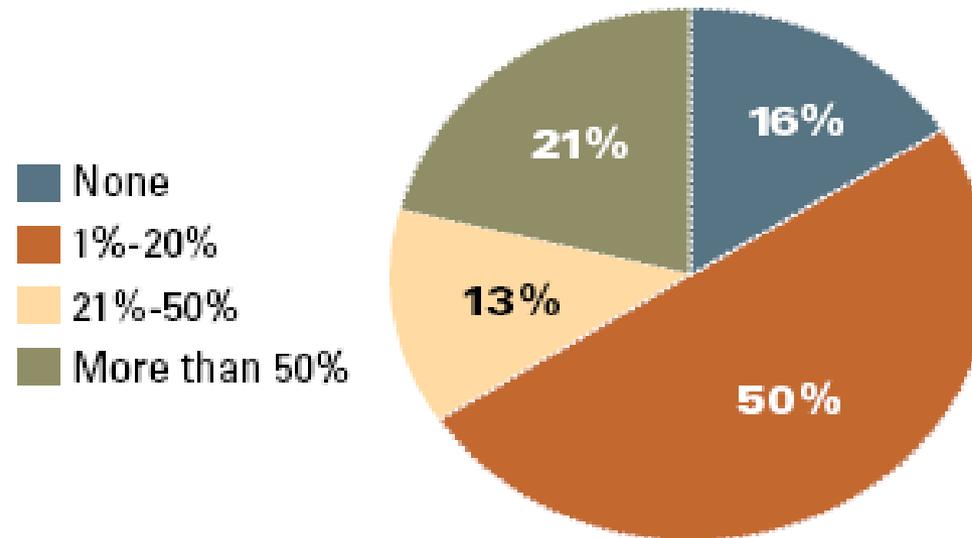
- ◆ 84% of Contractors, Owners, and A/E admit they had at least one infrastructure project that experienced a time overrun.
 - Delays are not necessarily endemic to infrastructure projects across the industry but rather depends on the management of those projects.
 - Indicates the significant impact that management and planning strategies can have on reducing time delays.
- ◆ 21% of respondents had more than 50% of projects that did not complete on time!



Reasons for Time and Cost Overruns

Percentage of Infrastructure Projects that Did Not Complete on Time

Source: McGraw-Hill Construction, 2011



Average **24%** Median **15%**



Reasons for Time and Cost Overruns



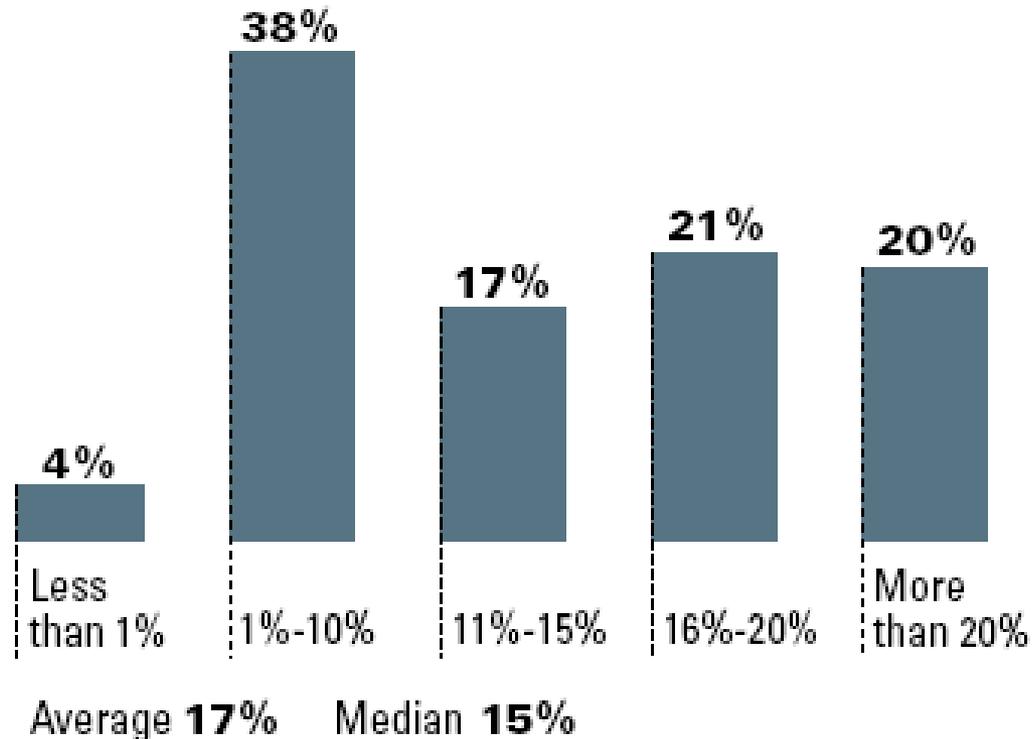
- ◆ For the projects that reported time overruns, the average length of the delay was 17% of the total project schedule.
 - For example, on an 12 month project the length of delay would be just over two months.



Reasons for Time and Cost Overruns

Average Time Overrun (Among Those Whose Projects Did Not Complete on Time)

Source: McGraw-Hill Construction, 2011





Reasons for Time and Cost Overruns



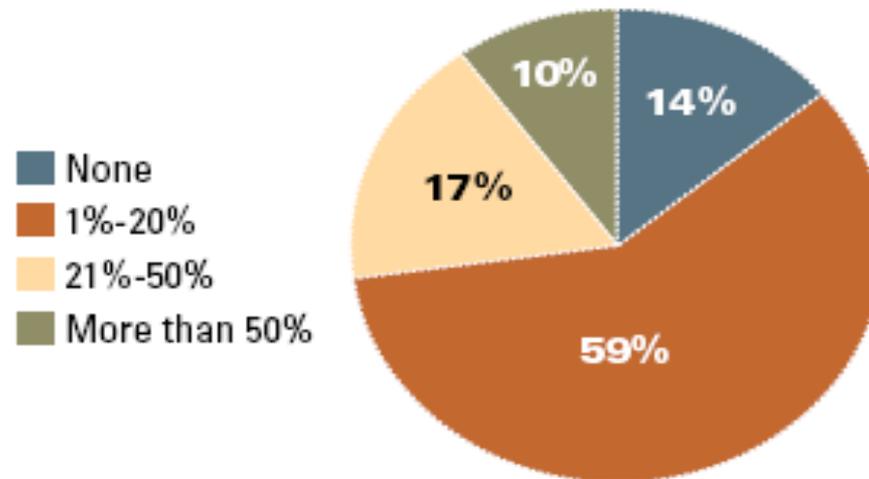
- ◆ 86% of those surveyed report at least some of their projects did not complete on budget.



Reasons for Time and Cost Overruns

Percentage of Infrastructure Projects Completed Over Budget

Source: McGraw-Hill Construction, 2011



Average **19%** Median **15%**



Reasons for Time and Cost Overruns



- ◆ The average budget overrun was 14% of the total project cost.
 - When considered as a percentage of work these respondents, whose largest infrastructure projects range from \$100 million to over \$1 billion, the implication is that millions of dollars are at stake in these overruns.

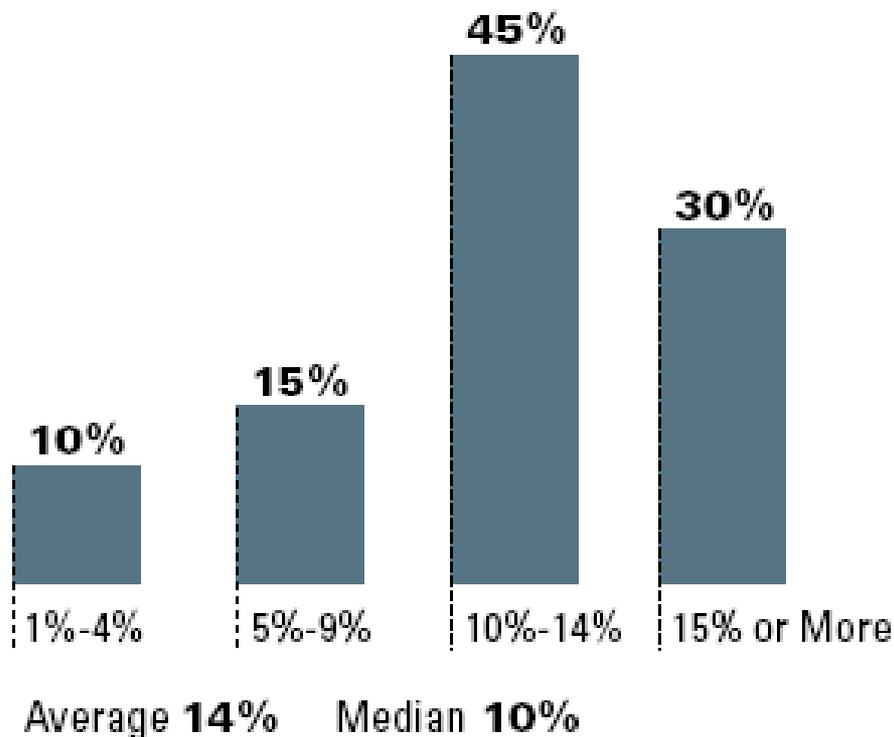


Reasons for Time and Cost Overruns

Percentage of Budget Overrun

(For Those Who Report Not Meeting Budget)

Source: McGraw-Hill Construction, 2011





Prevention of Time and Cost Overruns



- ◆ A combination of Standardized Best Practices and Enterprise Level Technology are key factors in effectively addressing project pressures.
 - SBPT – (Standardized Best Practices and Technology) are defined as those companies that have defined, documented, and standardized best practices across the enterprise and have implemented enterprise applications to provide visibility and assist in the management of projects.
 - SBP – (Standardized Best Practices) are those where best practices have been defined and standardized, but with limited use of technology. These firms may use a combination of desktop tools, spreadsheets, or manual processes to implement these standard best practices.

(2010 Project Management Report: AEC Industry; Aberdeen Group)



Prevention of Time and Cost Overruns



- ◆ A combination of Standardized Best Practices and Enterprise Level Technology are key factors in effectively addressing project pressures., (continued)
 - Those with neither may have defined and documented best practices but have not standardized them across the enterprise. Any technology used is almost exclusively resident on the individual desktop, severely limiting visibility as well as collaborative efforts.

(2010 Project Management Report: AEC Industry; Aberdeen Group)



Prevention of Time and Cost Overruns

Table I: Mean Performance in AEC Firms

Category of AEC Firms	Mean Performance
Standard Best Practices and Enterprise Level Technology (SBPT)	<ul style="list-style-type: none">▪ 89% of projects delivered early or on time▪ Projects not delivered on time are on average four weeks late▪ 89% of projects delivered within budget▪ 10% average overrun on those projects not delivered within budget
Standard Best Practices with Desktop Based or No Technology (SBP)	<ul style="list-style-type: none">▪ 71% of projects delivered early or on time▪ Projects not delivered on time are on average six weeks late▪ 79% of projects delivered within budget▪ 14% average overrun on projects not delivered within budget
Neither Best Practices or Enterprise Level Technology (Neither)	<ul style="list-style-type: none">▪ 64% of projects delivered early or on time▪ Projects not delivered on time are on average six weeks late▪ 73% of projects delivered within budget▪ 20% average overrun on projects not delivered within budget

Source: Aberdeen Group, January 2010



Prevention of Time and Cost Overruns



- ◆ Challenges in successfully managing projects are reduced by 22% by implementing standard best practices and enterprise level technology.
- ◆ Architecture, Engineering, and Construction (AEC) firms with SBPT implemented at the enterprise level are 40% more likely to deliver projects early or on time and 22% more likely to stay within budget than those that have neither.
- ◆ Projects managed with SBPT that do not stay within budget, result in overruns that are half of those in companies with neither SBPT and SBP.

(2010 Project Management Report: AEC Industry; Aberdeen Group)



Prevention of Time and Cost Overruns



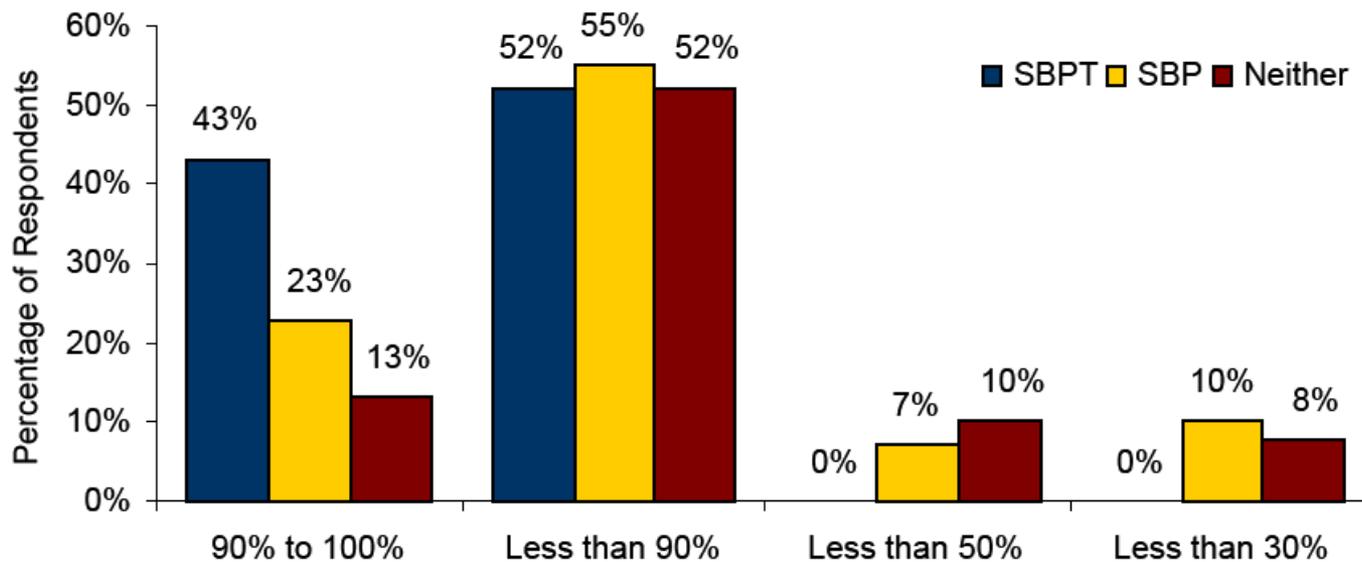
- ◆ Standardized processes and enterprise level technology improve performance.
 - Decision-makers are 132% more likely to be notified in real time about problems in order to react immediately.
 - Project managers are 180% more likely to have real-time visibility into all project milestones and schedule status.
 - Business executives are 232% more likely to have real-time visibility into all project budget versus actual costs.

(2010 Project Management Report: AEC Industry; Aberdeen Group)



Prevention of Time and Cost Overruns

Figure 4: Percentage of Projects Delivered Early or On Time



Note: Where percentages do not add up to be 100%, the remainder of companies either did not know or did not measure this performance metric

Source: Aberdeen Group, January 2010



Prevention of Time and Cost Overruns



- ◆ Cost Containment on Over Budget Projects
 - The degree of budget overrun is critical to the profitability of the enterprise.
 - With the standardization of best practices, AEC firms are more than twice as likely to contain those overruns to 10% or less.
 - Adding enterprise level project management applications increases that likelihood by another 35%.

(2010 Project Management Report: AEC Industry; Aberdeen Group)



Prevention of Time and Cost Overruns



Table 3: Organizational Differentiators

	SBPT	SBP	Neither
Organization	Cross functional teams of IT and line of business individuals are involved in both the selection and implementation of project management applications		
	73%	55%	40%
	Business development and project managers collaborate to set proper expectations with customers		
	82%	70%	44%
	Stakeholders across the full project lifecycle collaborate early and often		
	96%	74%	38%

(2010 Project Management Report: AEC Industry; Aberdeen Group)



Prevention of Time and Cost Overruns



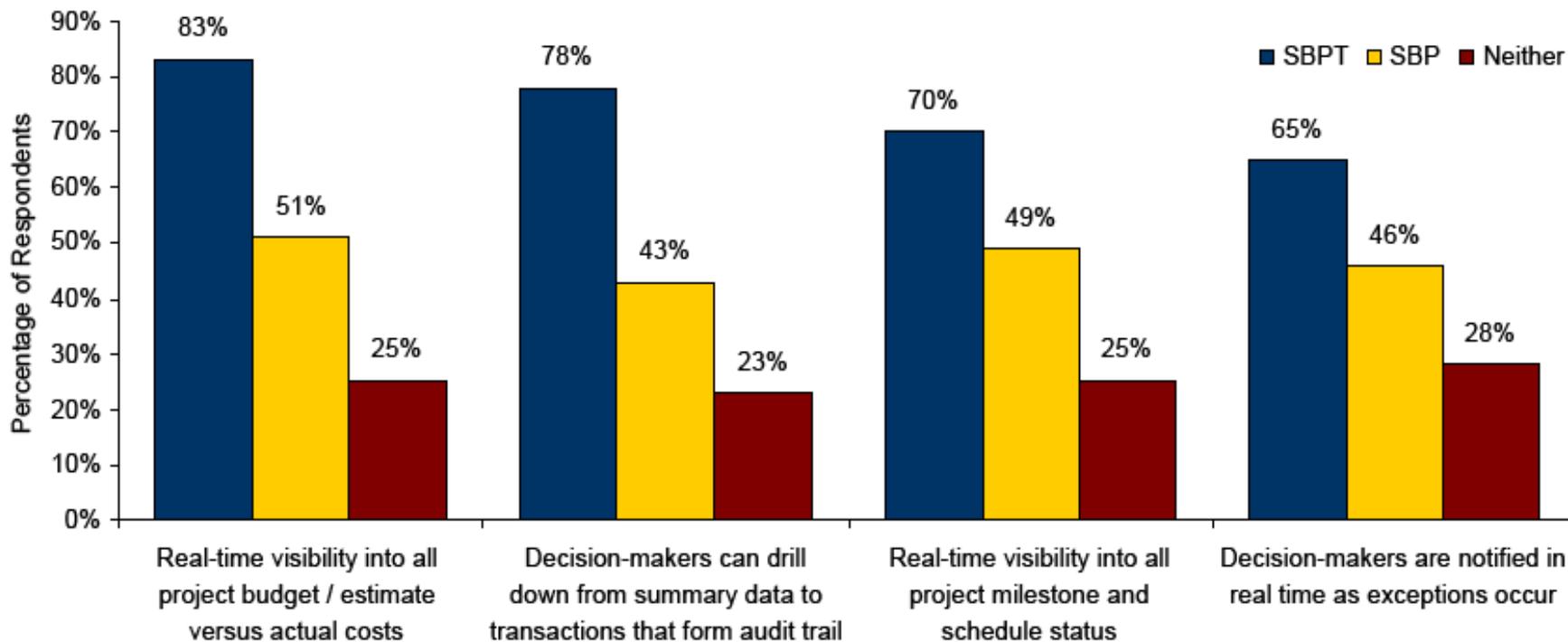
- ◆ Better Visibility thru SBPT
 - Companies have achieved a higher level of visibility throughout the lifecycle of the project.
 - Decision makers are better equipped to more proactively manage possible problems, therefore containing schedule and budget overruns.
 - Added visibility also provides greater insight into the causes of poor performance.
 - By being better informed and more proactive in managing problems, the impact of these factors can be minimized.

(2010 Project Management Report: AEC Industry; Aberdeen Group)



Prevention of Time and Cost Overruns

Figure 8: Improved Visibility



Source: Aberdeen Group, January 2010



Prevention of Time and Cost Overruns



- ◆ Inability to deal with changes introduced after the start of the project causes less of a problem for SBPT companies than either of the other categories of companies.
- ◆ Through best practice, technology, and improved visibility
 - SBPT companies are able to better contain schedule delays
 - Reduce the probability of the negative effect cascading throughout other projects.

(2010 Project Management Report: AEC Industry; Aberdeen Group)



Prevention of Time and Cost Overruns



- ◆ Required Actions
 - By simply defining, documenting, and standardizing best project management practices, AEC companies can deliver 11% more projects on time or early and are 83% more likely to deliver over 90% of their projects within budget.
 - When enterprise level project management solutions are added to these SBP there are significant higher jumps in performance.

(2010 Project Management Report: AEC Industry; Aberdeen Group)



Prevention of Time and Cost Overruns



- ◆ SBPT companies are:
 - 230% more likely to deliver more than 90% of projects early on or time.
 - 188% more likely to deliver more than 90% of projects within budget.
 - 183% more likely to contain budget overruns to be less than 10%.
 - 43% less likely to have poor performance on one project have a ripple effect on other projects.

(2010 Project Management Report: AEC Industry; Aberdeen Group)



Importance of Project Controls in CM

- Steve Pinnell, PE, of Pinnell/Busch, Inc. 2004 Survey
- “Risk Assessment and Best Practices in Scheduling”
 - Major causes of changes (as surveyed by Contractors)
 - *Scope changes – average 39%*
 - *Design errors – average 25%*
 - *Differing site conditions – average 13%*
 - *Owner delays and impacts – average 9%*
 - *Contractor estimate mistakes – average 4%*
 - *Contractor other errors – average 5%*
 - *Weather & other – average 5%*



Importance of Project Controls in CM

- “Risk Assessment and Best Practices in Scheduling”
 - Owner &/or project delays – total 91% by Contractors
 - *Scope changes – average 39%*
 - *Design errors – average 25%*
 - *Differing site conditions – average 13%*
 - *Owner delays and impacts – average 9%*
 - *Weather & other – average 5%*
 - Contractor responsible delay – total 9% by Contractors
 - *Contractor estimate mistakes – average 4%*
 - *Contractor other errors – average 5%*



Importance of Project Controls in CM

- Steve Pinnell, PE, of Pinnell/Busch, Inc. 2004 Survey
- “Risk Assessment and Best Practices in Scheduling”
 - Major causes of changes – (as surveyed by Owners)
 - *Scope changes – average 32%*
 - *Differing site conditions – average 19%*
 - *Design errors – average 18%*
 - *Contractor estimate mistakes – average 12%*
 - *Owner delays and impacts – average 7%*
 - *Contractor other errors – average 6%*
 - *Weather & other – average 6%*



Importance of Project Controls in CM

- “Risk Assessment and Best Practices in Scheduling”
 - Owner &/or project delays – total 82% by Owners
 - *Scope changes – average 32%*
 - *Design errors – average 18%*
 - *Differing site conditions – average 19%*
 - *Owner delays and impacts – average 7%*
 - *Weather & other – average 6%*
 - Contractor responsible delay – total 18% by Owners
 - *Contractor estimate mistakes – average 12%*
 - *Contractor other errors – average 6%*



- ▣ Contractors' perceptions of Owner responsible change: 91%
- ▣ Owners' perceptions of Owner responsible change: 82%
 - Less than 20% of the problems identified are the responsibility of the Contractor!
- ▣ Changes must be identified, analyzed, and negotiated contemporaneously to provide appropriate time extensions to avoid claims

- ▣ And, every project has change!



Importance of Project Controls

- Texas State Highway 130 Toll Road study, Asia Alvord, PMP, HDR Project Controls Manager
 - “One of the largest sources of cost growth on construction projects is change orders.”



Project Controls Oriented Corporate Culture



- ▣ Planning & monitoring are vital steps in process
- ▣ Senior management must actively support culture
- ▣ Culture requires:
 - Development of project controls process integrating all disciplines:
 - ▣ Planning and scheduling
 - ▣ Supported by cost estimating and budgets
 - ▣ Strong document control
 - ▣ Careful adherence to the contract
 - ▣ Claims avoidance
 - ▣ Speedy analysis and resolution of all issues
 - ▣ All project controls disciplines work together to identify, analyze, and resolve all issues affecting production or progress
- ▣ Requires a serious commitment



Integration with Project Management

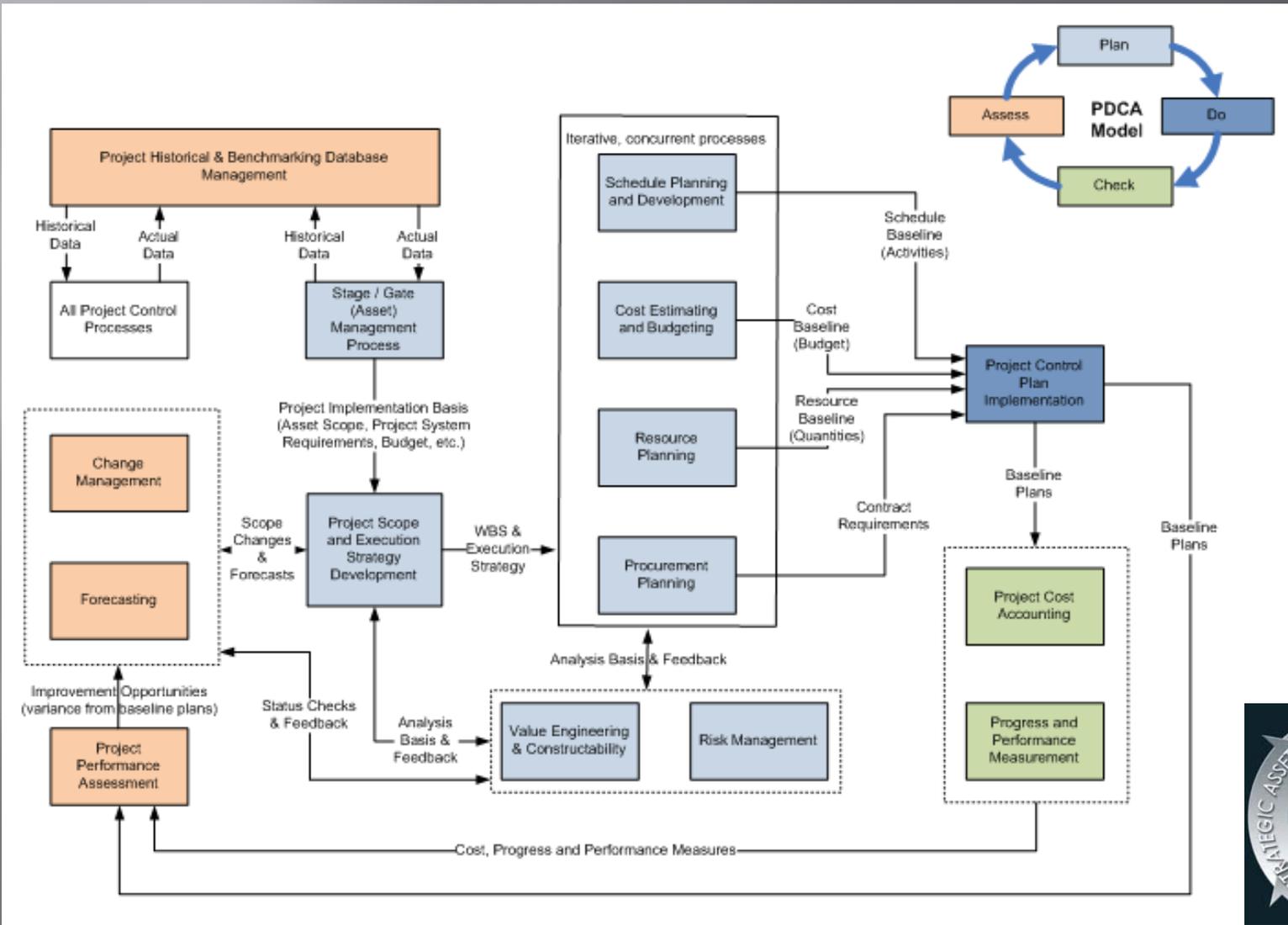
- ❑ Project management team should be deeply involved with planning for proper buy-in
- ❑ Project controls can provide useful analysis and recommendations
- ❑ PM team uses results from project controls
- ❑ PM team involves owner

- ❑ Requires strong and repetitive interaction between project management and controls



Design of Project Controls System

- ◆ Project Controls Process - AACE Total Cost Management Framework





Characteristics Of A Useful Schedule



- ❑ Schedule must model the project
- ❑ Proper level of detail (reasonable # critical activities)
- ❑ Summarize to one page
- ❑ Team buy-in; all stakeholders involved in schedule process
- ❑ Describes superintendent's plan (not President's)
- ❑ All activities tied to completion
- ❑ Resource-based durations
- ❑ Meet the specification
- ❑ Include procurement activities (and coordination)
- ❑ Written narrative to identify plan



The Planning Effort

- ❑ Early master or planning schedule/programme developed
- ❑ Integrated cost and schedule planning
- ❑ Careful contract review
- ❑ Constructability review for efficiency
- ❑ Schedule/programme is designed to suit purpose; components match needs
- ❑ Hold formal schedule development/planning session
 - Includes project management team
 - Incorporates claims avoidance
 - Incorporates risk assessment into session



The Maintenance Effort



- ❑ Effective process for maintenance/ usage of schedule
- ❑ Timely regular updates with short interim planning
- ❑ Eliminate progress-only reporting; power is in analysis
- ❑ Formal process of schedule analysis & feedback
 - Includes trending & completion predictions
 - Includes claims avoidance & risk review
- ❑ Continuous modeling of current means & methods
- ❑ Early identification of problems
 - Interactive implementation of any necessary course corrections
- ❑ Formal change management process includes Time Impact Analysis
- ❑ Resolve all time related issues contemporaneously



Planning & Scheduling

- ▣ There has been no well defined career path for project controls disciplines in the industry
- ▣ Project controls cannot be easily learned on the job
- ▣ Few companies offer training or mentoring
 - Nowhere is this more obvious than Forums, Groups, and Associations
 - Practitioners are crying out for help at all levels
 - International companies have recognized this industry shortcoming



Industry Associations Defining Best Practices



- ◆ Construction Management Organizations
 - CMAA – Construction Management Association of America
 - CM Standards of Practice, Time Management Chapter
 - PMI – Project Management Institute
 - The PMBOK® (Project Management Body of Knowledge)
 - Standards – Scheduling, EVMS, WBS, Program Mgmt..
 - DBIA – Design Build Institute of America
 - Design-Build Manual of Practice
 - CII – Construction Industry Institute
 - Individual papers in the Knowledge Structure website
 - CIOB – The Chartered Institute of Building
 - Guide to Good Practice in the Management of Time in Complex Construction Projects
 - APM – (Association for Project Management)
 - APM Body of Knowledge



Industry CM – PC Efforts



- CMAA – Construction Management Assoc. of America
 - Reps from AACE, PMI CoS, CII revised Time Management
- PMI – Project Management Institute
 - Volunteers revise The PMBOK[®] (Project Management Body of Knowledge) and Standards – Scheduling, EVMS, WBS, Program Mgmt..
- GAO – Government Accountability Office
 - Group led by David Hulett revised Scheduling Best Practices
 - Representatives from PMI CoS, AACE, CMAA
- CIOB – Chartered Institute of Building
 - Revised “Guide to Good Practice in the Management of Time in Complex Construction Projects”
- Collaboration efforts underway across associations



Industry Associations Defining Best Practices



- ◆ Project Controls Organizations
 - AACE – Association for the Advancement of Cost Engineering
 - PMI-SCoP – PMI Scheduling Community of Practice (formerly College of Scheduling)
 - PMI-CPM – The College of Performance Management
 - ANSI-EIA-748-98, Earned Value Management Systems
 - ASPE – American Society of Professional Estimators
 - Manual of Standard Estimating Practices
 - ACostE – The Association of Cost Engineers
 - Targeted books (Industrial Engineering Projects, etc.)
 - RICS – Royal Institute of Chartered Surveyors
 - Planning Planet and the Guild



Industry Project Controls Associations Efforts

- ▣ AACE international
 - True project controls association
 - Total Cost Management Framework with Recommended Practices supplying piecemeal bodies of knowledge
 - High level of quality, great products
 - ▣ Recommended Practices
 - ▣ Professional Practice Guides
 - Large amount of knowledge still to be captured
 - Webinars, Local Chapters, Annual Meeting, Regional Workshops



Project Controls

AACE International Recommended Practice No. 14R-90

RESPONSIBILITY AND REQUIRED SKILLS FOR A PROJECT PLANNING AND SCHEDULING PROFESSIONAL TCM Framework: 7.2 – Schedule Planning and Development

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AACE International Recommended Practice No. 14R-90
**RESPONSIBILITY AND REQUIRED SKILLS FOR A
PROJECT PLANNING AND SCHEDULING PROFESSIONAL**
TCM Framework: 7.2 – Schedule Planning and Development



September 19, 2006

INTRODUCTION

This recommended practice is intended to serve the following purposes:

- Describe the roles and responsibilities of a Planning and Scheduling Professional (PSP) during the various phases of project planning and schedule development, management and control.
- Define the core skills and knowledge a Planning and Scheduling Professional is required to have in order to be considered a professional practitioner, and in doing so,
- Establish the core subjects for AACE International PSP education and certification programs.

Knowledge is understanding gained through experience or study and skills are abilities that transform knowledge into use. Core subjects are those whose usage is occasional to frequent and which AACE International considers as being required for planning and scheduling professionals to know and use.

This Recommended Practice (RP) lists the core subjects and provides general performance statements (e.g., "describe", "perform", etc.) in order to represent the level of proficiency expected in each subject area. These statements are guiding examples only, and are presented in a "verb-object" format.

This outline is intended to be a structural foundation for additional planning and scheduling products to be developed by AACE International and will continue to be modified as current practices change.

BACKGROUND

This revision retains most of the content of the previous version and includes information from RP 11R-88 *Required Skills and Knowledge of Cost Engineering*. It also incorporates those elements of the Total Cost Management (TCM) Framework that are deemed applicable for a planning and scheduling professional. It provides organization of the subjects aligned with the TCM Framework.

TCM provides an integrated structure and organizes the development of RPs. The AACE International Constitution and Bylaws (Section 3) defines Total Cost Management as follows:

"Total Cost Management is that area of engineering practice where engineering judgment and experience are utilized in the application of scientific principles and techniques to problems of business and program planning; cost estimating; economic and financial analysis; cost engineering; program and project management; planning and scheduling; cost and schedule performance measurement; and change control."

PURPOSE



Recommended Practices

aace
International

AACE International Recommended Practice No. 38R-06
DOCUMENTING THE SCHEDULE BASIS
TCM Framework: 7.2 – Schedule Planning and Development

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International

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International

AACE International Recommended Practice No. 49R-06
IDENTIFYING THE CRITICAL PATH
TCM Framework: 7.2 – Schedule Planning and Development, 9.2 – Progress and Performance Measurement, 10.1 – Project Performance Assessment, 10.2 – Forecasting

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International

AACE International Recommended Practice No. 52R-06
TIME IMPACT ANALYSIS – AS APPLIED IN CONSTRUCTION
TCM Framework: 6.4 – Forensic Performance Assessment, 7.2 – Schedule Planning and Development, 10.2 – Forecasting, 10.3 – Change Management

AACE® International Recommended Practice No. 29R-03
FORENSIC SCHEDULE ANALYSIS
TCM Framework: 6.4 – Forensic Performance Assessment

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Professional Practice Guides



AAACE® International's Professional Practice Guide to

Planning and Scheduling, Third Edition

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Chapter 01: Contract Administration

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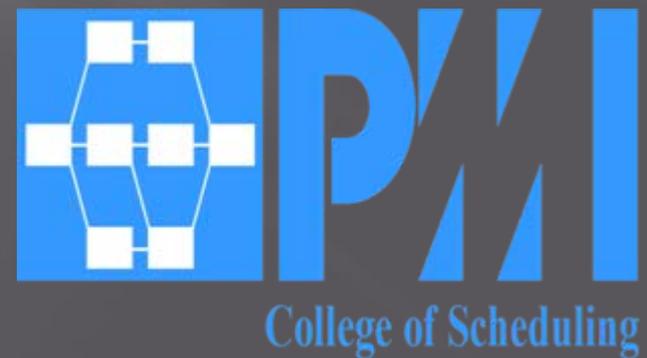
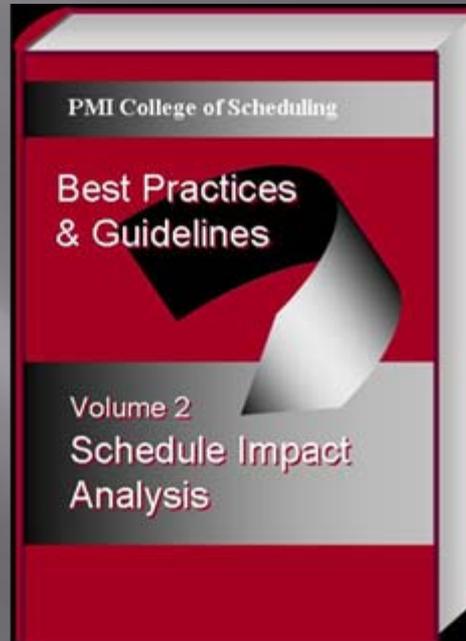
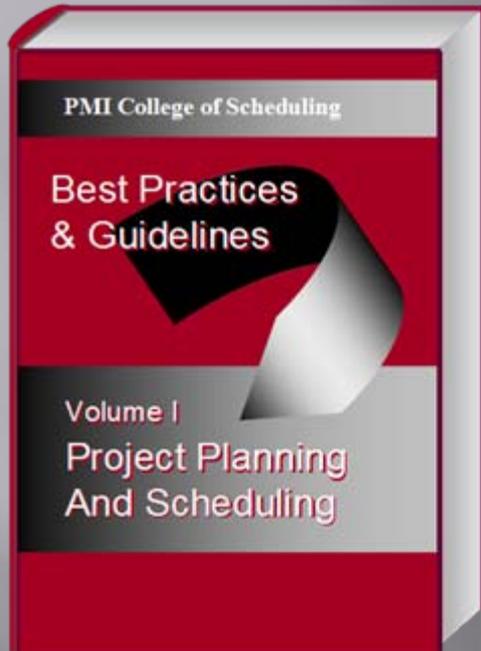
Industry Project Controls Associations Efforts



- PMI Scheduling Community of Practice
 - Planning and scheduling only association
 - Time Management Chapter of the PMBOK contains some body of knowledge
 - Working on Best Practices and Guidelines for Scheduling, due out Spring
 - Future efforts; BP&G for Schedule Impact Analysis
 - PMI has several high-level Standards: WBS, Scheduling, Earned Value
 - Webinars, Annual Conference



PMI SCOP





Industry Project Controls Associations Efforts



- The College of Performance Management
 - No longer Chartered under PMI
 - ANSI-EIA-748-98, Earned Value Management Systems
 - Membership ~ \$20/year
 - Annual Conference





Planning Planet & the Guild



- The International Guild of Project Controls
 - Developing a body to enable recognition within PP community as well as employers/organizations
 - Align global & industry variations in standards & methods
 - Support efforts of professional organisations
 - Supported by large body of professional organisations as sponsors
 - Developing Certifications, Training



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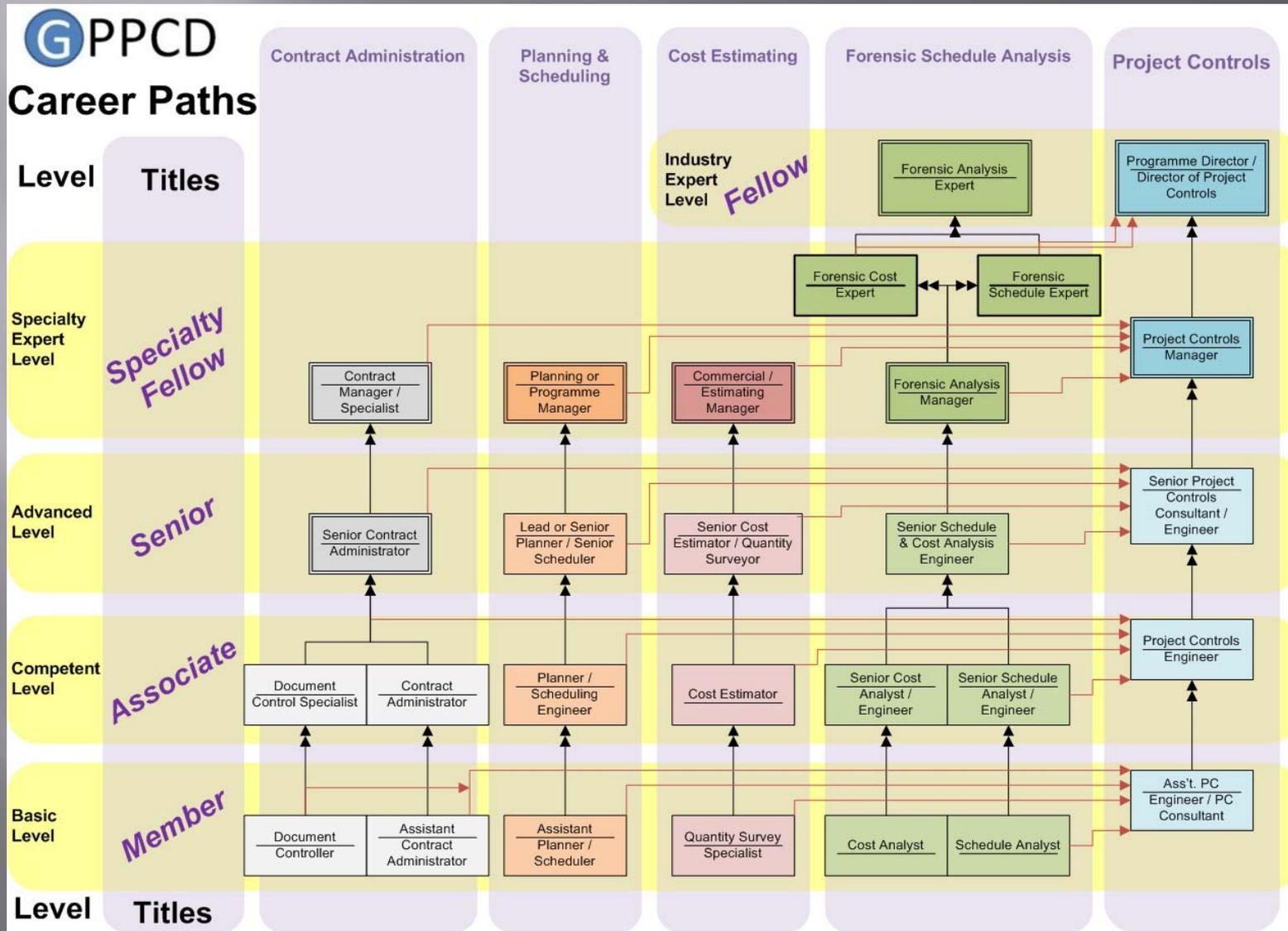


Planning Planet & the Guild

- ▣ Career Path
 - Focused by discipline
 - ▣ Contract Administration/Document Control
 - ▣ Cost Estimating
 - ▣ Planning and Scheduling
 - ▣ Forensic Analysis
 - ▣ Project Controls
 - Four or five levels of competence
 - ▣ Entry/Basic
 - ▣ Competent
 - ▣ Advanced
 - ▣ Specialty Manager or Expert
 - ▣ Industry Expert in Project Controls or Forensic Analysis



Planning Planet Career Paths





Roadmap to Successful Projects



- ▣ Professional Associations are the Centers of Progress and Innovation
- ▣ Development of Good Practices is the Goal
- ▣ This is the Roadmap to Successful Projects
- ▣ And it's Driven by World Class Project Controls!