

RISK ASSESSMENT AND BEST PRACTICES IN SCHEDULING

PMI College of Scheduling Paper by Steve Pinnell

Executive Summary

This report summarizes a 50-page paper presented to the Project Management Institute College of Scheduling at their Annual Conference in Scottsdale, Arizona, on 24May05. The paper reports on a survey of construction scheduling practices to show how current practices result in delays and claims. It also recommends 'best practices' to avoid changes, delays and claims.

The survey results provided informative and valuable information; it also highlighted the need for a more extensive survey. We recommend that a coalition of several large construction companies, project owners, and professional societies use our results as a blueprint for a more comprehensive study.

Survey Methodology and Response

Survey invitations were sent to over 600 individuals. 130 complete responses, equally divided between contractors and owners, were received.

Changes as a Percent of Annual Volume

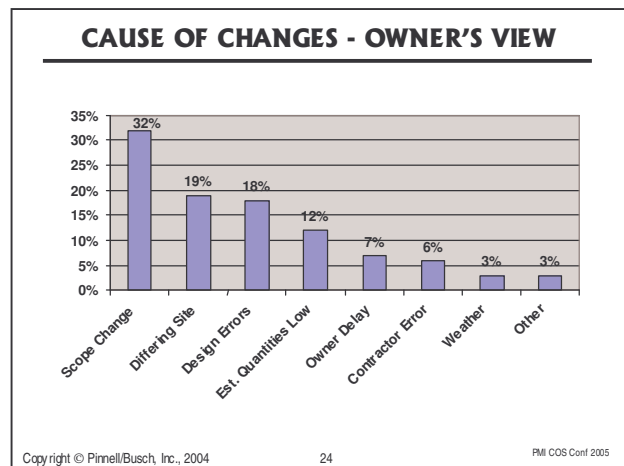
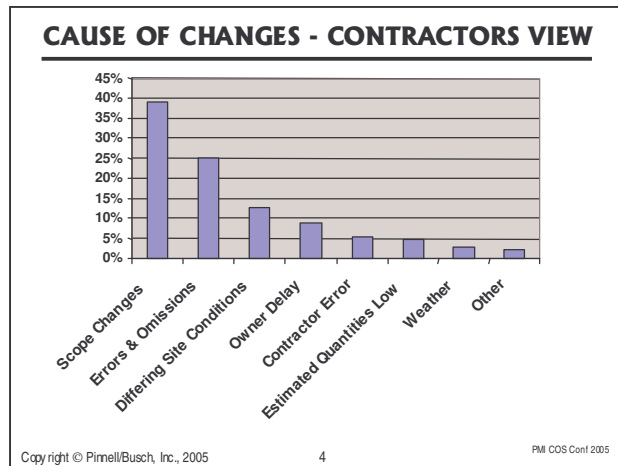
Changes as a percentage of annual volume varied from one *type* of organization to another, and even more from one *individual* organization to another. This means that substantial improvements can be made.

Changes for contractors averaged 10% of annual volume, but varied by type of contractor (8% for building contractors, 10% for heavy/highway contractors, 12% for subcontractors, and up to 20% for very large EPC, CM/GC, and Environmental Restoration contractors). The range for individual contractors showed more variation, from a low of 1% to a high of 100%. Project owners reported average changes of 10%, with public agencies averaging 9% and private owners averaging 11%. Individual owners reported a range from 2% to 100% changes, with 40% of the owners averaging 5% or less, and 18% of all owners averaging 15% or more changes. Two owners reported 50% or more.

The variation between the different *types* of organizations indicates either (or both) a difference of working conditions or a difference in procedures and standards. The extreme variation between *individual* organizations, and especially individual owners, indicates that some organizations do a much better job of controlling change and that others could also. The variations are presumably due to different practices. Identification of the practices by the more successful owners and correlation between those practices and fewer changes will aid in documenting best practices that others can use.

Cause of Changes

The primary cause of changes, as reported by both contractors and owners was Scope Change.



The next most frequent causes were design errors and differing site conditions. It is obvious that owners have control over almost all causes of change, including design error due to their selection, payment, and supervision of the designer. By improving practices, they could significantly reduce changes.

BEST PRACTICES TO REDUCE CHANGES

1. Scope Change
 - * Better scope definition (programming and predesign)
 - * Cost and scope management during design
 - * User groups/operations & maintenance in design reviews
2. Design Errors
 - * Select best qualified designer with project management skills
 - * Don't over-emphasize design fees – pay more, get more
 - * Evaluate performance and use for future selection
 - * Constructability reviews and value engineering
3. Differing Site Conditions
 - * Better as-builts of new projects
 - * Risk analysis of site investigation cost vs. benefits
4. Owner Delays
 - * "If you want it bad, you'll get it bad"

Copyright © Pinnell/Busch, Inc., 2005

5

PMI COS Conf 2005

Reducing Changes

Project owners have most of the responsibility for reducing changes, which includes selecting designers with good project management skills and quality control procedures. The low rate of changes by some individual owners is evidence that improvements can be made through better practices.

Contractors on a project can help mitigate the impact of changes by implementing pre-job planning and constructability reviews, better scheduling, weekly labor productivity reports to promptly identify labor inefficiencies, and timely notice of changes.

For owners, there was a correlation between the percentage of changes on a project and the percentage of those changes that became claims. The same correlation was not found for contractors. The reason for this difference was not identified in the survey.

SURVEY RESULT: BEST PRACTICES TO KEEP CHANGES FROM BECOMING CLAIMS

1. People skills, culture, attitude, trust, reasonable expectations
2. Prompt and fair negotiation and payment for change orders
3. Fair and effective contract administration
4. Timely notice of change and submission of change order price
5. Clear communication to avoid misunderstanding
6. Owner/design team understanding cost of delay and disruption
7. Willingness to accept responsibility for error
8. Timely responses to RFIs and questions
9. Win/win negotiation, instead of win/lose
10. Avoid unfair contract terms and conditions
11. Partnering and teambuilding

Based on a weighted value of 49 responses, evenly divided between contractors and project owners

Copyright © Pinnell/Busch, Inc., 2005

7

PMI COS Conf 2005

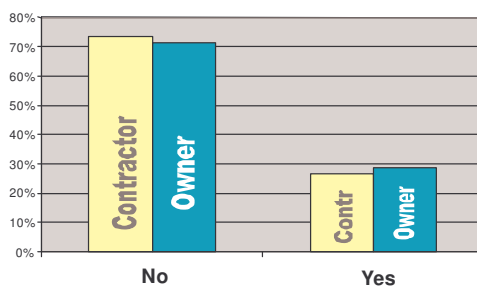
Claims

The percentage of changes that become claims varies widely – from zero to 50%, with an average of 6% to 7%. The wide variance in claims for the same type of work among individual contractors and owners means that improvements can be made.

To reduce claims, we recommend these practices:

- * Fair contracts that distribute risk appropriately
- * Better project management by everyone.
- * Partnering, teambuilding, and win/win negotiation
- * Timely response to RFIs and change proposals.
- * Prompt, fair payment for changes
- * Education and training by contractors and owners
- * Adequate staffing and attention to detail by all

WAS PARTNERING USED ON PROJECTS WITH CLAIMS?



Copyright © Pinnell/Busch, Inc., 2004

11

PMI COS Conf 2005

Partnering

Partnering, although spurned by some, is still the best means for team building and maintaining relationships. Good relationships are vital to settling changes without resorting to claims.

Settlement

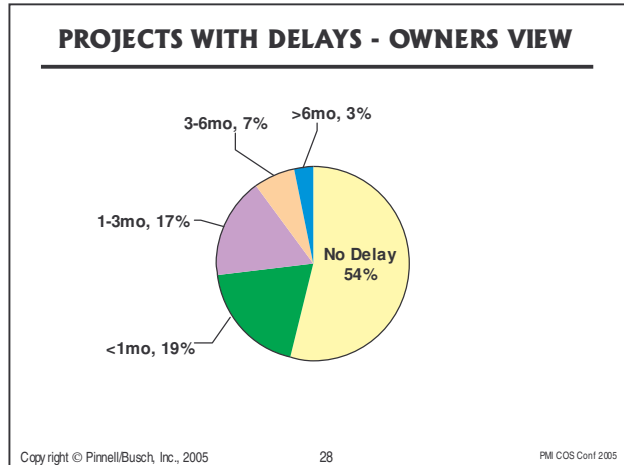
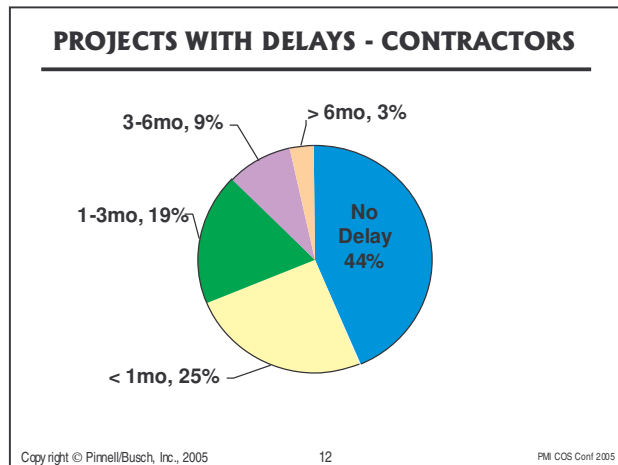
When changes become claims the vast majority (85%) are still negotiated, with the balance being settled equally by mediation, arbitration, or litigation.

The success rate of mediation is over 90%. We strongly recommend mediation over arbitration or litigation as mediation is far easier, faster, and less expensive. In addition, the parties maintain control as they ultimately decide whether to settle, and

business relationships can be preserved. The only risks are: (1) not being prepared when the other side is and (2) forgetting the the mediator's goal is to settle, not to find truth and justice for you.

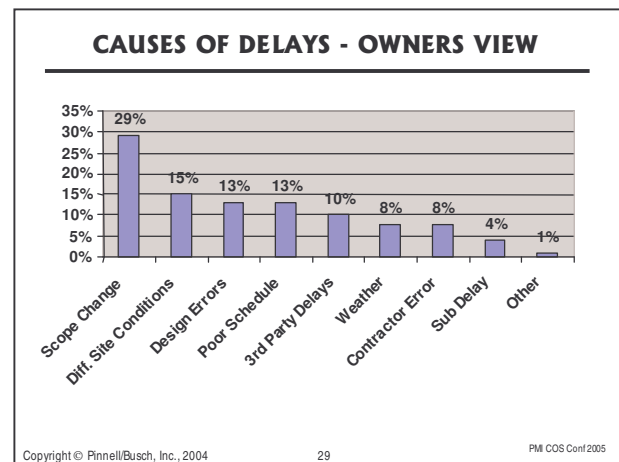
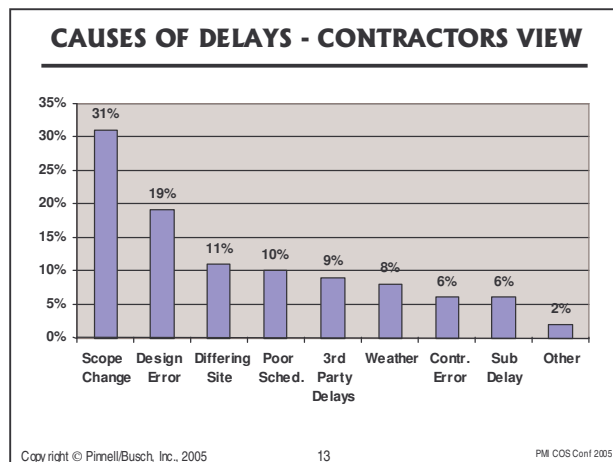
ReAlignment, formerly called Intervention Partnering, is a new technique for salvaging troubled projects that are headed for disaster. It "wipes" the slate clean with a change order for all delays and claims to date and turns around a problem project in 30 to 45 days using a small of experts and in-house staff.

Delay – Causes and How to Avoid



Approximately half of all projects are delayed, and over 10% are delayed more than 3 months. This shows a lack of discipline in the industry, since many contractors and project owners finished on time. For example, one-quarter of building contractors finished 95% of their projects on time while nearly half were one month late on more on 30% of their projects and 3 months late on over 10% of their projects. Owners had similar results, with nearly 1/3 of municipal owners finishing on time but 1/4 experiencing frequent and/or severe delays.

Smaller owners appear to have more delays than large owners and private owners had more frequent and more severe delays than public owners. Nevertheless, most owners (and contractors) could substantially reduce delays, as evidenced by those that have few delays.



The top three causes of delay are the same as for change: scope change, design error, and differing site conditions. That and third party delays (utility relocations), which are generally under the control of project owners for a total of two-thirds of all delays. Contractors are responsible for one-quarter of delays.

The recommended best practices to reduce delays are the same as to reduce changes, plus:

- * Training contractor, designer, owner representative, and owner personnel in critical path scheduling.
- * Using better scheduling specifications.
- * Enforcing the scheduling specifications
- * Contractors: Using better scheduling procedures
- * Owners Representatives using better schedule review, tracking, and time extension procedures.
- * Contractors and owners taking more pro-active measures to reduce delays and regain lost time.

There was a correlation between contractors using an in-house scheduler and more delays and between having the project team prepare the schedule and fewer delays. The recommended procedure is for the project team to prepare the schedule with support (especially on software features) from the home office.

OWNER SCHEDULING SPECIFICATIONS

Owners' View of their Scheduling Specifications	Yes	No
Satisfied with your scheduling specification?	61%	39%
CPM required for projects over \$5 million?	83%	17%
Do your specs require monthly updates?	93%	7%
Do your specs require narrative reports?	53%	47%
Do your specs require electronic schedules?	57%	43%
Do your specs require impact analysis if delay?	40%	60%

Copyright © Pinnell/Busch, Inc., 2005

30

PMI COS Conf 2005

OWNER EVALUATION OF CONTRACTOR SCHEDULING PRACTICES

Owner Evaluation of Contractor Scheduling Practices	Yes	No
Do your contractors submit monthly updates?	69%	31%
Do you carefully review their schedule updates?	86%	14%
If delayed, do they submit recovery schedule?	59%	41%
Do your contractors generally finish on time?	72%	28%

Owner's View of Contractor Scheduling Skills	Good	Fair	Poor
What is the quality of contractors' schedules?	35%	32%	32%

Copyright © Pinnell/Busch, Inc., 2005

32

PMI COS Conf 2005

Owners' Scheduling Specifications and Enforcement

Most owners were satisfied with their scheduling specifications, but only half required narrative reports, which are often essential to understanding the schedule logic, tracking progress, and identifying pending delays. Only half of the owners required electronic schedules, which are needed for independent progress tracking or delay analysis. Even fewer required contemporaneous time impact analyses to justify time extensions.

Quality of Contractors' Scheduling

Owners reported that only 69% of their contractors submitted monthly updates, even though 83% said they were required by the specification. They also reported that 72% of their contractors generally finished on time, even though they separately reported that only 54% of their projects finished on time. As noted below, contractors had a far more pessimistic view of their own practices. Worst of all, owners reported that only one-third of contractors were good schedulers, one-third were fair, and one-third poor.

CONTRACTOR SCHEDULING PRACTICES

Contractors View of Their Scheduling Practices	Always	Usually	Sometimes	Seldom
Do you request subcontractor input?	52%	32%	16%	0
Do you prepare monthly updates?	42%	47%	8%	3%
Do you submit narrative reports?	55%	0	0	45%
Do you prepare time impact analysis?	16%	32%	36%	16%

Contractors' Opinion of Scheduling Quality	Yes	No
Are you satisfied with your scheduling procedures and results?	75%	25%

Copyright © Pinnell/Busch, Inc., 2005

17

PMI COS Conf 2005

SUBCONTRACTOR OPINION OF CONTRACTOR SCHEDULING PRACTICES

Subcontractor Opinion of Contractor Scheduling Practices	Always	Usually	Sometimes	Seldom
Do they request subcontractor input?	5%	19%	62%	14%
Do they prepare monthly updates?	0%	33%	62%	5%
Do they keep subs informed?	0%	19%	43%	38%
Do they submit recovery schedules?	0%	19%	33%	48%
Do they hide delay and then accelerate the subcontractors?	10%	62%	19%	10%

Subcontractor Opinion of Quality of General Contractors' Scheduling	Good	Fair	Poor
What is the quality of contractors' schedules?	36%	28%	36%

Copyright © Pinnell/Busch, Inc., 2005

18

PMI COS Conf 2005

A major disconnect is evident between many contractors' view of their scheduling quality and the scheduling practices and results reported. Although three-quarters were satisfied with their scheduling quality, only half usually required subcontractor input or prepared monthly updates. Of 25 building contractors, 8 experienced severe delays with over 10% of their projects over three months late, 10 experienced frequent delays with 30% of their projects finishing over one month late, yet all but 3 were satisfied with their scheduling. Heavy/highway contractors reported similar problems.

Subcontractors had a far dimmer view of general contractors' scheduling practices. Their overall evaluation closely matched the owners. They reported that less than 25% of contractors always or usually requested sub-contractor input (which is vital for reliable scheduling), prepared monthly updates (needed to timely identify delays), keep subcontractors informed (required to ensure teamwork), or prepared recovery schedules when delayed. Worst of all, the majority of general contractors hide delays and caused trade stacking.

OWNER REPRESENTATIVE SKILLS AND PRACTICES – CONTRACTORS VIEW

Contractor Opinion of Owner Representatives Skills and Practices	Always	Usually	Sometimes	Seldom
Are they well trained in scheduling?	0%	19%	53%	28%
Do they meet to review schedule?	11%	38%	42%	9%
Do they enforce scheduling specs?	2%	33%	40%	25%
Do they keep detailed records?	4%	18%	54%	24%
Do they respond timely to RFIs?	2%	37%	52%	10%

Copyright © Pinnell/Busch, Inc., 2005

19

PMI COS Conf 2005

OWNER REPRESENTATIVE SKILLS AND PRACTICES - OWNERS VIEW

Owner View of Their Owner Representatives' Scheduling Skills and Practices	Yes	No
Are owners representatives trained in scheduling?	44%	56%
Do they meet with contractor to review the schedule?	78%	22%
Do they fully enforce the scheduling specifications?	38%	62%
Do they keep detailed records of progress and delays?	67%	33%

Owner View of Their Owner Representatives' Response Time	Always	Usually	Sometimes	Seldom
Timely response to RFIs and COs?	19%	78%	3%	0%

Copyright © Pinnell/Busch, Inc., 2005

37

PMI COS Conf 2005

Owner Representatives' (Construction Managers') Scheduling Skills and Practices

A disconnect also exists between the owners' view of their owners representatives' skills and practices and the contractors' view. This included training in scheduling, meeting with the contractor to review schedule submittals, enforcing the scheduling specifications, and keeping detailed records.

The most serious shortcoming was owners representatives not responding timely and reasonably to RFIs and change order proposals. Most owners felt that they usually did. Contractors reported that only one-third did. As noted, untimely response correlates to more claims and fewer claims settled in negotiation.

CORRELATION BETWEEN SCHEDULE PREPARER AND DELAYS

- 71% of on-time building contractors – project team
- Plus 1 bldg. contractor – project team and office staff
- Plus 1 contractor – project team and consultants
- 80% of late building contractors – office staff
- Both on-time heavy/hwy – project team/consultants
- All 5 fair heavy/hwy contractors – project team
- Both late heavy/hwy contractors – office staff

Copyright © Pinnell/Busch, Inc., 2005

16

PMI COS Conf 2005

CORRELATION BETWEEN TIMELY RESPONSE AND FEWER CLAIMS

Timely owner representatives' response corresponds with fewer claims and more settled by negotiation.

- Average changes that become claims = 7%
- Average claims settled by negotiation = 82%

SURVEY RESULTS:

<u>Timely Response</u>	<u>Resulting Claims and Settlement</u>
Always (1 of 1)	5% changes to claims and 100% negotiation/mediation
Usually (6 of 7)	0-1% changes to claims
Seldom (5 of 5)	10-33% changes to claims and 15-50% claims to arbitration/litigation

Copyright © Pinnell/Busch, Inc., 2005

20

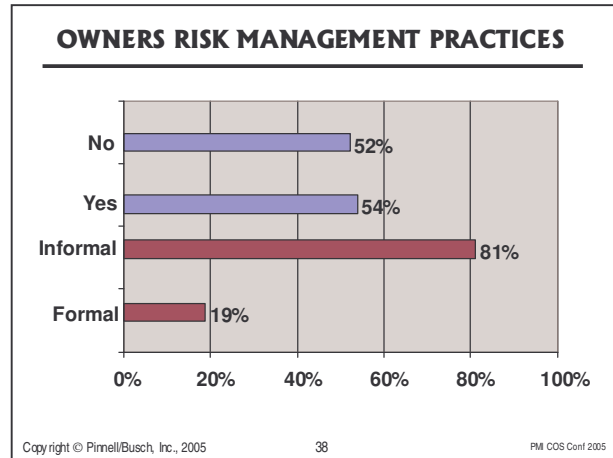
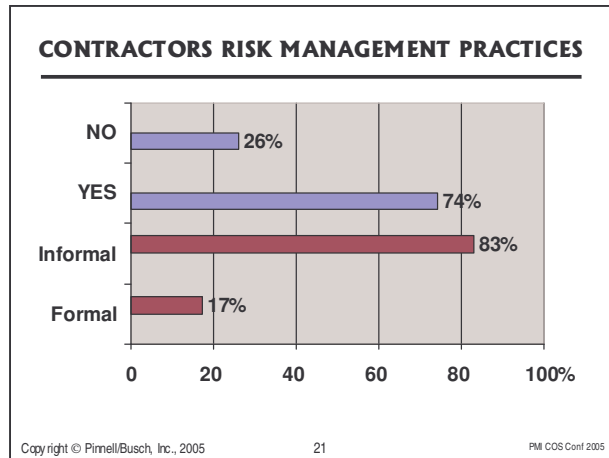
PMI COS Conf 2005

Correlation Between Practices and Results

The survey goals were not only to identify current practices and results, but to link practices to results and to develop 'best practices'. The sample size was too small for statistical analysis with too many variables, so we used a 'high-low correlation' to determine the linkage. If a practice resulted in favorable results (high end correlation) and absence of the practice resulted in poor results (low end), there was a correlation.

The correlations identified in the survey are as follows, most of which are confirmed to our experience:

1. Small subcontractors (<10M) have half the percentage of changes as large subcontracts (\$50M+).
2. Three-quarters of the projects with claims were not partnered vs. one-quarter that were.
3. Contractors with a home office scheduler had more delays than those using the project team.
4. Timely, reasonable owner representative responses led in fewer claims with more settled by negotiation.
5. For owners, high percentage of changes corresponded to more changes becoming claims.
6. Owners' opinion of poor contractor scheduling correlated with more delays.
7. Better owner representative scheduling skills and practices result in fewer delays and vice versa.



Risk Assessment

Although three-quarters of the contractors and owners reported using risk analysis on their larger projects, only 18% used formal risk analysis, with the majority preferring Quantitative Risk Analysis. One contractor practicing informal risk analysis noted: *"The major risk analysis factor is the agency we would work for and our experience with that agency in terms of fair dealing."*

There is a clear need for education in the benefits of risk analysis and training in its use.

- ### CONTRACTORS RECC'D BEST PRACTICES
1. Better design with fewer errors and omissions
 2. Constructability reviews and other contractor input
 3. Different contracts than low bid (e.g. CM, design/build, etc.)
 4. Partnering, timely payment, better communication, etc.
 5. Detailed site investigations and better as-builts for remodels
 6. Stricter prequalification of contractors on low bid contracts
 7. Better scheduling by general contractors
 8. Better owners representatives (construction managers)
 9. Better schedule input and fewer delays by subcontractors
 10. Better general conditions that distribute risk fairly to all parties
 11. Schedule training for construction managers and/or contractors
 12. Better scheduling specifications
 13. Dispute review boards (DRBs) on larger projects
 14. Stricter enforcement of scheduling specifications
 15. Better general conditions that protect the owner from claims
- Copyright © Pinnell/Busch, Inc., 2005 22 PMI COS Conf 2005

- ### OWNERS RECC'D BEST PRACTICES
1. Better design with fewer errors and omissions
 2. Constructability reviews and other contractor input
 3. More detailed site investigations and better as-builts
 4. Different contracts than low bid (e.g. CM, design/build, etc.)
 5. Better scheduling by general contractors
 6. Partnering, timely payment, better communication, etc.
 7. Better owners representatives (construction managers)
 8. Stricter prequalification of contractors on low bid contracts
 9. Stricter enforcement of scheduling specifications
 10. Better schedule input and fewer delays by subcontractors
 11. Better scheduling specifications
 12. Better general conditions that distribute risk fairly to all parties
 13. Schedule training for construction managers and/or contractors
 14. Better recordkeeping and contract administration
 15. Better general conditions that protect the owner from claims
 16. Dispute review boards (DRBs) on larger projects
- Copyright © Pinnell/Busch, Inc., 2005 39 PMI COS Conf 2005

Best Practices

There was strong agreement on the most recommended best practices: better design and constructability reviews with more contractor input. The next four recommendations were: better site investigations, different contracts than low bid, partnering, better contractor scheduling, and stricter contractor prequalification.

Our supplemental recommendations are:

- * Better scope definition prior to design, with user group input, and cost and scope management.
- * Selecting designers with good project management skills and quality control procedures.
- * Less emphasis on design fees and evaluation of past performance when selecting designers.
- * Better as-builts and site investigations.
- * Risk analysis of all project phases
- * Partnering on all projects – including informal partnering on projects under \$5 million.
- * Increased project staffing when multiple, continuing problems occur to avoid further delay.
- * Education and training of owner and contractor staff in contract law and scheduling
- * More use of mediation and win/win negotiation, plus Project ReAlignment on troubled projects.
- * Timely submittals, issuance of subcontracts and purchase orders, and RFI responses.
- * More detailed recordkeeping by both sides and prompt notice of change by contractors