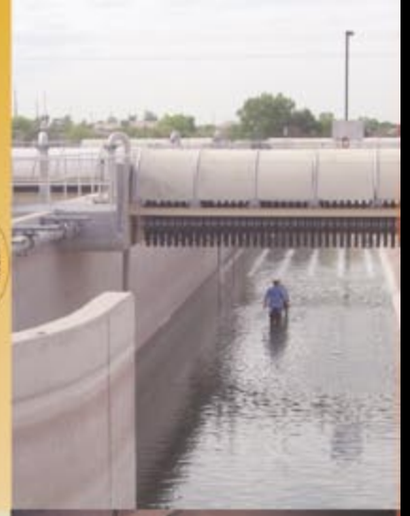
Arizona Benchmarking Study



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VANIR

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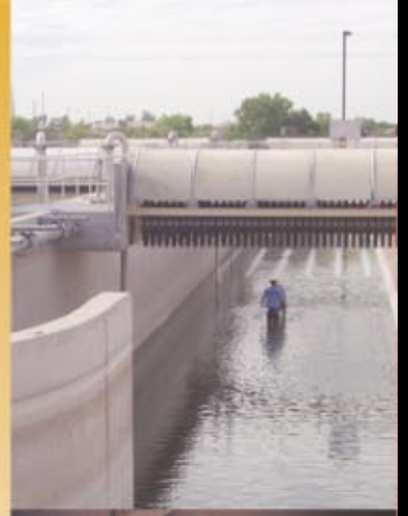

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CHAPTER 1

Executive Summary

A. INTRODUCTION

The Arizona Benchmarking Study began in July 2005 with four participating agencies: the cities of Tucson and Phoenix and the counties of Maricopa and Pima. The agencies all faced unique challenges in an intensely growing population leading to increased demand for public works infrastructure projects. The costs of public works projects were escalating. Projects were becoming more complex; and community involvement, as well as the requirements for environmental permitting compliance, was increasing. These factors led the agencies to form a Project Team with the admirable goal of determining the cost of project delivery within their Agencies/Departments and to identify ways of improving project delivery and controlling "soft" costs.

The Arizona Benchmarking Study is based on a model successfully applied in the State of California where seven of the state's largest cities joined together to find better ways to deliver public works projects.

This 2007 Arizona Benchmarking Study includes project data contributed by seven Agencies/Departments: Pinal County, Maricopa County, Maricopa County Community College District (MCCCD), Pima County, City of Phoenix, City of Tucson, and joining the study in 2006, the City of Mesa. The Study includes four elements:

- **Performance Benchmarking** – Collecting historical and current cost data on project delivery performance for comparison and budgeting on future projects and programs.
- **Process Benchmarking** – Identifying processes and procedures currently used in project delivery. Identifying new and improved Best Management Practices (BMPs), would lead to improved, more cost effective project delivery.
- **Best Management Practice Implementation and Tracking** – Agencies target BMPs for implementation within their agencies/departments and then track the use of those BMPs from the start of implementation to the point at which the BMPs are fully practiced on all applicable projects.
- **Online Forum** – Enables agencies to share the challenges and successes on the current challenges affecting public works project delivery in Arizona.

This is the third year of the Study. Since the beginning, the Project Team has systematically and methodically collected cost data for all aspects of planning, design, quality control, construction management, and the actual construction. As the size of the database has increased, more accurate analysis of the relationship between construction costs and total project delivery costs has been possible.

The Project Team has also identified and monitored the practices and procedures used by each agency or department to deliver their capital projects. New procedures have been proposed, considered, evaluated, and the most successful have been translated into Best Management Practices (BMPs). Process Benchmarking tracks the challenges each agency faces in implementing new practices into their organizations and, ultimately will

measure the impact of the implementation on project delivery costs.

The development of the online forum enables the agencies and departments to candidly discuss questions, problems, and solutions related to effective project delivery.

The most significant goal of this study remains to quantify the actual, measurable improvements in project delivery performance resulting from the agencies' implementation of BMPs. It is anticipated that the improvements will be in the form of project delivery cost reductions, time savings, and improved project quality, yet this goal is years distant because of the time it takes for changes for procedures to be implemented and result measurable impacts. This study, however, has given rise to a "culture of improvement" within the participating agencies.

The focus of the 2007 Study was to continue the collection of data to determine what the participating agencies were spending to deliver public works projects so that it could be compared to past project delivery performance. The team also continued to identify and implement Best Management Practices that improve project delivery performance and reduce project delivery costs. In addition, the 2007 Study includes audits of data and new perspectives on the results.

The objectives for this year were to:

- **Gather actual cost data on project delivery performance and audit data previously collected for accuracy.**
- **Update information on project delivery processes and procedures currently used.**
- **Update and track the implementation of targeted Best Management Practices.**
- **Identify new Best Management Practices related to utility relocations, right-of-way procurement, permits, environmental compliance and Project Manager training.**
- **Expand the database populated with historical project delivery cost data that could be used for comparative performance analysis and for budgeting purposes, to predict soft costs on similar projects.**
- **Expand the use of the online forum to create an informal method of asking questions, receiving suggestions, and sharing information.**

TRADITIONAL PROJECT DELIVERY – BEST MANAGEMENT PRACTICES (BMP)

Within the context of this Study, Best Management Practices are defined as procedures that are expected to make project delivery more efficient and effective. As part of the 2006 Study, the agencies were asked in a survey to either confirm the use of or to target the implementation of 36 Best Management Practices. As part of the 2007 Study, the agencies reported on the status of implementation of the Best Management Practices they had each targeted. The status of implementation is included in Chapter 3 and Table 3.1.

CM@RISK PROJECT DELIVERY – BEST MANAGEMENT PRACTICES (BMP)

A Best Management Practice survey was also developed to assess the use of procedures used in the delivery of projects using the CM@Risk delivery method. The City of Phoenix has an extensive resume of over 140 successful projects using this method and contributed many of the practices included in the survey. They also developed templates, flow charts, sample RFPs/RFQs and contracts related to this method of project delivery, which were made available to the Project Team.

The BMP CM@Risk Survey is included in this 2007 Study. The status of implementation of the CM@Risk BMPs is included in Appendix B, Table 3.2.

B. STUDY METHODOLOGY

It is the intent of the Study Team to improve the database by adding projects, and project delivery cost data, each year. In 2006, the Study Team collected data on additional project types and classifications, data on CM@Risk projects, and developed improved performance questionnaires to reduce errors in data entry.

The 2007 Study methodology included the following steps:

1. The traditionally delivered project data performance questionnaire was revised to make it more user-friendly for data entry by the Agencies/Departments. Data on 304 traditionally (design-bid-build) delivered projects with a construction value of over $1.1 Billion are included in the 2007 Study. A total of five project types (Flood Control, Municipal Facilities, Parks, Pipes and Plants, and Streets) and 16 classifications have been used in developing the regression graphs for the study. These graphs depict the design, construction management, and total project delivery costs as a percentage of total construction cost.
2. Data on change orders was collected and analyzed as a percentage of Total Construction Cost. While at this time there is insufficient data to draw reliable conclusions, as the database grows, it is anticipated that predictive tools will become available.
3. Data was collected and analyses performed on 50 CM@Risk projects with a construction value totaling $285 million in five project types and seven classifications. Based on this data, regression curves were developed of the total project delivery cost as a percentage of construction cost versus the total construction cost. An additional graph was developed depicting the "Total paid to Contractor" versus "Guaranteed Maximum Price (GMP)." These curves shows the growth percentage of the amount paid to the Contractor above the original agreed upon amount (GMP).
4. The study continued to be driven by and for the participating agencies/departments. All decisions are made by the Team and the direction of the Benchmarking Study is molded by the Team.

C. PROCESS BENCHMARKING

It is the goal of this continuing study to develop hard data that documents the impact of an Agency's/Department's implementation of Best Management Practices on its project delivery process. Participating Agencies/Departments continued to target BMPs they felt would result in an improved project delivery process for their Agency/Department.

The implementation of these targeted practices was tracked and the project delivery performance data was collected. The Agencies/Departments continued to make organizational and procedural changes based on the recommended Best Management Practices.
For example:

- Pima County implemented practices to clearly define the project scope early in the planning and design stage, and will also conduct post project reviews.
- Maricopa County Department of Transportation is increasing its training for project managers.
- The City of Phoenix's Water Services Department is adopting procedures to enhance the department's early planning and design phases. They have committed to performing feasibility studies to define scope and budget, and requiring that specifications for reliability, maintenance, and operations be defined prior to design initiation.

D. PERFORMANCE BENCHMARKING

Performance Benchmarking consists of collecting documented project delivery and construction costs, and then determining the relationship between actual project delivery costs and actual total construction costs. Considerable data has been gathered on projects delivered using the Design-Bid-Build, Traditional, project delivery method. In 2007, the Study Team also gathered additional data on projects that were delivered using the CM@Risk Project delivery method using improved performance data questionnaires.

1. The 2007 analyses of the Traditional Project data showed the following:

- The percentage of design costs averaged 17.8% of the total construction cost of 304 representative projects that were completed after 1999. Each had a total construction cost greater than $100,000.
- The Construction Management averaged 14.3% of the total construction cost of the 304 representative projects.
- Based on the performance data, the Total Project Delivery cost (sum of design cost and construction management cost) of the 304 projects averaged 32.1% of the total construction cost.

2. The database includes only 50 projects delivered using the CM@Risk method at this time. Analyses of the data on these projects was limited because of the size of the database. The Project Team will continue to contribute data and grow this portion of the study so that credible analyses can be performed in future reports.

E. CONCLUSIONS AND RECOMMENDATIONS

1. Continuous data collection is warranted. Where additional data was provided, some of the statistical

correlations improved significantly. In future benchmarking studies, more data should improve the correlation coefficients and make performance models more effective for analysis and prediction. This is especially true of the CM@Risk projects. More data will improve the credibility of the database.

2. By implementing Best Management Practices, the Agencies/Departments will improve their processes resulting in improvement of project delivery performance. The Team will track the Agency/Department's progress of implementing the BMPs and compare performance results to determine the actual effectiveness of implementing best practices.

3. The Online Forum is being used more to facilitate communication, promote the free exchange of ideas, and establish a collaborative atmosphere with the other Team members. By making the Online Forum available on the Pima County web site, it will be readily available to Team members and others interested in improving the project delivery process.

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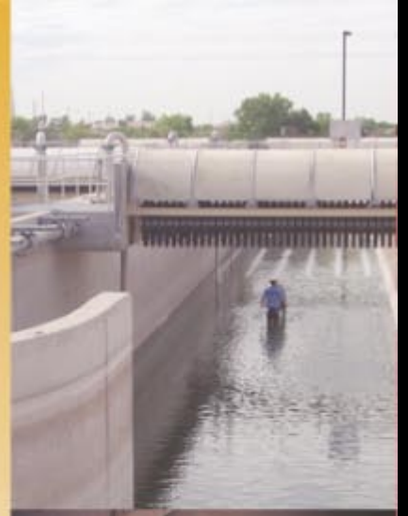

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CHAPTER 2

INTRODUCTION, OBJECTIVES AND METHODOLOGY

A. BENCHMARKING STUDY BACKGROUND

Pima County's Public Works Policy Group initiated this Benchmarking Study in the Spring of 2005, based on a similar effort by the City of Los Angeles and six of the largest cities in California (California Multi-Agency CIP Benchmarking Study 2002-2005). Both studies collected and analyzed project delivery costs as a percentage of construction costs. They also identified Best Management Practices which if implemented, would improve and reduce the cost of project delivery.

In 2006, the range of the Arizona Study changed to include not only Traditional, Design-Bid-Build projects, but also projects delivered under the alternative delivery method, CM@Risk.

Alternative delivery methods such as CM@Risk, Design/Build and Job Order Contracting (JOC) have been extensively used in the Arizona since 2001, when a change was made in Arizona laws that allowed the use of these methods. There was a strong interest among the Arizona participants to identify the costs and benefits of the CM@Risk delivery process. It became a goal of the 2006 Study to expand the existing database in order to accurately assess the benefits of this process.

During the 2007 Benchmarking Study period, the Team continued to expanded its efforts on:

1. Tracking, evaluating, and auditing the Agency's/Department's implementation of the 36 Traditional Best Management Practices and 33 CM@Risk Best Management Practices.
2. Collecting and evaluating data provided on projects delivered using the Traditional method and submitted by the Agencies/Departments in 2007. During this period the total number of projects increased from 274 in 2006 to 304 projects.
3. Collecting and evaluating the data provided on the projects delivered using the CM@Risk method and submitted by the agencies in 2007. During this period, the total number of projects increased to 50 projects (from the 24 projects submitted in 2006). Because of the smaller number of projects, evaluation of the data is more difficult and less statistically significant. As the size of the database increases, analysis of the CM@Risk data will be more useful to the agencies.
4. Expanding the database to allow for improved aggregation and analysis.

B. 2007 BENCHMARKING STUDY OBJECTIVES

In 2007, the Team built upon the experience and lessons learned from the 2005 and 2006 Studies. The Team is becoming a more cohesive unit whose members eagerly share information and helps each other find solutions to shared problems and develop better practices and processes related to project delivery. In

2007, the Team made considerable progress on continuing the 2006 Study objectives and initiating additional objectives for the 2007 Study. These objectives fall into two categories: process benchmarking and performance benchmarking.

PROCESS BENCHMARKING

- Update information on project delivery practices, processes and procedures currently used.
- Update and track the implementation of targeted Best Management Practices.
- Identify new Best Management Practices related to utility relocations, right-of-way procurement, permits, environmental compliance and Project Manager training.
- Expand the use of the online forum to create an informal method of asking questions, receiving suggestions, and sharing information.

PERFORMANCE BENCHMARKING

- Expand the database with historical project delivery cost data that could be used for comparative performance analysis and for budgeting purposes, to predict soft costs on similar projects.
- Gather actual cost data on project delivery performance and audit previously collected data for accuracy.

C. BENCHMARKING REPORT STRUCTURE

This report is organized as follows:

1. Chapter 2 provides a short discussion on the project history, objectives, study methodology, and benefits of participation by the participating agencies.
2. Chapter 3 describes process benchmarking and the implementation of Best Management Practices for improving project delivery performance.
3. Chapter 4 describes performance benchmarking and discusses the graphs generated from the project database for comparing project delivery costs with total construction costs.
4. Chapter 5 discusses the Online Forum, its use and method of archiving and retrieving information.
5. Chapter 6 contains the conclusion and recommendations based on the results of this year's study.

D. STUDY METHODOLOGY

1. From the initial conception of this Study, it was understood that the study would be molded and driven by and for the participating Agencies/Departments with the goal of improving their project delivery performance. Ideas are shared with the California Multi-Agency CIP Benchmarking Study Team and other information sources, but the goals and objectives of this study are focused on the needs of the participating Arizona Agencies/Departments.
2. The study team made an effort to develop data collection forms and surveys that are easy for the Agencies/Departments to complete and from which the data can be efficiently aggregated for analysis.
3. The Benchmarking data that has been collected, discussed, sorted and used is either process oriented or performance oriented. Since improvement in

processes precedes improvement in performance, most of the initial work is process oriented. All of the data collected is shared with and reviewed by the Team to ensure the end product will offer value to the participating Agencies/Departments.

E. BENEFITS OF PARTICIPATION

City of Phoenix

"This Benchmarking Study has been beneficial in comparing costs with other public owners and verifying that our soft costs are comparable to others. The time spent discussing delivery methods, costs, and best practices has afforded us opportunities to network and share successes as well as "near successes" in a forum where we can learn from everyone's experiences. We believe this study has and will provide valuable data and information that can be utilized in evaluating the efficiencies of our delivery methods and the effectiveness of our project delivery performance."

Maricopa County Parks

"As a result of participating in the Arizona Benchmarking Study, Maricopa County Parks & Recreation Department has benefited from the networking opportunities and sharing of data, especially the escalation rates, which we apply to our 10 Year Capital Improvement Plan. The online exchange of information is also useful.'

Pima County

- Provides a forum for local governments to exchange and discuss best practices and solutions to public sector capital development issues.
- Provides a means to measure and evaluate project delivery process and costs.
- Provides a means to implement and measure best management practices.
- Creates an opportunity to share information on emerging best practices.
- Exchange information on market conditions, material and labor costs, bidding climate.
- Provides a database of delivery cost data to assist with budget development of future capital projects.
- The relationships developed from this effort have proven invaluable. The group is focused on helping each other with ideas and data; both of which have been useful in advancing our process improvement efforts within our organization.

Maricopa County Department of Transportation

"Besides meeting some very nice people, it has provided two major benefits. It allows us to share information via the On-Line Forum and provides performance benchmarking information which provides a basis for process change so we can improve our delivery of projects and services."

F. PARTICIPATING AGENCIES

Pima County continues to facilitate the efforts of the Arizona Benchmarking Project Team and its consultants. The following agencies and departments contributed to the 2006 study:

1. Pima County
    - Wastewater Management Department (WMD)
    - Parks and Recreation
    - Department of Transportation (DOT)

- Flood Control District (FCD)
- Facilities Management

2. Pinal County - Public Works
3. Maricopa County
    - Department of Transportation (DOT)
    - Parks
    - Flood Control District (FCD)
4. Maricopa Community Colleges
5. City of Phoenix
    - Engineering-Architectural Services (EAS)
    - Street Transportation Department
    - Water Services Department (WSD)
6. City of Tucson
    - Parks and Recreation
    - Department of Transportation
    - General Services Department
7. City of Mesa

The 2006 Arizona Benchmarking Report contained a great deal of detailed information on the agencies participating in this study. It was decided not to repeat that information in the 2007 Arizona Benchmarking Report. Please refer to the 2006 report for detailed information on the participating Agencies/Departments.

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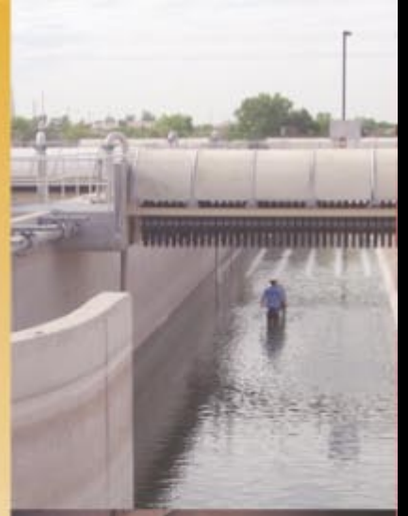

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CHAPTER 3

PROCESS BENCHMARKING

A. INTRODUCTION

The road to optimizing project delivery is challenging. It requires each Agency/Department to objectively review its own processes and the processes of other team members. This review identifies processes that provide a better and/or less costly way to deliver projects. We then designate the better and/or less costly way to deliver projects as "Best Management Practices" (BMP).

It is often difficult to integrate a BMP into the existing organizational structure or standard operating procedures. When Best Management Practices are integrated into the organizational structure, it is imperative that each Agency/Department audit itself to insure: 1) the Best Management Practice is really being followed; and 2)by following the Best Management Practice, the Agency/Department is accomplishing the goal of improving and/or reducing the cost of project delivery.

It is the goal of this continuing study to develop hard data that documents the impact of an Agency's/Department's implementation of Best Management Practices (BMP) on its project delivery performance. It is expected that implementing BMPs will result in improved project delivery performance.

During the first year of the study (2005), the Agencies/Departments were asked to respond to a BMP survey indicating the degree of implementation of the practices listed in the survey. This survey included BMPs related to project delivery on Design-Bid-Build projects. The results were tabulated and presented at the project team meetings throughout 2005 and were included in the final 2005 Benchmarking Report.

In 2006, Maricopa Community College District, Pinal County and the City of Mesa joined the study. During 2006, all Agencies/Departments were asked to respond to the revised BMP Survey, which included seven more BMPs, and to target or specify which BMPs they felt would be most beneficial for implementation in the coming year.

In 2006, a survey listing BMPs associated with CM@Risk delivery method was developed in conjunction with the City of Phoenix. Due to the City's extensive experience with this delivery process, they provided valuable input in the development of the survey. This survey was subsequently revised after a meeting with all the Agencies/Departments on October 5, 2006. Pima County, the City of Phoenix, Maricopa Community Colleges, and the City of Tucson were the only Agencies/Departments that submitted CM@Risk projects for both the 2006 and 2007 Study. The revised survey and the 2007 responses are included in Appendix B.

In 2007, all agency participants worked on implementing Best Management Practices and some of the Agencies/Departments targeted additional BMPs for implementation. The implementation of the targeted BMPs was tracked through self reporting surveys. The targeted BMPs for both 2006 and 2007 are identified in section C of this chapter. The responses to the BMP Surveys are included in Appendix B of this study report.

B. BEST MANAGEMENT PRACTICES FOR IMPROVED PERFORMANCE

The seven (7) Agencies/Departments are actively committed and share the objective of reducing capital project delivery costs. The Team is convinced that in order to improve performance, it is necessary to improve the practices, procedures and processes that impact the performance. Developing and implementing Best Management Practices is how the Team chose to improve their processes, resulting in improved performance.

As a result of this study, Pima County has started to clearly define projects prior to the start of design. It has also started to limit scope changes to early design, perform post project reviews, and involve the Construction Manager prior to completion of design. Additionally, Pima County is aggressively pursuing personnel and management changes to its Wastewater Management Department, and requiring that all departments target and implement Best Management Practices unique to the Department's mission.

Maricopa County DOT is requiring that all projects be shown on a Geographical Information System (GIS), to include a master schedule in the program plan, and to provide formal training for all project managers.

The City of Phoenix Water Services Department has implemented certain Best Management Practices, including:

- Complete feasibility studies are conducted on projects prior to defining scope and budget. Projects are well defined with respect to scope and budget, including obtaining tenant (or client) approval prior to the start of design.
- Designers are provided with clear, precise, scope, schedule and budget prior to design start.
- Value Engineering Studies are performed on all projects with a value greater than $1 million.
- A Formal Quality Management System is used to assure the quality of design documents and of construction.
- A consultant rating system is implemented that identifies the quality of each consultant's performance on previous projects.

C. TARGETED BEST MANAGEMENT PRACTICES

PIMA COUNTY

Pima County targeted four (4) Best Management Practices for implementation.

- No. 2, "Projects are well defined with respect to scope and budget, including obtaining tenant (or client) approval prior to the start of design." This target is to continue with the commitment to closely monitor the design, budget and project schedule. This is a goal to be implemented by the Water Management Department, Parks and Recreation, Department of Transportation, the Flood Control District, and Facilities Management Department.
- No. 10, "Scope changes are limited to the early stages in design." This target involves keeping with Pima County's mandate of requiring all departments to better control and manage the design process of its projects. This goal is to be implemented by all five

departments within the Public Works Division.

- No. 15, "Post-project reviews are performed and used to identify "lessons learned." Pima County understands that this is an important objective because post-project reviews can be beneficial to both the Department and the Agency in assessing what went right and what went wrong with a project. These reviews can provide fertile ground for project manager training sessions.

- No. 19, "The Construction Management Team is involved in the project before the completion of design." This practice is in concert with Pima County's attempt to integrate itself early in the design process. The County sees that the "construction" personnel have a lot to offer the team in the design phase in regards to constructability, suitability of construction materials and equipment, and scheduling of construction activities.

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION (MCDOT)

MDOT targeted three (3) Best Management Practices for implementation.

- No. 5, "Program planning includes a master schedule that includes start and finish dates for each project." MCDOT recognizes that a project master schedule is one of the most fundamental steps in its planning process.

- No. 6, "All projects are shown on a Geographical Information System."

- No. 24, "Formal training for project managers is provided on a regular basis". MCDOT managers have stated that they see project manager training as an important continuing goal.

These three (3) Best Management Practices are directly related to Maricopa County's stated goals improve its project delivery performance and enhance its training program for project managers.

CITY OF PHOENIX EAS

The City of Phoenix EAS Department targeted three (3) Best Management Practices to improve its planning and project management of projects in the construction phases.

- No. 6. "All projects are shown on a Geographical Information System.
- No. 24 "Formal training for project managers is provided on a regular basis.
- No. 25 "A standard Project Controls System is used on all projects.

These three (3) Best Management Practices are directly related to the City of Phoenix's stated goals to improve its overall project planning and management of projects during the construction phase.

CITY OF TUCSON

The City of Tucson targeted three (3) Best Management Practices in to improve its management of projects in the design and construction phases, and to ensure its selected contractors have the requisite project experience for successful project delivery.

- No. 11, "Approved scope changes are accompanied by budget and schedule modifications."
- No. 12, "A standardized Project Delivery Manual is used on all projects."

- No. 29, "A consultant rating system has been implemented that identifies the quality of each consultant's performance on previous projects."

In 2007, the City of Tucson's Department of Transportation targeted six (6) additional Best Management Practices for implementation.

- No. 1 "Complete feasibility studies are done on projects prior to defining scope and budget.
- No. 5 "Program planning includes design and construction resource loading."
- No. 13 "Value Engineering Studies are performed on all projects with a value greater than $1 million"
- No. 14 "A formal Quality Management System is used to assure the quality of the design documents and of construction"
- No. 32 "A Work Breakdown Structure (WBS) has been implemented to measure progress on project deliveries"
- No. 33 "Earned value" versus budgeted and actual expenditures monitored during project delivery"

These Best Management Practices indicate that the Department is actively concerned with trying to limit changes to the early stage of design, and ensure that critical clauses are included in its contracts, and that the department has a system for tracking cost and schedule on its projects.

Tables 3.1 and 3.2 in Appendix B list the targeted Best Management Practices for 2006 and 2007 by the participating Agencies/Departments and the results of the Surveys.

D. COMMON BEST MANAGEMENT PRACTICES

Determining Best Management Practices that are common to all of the Team Agencies/Departments is a difficult chore and leaves much room for debate of methodology and significance of the results. However, clearly some of the Best Management Practices are more important to most of the Agencies/Departments and/or they feel that they will make a greater impact on process improvement. The methodology used was to sum the scores (1 to 5) submitted by all of the Team members for each BMP and then sort the BMPs by total score from highest to lowest. The top eight (8) were chosen because for both 2006 and 2007 there was a natural break after the eighth BMP. We are assuming that the highest total score was the most important and/or highest priority to implement. See tables 3.3 and 3.5 in Appendix B for scores on these top eight (8) BMPs and all of the other BMPs.

STUDY YEAR 2006

1. No. 28 "Standard contracts for consulting services, with critical clauses (i.e. indemnification) are included in RFQ/RFPs."
2. No. 21 "Bid advertisements are available online."
3. No. 17 "A formal Dispute Resolution Process is included in all contracts."
4. No. 19 "The Construction Management team is involved in the project before the completion of design."
5. No. 31 "A financial system has been implemented that tracks expenditures by category, adequate

to monitor project hard and soft costs during project delivery."

6. No. 20 "A pre-qualification process is used on large, complex projects."
7. No. 36 "As-needed, rotating, or on call contracts are implemented for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects."
8. No. 3 "The Agency/Department has a prioritization system."

STUDY YEAR 2007

1. No. 36 "As-needed, rotating, or on call contracts are implemented for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects."
2. No. 21 "Bid advertisements are available online."
3. No. 17 "A formal Dispute Resolution Process is included in all contracts."
4. No. 31 "A financial system has been implemented that tracks expenditures by category, adequate to monitor project hard and soft costs during project delivery."
5. No. 28 "Standard contracts for consulting services, with critical clauses (i.e. indemnification) are included in RFQ/RFPs."
6. No. 11 "Approved scope changes are accompanied by budget and schedule modifications."
7. No. 19 "The Construction Management team is involved in the project before the completion of design."
8. No. 7 "Designers are provided with a clear, precise, scope, schedule, and budget prior to design start."

CONCLUSIONS AND SUMMARY

Six (6) of the eight (8) BMPs were in the top eight (8) for both 2006 and 2007. There are several conclusions that could be drawn from this tracking of the top BMPs and the other BMPs:

- Although the Agencies/Departments provide a wide variety of types of projects they share many of the same project delivery process issues.
- The Agencies/Departments entered this study at different levels of process development and standard practice levels; therefore, their focus and progress at implementing BMPs is at a different rate.
- Although there are common needs and goals among the Team members, each Agency/Department must tailor the identified Best Management Practices to their own needs, organizational structure, and goals.
- All of the Agencies/Departments are working hard to implement the Team's designated Best Management Practices.
- There is some consensus within the Team on which Best Management Practices can or should be implemented first.
- There is some consensus within the Team on which Best Management Practices can or should be a low priority for implementation. See table 3.3 in Appendix B.

E. CM@RISK PROJECTS BEST MANAGEMENT PRACTICES SURVEY FOR 2006

A CM@Risk BMP survey was developed with the help of the City of Phoenix. The City of Phoenix currently has the most experience and knowledge using this alternative delivery process.

After development of the survey, it was sent to the Agencies and it was found that four had constructed projects under the CM@Risk methodology. The preliminary results indicate that several of the Agencies questioned or commented on the meaning or intent of several of the Best Management Practices included in the survey.

Based on the comments received, it was decided to include a discussion on the survey content at the October 5, 2006 Benchmarking meeting with all the Agencies/Departments. The survey was revised to address the concerns expressed. The revised survey is included in Appendix A.

F. CM@RISK PROJECTS BEST MANAGEMENT PRACTICES SURVEY FOR 2007

The Project Team members now all have some familiarity with CM@Risk as an alternative method of project delivery as a result of this study. Some Agencies/Departments have chosen to use CM@Risk for projects that lend themselves to that project delivery method. As a result, it was possible to gather more data both on process (i.e. BMPs) and performance (i.e. project delivery costs vs. total construction costs) for analysis. The Team members who are using CM@Risk are in the process of implementing some of the Best Management Practices developed by the AZ Benchmarking Study Team. The following are the Best Management Practices for CM@Risk projects that the survey indicates are already implemented or are farthest along at being implemented.

No. 3 "One criteria for selection of the CM@Risk Contractor is selected based on the best fit of the Contractor to the size of the project."

No. 7 "Require that the A/E submits a fee proposal that includes all work to be performed".

No. 14 "Provide that the CM@Risk Contractor selects **major** subcontractors based on qualifications or a combination of qualifications and price."

No. 20 "The Contractor's GMP is evaluated for price and scope".

No. 21 "The Contractor's Contingency is identified and agreed-to by the Owner."

No. 22 "The Owner's Contingency is defined."

No. 32 "Proposed Change Orders to be funded by the Owner's Contingency are carefully evaluated for payment."

G. RECOMMENDED NEW BEST MANAGEMENT PRACTICES FOR "GREEN BUILDINGS"

Several project Team members recommended that some Best Management Practices related to sustainable building construction and energy reduction in accordance with the federal LEED program be added to the survey. The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ is the nationally accepted benchmark for the design, construction, and operation of

high performance green buildings. The following Best Management Practice was offered to address the LEED principles for sustainable buildings:

> **Sustainable design goals will be included in the initial project scope and performance outcomes measured at project completion. Operational measurements will follow annually.**

H. RECOMMENDED BEST MANAGEMENT PRACTICES FOR UTILITY RELOCATIONS

As a result of some Online Forum discussions, it became apparent that all of the Agencies/Departments were experiencing difficulties with project delivery because of utility relocation issues. The following Best Management Practice was offered to address Utility Relocation issues:

> **Additional effort will be expended during the design process to accurately locate existing utilizes and identify them on the contract documents.**

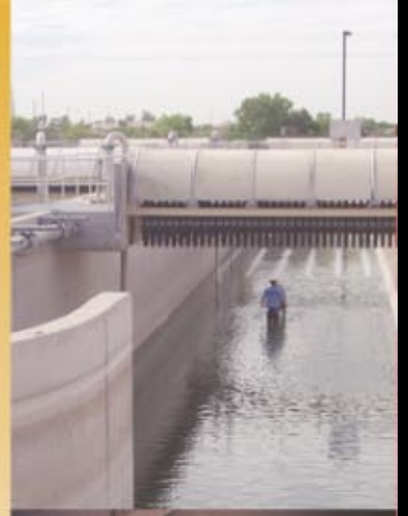
I. RECOMMENDED BEST MANAGEMENT PRACTICES FOR RIGHT-OF-WAYS

Right-of-Way issues are routine for the transportation departments and occasional issues for the non-transportation departments. As a result, most of the input on right-of-way BMP suggestions has come from the transportation departments. The following BMP was offered to facilitate resolution of right-of-way issues during project delivery:

> **Real Property is included in the initial project start-up to establish key deliverables and due dates.**

CHAPTER 4 – PERFORMANCE BENCHMARKING

A. Guiding Principles
B. Traditional Performance Questionnaire
C. CM@Risk Performance Questionnaire
D. Date Collection
E. Distribution of Projects
F. Performance Graphs Development – Traditional Projects
G. Performance Graphs Development – CM@Risk Projects



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CHAPTER 4

PERFORMANCE BENCHMARKING

A. GUIDING PRINCIPLES

Performance benchmarking consists of collecting documented costs of projects and comparing project delivery costs with total construction costs. For the 2006 and 2007 Study, data was collected for both Traditional and CM@Risk projects.

The intent of the data gathering process was to identify and collect all costs to deliver capital projects. While there are at least five identifiable phases in the delivery of capital projects, costs are not usually tracked, coded, or divided by these phases. Therefore, an attempt was made to collect all delivery costs by separating them into the planning, design, and bid/award phase and the construction and closeout phases.

In this study, the costs related to planning, design and bid/award are identified as "Design Phase Costs" and the costs related to construction management, inspection and commissioning/close-out are identified as "Construction Management Costs." The sum of the Design Phase Costs and the Construction Management Costs include all soft costs related to a particular project and is defined as "Project Delivery Costs."

The Total Construction Cost (TCC) is the sum of the construction contract amount, the cost of change orders, any utility relocation costs and any construction done by Agency/Department forces in support of the projects. TCC does not include the cost of land or the costs of any environmental mitigation that is not included in the construction contract amount.

In the 2006 study, the team revised the performance questionnaire to reduce the potential for errors in data collection and to facilitate input into the database. For traditionally delivered projects, the performance questionnaires allowed an Agency/Department to specify labor soft costs as "actual" or "projected." The CM@Risk performance questionnaire was developed along similar lines. The performance questionnaires were revised in this manner to account for the fact that some Agencies/Departments could not provide actual costs for their internal agency labor expenses. Analysis of the data submitted for the 2007 study enables the Team to determine what changes should be made to the questionnaire to improve the quality of the performance data and the resultant analyses.

The project information submitted by the Agencies/Departments was uploaded to the project database for both Traditional and CM@Risk projects. Following are the data guidelines established in the 2005 report:

- Costs – All projects included in the study have a total construction cost exceeding $100,000.
- Completion Date – Projects included in the study were completed after July 1, 2000.
- Representative Projects – The Study Team reviewed and corrected, or eliminated, all projects that had the potential to be outliers in the regression analysis. Projects included in the database are those types and classifications that appear in the Agencies/Departments current and future Capital Improvement Programs.

- Project Delivery Method – All projects included in the database were delivered using either the Traditional design-bid-build or the CM@Risk delivery method.

B. TRADITIONAL PERFORMANCE QUESTIONNAIRE

The Traditional Performance Questionnaire is shown in Appendix A. Highlights of the questionnaire are as follows:

- A number of new drop-down menus are provided to make data input easier for the team. Under all of these drop-down menus, the team member simply selects the appropriate data for the project.
- Under "Project Type," the projects being studied are listed. These are the same project types listed in the Project Distribution Matrix (see Table 4.1).
- Under the New/Rehab box, a similar dropdown menu is installed that allows for selection of whether the project is a new or rehab project.
- A "Complexity Index" was used to account for possible influence(s) in the project's complexity on the performance data. A new drop-down menu in this area allows the users to select between a "Simple," "Normal" or "Complex" project.
- In the Justification box, the Agencies/Departments were requested to provide justification for their indicated complexity index.
- Project costs included two delivery phases: Planning/Design and Construction Management. In the "Planning/Design Phase", the planning, design and bid and award costs are included. While it would be desirable to segregate the cost of design, planning and bid/award function, this was not possible due to data available from the Agencies/Departments. The "Construction Management Costs" include all construction management, inspection, testing, and other soft cost incurred during the construction phase of the project.
- In the first column, under "Agency Labor," is a drop-down box where the Agencies/Departments can select from either "actual" or "projection" (fee) costs.
- The total cost of each phase might include some costs other than labor, such as "art fees." It is the intent of the study to collect all project delivery costs and to have them reflected in the performance curves.
- For 2006 and 2007, it was decided to request that each agency provide change order information in the following categories:

  1. Owner Requested Changes
  2. Design Document Changes
  3. Unforeseen and Changed Conditions
  4. Unable to Categorize

- A discussion among the Agencies/Departments senior management concluded that most Agencies/Departments categorize cost items similarly. Some exceptions are, "Utility Relocation Costs," "City Forces Construction," and "Land Acquisition." Consequently, these items were not broken down in the phases. "Land Acquisition" was excluded from the construction cost.

The regression curves for all Traditional projects are shown in Appendix D.

C. CM@RISK PERFORMANCE QUESTIONNAIRE

The performance questionnaire for CM@Risk projects was developed with the aid of the City of Phoenix. Phoenix has constructed a number of projects under the CM@Risk delivery method, and a meeting was held with the City Engineer and the Deputy City Engineer to develop the new questionnaire. Based on the discussion, it was decided that two performance questionnaires should be developed: one where an Agencies/Departments could provide project soft costs during the Planning/Design and the Construction phase; and the second where Agencies/Departments could only provide soft costs for one phase.

For these CM@Risk questionnaires, drop-down menus were created to make the input of information easier. The dialogue boxes included menus for the participating Agencies/Departments, project type, whether the project was a new or rehab project, and for the complexity of the project. These dialogue boxes are similar to boxes for the Traditional performance questionnaire.

In the "Agency Labor" row, the soft costs are based on the City's projected cost for architectural/ engineering (essentially project manager's time). This column also contains boxes where costs for permits and any other costs incurred related to PM management of the project can be entered.

Under the "Outside Services" column, a number of services are listed. The services included the **soft** cost for design services, Construction Administration (which is a separate contract for a Contractor to perform Construction Administration), real estate, environmental oversight, material testing, telecommunications, utility coordination, miscellaneous items, and the cost of the CM@Risk contractor.

Under the hard cost of the construction, it was decided to provide a line for the agreed GMP, with contingency. A separate line is provided for the amount of contingency used by the Contractor, the Owner's Contingency, and any excess Change Order cost above the indicated contingencies. The regression curves for all CM@Risk projects are shown in Appendix D.

D. DATA COLLECTION

Participating Agencies/Departments provided project information by responding to the Traditional and CM@Risk performance questionnaires. The Study Team compiled the information into a database to develop new performance curves for this year's Study.

In order to increase the reliability of the study data collection, analysis and reporting process, the Team took the following steps:

- The Traditional performance questionnaire was improved to increase the reliability of the data. The questionnaire was revised to make the input of the data easier and to reduce errors by the Team. This change also facilitated the input of the data by the Team into the database.
- A new CM@Risk performance questionnaire was developed to include projects using this alternative delivery method in the study. Two CM@Risk questionnaires were developed in this effort as explained above. For the 2006 Study 24 CM@Risk projects were included in the database. For the 2007 Study, 23 additional projects were submitted to double the size of the database. Most of the CM@Risk BMPs came from the City of Phoenix, but nevertheless, by increasing the size of

the database reliability of the conclusions will also increase.

- The study continued to collect additional project data to increase the population of the database. The 2005 study examined 224 projects. The 2006 study expanded the number of projects to 274 projects. The 2007 study examined a total of 354 projects.
- The Team reviewed the data submitted in 2005 and 2006 to correct any errors.
- In 2005 Maricopa County's Flood Control District (FCD) submitted two projects. Therefore, in the 2006 study, it was decided to expand the categories to include Flood Control Projects. As a result, the 2006 and 2007 Study contains five categories and 16 different project types.
- The Agencies/Departments have included change order costs whenever possible, and to categorize them according to their origin. A meaningful analysis was not done due to the limited information;, however, continued collection of data should allow a meaningful analysis as part of the 2008 Study.

E. DISTRIBUTION OF PROJECTS

Table 4.1 summarizes the final project distribution for projects delivered using the Traditional method. The table shows a wide distribution of projects. As indicated at the start of the study, the addition of more projects to each classification increases the statistical credibility of the study and the associated regression curves. The number of projects increased from the 224 in the 2005 Study, to 354 in the 2007 Study.

Table 4.2 summarized the final project distribution for CM@Risk projects. Because of the small number of projects included, the statistical credibility is questionable but will improve as the size of the database increases

Table 4.3, "Consultant's Usage Summary" details the cost of design, construction management and project delivery costs by the Agencies/Departments. It also includes the comparative use of in-house staff versus outside consultants.

Table 4.4, "Project Count and Project Delivery", summarizes the 354 projects contained in the study by project completion year and shows the trends in average Total Construction Cost (TCC) values, median TCC values, design, construction management, and overall project delivery percentage costs.

F. PERFORMANCE GRAPHS DEVELOPMENT – TRADITIONAL PROJECTS

The 2006 Study added 50 new projects in various classifications. Examination of the Project Distribution Matrix, Table 4.1 indicates that 22 of the 50 new projects were added in the "Streets" type. The following is a comparison of the number of project types contained in the 2005 and 2006 Report versus the 2007 Report.

	2005	**2006**	**2007**	**Increase**
Municipal	40	44	47	3
Parks	48	51	51	0
Pipes and Plants	55	67	73	6
Streets	81	103	121	18
Flood Control	0	9	12	3
Total	**224**	**274**	**304**	**30**

An examination of the regression curves shows a high correlation for Streets (widening). The design percentage versus TCC for Streets (Widening) indicates a R2 value of 0.8244, for Construction Management versus TCC, R2 = 0.2004, and for Project Delivery versus TCC, R2 = 0.888.

The high R2 suggest that agencies may be using consistent procedures in delivering these projects and that the curves may be used with more confidence to predict soft costs on future projects. The project performance data is summarized for design, construction management, and total project delivery versus as a percentage of total construction cost (TCC) for each of the 16 classifications.

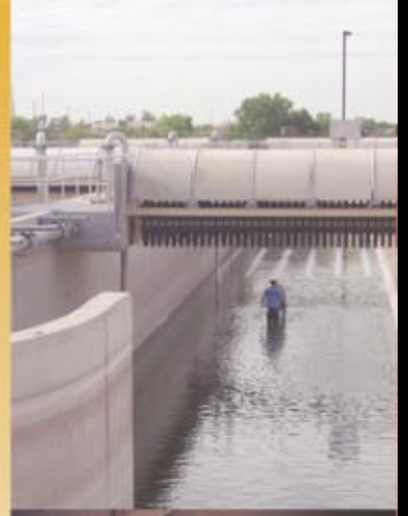
G. PERFORMANCE GRAPHS DEVELOPMENT – CM@RISK PROJECTS

Table 4.2 summarizes the final project distribution for CM@Risk projects. Since most agencies provided projected or estimated data for their CM@Risk projects, only total project delivery percentage versus TCC regression curves could be developed. Out of the four curves generated, Municipal Facilities and Parks showed reasonable correlation, given the limited number of projects (27 for Municipal and 13 for Parks). For Pipes and Plants (6 projects), the project delivery percentage versus TCC showed a R2 = 0.6599, and for Streets (3 projects), the R2 = 0.9937. In order to have a statistical credible curve, at least eight projects are needed from each agency. The high correlation of these graphs should be viewed as preliminary until more projects populate the database. One additional graph was developed depicting the "Total paid vs. Contractor" compared to the agreed "Guaranteed Maximum Price". The curve shows the percentage growth of the amount paid to the Contractor above the original agreed amount (GMP) for increasing project cost.

The CM@Risk project performance data is in Appendix D.

CHAPTER 5 – ON-LINE FORUM

A. Use of Online Forum
B. Online Forum 2007



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CHAPTER 5

ONLINE FORUM

A. USE OF ONLINE FORUM

The Team views the Online Forum as a valuable resource. The following procedure is used by the participants when receiving or responding to questions posed on this forum:

1. Once a question is received, every team member who has knowledge of the issue should respond to everyone on the email. (To send the response to all on the e-mail list – hit the "reply to all" button.)
2. Vanir should be copied on all questions and responses.
3. The question or the issue should be on the subject line and it should briefly describe the issue.
4. If the individual is not familiar with the subject matter, he/she should respond with "No comment." In this manner, all team members, including the initiating member, will be aware that the email was received by everyone.
5. Vanir will post all questions or issues and responses in the yearly Benchmarking Study Report.
6. Pima County has just finished modifying their web site to include all of the online forum questions and answers so all of the Team members can use this as a resource library. Pima County also includes the Arizona Benchmarking Study on their web site so both Team members and non-team members have access to the information the Team develops.

Issues discussed on the online forum include the following:

- ***Litter Control (11/30/2006)***
- ***Franchise Fees (12/19/2006)***
- ***BMP Implementation (12/26/2006)***
- ***Plaques (1/12/2007)***
- ***Utility Relocation Process (2/15/2007)***
- ***CPM Scheduling (3/8/2007)***
- ***Construction Trades Training Program***
- ***Moving Clients (3/22/2007)***
- ***Building Square Foot Costs (3/30/2007)***
- ***Bond Elections (4/12/2007)***
- ***Federal Energy Tax Incentives (5/17/2007)***
- ***Franchise Fees (6/26/2007)***
- ***In-house vs. Consultant Services (8/22/2007)***
- ***Roofing Material Problems (9/7/2007)***

B. ONLINE FORUM QUESTIONS AND ANSWERS 2007

1. Litter Control (11/30/2006) One agency asked how other agencies handle litter control on roadways. Do they contract it out, use in-house labor, inmate labor or a combination?

Pima County utilizes Adopt-a-Roadway Program with 150 volunteer groups participating, who are required to adopt a 2 mile portion of a roadway and perform 2 clean-ups per calendar year. In problematic areas, they schedule the adult probation crews to do weekend cleanups. Contract work is part of their vegetation maintenance program on

major streets, in which case crews pick up litter as they maintain vegetation.

2. Franchise Fees (12/19/06) Do other agencies charge a franchise fee to utilities in your ROW? If so, how is the fee calculated?

Community colleges, where the utility is serving the college, generally grant the easement at no cost. It is a general utility line serving other users. Should the impact to the property not be substantial, usually a trade in-value to the utility is sought after.

The City of Tucson charges a franchise fee, which was renewed in 2000. The fee is based upon consumption.
City of Mesa response: The City of Mesa does not charge such a fee to the various private utilities.

3. BMP Implementation (12/26/2006) - In order to help implement some BMP for next year please provide your tools, references and/or procedures for the following three BMPs?

1) *Ref #11 Approved scope changes are accompanied by budget and schedule modifications. (How is this reported, tracked and monitored for approval - maybe some samples of your documents would be helpful?)*
2) *Ref #12 - A standardized project delivery manual is used on all projects - (a hard or electronic copy would be helpful)*
3) *Ref #29 - A consultant rating system has been implemented that identifies the quality of each consultant's performance on previous projects*

Pima County has implemented a consultant past performance rating system based on an Office of Federal Procurement Policy best practices publication. (The Board of Supervisors Policy D29.1 was attached to the forum.) They are looking to formalize data collection on changes, in order to better identify traceable design issues. They recommended GSA's A&E performance form as a reference (a copy was attached to the forum.)

The City of Phoenix Water Services has electronically implemented Ref #11, yet commented Ref #12 is electronic and not easily reproduced. They invite others to come and view it. A rating system is yet to be developed for Ref - #29.

4. Plaques (1/12/2007) - Does anyone have a standard they are using for building plaques? There has been a request to establish a standard for plaques to ensure that in each instance of a naming, a meaningful, readable, durable "permanent" plaque is provided in an appropriate location coinciding with the dedication ceremony.

No responses

5. Utility Relocation Process (2/15/2007) - A consensus was reached at the meeting on October 5, 2006 that the Utility Relocation process frequently led to increased costs and delays to project delivery. Please share agency solutions to those delays and increased costs.

City of Tucson attached copies of their policies and procedures, guidelines, and recommendations for reducing delays and costs related to utility relocations. They can be viewed on the forum.

Pima County Appraisal Supervisor for Public Works Real Property Services attached responses in the forum to three of the items.

6. CPM Scheduling (3/8/2007) - Do any agencies use CPM Scheduling to ensure timely completion of projects, particularly large, complex projects? If so, is the project manager responsibile for monitoring the schedule and analyzing time impacts to the schedule or is some other party?

Pima County gave an example of their Marana BNROD Expansion and the Santa Cruz Interceptor. They are utilizing a Consulting Firm to provide Project Management Services and a Project Manager from the Wastewater Department and both use a CPM for scheduling (Projects 2003 or similar).

Pima County has an internally developed Program Management Application that is used for project schedule, budget and expenditure reporting and analysis. Most project managers use this for project scheduling management. It is the Pima County project manager's responsibility for monitoring the schedule. In cases where Pima County has hired a PM/CM, the Pima County project manager, as the owner's representative, still maintains oversight over the project schedule.
Microsoft Project, or similar commercial project management software, was recommended as an option for large, complex projects. Pima County is also exploring available commercial off the shelf CIP program management applications and are willing to share the options that are being considered.

City of Phoenix requires that construction contractors prepare a CPM schedule for all construction projects. They might make an exception on small, short duration JOC projects. In which case, updated schedules are submitted with the monthly progress payment application. Schedules are then reviewed by the designer and our City project manager. On large-scale projects, an outside scheduling consultant review and comment on the schedule.

Maricopa County requires the contractor to provide a complete schedule and bi-weekly updates. The construction manager uses it at the weekly construction meeting to assess progress along with the payment requests and cash flow diagram to monitor progress.

7. Construction Trades Training Program (3/21/2007) Our elected officials are considering requiring contractors on City projects to "donate" a small percentage of their labor cost to a construction trades training program. The model for the contemplated ordinance is a requirement that was part of a state funding bill for the UA's new biomedical research facility. Are any of you aware of similar construction trades' funding requirements used by public agencies and, if so, is it required by ordinance? 1% is the amount that has been suggested.

Pima County Facilities have not heard of this proposal, and commented that any added cost to the construction budget puts any project at risk. They mentioned that huge rises in construction costs, and additional consultant and material costs in order to satisfy LEED requirements has been a challenge. The increase in budget or construction costs will become an issue to monitor.
Pima County Design & Construction shared their research that the two bills, SB1303 and HB2404, are identical and appear to be companion bills. If enacted, the legislation would apply to state and state-assisted projects.
In summary it requires that a contractor who

does not use a registered apprenticeship program must include in its bid an amount "equal to one percent of its gross payroll" and deposit those funds in an apprentice fund. The bills stipulate that "The labor of the direct cost is calculated as thirty-five per cent of the direct cost of the contract," which may or may not equal 1% of their gross payroll on this project. Further comments and opinions can be found online.
City of Phoenix Water Services shared a link to SB 1303 – Apprentices/State Construction Projects:
http://www.azleg.gov/legtext/48leg/1r/bills/sb1303p.htm

8. Moving Clients (3/22/2007) How are other jurisdictions handling moves as part of projects. Specifically:

1) *Who is handling the details, i.e. contracting phone lines, related to moving clients into newly furnished spaces? Does the client handle it in-house, or do they have someone in the construction project management handle it?*
2) *For those who are potential clients to new projects involving new or renovated offices - how are the moves handled? Are you satisfied with the current approach?*
3) *If this service is provided by the construction project management group, are the clients billed for this?*
4) *If there is a consultant, Architect or Interior Designer involved, do you hire them for the moving coordination?*

When moving departments/staff , Pima County internally handles the details, coordinating among the client (or designee), the Facilities Management Department (FMD) architects/design specialist staff, and the Information Technology Department (ITD). A detailed flow of processes can be found in the forum.

Within the City of Phoenix, moving coordination is the responsibility of the client department. City departments that have several new facilities (Fire, Libraries, Parks, Police) have vast experience moving into new facilities. Detailed scenario of this coordination is in the online forum. In cases where large numbers of people and lots of equipment are being moved, and the planning is complex and detailed, the City of Phoenix recommends using a move coordinator.

9. Building Square Foot Costs (3/30/2007) A common question is, " what does it cost to build a certain type building." Square foot numbers can be difficult to use because of the unique circumstances that surround each project. Is anyone able to provide building square foot costs broken down by building type - police station, fire station, etc?

Pima County Facilities recommended R S means as an excellent resource book.

10. Bond Elections (4/12/2007) Pima County is undertaking the planning effort for the 3rd bond election in 10 years. The current project list is about $3.5 billion. Pima County limits its bonding to a level that will not increase our secondary tax rate. An example ballot question was posed on the forum for comments.
The general consensus from the MCCD, City of Phoenix and City of Mesa is that two different questions on the same ballot measure would

create voter confusion and could result in negative sentiment.

11. Federal Energy Tax Incentives (5/17/2007) The Federal Energy Policy Act has tax incentives that local governments are allowed to collect. This provision allows a tax deduction for energy-efficient commercial buildings that reduce annual energy and power consumption by 50% compared to the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) 2001 standard. The deduction would equal the cost of energy-efficient property installed during construction, with a maximum deduction of $1.80 per square foot of the building. Additionally, a partial deduction of 60 cents per square foot would be provided for building subsystems. The understanding is that local governments can receive these tax credits through the design consultants receiving the tax credits and then passing them along. Has anyone tried to receive the tax credits? How was it approached?

Response from Pima County - It appears that the credit is only issued to the "primary design/architects". Additional insight and comments can be read on the online forum.
The City of Scottsdale has not investigated this tax incentive benefit via consultants. Instead, they have been pursuing an energy service contract (ESCO) for a couple of their new facilities.

12. Franchise Fees (6/26/2007) Pima County currently charges a franchise fee for telecommunications / CLEC companies. The understanding is that many jurisdictions have standard franchise fees on a variety of utility companies.

1) *Which utilities, if any, are charged a franchise fee by your agency?*
2) *How is the fee calculated?*

Maricopa County Superintendent of Streets shared that public utilities (under regulatory authority of AZ Corp. Commission) are franchised for their respective service area, but do not pay annual fees to the county. This includes electric, water, sewer, telephone and gas. Cable television pays a franchise fee. A license is also required for telecommunications antennas within the right-of-way.

In Maricopa County all licensed cable television operators within unincorporated county areas are charged a franchise fee equal to 5% of their gross revenue. Two documents from the Arizona State Stature that defines franchise fees and other definitions relative to cable television are attached in the forum.

13. In-House vs. Consultant Services (8/22/2007) Pima County is beginning to outsource more of the project management/construction management needs. As a result, elected officials have asked us to do a cost/benefit analysis comparing the performance of both groups. The following list of items has been identified as possible measures:

- *Original budget vs. actual budget*
- *Original schedule vs. actual schedule*
- *Soft costs as a percentage of budget*
- *Length of time to complete design*
- *Length of Time to complete construction*
- *Total project delivery costs as a percent of total construction costs*

Without a reasonable sample of projects using this new approach, we are not able to provide this data. My questions are:

1) Have you done any similar analysis or do you know of any similar studies?

2) Are these the best measures for our analysis?

3) Is there a better way to "prove" that outsourcing is an efficient model?

4) Is this something we should track/measure in our study?

The City of Tucson DOT will be exploring this type of out-sourced project management, at least for design project management. In addition to the items identified, it is suggested to establish a means to closely track in-house staff's soft costs associated with overseeing these consultant management contracts. Our limited experience with this type of project management left us feeling as though we spent as much time managing and training the consultant management firm, particularly those firms performing construction management, as it would have taken to just do it ourselves. And, again, I would be really cautious about ever even considering having the firm that oversees the design project management also oversee the construction project management.

Response from MCCD - It seems to me that the outsourcing decision is a lot more complicated than just cost benefit analysis. We have hired outside contractors to help us for a couple of years doing project management. A couple of things to consider in the analysis, in no particular order:

1. The hourly cost of outside consultants/PM's is going to be much higher than your in-house rate, even if you have a decently generous benefit plan. You're still paying a profit margin to them, full retirement costs, costs of all pencils, etc. Your in-house cost structure is part of general organization "overhead". You already know what the hourly rate for some of your regular engineering and design consultants is as a quick check on costs.

2. For your own costs, are you going to calculate the cost of the space that a full time employee takes up?

3. One of the issues to consider is that if one don't have space to house your staff needs, one would have to build, buy or rent additional space for an expanded staff. The cost of getting the additional space is also a major consideration.

4. Outsourcing is a tremendous way to size staffing needs to meet project load, and there's no tears as you have to reduce that outside staff when project loads reduce. That's a lot different than the costs to recruit and train staff and then all of the issues that come when you have to lay them off as work load reduces. If you're not looking at a permanent increase in your base work load, but just a hump on the chart, outsourcing may be a really good decision, both for business, emotions and politics.

5. You have more control over the quality, consistency and tenure of your own staff than an outsourced staff. It's even harder to assure your organization that the outside project manager who you just spent a year bringing into your system and did a great job, but left for better opportunities or had to be moved to other projects within his own firm.

You may have the ability to tap better talented people with an outside firm because that firm may have more people to draw on, but remember that the better people also are going to cost you more.

6. The outsourcing firm's other capabilities. We've looked at this too as a big advantage to

using an outside firm. In addition to pure hands on project management assistance, does the outsourced firm have good cost estimating capability? Good scheduling analysis ability? A claims department? Survey crews? Other capabilities? You may not need these but once every great while, but if your RFP asks about these, you'll have the capability to tap these extra talents at a reasonable cost, with no additional RFP having to be issued, and it will be some critical need that you'll have.

7. Long term view of the work managed. Bluntly, an outsourcing firm has a profit motive and bottom line, has to be efficient as it can and move the work along. We outsourced project management on one of our bond programs in the 80's and spent years correcting errors, picking up the pieces and making peace with our users- the PM's approach was to push the work hard and fast, with only a short term view.
There's nothing like a full time employee knowing that he/she is going to have to live with the users and be around long enough to pick up and fix their own mistakes and messes to create a bit more care to begin with. These also are the kinds of costs that won't become evident for years and can't be measured easily, if at all.

8. Time allotted and taken for projects. Unless you're taking a hard line time card arrangement with your own employees, and even if you are, an in house employee is not going to be watching the clock if some additional time or hand holding is needed on a project. It's the difference between the time and care a baby sitter will provide for a child versus what the parent will do to nurture the project. Again, it may take years for the problems to surface, maybe not even until you do some new work on the old project when you find that the outsourcer looked the other way on a problem, since it was going to take a lot of time or effort to solve it, or they just didn't understand that it was an important issue to you.

9. Institutional knowledge/best practices. No matter how long an outsourced project manager may be on the job, there isn't any way that they can obtain the breadth of knowledge, experience, political nuance and "best approaches/lessons learned" between the projects that he/she may do for your organization vs. what your in-house staff will bring.

10. Culpability and responsibility. In house staff are supposed to know all of the rules, procedures, etc., and are held responsible for that.

Can you say the same for an outsider? Do they know public procurement rules like you do? State statute? Conflict of interest nuances? If they make a mistake, are you still going to cover it or is your organization "going to make them pay for it" (which ultimately gets rolled back into the prices charged).

11. You still need full time employees to manage, coordinate and provide functions that only FTE's can do, even if you outsource most of the work. Your outsourced firm can't sign change orders, they can't do Board items, probably can't do a lot of your in-house, intradepartmental coordination. Unless you're willing to have someone on staff sign a change order almost sight unseen, your own staff will have to spend some time acquainting themselves with the issue, doing your own responsible analysis, etc., before you'd support and sign something like a change order. The person doing this oversight is probably a mid to upper level employee because of the responsibilities- would it have been more efficient to have a couple of lower level, full time employees doing most of this work and allowing

that same middle level employee to do broader work within your organization?

12. Claims and difficult issues are a way of life and are not going to go away. Are you going to trust and rely on an outside firm to manage, process and decide these issues?
With a responsible in-house employee, you may be able to solve, avoid or resolve the issue sooner since there's a benefit and ownership to do that with full time, empowered employees. Claims and issues take time and that's something that outsiders don't want to spend, and certainly don't/can't make these kinds of really important decisions on behalf of an owner.

These are issues that aren't easy to quantify or put a cost to, for a simple cost/benefit analysis. Some of the items that you list are good measures, and if an outside firm couldn't perform as well or better than in-house staff on some of them, they've got no business doing PM work. But they also can toss a lot of manpower at an issue to get through it, which you'll pay for, that you won't be able to support with in-house staff. As noted above, there's a couple of items in your proposed measurements that you simply can't measure well- "soft costs" of your own total staff cost vs. the hourly or monthly rate for an outside firm. If you're not already tracking personnel costs and billing them to projects (we don't- we're just part of the District's overhead), your "project delivery costs" will be much higher using outsiders and will make a very cockeyed type of analysis.
All in all, I don't think that you can "prove" outsourcing is or isn't a better alternative simply on a financial basis- many things can't be measured. Even the best analysis may come up short because it simply can't be a 100% comprehensive view.

Maricopa County DOT - In answer to you four questions:

1) *Question:* Have you done any similar analysis or do you know of any similar studies? *Answer:* We have not done a similar analysis. You might try the APWA web site since outsourcing was a big topic a few years ago.

2) *Question:* Are these the best measures for our analysis? *Answer:* I'm not sure they are relevant except for project delivery cost as a percent of construction. It is a "bottom line" measure that may show a difference. The problem is the time it takes to complete the projects to gather the data.

If you can measure soft costs consistently for both groups it may be useful but it is not the complete picture so I'm not sure it is really relevant.

The other measures are not relevant and can be influenced by other project specific factors. For example one project may be held up over a design issue that is not related to who is doing the design so the results are skewed.

3) *Question:* Is there a better way to "prove" that outsourcing is an efficient model?

Answer: I believe sufficient information exists for you to show it is an "efficient" delivery method in the study results. Compare your existing contracts to other agencies for similar type and size projects for consultant design and construction management support. We use consultants for about 90% of our design and half our construction management. The database administrator should be able to get you the design consultant costs, the construction consultant costs, and total cost of construction for projects already in the database and you can use those to compare with your contracts to see if you are in the same range.

4) *Question:* Is this something we should track/measure in our study?

Answer: Each agency uses a different cost capture methodology for overhead rates so it would have to be compared within an agency rather than between agencies if we wanted to compare in-house design and construction management with consultant costs. We could compare consultant costs between agencies provided contract scopes of work are similar.

Response from Pima County - Coming up with a true cost-benefit analysis may be a tall order. A more practical alternative might be to compare our project delivery experience without PM services in terms of budget/schedule compliance with someone like Gilbert that has been using PM/CM almost exclusively for a period of years. My guess is that Gilbert probably has those kind of numbers -- or at least the raw date we could use to put them together.

Response from City of Phoenix - The City of Phoenix has four project managing departments:

1. Engineering,
2. Aviation,
3. Street Transportation, and
4. Water Services

Engineering and Street Transportation do not hire outside project managers. Water Services and Aviation do on an as-needed basis given work load and project complexity. They staff to the average or normal work load, and then hire consultants to take on the peaks. Phoenix has never tried to do a head-to-head cost comparison for all of the reasons given in responses by others.

Response from Maricopa County DOT – MCDOT has looked at recent projects to see if there is a cost difference between in-house delivered projects and consultant supported projects. It projects in the study and some that will be submitted next year. The projects considered were those under $1M completed in the last two years. They are all signal projects except for one small bridge replacement. Design costs and construction management costs were used as a percent of total construction cost for the measurement, grouping them to see if consultant delivered projects cost more than in-house delivered projects. I limited my look to this group of projects because they were completed recently and had the same emphasis on project delivery and followed the same project management methodology. It compares out of pocket costs to pay in-house labor and/or consultants.
Using small sample theory from my old Schaum's series I did two sample problems were checked. The t-test shows no difference between the two groups for either design or CM.

It is a very small sample of one type of project but this methodology can be used for like projects in an agency. There are significant labor costs involved with the consultant delivered projects. Each agency will have different amounts of cost and different overhead calculations. Soft costs are ignored. They are not relevant to the analysis. Contracts, finance, human resources, phones, computers are not impacted by how these 14 projects were delivered. It is an entirely different question if you are ramping up to deliver a large number of projects and you need additional contract personnel, more office space, etc.

Response from Pima County (From whom the original question originated) "This is very helpful info. Thanks for taking the time to prepare and share. A quick question (and somewhat subjective): Did you have any

different outcomes for either group? (Such as more change orders, schedule busts, etc.)"

Response from Pima County Waste Water Management - currently the County's PM for two on going Wastewater projects - one a Treatment Facility and one a major Conveyance facility. The Treatment Facility project started out as a CMAR and the Conveyance project is a Design-Bid-Build (DBB); however, they both are utilizing PinnacleOne as the Project Manager. In my opinion, because of the differences that every project has from every other project, it is very difficult to find a simple, common way to compare them without providing narratives, explanations, etc. So the measures that you have listed could be used, but not without providing the details behind all of the numbers, except for possibly the "soft costs as a percentage of budget" because the bottom line is that in the end, if the Project Management by an outside Consultant is costing the County a significantly large amount when compared to the traditional Project Management, without very impressive results with project delivery (cost savings and schedule deadlines met and quality of work) then in my mind, it would indicate to me that the County should concentrate on in-house Project Management with both people, training and methods.

Common among all projects, is the quality of the initial design services and pre-construction efforts. This has been the weakest part projects that I am associated with and also the area that, if it had been done better, would have saved a great deal of time and costs. The better the design, the easier the construction and project/construction management becomes. From the very start there needs to be clear, well defined direction/scope, a good design team and experienced, dedicated pre-construction services and I believe this will result in a cost effective, on time and within budget project.

Maricopa County DOT – Not aware of a comparison. The one differential that I know of is the in-house design was used when there were no intersection improvements (paving), just signal installation.

They are about as homogeneous a group as you will find in this arena. They are all small projects under $700,000 construction and had a short delivery time. They were started recently and completed in the same time period following the same PM process. Almost all suffered from optimistic scheduling but were completed within the target year.

Results on larger projects may not be the same. With larger projects there are too many issues to be resolved that impact delivery costs so without a large sample you may not get a valid answer.

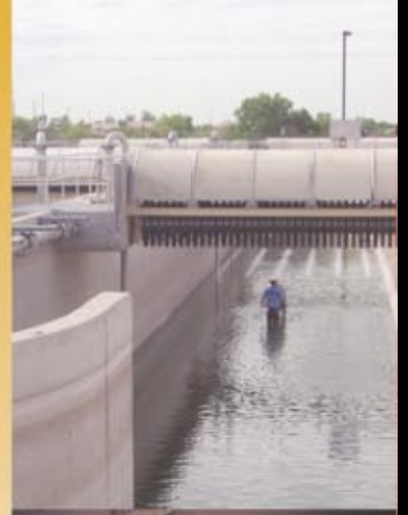
14. Roofing Material Problems (9/7/07) We are having a problem with our Siplast veral roofing material. I was wondering if any other jurisdictions are having similar problems with the Siplast veral or other aluminum foil faced type roofing materials. The issue is that at the parapets the aluminum material is delaminating from the underlying roofing material exposing it to the elements. Siplast is stating that it is due to structural movement and not covered by their warrantee.

Pima County was contacted by an Arizona distribution company offering a new roofing coating product that boasts a much longer (double) life than current products. Product information can be emailed upon request.

All of the questions and responses will be summarized on the Pima County web site at
http://www.co.pima.az.us/CIP/azstudy.htm

CHAPTER 6 – CONCLUSIONS AND RECOMMENDATIONS

A. Process Benchmarking
B. Performance Benchmarking
C. Study and Qualifications
D. Next Steps



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CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

A. PROCESS BENCHMARKING

Through the selection and implementation of certain Best Management Practices, the Agencies/Departments want to enhance their performance. Major changes have been made or will be made to Maricopa and Pima County's organizational structure as a direct result of their evaluation and execution of certain Best Management Practices. Other Agencies/Departments have also targeted specific Best Management Practices to improve their operations, with the ultimate goal of reducing project delivery costs. During the past two (2) years, the Agencies/Departments have had the opportunity to look at what other Agencies/Departments are changing and what works for them. The Agencies/Departments will use this experience to make changes and improve project delivery practices and processes.

Use of the Online Forum has increased during the study period. Nineteen different topics have been discussed to date, from questions on CPM Scheduling to Federal Energy Tax Incentives, to fees for professional services. Based on the forum discussions this year, it appears that agencies are starting to openly share their experiences and proposed solutions to the posed questions. Several of the Online Forum questions have resulted in recommendations for Best Management Practices. This is the ultimate goal of the Online Forum. Someone has a question, several people have viable answers, the answers are discussed, and the best answer generates a recommendation for a Best Management Practice.

TRADITIONALLY DELIVERED PROJECTS

In 2005, all of the agencies began implementing the Best Management Practices identified by the Team. The 2007 survey data indicated that several of the Best Management Practices were a high priority for all of the agencies. The 2007 survey data indicated that a great deal of progress has been made in implementing the BMPs and that 4 of the 26 Best Management Practices have been fully implemented by all of the agencies and departments on the Team. This is an accomplishment for which the Team is proud. The details for the level of implementation can be found on Table 3.3 in Appendix B.

CM@RISK PROJECTS

The Team, assisted by the City of Phoenix, developed a list of Best Management Practices and surveyed the Team on their use of those practices. In 2007, the survey was completed by the Team, and the data collected, reviewed and evaluated. The quality of the data on BMPs has improved and the survey results considered satisfactory. The details for the level of implementation can be found on Table 3.4 in Appendix B.

B. PERFORMANCE BENCHMARKING

TRADITIONALLY DELIVERED PROJECTS

In Traditionally delivered (design-bid-build) projects, the curves for Design versus TCC showed high correlations in Flood Control, Pipes and Plants (Gravity, Pressure Pipes and Treatment Plants), Streets (Bridges) and Streets (Widening).

In Construction Management versus TCC high correlations were achieved in Flood Control, Municipal Facilities (TIs), Pipes and Plants (Pressure Pipes), and Streets (Widening).

In Project Delivery versus TCC high correlations were shown in Municipal Facilities (TIs), and Pipes and Plants (Pressure Pipes, and Streets—Widening).

CM@RISK PROJECTS

Most Agencies/Departments have provided projected or estimated data for their CM@Risk projects. Only Project Delivery percentage versus TCC regression curves have been developed. Out of the four curves generated, high correlation was observed in the Pipes and Plants and the Streets projects; however, this information should be considered preliminary since the number of projects in each classification is small.

The CM@Risk Project data collected as part of the 2007 study will improve our ability to evaluate and analyze the project delivery costs for this alternative method of delivery. The Team will continue to provide additional data and review the existing data to insure accuracy. The benefit that the agencies can gain from the study's results is to use the performance curves as comparative rather than predictive tools. The best use of these curves, with the current data, is to compare an Agency's performance to industry trends.

C. STUDY CHARACTERISTICS AND QUALIFICATIONS

Performance Benchmarking measures the end result of the project delivery system prior to, during, and after making changes in practices and procedures. Data is collected on all costs to the Agencies/Departments required to deliver projects in addition to the actual construction costs. Additional project data will improve the results of the Performance Benchmarking part of this study by making the study curves and analyses more reliable. The quantity and quality of the data for the 2007 study improved greatly; however, until the size of the database for CM@Risk Projects increases for all of the classifications, the curves included in this study should be used with caution and only with full consideration of particular project timelines, site conditions, and complexities. The curves should not be used at this time as the sole source in guiding budget decreases for future projects.

D. NEXT STEPS

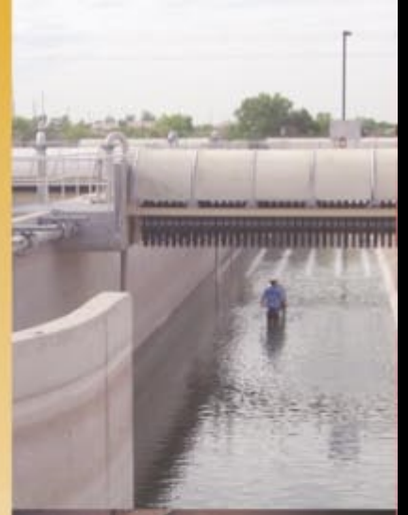
1. This study is building the foundation of a continuous benchmarking assessment and improvement process. The agencies are all moving toward implementing Best Management Practices to improve their delivery performance. The Team will continue to monitor the Agencies/Departments progress in this area and their implementation approach to these practices in future studies.
2. The Team will continue to review the Agencies/Departments data collection

processes for performance benchmarking to ensure that accurate information (consistent with the guidelines established in the study parameters) is received. The CM@Risk data received will be reviewed to ascertain that all Agencies/Departments are providing data consistent with the agreed format and guidelines.

3. The Project Team will continue to share experiences and questions through the Online Forum. This forum has been found to be an effective method to synergize the team and promote a collaborative effort. The Online Forum is now available on the Pima County web site, which will make it more accessible by the Team members and others interested in improving their project delivery process.

APPENDIX A

Performance Questionnaire – Traditional
Performance Questionnaire – CM@Risk



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Arizona Benchmarking Team Best Management Practices Survey

Name: _____

Agency: _____ Date: _____

Please rate the following questions on a scale of 1 to 5. A rating of "1" indicates that the process/procedure is not done and a rating of "5" indicates that the process/procedure is implemented on every project.	Scale				
Complete feasibility studies are done on projects prior to defining scope and budget.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Projects are well defined with respect to scope and budget, including obtaining tenant (or client) approval prior to the start of design.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
The Agency has a prioritization system.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Program planning includes design and construction resource loading.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Program planning includes a Master Schedule that includes start and finish dates for each project.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
All projects shown on a Geographical Information System.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Designers are provided with a clear, precise, scope, schedule, and budget prior to design start.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Requirements for reliability, maintenance, and operation are defined prior to design initiation.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Successful designs are re-used and site adapted whenever possible.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Scope changes are limited to the early stages in design.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Approved scope changes are accompanied by budget and schedule modifications.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
A standardized Project Delivery Manual is used on all projects.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Value Engineering Studies are performed on all projects with a value greater than $1 million.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
A formal Quality Management System is used to assure the quality of the design documents and of construction.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Post project reviews are performed and used to identify "lessons learned."	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Change orders are classified by type.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
A formal Dispute Resolution Process is included in all contracts.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
A team building process is used on all projects with a value greater than $5	☐	☐	☐	☐	☐

million.	1	2	3	4	5
The Construction Management Team is involved in the project before the completion of design.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
A pre-qualification process is used on large, complex projects.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Bid advertisements are available online.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Bid documents are available online.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Bids can be submitted/accepted online.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Formal training for project managers is provided on a regular basis.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
A standard Project Controls System is used on all projects.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
There is a special project management team for small projects.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
There are procedures in place to measure and ensure Project Manager performance and accountability.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Standard contracts for consulting services, with critical clauses (i.e. indemnification) are included in RFQ/RFPs.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
A consultant rating system has been implemented that identifies the quality of each consultant's performance on previous projects for the Agency.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
A rotating RFQ process for contracting small projects has been implemented to streamline the bidding and award process (including criteria for exemptions from formal Council/Board approval).	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
A financial system has been implemented that tracks expenditures by category, adequate to monitor project hard and soft costs during project delivery.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
A Work Breakdown Structure (WBS) has been implemented to measure progress on project deliverables.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
"Earned value" versus budgeted and actual expenditures is monitored during project delivery.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Verification procedures have been implemented to ensure that PM training includes agency policies, procedures, forms, and standards of practice (scheduling, claims avoidance, risk analysis, etc).	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Small projects are bundled whenever possible.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
As-needed, rotating, or on-call contracts are implemented for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Thank you for completing the survey.

Arizona Benchmarking Team CM@Risk Survey of Best Management Practices

Name: _____
Agency: _____ Date: _____

Please rate the following questions on a scale of 1 to 5. A rating of "1" indicates that the process/procedure is not done and a rating of "5" indicates that the process/procedure is implemented on every project.	Scale				
Planning/Selection Process					
1. Conduct pre-proposal conference(s) requiring attendance by A/E and CM@Risk Contractors proposing to participate in the project.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
2. The evaluation panels for selecting the A/E and the CM@Risk Contractor include appropriate user group representatives (the A/E should not be on the CM@Risk evaluation panel and the CM@Risk Contractor should not be on the A/E evaluation panel).	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
3. The CM@Risk Contractor is selected based on the fit of the Contractor to the size and type of project.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
4. The Engineer/Architect's Contract requires a design schedule for deliverables.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
5. The selected CM@Risk Contractor has experience with CM@Risk projects. (This requirement may be weighted in the selection evaluation, based on the type of project and the number of potential Contractors able to do the work.)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
6. The selected A/E has experience with CM@Risk projects.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
7. Require that the A/E submits a fee proposal that includes all work to be performed.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
8. Due diligence is performed on the selected CM@Risk Contractor including verifying client references.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
9. The CM@Risk Contractor and the Architect are selected at the same time.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
10. An accurate plan holder's list is maintained.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
11. Evaluate the ability of the CM@Risk Contractor to self-perform work.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

12. Provide that the CM@Risk Contractor must self-perform at least 45% of the work on "horizontal" projects.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Contractor Quality Assurance					
13. The GMP is provided at the 90%-95% Construction Documents Phase. (This will make subcontractor pricing more reliable.)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
14. Provide that the CM@Risk Contractor selects **major** subcontractors based on qualifications or a combination of qualification and price.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
15. The CM@Risk Contract contains provisions requiring the Contractor to provide a resource loaded work plan for pre-construction tasks.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
16. Owner approval is obtained on the CM@Risk Contractor's Subcontractor Plan. (The subcontractors to be used, scope of work, etc.).	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
17. Provide that major subcontractors are selected early so that they participate in the design process.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
18. Require that the CM@Risk Contractor make recommendations for long-lead procurement items, to expedite the project or to save costs.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
19. Require that the CM@Risk Contractor provide a narrative discussing his evaluation and approach to his critical path work as part of the selection process.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
GMP and Contingencies					
20. The Contractor's GMP is evaluated for price and scope.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
21. The Contractor's Contingency is identified and agreed-to by the Owner.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
22. The Owner's Contingency is defined.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Project Management					
23. Project Managers are trained on Alternative Delivery Methods.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
24. Project Managers continually receive technical training.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Design					
25. Require that Partnering sessions are held with all stakeholders.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
26. Require that the A/E submits a fee proposal that includes all work	☐	☐	☐	☐	☐

to be performed.	1	2	3	4	5
27. Require that the Project Team agree that the project cost estimate conforms to the project budget at 50% design documents.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
28. Require that the Project Team, including the CM@Risk Contractor, continually evaluates the Program versus the progress drawings to prevent scope creep.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
29. Require that informal Value Engineering is done continually during the design process.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
30. Require that a formal Value Engineering workshop is held for projects with a value greater than $10 million at the Design Development Phase.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Construction Management					
31. On federally funded projects, a Labor Compliance representative addresses the Federal Labor standards and requirements at the pre-proposal conference.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
32. Proposed Change Orders to be funded by the Owner's Contingency are carefully evaluated for payment.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
33. A clear protocol is established for resolving issues (a written program that establishes the documentation and communication chain between the team members).	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Revised November 2006
Thank you for completing the survey.

APPENDIX B

Table 3.1 - Traditional BMP Implementation Survey Results with Targets
Table 3.2 - CM@Risk BMP Implementation Survey Results
Table 3.3 - Status of BMP Implementation – Traditional
Table 3.4 - Status of BMP Implementation – CM@Risk
Table 3.5 – Implementation of BMPs in 2007

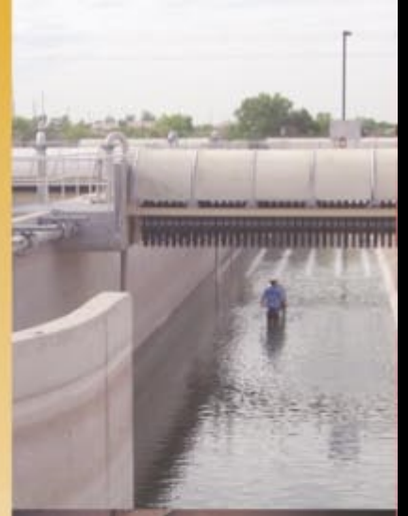


Table 3.1 - 2007 Implementation of Best Management Practices for Traditional Method

Process Category	Ref. No.	Best Management Practices	Pima County					Pinal County	Maricopa County		MCCCD	City of Phoenix			City of Tucson			
			WMD	PKS	DOT	FCD	FM		DOT	Parks		EAS	Streets	Water	Parks	DOT	Water	GSD
Planning	1	Complete feasibility studies are done on projects prior to defining scope and budget.	3	4	3	4	4	1	4	3	5	3	2	3	2	1 2007	2	2
	2	Projects are well defined with respect to scope and budget, including obtaining tenant (or client) approval prior to the start of design.	3	5	4	4	3	4	3	5	5	1	3	3	3	3	3	3
			2006 Target															
	3	The Agency has a prioritization system.	3	3	1	5	4	5	5	5	2	4	4	5	3	2	4	2
	4	Program planning includes design and construction resource loading.	2	4	3	3	4	5	1	5	2	4	4	4	1	2	1	1
	5	Program planning includes a Master Schedule that includes start and finish dates for each project.	2	5	4	3	4	5	1 2006	5	4	3	2	5	1	1 2007	3	3
	6	All projects are shown on a Geographical Information System.	2	5	5	5	2	3	1 2006	3	1	4 2007	3	5	1	5	5	1
Design	7	Designers are provided with a clear, precise, scope, schedule, and budget prior to design start.	2	5	4	4	4	5	3	5	5	5	3	3	4	4	3	3
	8	Requirements for reliability, maintenance, and operation are defined prior to design initiation.	3	3	4	3	2	5	3	5	3	4	4	3	2	2	3	2
	9	Successful designs are re-used and site adapted whenever possible.	3	4	1	5	2	5	1	5	2	5	3	3	4	4	4	2
	10	Scope changes are limited to the early stages in design.	3	2	3	3	4	3	2	4	4	2	2	0	4	2 2006	3	2
			2006 Target															
QA/QC	11	Approved scope changes are accompanied by budget and schedule modifications.	4	4	5	5	3	4	2	5	4	5	3	2	5	5	5	3
															2006 Target			
	12	A standardized Project Delivery Manual is used on all projects.	3	3	5	4	2	4	1	5	4	4	4	5	1	4	4	3
															2006 Target			
	13	Value Engineering Studies are performed on all projects with a value greater than $1 million.	2	4	2	3	4	2	2	4	4	5	3	3	1	1 2007	2	1
	14	A formal Quality Management System is used to assure the quality of the design documents and of construction.	3	3	3	3	2	3	2	2	3	3	2	2	2	1 2007	2	4
	15	Post project reviews are performed and used to identify "lessons learned."	4	4	2	4	3	3	2	5	4	5	4	4	2	3	3	3
			2006 Target															

Table 3.1 - 2007 Implementation of Best Management Practices for Traditional Method

Process Category	Ref. No.	Best Management Practice	Pima County					Pinal County	Maricopa County		MCCCD	City of Phoenix			City of Tucson			
			WMD	PKS	DOT	FCD	FM		DOT	Parks		EAS	Streets	Water	Parks	DOT	Water	GSD
Construction Management	16	Change orders are classified by type.	2	2	1	5	4	2	5	5	5	5	5	5	1	5	2	3
	17	A formal Dispute Resolution Process is included in all contracts.	5	5	4	5	5	5	5	5	3	5	5	1	5	5	5	5
	18	A team building process is used on all projects with a value greater than $5 million.	3	5	5	4	4	4	5	3	1	2	2	5	5	3	3	2
	19	The Construction Management team is involved in the project before the completion of design.	4	2	5	3	4	5	5	4	5	5	5	5	4	2	2	3
			2006 Target															
Project Management	20	A pre-qualification process is used on large, complex projects.	1	5	1	4	1	2	1	5	5	5	5	5	5	0	2	4
	21	Bid advertisements are available online.	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5
	22	Bid documents are available online.	5	2	2	3	1	5	5	4	2	1	1	1	1	1	1	1
	23	Bids can be submitted/accepted online.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	24	Formal training for project managers is provided on a regular basis.	3	4	4	4	2	4	2	3	4	5	4	5	2	0	2	2
									2006 Target			2007						
	25	A standard Project Controls System is used on all projects.	2	3	5	3	2	1	2	2	5		4	5	5	0	4	4
												2007						
	26	There is a special project management team for small projects.	1	3	1	4	4	1	1	5	1	1	3	4	1	3	1	2
	27	There are procedures in place to measure and ensure Project Manager performance and accountability.	3	4	1	3	2	3	3	4	5	4	3	3	3	0	5	2
	28	Standard contracts for consulting services, with critical clauses (i.e. indemnification) are included in RFQ/RFPs.	5	5	5	5	5	5	5	5	5		5	1	5	0	5	4
Consultant Selection	29	A consultant rating system has been implemented that identifies the quality of each consultant's performance on previous projects.	1	5	4	5	5	1	1	4	4	1	1	1	4	0	5	3
															2006 Target			

Table 3.1 - 2007 Implementation of Best Management Practices for Traditional Method

Process Category	Ref. No.	Best Management Practice	Pima County					Pinal County	Maricopa County		MCCCD	City of Phoenix			City of Tucson			
			WMD	PKS	DOT	FCD	FM		DOT	Parks		EAS	Streets	Water	Parks	DOT	Water	GSD
Program Management	30	A rotating RFQ process for contracting small projects has been implemented to streamline the bidding and award process (include criteria for exemptions from formal Council/Board approval).	1	5	1	4	5	1	5	5	5	1	1	5	1	0	2	3
	31	A financial system has been implemented that tracks expenditures by category, adequate to monitor project hard and soft costs during project delivery.	3	5	4	5	5	5	3	2	5	5	5	5	5	3	3	5
	32	A Work Breakdown Structure (WBS) has been implemented to measure progress on project deliverables.	4	4	1	5	4	4	3	1	1	4	4	5	1	1 2007	1	2
	33	"Earned value" versus budgeted and actual expenditures is monitored during project delivery.	1	2	2	3	1	1	3	1	2	1	1	5	1	1 2006 2007	1	2
	34	Verification procedures have been implemented to ensure that PM training includes agency policies, procedures, forms, and standards of practice (scheduling, claims avoidance, risk analysis, etc).	3	4	3	4	2	4	1	3	3	2	2	3	1	0	2	2
	35	Small projects are bundled whenever possible.	4	4	2	4	2	3	5	5	2	1	3	4	3	3	3	2
	36	As-needed, rotating, or on-call contracts are implemented for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects.	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

Table 3.2 - 2007 Implementation of Best Management Practices for CM@Risk Method

Ref	Best Management Practice	Pima County					Pinal County	MCCCD	City of Phoenix		City of Tucson		Maricopa County	
		PROC	WMD	PKS	DOT	FCD			EAS	Water	Parks	GSD	DOT	Parks
	Planning/Selection Process													
1	Conduct pre-proposal conference(s) requiring attendance by A/E and CM@Risk Contractors proposing to participate in the project.	1	5	4	4	2	4	2	3	3	5	1	4	5
2	The evaluation panels for selecting the A/E and the CM@Risk Contractor include appropriate user group representatives (the A/E should not be on the CM@Risk evaluation panel and the CM@Risk Contractor should not be on the A/E evaluation panel).	5	5	3	3	3	5	5	5	5	2	1	3	5
3	The CM@Risk Contractor is selected based on the fit of the Contractor to the size and type of project.	4	5	5	5	4	5	5	5	5	5	3	5	5
4	The Architect's Contract requires a design schedule for deliverables.	2	5	2	2	4	4	5	4	4	5	4	4	5
5	The selected CM@Risk Contractor has experience with CM@Risk projects. (This requirement may be weighted in the selection evaluation, based on the type of project and the number of potential Contractors able to do the work.)	4	5	4	2	4	5	5	3	3	4	5	5	5
6	The selected A/E has experience with CM@Risk projects.	3	5	4	2	4	5	4	3	3	4	5	1	5
7	Require that the A/E submits a fee proposal that includes all work to be performed.	2	5	3	4	5	5	5	5	5	5	5	5	5
8	Due diligence is performed on the selected CM@Risk Contractor including verifying client references.	3	5	3	4	5	5	3	5	3	3	4	5	5
9	The CM@Risk Contractor and the Architect are selected at the same time.	2	4	1	1	3	1	4	4	2	1	1	1	3
10	An accurate plan holder's list is maintained.	1	0	5	1	5	5	5		5	5	5	5	5
11	Evaluate the ability of the CM@Risk Contractor to self-perform work.	5	3	4	4	4	5	2	1	3	4	2	5	5
12	Provide that the CM@Risk Contractor must self-perform at least 45% of the work on "horizontal" projects.	5	0		5	5	5	0	5	1	1		5	5
	Contractor Quality Assurance													
13	The GMP is provided at the 90%-95% Construction Documents Phase. (This will make subcontractor pricing more reliable.)	2	4	4	3	4	2	5	4	4	4	4	4	5
14	Provide that the CM@Risk Contractor selects **major** subcontractors based on qualifications or a combination of qualification and price.	5	4	5	4	5	5	5	4	3	5	4	4	5
15	The CM@Risk Contract contains provisions requiring the Contractor to provide a resource loaded work plan for pre-construction tasks.	2	4	1	1	3	5	1	3	3	1	1	1	5
16	Owner approval is obtained on the CM@Risk Contractor's Subcontractor Plan. (The subcontractors to be used, scope of work, etc.)	3	3	4	3	5	5	5	1	5	5	3	3	5
17	Provide that major subcontractors are selected early so that they participate in the design process	3	2	4	4	5	3	3	3	5	1	3	1	5
18	Require that the CM@Risk Contractor make recommendations for long-lead procurement items, to expedite the project or to save costs.	4	3	3	4	4	5	5	5	5	3	3	4	5
19	Require that the CM@Risk Contractor provide a narrative discussing his evaluation and approach to his critical path work as part of the selection process.	3	2	4	1	4	4	2	3	4	1	3	1	4
	GMP and Contingencies													
20	The Contractor's GMP is evaluated for price and scope.	4	4	4	4	5	5	4	5	4	5	3	5	5
21	The Contractor's Contingency is identified and agreed-to by the Owner.	4	5	4	5	5	5	5	5	3	5	4	5	5
22	The Owner's Contingency is defined	4	5	3	5	5	5	5	5	5	5	5	3	5

Table 3.2 - 2007 Implementation of Best Management Practices for CM@Risk Method

Ref	Best Management Practice	Pima County					Pinal County	MCCCD	City of Phoenix		City of Tucson		Maricopa County	
		PROC	WMD	PKS	DOT	FCD			EAS	Water	Parks	GSD	DOT	Parks
	Project Management													
23	Project Managers are trained on Alternative Delivery Methods.	2	4	3	3	3	4	4	5	5	3	3	1	5
24	Project Managers continually receive technical training.	2	3	2	4	4	5	4	5	5	2	2	1	5
	Design													5
25	Require that Partnering sessions are held with all stakeholders.	2	3	2	5	5	5	1	5	4	5	2	4	5
26	Require that the A/E submits a fee proposal that includes all work to be performed.	2	5	3	4	5	5	5	5	5	5	5	4	5
27	Require that the Project Team agree that the project cost estimate conforms to the project budget at 50% design documents	2	1	4	2	5	5	5	3	2	3	2	1	5
28	Require that the Project Team, including the CM@Risk Contractor, continually evaluates the Program versus the progress drawings to prevent scope creep.	2	3	4	2	5	5	5	4	4	5	3	1	5
29	Require that informal Value Engineering is done continually during the design process.	3	4	5	4	5	5	3	4	4	5	3	1	5
30	Require that a formal Value Engineering workshop is held for projects with a value greater than $10 million at the Design Development Phase	1	1		1	2	3	2	1	1	0	1	3	5
	Construction Management													
31	On federally funded projects, a Labor Compliance representative addresses the Federal Labor standards and requirements at the pre-proposal conference.	3	N/A		5	5	1	0	5	1	5	5	0	0
32	Proposed Change Orders to be funded by the Owner's Contingency are carefully evaluated for payment.	3	5	3	4	5	5	5	5	5	5	5	4	5
33	A clear protocol is established for resolving issues (a written program that establishes the documentation and communication chain between the team members).	3	4	3	5	5	5	2	5	3	5	2	5	5

Table 3.3 - 2007 Level of Implementation of Best Management Practices for Traditional Method

Sum	Ref. No.	Best Management Practice	Pima County					Pinal County	Maricopa County		MCCCD	City of Phoenix			City of Tucson			
			WMD	PKS	DOT	FCD	FM		DOT	Parks		EAS	Streets	Water	Parks	DOT	Water	GSD
80	36	As-needed, rotating, or on-call contracts are implemented for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects.	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
79	21	Bid advertisements are available online.	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5
73	17	A formal Dispute Resolution Process is included in all contracts.	5	5	4	5	5	5	5	5	3	5	5	1	5	5	5	5
68	31	A financial system has been implemented that tracks expenditures by category, adequate to monitor project hard and soft costs during project delivery.	3	5	4	5	5	5	3	2	5	5	5	5	5	3	3	5
65	28	Standard contracts for consulting services, with critical clauses (i.e. indemnification) are included in RFQ/RFPs.	5	5	5	5	5	5	5	5	5		5	1	5	0	5	4
64	11	Approved scope changes are accompanied by budget and schedule modifications.	4	4	5	5	3	4	2	5	4	5	3	2	5	5	5	3
63	19	The Construction Management team is involved in the project before the completion of design.	4	2	5	3	4	5	5	4	5	5	5	5	4	2	2	3
62	7	Designers are provided with a clear, precise, scope, schedule, and budget prior to design start.	2	5	4	4	4	5	3	5	5	5	3	3	4	4	3	3
57	3	The Agency has a prioritization system.	3	3	1	5	4	5	5	5	2	4	4	5	3	2	4	2
57	16	Change orders are classified by type.	2	2	1	5	4	2	5	5	5	5	5	5	1	5	2	3
56	12	A standardized Project Delivery Manual is used on all projects.	3	3	5	4	2	4	1	5	4	4	4	5	1	4	4	3
56	18	A team building process is used on all projects with a value greater than $5 million.	3	5	5	4	4	4	5	3	1	2	2	5	5	3	3	2
55	2	Projects are well defined with respect to scope and budget, including obtaining tenant (or client) approval prior to the start of design.	3	5	4	4	3	4	3	5	5	1	3	3	3	3	3	3
55	15	Post project reviews are performed and used to identify "lessons learned."	4	4	2	4	3	3	2	5	4	5	4	4	2	3	3	3
53	9	Successful designs are re-used and site adapted whenever possible.	3	4	1	5	2	5	1	5	2	5	3	3	4	4	4	2
51	5	Program planning includes a Master Schedule that includes start and finish dates for each project.	2	5	4	3	4	5	1	5	4	3	2	5	1	1	3	3
51	6	All projects are shown on a Geographical Information System.	2	5	5	5	2	3	1	3	1	4	3	5	1	5	5	1
51	8	Requirements for reliability, maintenance, and operation are defined prior to design initiation.	3	3	4	3	2	5	3	5	3	4	4	3	2	2	3	2
51	20	A pre-qualification process is used on large, complex projects.	1	5	1	4	1	2	1	5	5	5	5	5	5	0	2	4
50	24	Formal training for project managers is provided on a regular basis.	3	4	4	4	2	4	2	3	4	5	4	5	2	0	2	2
50	35	Small projects are bundled whenever possible.	4	4	2	4	2	3	5	5	2	1	3	4	3	3	3	2
48	27	There are procedures in place to measure and ensure Project Manager performance and accountability.	3	4	1	3	2	3	3	4	5	4	3	3	3	0	5	2

Targeted in 2006 = Yellow
Targeted in 2007 = Orange

Table 3.3 - 2007 Level of Implementation of Best Management Practices for Traditional Method

Sum	Ref. No.	Best Management Practice	Pima County					Pinal County	Maricopa County		MCCCD	City of Phoenix			City of Tucson			
			WMD	PKS	DOT	FCD	FM		DOT	Parks		EAS	Streets	Water	Parks	DOT	Water	GSD
47	25	A standard Project Controls System is used on all projects.	2	3	5	3	2	1	2	2	5		4	5	5	0	4	4
46	1	Complete feasibility studies are done on projects prior to defining scope and budget.	3	4	3	4	4	1	4	3	5	3	2	3	2	1	2	2
46	4	Program planning includes design and construction resource loading.	2	4	3	3	4	5	1	5	2	4	4	4	1	2	1	1
45	29	A consultant rating system has been implemented that identifies the quality of each consultant's performance on previous projects.	1	5	4	5	5	1	1	4	4	1	1	1	4	0	5	3
45	30	A rotating RFQ process for contracting small projects has been implemented to streamline the bidding and award process (include criteria for exemptions from formal Council/Board approval).	1	5	1	4	5	1	5	5	5	1	1	5	1	0	2	3
45	32	A Work Breakdown Structure (WBS) has been implemented to measure progress on project deliverables.	4	4	1	5	4	4	3	1	1	4	4	5	1	1	1	2
43	10	Scope changes are limited to the early stages in design.	3	2	3	3	4	3	2	4	4	2	2	0	4	2	3	2
43	13	Value Engineering Studies are performed on all projects with a value greater than $1 million.	2	4	2	3	4	2	2	4	4	5	3	3	1	1	2	1
40	14	A formal Quality Management System is used to assure the quality of the design documents and of construction.	3	3	3	3	2	3	2	2	3	3	2	2	2	1	2	4
39	34	Verification procedures have been implemented to ensure that PM training includes agency policies, procedures, forms, and standards of practice (scheduling, claims avoidance, risk analysis, etc).	3	4	3	4	2	4	1	3	3	2	2	3	1	0	2	2
36	22	Bid documents are available online.	5	2	2	3	1	5	5	4	2	1	1	1	1	1	1	1
36	26	There is a special project management team for small projects.	1	3	1	4	4	1	1	5	1	1	3	4	1	3	1	2
28	33	"Earned value" versus budgeted and actual expenditures is monitored during project delivery.	1	2	2	3	1	1	3	1	2	1	1	5	1	1	1	2
16	23	Bids can be submitted/accepted online.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Targeted in 2006 = Yellow
Targeted in 2007 = Orange

Table 3.4 - 2007 Level of Implementation for Best Management Practices -- CM @Risk

Level of Implementation	Ref	Best Management Practice	Pima County					Pinal County	MCCCD	City of Phoenix		City of Tucson		Maricopa
			PROC	WMD	PKS	DOT	FCD			EAS	Water	Parks	GSD	DOT
61	3	The CM@Risk Contractor is selected based on the fit of the Contractor to the size and type of project.	4	5	5	5	4	5	5	5	5	5	3	5
60	21	The Contractor's Contingency is identified and agreed-to by the Owner.	4	5	4	5	5	5	5	5	3	5	4	5
60	22	The Owner's Contingency is defined	4	5	3	5	5	5	5	5	5	5	5	3
59	7	Require that the A/E submits a fee proposal that includes all work to be performed.	2	5	3	4	5	5	5	5	5	5	5	5
59	32	Proposed Change Orders to be funded by the Owner's Contingency are carefully evaluated for payment.	3	5	3	4	5	5	5	5	5	5	5	4
58	14	Provide that the CM@Risk Contractor selects **major** subcontractors based on qualifications or a combination of qualification and price.	5	4	5	4	5	5	5	4	3	5	4	4
58	26	Require that the A/E submits a fee proposal that includes all work to be performed.	2	5	3	4	5	5	5	5	5	5	5	4
57	20	The Contractor's GMP is evaluated for price and scope.	4	4	4	4	5	5	4	5	4	5	3	5
54	5	The selected CM@Risk Contractor has experience with CM@Risk projects. (This requirement may be weighted in the selection evaluation, based on the type of project and the number of potential Contractors able to do the work.)	4	5	4	2	4	5	5	3	3	4	5	5
53	8	Due diligence is performed on the selected CM@Risk Contractor including verifying client references.	3	5	3	4	5	5	3	5	3	3	4	5
52	33	A clear protocol is established for resolving issues (a written program that establishes the documentation and communication chain between the team members).	3	4	3	5	5	5	2	5	3	5	2	5
52	18	Require that the CM@Risk Contractor make recommendations for long-lead procurement items, to expedite the project or to save costs.	4	3	3	4	4	5	5	5	5	3	3	4
51	29	Require that informal Value Engineering is done continually during the design process.	3	4	5	4	5	5	3	4	4	5	3	1
50	2	The evaluation panels for selecting the A/E and the CM@Risk Contractor include appropriate user group representatives (the A/E should not be on the CM@Risk evaluation panel and the CM@Risk Contractor should not be on the A/E evaluation panel).	5	5	3	3	3	5	5	5	5	2	1	3
50	16	Owner approval is obtained on the CM@Risk Contractor's Subcontractor Plan. (The subcontractors to be used, scope of work, etc.)	3	3	4	3	5	5	5	1	5	5	3	3
50	4	The Architect's Contract requires a design schedule for deliverables.	2	5	2	2	4	4	5	4	4	5	4	4

Table 3.4 - 2007 Level of Implementation for Best Management Practices -- CM @Risk

Level of Implementation	Ref	Best Management Practice	Pima County					Pinal County	MCCCD	City of Phoenix		City of Tucson		Maricopa
			PROC	WMD	PKS	DOT	FCD			EAS	Water	Parks	GSD	DOT
49	13	The GMP is provided at the 90%-95% Construction Documents Phase. (This will make subcontractor pricing more reliable.)	2	4	4	3	4	2	5	4	4	4	4	4
48	25	Require that Partnering sessions are held with all stakeholders.	2	3	2	5	5	5	1	5	4	5	2	4
48	28	Require that the Project Team, including the CM@Risk Contractor, continually evaluates the Program versus the progress drawings to prevent scope creep.	2	3	4	2	5	5	5	4	4	5	3	1
48	6	The selected A/E has experience with CM@Risk projects.	3	5	4	2	4	5	4	3	3	4	5	1
47	11	Evaluate the ability of the CM@Risk Contractor to self-perform work.	5	3	4	4	4	5	2	1	3	4	2	5
47	10	An accurate plan holder's list is maintained.	1	0	5	1	5	5	5		5	5	5	5
45	23	Project Managers are trained on Alternative Delivery Methods.	2	4	3	3	3	4	4	5	5	3	3	1
44	24	Project Managers continually receive technical training.	2	3	2	4	4	5	4	5	5	2	2	1
43	1	Conduct pre-proposal conference(s) requiring attendance by A/E and CM@Risk Contractors proposing to participate in the project.	1	5	4	4	2	4	2	3	3	5	1	4
42	17	Provide that major subcontractors are selected early so that they participate in the design process	3	2	4	4	5	3	3	3	5	1	3	1
40	27	Require that the Project Team agree that the project cost estimate conforms to the project budget at 50% design documents	2	1	4	2	5	5	5	3	2	3	2	1
37	12	Provide that the CM@Risk Contractor must self-perform at least 45% of the work on "horizontal" projects.	5	0		5	5	5	0	5	1	1		5
36	19	Require that the CM@Risk Contractor provide a narrative discussing his evaluation and approach to his critical path work as part of the selection process.	3	2	4	1	4	4	2	3	4	1	3	1
35	31	On federally funded projects, a Labor Compliance representative addresses the Federal Labor standards and requirements at the pre-proposal conference.	3	N/A		5	5	1	0	5	1	5	5	0
31	15	The CM@Risk Contract contains provisions requiring the Contractor to provide a resource loaded work plan for pre-construction tasks.	2	4	1	1	3	5	1	3	3	1	1	1
28	9	The CM@Risk Contractor and the Architect are selected at the same time.	2	4	1	1	3	1	4	4	2	1	1	1
21	30	Require that a formal Value Engineering workshop is held for projects with a value greater than $10 million at the Design Development Phase	1	1		1	2	3	2	1	1	0	1	3

Table 3.5 - 2006 Level of Implementation of Best Management Practices for Traditional Method

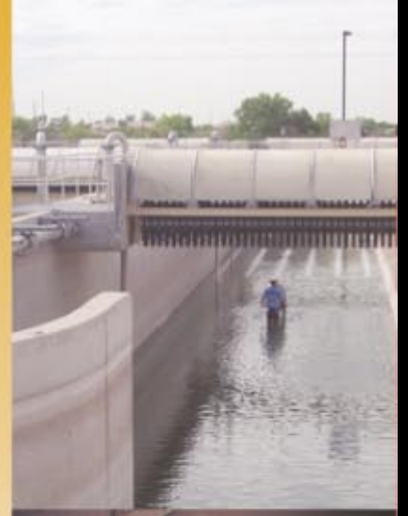
Level of Implementation	Ref.	Best Management Practice	Pima County					Pinal County	Maricopa County	MCCD	City of Phoenix			City of Tucson				City of Mesa
			WMD	PKS	DOT	FCD	FM				EAS	Streets	Water	Parks	DOT	Water	GSD	
68	28	Standard contracts for consulting services, with critical clauses (i.e. indemnification) are included in RFQ/RFPs.	5	5	4	5	5	4	5	5	2	5	1	5	4	4	4	5
67	21	Bid advertisements are available online.	5	5	5	5	5	1	5	4	4	3	5	5	4	1	5	5
65	17	A formal Dispute Resolution Process is included in all contracts.	4	5	3	5	5	3	5	3	4	4	1	5	4	5	4	5
65	19	The Construction Management team is involved in the project before the completion of design.	4	5	4	4	5	5	5	5	5	5	4	5	3	1	3	2
64	31	A financial system has been implemented that tracks expenditures by category, adequate to monitor project hard and soft costs during project delivery.	5	5	5	4	5	5	1	5	5	5	5	3	3	3	2	3
63	20	A pre-qualification process is used on large, complex projects.	4	5	3	5	4	5	1	5	5	5	5	4	4	2	4	2
63	36	As-needed, rotating, or on-call contracts are implemented for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects.	5	4	4	5	4	5	5	5	4	4	5		4	5	4	
61	3	The Agency has a prioritization system.	3	4	2	4	4	4	5	3	3	5	5	4	4	4	2	5
58	11	Approved scope changes are accompanied by budget and schedule modifications.	3	4	3	5	5	4	1	4	2	3	5	4	3	5	3	4
58	29	A consultant rating system has been implemented that identifies the quality of each consultant's performance on previous projects.	3	5	3	5	5	1	3	4	5	5	1	5	2	5	3	3
58	30	A rotating RFQ process for contracting small projects has been implemented to streamline the bidding and award process (include criteria for exemptions from formal Council/Board approval).	5	5	5	5	5	1	5	5	4	4	5	1	3	2	2	1
57	5	Program planning includes a Master Schedule that includes start and finish dates for each project.	4	5	1	2	5	4	1	4	4	4	5	5	3	3	3	4
56	2	Projects are well defined with respect to scope and budget, including obtaining tenant (or client) approval prior to the start of design.	3	3	3	4	3	4	3	5	2	4	3	5	4	3	3	4
55	7	Designers are provided with a clear, precise, scope, schedule, and budget prior to design start.	3	5	4	3	4	2	3	4	2	4	3	5	3	2	3	5
54	6	All projects are shown on a Geographical Information System.	5	5	3	5	5	2	1	1	2	4	4	2	4	5	1	5
54	18	A team building process is used on all projects with a value greater than $5 million.	4	4	4	5	3	4	5	1	2	2	5	4	4	3	1	3

Table 3.5 - 2006 Level of Implementation of Best Management Practices for Traditional Method

Level of Implementation	BMP	Best Management Practice	Pima County					Pinal County	Maricopa County	MCCD	City of Phoenix			City of Tucson				City of Mesa
			WMD	PKS	DOT	FCD	FM				EAS	Streets	Water	Parks	DOT	Water	GSD	
53	16	Change orders are classified by type.	4	2	3	1	5	1	5	5	5	5	5	2	4	2	2	2
53	32	A Work Breakdown Structure (WBS) has been implemented to measure progress on project deliverables.	4	5	1	3	5	2	5	1	5	5	5	4	2	1	5	
50	12	A standardized Project Delivery Manual is used on all projects.	4	3	3	4	4	4	1	2	2	3	4	3	2	4	2	5
48	27	There are procedures in place to measure and ensure Project Manager performance and accountability.	5	3	2	3	5	1	3	3	3	4	3	4	2	3	1	3
47	8	Requirements for reliability, maintenance, and operation are defined prior to design initiation.	4	5	3	2	3	3	3	2	4	3	3	4	2	1	2	3
46	1	Complete feasibility studies are done on projects prior to defining scope and budget.	2	2	3	3	3	3	4	5	2	3	3	4	3	2	2	2
45	9	Successful designs are re-used and site adapted whenever possible.	3	5	2	3	2	4	1	1	2	3	4	4	4	4	1	2
45	10	Scope changes are limited to the early stages in design.	2	3	2	2	3	4	2	4	1	2	4	4	2	3	3	4
44	15	Post project reviews are performed and used to identify "lessons learned."	2	4	2	2	1	2	2	3	3	4	4	4	3	1	4	3
44	25	A standard Project Controls System is used on all projects.	1	3	2	3	5	1	2	5	2	4	5	2	2	2	4	1
42	14	A formal Quality Management System is used to assure the quality of the design documents and of construction	2	4	2	3	4	1	2	2	3	4	3	3	2	2	4	1
41	13	Value Engineering Studies are performed on all projects with a value greater than $1 million	2	4	2	3	2	2	3	4	3	2	3	2	3	1	1	4
41	24	Formal training for project managers is provided on a regular basis.	3	3	3	4	3	1	1	3	3	3	3	2	2	2	2	3
41	35	Small projects are bundled whenever possible.	4	3	1	3	4	2	5	2	3	3	4		2	3	2	
40	4	Program planning includes design and construction resource loading.	1	4	1	2	1	5	1	2	2	5	4	4	3	1	2	2
39	34	Verification procedures have been implemented to ensure that PM training includes agency policies, procedures, forms, and standards of practice (scheduling, claims avoidance, risk analysis, etc).	5	3	1	3	1	3	1	3	4	4	3	2	2	2	2	
37	22	Bid documents are available online.	5	2	1	5	1	1	5	2	2	1	1	4	4	1	1	1
35	26	There is a special project management team for small projects.	1	2	2	3	5	2	1	1	2	2	4	4	2	1	2	1
35	33	"Earned value" versus budgeted and actual expenditures is monitored during project delivery.	2	2	1	1	1	2	3	2	5	5	5	2	1	1	2	
17	23	Bids can be submitted/accepted online.	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1

APPENDIX C

Table 4.1 - Project Distribution Matrix - Traditional Method
Table 4.2 - Project Distribution Matrix - CM@Risk Method
Table 4.3 - Consultant's Usage Summary Report
Table 4.4 - Project Count & Project Delivery



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2007 - Table 4.1

Project Distribution Matrix (Traditional)

	City of Phoenix	City of Tucson	Maricopa County	Maricopa Community Colleges	Pima County	Pinal County	Total
Flood Control	3	5	1	0	2	0	**11**
Detention Channels / Structural	3	5	1	0	2	0	**11**
Municipal Facilities	4	15	0	2	24	2	**47**
Community Bldg./Rec. Center/CC/Gym	1	10	0	1	10	0	**22**
Libraries	0	2	0	0	4	0	**6**
Office - (TIs)	0	0	0	1	5	0	**6**
Police / Fire Station	3	3	0	0	5	2	**13**
Parks	18	6	8	0	19	0	**51**
Park Development/Additions	10	5	6	0	11	0	**32**
Restrooms	8	1	2	0	0	0	**11**
Sports Lighting Projects	0	0	0	0	8	0	**8**
Pipes & Plants	49	6	4	0	11	0	**70**
Gravity Pipes	11	0	4	0	7	0	**22**
Pressure Pipes	17	6	0	0	0	0	**23**
Treatment Plants	21	0	0	0	4	0	**25**
Streets	14	20	47	0	29	11	**121**
Bridges - (Retrofits & New)	3	0	6	0	2	0	**11**
New Construction	0	0	3	0	2	0	**5**
Reconstruction	8	18	2	0	4	11	**43**
Signals & ITS[1]	2	2	24	0	12	0	**40**
Widening	1	0	12	0	9	0	**22**
Total	**88**	**52**	**60**	**2**	**85**	**13**	**300**

[1]ITS - Intelligent Transportation Systems

2007 - Table 4.2

Project Distribution Matrix (CM@Risk)

	City of Phoenix	City of Tucson	Maricopa Community Colleges	Pima County	Total
Flood Control	1	0	0	0	**1**
Detention Channels / Structural	1	0	0	0	**1**
Municipal Facilities	21	1	2	1	**25**
Community Bldg./Rec. Center/CC/Gym	10	0	2	1	**13**
Libraries	2	0	0	0	**2**
Offices (TIs)	2	0	0	0	**2**
Police / Fire Station	7	1	0	0	**8**
Parks	11	2	0	0	**13**
Park Development/Additions	11	2	0	0	**13**
Restrooms	0	0	0	0	**0**
Sports Lighting Projects	0	0	0	0	**0**
Pipes & Plants	4	0	0	1	**5**
Gravity Pipes	2	0	0	1	**3**
Pressure Pipes	2	0	0	0	**2**
Treatment Plants	0	0	0	0	**0**
Streets	0	0	0	3	**3**
Bridges - (Retrofits & New)	0	0	0	0	**0**
New Construction	0	0	0	0	**0**
Reconstruction	0	0	0	0	**0**
Signals & ITS	0	0	0	3	**3**
Widening	0	0	0	0	**0**
Total	37	3	2	5	**47**

2007 - Table 4.3

Consultant's Usage Summary Report - All Projects

Agency Name	DESIGN					CONSTRUCTION MANAGEMENT					PROJECT DELIVERY				
	In-House		Consultants		Total as % of TCC	In-House		Consultants		Total as % of TCC	In-House		Consultants		Total as % of TCC
	($M)	% of DES	($M)	% of DES		($M)	% of CM	($M)	% of CM		($M)	% of PD	($M)	% of PD	
Agency A	16.9	36.0%	30.3	64.0%	17.0%	32.5	25.7%	94.1	74.3%	15.0%	49.9	28.5%	124.3	71.5%	31.9%
Agency B	9.9	35.4%	18.1	64.6%	24.3%	7.1	31.6%	15.4	68.4%	13.2%	17.1	33.7%	33.5	66.3%	37.5%
Agency C	5.8	31.5%	12.8	68.5%	15.9%	12.1	91.6%	1.1	8.4%	11.5%	17.9	56.4%	13.8	43.6%	27.4%
Agency D	5.4	12.9%	36.9	87.1%	16.2%	18.2	32.3%	38.1	67.7%	17.1%	23.7	24.0%	75.0	76.0%	33.3%
Agency E	0.6	5.1%	1.2	94.9%	9.3%	1.7	80.8%	0.4	19.2%	15.5%	1.8	52.5%	1.6	47.5%	24.8%
Agency F	0.4	9.0%	3.6	91.0%	13.1%	0.6	68.9%	0.3	31.1%	4.5%	0.9	19.6%	3.8	80.4%	17.6%
Overall	38.6%	27.3%	102.8	72.7%	17.8%	72.2	32.6%	149.4	67.4%	14.2%	111.3	30.5%	252.0	69.5%	32.0%

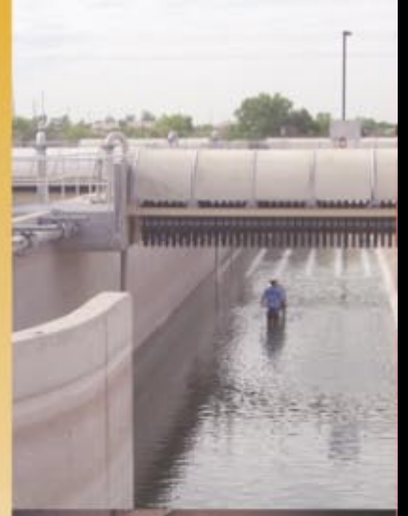
2007 - Table 4.4
Project Count and Project Delivery

2007 Project Count and Project Delivery By Completion Year											
Year Comp.	Project Type						Project Delivery Data				
	Mun. Fac.	Parks	Pipe Sys.	Streets	Flood Cntl	Total	Average TCC ($M)	Median TCC ($M)	Design %	CM %	PD %
1999	1	0	3	0	0	4	$ 2.11	$ 2.03	16.27%	23.72%	38.99%
2000	4	3	1	11	0	19	$ 2.99	$ 1.48	13.08%	15.89%	28.97%
2001	1	4	4	10	1	20	$ 2.68	$ 0.52	12.34%	12.52%	24.86%
2002	9	13	11	15	1	49	$ 4.55	$ 1.39	17.32%	12.05%	29.37%
2003	5	5	11	20	0	41	$ 4.28	$ 1.89	20.40%	14.58%	34.99%
2004	6	9	17	19	3	54	$ 2.64	$ 0.95	20.98%	13.94%	34.92%
2005	15	15	12	10	3	55	$ 3.74	$ 1.17	16.29%	12.81%	29.09%
2006	3	2	8	18	1	32	$ 4.31	$ 1.19	18.03%	16.28%	34.31%
2007	3	0	6	18	3	30					
Total	47	51	73	121	12	304	$ 3.71	$ 1.25	17.74%	14.10%	31.84%

APPENDIX D

Performance Curves – Traditional

- Flood Control
- Municipal Facilities
- Parks
- Pipes and Plants
- Streets



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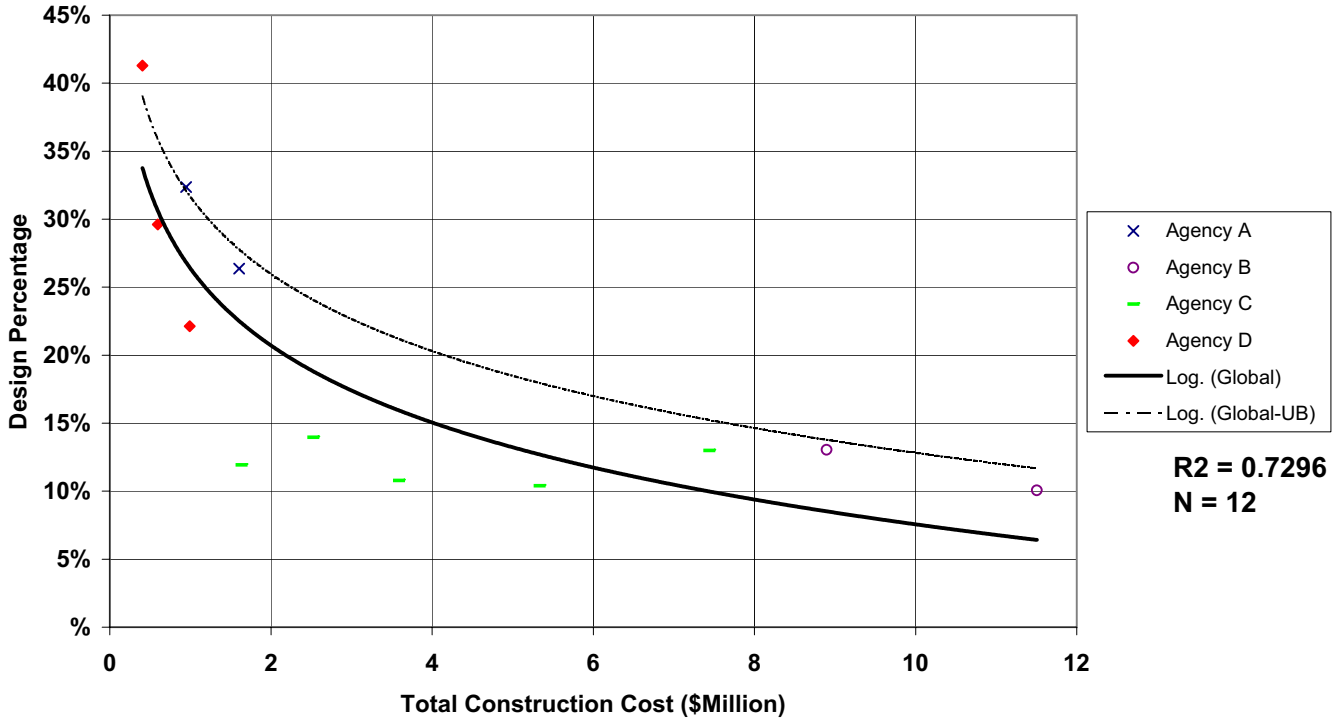
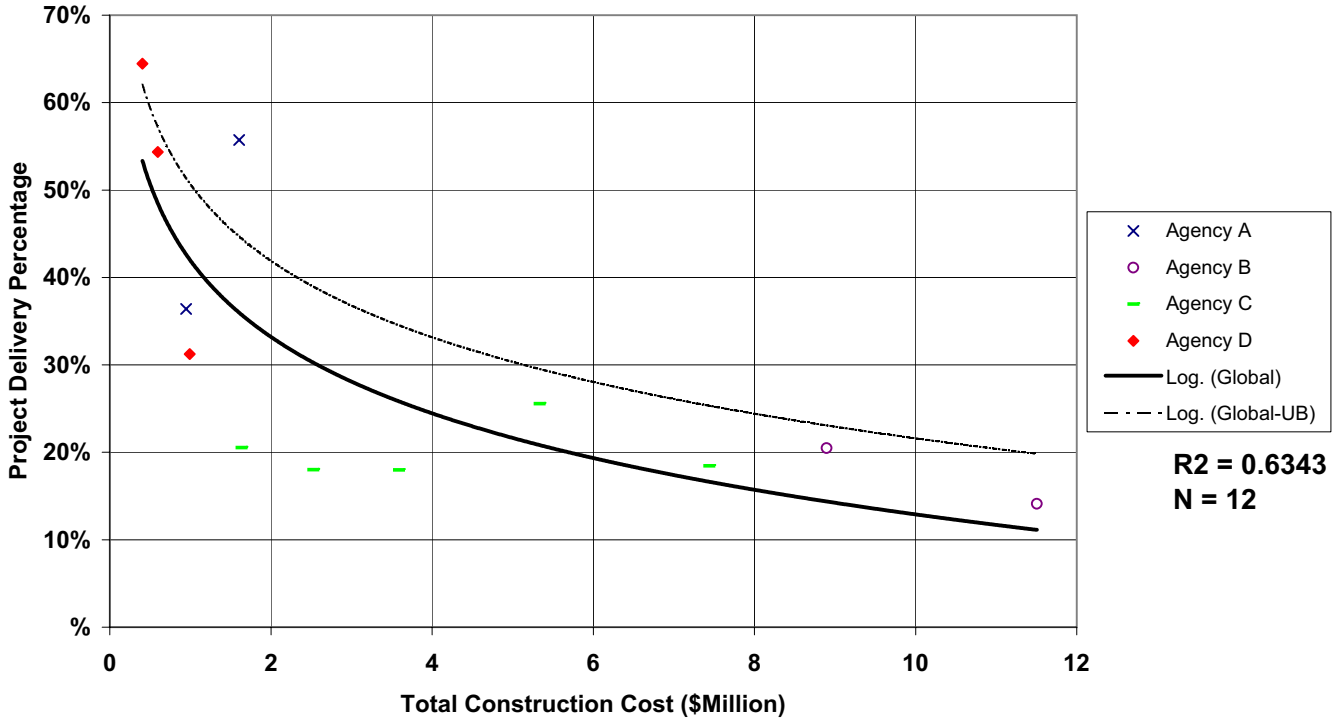
Flood Control - Detention Channels / Structural

Design Percentage Versus Total Construction Cost



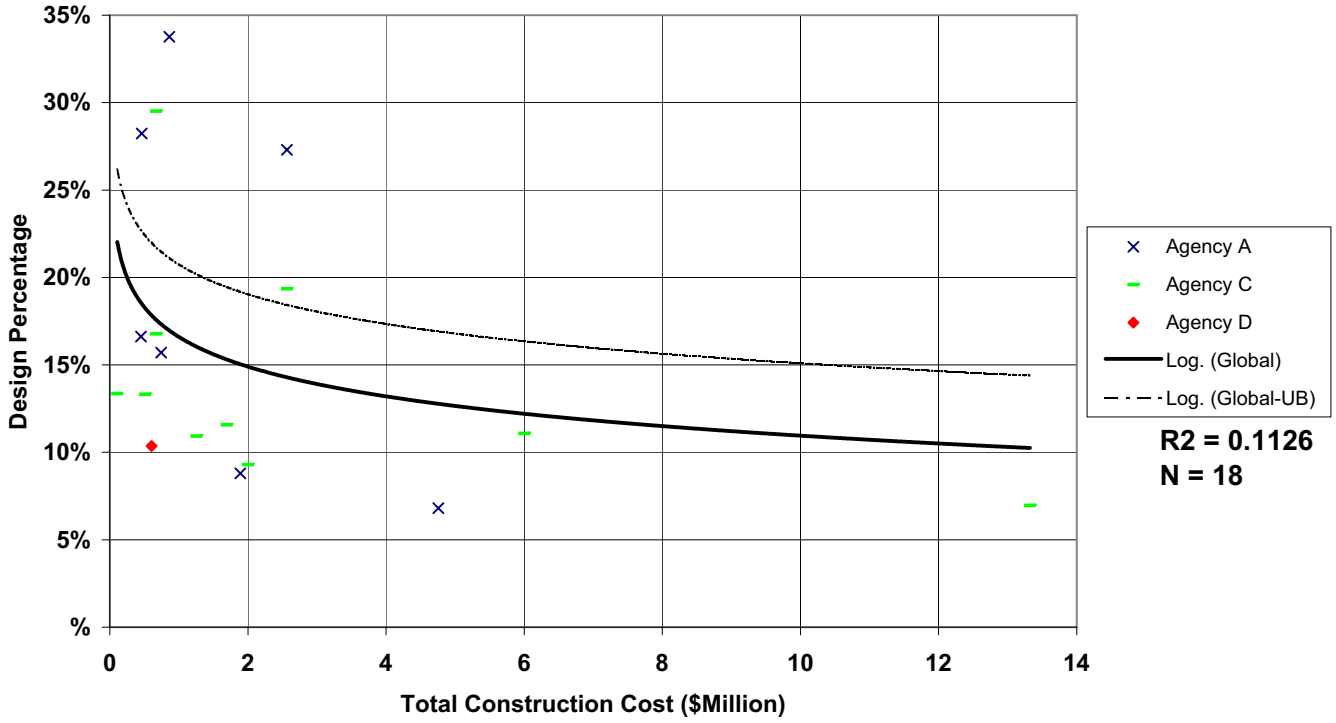
Flood Control - Detention Channels / Structural

Project Delivery Percentage Versus Total Construction Cost



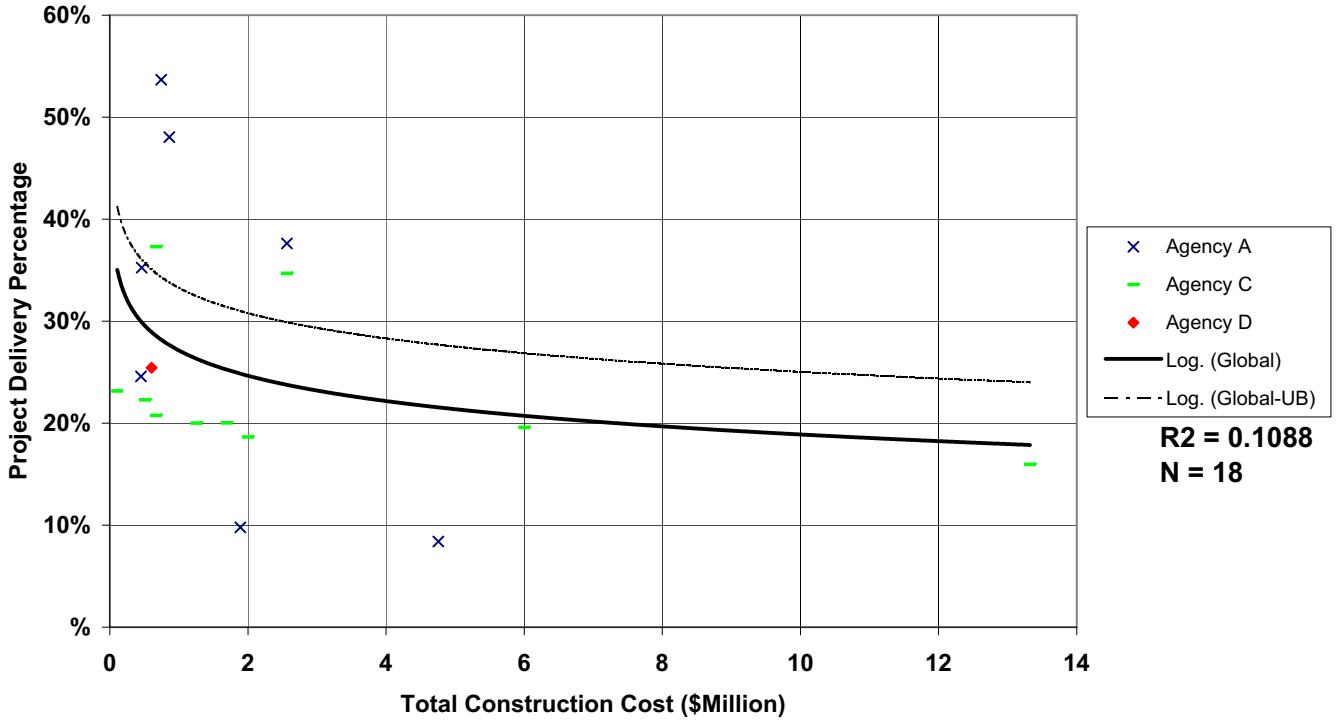
Municipal Facilities - Community Bldg./Rec. Center/CC/Gym

Design Percentage Versus Total Construction Cost



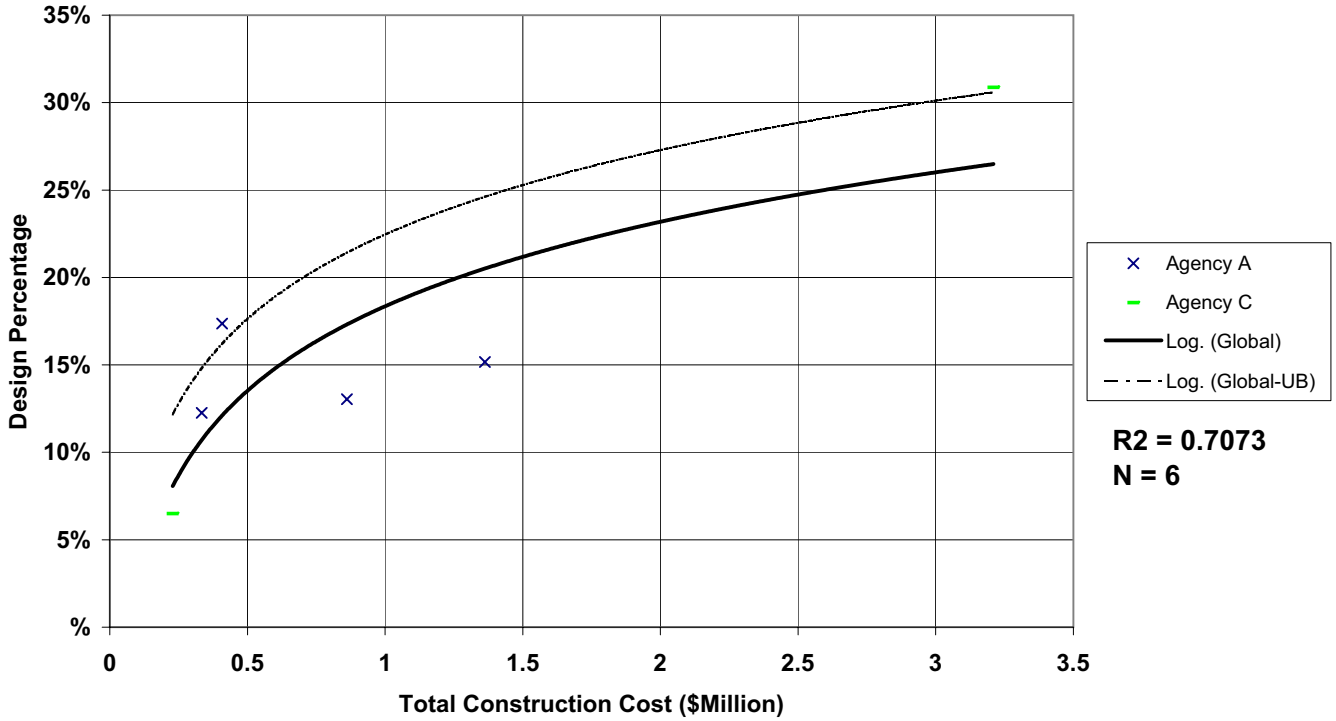
Municipal Facilities - Community Bldg./Rec. Center/CC/Gym

Project Delivery Percentage Versus Total Construction Cost



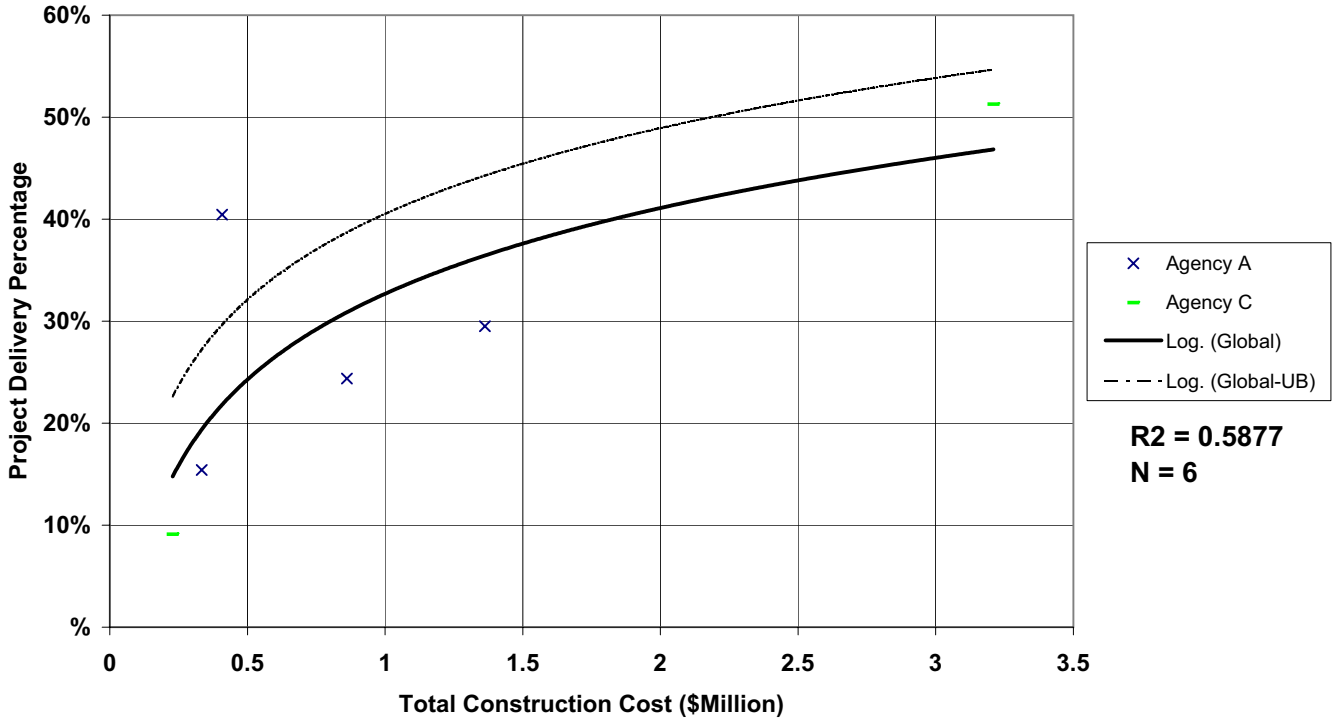
Municipal Facilities - Libraries

Design Percentage Versus Total Construction Cost



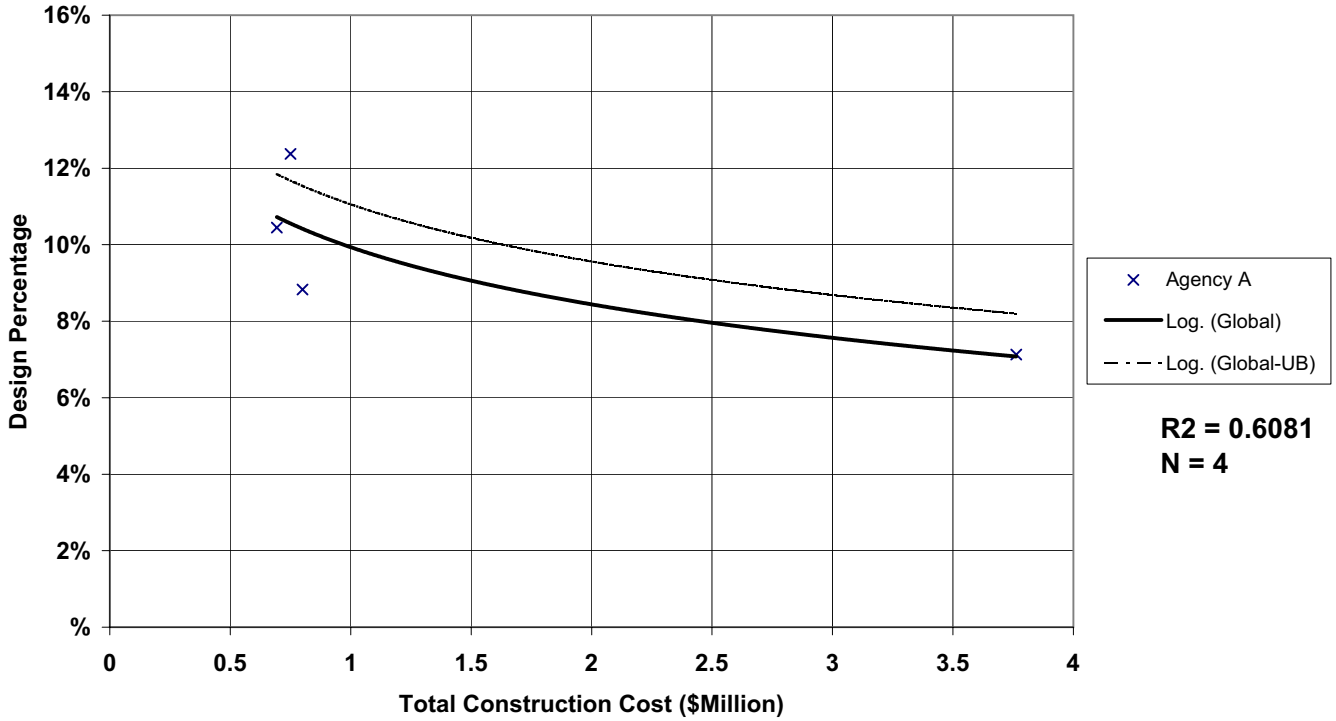
Municipal Facilities - Libraries

Project Delivery Percentage Versus Total Construction Cost



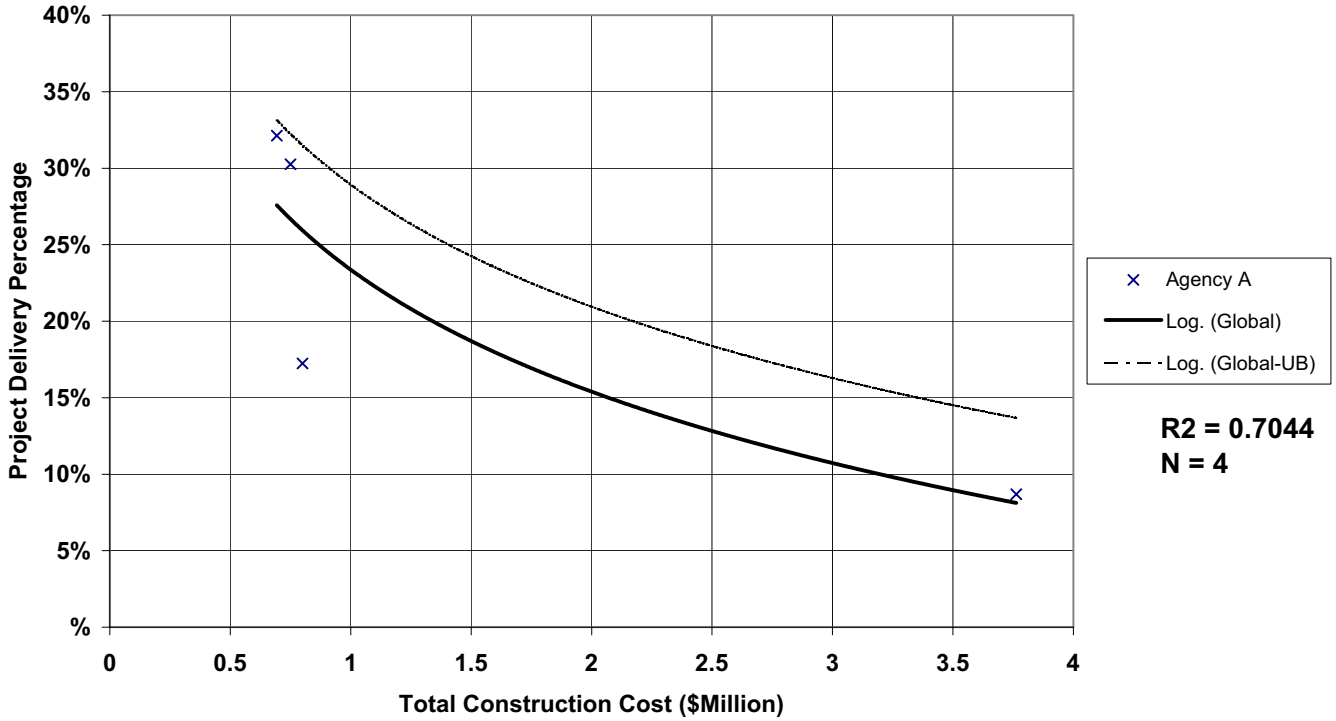
Municipal Facilities - Office - (TI's)

Design Percentage Versus Total Construction Cost



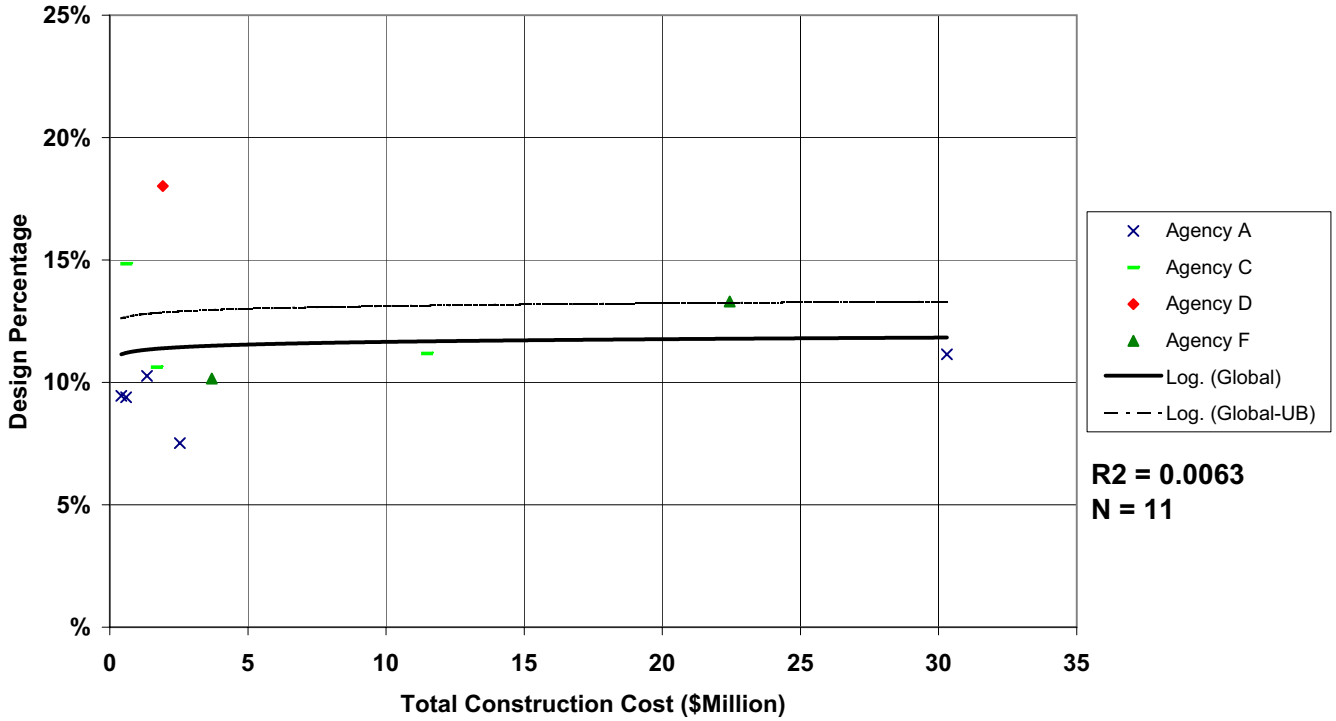
Municipal Facilities - Office - (TI's)

Project Delivery Percentage Versus Total Construction Cost



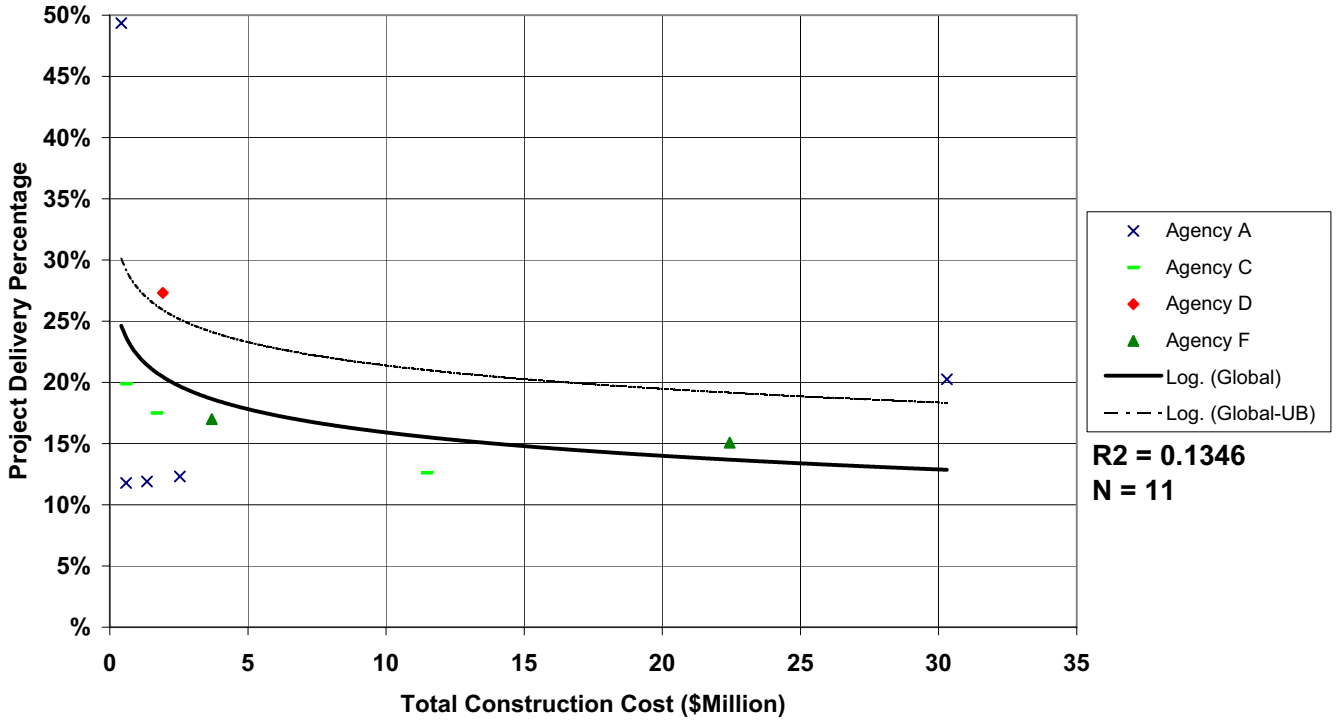
Municipal Facilities - Police / Fire Station

Design Percentage Versus Total Construction Cost



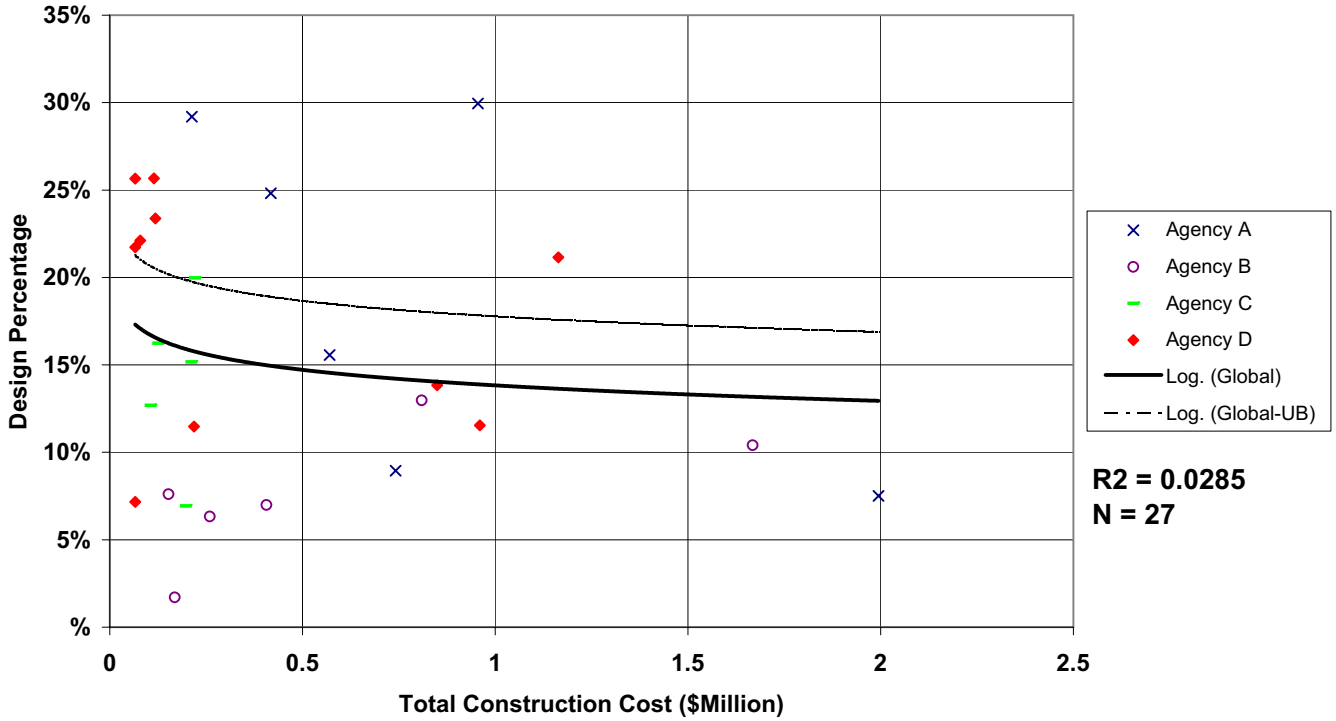
Municipal Facilities - Police / Fire Station

Project Delivery Percentage Versus Total Construction Cost



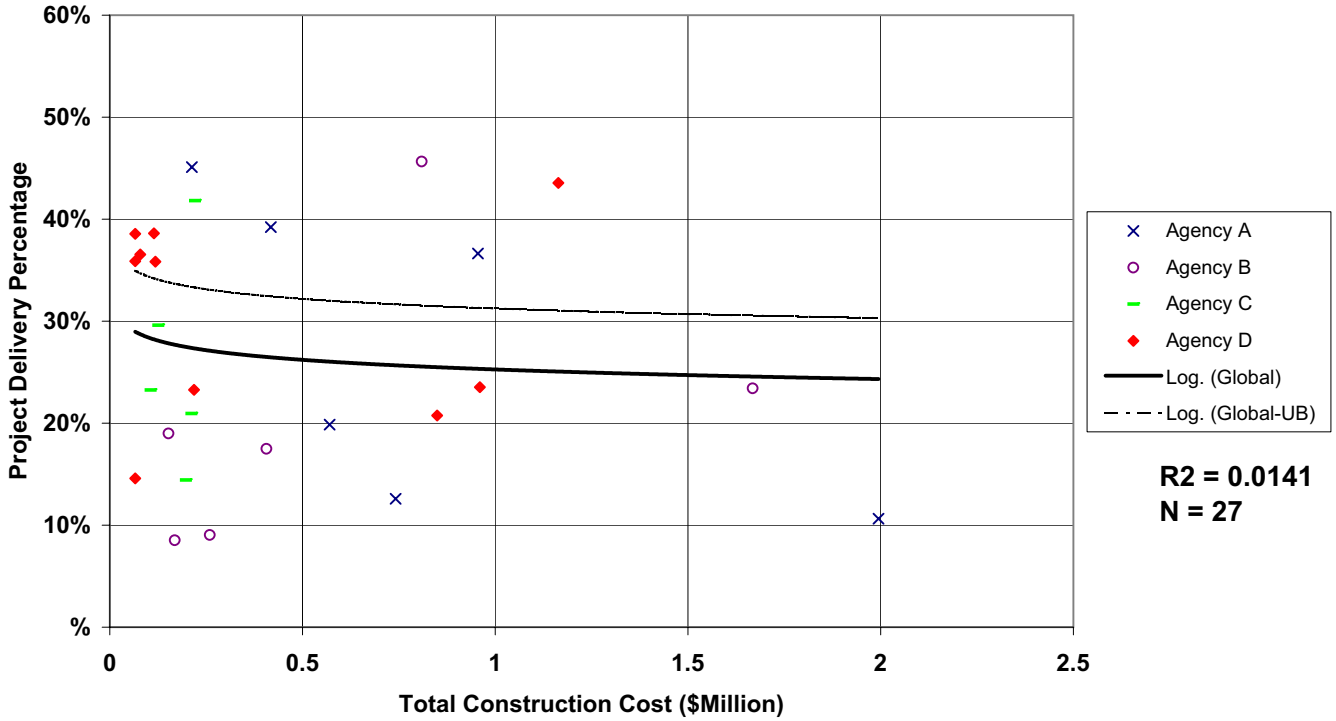
Parks - Park Development/Additions

Design Percentage Versus Total Construction Cost



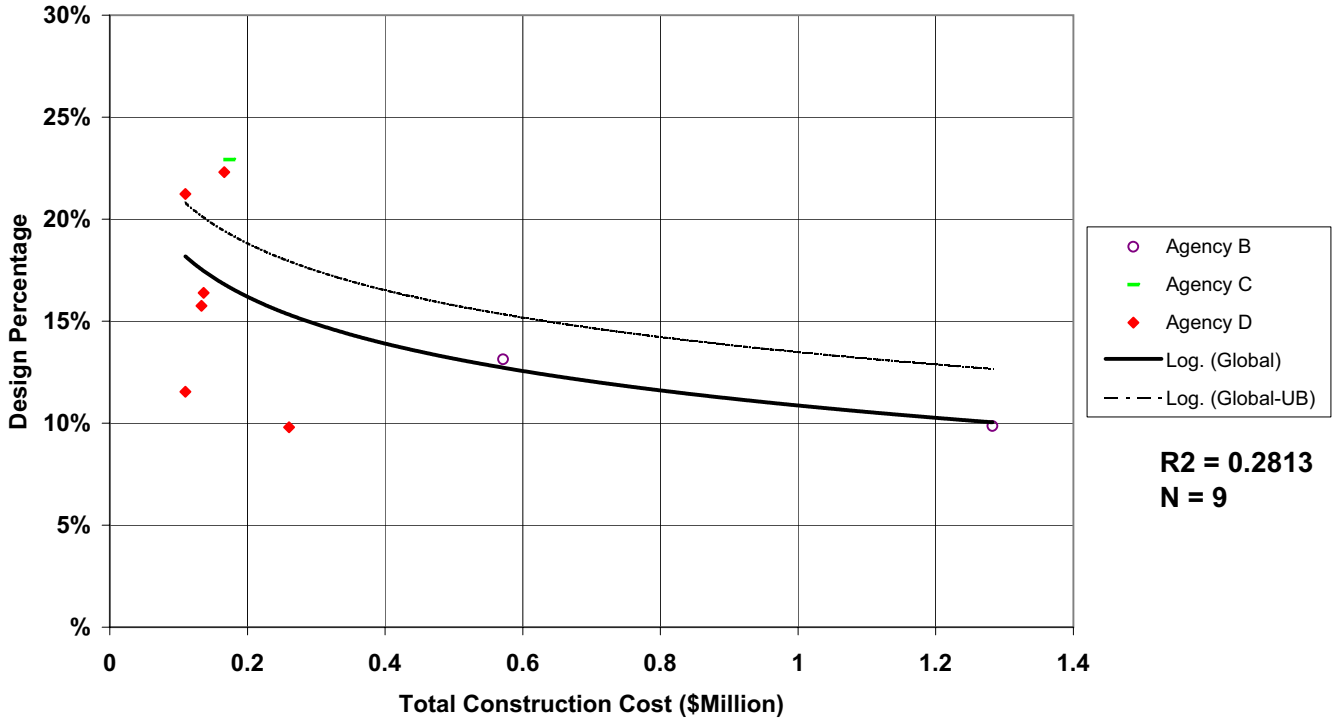
Parks - Park Development/Additions

Project Delivery Percentage Versus Total Construction Cost



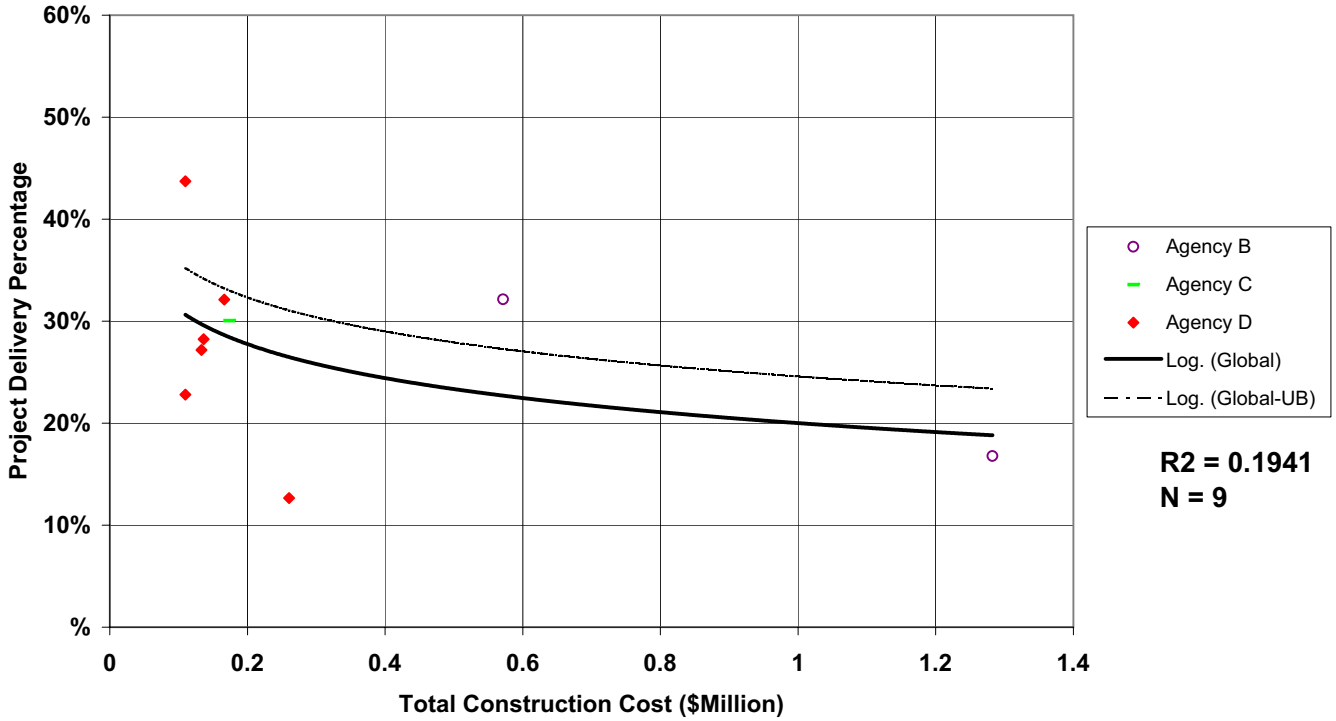
Parks - Restrooms

Design Percentage Versus Total Construction Cost



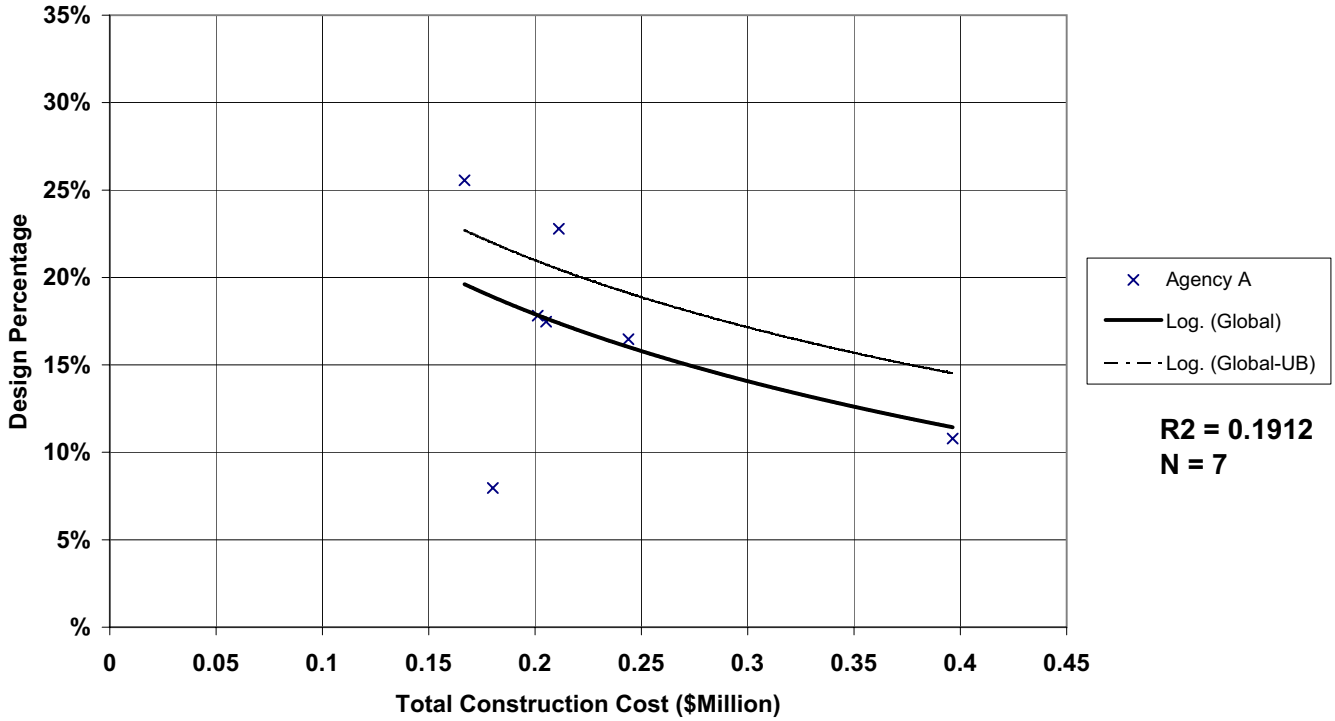
Parks - Restrooms

Project Delivery Percentage Versus Total Construction Cost



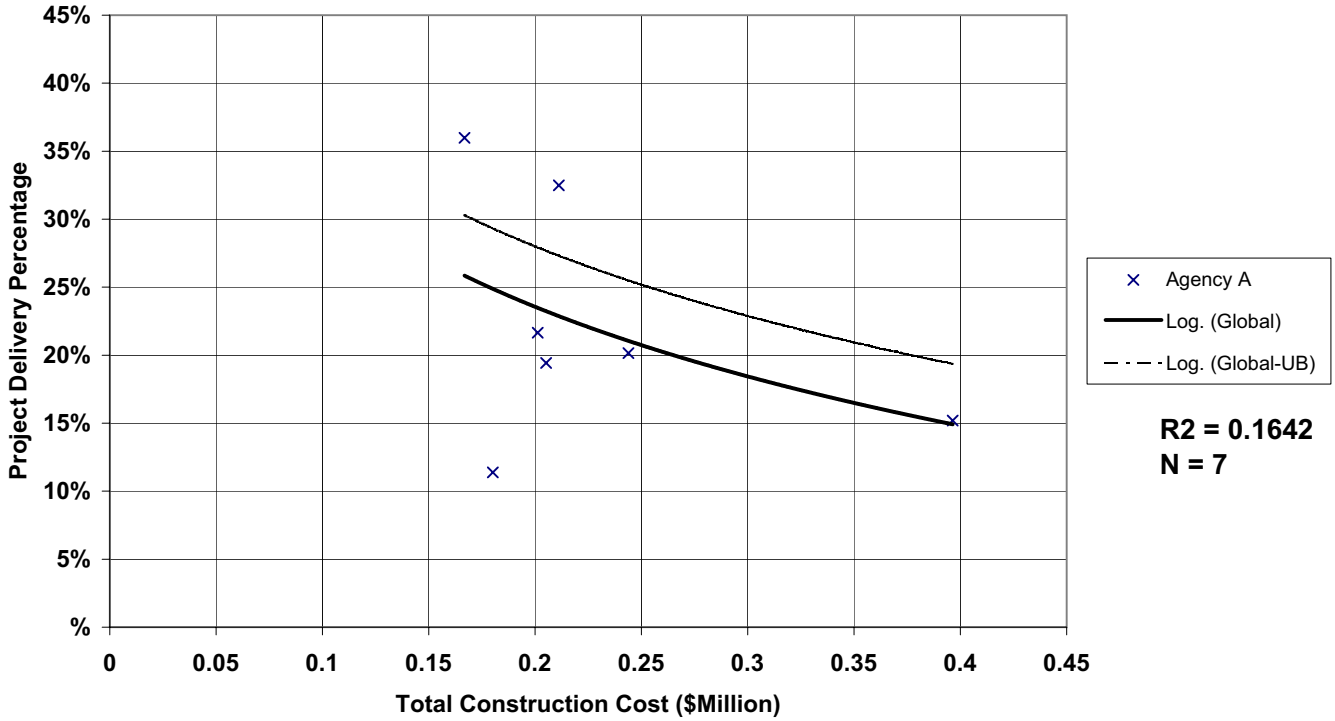
Parks - Sports Lighting Projects

Design Percentage Versus Total Construction Cost



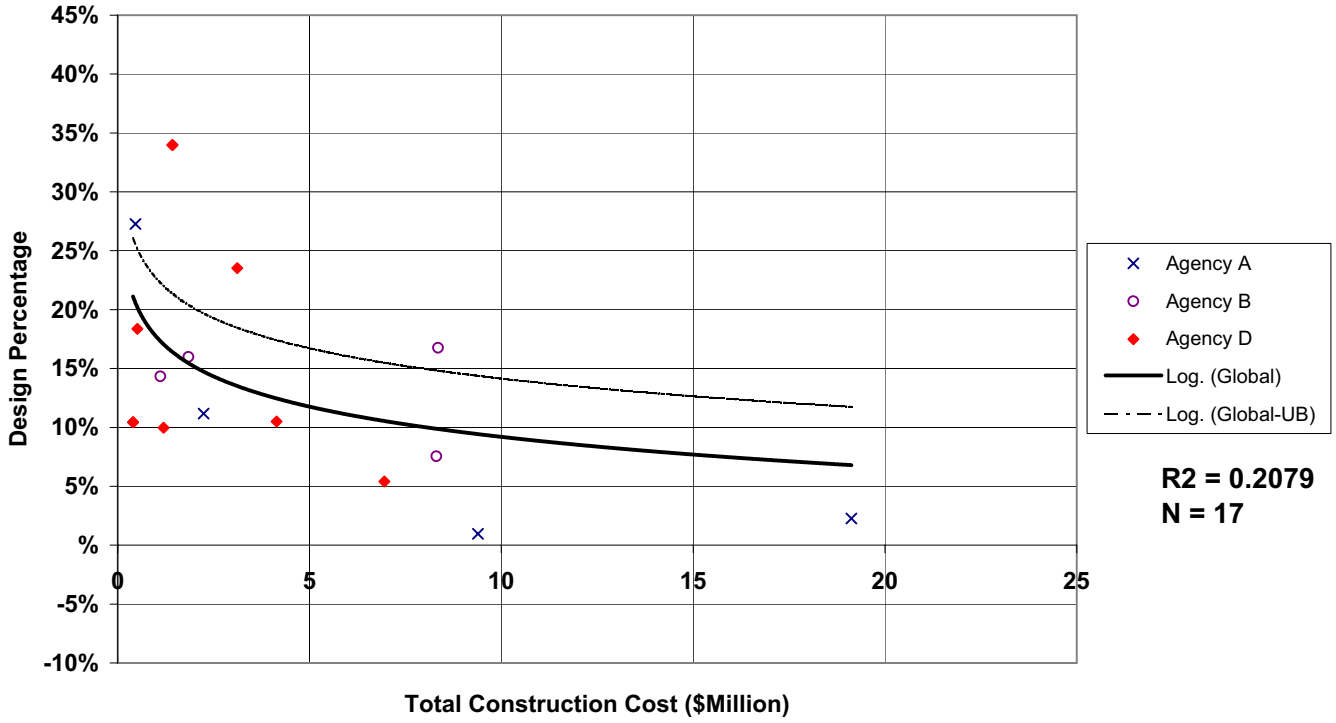
Parks - Sports Lighting Projects

Project Delivery Percentage Versus Total Construction Cost



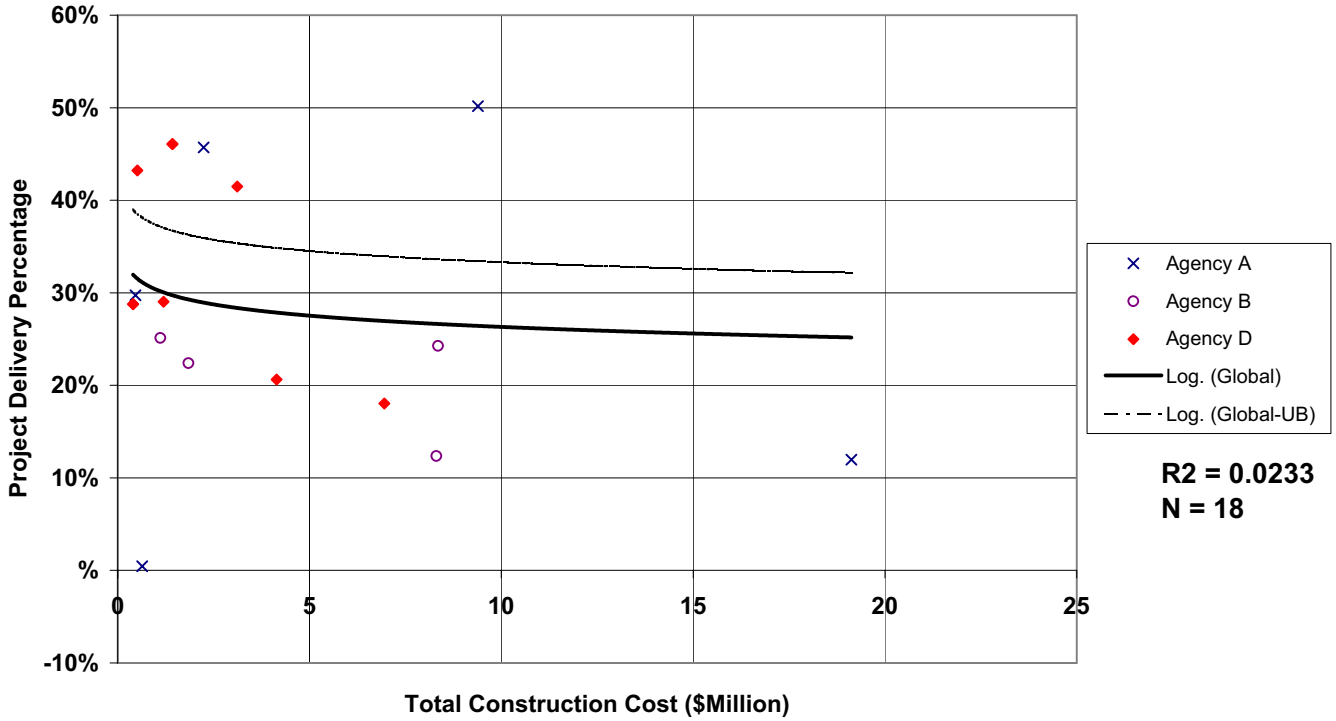
Pipes & Plants - Gravity Pipes

Design Percentage Versus Total Construction Cost



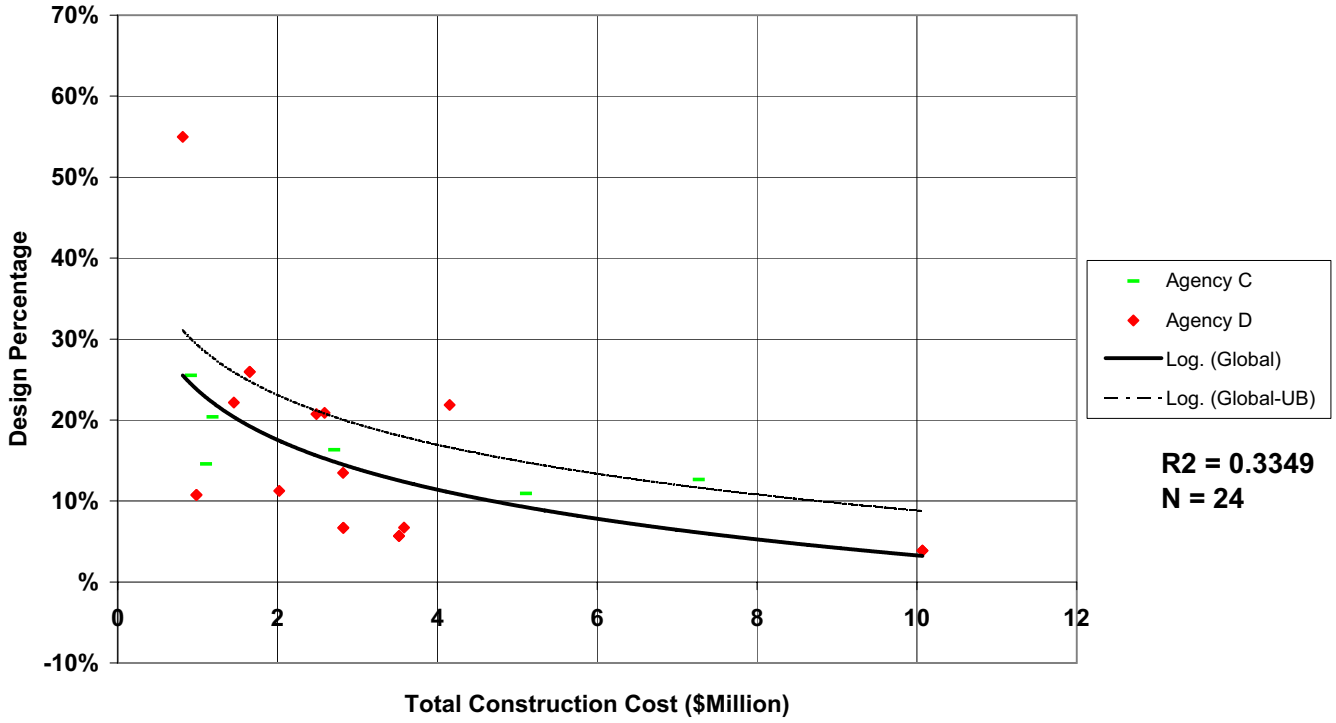
Pipes & Plants - Gravity Pipes

Project Delivery Percentage Versus Total Construction Cost



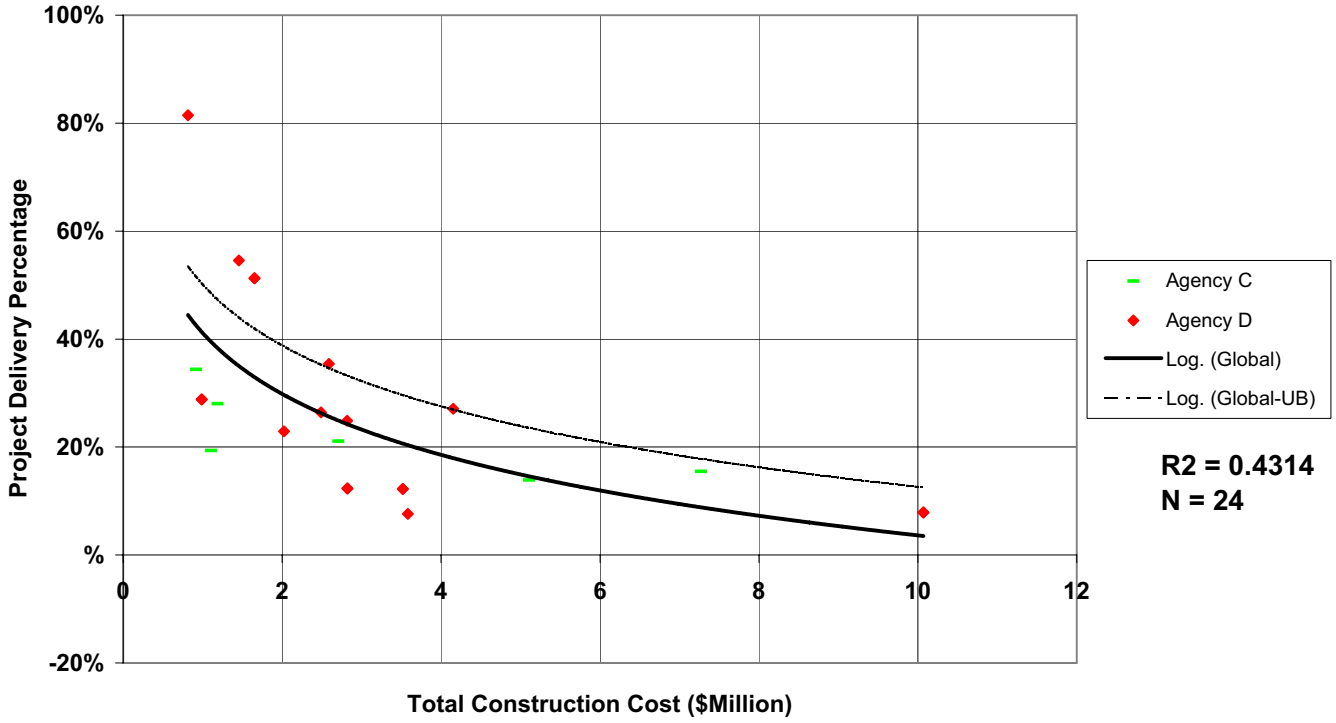
Pipes & Plants - Pressure Pipes

Design Percentage Versus Total Construction Cost



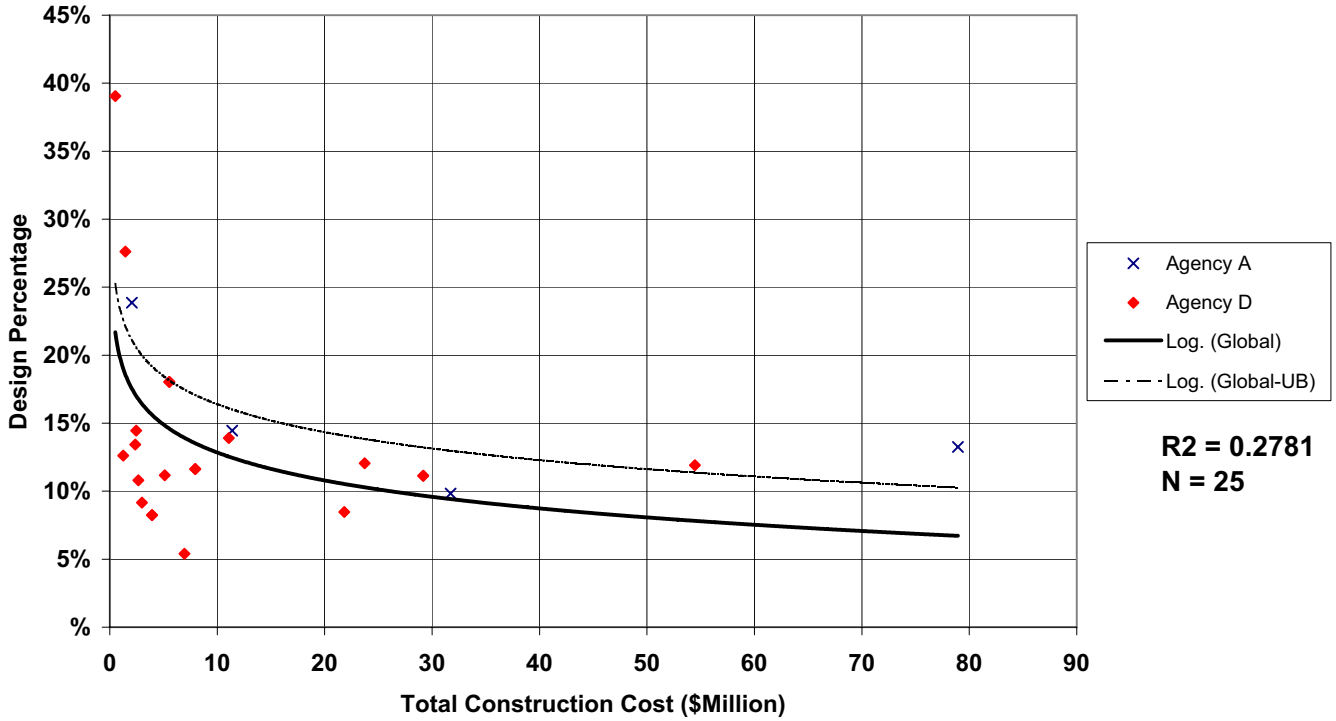
Pipes & Plants - Pressure Pipes

Project Delivery Percentage Versus Total Construction Cost



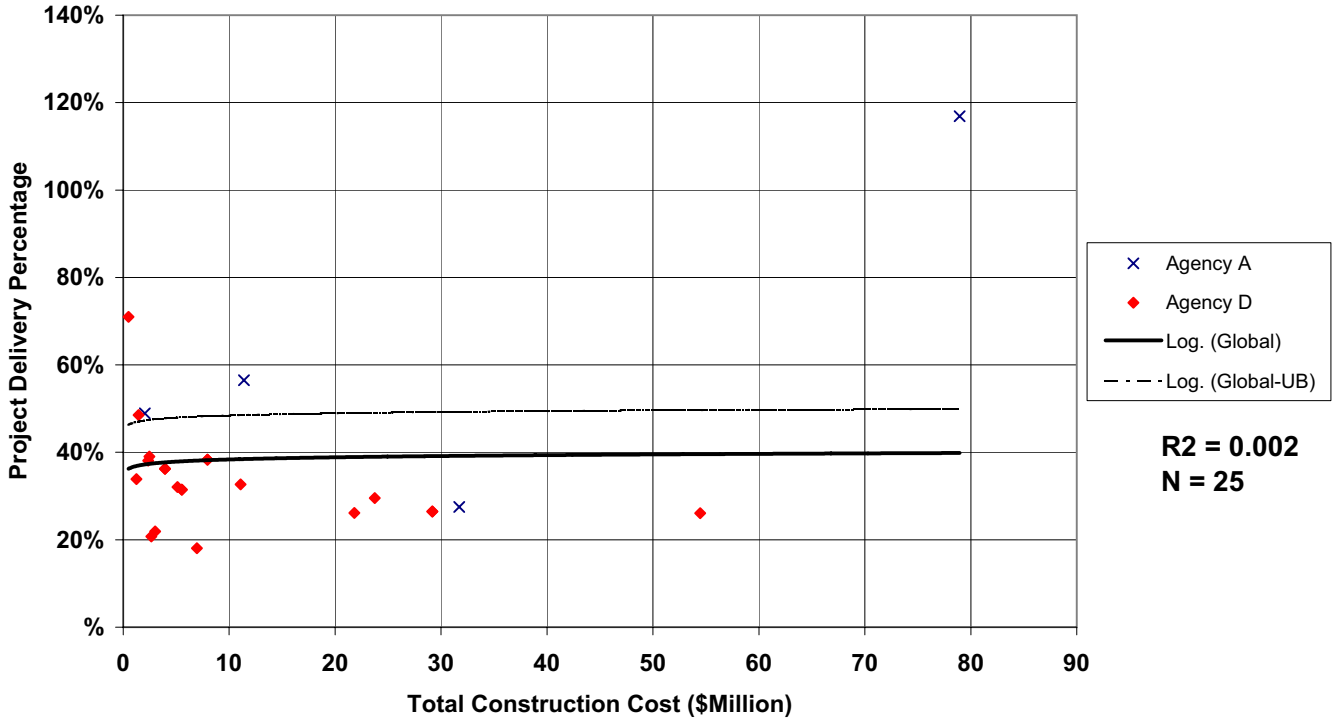
Pipes & Plants - Treatment Plants

Design Percentage Versus Total Construction Cost



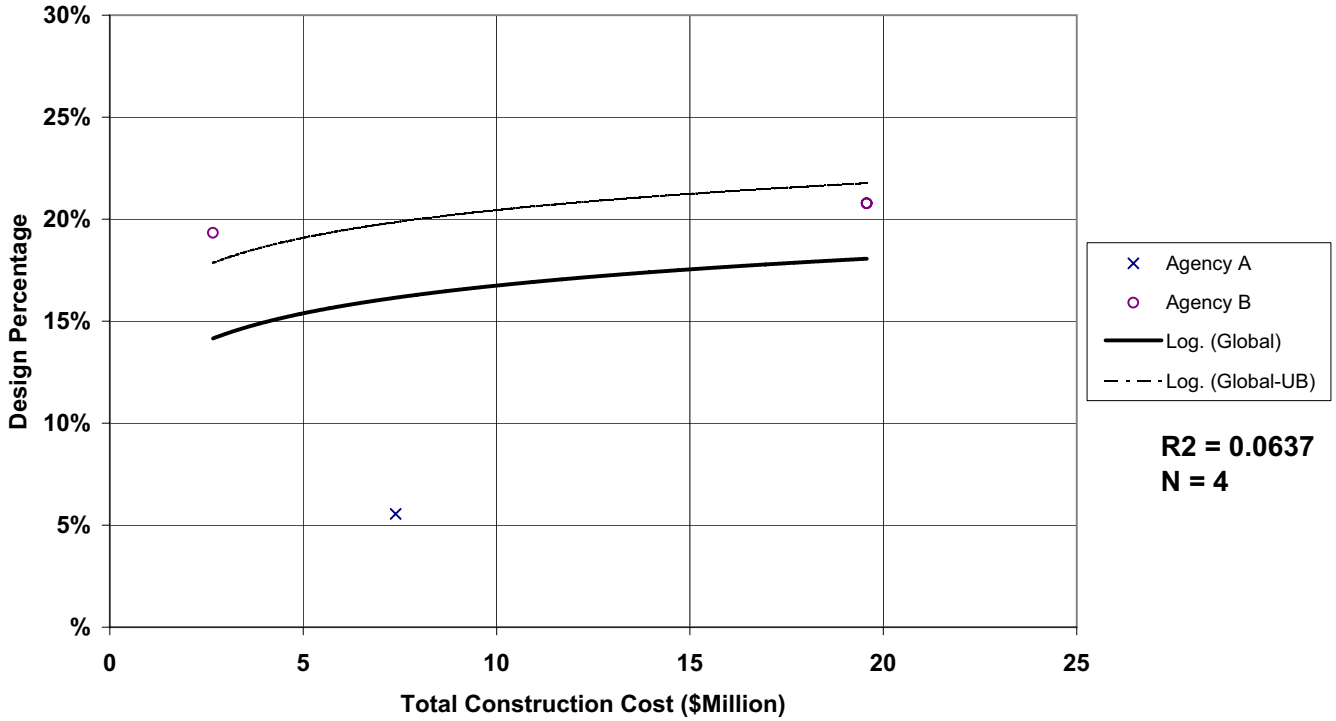
Pipes & Plants - Treatment Plants

Project Delivery Percentage Versus Total Construction Cost



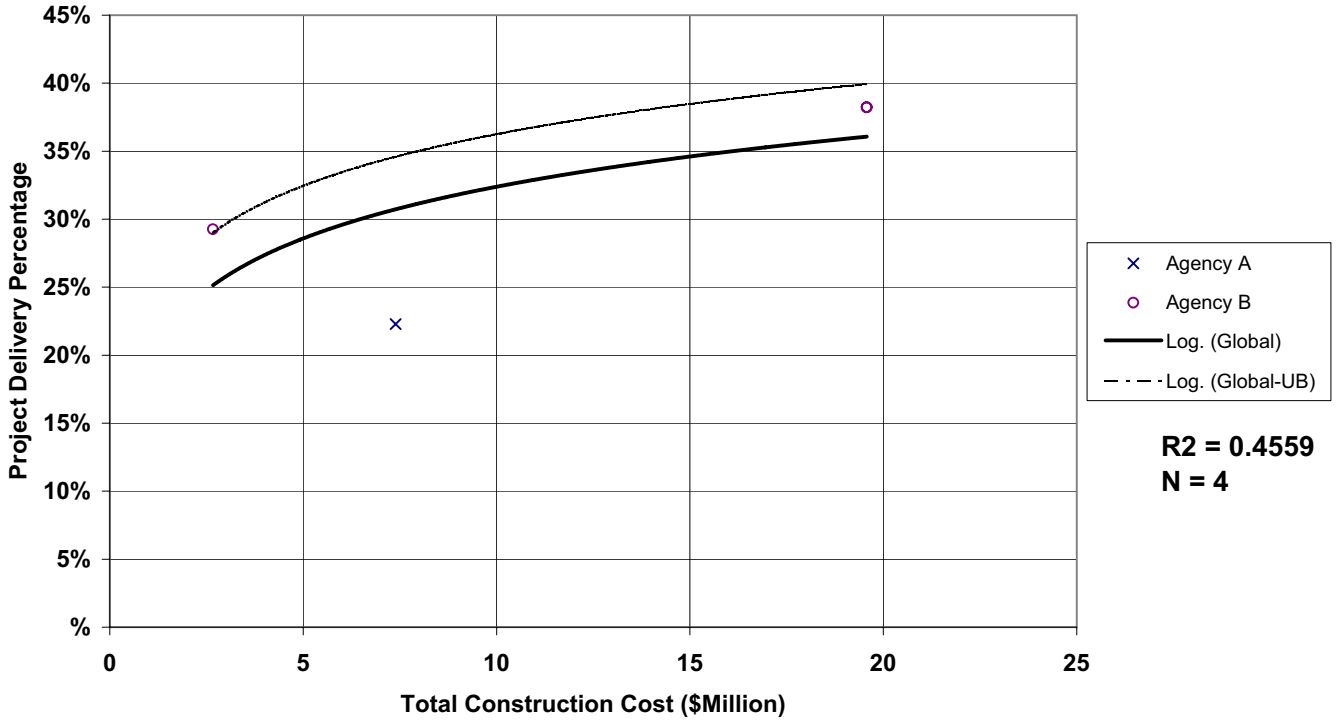
Streets - New Construction

Design Percentage Versus Total Construction Cost



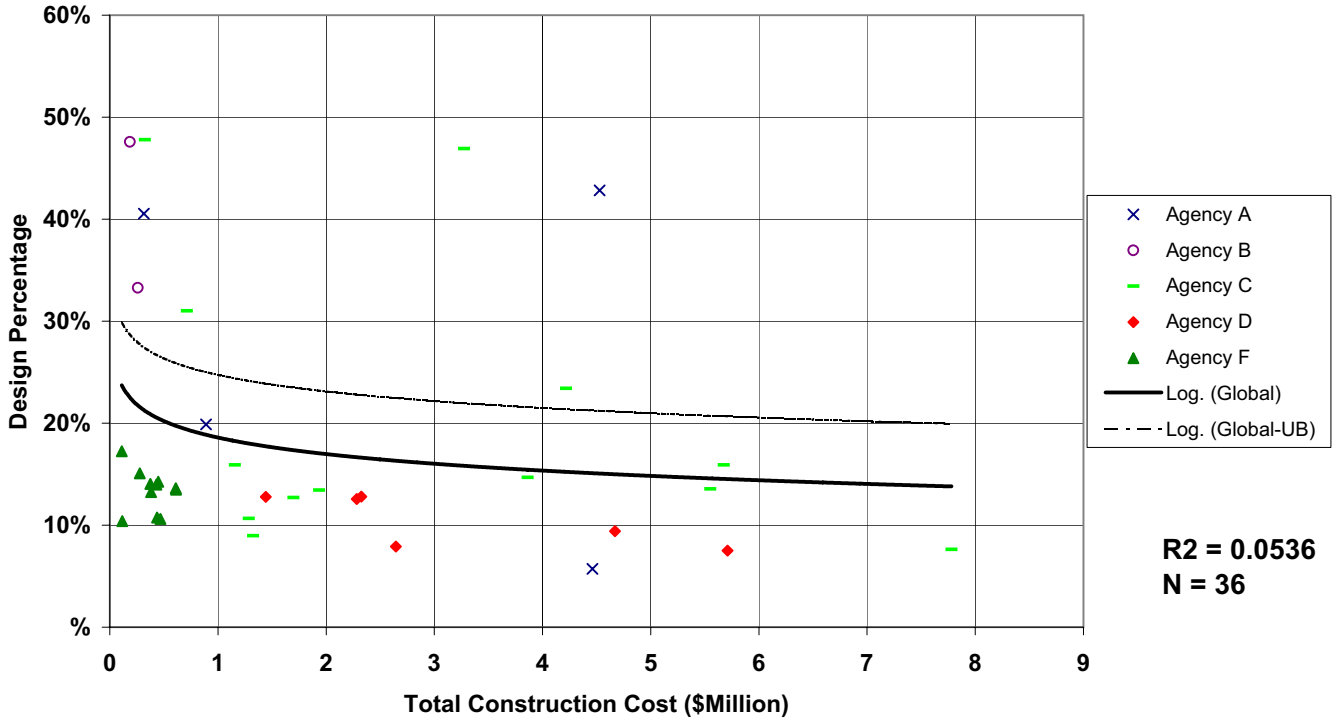
Streets - New Construction

Project Delivery Percentage Versus Total Construction Cost



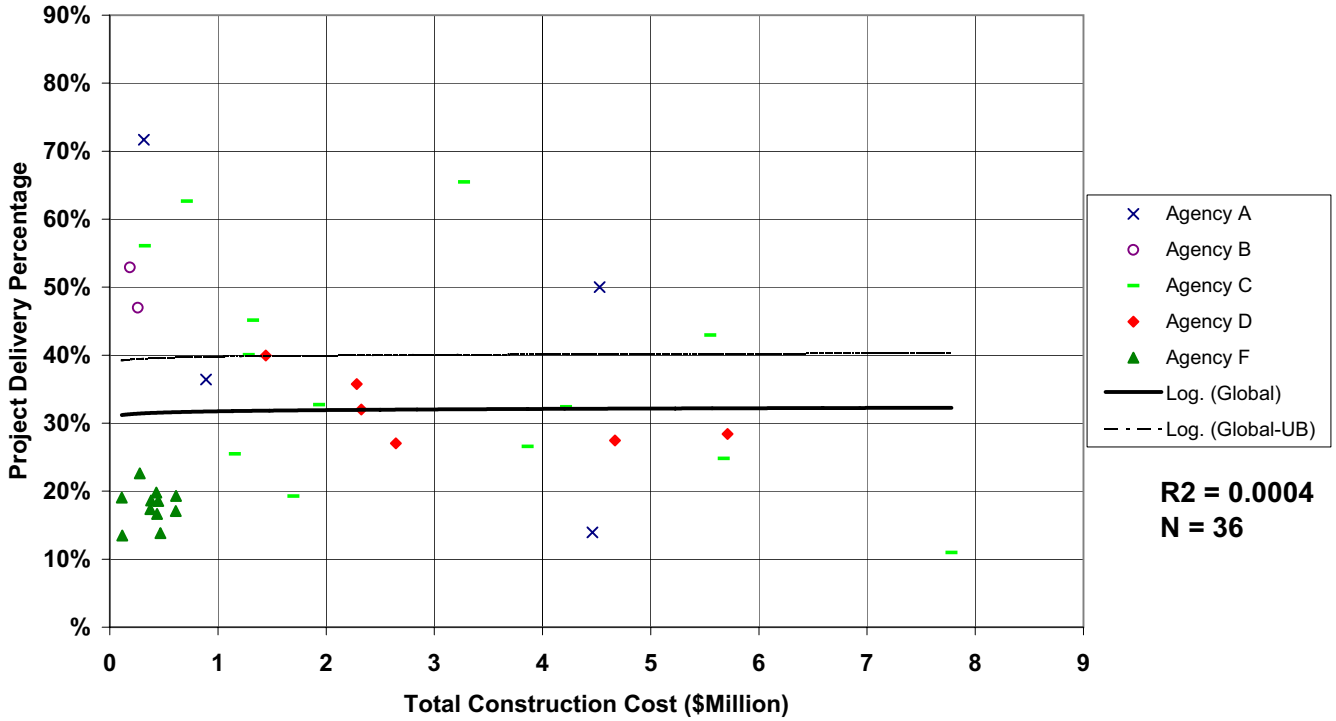
Streets - Reconstruction

Design Percentage Versus Total Construction Cost



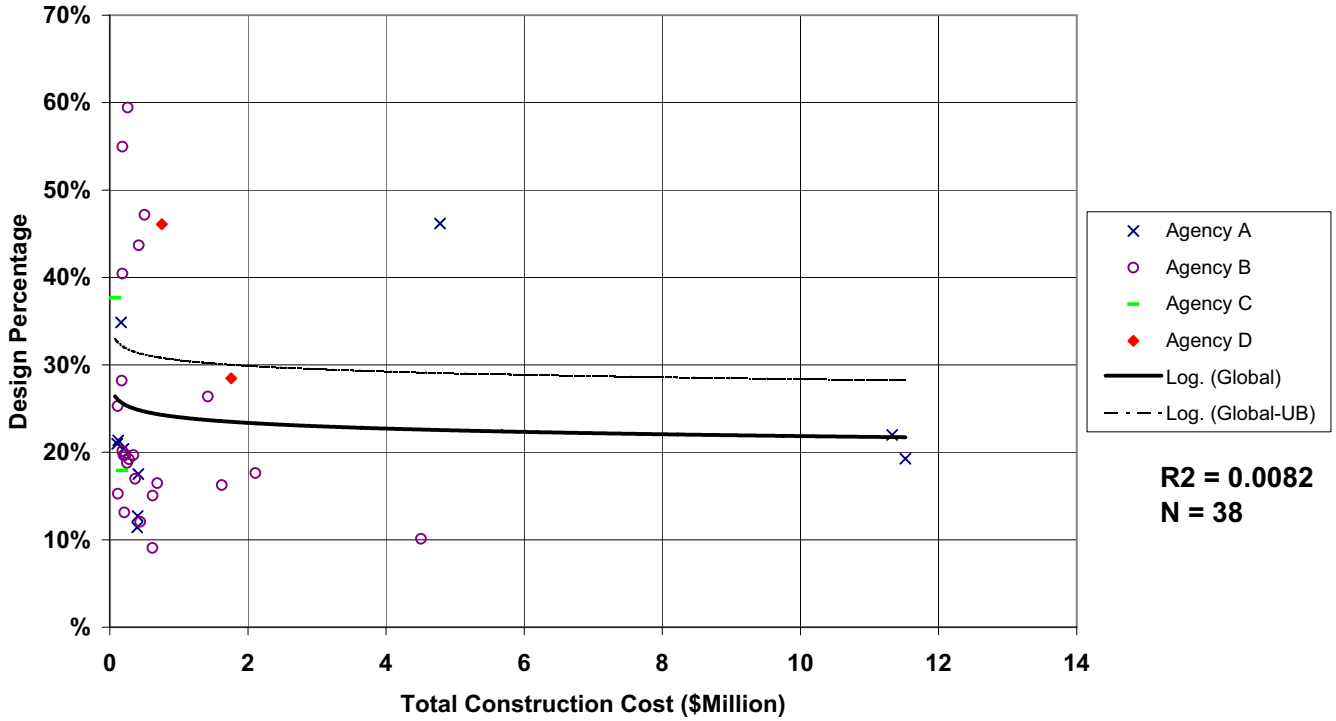
Streets - Reconstruction

Project Delivery Percentage Versus Total Construction Cost



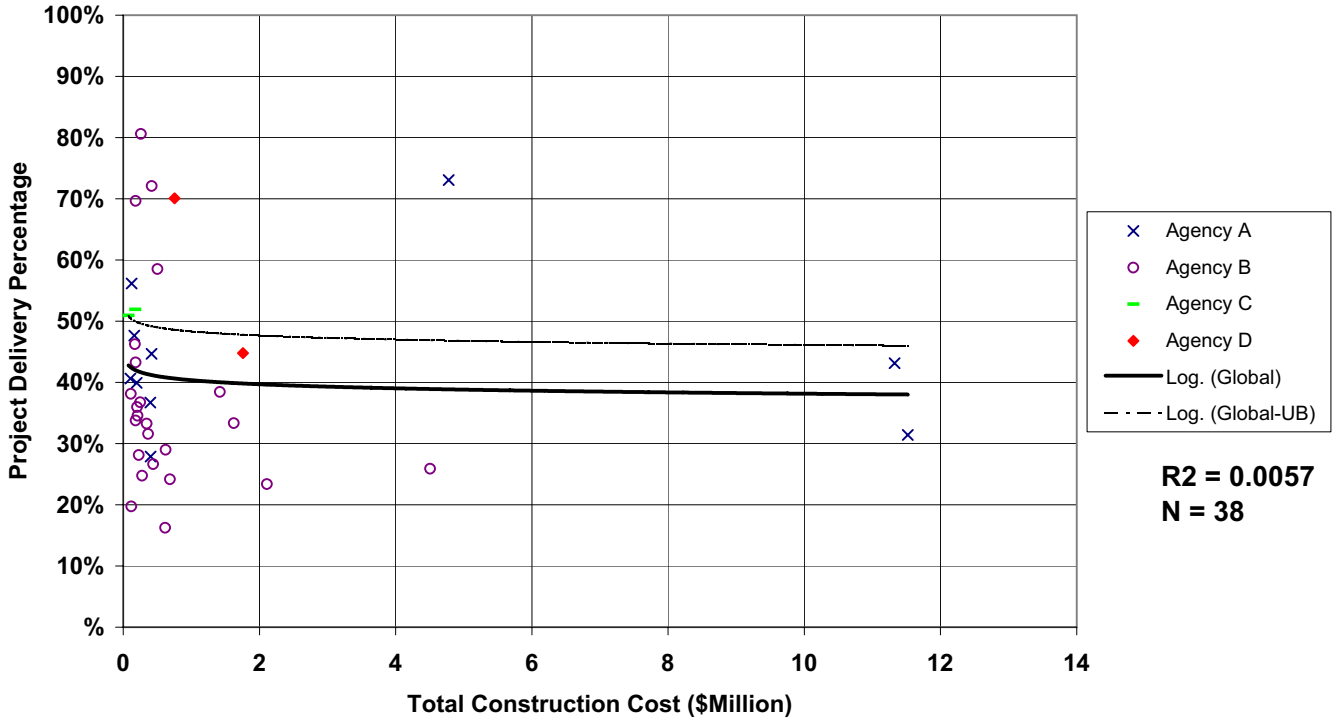
Streets - Signals & ITS

Design Percentage Versus Total Construction Cost



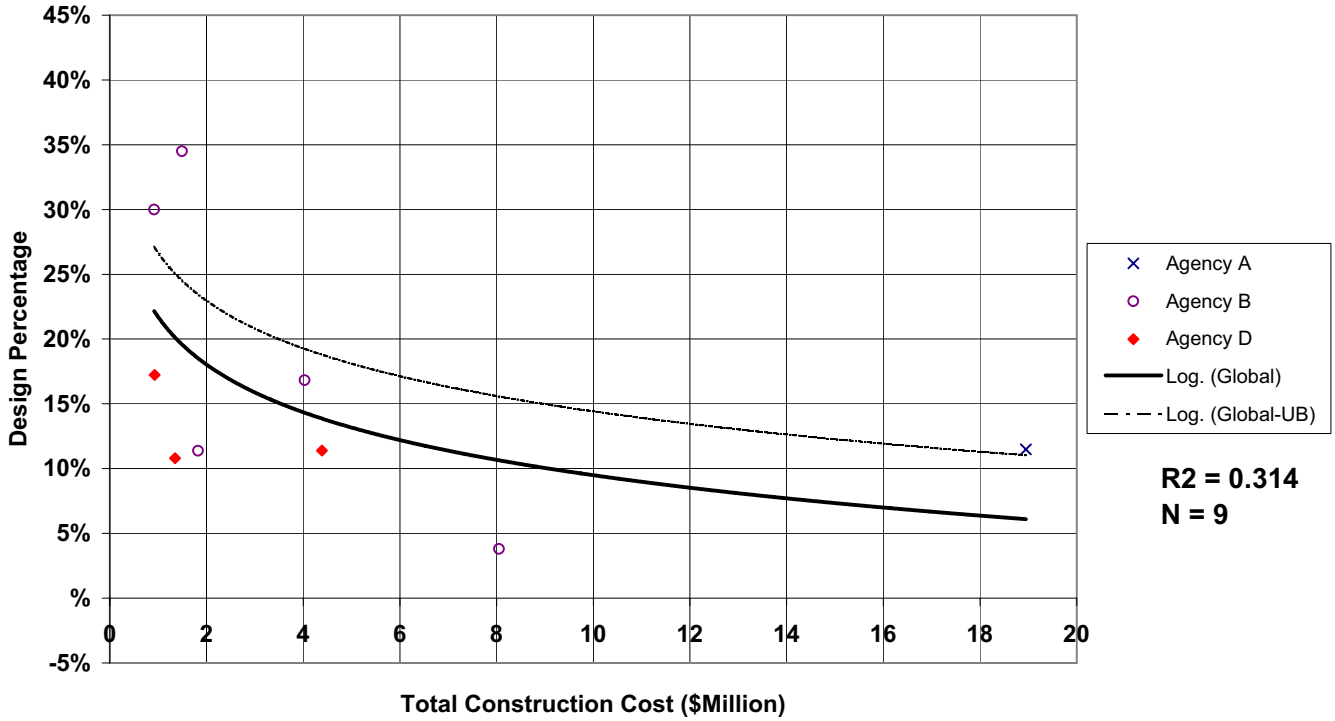
Streets - Signals & ITS

Project Delivery Percentage Versus Total Construction Cost



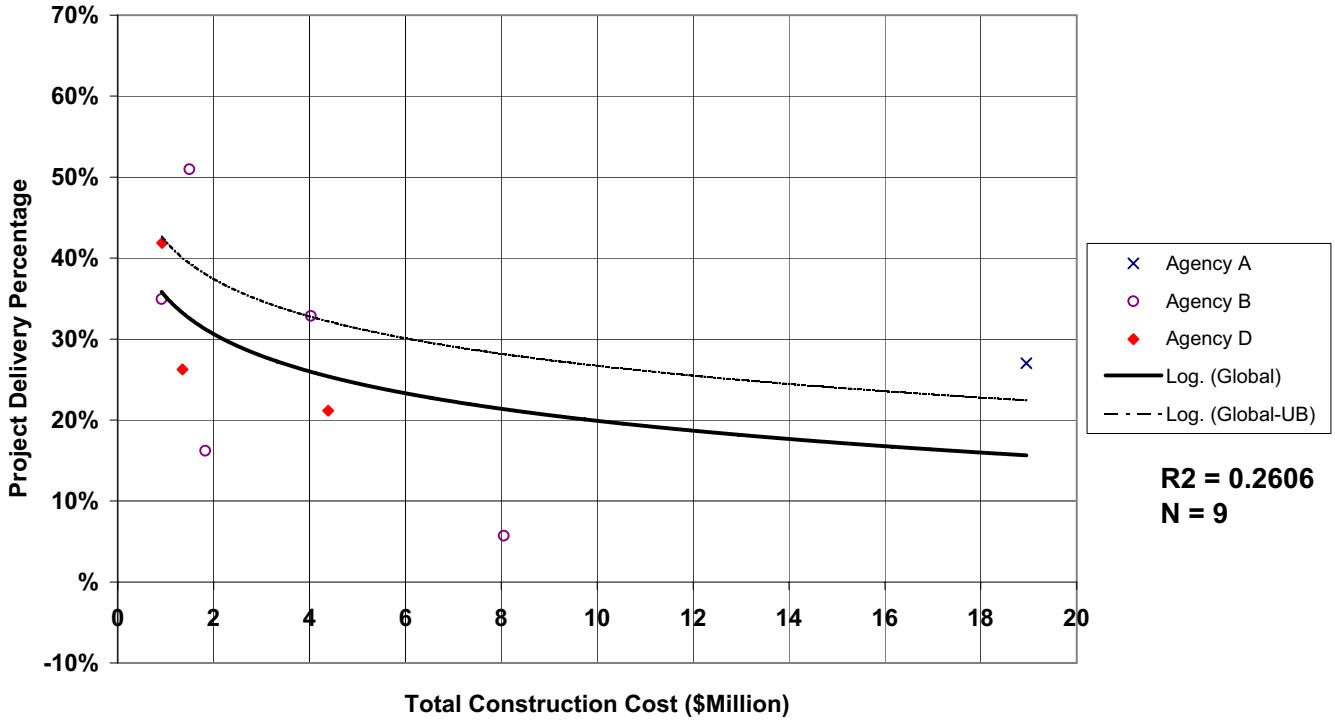
Streets - Bridges - (Retrofits & New)

Design Percentage Versus Total Construction Cost



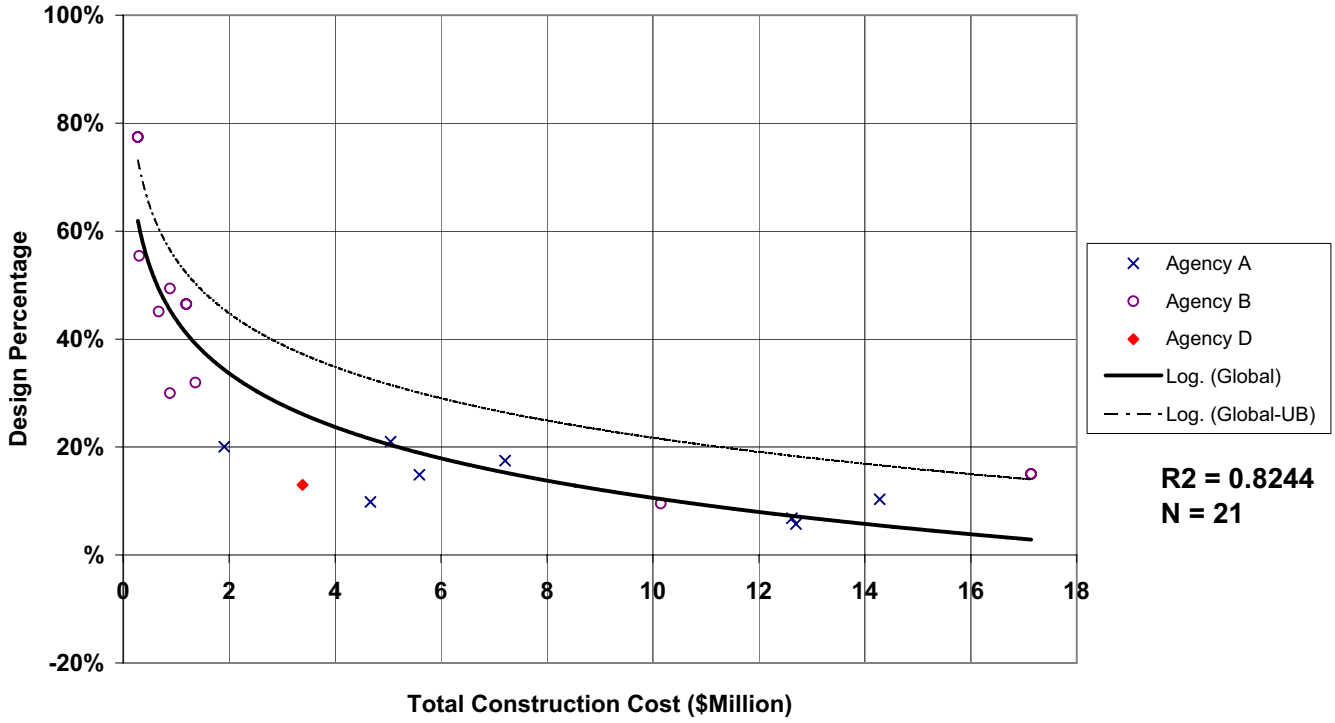
Streets - Bridges - (Retrofits & New)

Project Delivery Percentage Versus Total Construction Cost



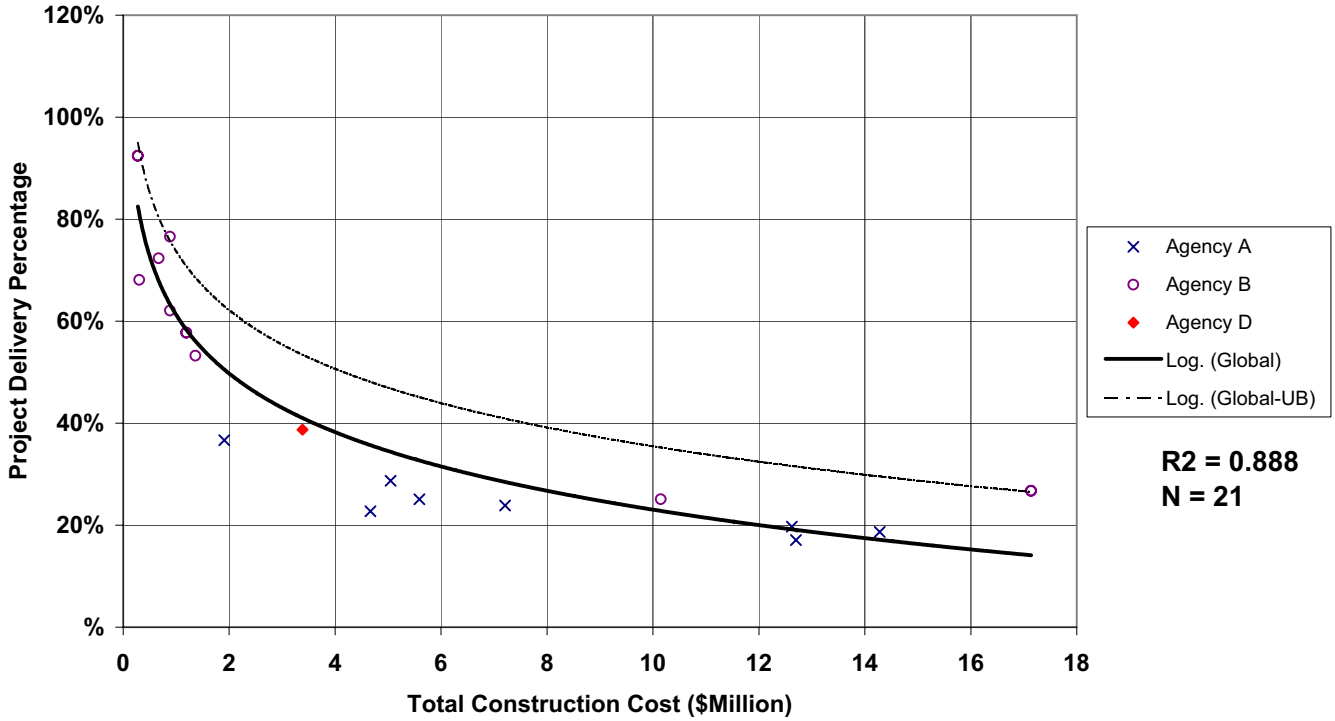
Streets - Widening

Design Percentage Versus Total Construction Cost

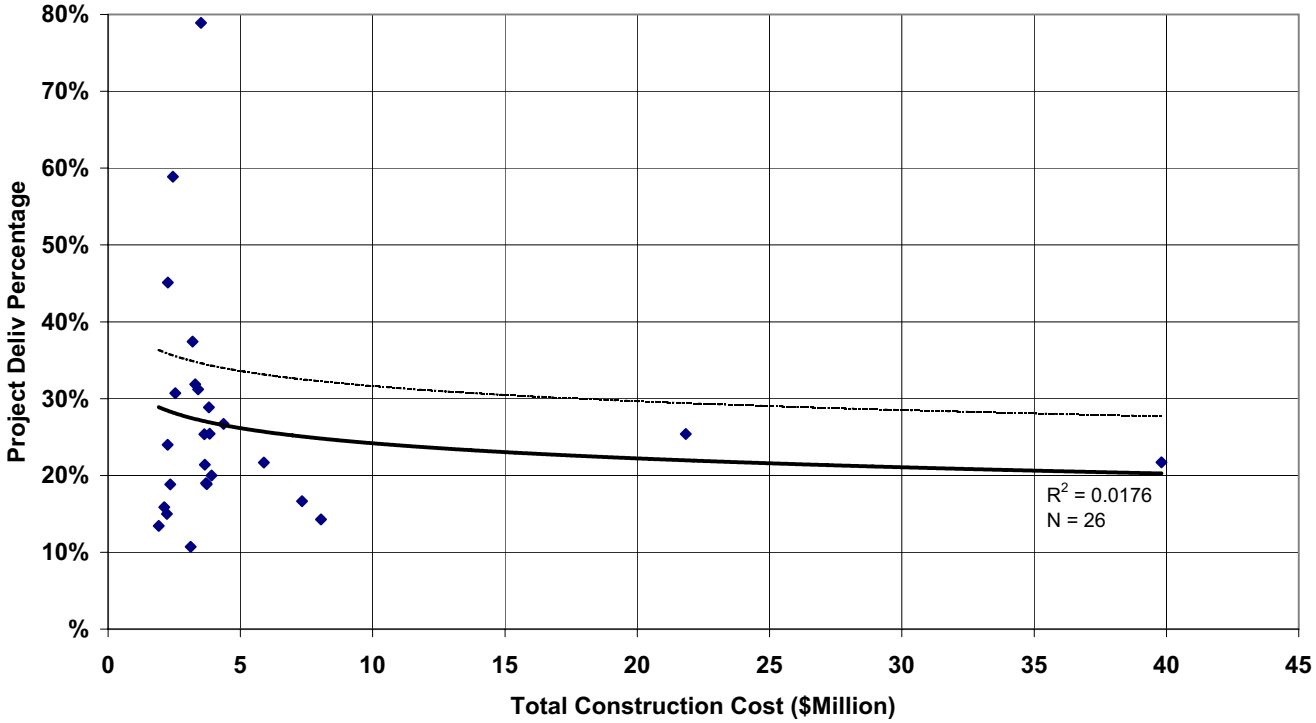


Streets - Widening

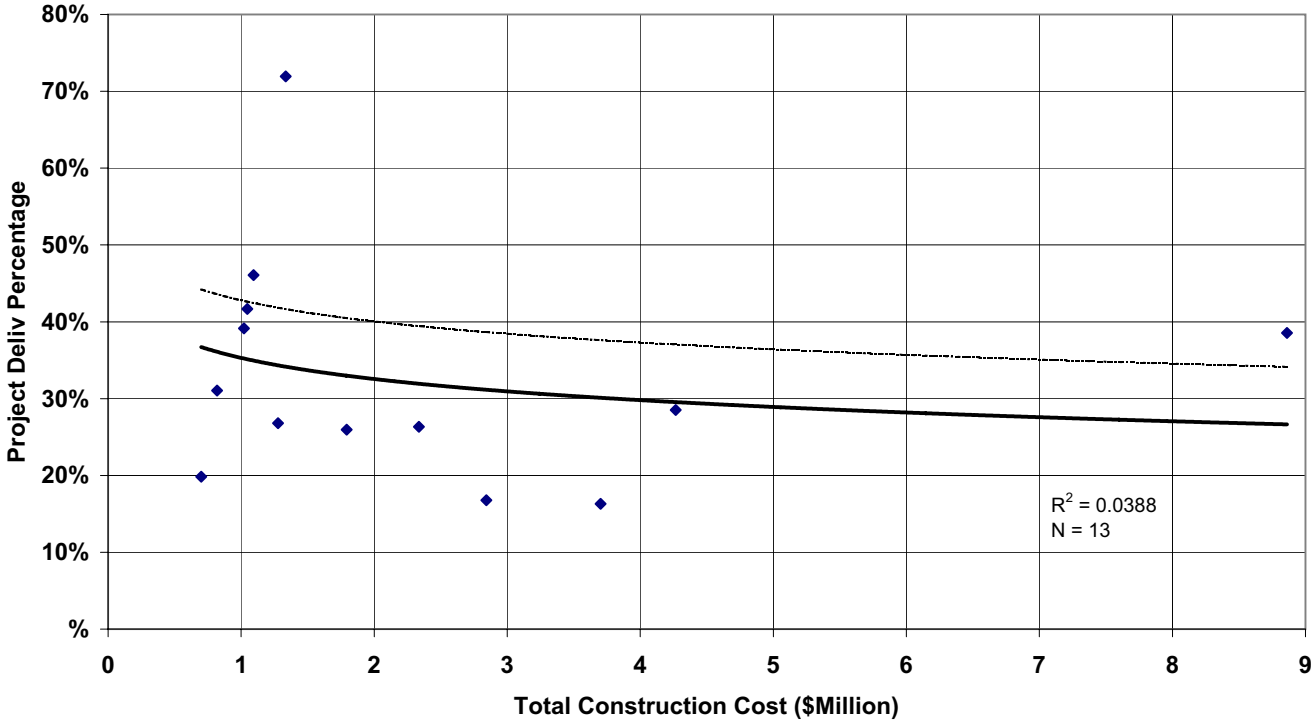
Project Delivery Percentage Versus Total Construction Cost



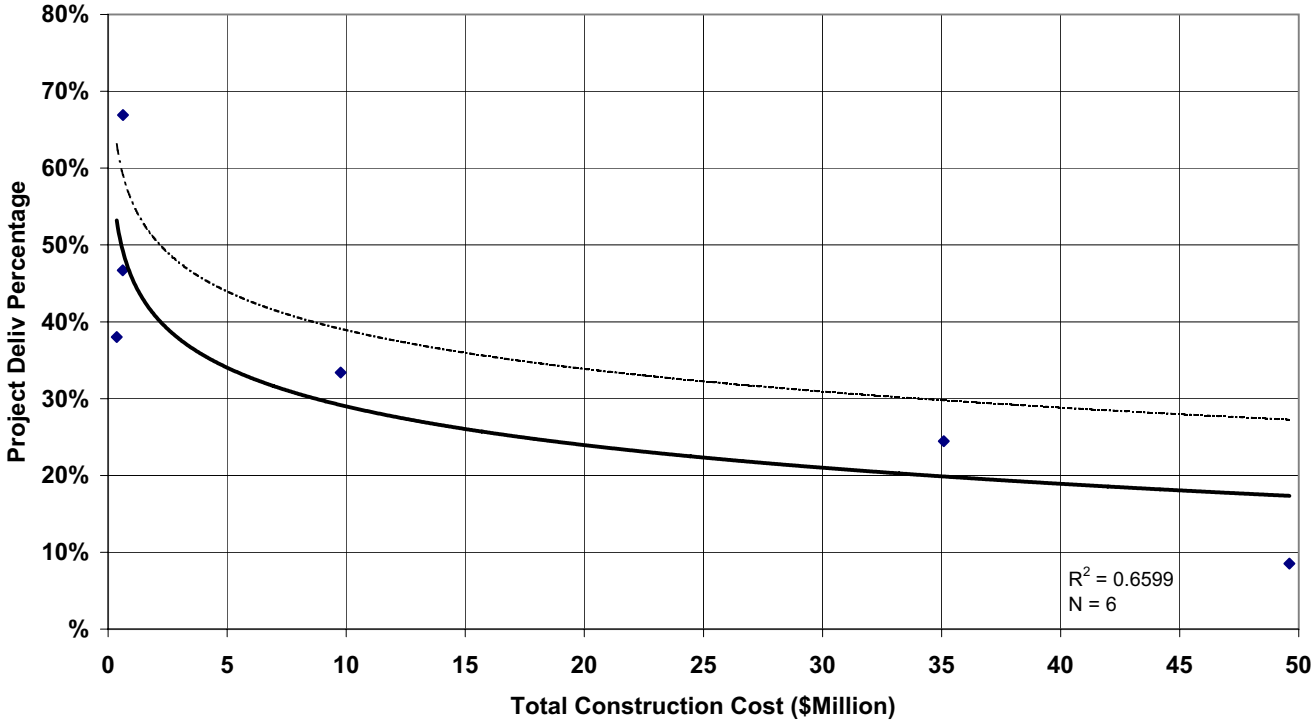
Municipal Facilities - All Classification
CM@Risk Projects
Project Delivery Percentage Versus Total Construction Cost



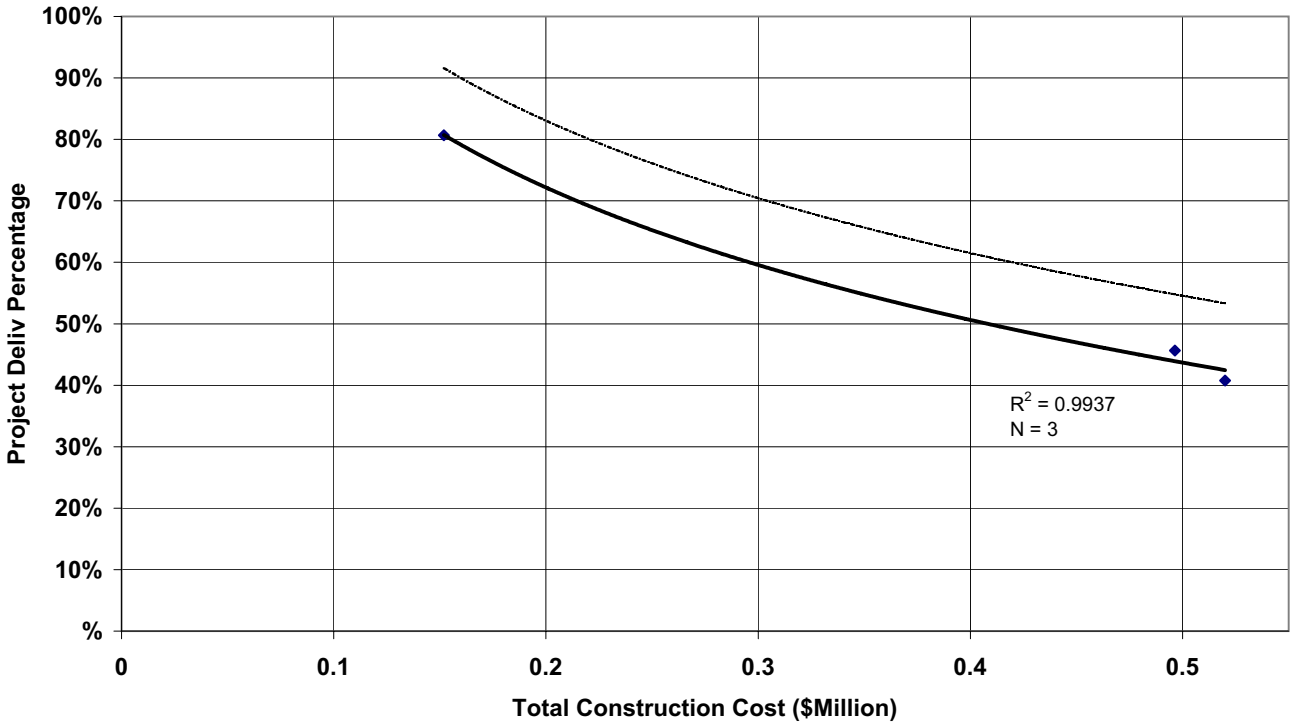
Parks - All Classification
CM@Risk Projects
Project Delivery Percentage Versus Total Construction Cost



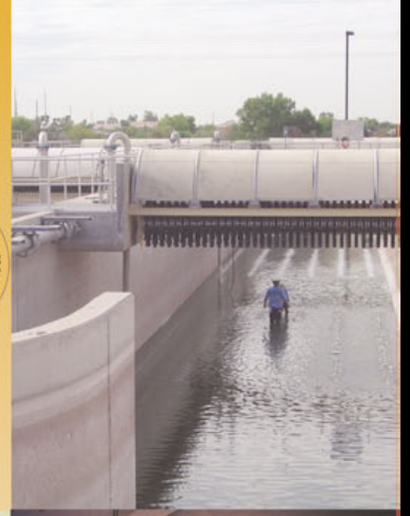
Pipes & Plants - All Classification
CM@Risk Projects
Project Delivery Percentage Versus Total Construction Cost



Streets - All Classification
CM@Risk Projects
Project Delivery Percentage Versus Total Construction Cost



Arizona Benchmarking Study



November 2007

VANIR