2008

ARIZONA BENCHMARKING

DECEMBER 2008

VANIR

TABLE OF CONTENTS

CHAPTER 1 – EXECUTIVE SUMMARY 1
A. Introduction
B. Study Methodology
C. Process Benchmarking
D. Performance Benchmarking
E. Conclusions and Recommendations

CHAPTER 2 – OBJECTIVES, & METHODOLOGY 6
A. Benchmarking Study Background
B. Benchmarking Study Guidelines
C. 2008 Benchmarking Study Objectives
D. Benchmarking Report Structure
E. Study Methodology
F. Benefits of Participation
G. Participating Agencies

CHAPTER 3 – PERFORMANCE BENCHMARKING.....10
A. Study Criteria and Definitions
B. CM@Risk Performance Questionnaire
C. Data Collection
D. Project Classification
E. Performance Data Analyses
F. Performance Curves

CHAPTER 4 – PROCESS BENCHMARKING / BEST

MANAGEMENT PRACTICES 18
A. Introduction
B. Best Management Practices for Improved Performance
C. New Best Management Practices
D. Targeted Best Management Practices
E. CM@Risk Projects Best Management Practices

CHAPTER 5 – ONLINE FORUM 21
A.Use of Online Forum
B.Online Forum Questions and Answers 2008

TABLE OF CONTENTS

CHAPTER 6 – CONCLUSIONS

AND RECOMMENDATIONS 25

A. Process Benchmarking
B. Performance Benchmarking
C. Online Forum
D. Continuous Improvement
E. New Members in 2008
F.Planning for 2009
G.Acknowledgements

APPENDIX A 31

Project Data Form and Instructions – Traditional
Project Data Form and Instructions – CM@R
BMP Survey - Traditional and CM@R

APPENDIX B 47

Table B-1 - Traditional BMP Implementation Survey Results with Targets
Table B-2 - CM@Risk BMP Implementation Survey Results
Table B-3 - Level of BMP Implementation – Traditional
Table B-4 - Level of BMP Implementation – CM@Risk

APPENDIX C 56

Table C-1 - Project Distribution Matrix - Traditional Method
Table C-2 - Project Distribution Matrix - CM@Risk Method
Table C-3 – Project Size Distribution

APPENDIX D 59

Performance Curves – Traditional
Construction Management Percentage vs Total Project Cost
Design Percentage vs Total Project Cost
Project Development Percentage vs Total Project Cost

Chapter 1

Executive Summary

A. INTRODUCTION

In July 2005 the Arizona Benchmarking Study was initiated by the cities of Tucson and Phoenix and the counties of Maricopa and Pima. This 2008 Study has expanded to include contributions from the City of Mesa, Pinal County, and the Maricopa County Community College District (MCCCD).

All of the agencies share the challenges of a rapidly growing population, increased demand for public works infrastructure projects, escalating costs, increasingly complex projects, greater demand for community involvement, and an increased concern for environmental issues. In addition, in the last year, sustainability, energy conservation and LEED issues, and budget shortfalls have exacerbated these challenges. These challenges have increased the value of Project Team members sharing their knowledge, experience, data and processes, in order to identify ways of improving project delivery and controlling both "hard" and "soft" costs.

As noted above, this 2008 Arizona Benchmarking Study includes project data contributed by Pinal County, Maricopa County, Maricopa County Community College District (MCCCD), Pima County, City of Phoenix, City of Tucson, and the City of Mesa. This year two additional cities joined the Arizona Project Team, the City of Casa Grande and the City of Peoria, and will participate and contribute to future editions of the report. It is anticipated that the Study effort and report will benefit from their participation and contributions to the database for both traditional and construction manager at risk projects.

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) which will lead to improved, more cost effective project delivery.

- ***Best Management Practice Implementation and Tracking*** – The Project Team members targeted BMPs for implementation within their agencies/departments and then tracked the use of those BMPs from the start of implementation to the point at which the BMPs are fully utilized on all applicable projects.

- ***Online Forum*** – Enables agencies to communicate on current challenges affecting public works project delivery in Arizona.

The Project Team has systematically and methodically collected cost information for all aspects of planning, design, quality control, construction management, and actual construction. As the size of the database increases, more accurate analyses of the relationship between construction costs and project delivery costs are becoming possible.

The Project Team has also gathered information relative to the practices and procedures used by each agency or department to deliver their capital projects. New procedures have been proposed, discussed, evaluated, and the most successful have been translated into Best Management Practices (BMPs). In 2008 the Project Team added four BMPs that grew from discussions within the online forum and issues presented at the study group meetings. Process Benchmarking includes tracking the challenges each agency faces in implementing new practices within their organizations and, measuring the impact of implementation on project delivery costs.

The development and use 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 and measurable improvements in project delivery performance as a result of implementing BMPs. Improvements are anticipated to be in the form of project delivery cost reductions, time savings, and improved project quality. Although it takes time for changes in processes and procedures to be implemented, this year's data indicates that the average project delivery costs for 2008 were less than 2007. Certainly, one year's data does not establish a trend but the results are encouraging. It has become clear to the Project

Team that the study has given rise to a "culture of improvement" within the participating agencies and departments.

This was a challenging year for the Project Team because of reduced operating and Capital Improvement

Budgets; however, substantial efforts were made toward implementing BMPs and providing performance results for the Study database.

The 2008 Study follows a successful 2007 effort and report. The 2008 Study includes current information on what the participating agencies are spending to deliver public works projects and what methods are being used. This information can be compared to past project delivery data and relative performance can be evaluated.

The objectives for 2008 were:

- Gather actual cost information on project delivery performance and perform self audits of the information 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 BMPs through the online forum and issues presented at the meetings.
- 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 as an informal method to ask questions, receive suggestions, and share information.

TRADITIONAL PROJECT DELIVERY – BEST MANAGEMENT PRACTICES (BMP)

Within the context of this Study, Best Management Practices (BMPs) are defined as "procedures that are expected to make project delivery more efficient and effective". As part of the 2006 Study, the Project Team was asked in a survey to either confirm the use of or to target the implementation of 36 BMPs for traditionally delivered projects. As part of the 2008 Study, the agencies reported on the status of implementing the original 36 BMPs, plus the additional four new BMPs. The implementation status is included in Chapter 4, and Table B-1 in Appendix B.

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

A Best Management Practice survey was also used to assess the procedures used under the CM@Risk delivery method. The City of Phoenix has extensive experience using this method and contributed many of the practices that were included in the survey. The 2008 BMP CM@Risk Survey added four new Best Management Practices to the 33 BMPs from the 2007 Study. The implementation status of the CM@Risk BMPs is included in Appendix B, Table B-2.

B. STUDY METHODOLOGY

Two teams are referred to in this report. Although both teams have worked together to achieve the common goal of improving processes for project delivery performance, each team has a distinct role:

Project Team: The Project Team is made up of member Agencies/Departments who have participated and contributed data and information.

Study Team: The Study Team, Vanir Construction Management, provides technical support to the Project Team with database development, data entry and analysis, logistical coordination and support, and publishing this report.

The Project Team's focus is to collect and contribute project performance data to improve the statistical significance of the database by adding projects and project delivery cost data each year. In 2007, the Project Team made the following changes in data collection:

1. Project types and classifications were added.
2. The traditionally delivered project data performance questionnaire was revised to be more user-friendly for data entry. Data on 245 traditionally (design-bid-build) delivered projects with a construction value of just under $788 Million are included in the 2008 Study.
3. The CM@Risk project data performance questionnaire was improved to reduce errors in data entry. Data on 62 CM@Risk delivered projects with a construction value totaling $486 million among five project types and seven classifications are included in the 2008 Study.

4. The method of data collection regarding change orders was revised for clarity. In 2008, as a result of questions initiated through the online forum, the Project Team focused on reviewing and analyzing change order data as a percent of Total Construction Cost.

The study continues to be driven by and for the participating agencies. All decisions and the direction of the Benchmarking Study are guided by the Project Team.

C. PROCESS BENCHMARKING

It is the goal of this on-going study to develop data documenting the impact of the implementation of Best Management Practices on the project delivery process. The Project Team members each targeted BMPs that would result in improved project delivery for their respective Agency/Department.

The implementation of these targeted practices was tracked and the performance data was collected. The Agencies/Departments made organizational and procedural changes based on the recommended Best Management Practices.

D. PERFORMANCE BENCHMARKING

Performance Benchmarking involves collecting documented project costs and creating data models of the component cost of project delivery versus the total construction cost. Project delivery costs are defined as the "sum of all agency and consultant costs associated with project planning, design, bid, award, construction management, and closeout activities". In 2005 the Project Team started collecting data for Performance on Design Bid Build projects completed as far back as 1999. In 2007, using improved performance data questionnaires, the Project Team also began gathering data on projects delivered using the CM@Risk Project delivery method.

This 2007 Study reports performance data and analyses of projects completed between January 1, 2003 and December 31, 2007, a five year span.

- The analysis of data on projects delivered from years 2003 through 2007, using the Traditional Delivery Method showed that:
  - The average design cost of a public works project is 17.5% of the total construction cost.
  - The average construction management cost of a public works project is 13.8% of the total construction cost.
  - The average total Project Delivery cost of a public works project is 31.3% of the total construction cost.
- The database currently includes only ***62*** projects delivered using the CM@Risk method at this time. Analyses of the data on these projects were limited by the small number of projects in 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.

Table 1-1 shows the Design percentage, Construction Management percentage, Total Project Delivery percentage, Median TCC and number of projects included for all classifications of projects submitted using the **Traditional Delivery Method for the years 2003 to 2007.**

During this period there were no significant variances in the cost of project delivery as a percentage of total construction cost. The Project Team initiated the Study and the implementation of Best Management Practices in July of 2005. While data shows that

Table 1-1 Project Delivery Costs by Project Completion Year as a percentage of Total Construction Cost (Traditional Delivery Method)

For projects completed in the 5 Year Rolling Window from 2003 through 2007

Year	Design	Construction Management	Project Delivery (TOTAL)	Median TCC ($M)	Number of Projects
2003	19.2%	14.8%	34.0%	$1.89	37
2004	19.7%	13.2%	32.9%	$0.92	49
2005	16.2%	12.9%	29.1%	$1.17	56
2006	16.2%	14.2%	30.4%	$1.26	62
2007	16.9%	14.4%	31.2%	$1.34	41
All	**17.5%**	**13.8%**	**31.3%**	**$1.24**	**245**

design costs as a percent of TCC dropped 3% in 2005, it is too early to attribute this drop solely to the agencies' participation in the Study.

In order to determine trends in performance, each annual report is prepared using performance data from the previous five years. As noted, Table 1 was developed using data on projects completed between January 1, 2003 and December 31, 2007. Table 1-1A includes data from the previous five years (2002 – 2006) and is provided for reference. This table shows the Design percentage, Construction Management percentage, Total Project Delivery percentage, Median TCC and number of projects included for all classifications of projects submitted using the Traditional Delivery Method. The Project Team's tracking and comparison of performance data within five year rolling windows is hoped to demonstrate improvements attributable to Best Management Practice implementation.

Table 1-1A Project Delivery Costs by Project Completion Year as a percentage of Total Construction Cost (Traditional Delivery Method)
For projects completed in the 5 Year Rolling Window from 2002 through 2006

Year	Design	Construction Management	Project Delivery (TOTAL)	Median TCC ($M)	Number of Projects
2002	16.9%	11.9%	28.9%	$1.42	45
2003	19.2%	14.8%	34.0%	$1.89	37
2004	19.7%	13.2%	32.9%	$0.92	49
2005	16.2%	12.9%	29.1%	$1.17	56
2006	16.2%	14.2%	30.4%	$1.26	62
All	**17.5%**	**13.4%**	**30.8%**	**$1.25**	**249**

Table 1-2 shows the 2008 Study data set by agency. The table also shows the percentage of soft costs expended on in-house resources versus consultants.

Among the agencies, consultant use for design phase services averages nearly 71%. Actual design phase costs as a percent of total construction cost varies significantly from just under 7.6% to just over 22.1%.

The agencies' use of consultants for construction management varies widely from 7.8 to 68.8%. Actual construction phase soft costs also vary significantly from 3.4% to almost 18.8%.

Finally, project delivery between agencies again varies significantly from 11 to almost 35.4%. It should be noted that agencies F and G, exhibiting the lowest project delivery cost data also contributed the least number of projects and had some of the highest percentages of outside consultants.

E. CONCLUSIONS AND RECOMMENDATIONS

The Arizona Benchmarking Study is intended as a long term effort and this 2008 Study phase is only the third year of a multi-year project of improving project delivery. Conclusions at this stage are cautious and Recommendations relate to improved data gathering and improvements in process implementation. The following items are worthy of note:

- Continuous data collection is warranted. In future benchmarking studies, more data should improve the correlation between soft costs and total construction cost. Improved correlation will make performance models more useful for analysis and prediction. This is particularly important in the CM@Risk projects database set where more project data is essential.
- Implementing Best Management Practices will improve project delivery performance. The Project Team and the Study Team will continue to track the progress of implementing the BMPs in order to correlate changes in performance data with the implementation of best practices.
- The Online Forum should continue to be used to facilitate communication, promote the free exchange of ideas, and establish a collaborative atmosphere for the Project Team members. The Online Forum is available on the Pima County web site at http://www.co.pima.az.us/CIP/azstudy.htm. It is readily available to Project Team members and others interested in improving the project delivery process.

Table 1-2 Project Delivery Performance and Consultant Usage by Agency (Traditional Delivery Method)
For projects completed in the 5 Year Rolling Window from 2003 through 2007

AGENCY	DESIGN					CONSTRUCTION MANAGEMENT					PROJECT DELIVERY					TCC	
	In-House		Consultants		Total % of TCC	In-House		Consultants		Total % of TCC	In-House		Consultants		Total % of TCC	Average	Median
	($M)	% of Design	($M)	% of Design		($M)	% of CM	($M)	% of CM		($M)	% of PD	($M)	% of PD			
Agency A	$14.43	37.1%	$24.45	62.9%	18.6%	$25.16	59.8%	$16.90	40.2%	14.7%	$39.58	48.9%	$41.35	51.1%	33.3%	$4.49	$1.29
Agency B	$10.83	35.0%	$20.14	65.0%	22.1%	$6.54	31.2%	$14.42	68.8%	13.3%	$17.37	33.4%	$34.56	66.6%	35.4%	$2.76	$0.44
Agency C	$5.23	31.6%	$11.32	68.4%	16.2%	$10.16	89.8%	$1.16	10.2%	10.9%	$15.39	55.2%	$12.47	44.8%	27.1%	$2.45	$1.28
Agency D	$2.79	12.3%	$19.93	87.7%	15.3%	$17.19	54.1%	$14.61	45.9%	17.9%	$19.97	36.6%	$34.54	63.4%	33.2%	$2.94	$1.68
Agency E	$0.06	7.3%	$0.77	92.7%	11.0%	$1.15	80.9%	$0.27	19.1%	18.8%	$1.21	53.7%	$1.04	46.3%	29.8%	$7.56	$7.56
Agency F	$0.48	9.5%	$4.58	90.5%	9.1%	$0.67	73.1%	$0.25	26.9%	4.7%	$1.15	19.3%	$4.83	80.7%	13.9%	$4.16	$0.63
Agency G	$0.13	15.1%	$0.74	84.9%	7.6%	$0.29	92.2%	$0.02	7.8%	3.4%	$0.42	35.6%	$0.77	64.4%	11.0%	$2.17	$2.11
OVERALL	$33.95	29.3%	$81.94	70.7%	17.5%	$61.15	56.2%	$47.62	43.8%	13.8%	$95.10	42.3%	$129.56	57.7%	31.3%	$3.22	$1.24

Notes:
1. In-House and Consultant costs are expressed as percentages of total agency Design, Construction Management (CM), and Project Delivery (PD) costs
2. Total Construction Cost (TCC) is the sum of construction contract award, change orders, utility relocation costs, and agency forces construction costs
3. Design, CM, and PD costs are expressed as percentages of TCC and are unweighted, arithmetic averages of projects by agency

CHAPTER 2

OBJECTIVES AND METHODOLOGY

A. BENCHMARKING STUDY BACKGROUND

This is the fourth consecutive year the Arizona Benchmarking Project Team has been working to share the collective Capital Improvement Project implementation experience of the Project Team. The effort was initiated by Pima County's Public Works Policy Group in the spring of 2005, based on a similar effort by the seven largest cities in California (California Multi-Agency CIP Benchmarking Study 2002-2008). The original four members were the Cities of Tucson and Phoenix and the Counties of Pima and Maricopa. The membership expanded in 2007 to include Pinal County, the City of Mesa, and the Maricopa County Community College District (MCCCD). In late 2008, the Cities of Peoria and Casa Grande joined the Project Team.

The Arizona Study Team collects and analyzes project delivery costs as a percentage of total construction costs. They also assist the agencies to identify Best Management Practices which, if implemented, will improve and, potentially reduce the cost of, project delivery.

In 2006, the range of the Arizona Study expanded 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 used in Arizona since 2001 when Arizona laws changed to allow the use of such methods. In response to an interest among the study 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 2008 Benchmarking Study period, the Team continued to expand its efforts on:

- Tracking, evaluating, and auditing the Project Team's implementation of the 36 Best Management Practices (BMP)for Traditional delivery projects and 33 Best Management Practices for CM@Risk delivery projects. See Appendix B for the lists.
- In 2008, four Best Management Practices were added to both the traditional BMPs and the CM@Risk BMPs.
- Collecting and evaluating data submitted for Traditional Delivery method projects. The total number of projects for the five year rolling window equaled 245 with a total construction cost over $788 Million.
- Collecting and evaluating submitted data on the projects using the CM@Risk delivery method. The total number of projects increased to 62 with a total construction cost of $486 million. Because of the smaller number of projects the regression curves are less reliable. As the size of the database increases, analysis of the CM@Risk data will be more useful to the Project Team.
- Expanding the database to allow for improved aggregation and analysis.

B. BENCHMARKING STUDY GUIDELINES

In 2008, the Arizona Benchmarking Project Team acknowledged the structure and parameters under which it operates as follows:

Informal Charter/Guiding Principles

"This is a planned, cooperative and continuous study intended to provide a general analysis of the efficiency of capital project delivery systems within various agencies in Arizona, based on observed performance and processes over the past several years.

The agencies enter into the study with the intent of making improvements, not comparisons. The agencies perform non-competitive analyses of their own projects and processes in order to contribute to the development of benchmarks based on industry trends. In order to preserve this non-competitive spirit, agencies and projects are referred to generically when anonymity is appropriate."

Incentives

- Billions of dollars in facilities and infrastructure construction is planned in the near future.
- Implementation of these projects will take significant Design and Construction Management cost commitments.
- A reduction in Project Delivery costs of just

1% would lead to millions of dollars becoming available for additional capital needs.

The Project Team will *"Build a Framework for Improvement"* by:

- Comparing current project delivery processes.
- Collecting data on historical performance.
- Defining and implementing Best Management Practices (BMPs).
- Tracking and measuring performance improvement from BMP implementation.

The Study Process Involves:

- Analysis of performance data provided by all agencies.
- Identification of process similarities and differences.
- Adaptation of key processes for implementation into one's own organization.

Original expressions of the desirable outcomes of The Study:

1. Initiation of an open forum to enable agency representatives to communicate and network with one another.
2. A learning experience for all agencies to understand each other's processes for managing CIP project delivery.
3. A "predictive tool": a basis to estimate CIP delivery costs in the future.
4. A "comparative tool": a basis for every agency to compare their performance against industry trends.

C. 2008 BENCHMARKING STUDY OBJECTIVES

In 2008, the Project Team built upon the experience and lessons learned from previous Studies. The Project Team is a cohesive unit whose members eagerly share information and help each other find solutions to shared challenges and develop better practices and processes related to project delivery. In 2008, the Team made progress toward project delivery improvement in spite of significant agency budget shortfalls. Their tools were:

- knowledge of what they were spending to deliver projects;
- knowledge of what processes could be added or improved to make project delivery more efficient; and
- the online forum wherein any participating agency could post a current challenge and receive constructive feedback from their peers.

PROCESS BENCHMARKING

- Four new Best Management Practices were initiated as a result of the online forum and discussions during the project meetings.
- Information on project delivery practices, processes and procedures currently used was updated.
- Progress on the implementation of targeted Best Management Practices was tracked.

PERFORMANCE BENCHMARKING

The database was expanded to include historical project delivery cost data that could be used for comparative performance analysis and, cautiously, for budgeting purposes, to predict soft costs on similar projects.

Actual cost data on project delivery performance was gathered and an audit was conducted on previously collected data to confirm accuracy.

ONLINE FORUM

The online forum was used by all members to exchange ideas on issues and to discuss legislation related to project delivery and CIP programs. The online tool has proven to be a valuable tool, enabling the Project Team members to network with each other to the benefit of all participating agencies.

D. BENCHMARKING REPORT STRUCTURE

This report is organized as follows:

- ***Chapter 1*** provides an **Executive Summary** of the Arizona Benchmarking Study history and recent accomplishments.
- ***Chapter 2*** provides a short discussion on the **Arizona Benchmarking Study history**, objectives, study methodology, and benefits of participation by the Project Team.
- ***Chapter 3*** describes **Performance Benchmarking** and discusses the tables generated from the project database for comparing project delivery costs with total construction costs.
- ***Chapter 4*** describes **Process Benchmarking** and the implementation of Best Management Practices for improving project delivery performance.
- ***Chapter 5*** discusses the **Online Forum**, its

use and method of archiving and retrieving information. It also includes a redacted version of the Online Forum responses.

- ***Chapter 6*** contains the **Conclusion and Recommendations** based on the results of this year's study.
- ***Appendices*** provide sample questionnaires, BMP implementation Tables, Project Count and Cost Tables, and Performance Curves by type and categories.

E. STUDY METHODOLOGY

- From the initial conception of this Study, it was understood that the study would be molded and driven by and for the Project Team members. The goal: improving project delivery performance. The objectives of this study specifically focus on the needs of the participating Arizona Agencies/ Departments.
- The Study Team has developed 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.
- The Benchmarking data that has been collected, discussed, sorted and analyzed is either process -oriented or performance-oriented. Since, intuitively, improvement in processes precedes improvement in performance; most of the initial work is process-oriented. All information collected is shared with and reviewed by the Project Team to ensure the end evaluation is valuable to the Project Team members.

F. BENEFITS OF PARTICIPATING

The participating agencies have been supportive of the Arizona Benchmarking Study. It is made possible only because the Project Team members believe there are benefits resulting from their participation. The Project Team members have expressed the benefits they experience. Below are examples:

Pima County Natural Resources, Parks & Recreation Development Division Manager – "In general the Benchmarking and Best Management Practice initiative has provided opportunity for reviewing current business paradigms, mindsets and practice in a comprehensive business environment within an environment of similarly structured agencies with common goals and guidelines. This has allowed Pima County Natural Resources, Parks and Recreation (NRPR), to study its existing practice in light of the successful performance of like agencies and our common future goals. NRPR is at the threshold of implementation of these new procedures and has not yet a full measure of their affect on achieving our mission and goals. Nevertheless, there has been clearly a shift in the model regarding our approach to efficiency, economic, and practical applications. This change is evident in being able to better address the issue of accuracy when dealing with project schedules and budget projections as well as expenditure expectations. This newly found benefit has positively affected moral, which as we all know is key to the gate of quality in performance."

Pima County Public Works – "…the online forum is one of the most useful tools that we have available to us from the Arizona Benchmarking effort"

City of Mesa – "The Arizona Benchmarking Group has brought many different agencies together to share information, discuss methodologies for documenting business process metrics, analyze information between agencies to improve the way we do business, and provide a forum to be able to ask questions of colleagues. I'm looking forward to continuing to be involved with this group and want to say "Thank You" from the City of Mesa Engineering Department."

City of Phoenix / Engineering and Architectural Services Department

"This Benchmarking Study has been beneficial for us to be able to compare projects and project costs with other public owners, and to verify that our soft costs are comparable to others for similar projects. These cost analyses will be helpful in evaluating and estimating project costs, which is critical in forecasting capital improvement budgets.

The time spent discussing delivery methods, costs, project management, and best practices has afforded us opportunities to network in a forum where we can learn from other members' experiences, successes, and challenges.

The data and information obtained from this study can be utilized in conjunction with our own in-house evaluations and audits for efficiencies of delivery methods and effectiveness of project delivery performance."

Maricopa County Parks and Recreation Department – "The benefits of participating in this study have been the networking opportunities."

Maricopa County - Flood Control District – "The on-line forum and statistically significant project delivery cost comparisons"

Maricopa County Department of Transportation - "In 24 hours I received 14 responses to my question."

Pinal County - Public Works - "One of the greatest benefits for Pinal County, besides meeting and discussing issues with our peers, is getting a good idea of how we are doing as a county that is transitioning from a rural county, to a more urbanized and populated one. There are more demands placed on us for services, not just quantity of demands, but types of demands and participating in this study helps us with this transition."

G. PARTICIPATING AGENCIES

Pima County continues to provide leadership in the efforts of the Arizona Benchmarking Project Team and its consultants. The following agencies and departments contributed to the 2008 study:

Pima County

- Regional Wastewater Reclamation Department (RWRD)
- Natural Resources, Parks and Recreation
- Department of Transportation (DOT)
- Regional Flood Control District (RFCD)
- Facilities Management

Pinal County

- Public Works

Maricopa County

- Department of Transportation (DOT)
- Parks & Recreation Department
- Flood Control District (FCD)

Maricopa County Community Colleges District (MCCCD)

City of Phoenix

- Engineering-Architectural Services (EAS)
- Street Transportation Department
- Water Services Department (WSD)

City of Tucson

- Parks and Recreation
- Department of Transportation
- General Services Dept.
- Tucson Water

City of Mesa

City of Peoria

- Utilities
- Public Works

City of Casa Grande

For more detailed information on the agencies participating in this report, please reference the 2006 Arizona Benchmarking Report on the Pima County web site:

http://www.co.pima.az.us/CIP/azstudy.htm

CHAPTER 3

PERFORMANCE BENCHMARKING

A. STUDY CRITERIA AND DEFINITIONS

Performance benchmarking, within the context of this report, involves collecting documented actual costs on completed projects and plotting the component costs of project delivery against the total construction cost (TCC). The entire actual project costs are collected by the Project Team members and entered into a Performance Questionnaire created in Microsoft Excel. Data are then compiled from the questionnaires in MS Excel and transferred into a MS Access database where it can be retrieved for analysis.

The intent of the data gathering process is to identify and collect all costs to deliver a capital project. While there are at least five identifiable phases in the delivery of capital projects using the traditional design-bid-build process, costs are not usually tracked, coded, or divided by all of these phases by each agency.

For the purpose of this study, the costs related to planning, design and bid/award, through the issuance of the Notice-To-Proceed with Construction, are identified as "Design Phase Costs." Similarly, all costs related to construction management, inspection and commissioning/close-out, from NTP through the Notice-of-Completion, 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." See the Table 3-1 for the all of the Cost Categories for Traditional Method projects

Ongoing data analysis has generated revisions in the performance questionnaire to reduce the potential for errors in data collection and to facilitate both input into the database and clear analyses. For traditionally delivered projects, the performance questionnaires allow the Project Team member to specify labor soft costs as "actual" or "projected." "Projected" costs are used only when agencies budget particular line items by percentage and no adjustment is made during the cost of project delivery, in which case the "budget" becomes the actual cost.

The CM@Risk performance questionnaire was developed along similar lines. The performance questionnaires were revised to account for the fact that some Agencies/Departments could not provide actual costs for discrete line items for internal agency labor expenses.

Total Construction Cost (TCC)

TCC is the sum of the awarded construction contract, net change orders, utility relocation, and construction by internal agency forces. TCC does not include land acquisition, environmental/cultural resources monitoring and mitigation, design, or construction management. All projects included in the analyses have a TCC exceeding $100,000.

Outlier Elimination

The total project delivery cost of each project in the database is statistically evaluated against all other projects in the same classification. Potential outliers are referred to the respective agency / department to confirm whether project delivery used for the suspected outlier project was representative of the conditions and procedures normally used to deliver projects. Projects that are confirmed as outliers are excluded from the database so as not to skew the regression curves or the analyses.

Project Delivery Methods

The Benchmarking Study Group is tracking projects delivered using both the traditional design-bid-build delivery method and the CM@Risk delivery method. Limited performance data on projects delivered using the CM@Risk delivery method is available at this time, but due to the popularity of this method, the Project Team will continue to collect data in an effort to create a statistically significant database.

Study Projects

Projects included in the 2008 Study analyses must have been completed from 2003 through 2007, must not be an outlier, and must have a TCC exceeding $100,000.

Table 3-1 Project Cost Categories – Traditional Method

Category and Phase	Description
1) Design Costs:	The design phase (and associated costs) begins with the initial concept development, includes planning as well as design, and ends with the issuance of a construction notice-to-proceed. Design costs consist of direct labor costs, other direct agency costs such as art fees and permits, and consultant services cost associated with planning and design. Design may include the following:
Pre-Design	• Complete schematic design documents • Review and develop scope • Evaluate schedule and budget • Review alternative approaches to design and construction • Obtain owner approval to proceed • Attend hearings and proceedings in connection with the project • Prepare feasibility studies • Prepare comparative studies of sites, buildings, or locations • Provide submissions for governmental approvals • Provide services related to future facilities, systems, or equipment • Provide services as related to the investigation of existing conditions of site or buildings or to prepare as-built drawings • Develop life cycle costs • Complete environmental documentation and clearances • Manage right-of-way procurement process • Monitor and control project costs
Design	• Complete design development documents including outline specifications • Evaluate budget and schedule against updated construction cost estimate • Complete design and specifications • Develop bid documents and forms including contracts • Complete permit applications • Coordinate agency reviews of documents • Review substitutions of materials and equipment • Prepare additive or deductive alternate documentation • Coordinate geotechnical, hazardous material, acoustic or other specialty design requirements • Provide interior design services • Monitor and control project costs
Bid and Award	• Prepare advertisement for bids • Perform prequalification of bidders • Manage the pre-bid conference • Perform the bid evaluations • Prepare the recommendation for award • Obtain approval of contract award from Board/Council • Prepare the notice to proceed • Monitor and control project costs

Category and Phase	Description
2) Construction Management Costs:	All costs associated with construction management, including closeout costs, are included in this category. Construction management costs consist of direct labor, other agency costs, and consultant usage. Construction management may include the following:
Construction	• Hold pre-construction conference • Review and approve schedule and schedule updates • Perform on-site management • Review shop drawings, samples, and submittals • Perform testing and inspection • Process payment requests • Review, and negotiate change orders • Prepare monthly reports to owner and agencies • Respond to requests for information • Develop and implement a project communications plan • Perform document control • Manage claims • Perform final inspections and develop/track punch list
Closeout Phase	• Commission facilities and equipment • Train maintenance and operation personnel • Document and track warranty and guarantee information • Plan move-in • File notices (occupancy, completion, etc.) • Check and file as-built documents • Monitor and control project costs
3) Total Project Delivery Costs:	This is the total cost of delivering a capital improvement project, equal to the sum of the design cost and construction management costs indicated above.
4) Change Order Cost:	The following defines types of change orders: • Unforeseen changes • Design document changes • Owner requested changes
5) Construction Cost:	This is the direct construction cost, including all change orders during the construction phase (from the issuance of Notice to Proceed to Notice of Acceptance). The following costs are associated with construction and are included in the TCC: • Direct actual construction • Total amount of positive change orders throughout construction • Fixtures, furnishing, and equipment (FFE) • Utilities relocation • Work performed by the agency's staff and other agencies staff

Change Order Classification

Change orders have always been the subject of great interest in the construction industry. In order to provide meaningful change order analyses, the Project Team members report change order data in accordance with predetermined categories as follows:

1. Owner Requested Changes
2. Design Document Changes
3. Unforeseen or Changed Conditions
4. Unable to categorize

Note: Occasionally contracts will include "indefinite quantities" or "allowances." Preliminary analyses indicate the costs associated with these items, which are captured in Total Construction Cost, do not have significant impact on change order curves drawn from the complete data base. The Project Team will continue to examine their impact on specific Types or Classifications of projects and may implement changes in the way this data is captured in future phases of this Arizona Benchmarking Study.

Other Questionnaire Features

- A number of new drop-down menus are provided to make data input easier for the team.
- "Project Type" can be selected from a list. The project types are listed in the Project Distribution Matrix (see Table 4-1).
- A dropdown menu 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 are able to provide justification for their indicated complexity index.
- Project costs include 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 found not to be 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. (Note: Some agencies' programs budget a specific percentage of construction cost for "fees" related to some cost items. In these cases, "actual" expenditures are not tracked and "actual" cost data was not available. Therefore, the percentages allowed in the budgets were included. The database allows for exclusion of these projects from regression curves where the user prefers only "actual" costs as the basis for any analysis.)
- 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.

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

B. CM@RISK PERFORMANCE QUESTIONNAIRE

Most of the information provided in section A of this Chapter is also applicable to CM@Risk projects, however, elements that are specific to CM@Risk projects are identified in this section.

The performance questionnaire for CM@Risk projects was developed with the aid of the City of Phoenix. Phoenix had constructed a number of projects under the CM@Risk delivery method. Due to varying methods of documenting actual costs by the participating agencies, two performance questionnaires were developed capture costs categories found in the different CM@Risk contract types: one type of questionnaire is used when an Agency/Department is able to segregate project soft costs between the Planning/Design and the Construction phases; and the second type of questionnaire is used when Agencies/Departments are unable to segregate costs and could only provide soft costs for the total project.

The CM@Risk questionnaires also include drop-down menus created to make the input of information easier. Drop down menus are included for project

type, whether the project was a new or rehab project, and for the complexity of the project. In the "Agency Labor" row, the soft costs are based on the Agency'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 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, 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.

C. DATA COLLECTION

The Project Team 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.

- The study continues to collect additional traditional 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, and the 2007 study examined a total of 304 projects. The 2008 study started with a project count of 363 projects however this number has been reduced by eliminating projects with questionable data and eliminating projects completed prior to 2003. The 2008 Study consists of a total of 245 Traditional Design Bid Build projects completed with in 2003 through 2007 five year rolling window period. The construction value of the projects in the 2008 study was over $788 Million.
- More of the agencies are using CM@Risk and the number of projects being entered into the database is increasing. For the 2006 Study, 24 CM@Risk projects were included in the database. For the 2007 Study, 47 projects were submitted to double the size of the database. In the 2008 Study the project total increased to 62 with a value of $486 million.
- The Agencies/Departments have included change order costs whenever possible, and categorized them according to origin. Next year a new category will be added to include "indefinite quantities" or "allowances" to improve the quality of the change order data.

D. PROJECT TYPES AND CLASSIFICATIONS

All projects are divided by Project Type and further divided by Project Classification to enable the Project Team and the Study Team to perform a variety of cost analyses. Table 3-2 below identifies the project types and classifications.

Table 3-2 Project Types and Classifications (Traditional Delivery Method and CM@Risk)

Project Types	Classifications
Municipal Facilities	Libraries Police and Fire Stations Community Centers, Recreation Centers, Child Care Facilities, Gymnasiums Office (Tenant Improvements)
Streets	Widening Bridges (Retrofit and New) Reconstruction New Construction Signal and ITS
Pipes and Plants	Treatment Plants Gravity Pipes Pressure Pipes
Parks	Park Development / Additions Restrooms Sports Lighting Projects
Flood Control	Detention Channels - Structural

E. PERFORMANCE DATA ANALYSES

Table 3-3 shows the Design percentage, Construction Management percentage percentage, Total Project Delivery percentage, Median TCC and number of projects included for all classifications of projects submitted using the Traditional Delivery Method for the years 2003 to 2007. In order to measure the expected improvement in project delivery resulting from Best Management Practice implementation, the Project Team uses a "rolling window" of the most recent five years of project delivery data. Each subsequent year the oldest year will be dropped off and the newest year will be added into the study.

expended on in-house resources VS consultants. This table shows a large variance between the Agencies for the Total Percent of TCC for all three categories. However, the overall percent of TCC (for all agencies combined) appears to be credible. The difference between agencies is likely the manner in which the data is collected and reported by the various agencies. One of the consistencies that this table indicates is a majority of Design, Construction Management and overall Project Delivery efforts are completed by consultants rather than in-house.

Table 3-3 Project Delivery Costs by Project Completion Year as a percentage of Total Construction Cost (Traditional Delivery Method)

For projects completed in the 5 Year Rolling Window from 2003 through 2007

Year	Design	Construction Management	Project Delivery (TOTAL)	Median TCC ($M)	Number of Projects
2003	19.2%	14.8%	34.0%	$1.89	37
2004	19.7%	13.2%	32.9%	$0.92	49
2005	16.2%	12.9%	29.1%	$1.17	56
2006	16.2%	14.2%	30.4%	$1.26	62
2007	16.9%	14.4%	31.2%	$1.34	41
All	**17.5%**	**13.8%**	**31.3%**	**$1.24**	**245**

Table 3-4 shows the Design, Construction Management, Project Delivery and Total Construction Costs for each agency included in the 2008 data set. This table also shows the percentage of those costs

Table 3-4 Project Delivery Performance and Consultant Usage by Agency (Traditional Delivery Method)
For projects completed in the 5 Year Rolling Window from 2003 through 2007

AGENCY	DESIGN					CONSTRUCTION MANAGEMENT					PROJECT DELIVERY					TCC	
	In-House		Consultants		Total % of TCC	In-House		Consultants		Total % of TCC	In-House		Consultants		Total % of TCC	Average	Median
	($M)	% of Design	($M)	% of Design		($M)	% of CM	($M)	% of CM		($M)	% of PD	($M)	% of PD			
Agency A	$14.43	37.1%	$24.45	62.9%	18.6%	$25.16	59.8%	$16.90	40.2%	14.7%	$39.58	48.9%	$41.35	51.1%	33.3%	$4.49	$1.29
Agency B	$10.83	35.0%	$20.14	65.0%	22.1%	$6.54	31.2%	$14.42	68.8%	13.3%	$17.37	33.4%	$34.56	66.6%	35.4%	$2.76	$0.44
Agency C	$5.23	31.6%	$11.32	68.4%	16.2%	$10.16	89.8%	$1.16	10.2%	10.9%	$15.39	55.2%	$12.47	44.8%	27.1%	$2.45	$1.28
Agency D	$2.79	12.3%	$19.93	87.7%	15.3%	$17.19	54.1%	$14.61	45.9%	17.9%	$19.97	36.6%	$34.54	63.4%	33.2%	$2.94	$1.68
Agency E	$0.06	7.3%	$0.77	92.7%	11.0%	$1.15	80.9%	$0.27	19.1%	18.8%	$1.21	53.7%	$1.04	46.3%	29.8%	$7.56	$7.56
Agency F	$0.48	9.5%	$4.58	90.5%	9.1%	$0.67	73.1%	$0.25	26.9%	4.7%	$1.15	19.3%	$4.83	80.7%	13.9%	$4.16	$0.63
Agency G	$0.13	15.1%	$0.74	84.9%	7.6%	$0.29	92.2%	$0.02	7.8%	3.4%	$0.42	35.6%	$0.77	64.4%	11.0%	$2.17	$2.11
OVERALL	$33.95	29.3%	$81.94	70.7%	17.5%	$61.15	56.2%	$47.62	43.8%	13.8%	$95.10	42.3%	$129.56	57.7%	31.3%	$3.22	$1.24

Notes:
1. In-House and Consultant costs are expressed as percentages of total agency Design, Construction Management (CM), and Project Delivery (PD) costs
2. Total Construction Cost (TCC) is the sum of construction contract award, change orders, utility relocation costs, and agency forces construction costs
3. Design, CM, and PD costs are expressed as percentages of TCC and are unweighted, arithmetic averages of projects by agency

Table 3-5 shows the Project Delivery cost as a percentage of the Total Construction Cost by Project Type for each agency for the five year rolling window period of 2003 through 2007. The table indicates a wide variation in percentage between agencies.

As indicated by Table 3-6, project size (measured as median total construction cost), has been generally rising since 2004. Project delivery costs (as a percentage of total construction costs) are influenced by economies of scale and exhibit an inverse relationship with total construction costs, Thus, project delivery costs intuitively should be lower on larger projects than they are on smaller projects. This trend is not overwhelmingly evident in Table 3-6, but is clearly seen in the regression curves in Appendix D.

F. PERFORMANCE CURVES

Performance curves produced for this Study are regressions of data, demonstrating how close of a relationship exists between the dependent variable (Y-axis) and the independent variable (X-axis). For instance, a regression curve of design cost as a percentage of Total Construction Cost (TCC) versus TCC is prepared to evaluate how dependent design cost is to TCC.

The regression trend line provides a running average of project delivery cost for each TCC that can be used as a starting point for developing budgets for a program of projects. Caution and use of professional judgment regarding other project cost influences is required if using the regression trend line to develop budgets, particularly for individual projects.

CONFIDENCE INTERVAL

The upper bound of the 40 percent confidence interval is displayed on each of the regression curves within this study. The upper and lower bounds of the confidence interval indicates the level of certainty in a data set, and how likely it is that a random sample of the data set will fall within the interval, the less certainty in the model and greater the need to collect more data before drawing conclusions from the data set.

COEFFICIENT OF DETERMINATION

A best-fit logarithmic curve is calculated using the least-squares method in Excel, and a R^2 value is displayed. The R^2 value, also called the coefficient of determination is a value between 1 and 0, with a value approaching 0 indicating a poor model and a value approaching 1 indicating a high dependence of the Y-value statistic on the X-value statistic.

Project performance data were analyzed using the custom database application at both the Project Type level and the Project Classification level. The database application was used to select data and generate regression curves for the Study.

AZ STUDY REGRESSION CURVES

The regression curves derived from the database for this Study become more statistically significant as more projects are added. However, with the number of projects that are input for each project type and classification, most of the curves should be used for general analyses and only cautiously for prediction of future performance.

The reliability of each curve improves as R^2 approaches "1.0" and many of the regression curves have reasonable R^2 values. The regression curves are included in Appendix D for review and evaluation.

Table 3-5 Project Delivery Cost / Total Construction Cost Percentage by Project Type
For projects completed in the Five Year Rolling Window from 2003 theough 2007

Project Type / Agency	City of Mesa	City of Phoenix	City of Tucson	Maricopa C.C.	Maricopa County	Pima County	Pinal County	Average All Agencies
Municipal Facilities	**N/A**	**N/A**	**18.59%**	**29.79%**	**N/A**	**25.59%**	**14.54%**	**22.13%**
Libraries	N/A	N/A	48.46%	N/A	N/A	30.65%	N/A	**39.56%**
Police / Fire Station	N/A	N/A	13.61%	N/A	N/A	19.81%	15.35%	**16.26%**
Community Bldg./Rec. Center	N/A	N/A	19.45%	29.79%	N/A	30.00%	12.76%	**23.00%**
Office - (TI's)	N/A	N/A	8.28%	N/A	N/A	26.19%	N/A	**17.24%**
Streets	**9.06%**	**30.36%**	**37.48%**	**N/A**	**33.35%**	**34.23%**	**12.62%**	**26.18%**
Widening	N/A	37.70%	N/A	N/A	31.31%	21.39%	N/A	**30.13%**
Bridges - (Retrofits & New)	N/A	29.32%	N/A	N/A	37.36%	27.02%	N/A	**31.23%**
Reconstruction	5.83%	30.18%	37.39%	N/A	46.96%	51.43%	N/A	**34.36%**
New Construction	N/A	N/A	N/A	N/A	38.23%	N/A	12.62%	**25.42%**
Signals & ITS	12.30%	29.30%	51.93%	N/A	30.93%	39.47%	N/A	**32.79%**
Pipes & Plants	**12.24%**	**29.32%**	**17.86%**	**N/A**	**24.04%**	**35.14%**	**N/A**	**23.72%**
Treatment Plants	N/A	29.47%	N/A	N/A	N/A	35.14%	N/A	**32.31%**
Gravity Pipes	N/A	34.47%	N/A	N/A	24.04%	N/A	N/A	**29.26%**
Pressure Pipes	12.24%	30.09%	17.86%	N/A	N/A	N/A	N/A	**20.06%**
Parks	**N/A**	**25.74%**	**29.92%**	**N/A**	**24.37%**	**21.75%**	**N/A**	**25.44%**
Park Development/Additions	N/A	22.28%	29.89%	N/A	31.37%	23.38%	N/A	**26.73%**
Restrooms	N/A	22.09%	30.04%	N/A	16.77%	N/A	N/A	**22.97%**
Sports Lighting Projects	N/A	N/A	N/A	N/A	N/A	14.72%	N/A	**14.72%**
Flood Control	**N/A**	**39.90%**	**20.30%**	**N/A**	**20.47%**	**30.79%**	**N/A**	**27.87%**
Detention Channels / Structural	N/A	39.90%	20.30%	N/A	20.47%	30.79%	N/A	**27.87%**

Table 3-6 Project Count and Project Delivery by Completion Year (Traditional Delivery Method)
For projects completed in the 5 Year Rolling Window from 2003 through 2007

Project Completion Date	Count by Project Type						Project Delivery Data				
	Municipal Facilities	Streets	Pipes & Plants	Parks	Flood Control	Total	Average TCC ($M)	Median TCC($M)	Design Cost (% of TCC)	Construction Management Cost(% of TCC)	Project Delivery Cost (% of TCC)
2003	5	18	9	5	0	37	$3.83	$1.89	19.2%	14.8%	34.0%
2004	6	17	14	9	3	49	$2.66	$0.92	19.7%	13.2%	32.9%
2005	16	14	10	13	3	56	$3.26	$1.17	16.2%	12.9%	29.1%
2006	9	38	9	2	4	62	$3.06	$1.26	16.2%	14.2%	30.4%
2007	8	26	5	1	1	41	$3.52	$1.34	16.9%	14.4%	31.2%
Total	**44**	**113**	**47**	**30**	**11**	**245**	**$3.22**	**$1.24**	**17.5%**	**13.8%**	31.3%

CHAPTER 4

PROCESS BENCHMARKING/ BEST MANAGEMENT PRACTICES

A. INTRODUCTION

Optimizing project delivery requires that each Project Team member objectively review its integral processes and also consider the processes employed by other team members. This objective consideration leads to the adoption of processes that may provide a better and/or less costly way to deliver projects. Whenever the Project Team reaches consensus on a better and/or less costly procedure, it is identified as "Best Management Practices" (BMP).

It is 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 Project Team member audit itself to insure: 1) the Best Management Practice is followed; and 2) by following the Best Management Practice, the Agency/Department is improving quality and/or reducing the cost of project delivery.

The goal of this study is to develop hard data, documenting the impact of implementing Best Management Practices (BMP) on project delivery performance. The objective is that implementing BMPs will improve project delivery performance.

Tables B-1 and B-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.

During the first year of the study (2005), the Project Team focused on Best Management Practices as a means of defining and evaluating their internal processes and developing ways to improve them. The next step was to develop a survey to monitor and track the progress of implementing the identified BMPs.

In 2006, the Project Team was asked to respond to the revised BMP Survey, which included seven more BMPs, and to target or specify which BMPs would be most beneficial to implement in the coming year. In 2006, a survey listing BMPs associated with CM@ Risk delivery method was developed with assistance of 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. The original BMPs for CM@Risk were subsequently revised after a meeting with the Project Team on October 5, 2006.

In 2007, the Project Team focused on implementing Best Management Practices. Some of the Agencies/ Departments targeted additional BMPs for implementation. The implementation of the targeted and non-targeted BMPs was tracked through self reporting surveys. The 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 eight (8) Cities and Counties plus the Maricopa County Community College District are actively committed to reducing capital project delivery costs. The Project Team is convinced that in order to improve performance, it is necessary to improve the practices, procedures and processes that impact performance. Developing and implementing Best Management Practices is the primary manner in which the Project Team chose to improve their processes and performance.

C. NEW BEST MANAGEMENT PRACTICES

In the later part of 2007, the Project Team began discussing areas of concern for which Best Management Practices had not yet been developed. These areas of concern were the result of issues discussed on the online forum and at Project Team meetings. In 2008, these concerns were further defined and BMPs were developed and included as part of both the Traditional and CM@ Risk Best Management Practices. The following are the new BMPs added in 2008.

- RIGHT-OF-WAY

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

- UTILITY RELOCATION

Additional efforts will be committed during the design process to accurately locate existing utilities

and define them in the contract documents.

- GREEN BUILDING

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

- PROJECT INITIATION

All inter-departments and intra-departments related to scope, operations or funding are clearly defined and documented prior to design start.

D. TARGETED BEST MANAGEMENT PRACTICES FOR TRADITIONAL PROJECTS

The project team members targeted different BMPs.

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 Waste 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 for 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." 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)

MCDOT 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 to improve project delivery performance and enhance the 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 overall project planning and management of projects during the construction phase.

CITY OF TUCSON

The City of Tucson targeted three (3) Best Management Practices to improve its project management in the design and construction phases, and to ensure 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: 1) limiting changes to the early stage of design 2) ensuring critical clauses are included in its contracts, 3) having a system in place to track project cost and schedule.

PINAL COUNTY

Targeted BMP's continuing or implemented in 2008:

- The County continues to work on BMP's previously listed. One of the things the department and county is implementing is: MFR (Managing for Results). As a department, measurements and goals are being established that incorporate the use of many BMP's. As a result, this will give a better quantifiable measure of the department's success and the efficiencies they are striving to obtain.

New BMP's for 2009: None at this time. The assimilation of previous BMP's into our Departmental MFR process and strategic business plan is their main goal.

STUDY YEAR 2008

In 2008, the Study Team did not target any additional Best Management Practices for either Traditional or CM@Risk delivery methods. The reason was two fold. First, many of the targeted BMPs from 2006 and 2007 require additional time to be adequately implemented. Second, 2008 was a difficult budget year for all of the agencies and departments and the resources were not available to tackle additional tasks.

City of Phoenix / Engineering and Architectural Services Department

Targeted BMP's are in process or were implemented in 2008:

- **No. 6** "All projects are shown on a Geographical Information System."– implemented
- **No. 24** "Formal training for project managers is provided on a regular basis."– implemented (on-going as well due to staff turnover)
- **No. 25** "A standard Project Controls System is used on all projects." - implemented

New BMP's for 2009:

- **No. 24 –** "Formal training for project managers …" - PM training (on-going)
- **No. 27 –** "There are procedures in place to measure and ensure Project Manager Performance and Accountability." -
- **No. 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)."

E. CM@RISK PROJECTS BEST MANAGEMENT PRACTICES

As mentioned, the 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 Project Team 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 the Project Team. The survey was revised to address the concerns expressed.

CHAPTER 5

ONLINE FORUM

A. USE OF ONLINE FORUM

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

1. Once a question is received, every Project Team member who has knowledge of or interest in the issue should respond to everyone on the email.
2. The Study Team should be copied on all questions and responses.
3. The subject line of the email should contain the question or the issue as well as a brief description.
4. If the individual is not familiar with the subject matter, he/she should respond with "No comment." In this manner, all Project Team members, including the initiating member, will be aware that the email was received by everyone.
5. The Study Team will post all questions or issues and responses in the yearly Benchmarking Study Report.
6. Pima County modified their web site to include all of the online forum questions and answers so the Project Team members can use this as a resource library. Pima County also includes the Arizona Benchmarking Study on their web site so both Project Team members and non-team members have access to the information the Project Team develops.

Issues discussed on the online forum during 2008 include the following:

- Value Engineering
- Inflation Escalation
- Building Information Modeling
- Project Tracking Software
- Consultant Evaluation System
- Change Order Data

B. ONLINE FORUM QUESTIONS AND ANSWERS 2008

Value Engineering (1/16/08)

Value Engineering Studies are performed on all projects greater than $1 million - How specifically are you performing the value engineering studies - for example is it with a third party, thru the design team - if you have scopes of work can you send a sample? We talk a lot about value engineering on projects but it is usually a part of the designers work and is considered as the design proceeds but not as a separate and distinct item so any help/advice is appreciated.

Team Building Process is used on all projects with a value greater than $5 million - How specifically are you performing the team building, what is your process, how is it being implemented, if you have any scopes of work can you send a sample? I believe the CM@R projects have much better team work than the traditional DBB projects - do you make a distinction between these when you are performing team building?

The City of Phoenix

Value Engineering is a basic design phase service for both CMAR and Design-Build delivery methods. The City has engaged a 3rd party VE facilitator on formal teambuilding workshops for large projects, such as the Convention Center ($560 M) and Downtown Hotel ($220M). The Water Services and Aviation Departments have also implemented formal teambuilding into their project process.

Other value engineering depends on the size and delivery method of the project. For example, on a small JOC (less than $1M), the contractor might be given a consultant fee to do a quick buildability review at 90% plans and make suggestions. Similarly on a larger CMAR, sometimes the contractor is tasked with the cost estimates on each submittal (such as the 30-60-90-100). This process allows the contractor to constantly review the plans for constructability, interacting with the designers, and identifying expensive areas that could be changed in subsequent submittals. During this process the owner, designer, and contractor are working together to make sure the needs are being met.

In the City's experience, team building tends to occur naturally with CMAR if the contract specifies the designer and contractor to work together. On

DBB jobs, however, team building has occurred mostly out of necessity (i.e. when a project is obviously in trouble). In the past, "lessons learned" meetings with designers and contractors have been more insightful and productive than team building meetings.

Pima County DOT

The Department plans to have a Value Engineering consultant contracted by February 2009, to be used on all Capital Projects. As teambuilding "Partnering Principles," Pima County DOT has implemented a successful process of conducting partnering workshops on all roadway projects for both the design and construction phases. Teamwork is the most important principle of Partnering. When all parties agree and commit to the project partnering charter, they commit to working together. The Partnering process includes monthly evaluation that allows the team to reevaluate their goals and commitment to the project.

Maricopa County DOT

Value engineering (VE) is conducted on large projects at 40% plans. An outside consultant facilitates the workshop with a nonbiased team. For a more complete perspective, one member of the VE team is usually from an outside agency. Partnering is conducted at the start of construction by a facilitator chosen by the contractor.

Inflation/Escalation (1/16/08) -

We are wondering if anyone has an effective means of indexing project cost estimates to account for inflation/escalation that is likely to occur before the construction contract is awarded. Does everyone still agree that 5% is a realistic factor to use for inflation/escalation over the next three to five years?

City of Tucson

The City has been using 5%, which is the inflation percentage that the Project Team agreed upon.

Pima County DOT

It isn't known whether contacts have been indexed from award to construction start; however, many fees are indexed. The CCI, which has averaged just over 3% annually, has been used. Depending on the type of construction, the ARTBA (transportation index) has been considerably higher—8-10% in the last 2 years.

Maricopa County Community College District

Different rates will have to be applied towards horizontal vs. vertical construction. Horizontal work weighs heavily in asphalts, concrete, oil based products and diesel fuel for construction vehicles. While vertical projects include these materials, there are many others materials that fluctuate in price. The City of Phoenix, in recent years, noted a decrease in inflation among horizontal project cost. There has been an upward trend in vertical project cost. MCCCD continues to use 6.5% to 7.5% forward looking, but proactively monitors the marketplace for mitigation opportunities.

Labor force is a critical issue, particularly the impact new state laws have had on the undocumented workforce in Arizona. The affects of cutting 25% of an already short workforce is a concern on overall construction cost. While the fall in the residential market has moved tradesmen into non-residential activities, it is still unknown whether the market changes will result in reduced or increased costs. Recent economic changes will impact costs this year and in the future.

City of Phoenix

On a quarterly basis, the City conducts annual forecast and track escalation on water/wastewater projects. The model was designed to generate and monitor escalation specifically on the City's water projects.

City of Mesa

The City uses "The Data DIGest" put out by AGC, which is a reliable source for analyzing construction cost escalation factors. The charts and graphs are available every quarter, which plot cumulative change in PPI (producer price index). PPI is the price charged by a producer of that material (concrete, asphalt paving, diesel, gypsum, wood, etc.). There are PPI graphs for cumulative change for construction types (highway/street construction, heavy construction, non-residential buildings, etc.) and compares it to the CPI, which is the standard of measuring cost escalation and is familiar to most officials. Usually these escalation factors can be 3-4% higher than the CPI. To access this information, contact: simonsonk@agc.org and http://www.agc.org/galleries/econ/CIA08.pdf.

City of Mesa

Regarding cost escalation, AGC's "Data DIGest" provides information on historical trends for various construction inputs. It analyzes and compares producer price index (PPI) to the general index (CPI) used by administrative and financial leaders when looking at escalation factors for particular project costs. It also gives labor statistics for the various trades, although it measures nationwide rather than "local" conditions of labor rates. The Project Team can view this information at: http://www.agc.org/cs/industry_topics/construction_economics/data_analysis.

MCCCD

MCCCD recommends that the Project Team visit the Associated General Contractors website, and subscribe to the email distribution from Ken Simonson (simonsonk@agc.org). "The Data Digest" is published weekly and is an excellent resource for industry pricing/work load trends, materials costs history and projections, etc.

BIM (3/17/08)

Attached is a draft of a document being prepared by ASU's Alliance Construction Excellence on BIM- Building Information Modeling. Many of the documents prepared by ASU's ACE group become guidelines for the State's construction industries. It may be interesting for our best practices group to read this and if they have any comments, send them on to: Beth.Scarano@mortenson.com, who is coordinating this effort. As public owners, we have a significant stake in how and where BIM will be used.

No Responses

Project Tracking Software (4/1/08)

I am looking for a way to track budget and schedule performance of a portfolio of projects and even beyond that to program performance (possibly looking at dissimilar projects - i.e., planning vs. design vs. construction vs. operations). What tools or methods are your agencies using to report on schedule slippage or budget changes?

Pima County CIP

For over 10 years, the CIP unit used an in-house application. A new software platform is currently being implemented to help track all project information.

Contractor Rating System (4/8/08)

City of Tucson is implementing a survey for contractors to use as a vehicle for providing feedback to the City. We are also developing a performance evaluation form for project managers to evaluate contractors' performance. A question has been raised as to whether evaluating contractors is problematic from a legal standpoint. My question to the group:

Does any public agency currently rate the performance of construction bid contractors after project completion? If so, what types of categories are they rated in and how are the results utilized?

Pima County Procurement Design and Construction

There were two standardized federal forms shared for evaluation—one for the designer/engineer and one for the contractor. Both are GSA forms and focus on vertical construction. Pima County will be developing a similar tool to evaluate all types of construction projects. The evaluation would be retained in the contract file and be accessible for future responsibility determinations or in conjunction with past performance evaluations.

MCCCD

Evaluation of contractors and designers, whether on a traditional or CMAR project, is really important. For CMAR and other alternative delivery, it provides a record to refer to in a future selection. For traditional bid, the evaluation can become a valuable part of the record to be able to reject a bid from a contractor who has performed badly in the past.

MCCCD refers to the evaluation forms when providing references to others on a contractor's past performance. Both the designer and contractor are also given the opportunity to fill out an evaluation on MCCCD at the end of the project.

Change Order Data (5/6/09)

I know that we provide change order information as part of the benchmarking effort. The benchmarking report, however, does not appear to aggregate the raw data. Do you have the data on change orders as a percentage of total construction cost? Is there an industry standard for public works projects?

Vanir CM

Change order data has been collected in the database. With the increase in database size, the data can be

manipulated to provide useful information such as change orders as a percentage of total construction costs. The Project Team will be asked about what kind of information they would like to see.

Pima County

Pima County has worked with several large CM firms that target 1-2% maximum for change orders. As a guideline, Pima County maintains contingencies of 5% for change orders with a goal of getting it down to 1-2%.

All of the questions and responses will be summarized on the Pima County web site:

http://www.co.pima.az.us/CIP/azstudy.htm

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

In 2008, the Project Team focused on reviewing and modifying their internal processes to align with and capture the intent of the Best Management Practices. Some of the Project Team members are developing matrices to track project performance and are using the Best Management Practices to help improve project performance.

In 2008, the participating agencies have continued to contribute project delivery cost data and the Study Team has continued to analyze the data.

A. PROCESS BENCHMARKING

Through the selection and implementation of certain Best Management Practices, the Project Team continues to work toward improving project delivery performance. During the past three (3) years, the Project Team Members have had the opportunity to look at what other Members are doing and what may work for them. The Project Team will continue to use this study to adjust, improve, and add project delivery practices and processes which have the potential for reducing project delivery costs and improving project quality.

In 2008 four (4) new Best Management Practices (BMP) were added to both the Traditional and CM@ Risk BMPs.

In this, the fourth year of the study, it is too early to tie improvements in project delivery performance data to the implementation of BMP's. However, linking implementation to improvements remains a long term goal of the Project Team.

TRADITIONALLY DELIVERED PROJECTS

Since the initiation of the study by Pima County four years ago, the participating agencies have been implementing Best Management Practices identified by the Project Team. The results of the 2008 survey indicate that several Best Management Practices remain a high priority for all of the Project Team members. The 2008 survey also indicates that substantial progress has been made in implementing BMPs. Five the 40 Best Management Practices have been fully implemented by almost all of the Project Team members. The Project Team is proud of this accomplishment. The details on the level of implementation are in Appendix B, Table B-3.

CM@RISK PROJECTS

The Project Team has made progress in implementing many of the CM@Risk Best Management Practices. An analysis of the implementation survey indicates that the members of the Project Team are targeting many similar BMPs. The level of implementation can be found in Appendix B Table B-4.

B. PERFORMANCE BENCHMARKING

In 2008, the Project Team recognized that project delivery costs are driven by a combination of factors that can be controlled by the Agency/Department. These factors include cost data capture and reporting, increased implementation of BMPs, and the introduction of tracking of project performance metrics.

The Project Team has continued to contribute project delivery cost information. The Study Team has continued to analyze the vast information in different ways to better understand the drivers of performance.

Overall project delivery costs for the duration of the study 2003 through 2007 are as follows:

- Design as a percentage of Total construction Cost = 17.5%
- Construction Management as a percentage of Total Construction Cost = 13.8%
- Project Delivery as a percentage of Total Construction Cost = 31.3%

C. ONLINE FORUM

Use of the Online Forum has increased throughout the study period. Twenty-five different topics were discussed that included questions varying from CPM Scheduling, Federal Energy Tax Incentives, to fees for professional services. Project Team members 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. If 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.

D. CONTINUOUS IMPROVEMENT

1. This study strengthens the foundation for continuous benchmarking assessment and improvement process. The Project Team members strive to implement Best Management Practices to improve project delivery performance. The Study Team monitors the Project Team's progress and approach to implementing these practices in future studies.
2. The Study Team will continue to review the Project Team's data collection processes for performance benchmarking to ensure that information received is consistent with the established guidelines in the study.
3. The Project Team will continue to share experiences and questions through the Online Forum. This forum has been an effective method to synergize the team and promote collaboration. The Online Forum is available on the Pima County web site, which makes it more accessible to the Project Team members and others interested in improving their project delivery process.

E. NEW MEMBERS IN 2008

In 2008, the Cities of Peoria and Casa Grande joined the Arizona Benchmarking Study. The project team welcomes their interest and eagerly awaits their future contributions.

F. PLANNING FOR 2009

During the Project Team meetings, several topics were identified that would be beneficial to address in the 2009 Study. These topics include:

- How to make contractors aware of all project requirements
- CM@Risk to the rescue: Is it really that good?
- Creating and implementing new BMPs
- CM@Risk: Getting the contractor to commit

ACKNOWLEDGEMENTS

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MESA CITY PLAZA
20 E. MAIN

Appendix A

Project Data Form & Instructions - Traditional
Project Data Form & Instructions - CM@Risk
BMP Survey - Traditional
BMP Survey - CM@Risk

Traditional Project Data Form

PROJECT DATA FORM

Agency: **Proj. Name:**

Project Type:

Project Index: **New / Rehab.:** **Complexity:**

Justification:

Description:

Comments:

	PLANNING		DESIGN		CONSTRUCTION		TOTAL	
	DOLLAR	% OF TCC	DOLLAR	% OF TCC	DOLLAR	% OF TCC	DOLLAR	% OF TCC
Agency Labor							$0	
Other Costs							$0	
Subtotal Agency	**$0**		**$0**		**$0**		**$0**	
Consultant							$0	
Total	**$0**		**$0**		**$0**		**$0**	
Duration		Months		Months		Months	0	Months

AMOUNT OF CONSTRUCTION CONTRACT		
CHANGE ORDERS:	OWNER REQUESTED CHANGES	
	DESIGN DOCUMENT CHANGES	
	UNFORSEEN CHANGES	
	(UNABLE TO CATEGORIZE)	
TOTAL CHANGE ORDERS		**$0.00**
UTILITY RELOCATION COSTS		
IN HOUSE CONST. RELATED MATERIALS AND SERVICES		
LAND ACQUISITION		
TOTAL CONSTRUCTION COST (TCC)		**$0.00**

CONTRACT COMPLETION DATE (MONTH YEAR)

Traditional Project Data Form

Instructions

PROJECT DATA FORM

Agency: 1 **Proj. Name:** 2

Project Type: 3

Project Index: **New / Rehab.:** 4 **Complexity:** 5

Justification: 6

Description: 7

Comments: 8

	PLANNING		DESIGN		CONSTRUCTION		TOTAL	
	DOLLAR	% OF TCC	DOLLAR	% OF TCC	DOLLAR	% OF TCC	DOLLAR	% OF TCC
Agency Labor 9	10		11		12		$0	
Other Costs	13		14		15		$0	
Subtotal Agency	**$0**		**$0**		**$0**		**$0**	
Consultant	16		17		18		$0	
Total	**$0**		**$0**		**$0**		**$0**	
Duration	19	Months	20	Months	21	Months	0	Months

AMOUNT OF CONSTRUCTION CONTRACT		22
CHANGE ORDERS:	OWNER REQUESTED CHANGES	23
	DESIGN DOCUMENT CHANGES	24
	UNFORSEEN CHANGES	25
	(UNABLE TO CATEGORIZE)	26
TOTAL CHANGE ORDERS	**$0.00**	
UTILITY RELOCATION COSTS		27
IN HOUSE CONST. RELATED MATERIALS AND SERVICES		28
LAND ACQUISITION		29
TOTAL CONSTRUCTION COST (TCC)	**$0.00**	
CONTRACT COMPLETION DATE (MONTH YEAR)		30

Item 1, Agency - In this item, the user selects the name of the applicable agency from a dropdown menu.

Item 2, Project Name - This is the name of the project (assigned by the Agency).

Item 3, Project type - The user selects the project type from the drop-down menu (these are the project types contained in the Project Distribution Matrix).

Item 4, New / Rehab - Select from two categories, "New Construction" or "Rehabilitation/Renovation" depending on the project.

Item 5, Complexity - This description is based on the Agency's experience and judgment, select the complexity of the project among 3 characteristics: Simple, Normal and Complex.

Item 6, Justification - Briefly discuss the rationale for defining the project as simple, normal, or complex in this cell.

Item 7, Description - Provide a brief description of the project such as place, activities or total square footage.

Item 8, Comments - If there are any specific comments or outstanding issues in the project or any explanation about the complexity, it could be mentioned here.

****NOTE:** Items 5-8 can be completed based on project records or on the project manager's comments.

The second section of the form includes item 9 to 21. These items determine soft costs (project delivery cost) and duration of each phase of the project. A detailed list of the types of costs that should be

included in each phase is included below. This portion of the form has been designed to categorize these costs into 3 groups; "Agency Labor", "Other Costs" and "Consultant" for each phase of the project.

In many projects it may not be possible to segregate planning and design costs. In this case, these two phases will be merged and categorized as "Design Costs."

Item 9, In this box the user selects from a drop-down box, either "Actual" or "Projection" to indicate whether the costs entered are based on "Actual" costs from the Agency's records or "Projected' or estimated based on the Agency's internal agency labor forecasts.

Items 10, 11 and 12, Agency Labor - These 3 items include all in-house labor (agency manpower) charges during each phase of the project.

****NOTE:** Labor costs from all departments on a project should be included in "Agency Labor."

Items 13, 14 and 15, Other costs - Any other soft cost during each phase, such as permit fees, advertisements, print and publishing and government approvals.

Items 16, 17 and 18, Consultant - Any cost related to the services which have been provided by outsiders to the agency, such as design, engineering services, inspection, construction, program management and any other consultants.

Items 19, 20 and 21, Duration of each of the phases of the work in months

- Duration of planning phase: between the time that the concept is first identified and the time that the scope and budget is documented to the design professional.
- Duration of design phase: between the time that the scope and budget is documented and NTP issued.
- Duration of construction phase is between "Notice-to-Proceed" and "Notice of Completion" dates.

The third section of the form relates to all hard costs (Construction Costs) of the projects and includes the contract completion date. This portion includes items 22 to 30.

Item 22, Amount of Construction Contract - All general contractor costs or any other construction costs incurred during the construction phase.

****NOTE:** If the project has more than one construction contract, total amount of the all contracts should be included.

Item 23, Change Orders – Owner Requested Changes – The cost of all Owner Requested Changes.

Item 24, Change Orders – Design Document Changes – The cost of all Design Document Changes.

Item 25, Change Orders – Unforeseen Changes – The cost of all Unforeseen Changes.

Item 26, Change Orders – Unable to Categorize – The cost of all changes that could not be categorized as Owner Requested, Design Document or Unforeseen Changes.

Item 27, Utility Relocation Costs- Any cost related to construction activities which have been done to relocate utilities.(if applicable).

Item 28, In House Construction related material and services - Cost of all the construction activities or materials, which have been performed or used by agency labor or paid directly by agency. Such as maintenance and operation, traffic signs, construction facilities and inventory.

Item 29, Land Acquisition- This item is to capture and segregate land acquisition costs. Item 29 is not included in the total construction cost.

Item 30, Contract Completion Date - This is the date that the notice of final construction completion was issued (in month/year).

CM@Risk Project Data Form- One Phase

PROJECT DATA FORM

Agency:

Project Name:

Project Type:

Project Index: **New / Rehab.:**

Complexity:

Justification:

Description:

Comments:

	SOFT COSTS	
	DOLLAR	% OF TCC
AGENCY LABOR		
Eng/Arch Services:		
Permits:		
Other:		
Subtotal Agency Labor	$0	
OUTSIDE SERVICES		
Design:		
Construction Admin:		
Real Estate:		
Environmental Oversight:		
Materials Testing:		
Telecommunications:		
Utility Coordination:		
Misc:		
CM at Risk Contractor:		
Total	**$0**	

Planning/Design Duration: Months

Construction Duration: Months

Total Duration: **0** Months

GMP	
CONTRACTOR'S CONTINGENCY USED	
OWNER'S CONTINGENCY USED	
EXCESS CHANGE ORDER COST	
TOTAL PAID TO CONTRACTOR	**$0**
FF&E	
UTILITY RELOCATION COSTS	
IN HOUSE CONST. RELATED MATERIALS AND SERVICES	

CM@Risk Project Data Form- One Phase

Instructions

PROJECT DATA FORM CMAR ONE PHASE

Agency: 1

Project Name: 2

Project Type: 3

Project Index: **New / Rehab.:** 4

Complexity: 5

Justification: 6

Description: 7

Comments: 8

	SOFT COSTS	
	DOLLAR	% OF TCC
AGENCY LABOR		
Eng/Arch Services:		9
Permits:		10
Other:		11
Subtotal Agency Labor	$0	
OUTSIDE SERVICES		
Design:		12
Construction Admin:		13
Real Estate:		14
Environmental Oversight:		15
Materials Testing:		16
Telecommunications:		17
Utility Coordination:		18
Misc:		19
CM at Risk Contractor:		20
Total	**$0**	

Planning/Design Duration: Months 21

Construction Duration: Months 22

Total Duration: **0** Months

GMP		23
CONTRACTOR'S CONTINGENCY USED		24
OWNER'S CONTINGENCY USED		25
EXCESS CHANGE ORDER COST		26
TOTAL PAID TO CONTRACTOR	**$0**	
FF&E		27
UTILITY RELOCATION COSTS		28
IN HOUSE CONST. RELATED MATERIALS AND SERVICES		29
LAND ACQUISITION		30
TOTAL CONSTRUCTION COST (TCC)	**$0**	
CONTRACT COMPLETION DATE (MONTH YEAR)		31

Item 1. Agency - In this item, the user selects the name of the applicable agency from a dropdown menu.

Item 2. Project Name - This is the name of the project (assigned by the Agency).

Item 3. Project Type - The user selects the project type from the drop-down menu (these are the project types contained in the Project Distribution Matrix).

Item 4. New / Rehab - Select from two categories, "New Construction" or "Rehabilitation / Renovation" depending on the project.

Item 5. Complexity – This description is based on the Agency's experience and judgment. The users select the complexity of the project from 3 options: Simple, Normal and Complex.

Item 6. Justification – This cell allows the users to briefly discuss the rationale for defining the project as simple, normal, or complex.

Item 7. Description – For this item, the user provides a brief description of the project (including place, activities or total square footage).

Item 8. Comments - If there are any specific comments or outstanding issues in the project, or any explanation about the complexity, it could be mentioned here.

****NOTE:** Items 5-8 can be completed based on project records or on the project manager's comments.

The second section of the form includes items 9 to 22. These items determine the soft costs (project delivery cost) and the total duration of the project. A detailed list of the types of costs that should be included is discussed below.

Item 9. Engineering/Architect/Agency Department Services – These are costs incurred by the Agency in performing in-house project related duties. This includes manpower expenditures from the planning phase through construction completion. It includes all in-house charges by all Agency personnel, including project managers, administrative personnel, and all other Agency inter-department charges to the project.

Item 10. Permits – This includes all Agency payments for permits.

Item 11. Other – This line item is to capture all other Agency costs not captured in items 9 and10, including advertisements, printing, publishing and any government approvals.

Item 12. Design – This is the cost paid to all designers (including the cost of all change orders). This would include all fees paid to other Architects/ Designers to perform other design related services, such as peer reviews.

Item 13. Construction Administration – This is the cost paid to any consultant to perform construction administration on the project (including the cost of any change orders issued).

Item 14. Real Estate – These are the fees paid to real estate consultants, including any costs to perform real estate appraisals.

Item 15. Environmental Oversight – This is the amount paid to any consultant to perform environmental oversight and/or remediation on the project.

Item 16. Material Testing – This is the cost paid to any Material Testing consulting firm.

Item 17. Telecommunications – This is the cost paid to any telecommunications consultant for installation and engineering services.

Item 18. Utility Coordination – This is the cost paid to any consultant to perform utility coordination if not done in-house.

Item 19. Misc. – Any other Consultant soft costs not captured above.

Item 20. CM@Risk Contractor – This is the cost paid to the CM@Risk Contractor for its reconstruction services (design phase).

Item 21. Planning and Design Duration – Total duration of these phases in months.

Item 22. Construction Duration – Total construction duration in months.

Item 23. GMP – Guaranteed Maximum Price (GMP) – The agreed upon contract cost to perform the work, including the Contractor's contingency.

Item 24. Contractor's Contingency Used – The amount of the Contractor's contingency used during the project.

Item 25. Owner's Contingency Used – The amount of the Owner's contingency used during the project.

Item 26. Excess Change Order Cost – Any approved change order costs incurred above the Contractor's and Owner's contingencies.

Item 27. FF&E

Item 28. Utility Relocation Costs - Any construction cost incurred to relocate utilities.

Item 29. In-House Construction Related Material and Services **-** Cost of all the construction activities or materials that have been performed or used by agency labor or paid directly by agency, such as maintenance and operation, traffic signs, construction facilities and inventory.

Item 30. Land Acquisition - This item is to capture and segregate land acquisition costs. This item is not included in the total construction cost.

Item 31. Contract Completion Date - This is the date that the notice of final completion was issued.

CM@Risk Project Data Form- Two Phase

PROJECT DATA FORM

Agency:

Project Name:

Project Type:

Project Index: **New / Rehab.:**

Complexity:

Justification:

Description:

Comments:

	PLANNING & DESIGN PHASE		CA/CM PHASE		TOTAL	
	DOLLAR	% OF TCC	DOLLAR	% OF TCC	DOLLAR	% OF TCC
AGENCY LABOR						
Eng/Arch Services					$0	
Permits					$0	
Other					$0	
Subtotal Agency Labor	**$0**		**$0**		**$0**	
OUTSIDE SERVICES						
Design					$0	
Construction Admin					$0	
Real Estate					$0	
Environmental Oversight					$0	
Materials Testing					$0	
Telecommunications					$0	
Utility Coordination					$0	
Misc					$0	
CM at Risk Contractor					$0	
Total	**$0**		**$0**		**$0**	
Duration		Months		Months	0	Months

GMP	
CONTRACTOR'S CONTINGENCY USED	
OWNER'S CONTINGENCY USED	
EXCESS CHANGE ORDER COST	
TOTAL PAID TO CONTRACTOR	**$0**
FF&E	
UTILITY RELOCATION COSTS	
IN HOUSE CONST. RELATED MATERIALS AND SERVICES	
LAND ACQUISITION	
TOTAL CONSTRUCTION COST (TCC)	**$0**

CONTRACT COMPLETION DATE (MONTH YEAR)

CM@Risk Project Data Form- Two Phase

Instructions

PROJECT DATA FORM

Agency: 1

Project Name: 2

Project Type: 3

Project Index: **New / Rehab.:** 4

Complexity: 5

Justification: 6

Description: 7

Comments: 8

	PLANNING & DESIGN PHASE		CA/CM PHASE		TOTAL	
	DOLLAR	% OF TCC	DOLLAR	% OF TCC	DOLLAR	% OF TCC
AGENCY LABOR						
Eng/Arch Services	9		10		$0	
Permits	11		12		$0	
Other	13		14		$0	
Subtotal Agency Labor	**$0**		**$0**		**$0**	
OUTSIDE SERVICES						
Design	15		16		$0	
Construction Admin	17		18		$0	
Real Estate	19		20		$0	
Environmental Oversight	21		22		$0	
Materials Testing	23		24		$0	
Telecommunications	25		26		$0	
Utility Coordination	27		28		$0	
Misc	29		30		$0	
CM at Risk Contractor	31		32		$0	
Total	**$0**	33	**$0**	34	**$0**	
Duration		Months		Months	0	Months

GMP	35
CONTRACTOR'S CONTINGENCY USED	36
OWNER'S CONTINGENCY USED	37
EXCESS CHANGE ORDER COST	38
TOTAL PAID TO CONTRACTOR	**$0**
FF&E	39
UTILITY RELOCATION COSTS	40
IN HOUSE CONST. RELATED MATERIALS AND SERVICES	41
LAND ACQUISITION	42
TOTAL CONSTRUCTION COST (TCC)	**$0**

CONTRACT COMPLETION DATE (MONTH YEAR) 43

Item 1. Agency - In this item, the user selects the name of the applicable agency from a dropdown menu.

Item 2. Project Name - This is the name of the project (assigned by the Agency).

Item 3. Project Type - The user selects the project type from the drop-down menu (these are the project types contained in the Project Distribution Matrix).

Item 4. New / Rehab - Select from two categories, "New Construction" or "Rehabilitation/ Renovation" depending on the project.

Item 5. Complexity – This description is based on the Agency's experience and judgment, select the complexity of the project among 3 characteristics: Simple, Normal and Complex.

Item 6. Justification - Briefly discuss the rationale for defining the project as simple, normal, or complex in this cell.

Item 7. Description- Provide a brief description of the project such as place, activities or total square footage.

Item 8. Comments - If there are any specific comments or outstanding issues in the project or any explanation about the complexity, it could be mentioned here.

****NOTE:** Items 5-8 can be completed based on project records or on the project manager's comments.

The second section of the form includes items 9 to 32. These items determine the soft costs (project delivery cost) and the total duration of the project. A detailed list of the costs that should be included in each phase is discussed below.

This portion of the form has been designed to capture Agency soft costs in two phases, the "Planning and Design" and the "CA/CM" Phases.

Items 9 and 10: Engineering/Architect/Agency Department Services - is that cost incurred by the Agency in performing in-house project related duties. This includes all in-house manpower expenditures by all Agency personnel including project managers, administrative personnel, and all other Agency inter-department charges on to the project.

Items 11 and 12: Permits – This includes all Agency payments for permits.

Items 13 and 14: Other – This line item is to capture all other Agency costs not captured in items 9 and 10, including advertisements, printing, publishing and any government approvals.

Items 15 and 16: Design – This is the cost paid to all designers (including the cost of all change orders), segregated by phase. This would include all fees paid to other Architects / Designer to perform other design related services, such as peer reviews.

Items 17 and 18: Construction Administration – This is the cost paid to any consultant to perform construction administration on the project (including the cost of any change orders issued).

Items 19 and 20: Real Estate – These are the fees paid to real estate consultants including any costs to perform real estate appraisals.

Items 21 and 22: Environmental Oversight – This is the amount paid to any consultant to perform environmental oversight and/or remediation on the project.

Items 23 and 24: Material Testing – This is the cost paid to any Material Testing consulting firm.

Items 25 and 26: Telecommunications – This is the cost paid to any telecommunications consultant for installation and engineering services.

Items 27 and 28: Utility Coordination – This is the cost paid to any consultant to perform utility coordination if not done in-house.

Items 29 and 30: Misc. – Any other Consultant soft costs not captured above.

Items 31 and 32: CM@Risk Contractor – This is the cost paid to the CM@Risk Contractor for his pre-construction services (design phase).

Item 33. Planning and Design Duration – Total duration of these phases in months.

Item 34. Construction Duration – Total construction duration in months.

The third section of the form relates to all hard costs (Construction Costs) of the projects

and includes the contract completion date. This portion includes item 35 to 43.

****NOTE:** If the project has more than one construction contract, the total amount of the all contracts should be included.

Item 35. GMP – Guaranteed Maximum Price (GMP) – The agreed upon contract cost to perform the work including the Contractor's contingency.

Item 36. Contractor's Contingency Used – The amount of the Contractor's contingency used during the project.

Item 37. Owner's Contingency Used – The amount of the Owner's contingency used during the project.

Item 38. Excess Change Order Cost – Any approved change order costs incurred above the Contractor's and Owner's contingencies.

Item 39. FF&E - Total costs related to FF&E.

Item 40. Utility Relocation Costs - Any construction cost incurred to relocate utilities.

Item 41. In House Construction related material and services - Cost of all the construction activities or materials, which have been performed or used by agency labor or paid directly by agency. Such as maintenance and operation, traffic signs, construction facilities and inventory.

Item 42. Land Acquisition - This item is to capture and segregate land acquisition costs. This item is not included in the total construction cost.

Item 43. Contract Completion Date - This is the date that the notice of final completion was issued.

TRADITIONAL BMP SURVEY

Arizona Benchmarking Team Best Management Practices Survey for Traditional Projects

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
Right-of-Way : Real Property is included in the initial project start-up to establish key deliverables and due dates.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Utility Relocation : Additional efforts will be expanded during the design process to accurately locate existing utilities and identify them on the contract documents.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Green Buildings : Sustainable design goals will be included in the initial project and performance outcomes measured at project completion. Operational measurements will follow annually.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Project Initiation : All inter-departments and intra-departments related to scope, operations or funding are clearly defined and documented prior to design start.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Revised August 2008
Thank you for completing the survey.

CM@Risk BMP Survey

Arizona Benchmarking Team Best Management Practices Survey for CM@Risk Projects

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
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
New Best Management Practices in 2008				
Right-of-Way : Real Property is included in the initial project start-up to establish key deliverables and due dates.	☐ 1	☐ 2	☐ 3	☐ 4
Utility Relocation : Additional efforts will be expanded during the design process to accurately locate existing utilities and identify them on the contract documents.	☐ 1	☐ 2	☐ 3	☐ 4
Green Buildings : Sustainable design goals will be included in the initial project and performance outcomes measured at project completion. Operational measurements will follow annually.	☐ 1	☐ 2	☐ 3	☐ 4
Project Initiation : All inter-departments and intra-departments related to scope, operations or funding are clearly defined and documented prior to design start.	☐ 1	☐ 2	☐ 3	☐ 4

Revised August 2008
Thank you for completing the survey.

Appendix B

Table B-1 - Traditional BMP Implementation Survey Results with Targets
Table B-2 - CM@Risk BMP Implementation Survey Results
Table B-3 - Level of BMP Implementation – Traditional
Table B-4 - Level of BMP Implementation – CM@Risk

Table B-1 - 2008 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				City of Mesa	City of Peoria
			WMD	PKS	DOT	FCD	FM		DOT	FCD		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	5	4	5	4	2	3	2	1 2007	2	2	1	4
	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	3	5	3	3	3	3	3	3	3	3	4
			2006 Target																	
	3	The Agency has a prioritization system.	3	3	2	5	4	5	5	5	2	4	4	5	3	2	4	2	5	5
	4	Program planning includes design and construction resource loading.	2	4	3	3	4	5	1	4	2	4	4	4	1	2	3	1	3	4
	5	Program planning includes a Master Schedule that includes start and finish dates for each project.	3	5	4	3	3	5	1 2006	4	4	3	2	5	1	1 2007	4	3	3	5
	6	All projects are shown on a Geographical Information System.	2	5	5	5	2	3	1 2006	5	1	4 2007	4	5	1	5	5	1	1	5
Design	7	Designers are provided with a clear, precise, scope, schedule, and budget prior to design start.	3	5	4	4	3	5	3	4	5	5	4	3	4	4	3	3	4	5
	8	Requirements for reliability, maintenance, and operation are defined prior to design initiation.	3	3	4	3	2	5	3	4	3	4	3	3	2	2	3	2	3	3
	9	Successful designs are re-used and site adapted whenever possible.	3	4	1	5	2	5	1	4	2	5	4	3	4	4	4	2	5	1
	10	Scope changes are limited to the early stages in design.	3	2	3	3	4	3	2	4	4	2	2	1	4	2 2006	3	2	4	3
			2006 Target																	
QA/QC	11	Approved scope changes are accompanied by budget and schedule modifications.	4	4	5	5	3	4	4	4	4	5	2	3	5	5	5	3		
															2006 Target					
	12	A standardized Project Delivery Manual is used on all projects.	3	3	5	4	2	4	1	3	4	4	3	5	1	4	3	3	1	1
															2006 Target					
	13	Value Engineering Studies are performed on all projects with a value greater than $1 million.	3	4	4	3	4	2	5	4	4	5	3	3	1	1 2007	2	1	2	4
	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	3	3	3	1	2	2	1 2007	2	4	5	1
	15	Post project reviews are performed and used to identify "lessons learned."	4	4	2	4	3	3	2	4	4	5	3	3	2	3	2	3	4	5
			2006 Target																	

Table B-1 - 2008 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				City of Mesa	City of Peoria
			WMD	PKS	DOT	FCD	FM		DOT	FCD		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	4	1
	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	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	5	1	2	2	5	5	3	3	2	5	5
	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	4	5	4	2	2	3	5	5
			2006 Target																	
Project Management	20	A pre-qualification process is used on large, complex projects.	3	5	2	4	1	2	1	1	5	5	5	5	5	0	2	4	5	5
	21	Bid advertisements are available online.	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5
	22	Bid documents are available online.	5	2	2	3	1	5	5	1	2	1	1	1	1	1	1	1	2	5
	23	Bids can be submitted/accepted online.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1
	24	Formal training for project managers is provided on a regular basis.	3	4	3	4	2	4	2 (2006 Target)	2	4	5 (2007)	4	5	2	0	2	2	4	3
	25	A standard Project Controls System is used on all projects.	2	3	5	3	2	1	4	5	5	1 (2007)	3	5	5	0	4	4	3	3
	26	There is a special project management team for small projects.	2	3	3	4	4	1	1	1	1	1	3	4	1	3	1	2	2	1
	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	2	1
	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	4	2	5	0	5	4	5	5
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	5	4	3	1	1	4	0	5	3	2	5
															2006 Target					

Table B-1 - 2008 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				City of Mesa	City of Peoria
			WMD	PKS	DOT	FCD	FM		DOT	FCD		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).	4	5	3	4	5	1	5	3	5	1	1	5	1	0	2	3	1	1
	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	5	5	4	5	4	5	5	5	5	5	5	3	2	5	1	5
	32	A Work Breakdown Structure (WBS) has been implemented to measure progress on project deliverables.	4	4	1	5	3	4	3	2	1	4	4	5	1	1 2007	1	2	4	3
	33	"Earned value" versus budgeted and actual expenditures is monitored during project delivery.	3	2	2	3	1	1	3	4	2	1	2	5	1	1 2006 2007	1	2	1	5
	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	2	3	3	2	3	1	0	2	2	3	5
	35	Small projects are bundled whenever possible.	4	4	3	4	3	3	5	3	2	2	3	4	3	3	2	2	5	4
	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.	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	1
New Best Management Practices	37	Right-of-Way - Real Property is included in the initial project start-up to establish key deliverables and due dates.	2	5	5		1	1	4	5			1	4			3		3	5
	38	Utility Relocation - Additional effort will be expended during the design process to accurately locate existing utilities and identify them on the contract documents.	3	5	5		2	3	5	5			3	4			3		5	5
	39	Green Buildings - Sustainable design goals will be included in the initial project and performance outcomes measured at project completion. Operational measurements will follow annually.	2	3	1		3	1	N/A			3		4			1		1	5
	40	Project Initiation - All inter-department and intra-departments related to scope, operations or funding are clearly defined and documented prior to design start.	2	5	4		2	1	4	4		2	2	4			2		3	5

Table B-2 - 2008 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		City of Mesa	City of Peoria
		PROC	WWM	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	3	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	5	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	5	3
4	The Architect's Contract requires a design schedule for deliverables.	2	5	5	2	4	4	5	4	4	5	4	4	5	5	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	3	5	4	3	4	5	5	5	5	5
6	The selected A/E has experience with CM@Risk projects.	3	5	4	2	4	5	4	4	3	4	5	1	5	4	5
7	Require that the A/E submits a fee proposal that includes all work to be performed.	2	5	4	4	5	5	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	5	5
9	The CM@Risk Contractor and the Architect are selected at the same time.	2	4	4	1	3	1	4	4	2	1	1	1	3	3	2
10	An accurate plan holder's list is maintained.	1	1	5	1	5	5	5	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	5	5
12	Provide that the CM@Risk Contractor must self-perform at least 45% of the work on "horizontal" projects.	5	3		5	5	5	0	5	1	1		5	5	1	1
	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	5	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	5	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	5	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	5	1
17	Provide that major subcontractors are selected early so that they participate in the design process	3	2	4	4	5	3	3	4	5	1	3	1	5	5	1
18	Require that the CM@Risk Contractor make recommendations for long-lead procurement items, to expedite the project or to save costs.	4	4	3	4	4	5	5	5	5	3	3	4	5	5	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	3	4	1	4	4	2	3	4	1	3	1	4	4	5

Table B-2 - 2008 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		City of Mesa	City of Peoria
		PROC	WWM	PKS	DOT	FCD			EAS	Water	Parks	GSD	DOT	Parks		
	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	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	3	5
22	The Owner's Contingency is defined	4	5	3	5	5	5	5	5	5	5	5	3	5	5	5
	Project Management															
23	Project Managers are trained on Alternative Delivery Methods.	2	4	3	3	3	4	4	5	5	3	3	1	5	3	5
24	Project Managers continually receive technical training.	2	3	2	4	4	5	4	5	5	2	2	1	5	3	5
	Design															
25	Require that Partnering sessions are held with all stakeholders.	2	3	2	5	5	5	1	5	4	5	2	4	5	3	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	5	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	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	5	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	5	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	1	3
	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	1	5
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	5	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	5	2
	New Best Management Practices															
34	Right-of-Way - Real Property is included in the initial project start-up to establish key deliverables and due dates.		3	4											3	5
35	Utility Relocation - Additional effort will be expended during the design process to accurately locate existing utilities and identify them on the contract documents.		3	4											5	5
36	Green Buildings - Sustainable design goals will be included in the initial project and performance outcomes measured at project completion. Operational measurements will follow annually.		1	3					3						1	4
37	Project Initiation - All inter-department and intra-departments related to scope, operations or funding are clearly defined and documented prior to design start.		3	4					2						3	5

Table B-3 - 2008 Level of Implementation of Best Management Practices -- Traditional Method

Ref. No.	Best Management Practices	Pima County					Pinal County	Maricopa County		MCCCD	City of Phoenix			City of Tucson				City of Mesa	City of Peoria
		WMD	PKS	DOT	FCD	FM		DOT	FCD		EAS	Streets	Water	Parks	DOT	Water	GSD		
21	Bid advertisements are available online.	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5
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	5	5
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.	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	1
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	4	2	5	0	5	4	5	5
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	5	5	4	5	4	5	5	5	5	5	5	3	2	5	1	5
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	4	5	4	2	2	3	5	5
7	Designers are provided with a clear, precise, scope, schedule, and budget prior to design start.	3	5	4	4	3	5	3	4	5	5	4	3	4	4	3	3	4	5
3	The Agency has a prioritization system.	3	3	2	5	4	5	5	5	2	4	4	5	3	2	4	2	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	5	1	2	2	5	5	3	3	2	5	5
11	Approved scope changes are accompanied by budget and schedule modifications.	4	4	5	5	3	4	4	4	4	5	2	3	5	5	5	3		
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	3	5	3	3	3	3	3	3	3	3	4
16	Change orders are classified by type.	2	2	1	5	4	2	5	5	5	5	5	5	1	5	2	3	4	1
6	All projects are shown on a Geographical Information System.	2	5	5	5	2	3	1	5	1	4	4	5	1	5	5	1	1	5
15	Post project reviews are performed and used to identify "lessons learned."	4	4	2	4	3	3	2	4	4	5	3	3	2	3	2	3	4	5
20	A pre-qualification process is used on large, complex projects.	3	5	2	4	1	2	1	1	5	5	5	5	5	0	2	4	5	5
5	Program planning includes a Master Schedule that includes start and finish dates for each project.	3	5	4	3	3	5	1	4	4	3	2	5	1	1	4	3	3	5
9	Successful designs are re-used and site adapted whenever possible.	3	4	1	5	2	5	1	4	2	5	4	3	4	4	4	2	5	1
35	Small projects are bundled whenever possible.	4	4	3	4	3	3	5	3	2	2	3	4	3	3	2	2	5	4
25	A standard Project Controls System is used on all projects.	2	3	5	3	2	1	4	5	5	1	3	5	5	0	4	4	3	3
8	Requirements for reliability, maintenance, and operation are defined prior to design initiation.	3	3	4	3	2	5	3	4	3	4	3	3	2	2	3	2	3	3
13	Value Engineering Studies are performed on all projects with a value greater than $1 million.	3	4	4	3	4	2	5	4	4	5	3	3	1	1	2	1	2	4

Targeted in 2006 = Grey
Targeted in 2007 = Light Grey

Table B-3 - 2008 Level of Implementation of Best Management Practices -- Traditional Method

Ref. No.	Best Management Practices	Pima County					Pinal County	Maricopa County		MCCCD	City of Phoenix			City of Tucson				City of Mesa	City of Peoria
		WMD	PKS	DOT	FCD	FM		DOT	FCD		EAS	Streets	Water	Parks	DOT	Water	GSD		
24	Formal training for project managers is provided on a regular basis.	3	4	3	4	2	4	2	2	4	5	4	5	2	0	2	2	4	3
1	Complete feasibility studies are done on projects prior to defining scope and budget.	3	4	3	4	4	1	5	4	5	4	2	3	2	1	2	2	1	4
4	Program planning includes design and construction resource loading.	2	4	3	3	4	5	1	4	2	4	4	4	1	2	3	1	3	4
12	A standardized Project Delivery Manual is used on all projects.	3	3	5	4	2	4	1	3	4	4	3	5	1	4	3	3	1	1
32	A Work Breakdown Structure (WBS) has been implemented to measure progress on project deliverables.	4	4	1	5	3	4	3	2	1	4	4	5	1	1	1	2	4	3
10	Scope changes are limited to the early stages in design.	3	2	3	3	4	3	2	4	4	2	2	1	4	2	3	2	4	3
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	2	1
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).	4	5	3	4	5	1	5	3	5	1	1	5	1	0	2	3	1	1
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	5	4	3	1	1	4	0	5	3		
38	Utility Relocation - Additional effort will be expended during the design process to accurately locate existing utilities and identify them on the contract documents.	3	5	5		2	3	5	5			3	4			3		5	5
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	2	3	3	2	3	1	0	2	2	3	5
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	3	3	3	1	2	2	1	2	4	5	1
22	Bid documents are available online.	5	2	2	3	1	5	5	1	2	1	1	1	1	1	1	1	2	5
33	"Earned value" versus budgeted and actual expenditures is monitored during project delivery.	3	2	2	3	1	1	3	4	2	1	2	5	1	1	1	2	1	5
40	Project Initiation - All inter-department and intra-departments related to scope, operations or funding are clearly defined and documented prior to design start.	2	5	4		2	1	4	4		2	2	4			2		3	5
37	Right-of-Way - Real Property is included in the initial project start-up to establish key deliverables and due dates.	2	5	5		1	1	4	5			1	4			3		3	5
26	There is a special project management team for small projects.	2	3	3	4	4	1	1	1	1	1	3	4	1	3	1	2	2	1
39	Green Buildings - Sustainable design goals will be included in the initial project and performance outcomes measured at project completion. Operational measurements will follow annually.	2	3	1		3	1	N/A			3		4			1		1	5
23	Bids can be submitted/accepted online.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1

Targeted in 2006 = Grey
Targeted in 2007 = Light Grey

Table B-4 - 2008 Level of Implementation for Best Management Practices -- CM@Risk

Ref	Best Management Practice	Pima County					Pinal County	MCCCD	City of Phoenix		City of Tucson		Maricopa County		City of Mesa	City of Peoria
		PROC	WWM	PKS	DOT	FCD			EAS	Water	Parks	GSD	DOT	Parks		
7	Require that the A/E submits a fee proposal that includes all work to be performed.	2	5	4	4	5	5	5	5	5	5	5	5	5	5	5
22	The Owner's Contingency is defined	4	5	3	5	5	5	5	5	5	5	5	3	5	5	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	5	3
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	5	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	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	3	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	5	5
20	The Contractor's GMP is evaluated for price and scope.	4	4	4	4	5	5	4	5	4	5	3	5	5	5	5
18	Require that the CM@Risk Contractor make recommendations for long lead procurement items, to expedite the project or to save costs.	4	4	3	4	4	5	5	5	5	3	3	4	5	5	5
4	The Architect's Contract requires a design schedule for deliverables.	2	5	5	2	4	4	5	4	4	5	4	4	5	5	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	3	5	4	3	4	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	5	5
10	An accurate plan holder's list is maintained.	1	1	5	1	5	5	5	5	5	5	5	5	5	5	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	5	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	5	5
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	5	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	5	2
6	The selected A/E has experience with CM@Risk projects.	3	5	4	2	4	5	4	4	3	4	5	1	5	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.	2	3	4	2	5	5	5	4	4	5	3	1	5	5	5

Table B-4 - 2008 Level of Implementation for Best Management Practices -- CM@Risk

Ref	Best Management Practice	Pima County					Pinal County	MCCCD	City of Phoenix		City of Tucson		Maricopa County		City of Mesa	City of Peoria
		PROC	WWM	PKS	DOT	FCD			EAS	Water	Parks	GSD	DOT	Parks		
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	5	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	5	1
25	Require that Partnering sessions are held with all stakeholders.	2	3	2	5	5	5	1	5	4	5	2	4	5	3	5
23	Project Managers are trained on Alternative Delivery Methods.	2	4	3	3	3	4	4	5	5	3	3	1	5	3	5
24	Project Managers continually receive technical training.	2	3	2	4	4	5	4	5	5	2	2	1	5	3	5
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	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	4	5	1	3	1	5	5	1
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	3	4	1	4	4	2	3	4	1	3	1	4	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	1	5
12	Provide that the CM@Risk Contractor must self-perform at least 45% of the work on "horizontal" projects.	5	3		5	5	5	0	5	1	1		5	5	1	1
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	5	5
9	The CM@Risk Contractor and the Architect are selected at the same time.	2	4	4	1	3	1	4	4	2	1	1	1	3	3	2
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	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	1	3
36	Utility Relocation - Additional effort will be expended during the design process to accurately locate existing utilities and identify them on the contract documents.		3	4											5	5
37	Project Initiation - All inter-department and intra-departments related to scope, operations or funding are clearly defined and documented prior to design start.		3	4					2						3	5
34	Right-of-Way - Real Property is included in the initial project start-up to establish key deliverables and due dates.		3	4											3	5
38	Green Buildings - Sustainable design goals will be included in the initial project and performance outcomes measured at project completion. Operational measurements will follow annually.		1	3					3						1	4

Appendix C

Table C-1 - Project Distribution Matrix - Traditional Method
Table C-2 - Project Distribution Matrix - CM@Risk Method
Table C-3 – Project Size Distribution

2008 Arizona Benchmarking Study
Traditional Delivery Method
Projects Distribution Matrix

Project Type \ Agency	City of Mesa	City of Phoenix	City of Tucson	Maricopa C.C.	Maricopa County	Pima County	Pinal County	Total All Agencies
Municipal Facilities	**0**	**0**	**20**	**1**	**0**	**20**	**3**	**44**
Libraries	0	0	2	0	0	3	0	**5**
Police / Fire Station	0	0	4	0	0	3	2	**9**
Community Bldg./Rec. Cente	0	0	12	1	0	11	1	**25**
Office - (TI's)	0	0	2	0	0	3	0	**5**
Streets	**2**	**20**	**14**	**0**	**50**	**20**	**7**	**113**
Widening	0	2	0	0	4	3	0	**9**
Bridges - (Retrofits & New)	0	5	0	0	3	1	0	**9**
Reconstruction	1	6	13	0	1	2	7	**30**
New Construction	0	0	0	0	2	0	0	**2**
Signals & ITS	1	7	1	0	40	14	0	**63**
Pipes & Plants	**3**	**33**	**6**	**0**	**3**	**2**	**0**	**47**
Treatment Plants	0	13	0	0	0	2	0	**15**
Gravity Pipes	0	8	0	0	3	0	0	**11**
Pressure Pipes	3	12	6	0	0	0	0	**21**
Parks	**0**	**8**	**5**	**0**	**5**	**12**	**0**	**30**
Park Development/Additions	0	5	4	0	4	8	0	**21**
Restrooms	0	3	1	0	1	0	0	**5**
Sports Lighting Projects	0	0	0	0	0	4	0	**4**
Flood Control	**0**	**2**	**4**	**0**	**1**	**4**	**0**	**11**
Detention Channels / Structur	0	2	4	0	1	4	0	**11**
Total All Types	**5**	**63**	**49**	**1**	**59**	**58**	**10**	**245**

2008 Arizona Benchmarking Study

Projects Distribution Matrix (CM@Risk)

Project Type / Agency	City of Mesa	City of Phoenix	City of Tucson	Maricopa C.C.	Maricopa County	Pima County	Pinal County	Total All Agencies
Municipal Facilities	**0**	**23**	**4**	**2**	**0**	**1**	**0**	**30**
Libraries	0	2	0	0	0	0	0	**2**
Police / Fire Station	0	8	4	0	0	0	0	**12**
Community Bldg./Rec. Center/CC/Gym	0	11	0	2	0	1	0	**14**
Office - (TI's)	0	2	0	0	0	0	0	**2**
Streets	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**5**
New Construction	0	0	0	0	0	2	0	**2**
Signals & ITS	0	0	0	0	0	3	0	**3**
Pipes & Plants	**0**	**6**	**0**	**0**	**0**	**2**	**0**	**9**
Treatment Plants	0	0	0	0	0	0	0	**1**
Gravity Pipes	0	3	0	0	0	2	0	**5**
Pressure Pipes	0	3	0	0	0	0	0	**3**
Parks	**0**	**14**	**2**	**0**	**0**	**0**	**0**	**17**
Park Development/Additions	0	12	2	0	0	0	0	**15**
Sports Lighting Projects	0	2	0	0	0	0	0	**2**
Flood Control	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**
Detention Channels / Structural	0	1	0	0	0	0	0	**1**
Total All Types	**0**	**44**	**6**	**2**	**0**	**8**	**0**	**62**

2008 Arizona Benchmarking Study

PROJECTS SIZE DISTRIBUTION - ALL PROJECTS

Project Type	APPROXIMATE RANGE OF TOTAL CONSTRUCTION COST (INCLUDING ALL CHANGEORDERS)
Municipal Facilities	$108,000 – $30,303,000
Libraries	$228,000 – $3,210,000
Police / Fire Station	$180,000 – $30,303,000
Community Bldg./Rec. Center/CC/Gym	$108,000 – $23,467,000
Office - (TI's)	$693,000 – $4,886,000
Streets	$106,000 – $28,599,000
Widening	$277,000 – $17,137,000
Bridges - (Retrofits & New)	$754,000 – $18,948,000
Reconstruction	$237,000 – $5,709,000
New Construction	$19,567,000 – $19,568,000
Signals & ITS	$106,000 – $28,599,000
Pipes & Plants	$398,000 – $31,723,000
Treatment Plants	$506,000 – $31,723,000
Gravity Pipes	$398,000 – $8,351,000
Pressure Pipes	$405,000 – $7,271,000
Parks	$105,000 – $3,739,000
Park Development/Additions	$105,000 – $3,739,000
Restrooms	$109,000 – $1,282,000
Sports Lighting Projects	$166,000 – $957,000
Flood Control	$595,000 – $8,898,000
Detention Channels / Structural	$595,000 – $8,898,000
OVERALL	$105,000 – $31,723,000

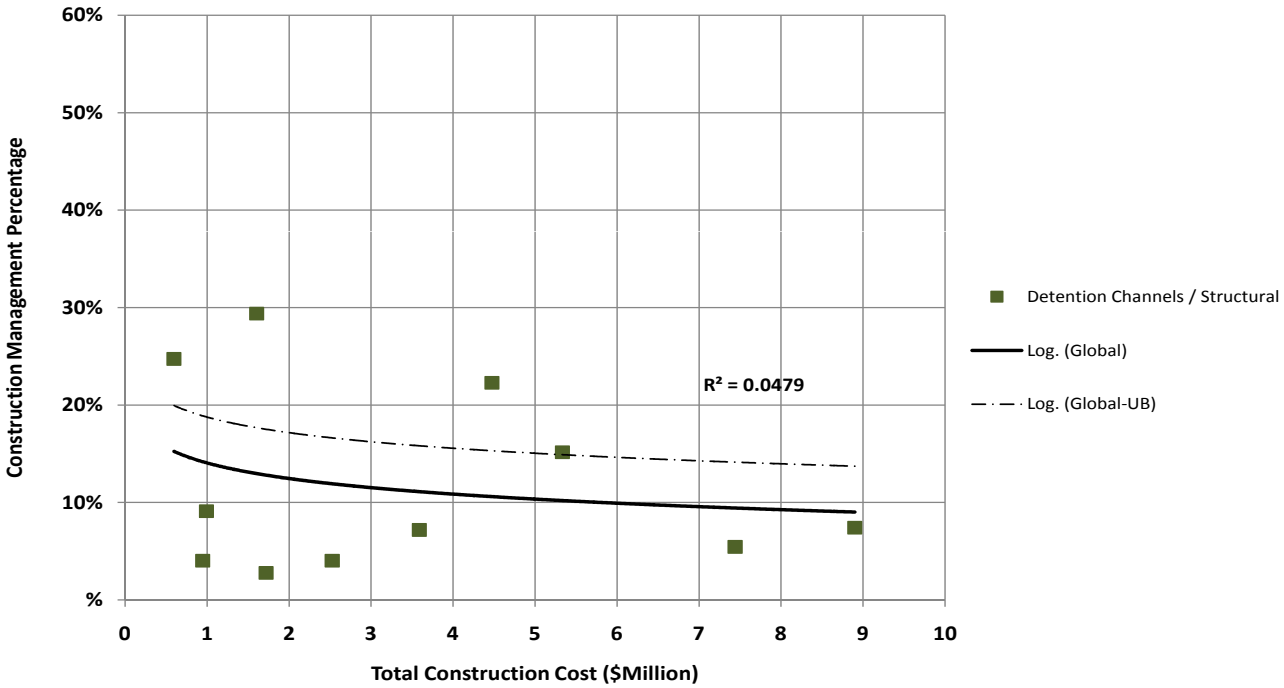
Appendix D

Performance Curves – Traditional
Design Percentage vs Total Project Cost
Construction Management Percentage vs Total Project Cost
Project Development Percentage vs Total Project Cost

Flood Control - Detention Channels / Structural

Construction Management Percentage Versus Total Construction Cost

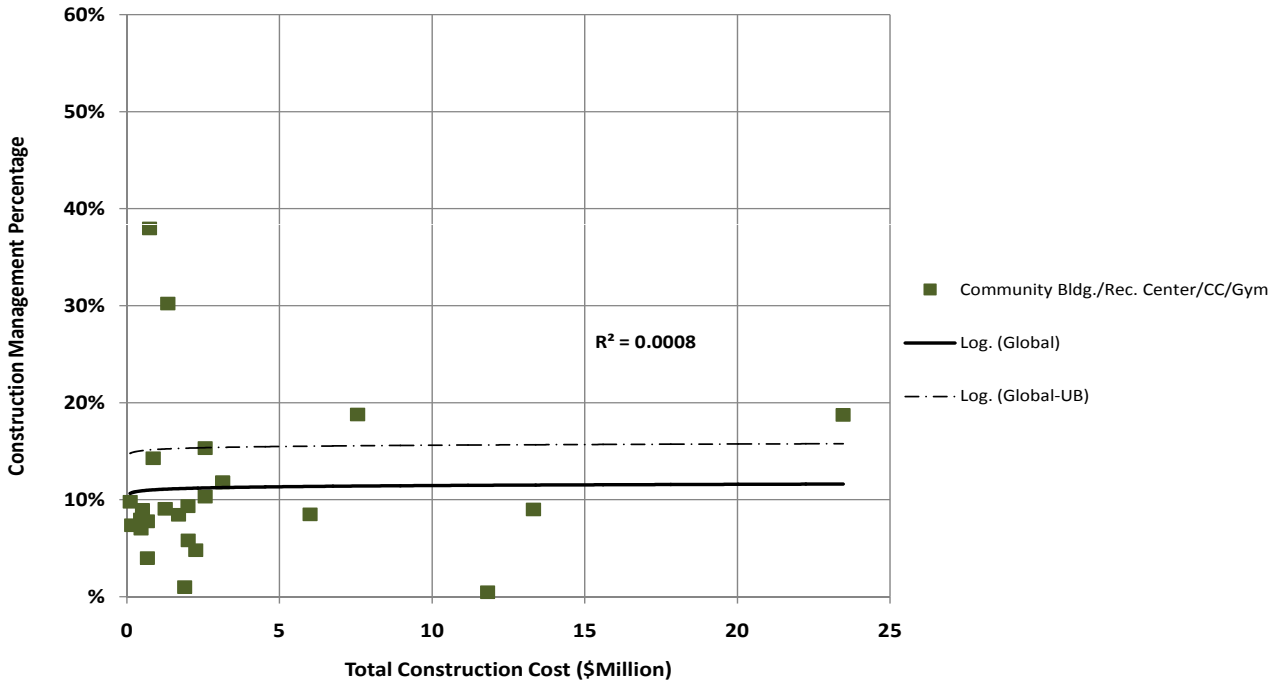
N = 11

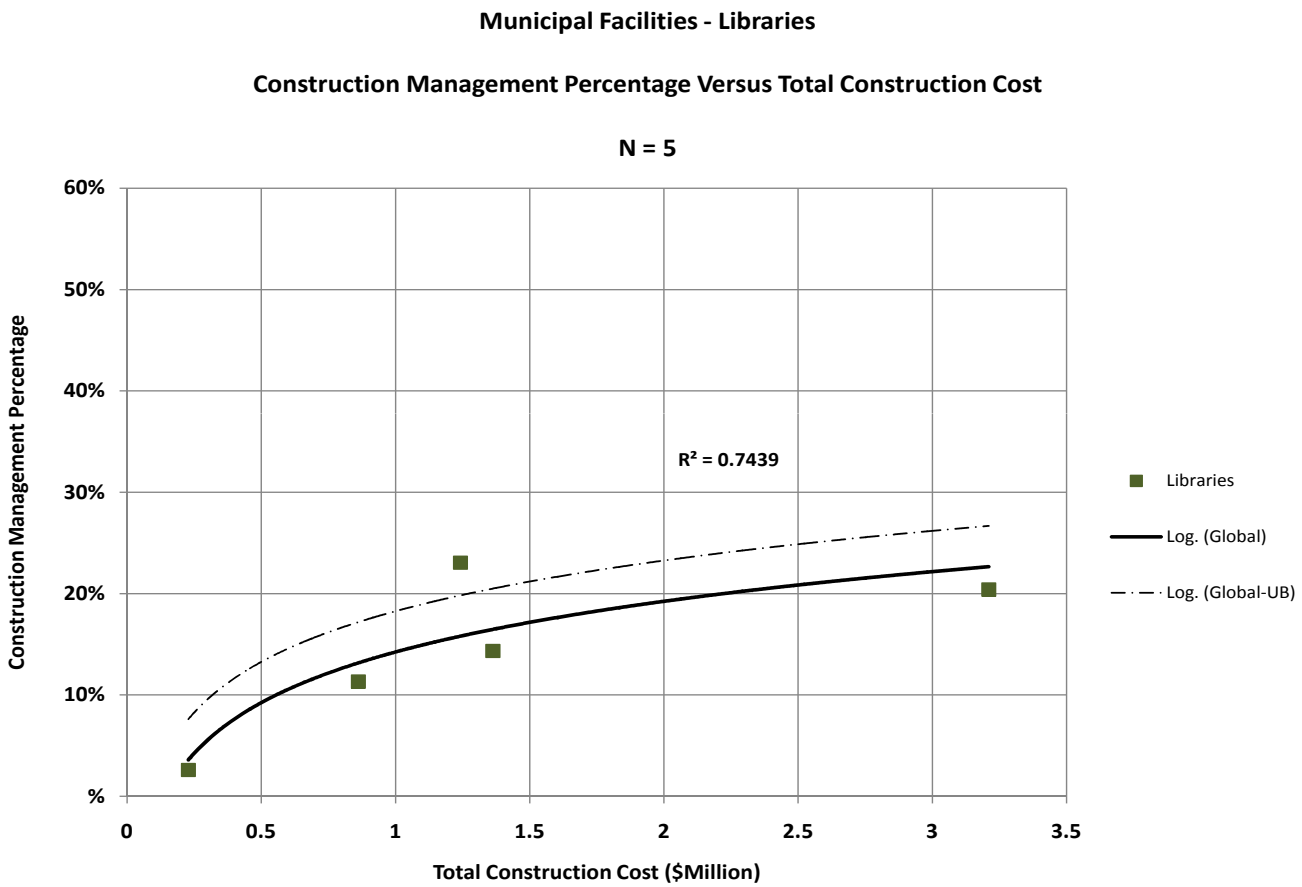


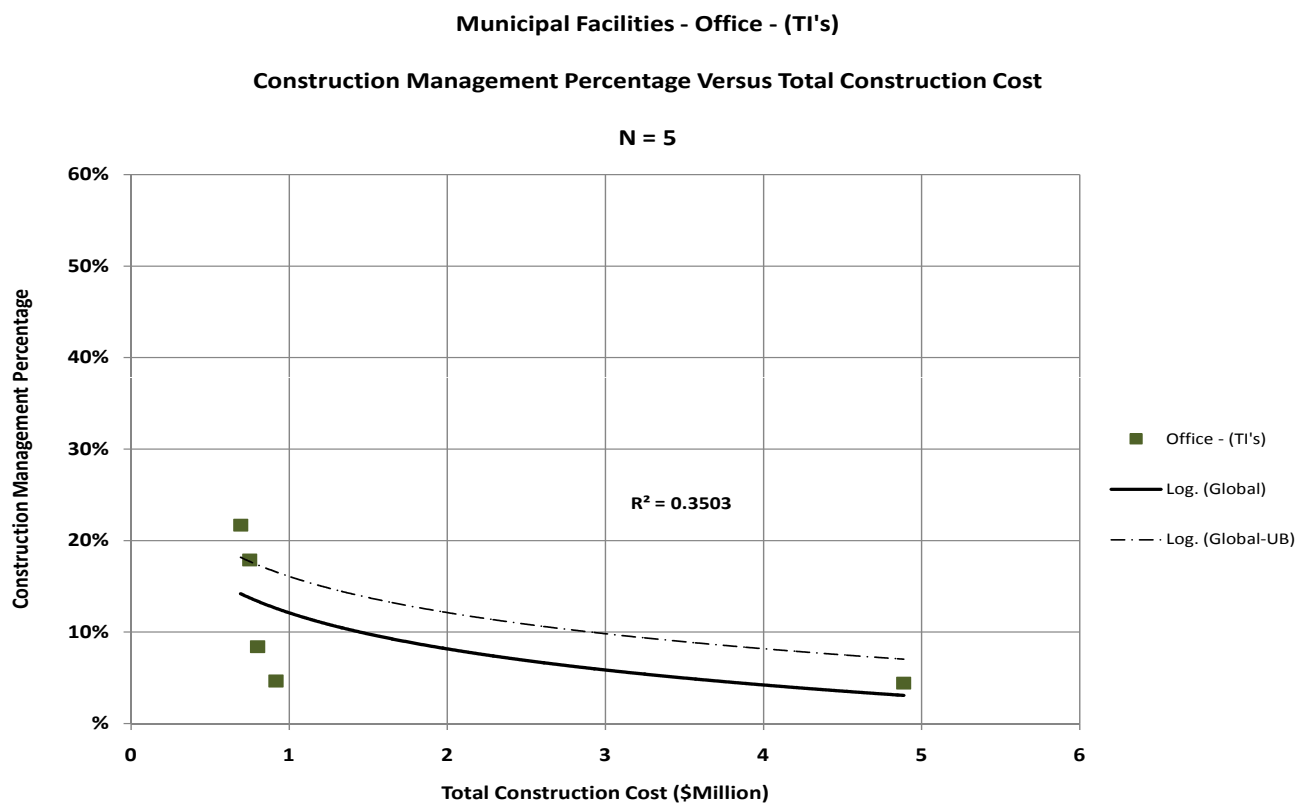
Municipal Facilities - Community Bldg./Rec. Center/CC/Gym

Construction Management Percentage Versus Total Construction Cost

N = 25



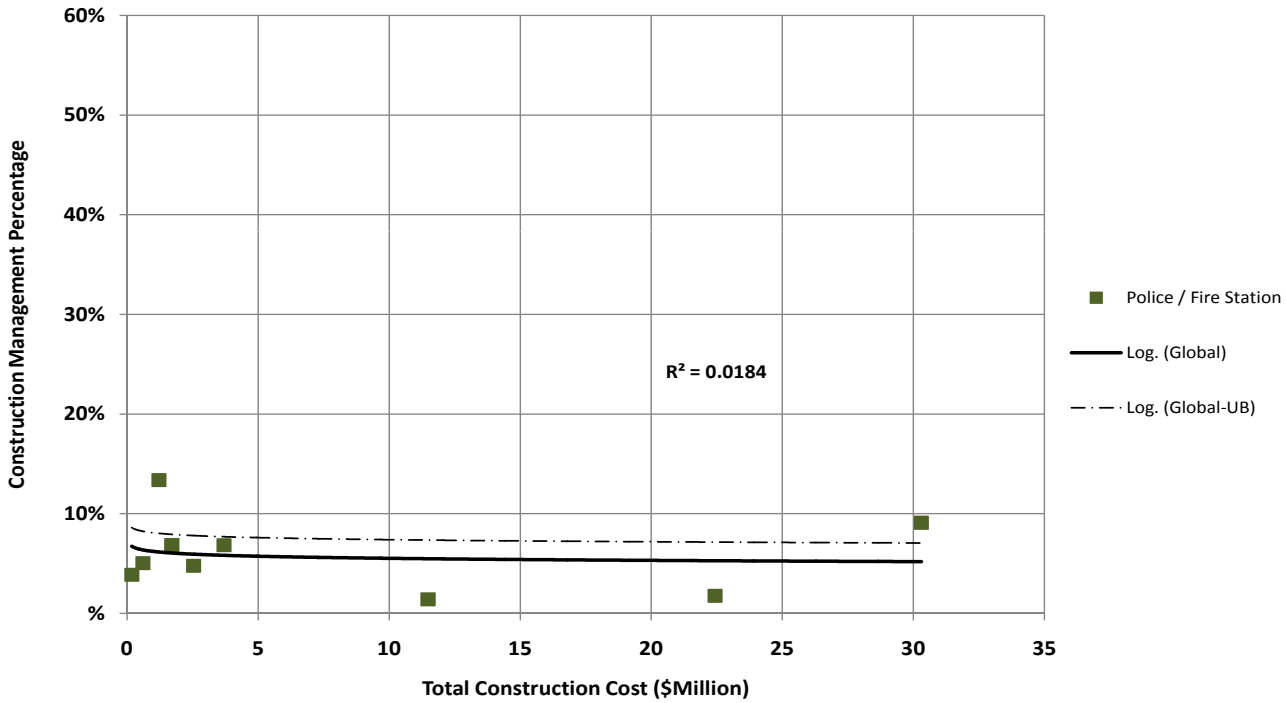

Municipal Facilities - Libraries
Construction Management Percentage Versus Total Construction Cost
N = 5
60%
50%
40%
30%
20%
10%
%
Construction Management Percentage
R² = 0.7439
0
0.5
1
1.5
2
2.5
3
3.5
Total Construction Cost ($Million)
Libraries
Log. (Global)
Log. (Global-UB)


Municipal Facilities - Office - (TI's)
Construction Management Percentage Versus Total Construction Cost
N = 5
60%
50%
40%
30%
20%
10%
%
Construction Management Percentage
R² = 0.3503
0
1
2
3
4
5
6
Total Construction Cost ($Million)
Office - (TI's)
Log. (Global)
Log. (Global-UB)

Municipal Facilities - Police / Fire Station

Construction Management Percentage Versus Total Construction Cost

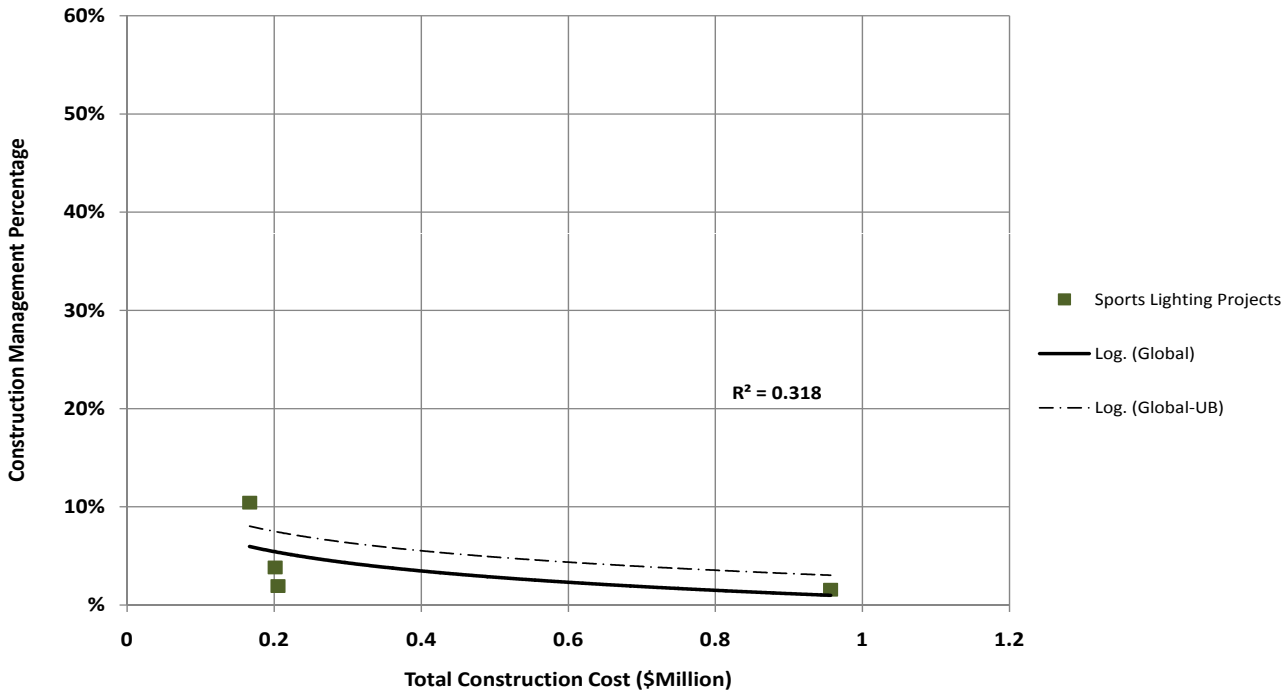
N = 9

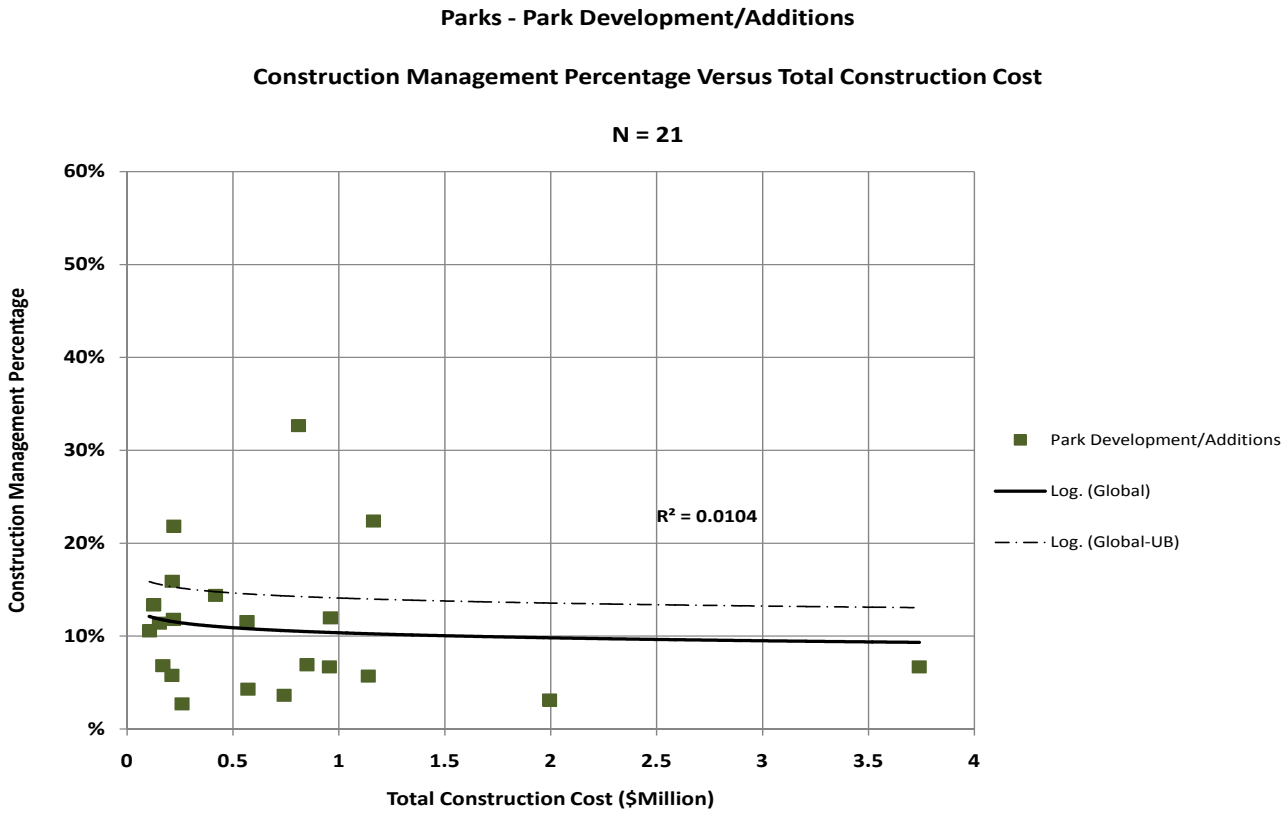


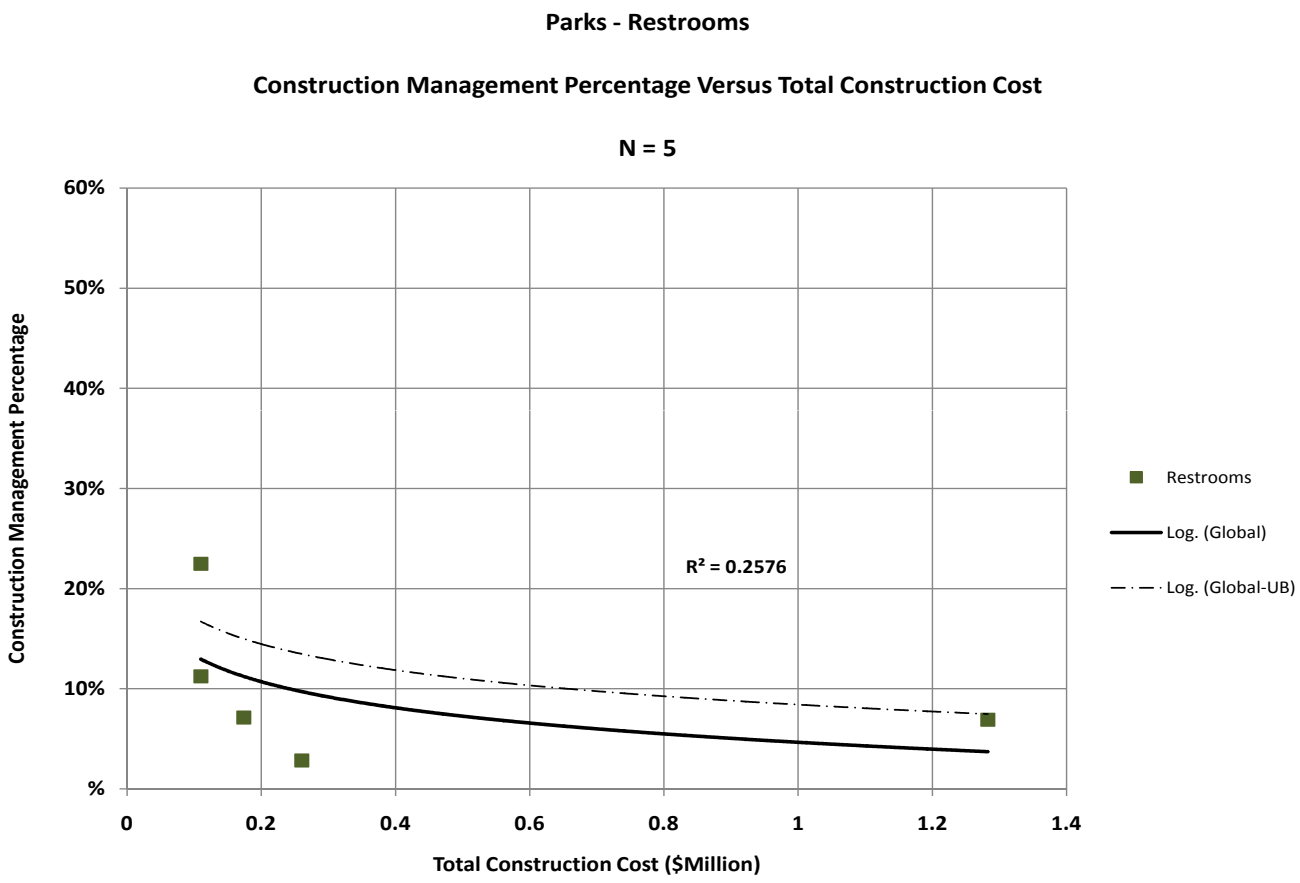
Parks - Sports Lighting Projects

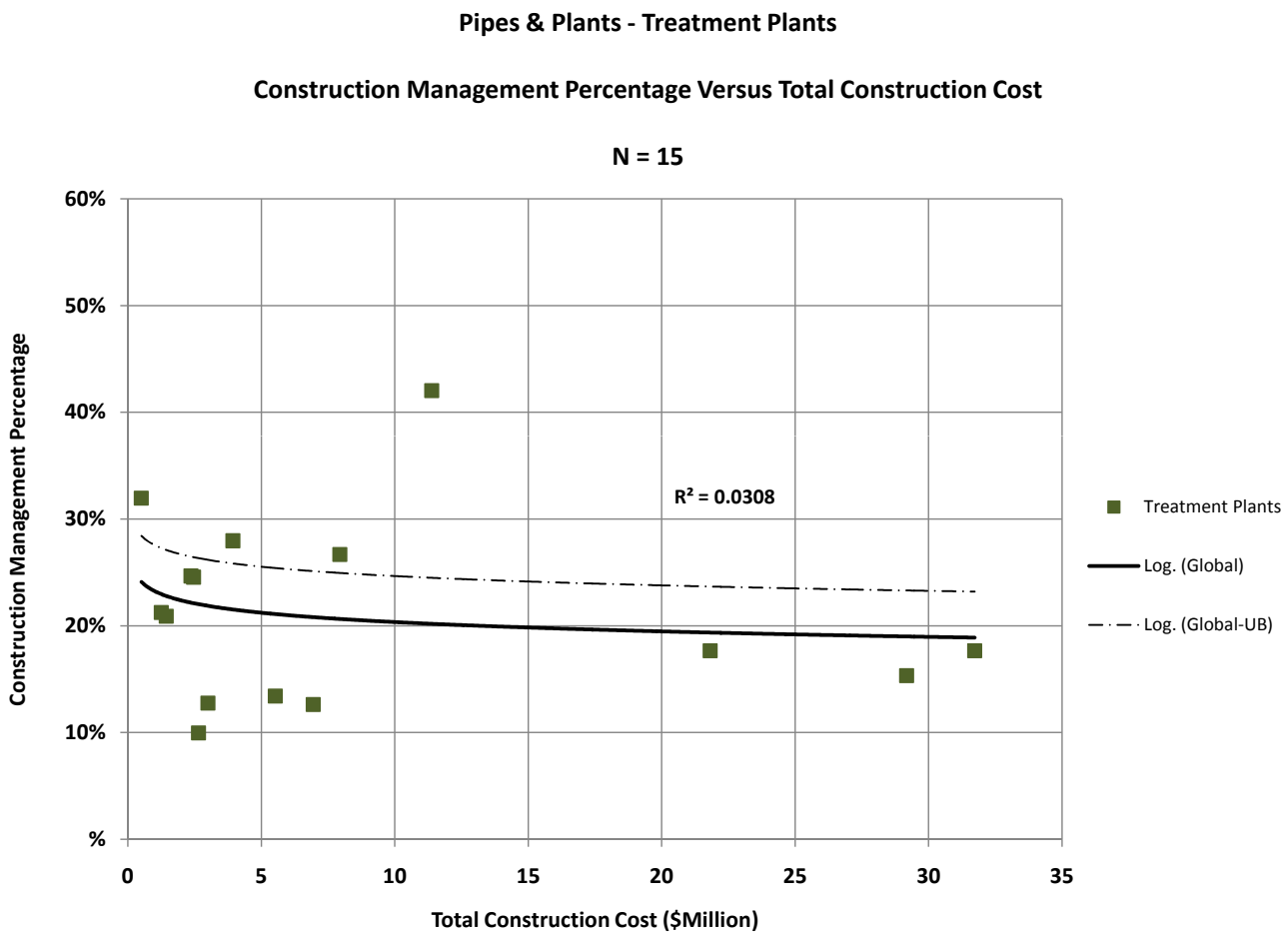
Construction Management Percentage Versus Total Construction Cost

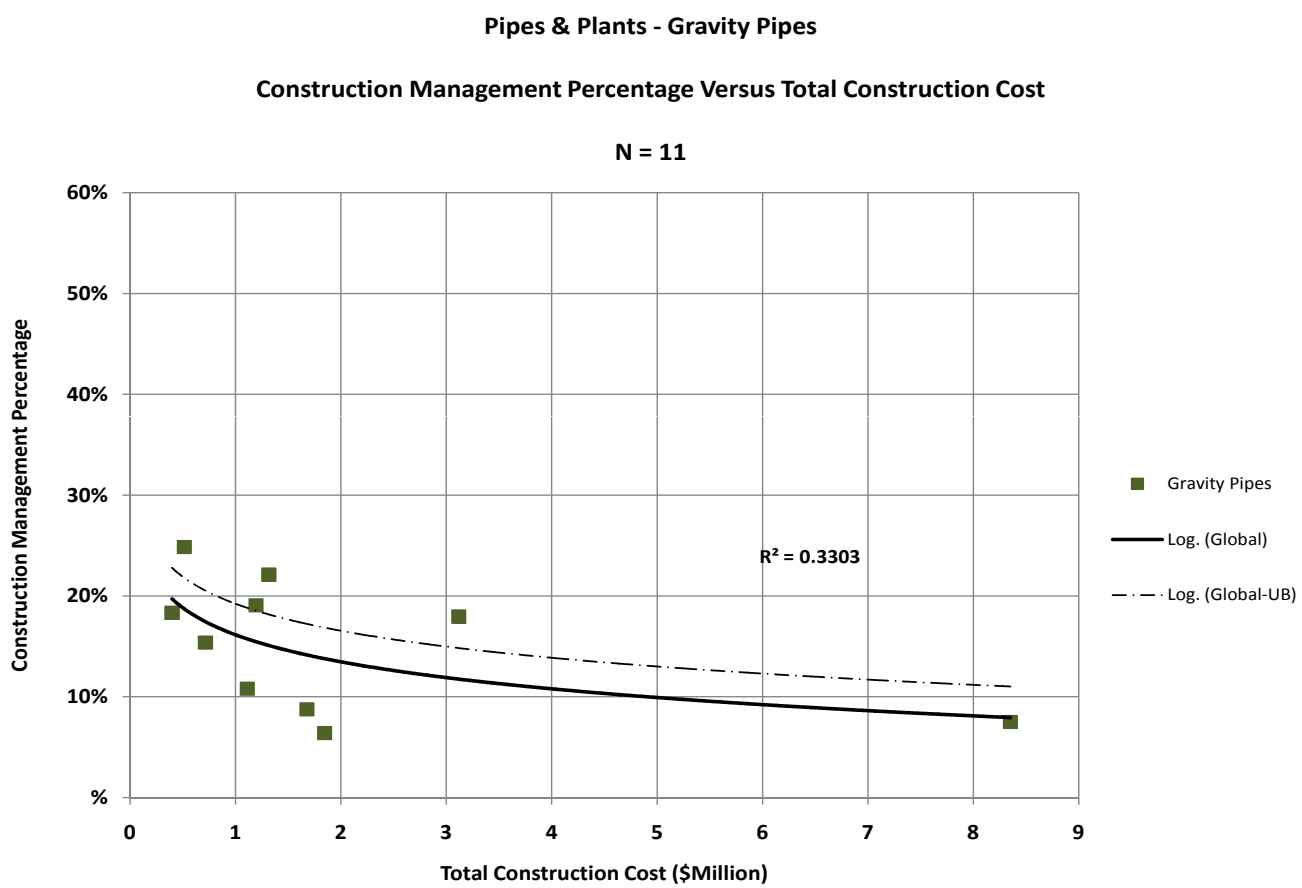
N = 4




Parks - Park Development/Additions
Construction Management Percentage Versus Total Construction Cost
N = 21
60%
50%
40%
30%
20%
10%
%
Construction Management Percentage
0
0.5
1
1.5
2
2.5
3
3.5
4
Total Construction Cost ($Million)
R² = 0.0104
Park Development/Additions
Log. (Global)
Log. (Global-UB)


Parks - Restrooms
Construction Management Percentage Versus Total Construction Cost
N = 5
60%
50%
40%
30%
20%
10%
%
Construction Management Percentage
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Total Construction Cost ($Million)
R² = 0.2576
Restrooms
Log. (Global)
Log. (Global-UB)

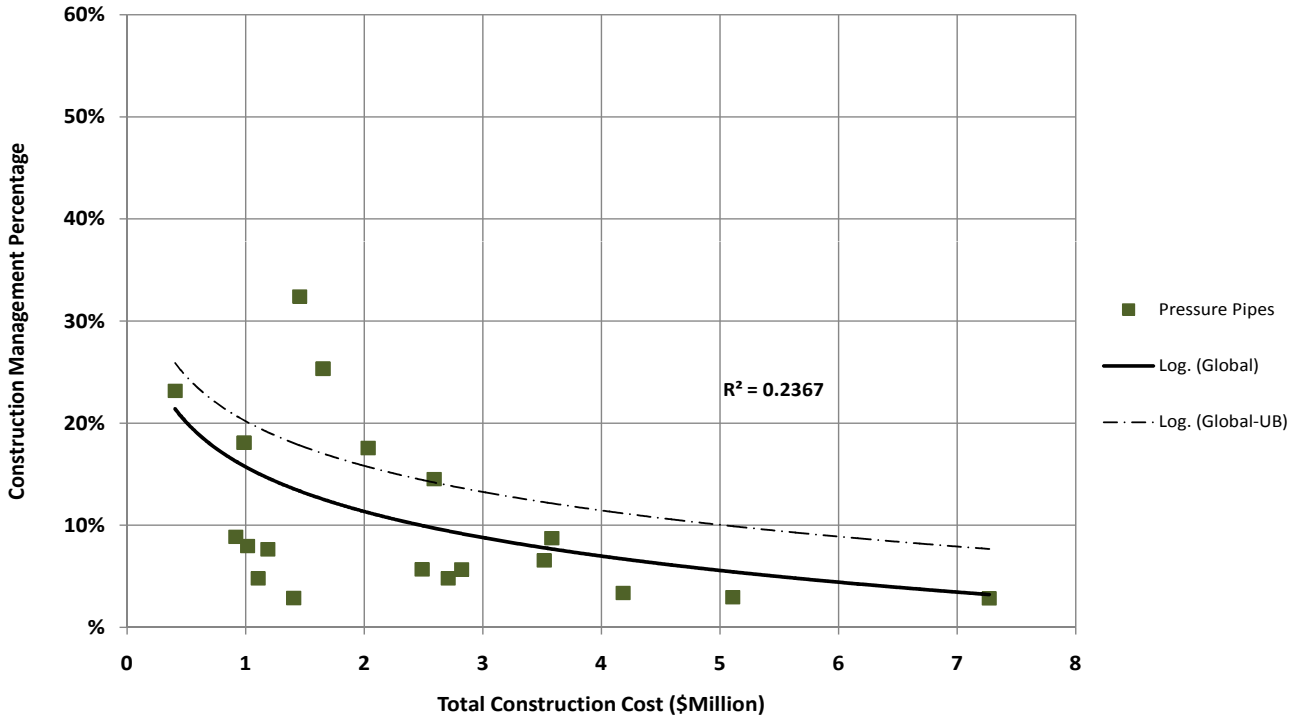

Pipes & Plants - Treatment Plants
Construction Management Percentage Versus Total Construction Cost
N = 15
60%
50%
40%
30%
20%
10%
%
Construction Management Percentage
0
5
10
15
20
25
30
35
Total Construction Cost ($Million)
R² = 0.0308
Treatment Plants
Log. (Global)
Log. (Global-UB)


Pipes & Plants - Gravity Pipes
Construction Management Percentage Versus Total Construction Cost
N = 11
60%
50%
40%
30%
20%
10%
%
Construction Management Percentage
0
1
2
3
4
5
6
7
8
9
Total Construction Cost ($Million)
R² = 0.3303
Gravity Pipes
Log. (Global)
Log. (Global-UB)

Pipes & Plants - Pressure Pipes

Construction Management Percentage Versus Total Construction Cost

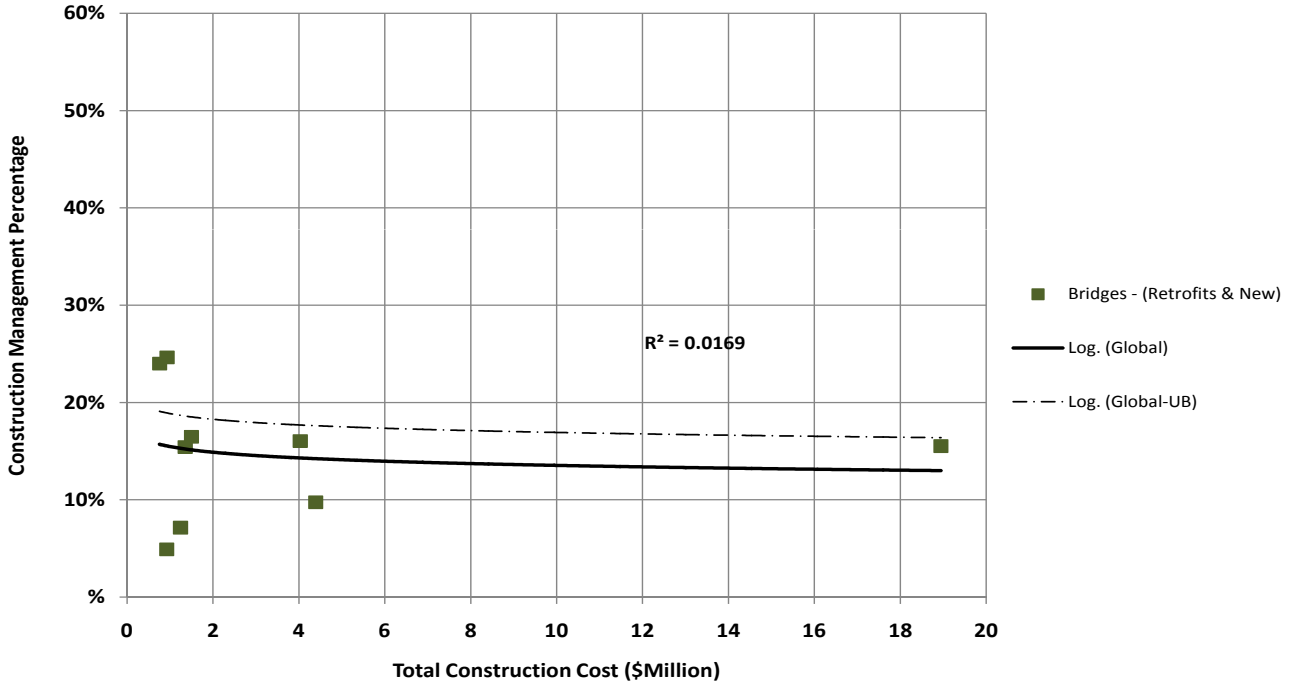
N = 21

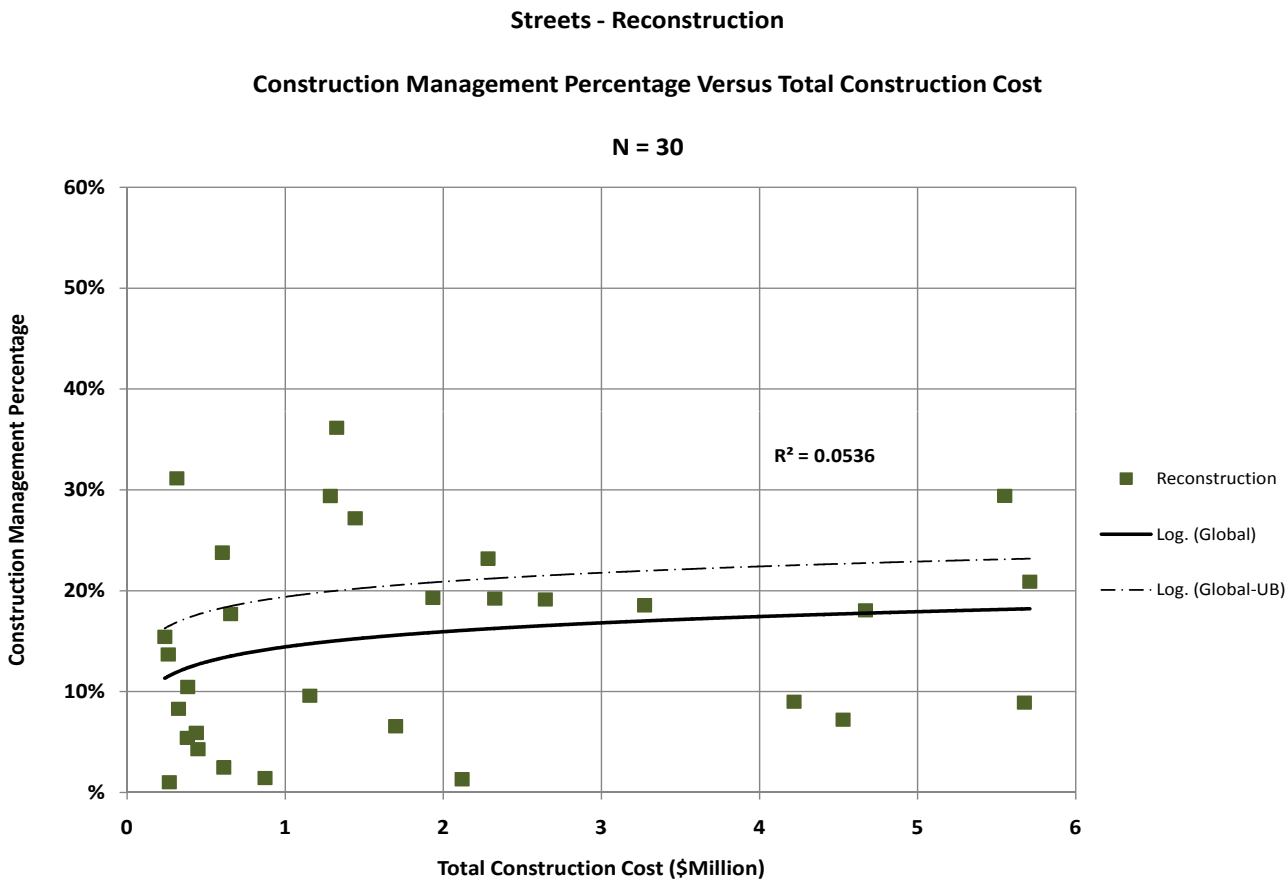


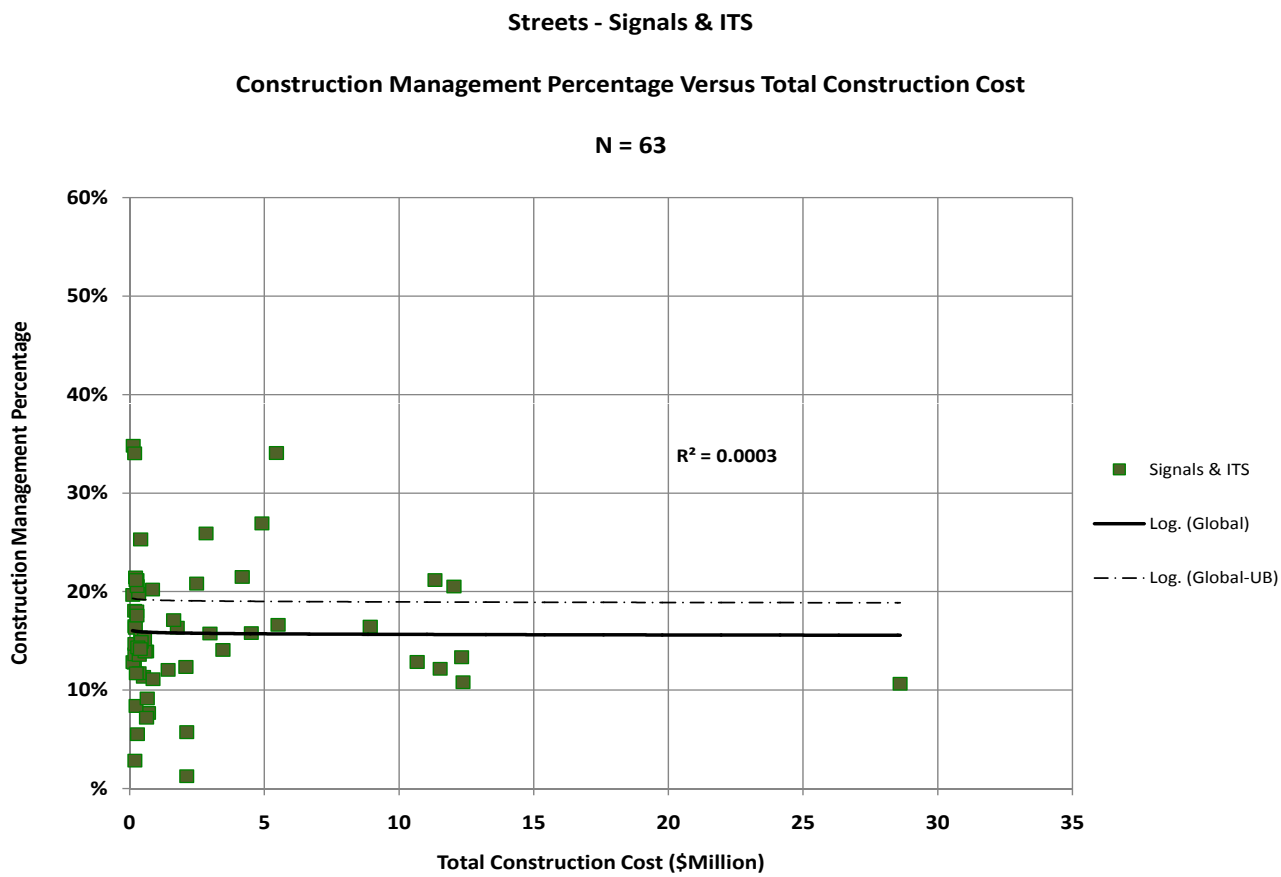
Streets - Bridges - (Retrofits & New)

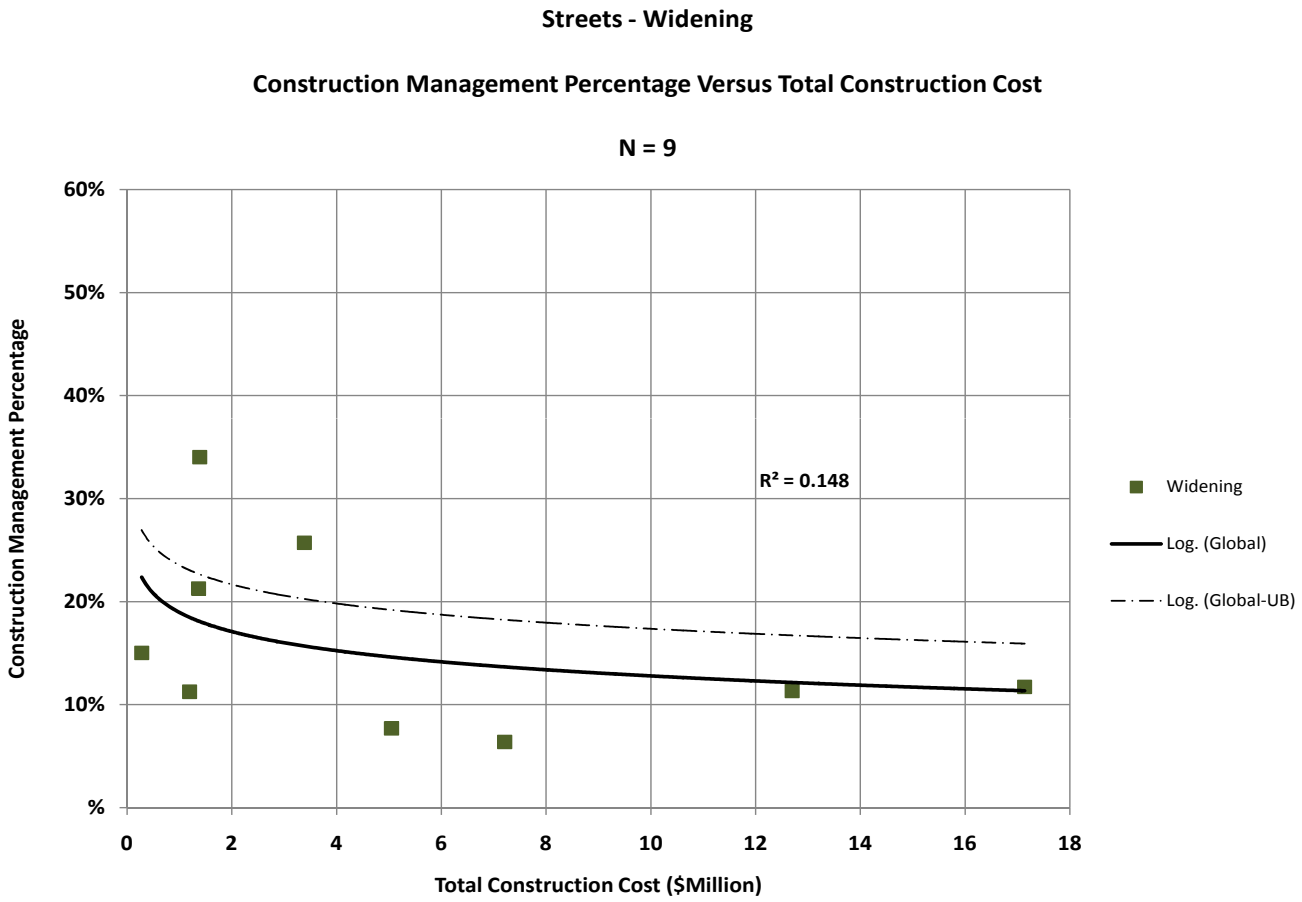
Construction Management Percentage Versus Total Construction Cost

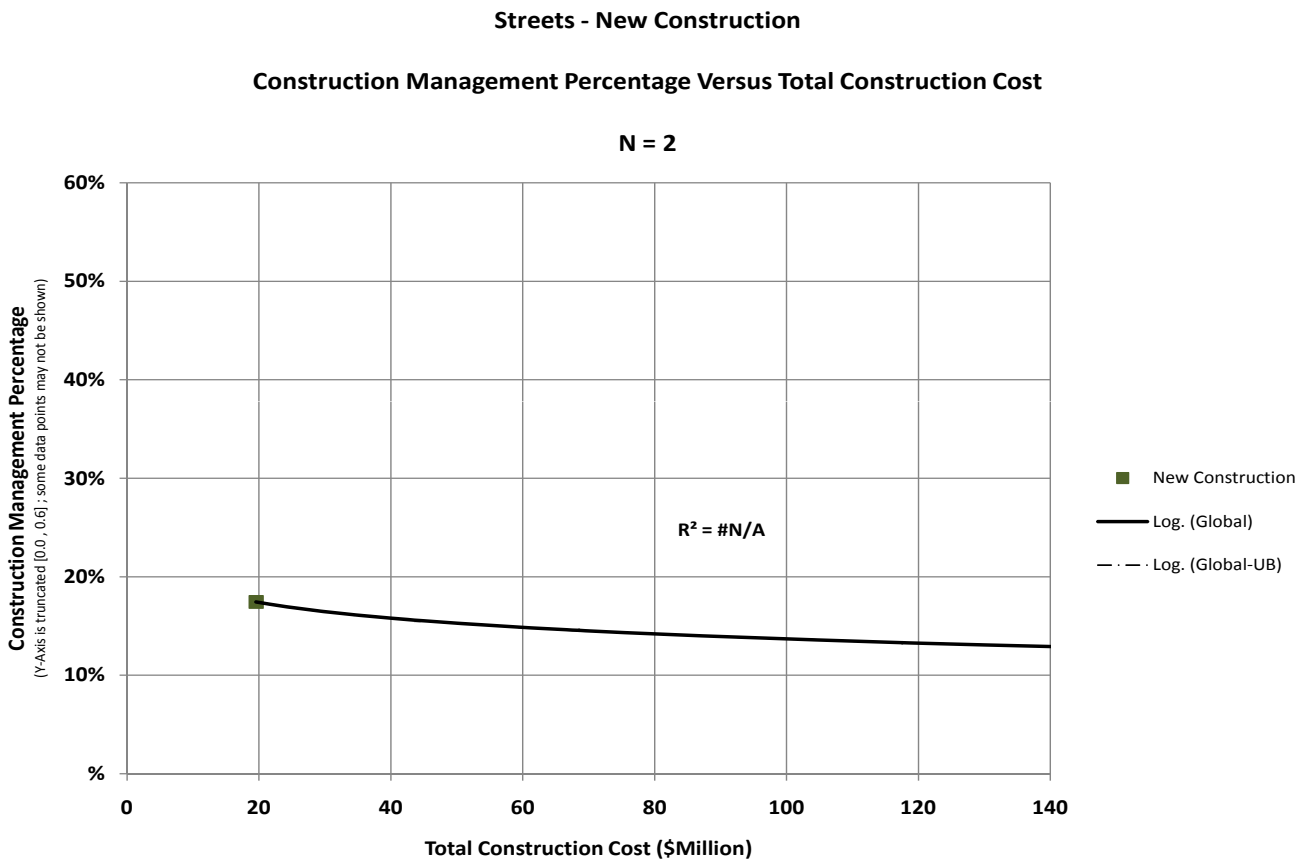
N = 9

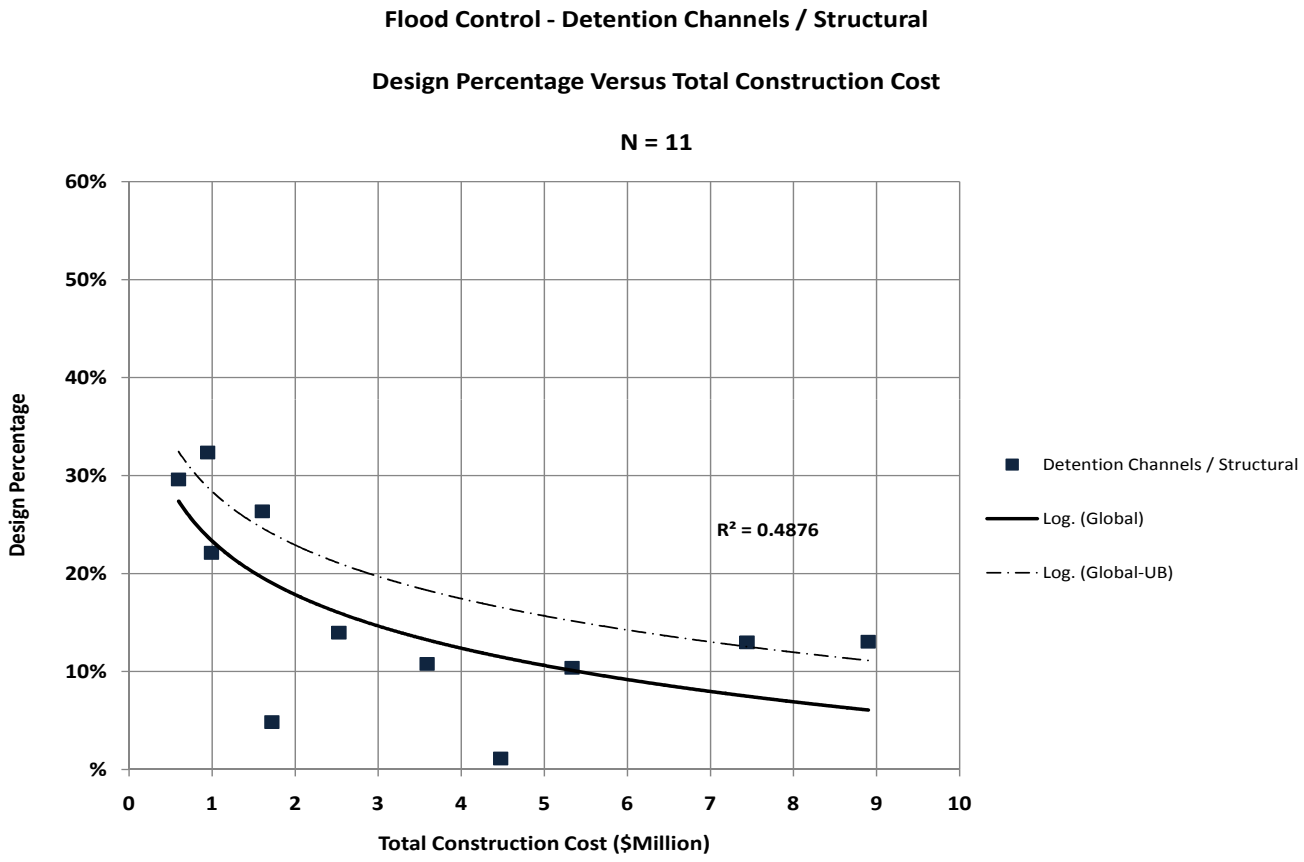


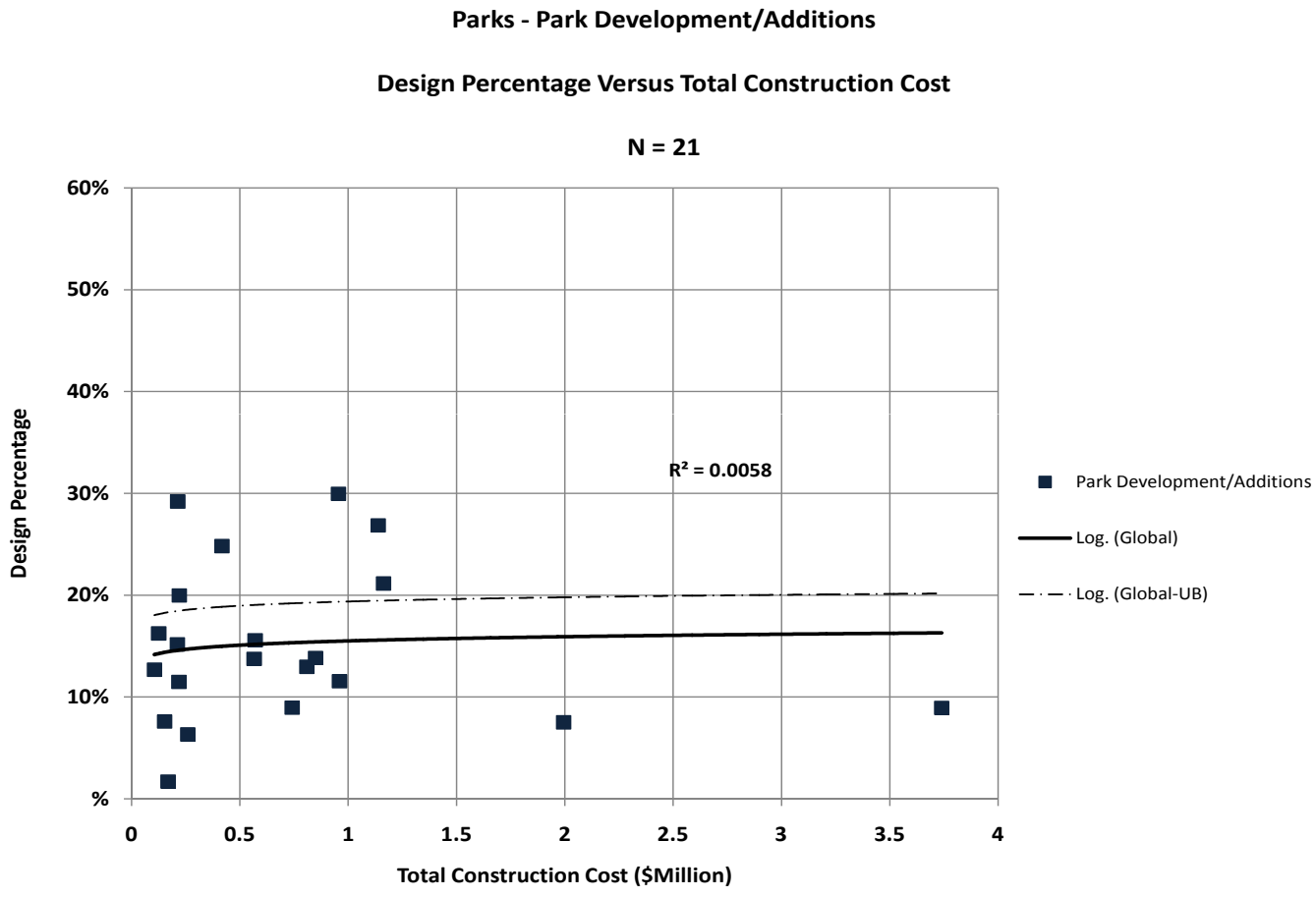

Streets - Reconstruction
Construction Management Percentage Versus Total Construction Cost
N = 30
60%
50%
40%
30%
20%
10%
%
Construction Management Percentage
R² = 0.0536
0
1
2
3
4
5
6
Total Construction Cost ($Million)
Reconstruction
Log. (Global)
Log. (Global-UB)

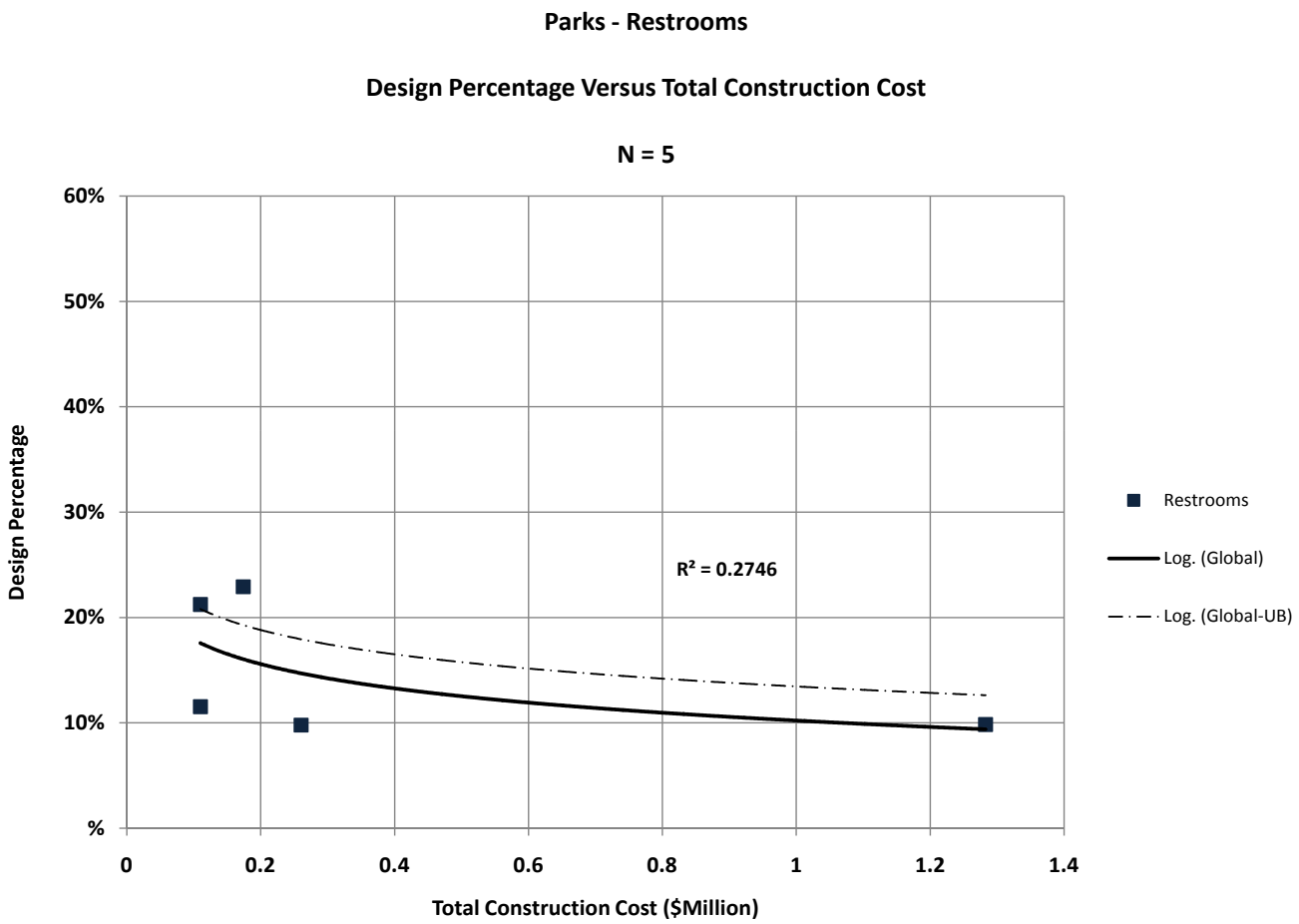

Streets - Signals & ITS
Construction Management Percentage Versus Total Construction Cost
N = 63
60%
50%
40%
30%
20%
10%
%
Construction Management Percentage
R² = 0.0003
0
5
10
15
20
25
30
35
Total Construction Cost ($Million)
Signals & ITS
Log. (Global)
Log. (Global-UB)

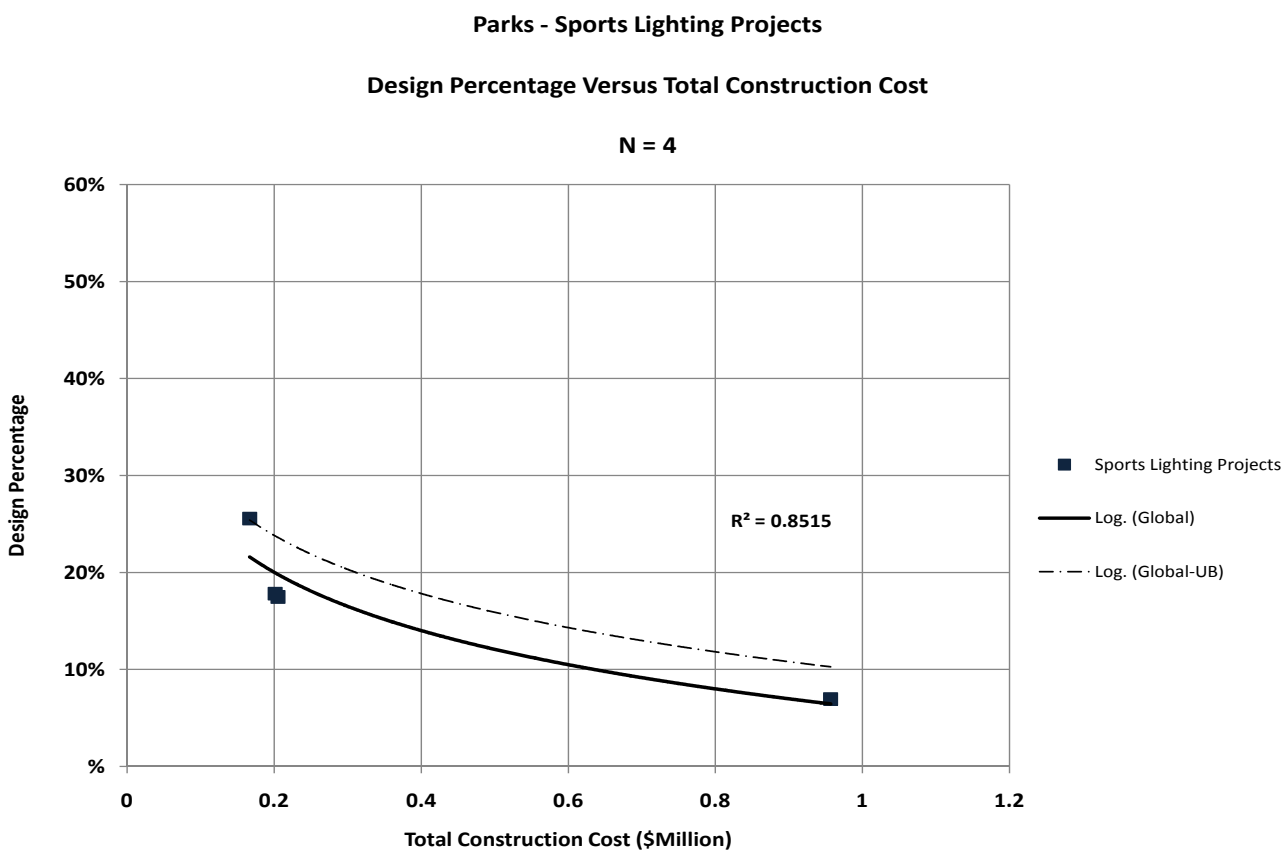

Streets - Widening
Construction Management Percentage Versus Total Construction Cost
N = 9
60%
50%
40%
30%
20%
10%
%
Construction Management Percentage
R² = 0.148
0
2
4
6
8
10
12
14
16
18
Total Construction Cost ($Million)
Widening
Log. (Global)
Log. (Global-UB)

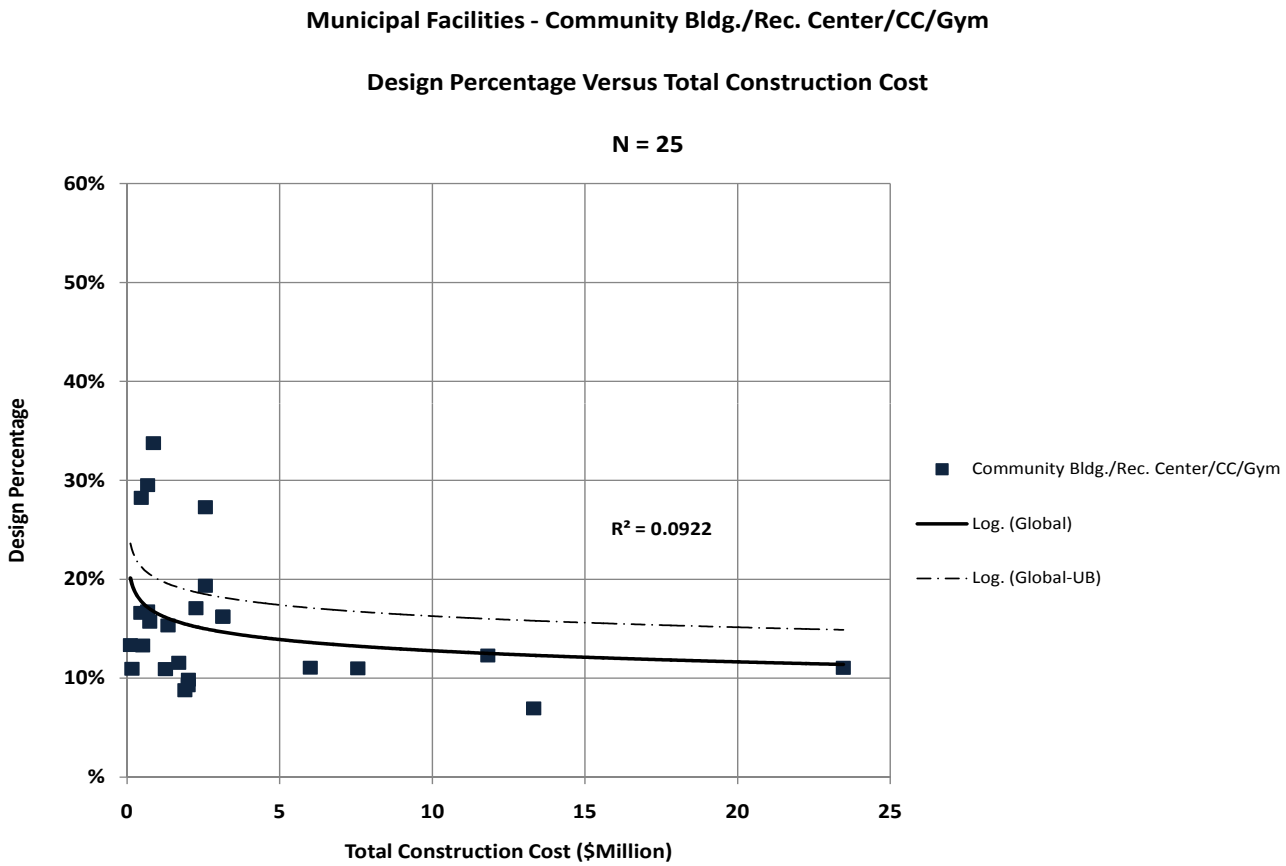

Streets - New Construction
Construction Management Percentage Versus Total Construction Cost
N = 2
60%
50%
40%
30%
20%
10%
%
Construction Management Percentage
(Y-Axis is truncated [0.0 , 0.6] ; some data points may not be shown)
R² = #N/A
0
20
40
60
80
100
120
140
Total Construction Cost ($Million)
New Construction
Log. (Global)
Log. (Global-UB)

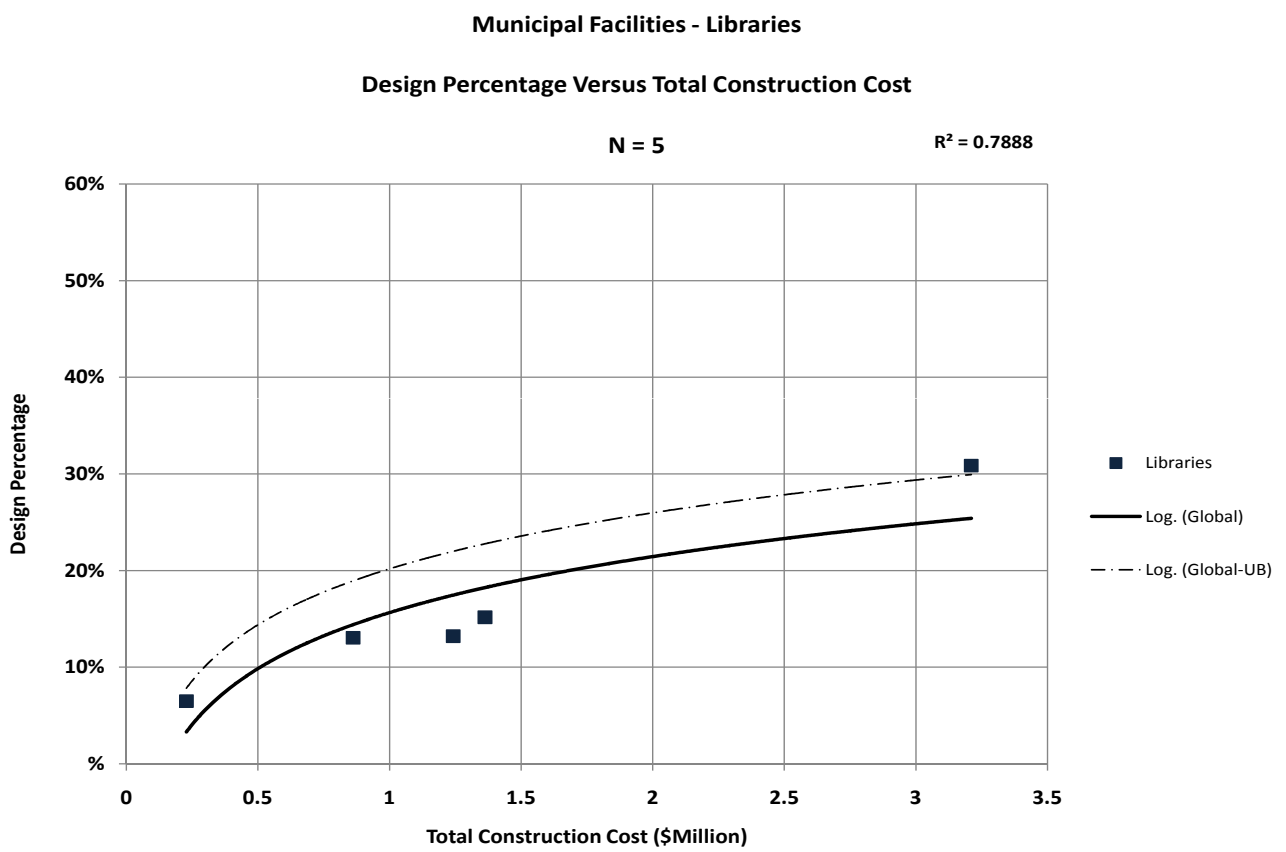

Flood Control - Detention Channels / Structural
Design Percentage Versus Total Construction Cost
N = 11
60%
50%
40%
30%
20%
10%
%
Design Percentage
0
1
2
3
4
5
6
7
8
9
10
Total Construction Cost ($Million)
R² = 0.4876
Detention Channels / Structural
Log. (Global)
Log. (Global-UB)

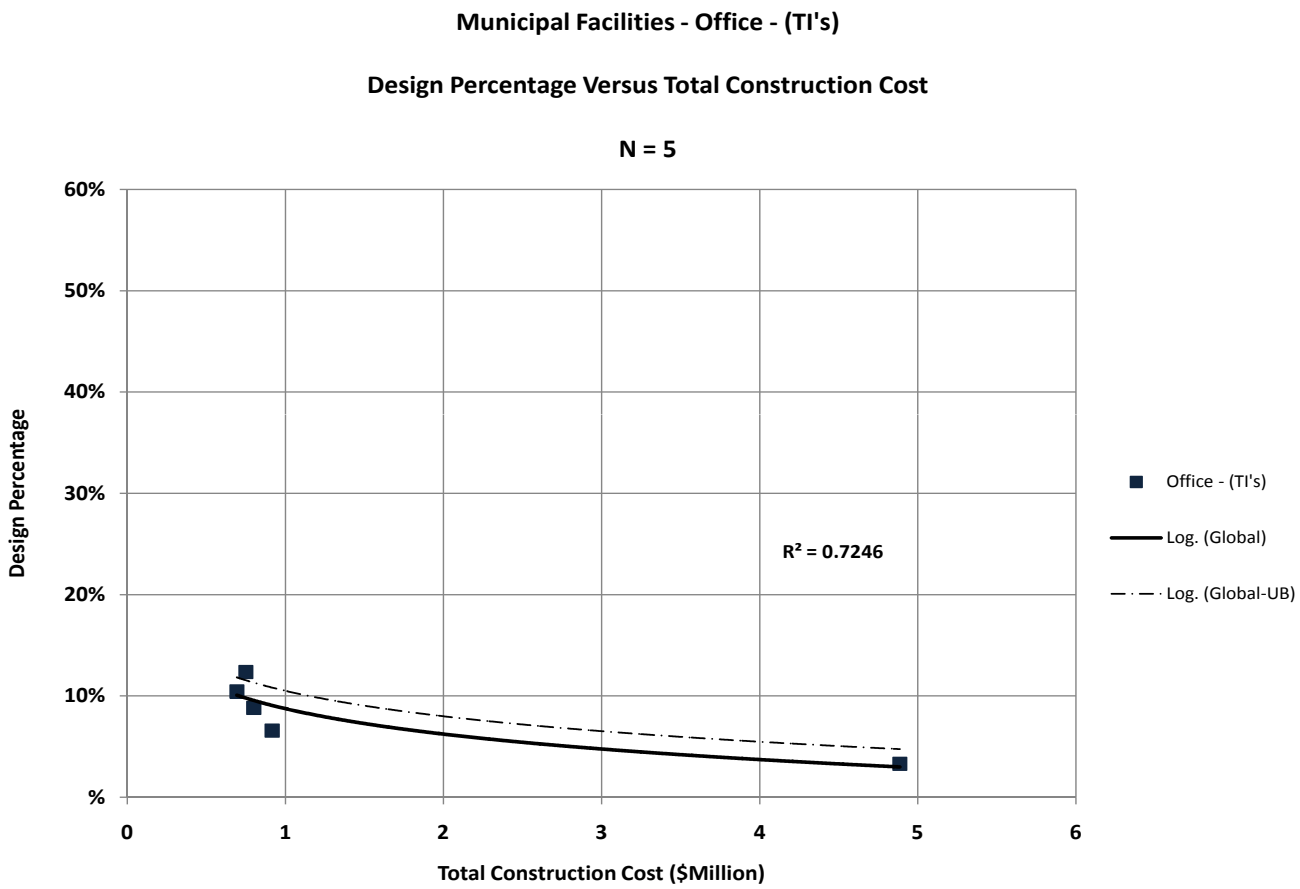

Parks - Park Development/Additions
Design Percentage Versus Total Construction Cost
N = 21
60%
50%
40%
30%
20%
10%
%
Design Percentage
0
0.5
1
1.5
2
2.5
3
3.5
4
Total Construction Cost ($Million)
R² = 0.0058
Park Development/Additions
Log. (Global)
Log. (Global-UB)

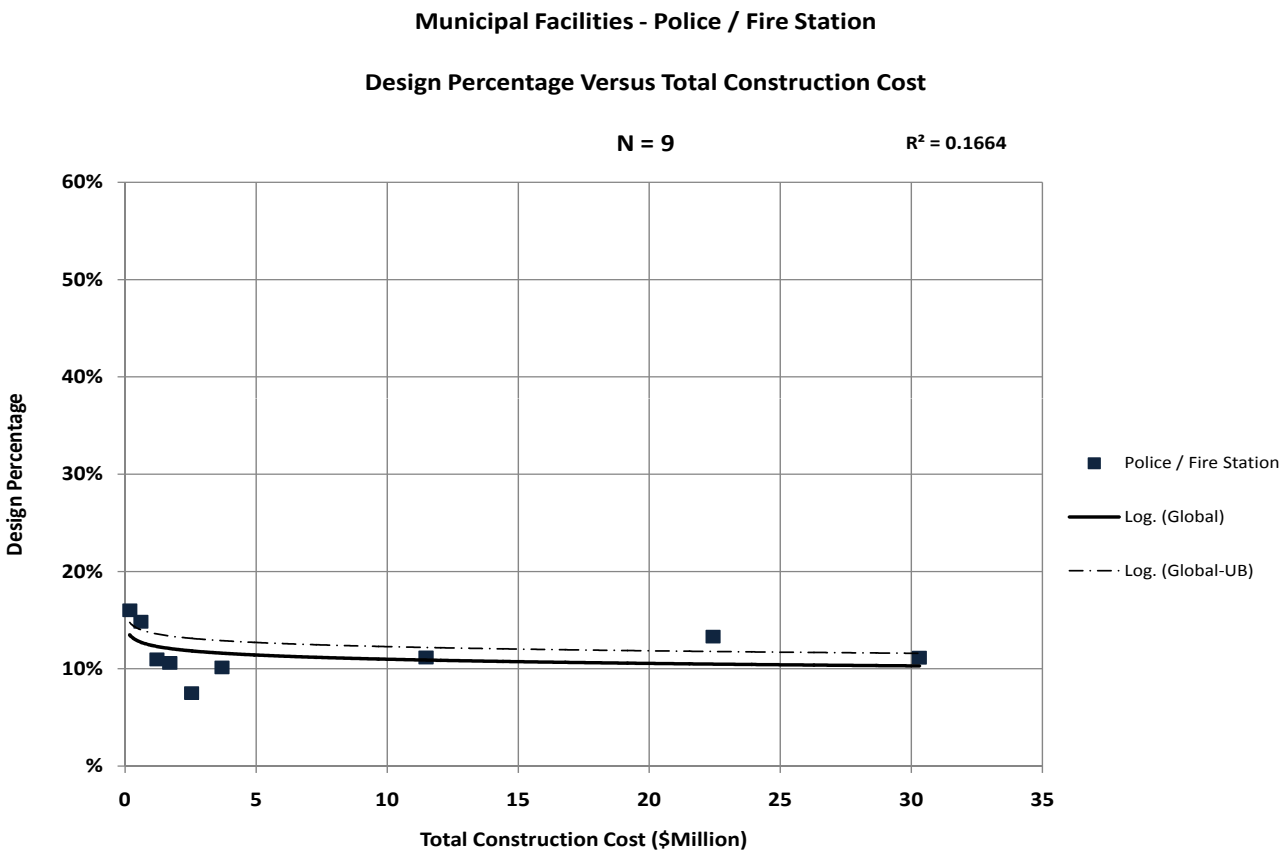

Parks - Restrooms
Design Percentage Versus Total Construction Cost
N = 5
60%
50%
40%
30%
20%
10%
%
Design Percentage
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Total Construction Cost ($Million)
R² = 0.2746
Restrooms
Log. (Global)
Log. (Global-UB)


Parks - Sports Lighting Projects
Design Percentage Versus Total Construction Cost
N = 4
60%
50%
40%
30%
20%
10%
%
Design Percentage
0
0.2
0.4
0.6
0.8
1
1.2
Total Construction Cost ($Million)
R² = 0.8515
Sports Lighting Projects
Log. (Global)
Log. (Global-UB)


Municipal Facilities - Community Bldg./Rec. Center/CC/Gym
Design Percentage Versus Total Construction Cost
N = 25
60%
50%
40%
30%
20%
10%
%
Design Percentage
0
5
10
15
20
25
Total Construction Cost ($Million)
R² = 0.0922
Community Bldg./Rec. Center/CC/Gym
Log. (Global)
Log. (Global-UB)


Municipal Facilities - Libraries
Design Percentage Versus Total Construction Cost
N = 5
R² = 0.7888
60%
50%
40%
30%
20%
10%
%
Design Percentage
0
0.5
1
1.5
2
2.5
3
3.5
Total Construction Cost ($Million)
Libraries
Log. (Global)
Log. (Global-UB)

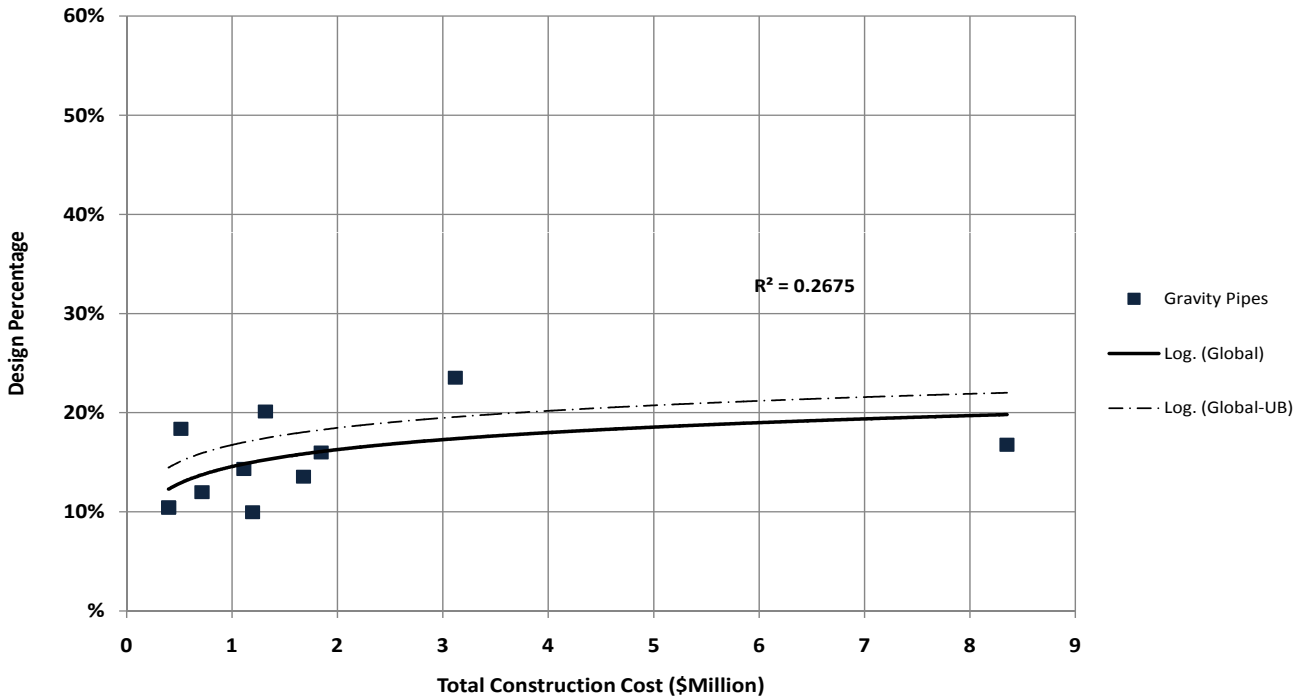

Municipal Facilities - Office - (TI's)
Design Percentage Versus Total Construction Cost
N = 5
60%
50%
40%
30%
20%
10%
%
Design Percentage
0
1
2
3
4
5
6
Total Construction Cost ($Million)
R² = 0.7246
Office - (TI's)
Log. (Global)
Log. (Global-UB)


Municipal Facilities - Police / Fire Station
Design Percentage Versus Total Construction Cost
N = 9
R² = 0.1664
60%
50%
40%
30%
20%
10%
%
Design Percentage
0
5
10
15
20
25
30
35
Total Construction Cost ($Million)
Police / Fire Station
Log. (Global)
Log. (Global-UB)

Pipes & Plants - Gravity Pipes

Design Percentage Versus Total Construction Cost

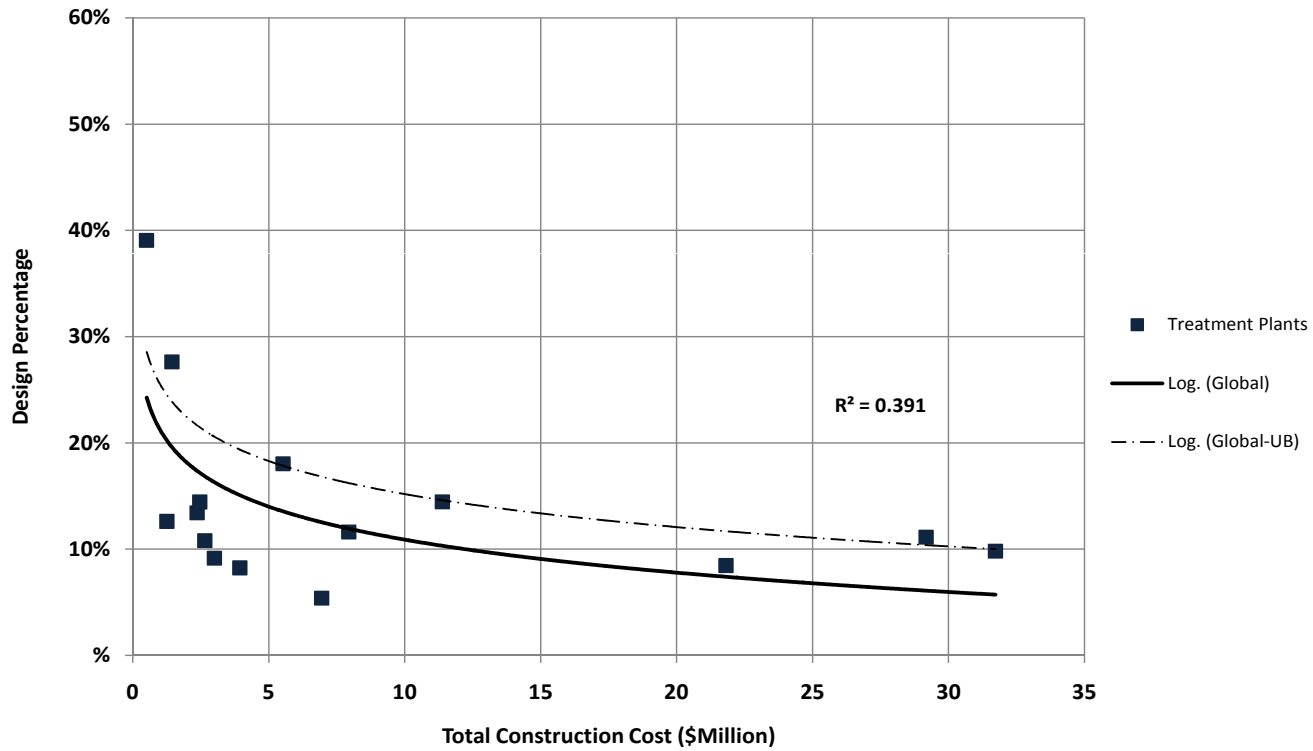
N = 11

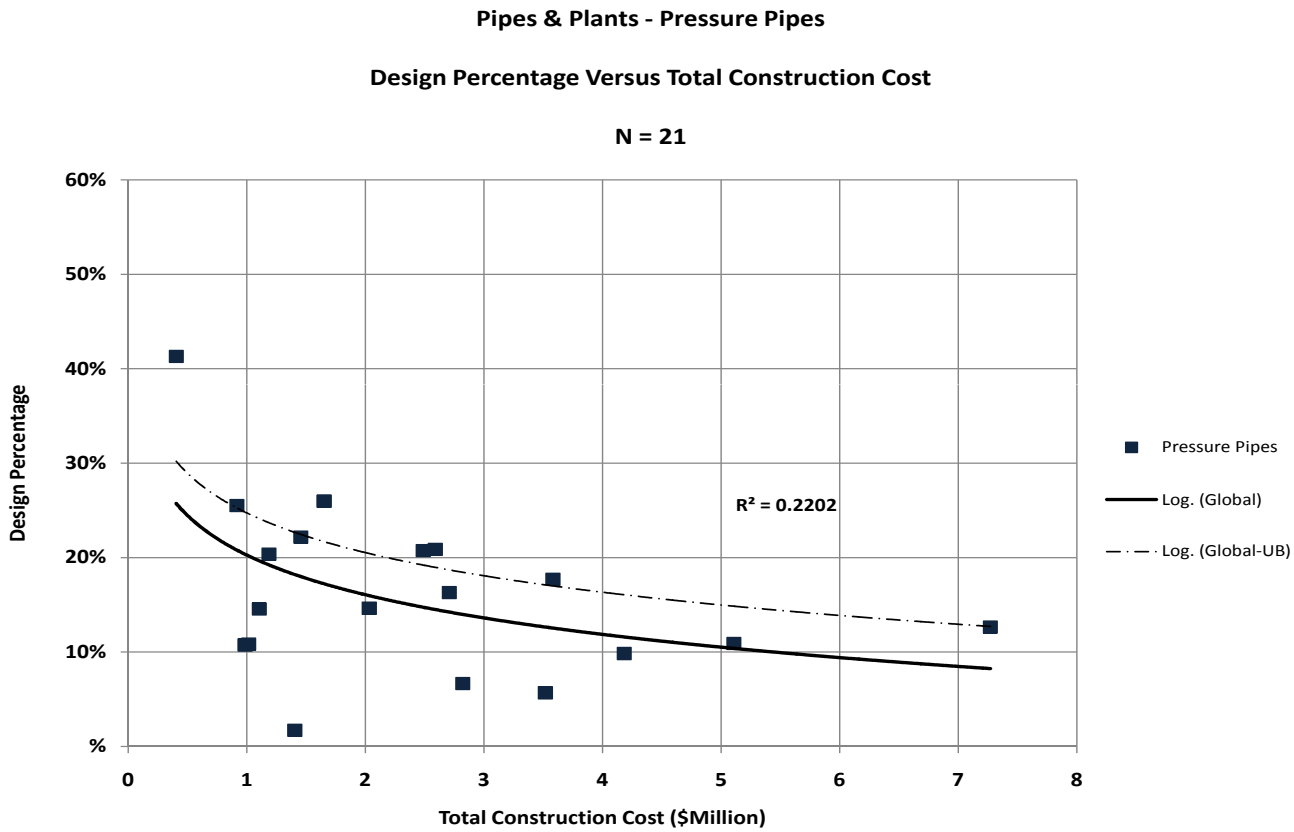


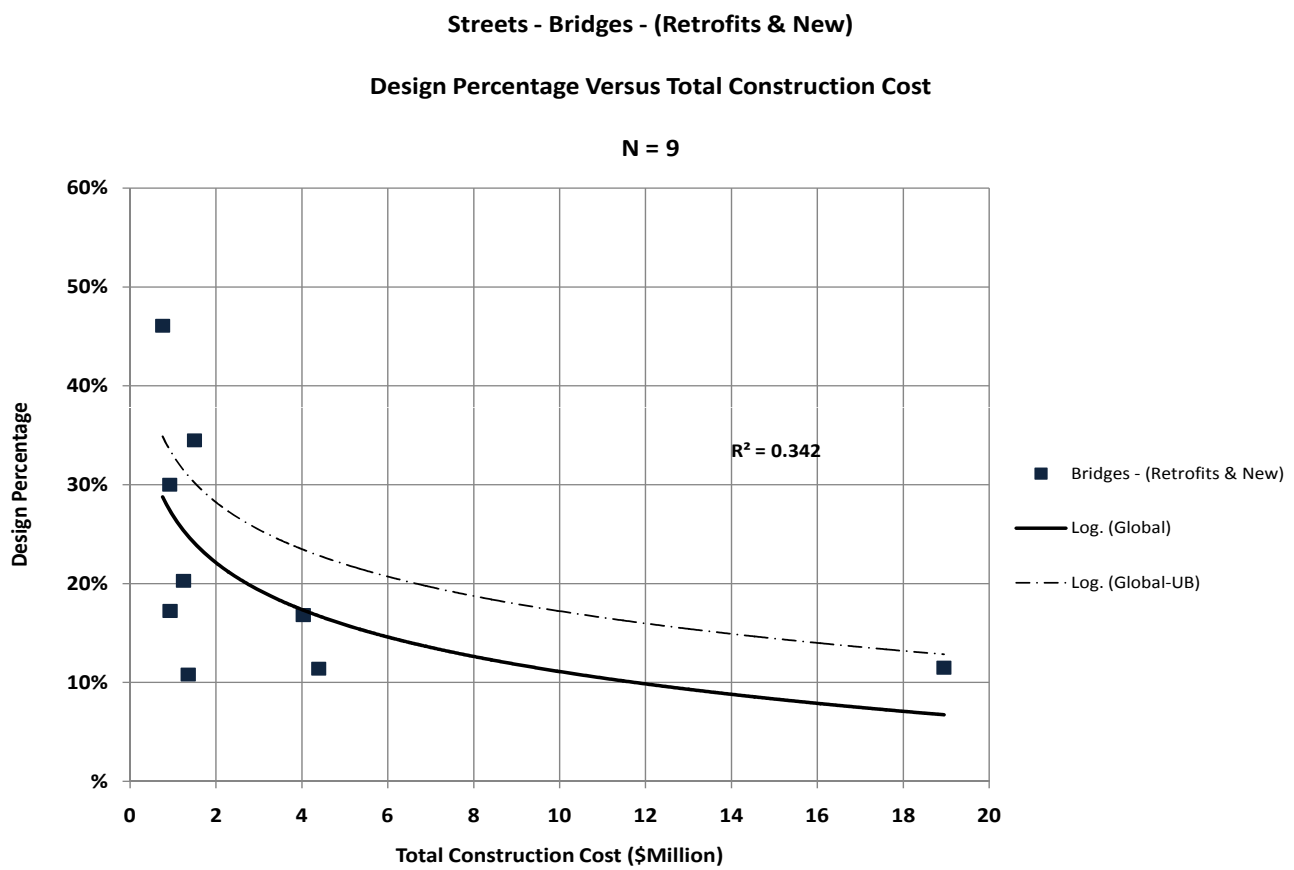
Pipes & Plants - Treatment Plants

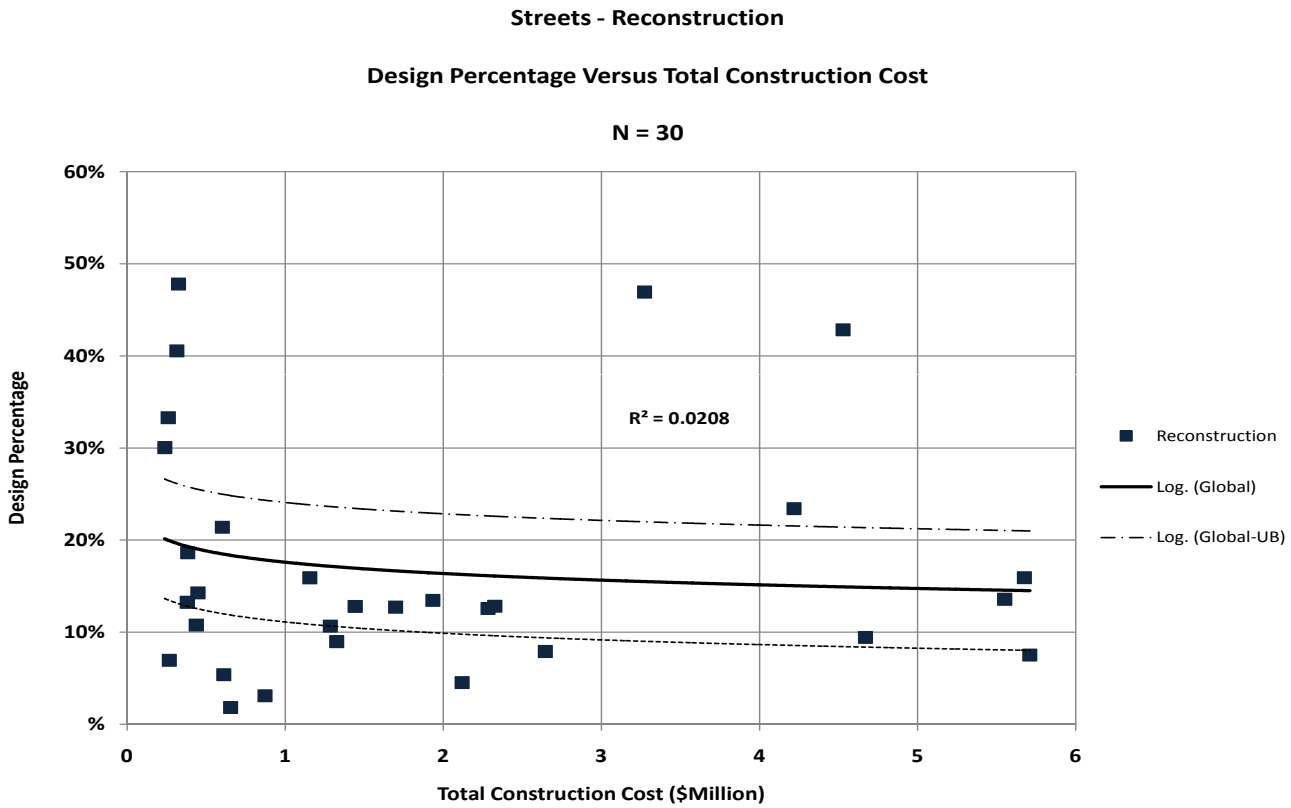
Design Percentage Versus Total Construction Cost

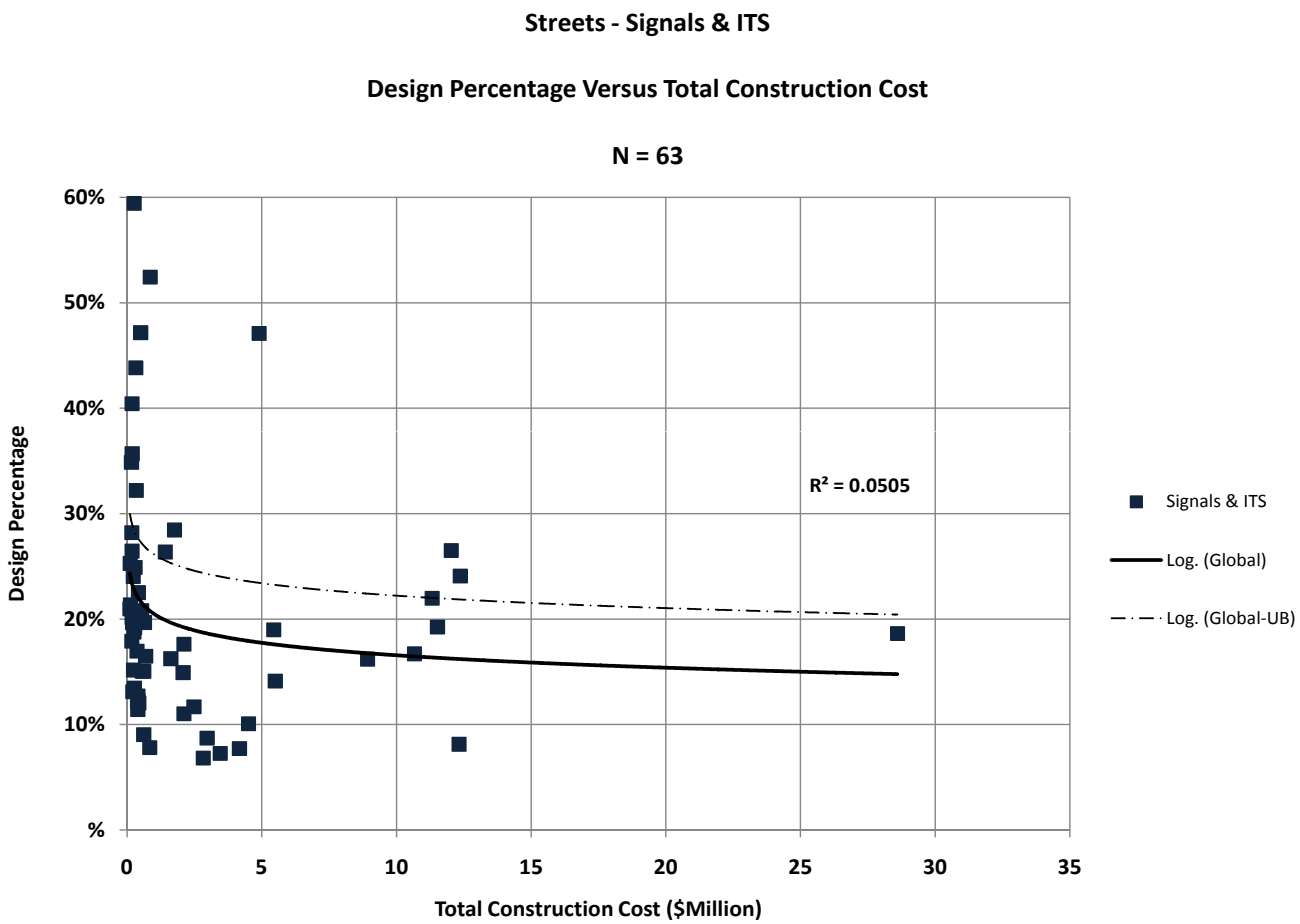
N = 15

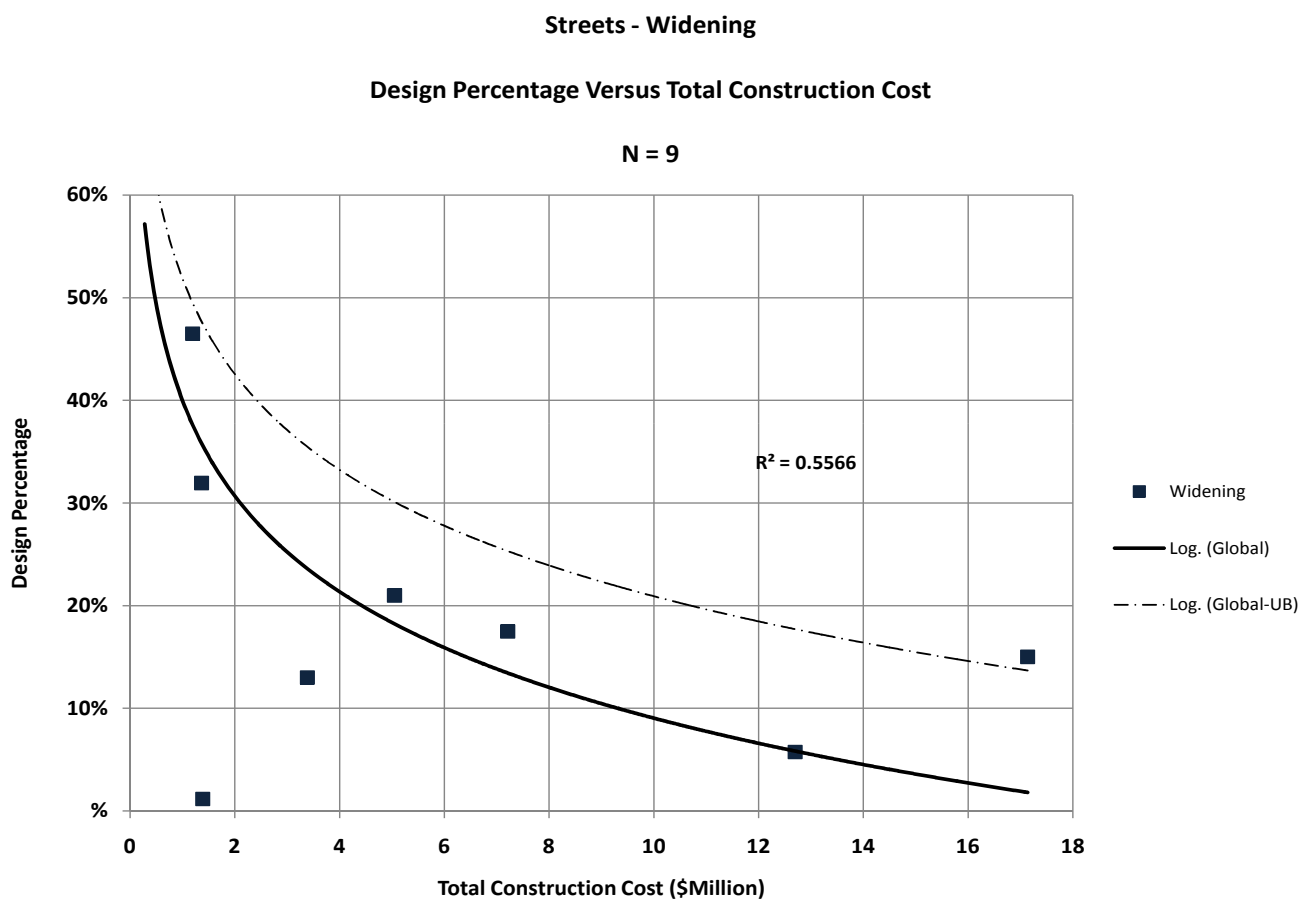


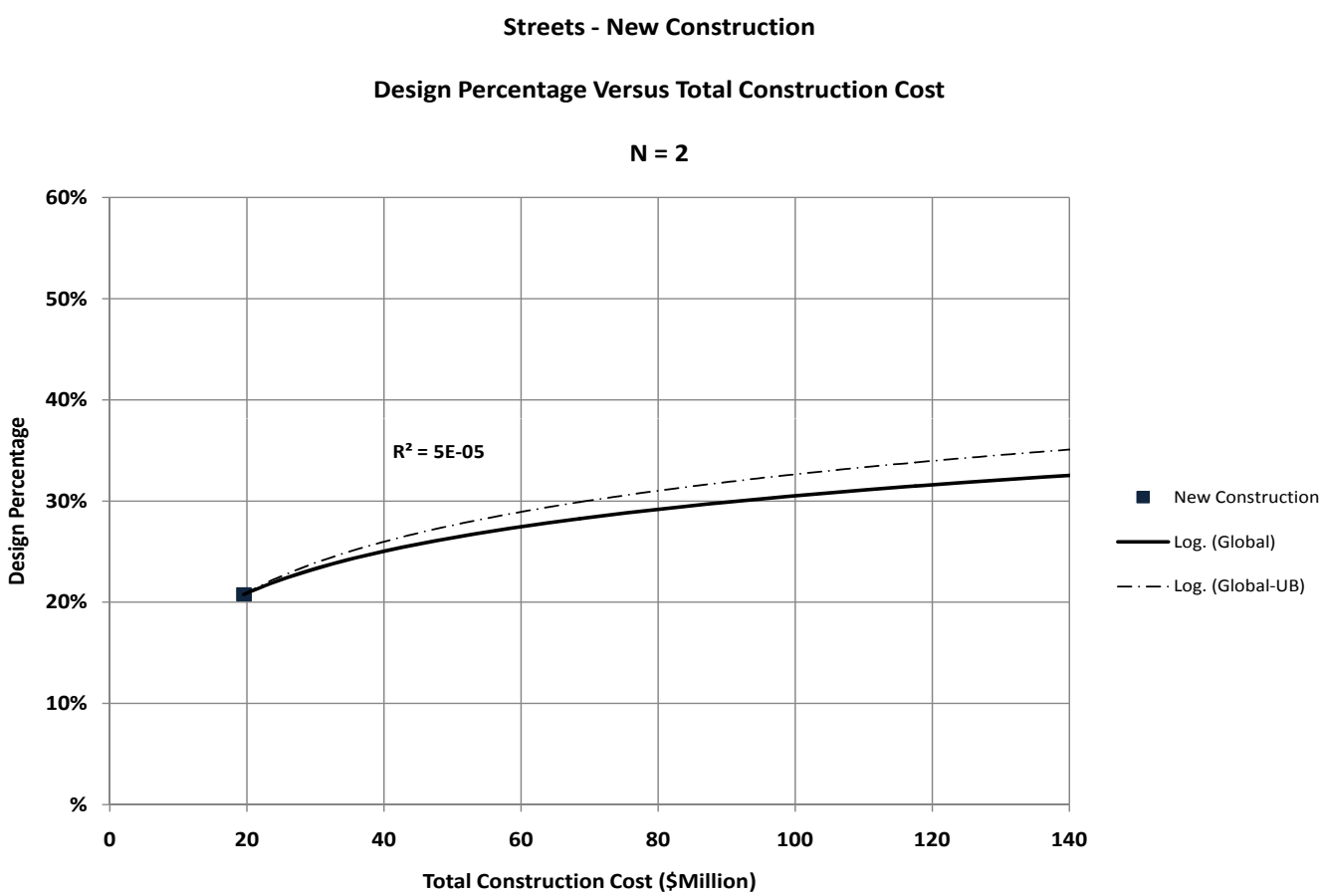

Pipes & Plants - Pressure Pipes
Design Percentage Versus Total Construction Cost
N = 21
60%
50%
40%
30%
20%
10%
%
Design Percentage
0
1
2
3
4
5
6
7
8
Total Construction Cost ($Million)
R² = 0.2202
Pressure Pipes
Log. (Global)
Log. (Global-UB)

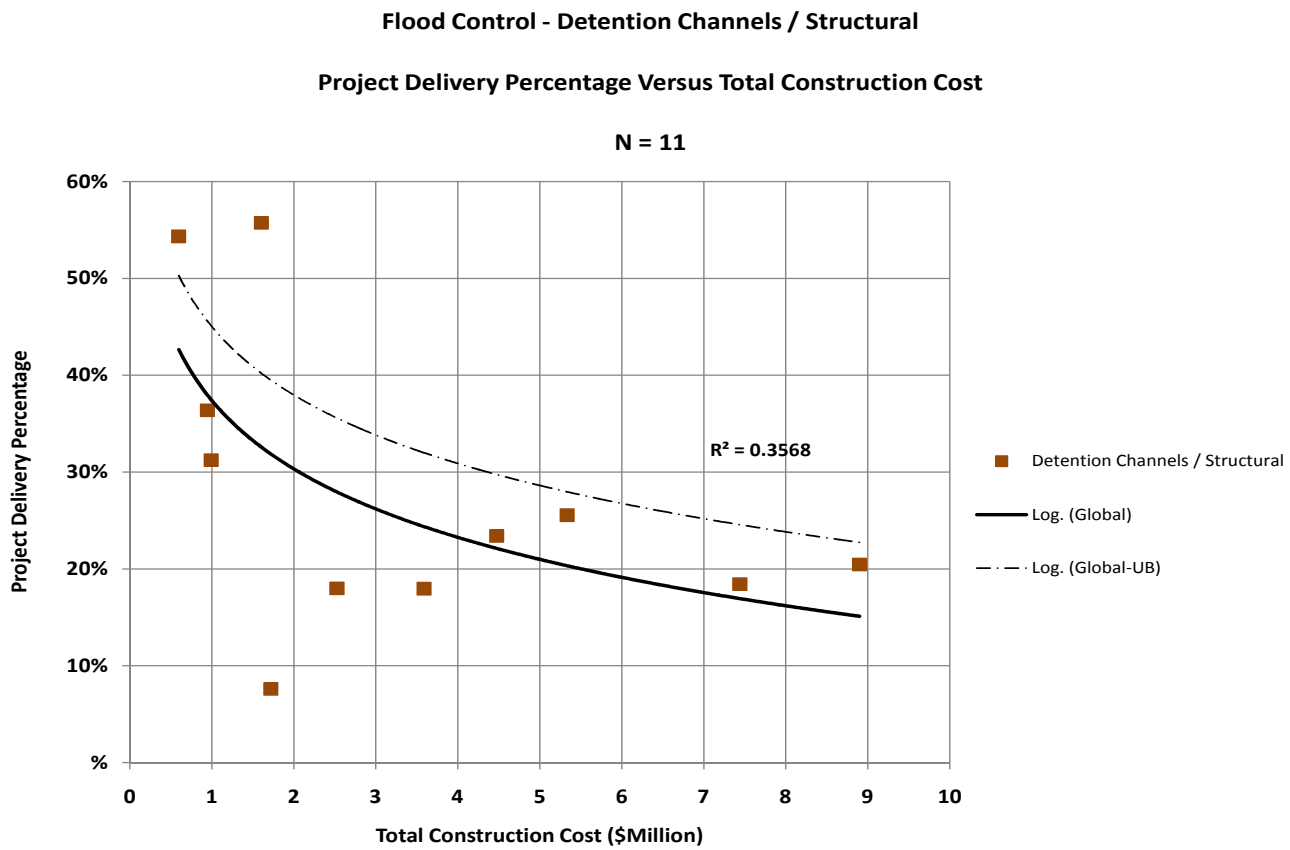

Streets - Bridges - (Retrofits & New)
Design Percentage Versus Total Construction Cost
N = 9
60%
50%
40%
30%
20%
10%
%
Design Percentage
0
2
4
6
8
10
12
14
16
18
20
Total Construction Cost ($Million)
R² = 0.342
Bridges - (Retrofits & New)
Log. (Global)
Log. (Global-UB)

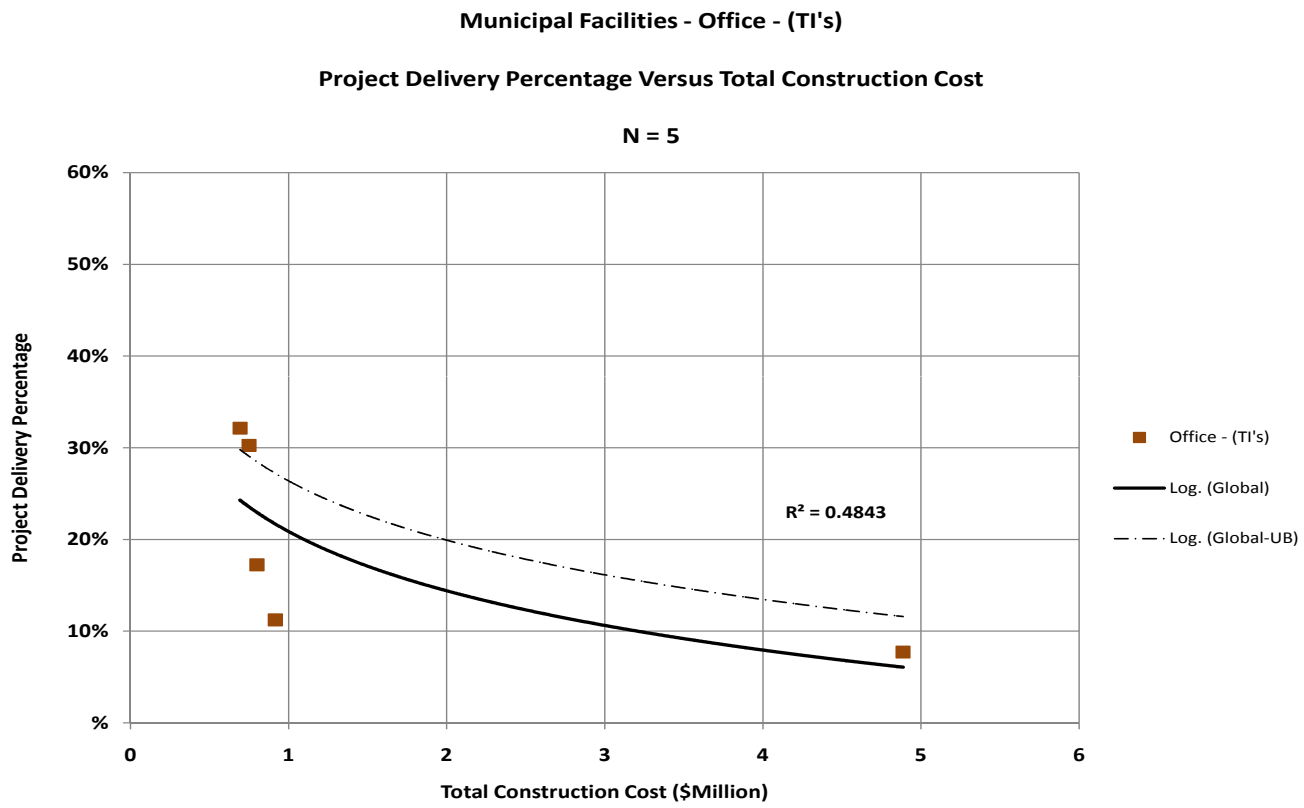

Streets - Reconstruction
Design Percentage Versus Total Construction Cost
N = 30
60%
50%
40%
30%
20%
10%
%
Design Percentage
R² = 0.0208
0
1
2
3
4
5
6
Total Construction Cost ($Million)
Reconstruction
Log. (Global)
Log. (Global-UB)


Streets - Signals & ITS
Design Percentage Versus Total Construction Cost
N = 63
60%
50%
40%
30%
20%
10%
%
Design Percentage
R² = 0.0505
0
5
10
15
20
25
30
35
Total Construction Cost ($Million)
Signals & ITS
Log. (Global)
Log. (Global-UB)


Streets - Widening
Design Percentage Versus Total Construction Cost
N = 9
60%
50%
40%
30%
20%
10%
%
Design Percentage
R² = 0.5566
0
2
4
6
8
10
12
14
16
18
Total Construction Cost ($Million)
Widening
Log. (Global)
Log. (Global-UB)


Streets - New Construction
Design Percentage Versus Total Construction Cost
N = 2
60%
50%
40%
30%
20%
10%
%
Design Percentage
R² = 5E-05
0
20
40
60
80
100
120
140
Total Construction Cost ($Million)
New Construction
Log. (Global)
Log. (Global-UB)

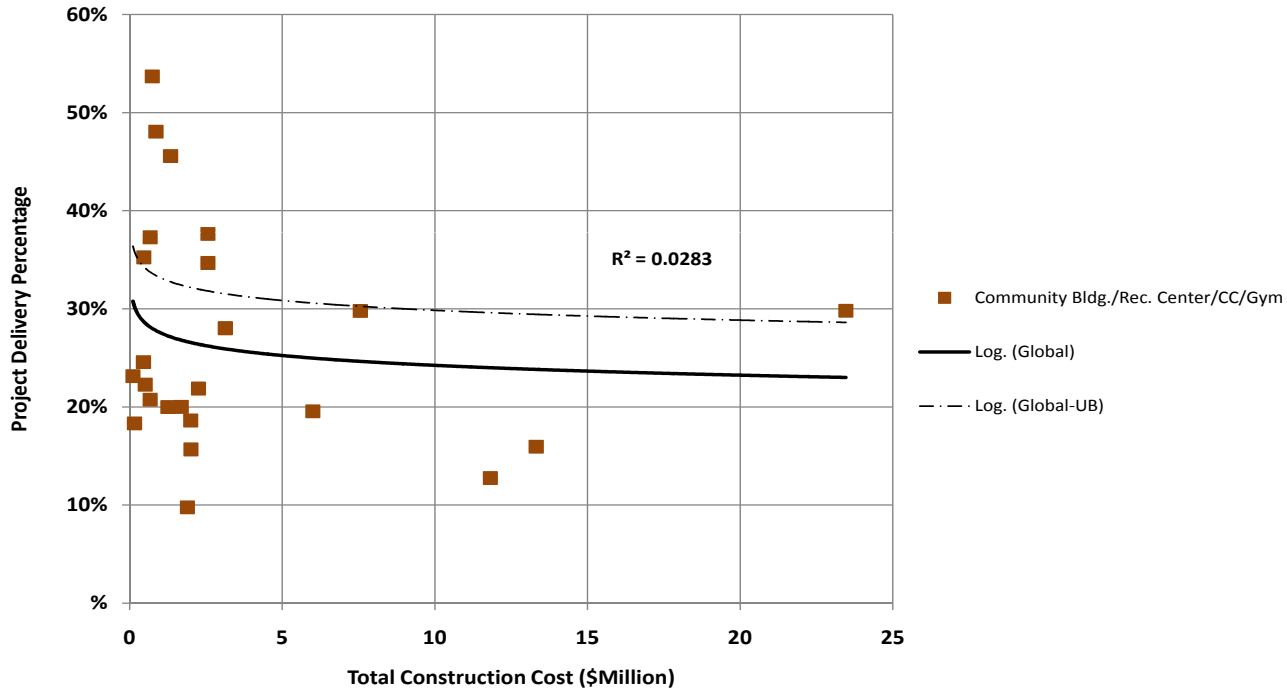

Flood Control - Detention Channels / Structural
Project Delivery Percentage Versus Total Construction Cost
N = 11
60%
50%
40%
30%
20%
10%
%
Project Delivery Percentage
0
1
2
3
4
5
6
7
8
9
10
Total Construction Cost ($Million)
R² = 0.3568
Detention Channels / Structural
Log. (Global)
Log. (Global-UB)


Municipal Facilities - Office - (TI's)
Project Delivery Percentage Versus Total Construction Cost
N = 5
60%
50%
40%
30%
20%
10%
%
Project Delivery Percentage
0
1
2
3
4
5
6
Total Construction Cost ($Million)
R² = 0.4843
Office - (TI's)
Log. (Global)
Log. (Global-UB)

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

Project Delivery Percentage Versus Total Construction Cost

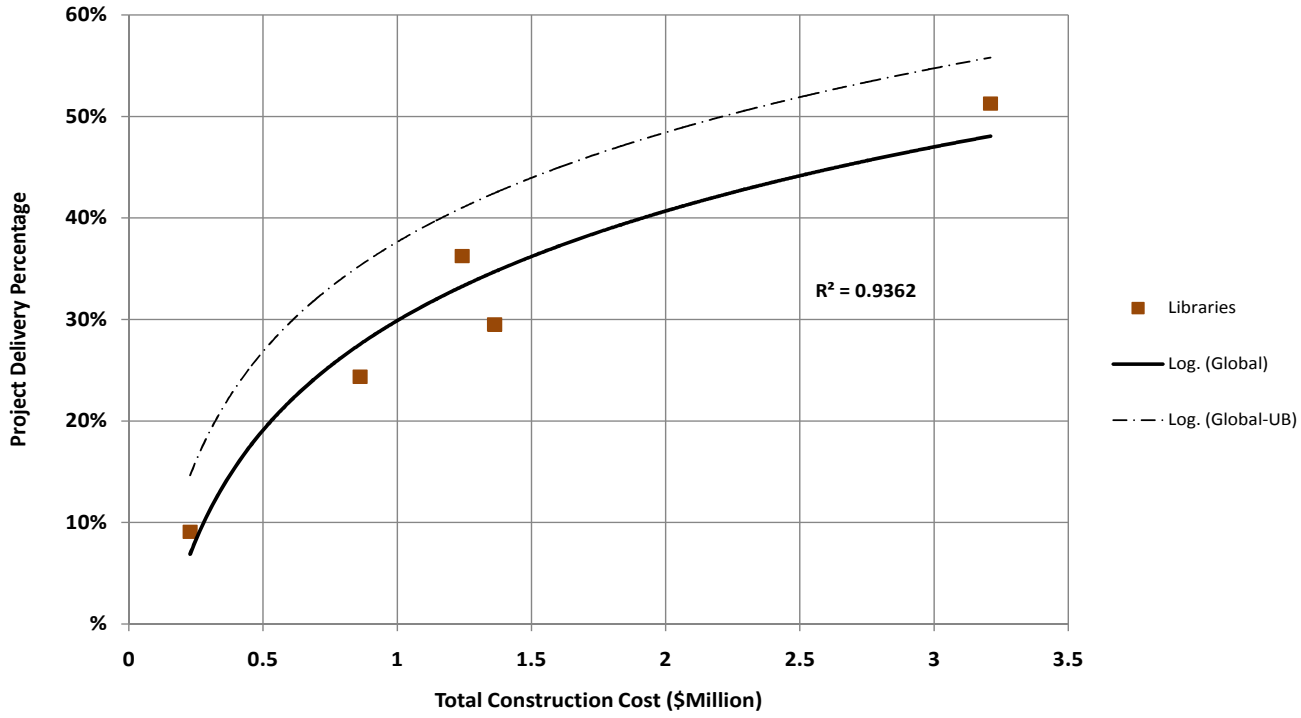
N = 25

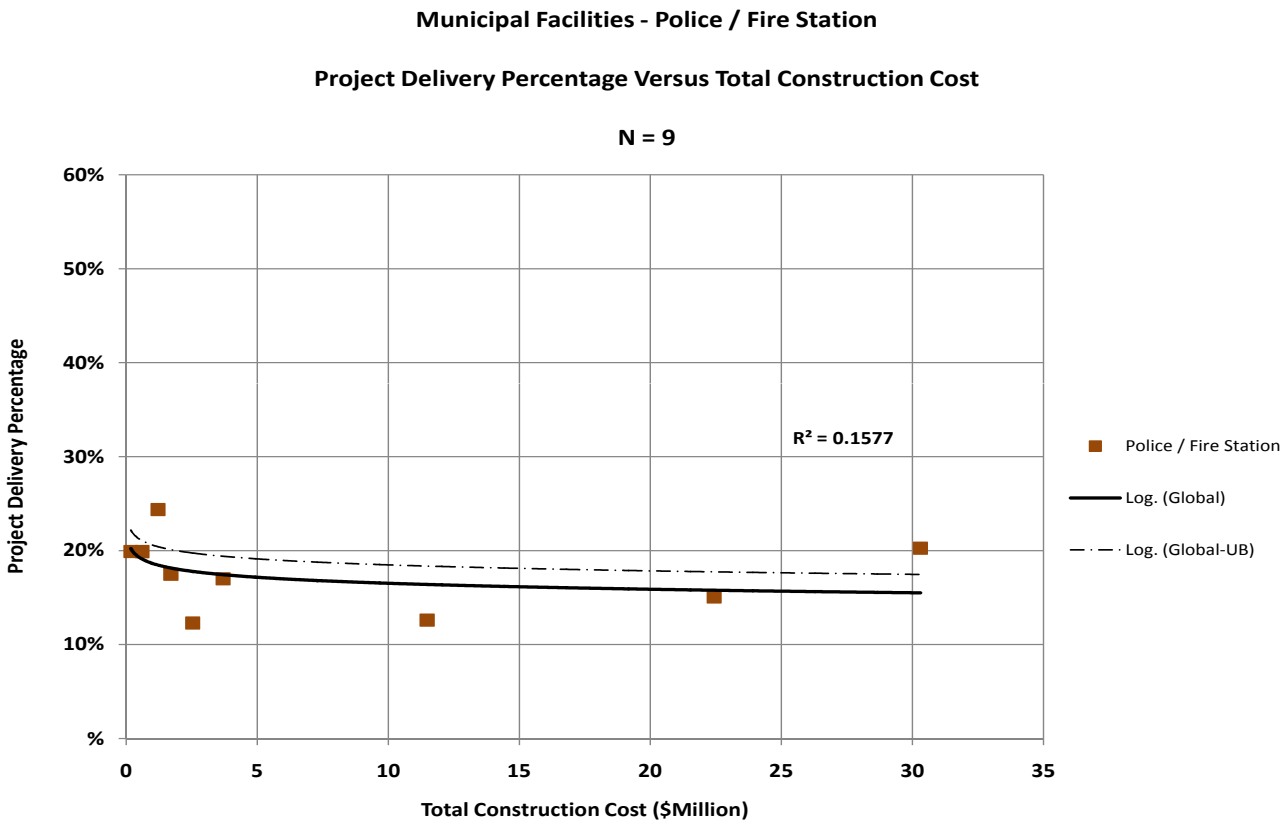


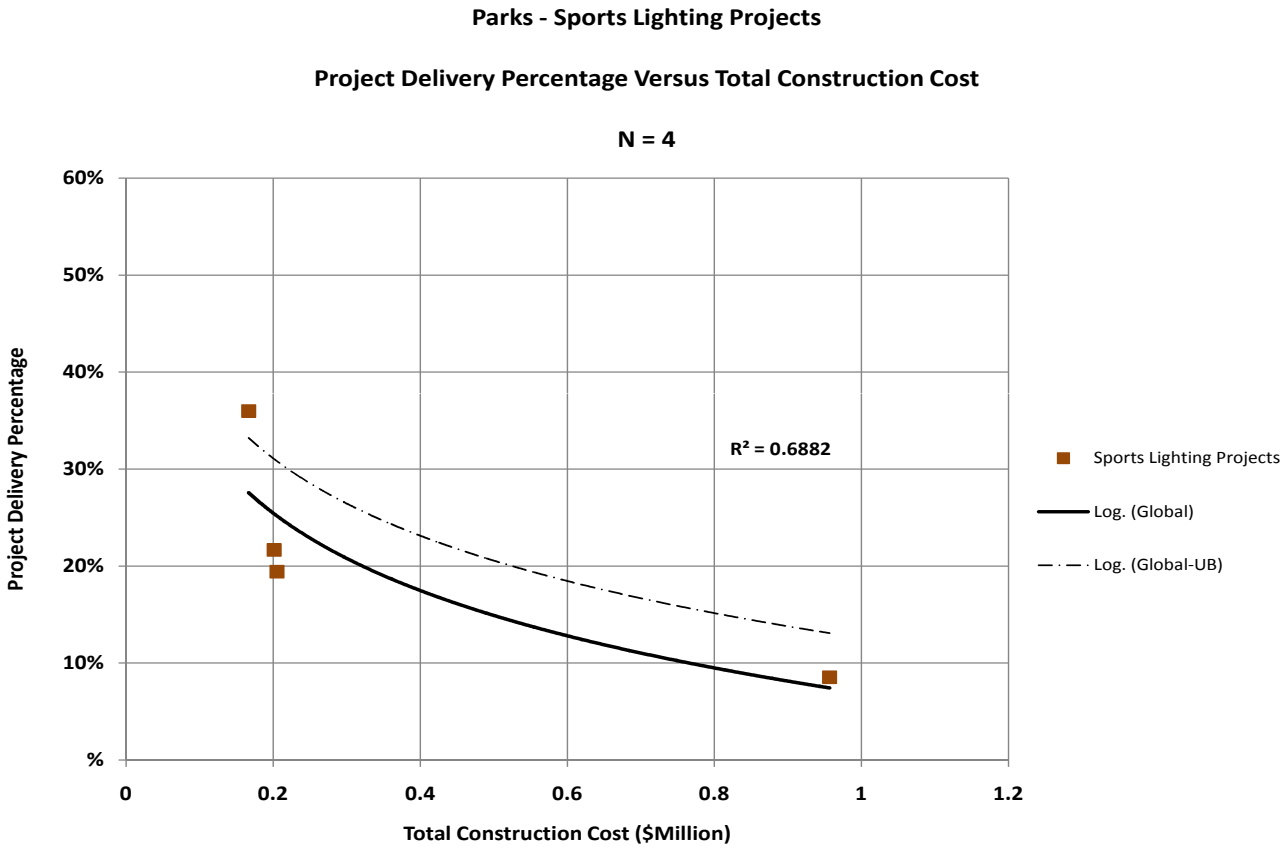
Municipal Facilities - Libraries

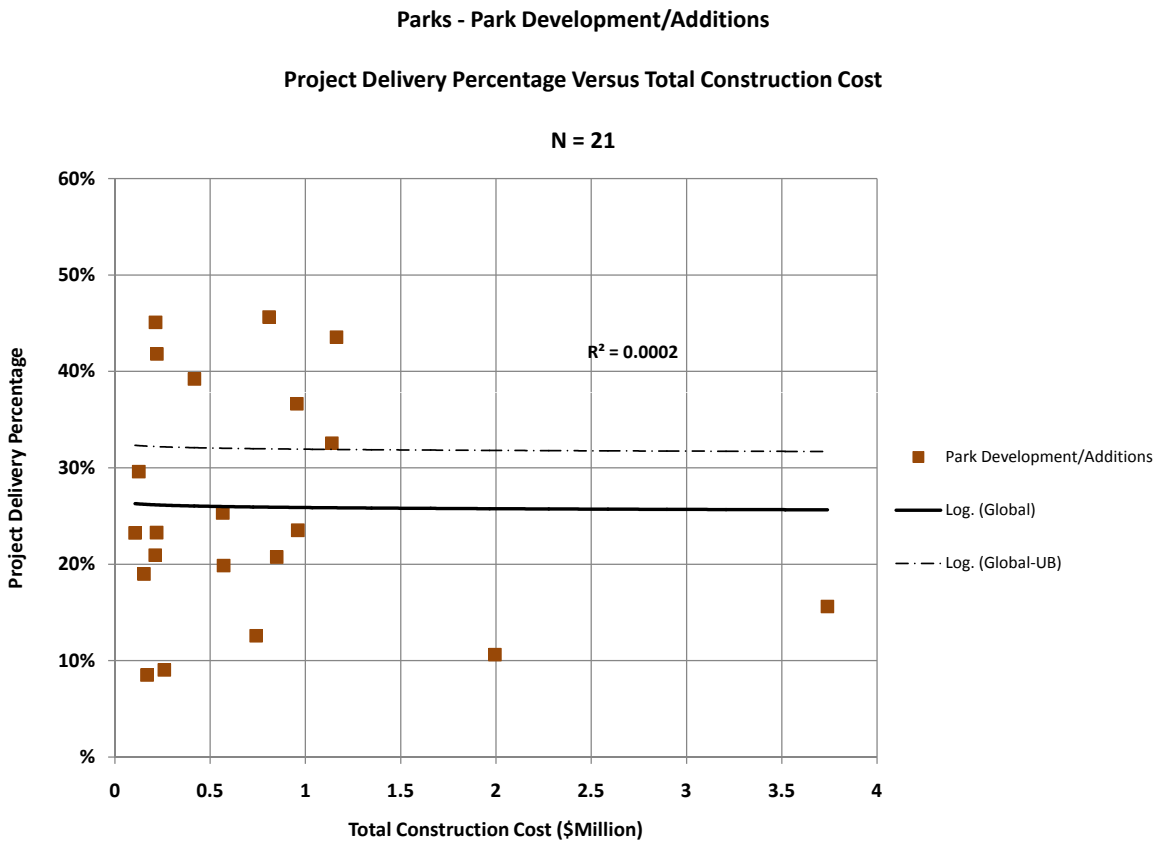
Project Delivery Percentage Versus Total Construction Cost

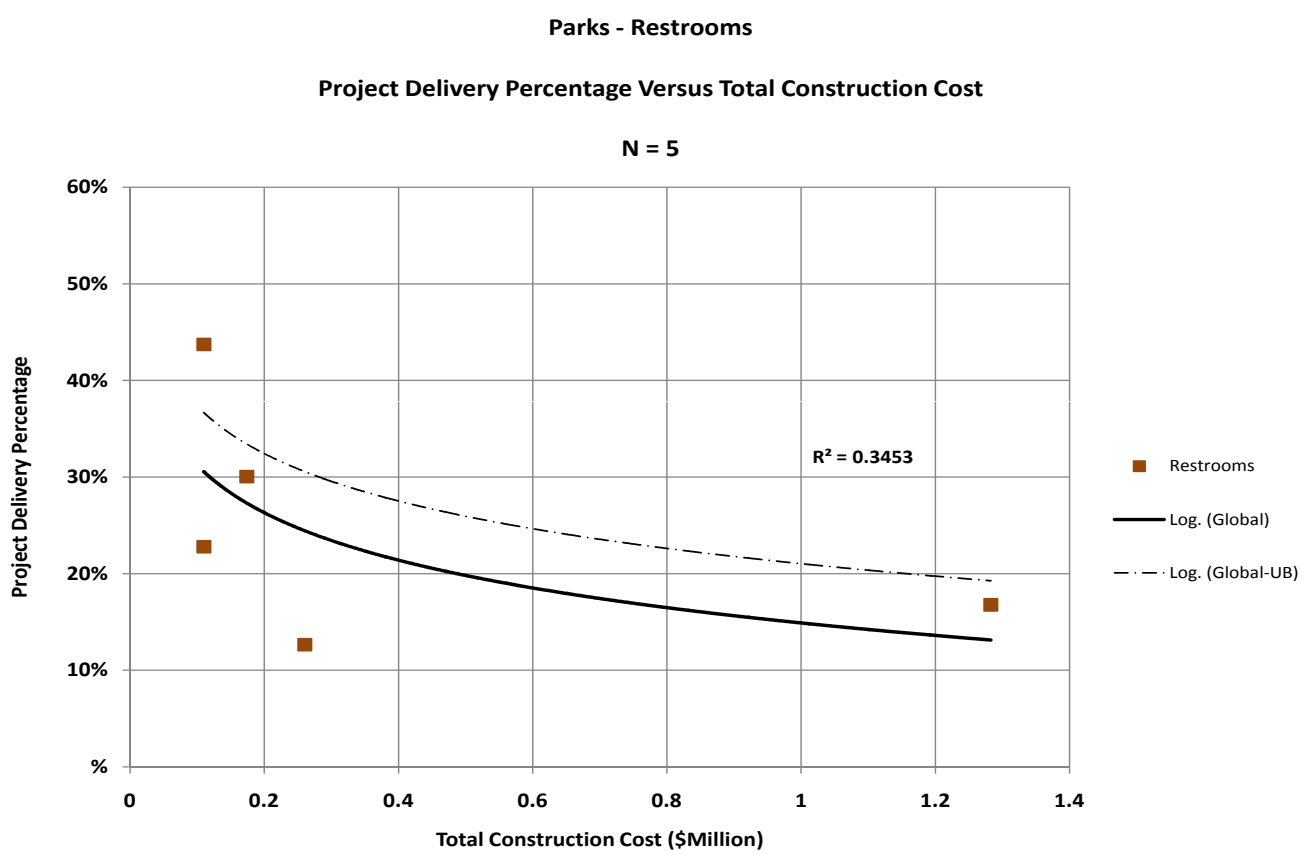
N = 5

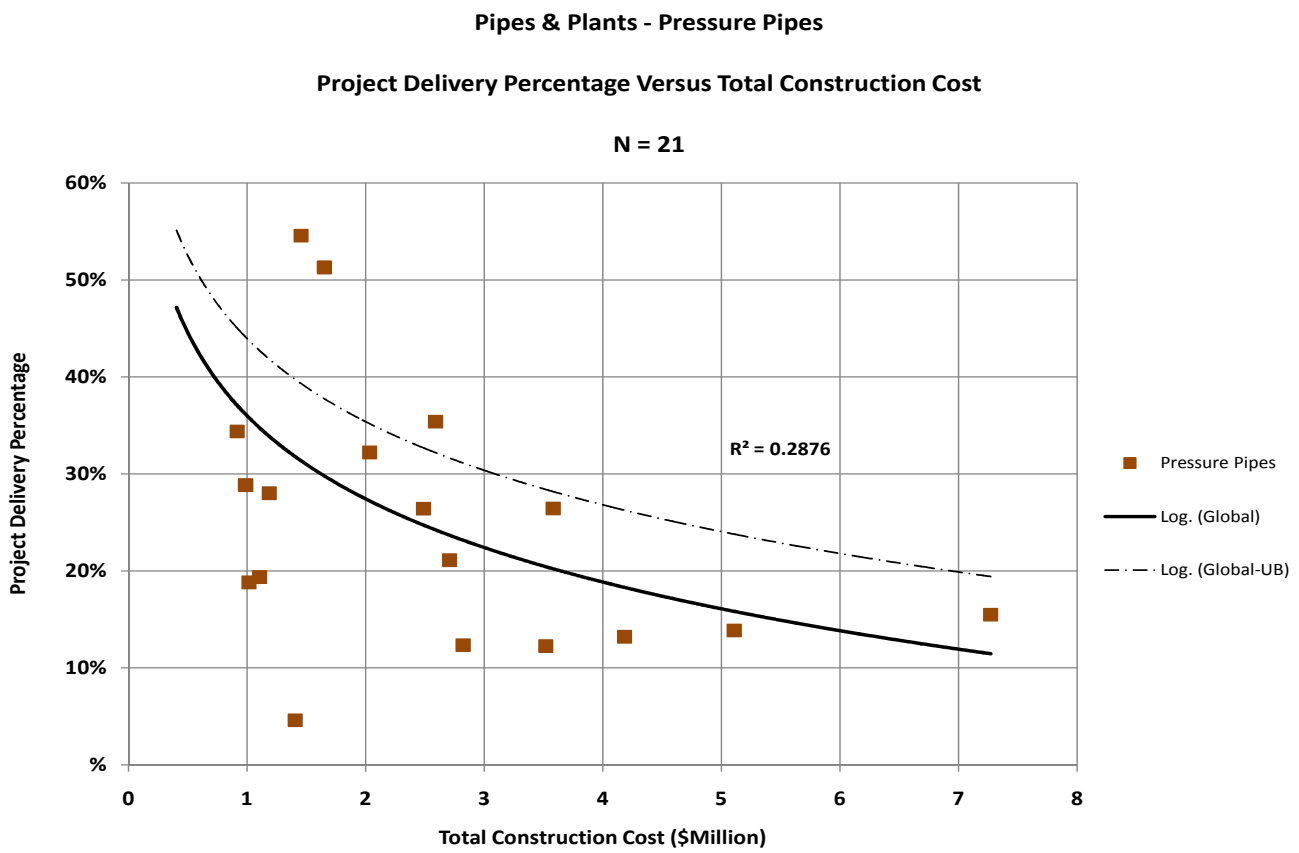


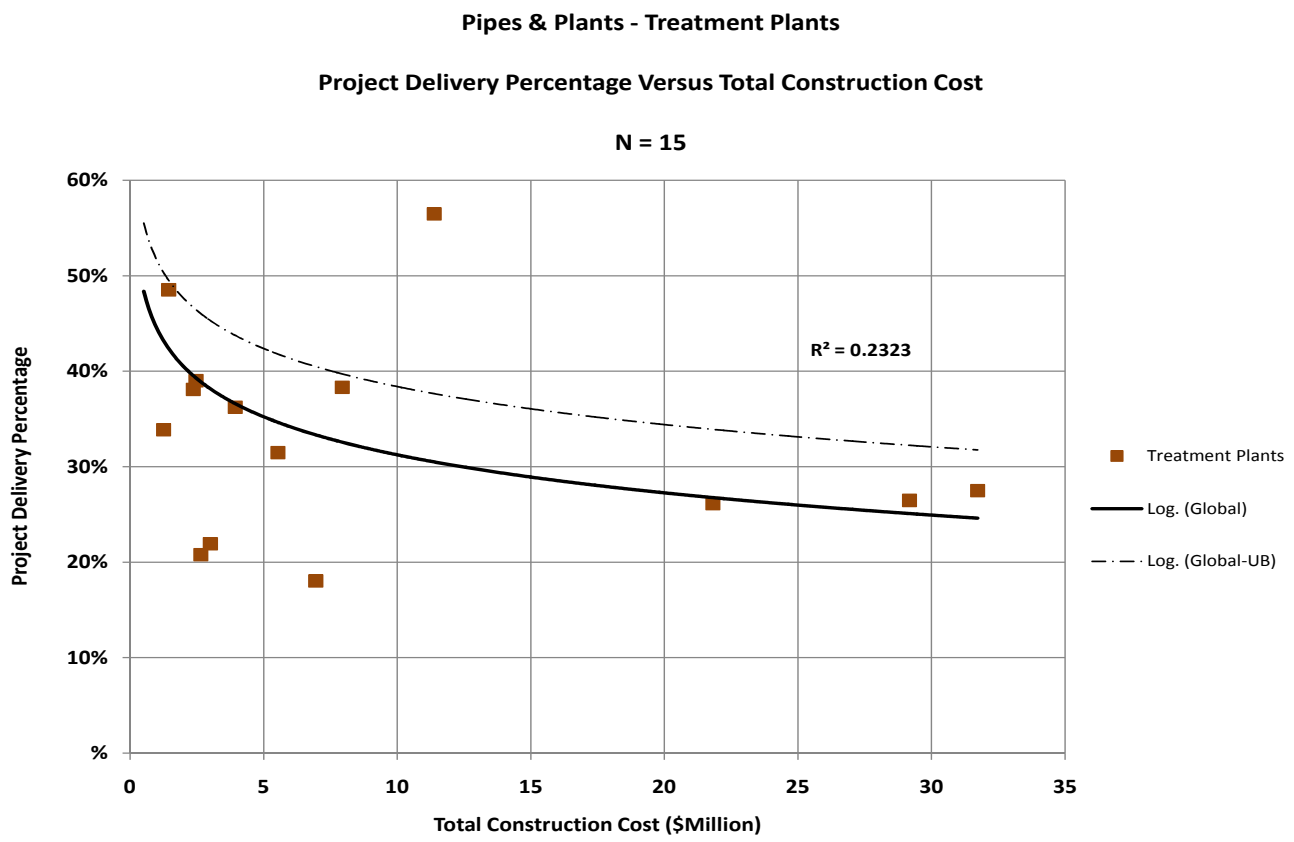

Municipal Facilities - Police / Fire Station
Project Delivery Percentage Versus Total Construction Cost
N = 9
60%
50%
40%
30%
20%
10%
%
Project Delivery Percentage
0
5
10
15
20
25
30
35
Total Construction Cost ($Million)
R² = 0.1577
Police / Fire Station
Log. (Global)
Log. (Global-UB)

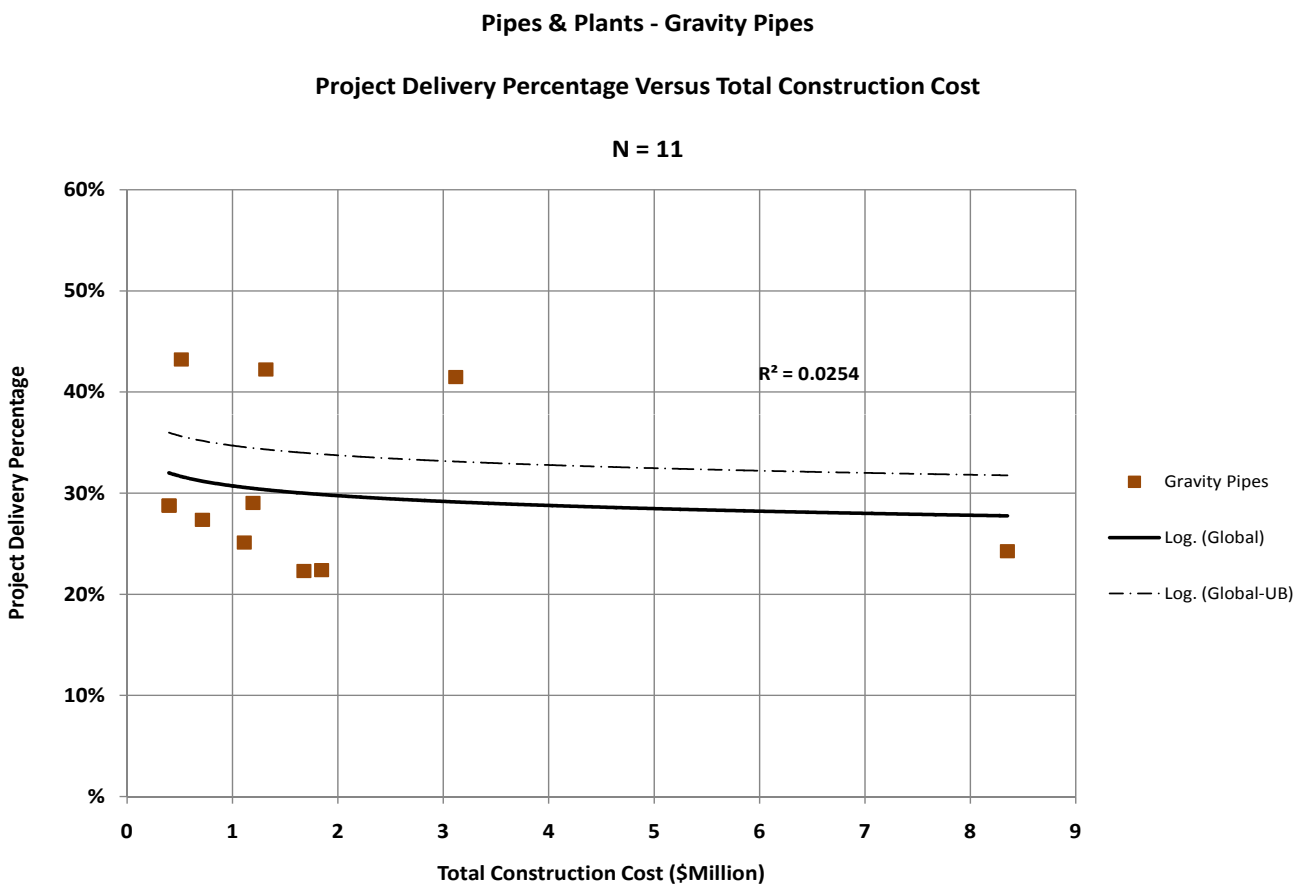

Parks - Sports Lighting Projects
Project Delivery Percentage Versus Total Construction Cost
N = 4
60%
50%
40%
30%
20%
10%
%
Project Delivery Percentage
0
0.2
0.4
0.6
0.8
1
1.2
Total Construction Cost ($Million)
R² = 0.6882
Sports Lighting Projects
Log. (Global)
Log. (Global-UB)

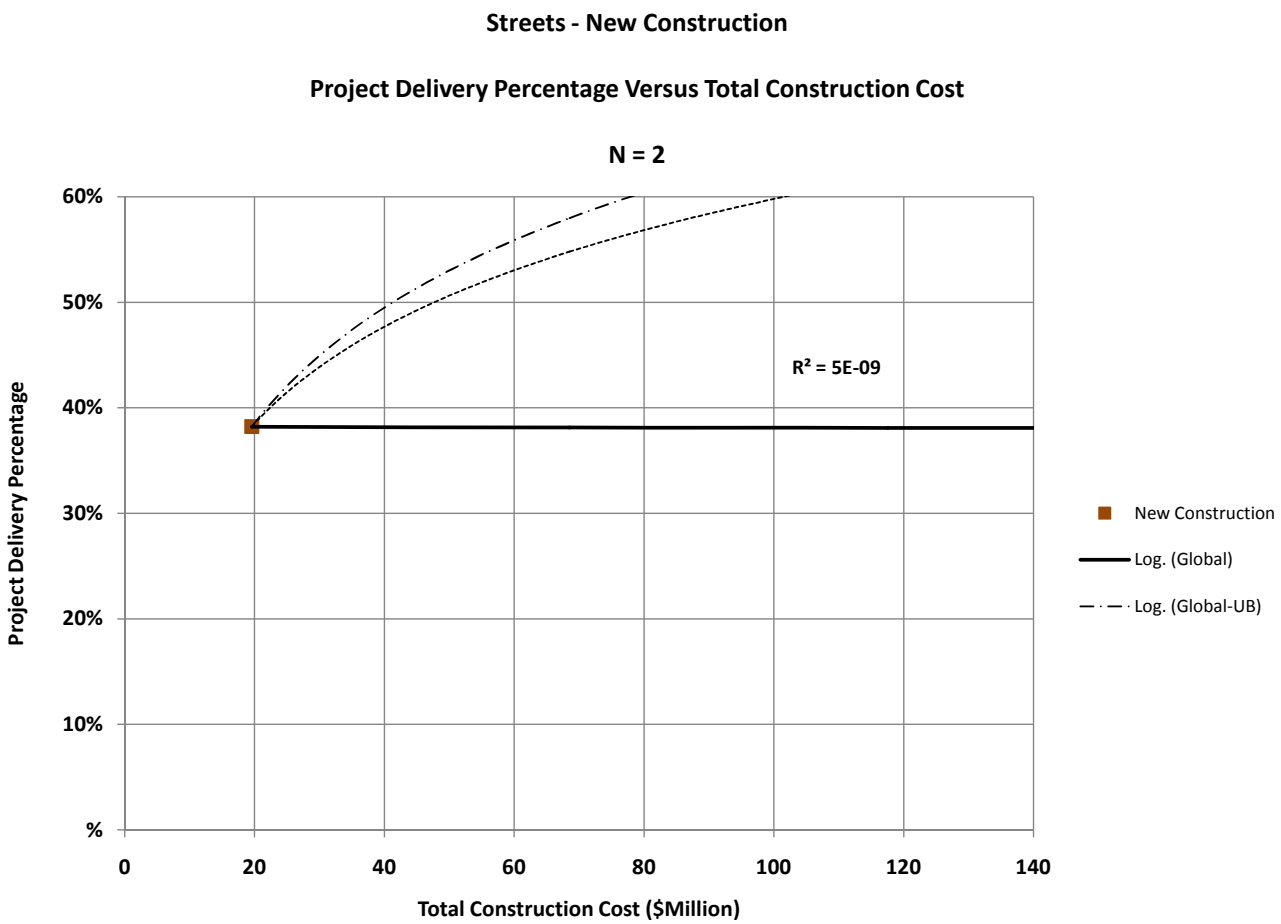

Parks - Park Development/Additions
Project Delivery Percentage Versus Total Construction Cost
N = 21
60%
50%
40%
30%
20%
10%
%
Project Delivery Percentage
R² = 0.0002
0
0.5
1
1.5
2
2.5
3
3.5
4
Total Construction Cost ($Million)
Park Development/Additions
Log. (Global)
Log. (Global-UB)

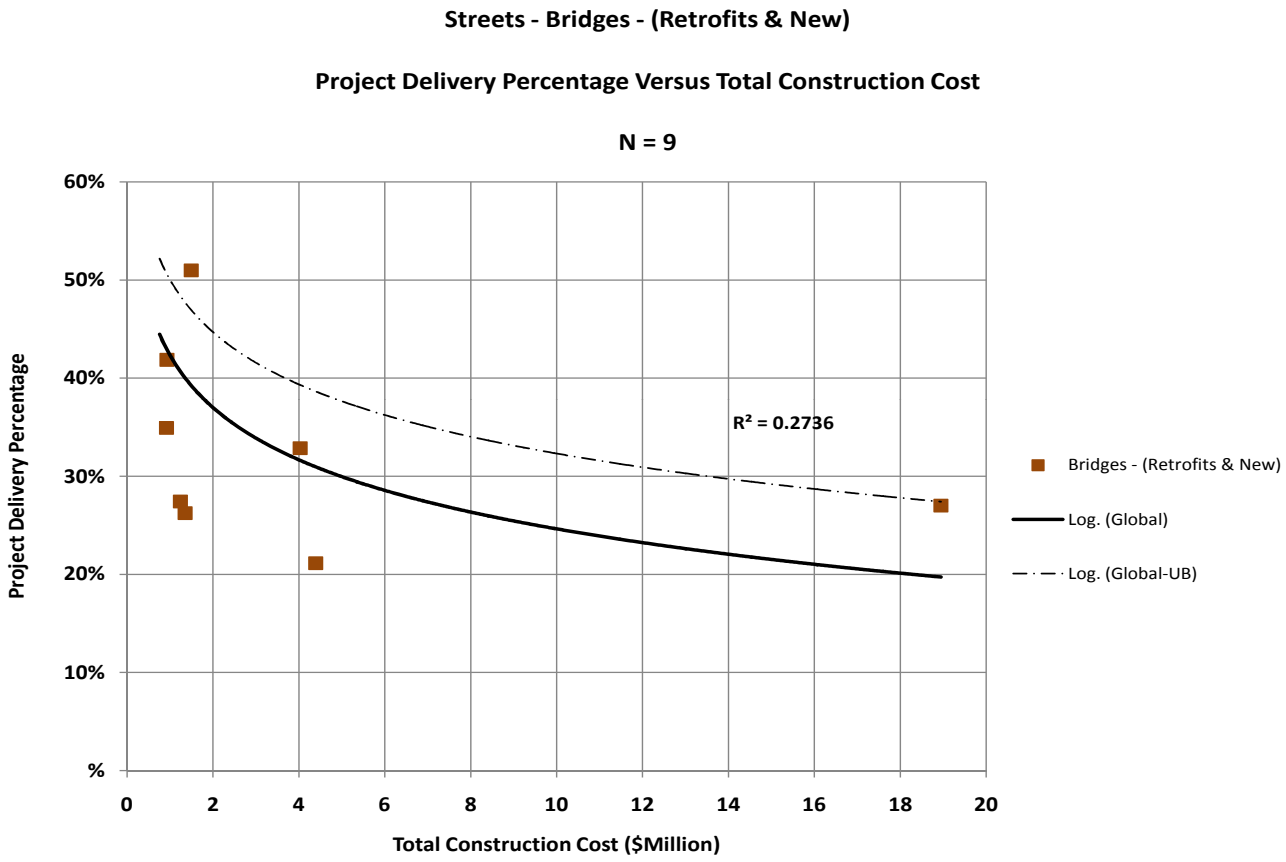

Parks - Restrooms
Project Delivery Percentage Versus Total Construction Cost
N = 5
60%
50%
40%
30%
20%
10%
%
Project Delivery Percentage
R² = 0.3453
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Total Construction Cost ($Million)
Restrooms
Log. (Global)
Log. (Global-UB)

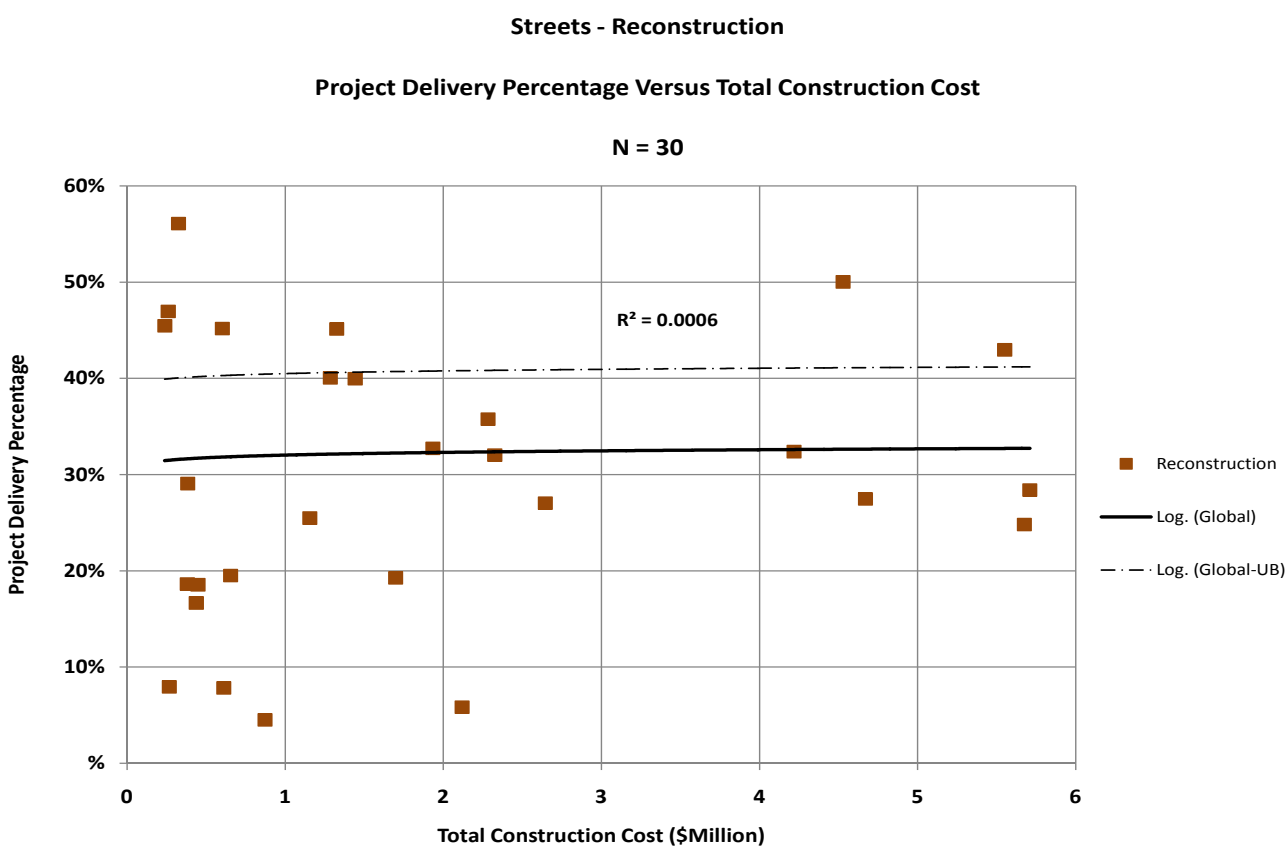

Pipes & Plants - Pressure Pipes
Project Delivery Percentage Versus Total Construction Cost
N = 21
60%
50%
40%
30%
20%
10%
%
Project Delivery Percentage
0
1
2
3
4
5
6
7
8
Total Construction Cost ($Million)
R² = 0.2876
Pressure Pipes
Log. (Global)
Log. (Global-UB)

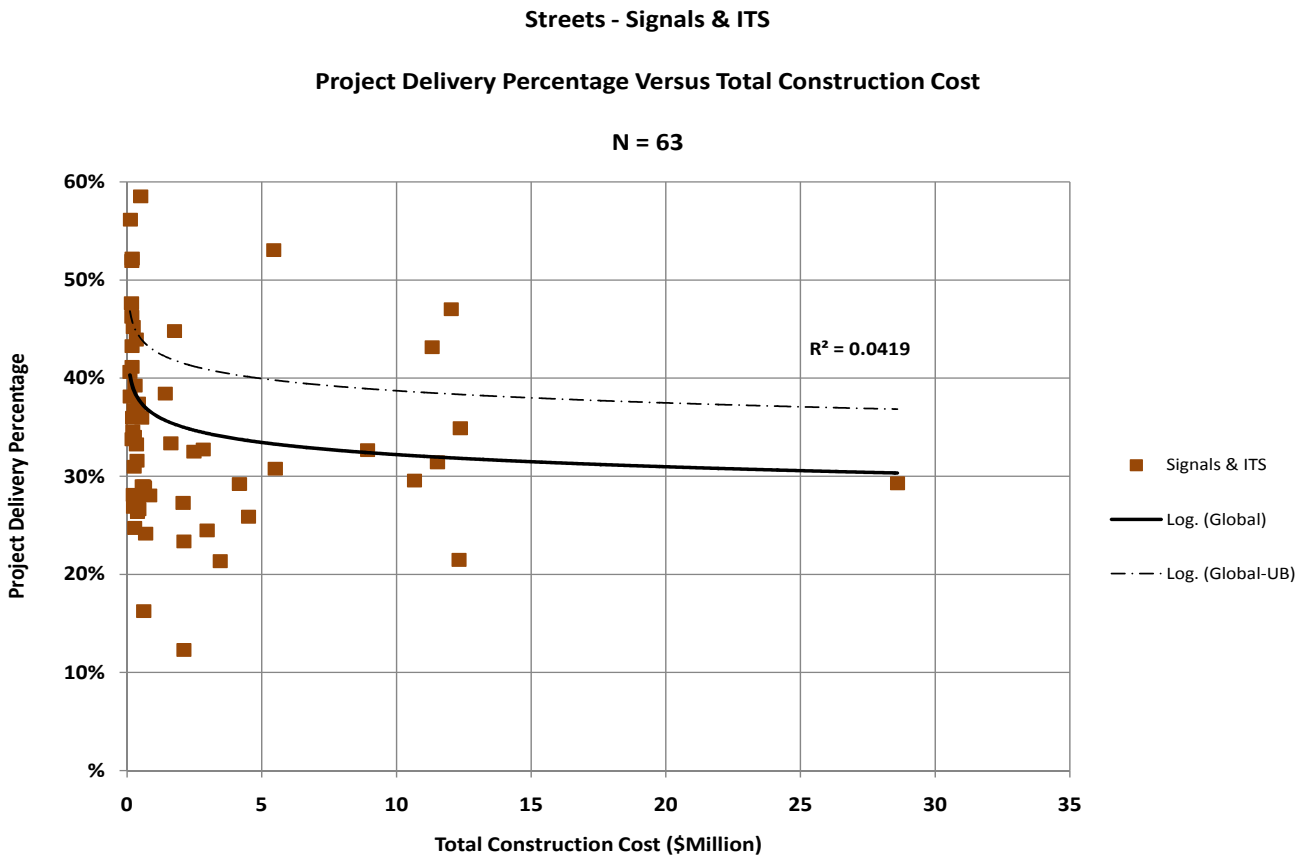

Pipes & Plants - Treatment Plants
Project Delivery Percentage Versus Total Construction Cost
N = 15
60%
50%
40%
30%
20%
10%
%
Project Delivery Percentage
0
5
10
15
20
25
30
35
Total Construction Cost ($Million)
R² = 0.2323
Treatment Plants
Log. (Global)
Log. (Global-UB)

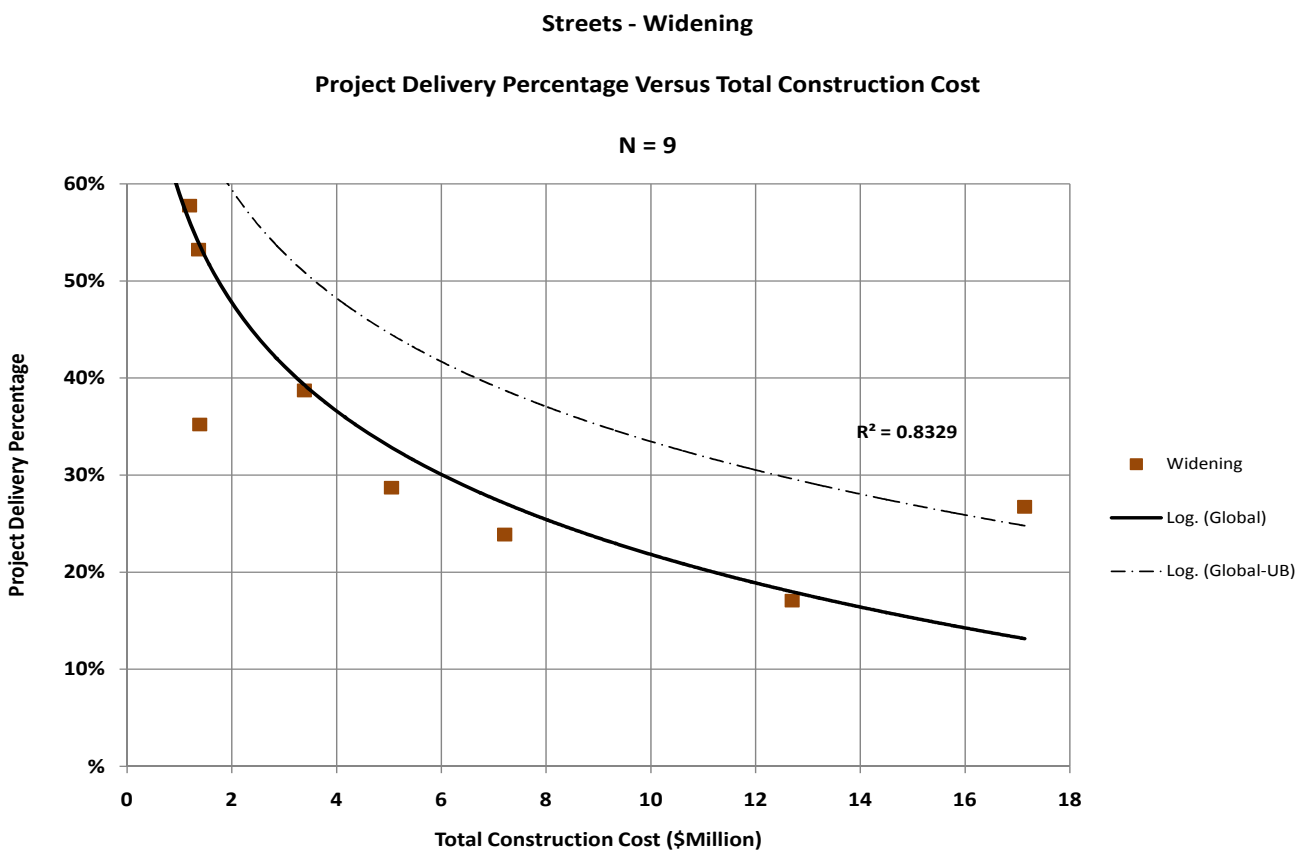

Pipes & Plants - Gravity Pipes
Project Delivery Percentage Versus Total Construction Cost
N = 11
60%
50%
40%
30%
20%
10%
%
Project Delivery Percentage
R² = 0.0254
0
1
2
3
4
5
6
7
8
9
Total Construction Cost ($Million)
Gravity Pipes
Log. (Global)
Log. (Global-UB)

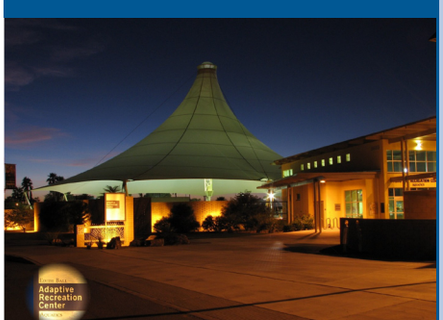

Streets - New Construction
Project Delivery Percentage Versus Total Construction Cost
N = 2
60%
50%
40%
30%
20%
10%
%
Project Delivery Percentage
R² = 5E-09
0
20
40
60
80
100
120
140
Total Construction Cost ($Million)
New Construction
Log. (Global)
Log. (Global-UB)


Streets - Bridges - (Retrofits & New)
Project Delivery Percentage Versus Total Construction Cost
N = 9
60%
50%
40%
30%
20%
10%
%
Project Delivery Percentage
0
2
4
6
8
10
12
14
16
18
20
Total Construction Cost ($Million)
R² = 0.2736
Bridges - (Retrofits & New)
Log. (Global)
Log. (Global-UB)


Streets - Reconstruction
Project Delivery Percentage Versus Total Construction Cost
N = 30
60%
50%
40%
30%
20%
10%
%
Project Delivery Percentage
0
1
2
3
4
5
6
Total Construction Cost ($Million)
R² = 0.0006
Reconstruction
Log. (Global)
Log. (Global-UB)


Streets - Signals & ITS
Project Delivery Percentage Versus Total Construction Cost
N = 63
60%
50%
40%
30%
20%
10%
%
Project Delivery Percentage
0
5
10
15
20
25
30
35
Total Construction Cost ($Million)
R² = 0.0419
Signals & ITS
Log. (Global)
Log. (Global-UB)


Streets - Widening
Project Delivery Percentage Versus Total Construction Cost
N = 9
60%
50%
40%
30%
20%
10%
%
Project Delivery Percentage
0
2
4
6
8
10
12
14
16
18
Total Construction Cost ($Million)
R² = 0.8329
Widening
Log. (Global)
Log. (Global-UB)



Participating Agencies

Pima County

Pinal County

Maricopa County

City of Tucson

City of Mesa

City of Peoria

City of Phoenix

Maricopa County Community Colleges

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