Arizona Benchmarking Study

November 2006

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Chapter 1
EXECUTIVE SUMMARY

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CONSTRUCTION
MANAGEMENT, INC.

CHAPTER 1

Executive Summary

A. INTRODUCTION

The Arizona Benchmarking Study began in July 2005 with four participating agencies. They included the cities of Tucson and Phoenix and the counties of Maricopa and Pima. The Project Team had the goal of determining the cost of project delivery within their Agency and the development of a list of Best Management Practices (BMP) that would improve and reduce the cost of project delivery. In January 2006 Pinal County, Maricopa Community Colleges (MCC), and the City of Mesa joined the Study.

Similarly, the focus of the 2006 study was to determine what the participating agencies were spending to deliver public works projects and identify and implement Best Management Practices that improve project delivery performance and reduce project delivery costs.

The objectives for this year were to:

- Gather actual cost data on project delivery performance.
- Gather information on project delivery processes and procedures currently used.
- Identify and implement new Best Management Practices.
- Continue performance measurement and prepare to determine the impact of BMP implementation.
- Create a database tool 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.

Traditional Project Delivery - BMP Survey

Best Management Practices are procedures that may contribute to more efficient or more effective project delivery. As part of the 2006 update, the agencies were asked to confirm or target the implementation of 36 Best Management Practices in a survey conducted by the Study Team. The practices were developed by reviewing Construction Industry Institute and Project Management Institute reports, the 2005 California Multi-Agency Benchmarking Study and from discussions among the agency representatives. The results of the survey are included in Chapter 4, Table 4.1 (pages 44-46). Analysis of the survey results indicate that 14 of the 36 Best Management Practices appear to be common practices within the agencies (page 49). The other 22 Best Management Practices were considered for immediate or future implementation and each agency's plan for implementation is indicated in Table 4.1.

CM@Risk Projects - BMP Survey

A survey was also developed for the CM@Risk projects. The CM@Risk BMP survey was developed with the assistance from the City of Phoenix. They have used this alternative delivery method on over 140 projects and more than 60 different contractors. They also developed a number of procedures and processes for this delivery method, including: templates, flow charts, sample RFPs/RFQs and contracts.

The survey was sent to the four Agencies (City of Phoenix, Pima County, Maricopa Community Colleges, and the City of Tucson) that have completed

projects using the CM@Risk method. The preliminary results of this Survey are contained in Table 4.3 (pages 50-52).

Based on the agencies' comments received on the BMP survey items, a significant discussion on the CM@Risk project delivery was held on October 5, 2006 in the City of Phoenix. From the comments received during the meeting, the BMP CM@Risk Survey was revised and is included in Appendix A.

B. STUDY METHODOLOGY

During 2006, the Study Team wanted to improve the database by verifying the accuracy of the data. It collected additional project types and classifications, data on CM@Risk projects, and developed improved performance questionnaires to reduce errors in entering data. The following steps were utilized in conducting this year's study:

1. The traditional performance questionnaire was revised to make it more user-friendly for data entry by the Agencies and the Study Team. For traditional projects, a total of 274 projects that had a construction value of over $1.0 billion were evaluated.

   A total of five project types (Flood Control, Municipal Facilities, Parks, Pipes and Plants, and Streets) and 16 classifications were used in developing the regression graphs for the study. These graphs depict the design, construction management, and project delivery costs as a percentage of total construction cost.

2. For 2006, the Team performed an additional analysis on change orders issued on the projects. There is insufficient data to make any valid evaluation of this information at this time. Future data may improve the credibility of this database.

3. On CM@Risk projects, the study examined 24 projects, totaling $112 million in five project types and seven classifications. Based on this data, regression graphs were developed to compare the total project delivery percentage versus the total construction cost. An additional graph was developed depicting the "Total paid to Contractor versus the Guaranteed Maximum Price (GMP). The curve shows the growth percentage of the amount paid to the Contractor above the original agreed amount (GMP) for increasing project cost.

4. The next step was to review how the Agencies implemented the Study's recommendations for Best Management Practices. For this year's study, seven more Best Management Practices were added to the survey and the Agencies were asked to target specific practices for implementation in 2006.

5. The results were reviewed with Agencies in various meetings throughout the study period.

C. PROCESS BENCHMARKING

It is the goal of this continuing study to develop hard data that documents the impact of an Agency's implementation of Best Management Practices on its project delivery process.

This year all Agencies were asked to respond to the revised BMP survey and target or specify which BMP would be beneficial for implementation in the coming year, and would result in an improved project delivery process for their agency.

The implementation of the BMP and the targeted practices were tracked and project delivery performance data was collected. It is anticipated that the performance data will eventually demonstrate that as Best Management Practices are implemented, project delivery costs will be reduced.

For 2006, a CM@Risk survey was developed in conjunction with the City of Phoenix and the other participating Agencies. Due to its extensive experi-

ence with this delivery process, the City of Phoenix provided valuable input in the development of the CM@Risk BMP survey. After the first CM@Risk survey was developed, the survey was further refined in discussion with the participating Agencies. The revised survey is included in Appendix A.

This year, some of the agencies started to make organizational and procedural changes based on the recommended Best Management Practices. In addition, each participant was asked to target certain practices for implementation in 2006 that would further improve their project delivery performance.

For example:

- Pima County implemented certain practices to clearly define the project scope early in the planning and design stage and will also conduct post project reviews.
- Maricopa County Department of Transportation is making changes that will allow the department to improve its efficiency in project delivery by changing its process and increasing its training for project managers.
- The City of Phoenix's Water Services Department has implemented certain Best Management Practices that will enhance the department's early planning and design phases. The management practices include performing feasibility studies to define scope and budget, and requiring the specifications for reliability, maintenance, and operations be defined prior to design initiation.

Common Best Management Practices

Reviewing the survey results for 2006 indicates there are 14 Best Management Practices that most of the participating agencies rated as partially implemented or fully implemented (at least a four or a five rating). However, there were no clear preferences that the agencies felt were commonly accepted BMP that all were following (Table 4.2, page 49).

D. PERFORMANCE BENCHMARKING

Performance Benchmarking consists of collecting documented costs of projects and comparing project delivery costs with total construction costs. During the 2006 Study, data was gathered for both Traditional and CM@Risk projects.

Part of the effort for this year included revising the performance questionnaires to reduce errors in collecting data and facilitating data entry into the database. For Traditional Design-Bid-Build projects, the performance questionnaires allowed an Agency to provide its labor cost as "actual" or "projected." The performance questionnaires were revised in this manner to account for the fact that some Agencies could not provide actual costs for its internal agency labor expenses. (One Agency, used accounting methods based on formula allocations for certain project delivery costs. Time cards tracking and allocating employee time/costs to project accounts were not available.)

1. The following is the Study Team's analysis of the 2006 Traditional project data:
   - The percentage of design costs decreased with the increasing size of projects. The design costs averaged 17.6% of the total construction cost of 274 representative projects that were completed after 1999. Each had a total construction cost greater than $100,000.
   - The construction management averaged 14.2% of the total construction cost of the 274 representative projects.
   - Based on the performance data, the total project delivery cost (total design cost and construction management cost) of the 274 projects averaged 31.8% of the total construction cost.
2. Analysis of the CM@Risk projects found that the data at this time is insufficient to make a credible determination of these projects. The CM@Risk performance questionnaire was de-

veloped in a similar manner to the Traditional performance questionnaire.

E. CONCLUSION AND RECOMMENDATIONS

1. Additional data collection is warranted. Where additional data was provided, some of the statistical correlations improved significantly. In future benchmarking studies, more data should improve the correlation coefficients and make performance models more effective for prediction. This is especially true of the CM@Risk projects. More data will improve the credibility of the database.

2. Implementing the recommended Best Management Practices is essential if the agencies want to improve their project delivery performance. The team will monitor the Agencies' progress to implement these practices and compare performance results to study the actual effectiveness of such practices.

3. The Online Forum should be used more to facilitate communication, promote the free exchange of ideas, and establish a collaborative atmosphere with the other team members.

Chapter 2
INTRODUCTION & METHODOLOGY

CHAPTER 2 Introduction and Methodology

A. STUDY BACKGROUND

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

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

CM@Risk, Design/Build and Job Order Contracting (JOC) have been extensively used in the Arizona since 2001, when a change was made in Arizona laws that allowed the use of these methods. There is a strong interest among the Arizona participants to identify the costs and benefits of the CM@Risk delivery process. More agencies find these delivery methods as a useful alternative instead of dealing with the issues of the Traditional delivery process. It is the goal of this year's study to start and build a database in order to accurately assess the benefits of this process.

During the past nine months, the Project Team concentrated on:

1. Reviewing and evaluating the Agency's implementation of the 36 Best Management Practices included in the 2006 survey.
2. Collecting and evaluating data provided on the projects delivered using the Traditional method and submitted by the agencies in 2006. During this period the total number of projects in creased to 274 projects (from the 224 projects were submitted in 2005).
3. Collecting and evaluating the data on 24 CM@Risk projects submitted by the agencies for 2006.

B. STUDY OBJECTIVES

The study's objectives were to increase the number and data of projects delivered by the Traditional method and for projects delivered under the CM@Risk methodology. The Agencies were also challenged to identify certain Best Management Practices for implementation in 2006 and internally track the implementation of the targeted practices.

To increase the statistical credibility and accuracy of the 2006 database, the study team:

1. Collected additional data to increase the number of projects included in the database, especially where less than eight projects were included in a classification.
2. Collected data on additional project types and classifications.
3. Began the process of linking the implementation of Best Management Practices to Agency performance.

4. Verified that project data was accurately entered into the database.

5. Improved Performance Questionnaires for Traditional projects that would facilitate the entering of the data.

6. Developed a Performance Questionnaire for CM@Risk projects that would provide credible information for this delivery process.

7. Modified the database so that the regression curves could be developed for both the Traditional and CM@Risk projects.

8. Facilitated the Online Forum so that the team would be able to use it effectively and the information would be organized and archived for retrieval.

C. PARTICIPANTS

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

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

D. REPORT STRUCTURE

This report is organized as follows:

1. Chapter 2 provides a short discussion on the project history, objectives, and identifies the participant agencies.

2. Chapter 3 provides a profile of each participating Agency including information related to geographical area, population, and its form of government. It also includes organizational structures, overhead rates, and a narrative by the Agencies on the benefits of participating in the study.

3. Chapter 4 describes process benchmarking and the implementation of Best Management Practices for improving project delivery performance.

4. Chapter 5 describes performance benchmarking and discusses the graphs generated from the project database for comparing project delivery costs with total construction costs.

5. Chapter 6 discusses the Online Forum and its use and method of archiving and retrieving of information.

6. Chapter 7 contains the conclusion and recommendations based on the results of this year's study.

Chapter 3
PARTICIPATING AGENCIES

CHAPTER 3

Participating Agencies

A. INTRODUCTION

This section profiles the seven agencies participating in the Arizona Benchmarking Study.

1. In Section B, the participating agencies are profiled. This summary includes a description of each agency's geographical area, population, website, government structure, work process, project management approach, and Capital Improvement Program (CIP) for Fiscal Year (FY) 2005 – 2006 through Fiscal Year (FY) 2007 - 2008.

2. In Section C, the similarities and differences of the agencies are described.

3. Section D includes, a table on the overall information from the agencies, including the number of personnel devoted to project management and the total value of CIP projects awarded for Fiscal Years (FY) 2005 to 2008.

4. In Section E, the agencies' organization charts are provided. These charts show the policy makers for the organizations and the personnel charged with carrying out the policy.

5. In Section F, the agencies' overhead rates are shown. These rates are shown in a series of tables indicating what the particular agency considers Fringe Benefits, Compensated Time-Off, City Overhead, Department Overhead, Agency Overhead, and the Indirect Rate Factor.

6. In Section G, the agencies provide a narrative on the benefits of participating in the Benchmarking Study.

In total, the seven participating agencies are expected to award nearly $5 billion in public works CIP contracts within the next three years.

B. PARTICIPATING AGENCIES

This section provides a profile of the participating agencies. This summary includes a description of each agency's geographical area, population, website, government structure, work process, project management approach, and Capital Improvement Program for FY 2005 – 2006 through FY 2007 – 2008.

For Pima County, Pinal County, and Maricopa Community Colleges, only the CIP information for FY 2006 – 2007 was provided.

PIMA COUNTY

POPULATION:	957,600
AREA:	9,186 square miles
WEBSITE ADDRESS:	http://www.co.pima.az.us/
FORM OF GOVERNMENT:	Board of Supervisors

Pima County, Arizona is governed by a five member Board of Supervisors. The supervisors are elected by the people every four years. Pima County came into existence at the time Arizona was granted statehood in 1912. At that time, Pima County had a total population of 23,000 citizens.

COUNTY ADMINISTRATION-PUBLIC WORKS

County Administration is overall responsible for the CIP. The County CIP unit oversees the program and provides centralized data management and program analysis as well as a central project delivery for the largest CIP projects. Departments are responsible for delivering the CIP projects assigned to their department. Both the departments and the CIP unit report to the Deputy County Administrator – Public Works.

CONSTRUCTION CONTRACTS/CAPITAL IMPROVEMENT PROGRAM

Construction contracts to be awarded for Fiscal Year 2006-07

Program	Total Projects	Total Construction Cost (millions)
Facilities	20	$23.9
Transportation	13	$36.4
Flood Control	21	$30.6
Parks	19	$12.1
Historic Preservation	9	$ 3.6
Neighborhood Conservation	10	$ 3.7
Wastewater Management	21	$88.1
Total	113	$198.4

CITY OF TUCSON

POPULATION:	538,000
AREA:	227 square miles
WEBSITE ADDRESS:	http://www.tucsonaz.gov
FORM OF GOVERNMENT:	Mayor and Council

Tucson, Arizona is governed by the Mayor and six Council members who are elected at-large to represent each of six Wards.

ADMINISTRATION - CAPITAL IMPROVEMENT PROGRAM

Delivering the City's capital improvement projects is the responsibility of various departments, including Water, Transportation, General Services, Parks and Recreation, Community Services, and Rio Nuevo Office (serving the Rio Nuevo District). The Department of Procurement provides a centralized contracting function for design and construction services to all City departments.

CONSTRUCTION CONTRACTS/CAPITAL IMPROVEMENT PROGRAM

Construction contracts to be awarded for Fiscal Year 2006-07

Program	Total Projects	Total Construction Cost (millions)
Facilities	4	$18.5
Transportation	23	$33.7
Water	19	$60.3
Parks	10	$19.0
Total	57	$131.5

MARICOPA COMMUNITY COLLEGES

POPULATION:	Serving all of Maricopa County - 2005 estimate of just over 3.6 million. Current enrollment is just under 70,000. Full-Time-Student-Equivalent (FTSE) - about 255,000 head count.
AREA:	9,226 square miles
WEBSITE ADDRESS:	www.maricopa.edu (general district) www.maricopa.edu/facilitiesplanning (Facilities Planning and Development)
FORM OF GOVERNMENT:	Five elected individuals from geographical districts which are the same as the County Supervisors

Community College Districts are a political subdivision of the State of Arizona, organized on a county basis.

The Governing Board of the Maricopa County Community College District is made up of five individuals, elected from geographical districts which are the same as the County Supervisors. These individuals are elected in staggered years up to six-year terms. The Chancellor, Dr. Rufus Glasper, reports to the Board; four Vice Chancellors and ten college presidents report to Dr. Glasper.

FACILITIES PLANNING AND DEVELOPMENT-CAPITAL PROJECT DELIVERY

Facilities Planning and Development serves as a district-wide resource for capital planning, development and facilities maintenance in support of Maricopa's education and training mission. The department works on project planning with colleges and users, and then provides project management and delivery responsibilities on behalf of the colleges for large capital improvement, remodeling, site and utilities development, and major maintenance/repairs.

The department also provides the following expertise and support for the colleges and District:

- Campus master planning and capital programs
- Selection and management of architects, engineers, contractors, and other consultants
- Construction permits and other community regulatory processes related to facilities and sites
- Property purchases and other issues related to growth or expansion of facilities.
- Liaison to local and state government agencies, and public utilities related to facilities
- Project costs, funding and overall budgets
- Facilities infrastructure and systems maintenance
- District's energy and water conservation programs
- Energy management and life safety systems
- Optimum utilization, operation and efficiency of central plants and utilities systems

The department is led by the Director and Assistant Director. The balance of the group consists of three architectural project managers; four facility project managers (specializing in energy management and life safety systems, central plant optimization and small project management), and four support/accounting staff. Until last month, the department also managed the Maintenance and Operations for the main District office building and warehouse.

PROJECT MANAGEMENT/DELIVERY

The department uses a project management delivery system in which the projects are assigned to a project manager who is responsible for the total budget, schedule and delivery of the project. The college/users generally develop the Education Specification (program of needs and requirements) on their own with some assistance from the project manager. Once the Education Specification is ready to present to the Governing Board for project approval, the project manager assumes full responsibility for the balance of the project development, selection of consultants and contractors, management of the design/pricing/construction and close-out of the project, including resolving claims as necessary.

Typically, project managers handle projects assigned by college (ten colleges and numerous other sites), but the department also will assign based upon specialized knowledge/expertise of the project manager (science labs, libraries, student services, strict acoustic performance, etc.) regardless of the college location. Last, the district also balances project assignments by evening workloads among all project managers, regardless of project type or location.

CONSTRUCTION CONTRACTS/CAPITAL IMPROVEMENT PROGRAM

The department is currently managing the District's ten-year, $951 million capital program (about $165 million is in technology and occupational equipment, with the balance in construction, remodeling, maintenance work, new property purchases, and facilities upgrades). This program is intended to produce 1.6 million square feet of new construction and 600,000 square feet of remodeling, along with multiple new locations over the bond period.

Program	Total Projects	Total Construction Cost (millions)
Streets-New	3	$ 3.0
Municipal Facilities	11	$66.0
Total	14	$69.0

PINAL COUNTY

POPULATION:	267,142
AREA:	5,386 square miles
WEBSITE ADDRESS:	http://www.co.pinal.az.us
FORM OF GOVERNMENT:	County Board Supervisors

There are currently three Board Members who represent the three individual districts that make up the County. They are elected for a four-year term and include among others, the Treasurer, Assessor, Recorder, Clerk of the Courts, Sheriff, Judges, and Justices of the Peace.

DEPARTMENT OF PUBLIC WORKS-PROJECT DELIVERY

Project delivery is separated into four areas: Districts I, II, III (representing the Supervisors' Districts) and a Special Projects Group that handles issues such as vertical construction. Each District has a Project Engineer who oversees capital projects in that District. The Division is managed by the Deputy County Engineer who reports to the Director of Public Works.

PROJECT MANAGEMENT/DELIVERY

The department uses a project management delivery system in which the projects are assigned to the respective District Project Engineer who is responsible for the budget and schedule.

CONSTRUCTION CONTRACTS/CAPITAL IMPROVEMENT PROGRAM

Construction contracts to be awarded for Fiscal Year 2006-07

Program	Total Projects	Total Construction Cost (millions)
Streets/Roads/Highways	7	$374.0
Total	7	$374.0

CITY OF PHOENIX

POPULATION:	1,475,834
AREA:	516 square miles
WEBSITE ADDRESS:	http://www.phoenix.gov
FORM OF GOVERNMENT:	Mayor/City Manager

The City has a Mayor/City Manager form of government as provided by Charter effective 1913. The current city code became effective June 21, 2006. The Mayor is elected at-large every four years. The City is divided into eight Council Districts, and council members are elected every four years by voters within each geographical district. Council elections are staggered so that odd numbered districts (1, 3, 5, and 7) will be up for election in 2007. The next election for odd numbered districts will be in 2009.

ENGINEERING AND ARCHITECTURAL SERVICES DEPARTMENT (EAS)

The EAS Department is responsible for procuring all architects, engineers, and contractors to execute the City's capital construction projects. After award of contracts, project management responsibilities remain with EAS for vertical or building projects. Contracts for infrastructure type projects in support of Street Transportation, Water Services, and Aviation departments are handed off to those departments for project management. Within the EAS Department there is a Contracts Section that manages public works procurement and a Project Management Division that manages projects. The Streets, Water, and Aviation departments also have their own project management group.

PROJECT MANAGEMENT/DELIVERY

The City uses a project management delivery system in which the projects are assigned to a project manager who is responsible for the budget and schedule for design and construction.

An EAS project manager is assigned to every project that remains with EAS for project management services. The EAS project manager will manage the project from "cradle to grave" or from design through construction and close-out of warranty work. The client department or end user will also assign a project manager to the project who will manage the overall budget (to include FF&E, additional staffing, support vehicles, etc.) as well as other end user needs and coordination with stakeholders, if any.

Projects that are handed off to Street Transportation and Aviation use a similar cradle to grave project management process. In the Water Services Department, there is a hand off of the project between respective project managers for design and construction.

CONSTRUCTION CONTRACTS/CAPITAL IMPROVEMENT PROGRAM

CIP summary for 2006 through 2011:

2006-2011 CAPITAL IMPROVEMENT PROGRAM

SCHEDULE 1
SUMMARY OF 2006-11 CAPITAL IMPROVEMENT PROGRAM
By Program
(In Thousands)

Program	2006-07	2007-08	2008-09	2009-10	2010-11	Total
Arts and Cultural Facilities	$ 16,386	$ 17,471	$ 10,327	$ 28	$ 238	$ 44,450
Aviation	581,048	52,435	7,165	1,236	-	641,884
Economic Development	105,487	61,100	50,640	11,730	8,912	237,869
Energy Conservation	1,500	1,250	1,250	1,388	1,450	6,838
Facilities Management	15,832	8,895	11,449	7,852	10,004	54,032
Fire Protection	27,128	12,500	14,800	20,103	19,197	93,728
Freeway Mitigation	4,220	914	-	-	-	5,134
Historic Preservation	4,272	2,603	3,085	1,730	3,055	14,745
HOPE	8,284	1,200	1,178	3,329	850	14,841
Housing	14,936	8,925	8,281	11,909	12,330	56,381
Human Services	17,135	3,900	5,400	6,000	5,900	38,335
Information Technology	18,024	2,184	8,283	9,135	6,233	43,859
Libraries	21,301	9,885	5,267	3,487	8,931	48,871
Neighborhood Services	8,681	6,500	7,850	7,850	8,120	39,001
Parks, Recreation and Mountain Preserves	182,480	61,654	43,424	36,609	20,145	344,312
Phoenix Convention Center	48,336	3,100	9,508	12,067	8,894	81,905
Police Protection	23,397	-	26,487	44,120	18,619	112,623
Public Transit	338,033	192,796	79,224	103,720	111,034	824,807
Solid Waste Disposal	44,802	21,980	4,777	4,500	4,853	80,912
Storm Sewers	49,373	16,435	16,234	17,505	22,738	122,285
Streets - Major Streets	93,050	52,076	63,733	44,665	56,666	310,190
Streets - Other Streets	36,314	23,804	36,801	42,497	34,531	173,947
Streets - Traffic Improvements	17,119	8,440	15,286	19,921	14,531	75,297
Wastewater	393,653	321,295	132,270	124,130	51,488	1,022,836
Water	255,873	293,343	265,787	211,245	110,542	1,136,790
Total CIP	**$ 2,326,664**	**$ 1,184,685**	**$ 828,506**	**$ 746,756**	**$ 539,261**	**$ 5,625,872**

MARICOPA COUNTY

POPULATION:	3,635,528
AREA:	9,226 square miles
WEBSITE ADDRESS:	http://www.maricopa.gov
FORM OF GOVERNMENT:	Board of Supervisors

County government in Arizona is an arm of the state government. Its authority is provided by both the state constitution and the state legislature. The Maricopa County Board of Supervisors is the governing body for the county. Each member represents one of the five supervisorial districts, which are divided geographically and by population to include a mix of urban and rural constituencies. The five districts meet in the center of Phoenix. Members are elected to four-year terms and may serve an unlimited number of terms. Board members elect a new chairman at their first meeting each year. The chairman conducts all formal and informal meetings, which are held every other week and are open to the public.

The Flood Control District, founded in 1959, is a separate municipal corporation and political subdivision of the State of Arizona. The District is governed by a Board of Directors, made up of the County Board of Supervisors, with advice of a Citizens' Flood Control Advisory Board.

CAPITAL PROJECT DELIVERY

Capital project delivery is dispersed within the county with each department and the district responsible for delivery of their capital projects.

The newly formed Public Works Organization integrates many common responsibilities previously assumed by the Maricopa County Department of Transportation, Flood Control District of Maricopa County and Solid Waste Management. The consolidation of these agencies enables the three departments to share resources and responsibilities.

The Department of Transportation has recently added a new Project Management and Construction (PM&C) Division, which has the responsibility for the design and con-

struction of transportation improvement projects and will lead the projects through their many phases, from concept to completion. Its Division Manager reports through the Department Director to the Public Works Director.

The Flood Control District's Planning and Project Management Division is responsible for its capital projects.

PROJECT MANAGEMENT/DELIVERY

Common to all departments is the use of a project manager who is responsible for project completion. Each project manager is responsible for monitoring the project scope, schedule and budget. The exact duties vary by department and type of project but can include management of: the preliminary engineering project scoping, the design effort, securing partnership funding, right-of-way acquisition, utility relocation, environmental clearance and permits, public involvement, and construction.

CONSTRUCTION CONTRACTS/CAPITAL IMPROVEMENT PROGRAM

Construction contracts to be awarded for Fiscal Year 2005-06 through Fiscal Year 2007-08.

Program	Total Projects	Total Construction Cost (millions)
Flood Control	14	$118.5
Parks	22	$ 5.4
Transportation	57	$141.1
Total	93	$265.1

C. PROJECT MANAGEMENT

This section of the report looks at how the different Agencies are organized and what type of project delivery structure they have to manage their projects.

The consensus is that all Agencies see the value of providing personnel experienced in project management, whether this means utilizing in-house personnel or contracting with outside consultants to manage their CIP work. However, there is no common structure that the Agencies use to manage their work. Some agencies, like the City of Phoenix (because of its large capital program) have various departments for managing their programs. The City also has several very defined procedures in place and has developed templates for issuing requests for proposals for Architects, Engineers and Contractors. It has standard contracts for both traditional and CM@Risk projects. The City also has flow charts that depict the various steps required to bring a project from the conceptual/planning stages and the internal approval process, to the advertising, bidding and award, and selection of the Architect, Engineer or Contractor.

The City of Tucson has no centralized Public Works agency that has overall program management responsibility of its projects. Each of the four departments, Water, DOT, GSD, and Parks, has responsibility and control over its projects. The only umbrella organization over all of the departments is Procurement. All projects are advertised and bid and awarded through the Procurement Department.

For Pima County, the County Administration has overall responsibility for the CIP. The County CIP unit oversees the program and provides centralized data management and program analysis as well as a central project delivery for the largest CIP projects. Departments are responsible for delivering the CIP projects assigned to their department. Both the departments and the CIP Unit report to the Deputy County Administrator of Public Works.

Maricopa Community Colleges Facilities Department consists of a Director and Assistant Director, three Architectural Project Managers, four Facility Project Managers, and four support/accounting staff. Because of the small size of staff, projects are assigned to a project manager who is responsible for project development, selection of consultants and contractors, management of the design/pricing/construction and close-out the project, including resolving claims as necessary.

Maricopa County has recently reorganized and its Public Works Organization integrates many common responsibilities previously assumed by the Maricopa County Department of Transportation, Flood Control District of Maricopa County, and Solid Waste Management. The consolidation of these agencies enables the three departments to share resources and responsibilities. The Department of Transportation has recently added a new Project Management and Construction (PM&C) Division, which has the responsibility for the design and construction of transportation improvement projects.

D. OVERALL INFORMATION FROM AGENCIES

Table 3.1 summarizes the project delivery personnel available for each agency and the total CIP value of projects to be awarded in FY 2005 to FY 2008.

Table 3.1

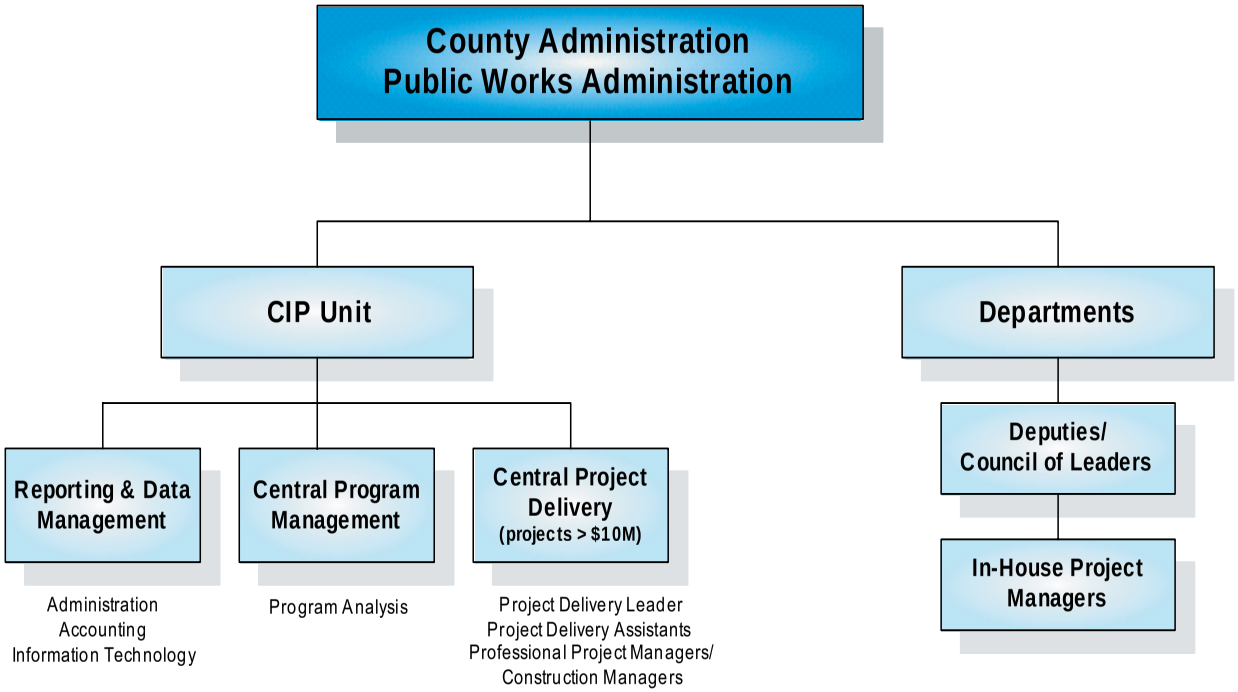
Agency	Population	Area (sq.mi.)	Website	Government Form	FY 05-06 to FY 07-08	
					Size of project delivery staff[1]	Total value of projects awarded annually (average)
Pima County Public Works Facilities DOT Parks FCD WMD	957,600	9,186	http://www.co.pima.az.us	Board of Supervisors	30 PMs and Engineers	$198 millon[3]
Pinal County	267,142	5,386	http://www.co.pinal.az.us	Board of Supervisors	5 Engineers	$374 million[3]
Maricopa County DOT Parks FCD	3,635,528[2]	9,226	http://www.maricopa.gov	Board of Supervisors	DOT: 5-14 PMs FCD: 10 PMs Parks: 4 PMs & one Eng. Mgr.	$265 million
Maricopa Community Colleges	3,635,528	9,226	http://www.maricopa.edu	Governing Board	3 Arch. PMs and 4 Facility PMs	$69 million[3]
City of Phoenix EAS Water Services Streets	1,475,834	516	http://www.phoenix.gov	Mayor-Council	GSD - 14 PMs DOT - 39 PMs PKS - 7 PMs Water - 49 PMs	$3.5 billion
City of Tucson GSA DOT Water Parks	538,000	227	http://www.tucsonaz.gov	Mayor-Council	30 PMs - EAS 30 PMs - Streets 50 PMs - Water	$132 million
City of Mesa	451,860	324	http://www.cityofmesa.org	Mayor-Council-Manager	No information provided	No information provided

Notes:
[1] Number of staff involved in project delivery
[2] Includes incorporated and unincorporated
[3]CIP project cost for FY2006-2007 only

E. AGENCY ORGANIZATION CHARTS

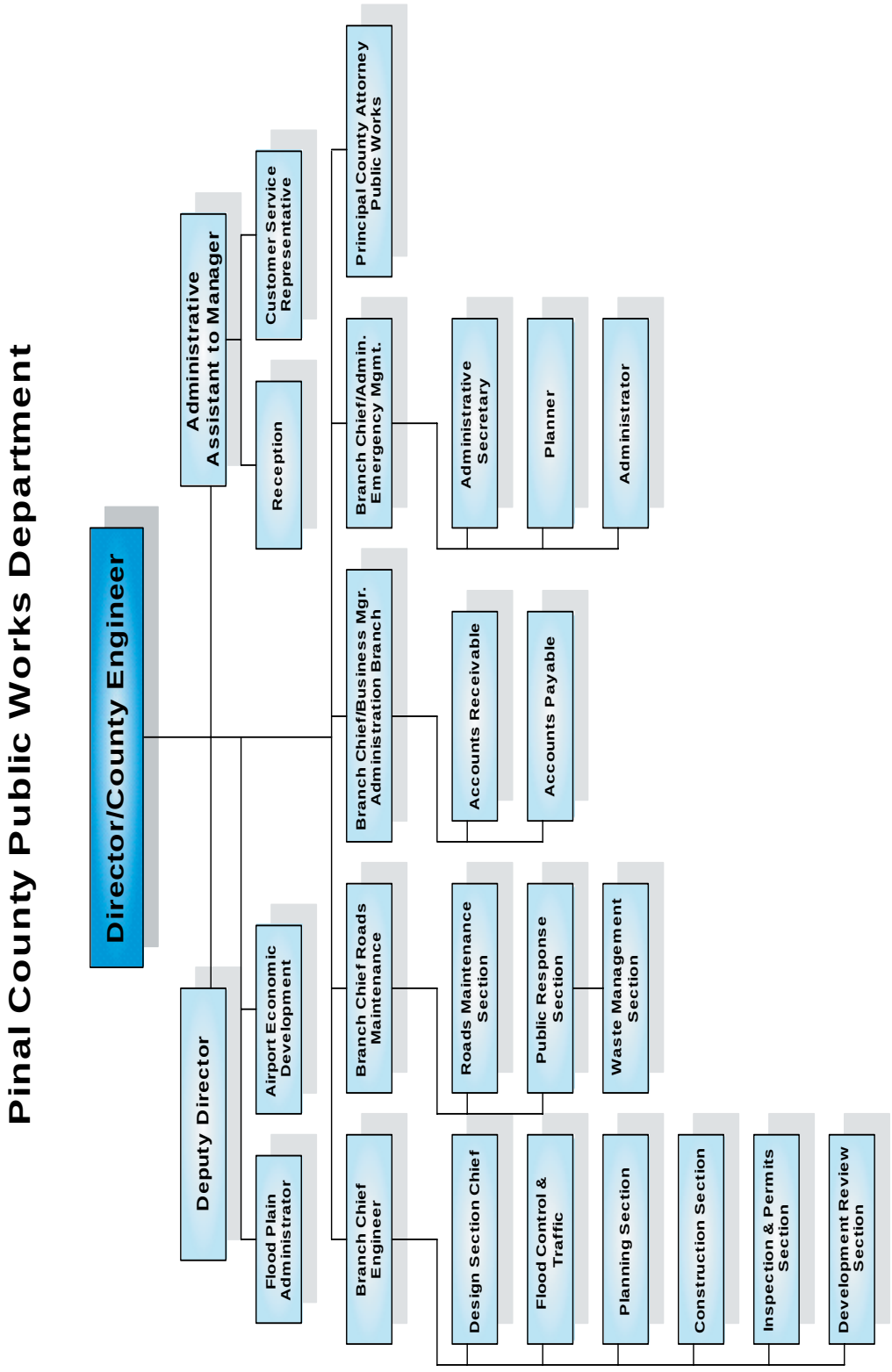
In this section, each agency's organizational structure is shown. These organizational charts show the personnel charged with developing Agency policies and the personnel responsible with carrying out the policy.

Pima County Capital Project Delivery

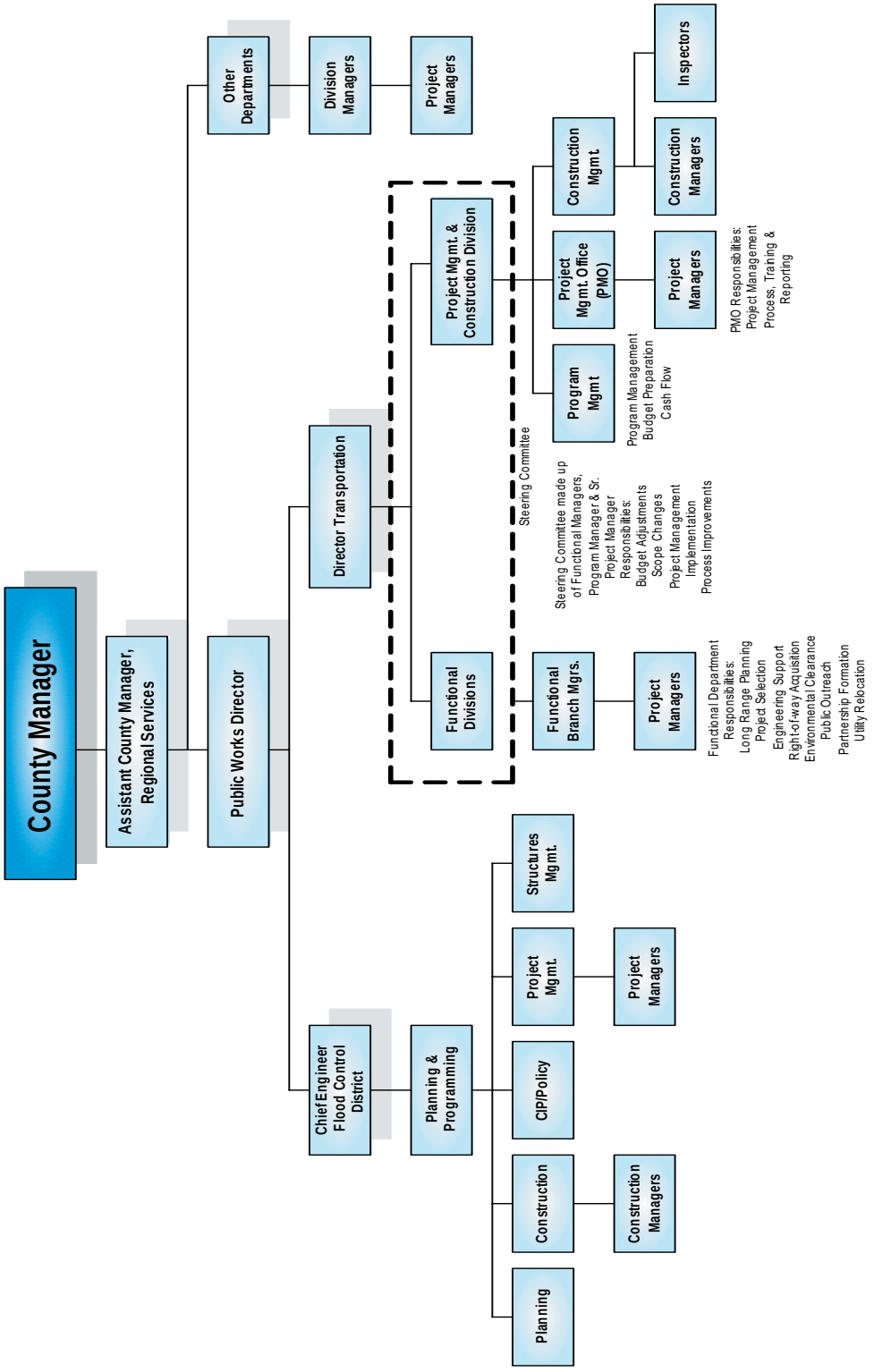


Departments:

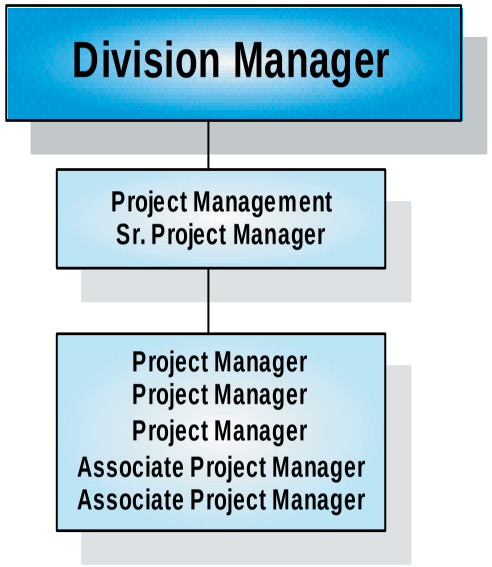
Facilities Management
Transportation
Regional Flood Control
Natural Resources, Parks & Recreation
Cultural Resources/Historic Preservation
Community Development
Wastewater Management
Environmental Quality/Solid Waste Management


Pinal County Public Works Department
Director/County Engineer
Deputy Director
Flood Plain Administrator
Airport Economic Development
Branch Chief Engineer
Design Section Chief
Flood Control & Traffic
Planning Section
Construction Section
Inspection & Permits Section
Development Review Section
Branch Chief Roads Maintenance
Roads Maintenance Section
Public Response Section
Waste Management Section
Branch Chief/Business Mgr. Administration Branch
Accounts Receivable
Accounts Payable
Administrative Assistant to Manager
Reception
Customer Service Representative
Branch Chief/Admin. Emergency Mgmt.
Administrative Secretary
Planner
Administrator
Principal County Attorney Public Works

Maricopa County Public Works Agency Project Delivery

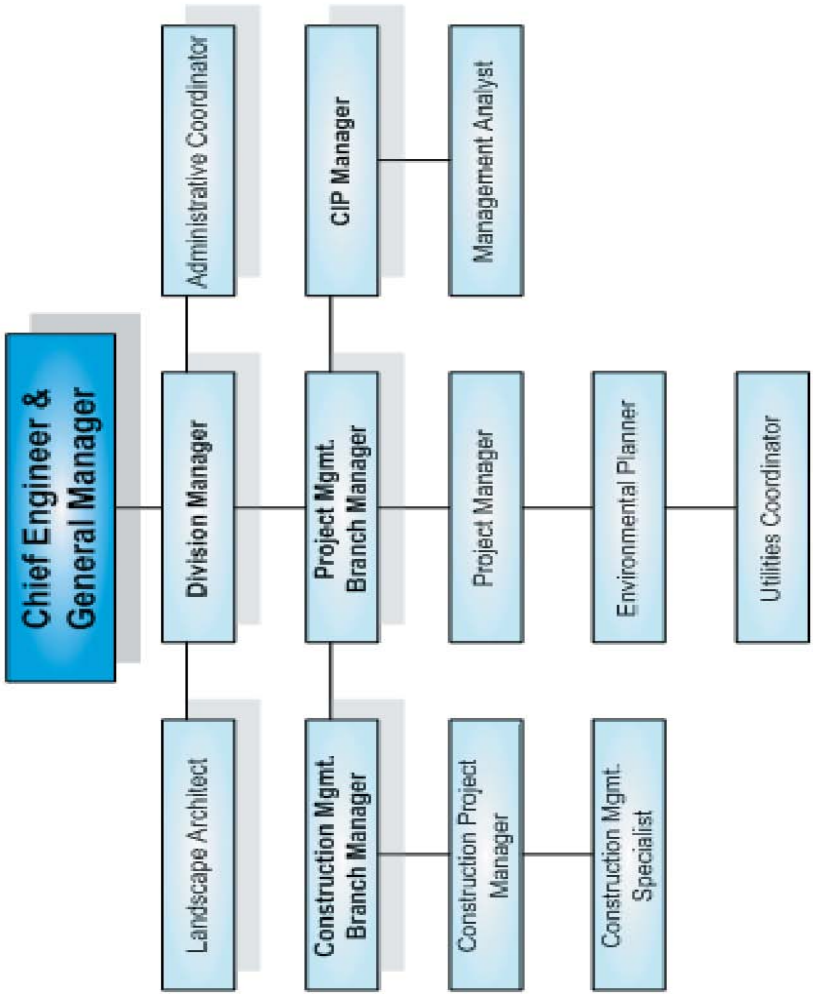


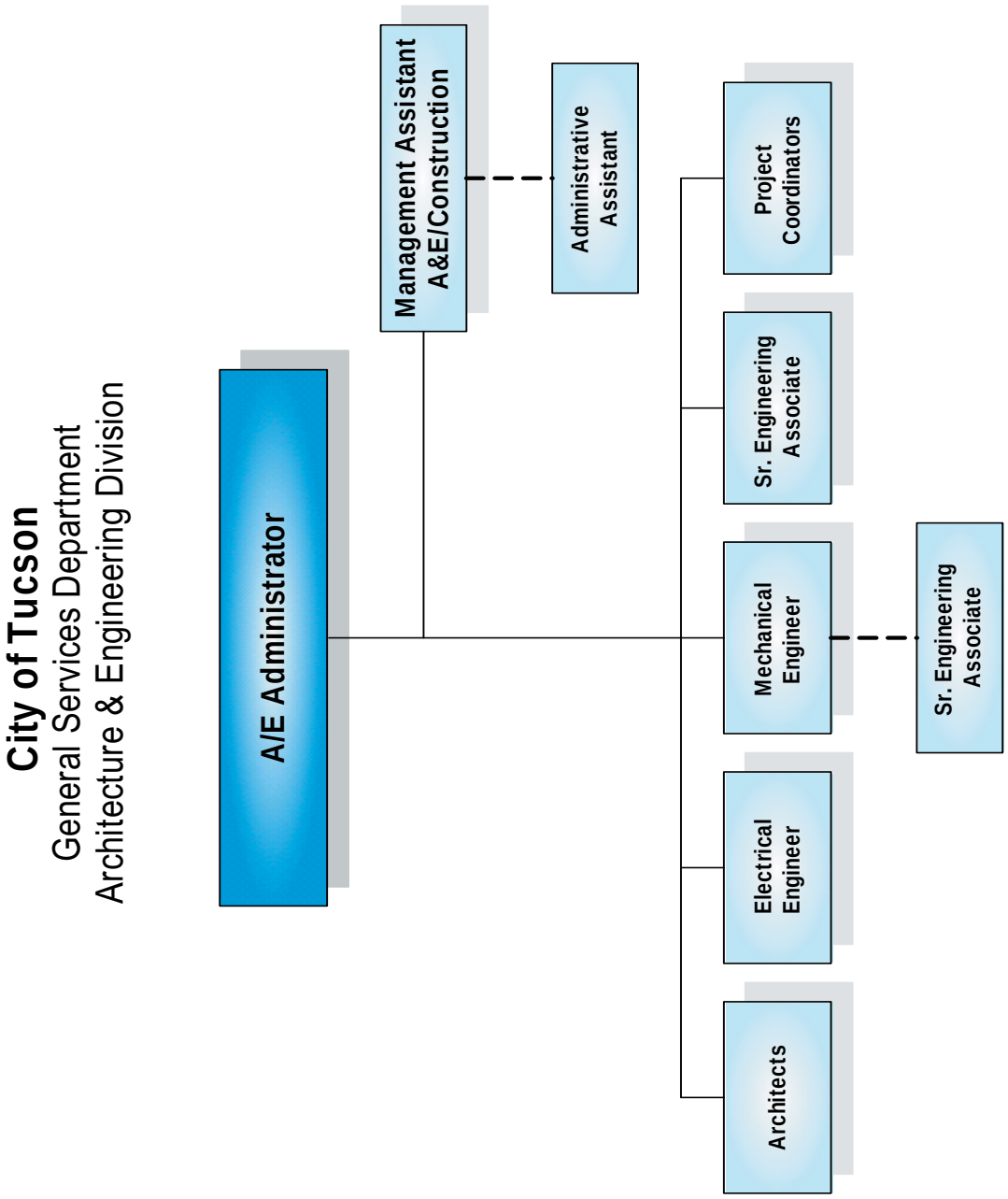
Maricopa County Department of Transportation

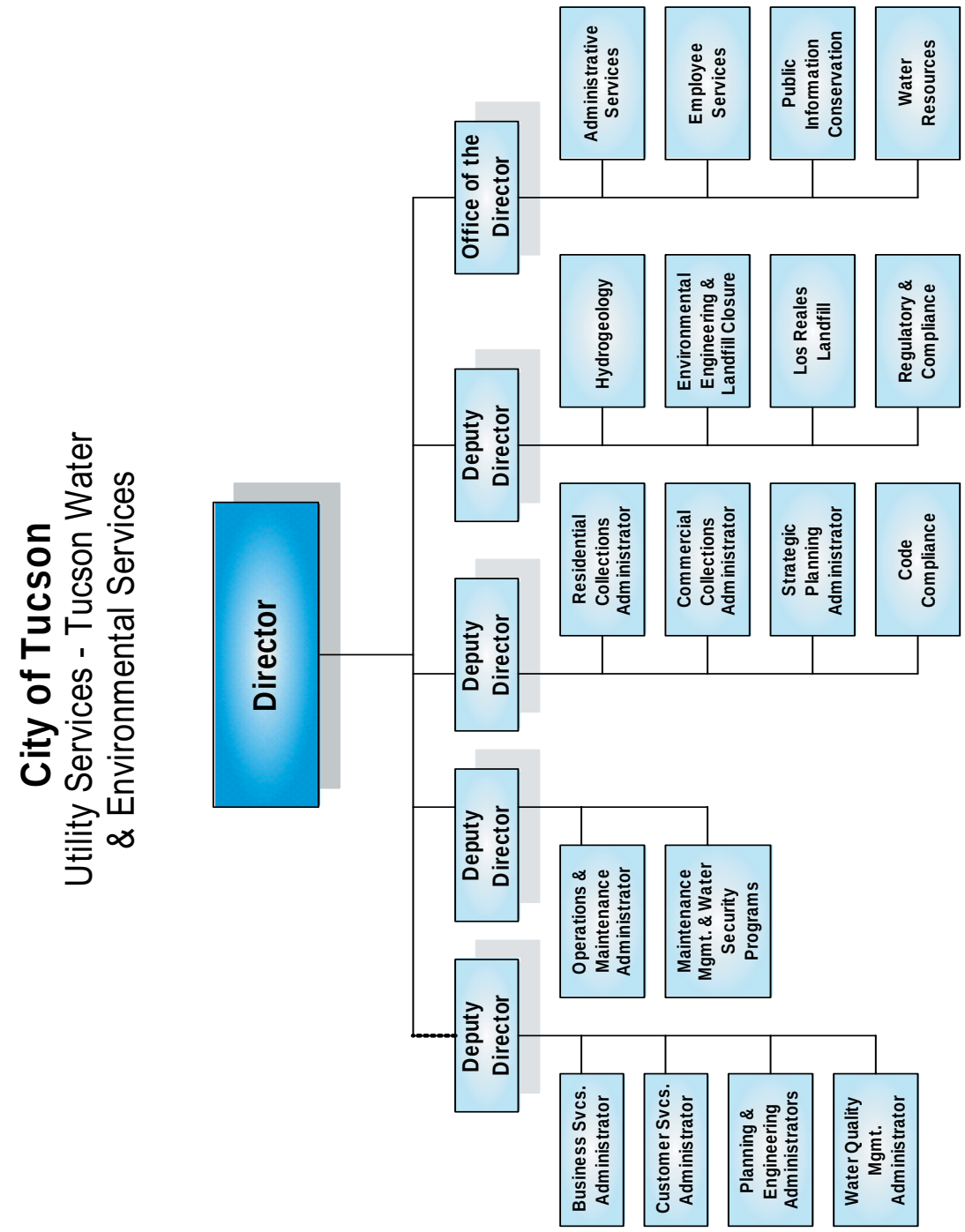


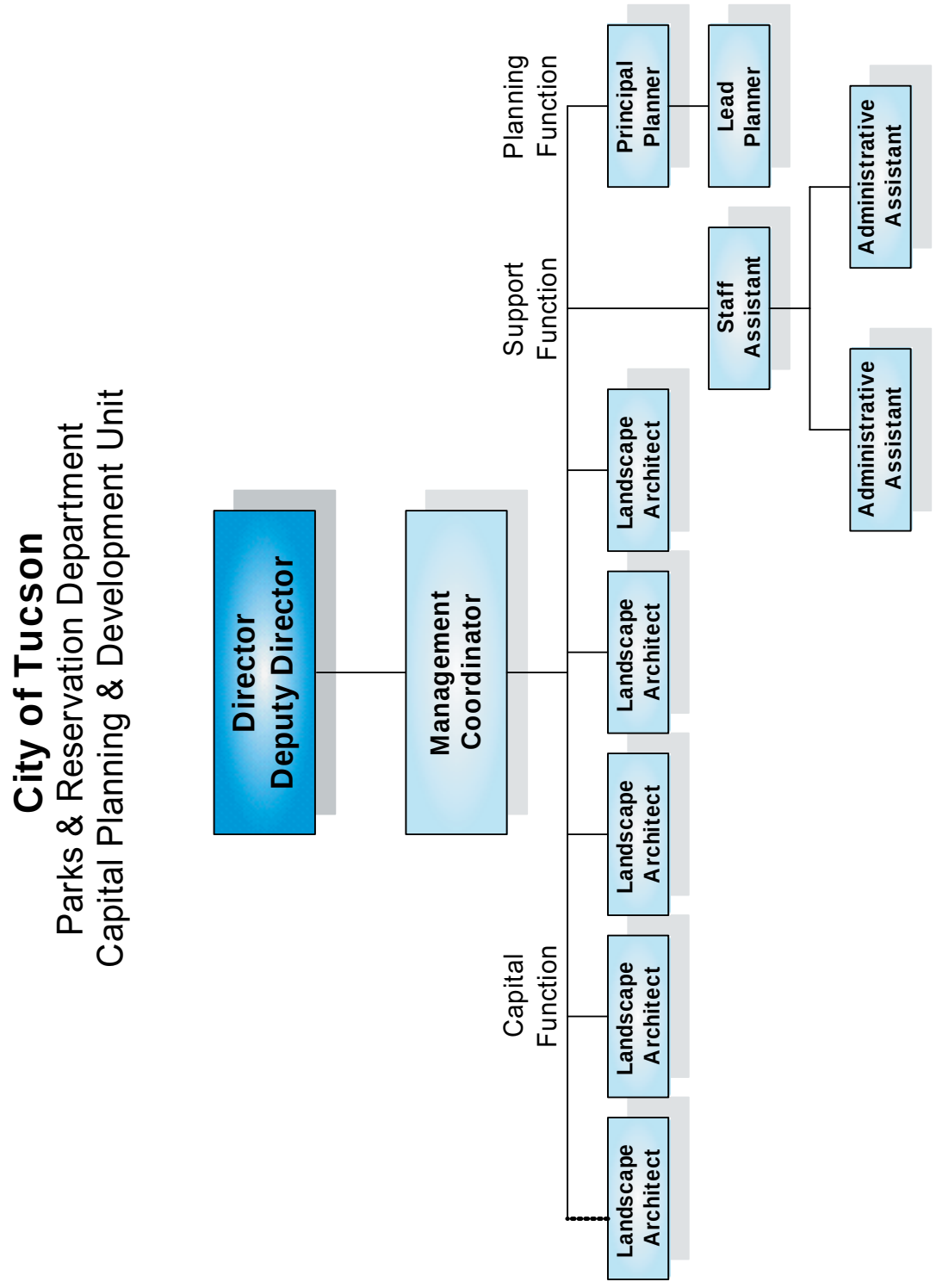
Note: There are eight additional Project Managers in the Department in various divisions.

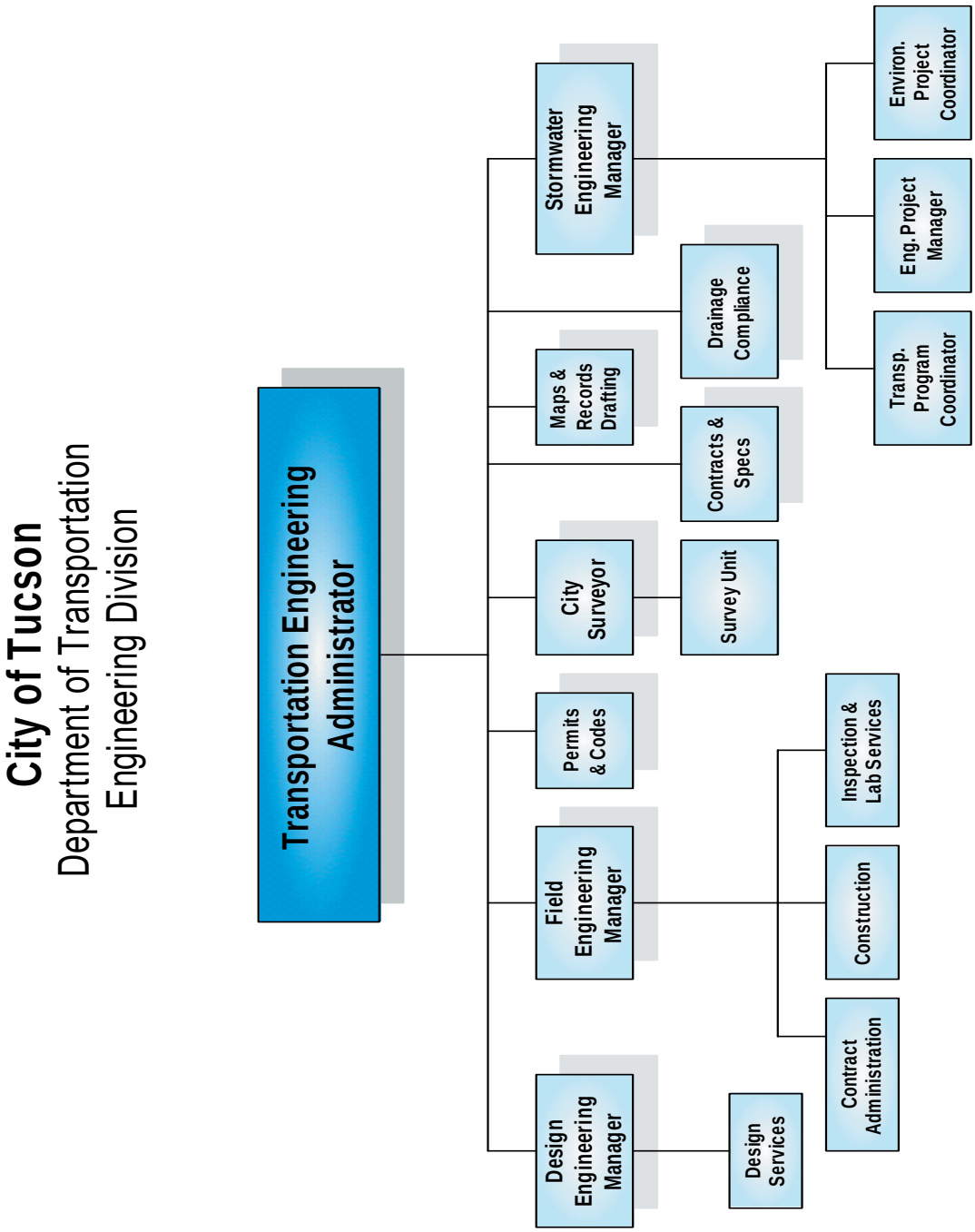
Flood Control District of Maricopa County
CIP Project Management Organization Chart



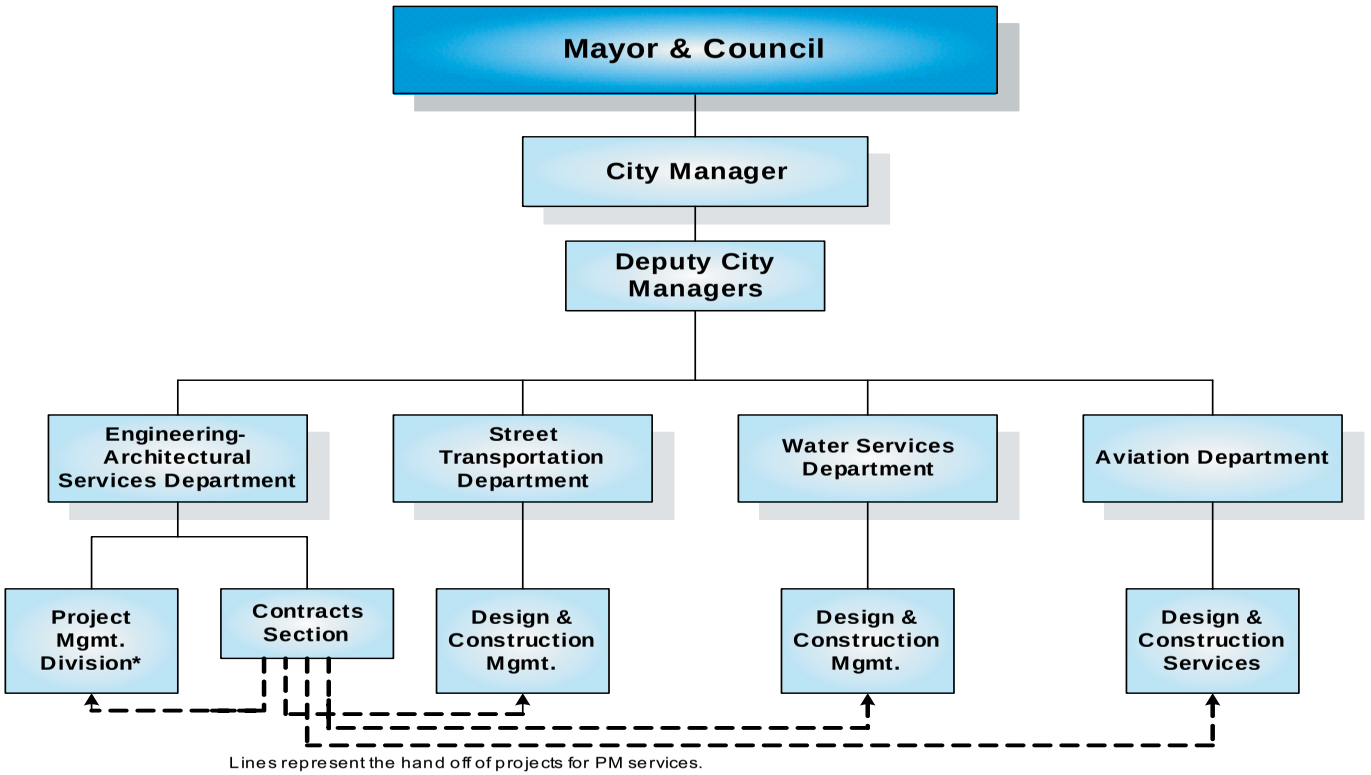

City of Tucson
General Services Department
Architecture & Engineering Division
A/E Administrator
Management Assistant A&E/Construction
Administrative Assistant
Project Coordinators
Sr. Engineering Associate
Mechanical Engineer
Sr. Engineering Associate
Electrical Engineer
Architects


City of Tucson
Utility Services - Tucson Water
& Environmental Services
Director
Office of the Director
Administrative Services
Employee Services
Public Information Conservation
Water Resources
Deputy Director
Hydrogeology
Environmental Engineering & Landfill Closure
Los Reales Landfill
Regulatory & Compliance
Deputy Director
Residential Collections Administrator
Commercial Collections Administrator
Strategic Planning Administrator
Code Compliance
Deputy Director
Operations & Maintenance Administrator
Maintenance Mgmt. & Water Security Programs
Deputy Director
Business Svcs. Administrator
Customer Svcs. Administrator
Planning & Engineering Administrators
Water Quality Mgmt. Administrator


City of Tucson
Parks & Reservation Department
Capital Planning & Development Unit
Director
Deputy Director
Management
Coordinator
Capital
Function
Support
Function
Planning
Function
Landscape
Architect
Landscape
Architect
Landscape
Architect
Landscape
Architect
Landscape
Architect
Principal
Planner
Lead
Planner
Staff
Assistant
Administrative
Assistant
Administrative
Assistant


City of Tucson
Department of Transportation
Engineering Division
Transportation Engineering Administrator
Stormwater Engineering Manager
Maps & Records Drafting
Drainage Compliance
Contracts & Specs
City Surveyor
Survey Unit
Permits & Codes
Field Engineering Manager
Inspection & Lab Services
Construction
Contract Administration
Design Engineering Manager
Design Services
Environ. Project Coordinator
Eng. Project Manager
Transp. Program Coordinator

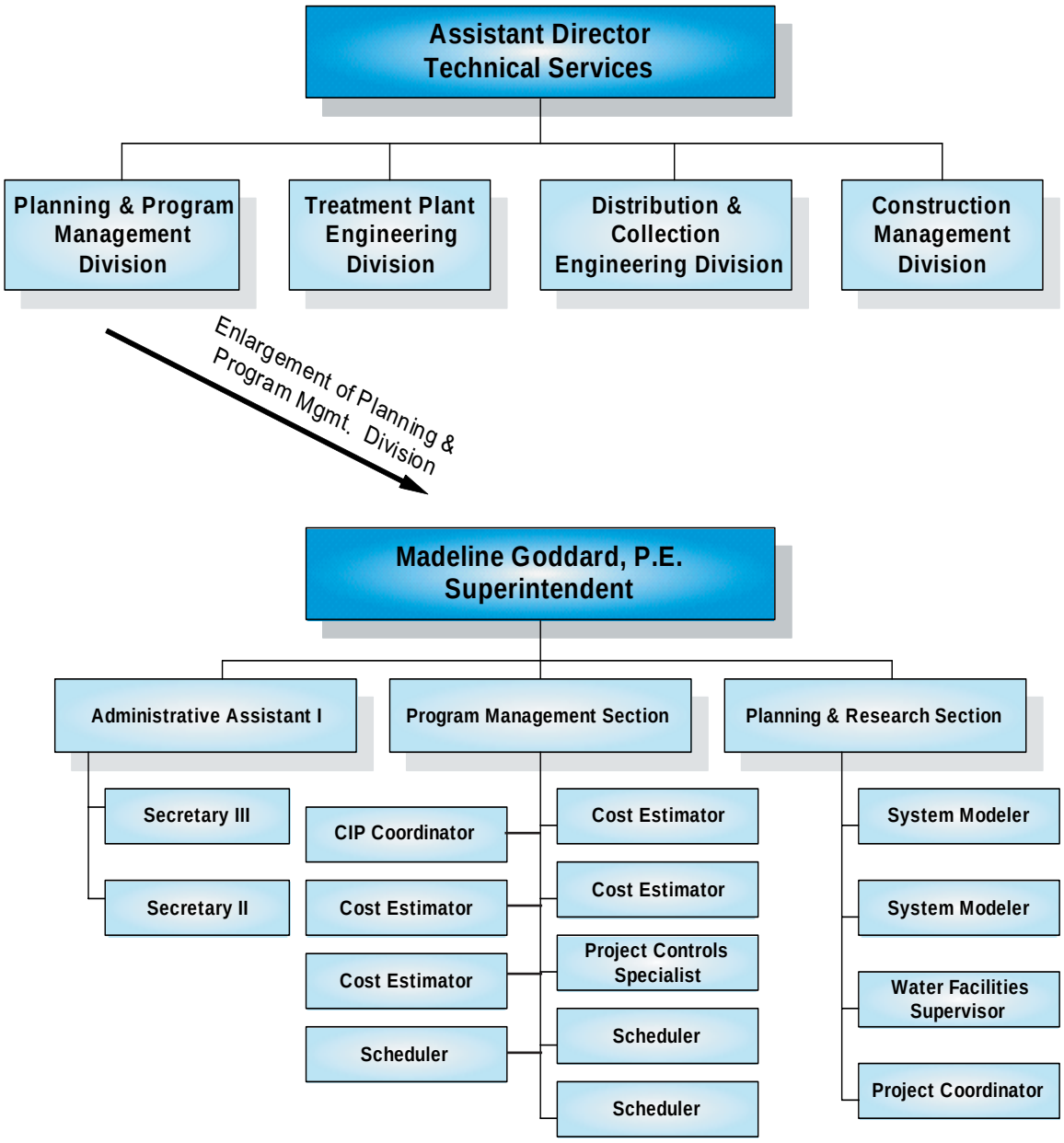
City of Phoenix
Capital Projects Organization



*** Manages projects for the following departments:**

Fire	Economic Development
Police	Neighborhood Services
Parks	Human Services
Library	Housing
Convention Center	Public Works

City of Phoenix
Water Services Department (WSD)



F. AGENCY OVERHEAD RATES

In this section of the report, each Agency's Overhead Rate structure is shown. The Agencies were requested to provide their information for Fringe Benefits, Compensated Time-Off, City Overhead, Department Overhead, Agency Overhead, and Indirect Rate Factor.

A review of the Agencies' information for Table A – Summary of Overhead Rates, suggest that there were variations in the information agencies were able to provide. Some Agencies were able to provide complete fringe and overhead rates for each of the items (see Maricopa County's Flood Control District), while other Agencies could only provide partial information for each of the items (see City of Tucson).

For example, discussion with the administrators from the City of Tucson indicated that they have an hourly rate structure for each of their professional staff to which they add 43% on top of the hourly rate (depending on the professional) to account for fringe benefits. No other overhead factors are applied or calculated.

The ability of the Agencies to provide this information is also dependent on their organizational requirements. Maricopa Community Colleges, for instance, indicates that based on its makeup of capital management staff, the types of projects, and its policy of not charging back to the projects, this type of information is not relevant, and therefore not collected within its organization.

As shown in Tables B through F, the Agencies were fairly consistent with the benefits provided (Fringe Benefits, compensated Time-off, City Overhead, Department Overhead, and Agency Overhead). Each Agency provides similar fringe benefits, and compensated time-off and its agency, city, and department overhead were similarly structured. While Maricopa Community Colleges did not provide any information for these tables, it is believed that it provides similar benefits as other Maricopa County agencies.

Table A - Summary of Overhead Rates

Agency	Fringe Benefits	Compensated Time-Off	City Overhead	Department Overhead	Agency Overhead	Indirect Rate Factor[1]	Entity Receives General Fund Support for Projects (YES/NO)
Pima County							
Public Works[2]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Facilities	27.87%					27.87%[5]	Small Amount
DOT	27.87%	18.17%			81.18%[3]	127.22%	No
Parks	None	None	None	None	None	None	Yes
FCD	27.87%	18.17%			81.18%[3]	133.85%	No
WMD	26.28%	18.17%			66.57%[3]	111.02%	No
Pinal County	36%	22%	35%	N/A	N/A	93.20%	No
Maricopa County							
DOT	32%	21%	21%	26%	19%	155%	No
Parks							
FCD	22.0%	16.6%	14.6%	90.1%	13.8%	157.7%	No
Maricopa Community Colleges[4]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
City of Phoenix	42.12%		10%-20%	25%-50%	N/A	N/A	N/A
EAS							
Streets							
Water Services							
City of Tucson	43%[6]	N/A	N/A	N/A	N/A	N/A	N/A
GSD							
DOT							
Parks							
Water Services							
City of Mesa[7]	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(1) This value may be different from the summation of overhead values.
(2) For Pima County - Public Works does not charge directly out to CIP projects.
(3) For Pima County - this is the combined Dept/Agency Overhead Rate.
(4) MCC does not capture these overhead rates.
(5) This percentage is being re-calculated by Pima County.
(6) This is a City of Tucson mandated fringe or indirect labor number used by all departments. It includes government payroll taxes, pension contributions, self-insured workers' compensation, group insurance, and other insurance costs.
(7) No information received from the City of Mesa.

Table B - Fringe Benefits

FRINGE BENEFITS						
Pima County	Pinal County	Maricopa County	Maricopa Community Colleges	City of Phoenix	City of Tucson	City of Mesa
Deferred Comp (agency contributions)	Arizona Retirement System	FICA/Medicare	N/A	Industrial Insurance	Deferred Comp (agency contributions)	No information received
FICA Medicare	Health, Dental, Life Insurance	Health Insurance	N/A	Retirement System	FICA Medicare	
Health, dental, life insurance	Worker's Comp	Dental Insurance	N/A	Social Security	Health, dental, life insurance	
Payroll Admin	Medicare, FICA	Retirement Contributions	N/A	Health, Dental, L/T Disability	Payroll Admin	
Retirement pension		Unemployment Insurance	N/A	Unemployment, Deferred Compensation	Retirement pension	
Worker's Comp		Workman's Compensation	N/A	Education Benefits	Worker's Comp	
		Bus pass	N/A			

Table C - Compensated Time-Off

COMPENSATED TIME-OFF						
Pima County	Pinal County	Maricopa County	Maricopa Community Colleges	City of Phoenix	City of Tucson	City of Mesa
Bereavement	11- Paid Holidays	Bereavement	N/A	Bereavement - 3 days	Bereavement	No information received
Holiday	2 Weeks Vacation after five (5) years of service	Holiday Pay	N/A	Holiday - 11.5 days	Holiday	
Jury Duty	Jury Duty	Jury Duty	N/A	Jury Duty - as much as required	Jury Duty	
Sick Leave	Sick Leave	FML Sick Leave	N/A	Sick Leave - 10 hrs/month	Sick Leave	
Union Leave		Personal Leave	N/A	Personal Days - 2 days/yr depending on classification	Union Leave	
Vacation		Industrial Leave	N/A	Vacation - 12-22.5 days, depending on years of service		

Table D - City Overhead

CITY OVERHEAD				
Maricopa Community Colleges	Maricopa County	City of Phoenix	City of Tucson	City of Mesa
N/A	County wide support functions, such as:	Various Departments, such as:	See Department overhead information	No information received
N/A	County Auditor	Auditor		
N/A	County Finance	ITD		
N/A	Human Resources	Computer Systems		
N/A	Information Technology	Telecommunications		
N/A	Procurement	City Clerk		
N/A	County Attorney	Facilities		
N/A	County Manager			
N/A	Treasurer			
N/A	Liability Insurance			
N/A	Telecommunications			

Table E - Department Overhead

DEPARTMENT OVERHEAD						
Pima County[1]	Pinal County	Maricopa County	Maricopa Community Colleges	City of Phoenix	City of Tucson	City of Mesa
Accounting		Accounting	N/A	Accounting	Accounting	No information received.
Budget Management		Budget	N/A	Budget Management	Budget Management	
Contract processing		Contracts	N/A	Personnel	Contract processing	
Personnel Admin		Purchasing	N/A	Resource planning	Personnel Admin	
Building Rent		Customer Service	N/A	Contract processing, etc.	Building Rent	
Consultants		Human Resources	N/A		Consultants	
Fleet Service		Warehouse	N/A		Fleet Service	
Phones		Travel/Training	N/A		Phones	
Salaries & Wages		Office Space	N/A		Salaries & Wages	
Technology services					Technology services	

(1) The Department and Agency Overhead are combined for Pima County.

Table F - Agency Overhead

AGENCY OVERHEAD						
Pima County	Pinal County	Maricopa County	Maricopa Community Colleges	City of Phoenix	City of Tucson	City of Mesa
The Department and Agency Overhead are combined for Pima County. See Table E.	County Attorney	PW Director	N/A	Combined with City Overhead	Combined with Department Overhead	No information received
	County Finance and Purchasing	PW Admin Staff	N/A			
	Human Resources	Computer Network Support	N/A			
	IT	GIS Information Technology	N/A			
	Telecommunications					
	County Manager					

G. BENEFITS OF PARTICIPATING IN THE ARIZONA BENCHMARKING STUDY

In this section, the Agencies provided a narrative on the benefits of participating in the benchmarking study.

PIMA COUNTY

The Arizona Benchmarking Study provides an excellent opportunity to exchange capital project information and cost data among jurisdictions/agencies doing similar work. The study includes opportunities to benefit from lessons learned, implementation of best management practices, review and discussion of alternative delivery methods, and comparison of project delivery costs. The online forum additionally provides an excellent tool to quickly determine how other jurisdictions function for a special topic of interest.

A result of the benchmarking study and its processes is increasing the public's and elected officials' confidence in our ability to deliver capital projects efficiently at the best possible value of tax payers dollars and the willingness of voters to approve future bond improvement programs.

MARICOPA COMMUNITY COLLEGES

Since we're a bit of a different animal compared to the balance of the study participants (in size of capital management staff, types of project and in not charging back to the projects) we look at this study to provide a couple of different opportunities.

1. Best practices transcend the issues that make us different. We'd like to see how everyone else handles capital project management and delivery and see if there are ways that we can improve and increase our own efficiency.

2. We believe that there is a benefit to having some level of consistency if not in delivery, at least in the approach to project delivery, contracts and terms, etc. That tends to prevent contractors and consultants gaming one organization against another, by taking the most advantageous position offered by one organization and negotiating to that point with others.

3. Regardless of the differences in agencies, some views of the costs to deliver our projects (ratios of hard to soft costs, etc.), are still relevant to our work. They become more relevant as more vertical construction is included in the study.

4. Owners have been at a significant disadvantage at the legislature with the con-

struction industry. Being able to discuss common areas of interest among large public agencies and perhaps create common interests/approaches/goals may allow us to create larger owner-based interest groups to affect future legislation.

5. Getting to know and understand other public institution management creates relationships and opportunities to exchange views, answer questions, etc. in our daily work and practice.

PINAL COUNTY

The Arizona Benchmarking Study is giving a fresh perspective to us on what large volume capital project delivery agencies are doing. By observing what our peers are doing and how they are doing it, we feel this will give us a much needed edge on the tasks ahead. This effort also allows us to informally network with our peer agencies and develop much needed relationships with them.

MARICOPA COUNTY

The study allows us to have an opportunity to compare how efficient we are in delivering projects in comparison to other agencies in the state, and it provides a forum to discuss common problems we are encountering in providing results to our citizens.

CITY OF TUCSON

In addition to allowing the City of Tucson to compare costs for delivering capital projects with other public owners around the state, the Arizona Benchmarking Study has given us the opportunity to identify and compare current practices and "best practices" being used by other public agencies.

CITY OF PHOENIX

The Arizona Benchmarking Study has given the City of Phoenix the opportunity to compare notes with other municipalities to see if our soft costs are within the norm for our capital projects. It was reassuring to see that our costs are consistent with other public work agencies around the state.

Chapter 4
PROCESS BENCHMARKING

CHAPTER 4 Process Benchmarking

A. INTRODUCTION

It is the goal of this continuing study to develop hard data that documents the impact of an Agency's implementation of Best Management Practices (BMP) on its project delivery process. Utilizing and implementing Best Management Practices results in improved project delivery performance.

The study began in July 2005 by gathering data on project delivery performance submitted by Pima County, Maricopa County, the City of Tucson and the City of Phoenix. It also identified which project delivery processes were used to deliver projects and what processes might be implemented in the future.

During the first year of the study (2005), the Agencies were asked to respond to a BMP survey indicating the degree of implementation of the practices listed in the survey. The results were tabulated and presented at the various benchmarking meetings throughout 2005. The results were included in the final 2005 Benchmarking Report.

In 2006, Maricopa Community Colleges, Pinal County and the City of Mesa joined the study. During this year, all Agencies were asked to respond to the revised BMP Survey (which included seven more practices for a total of 36) and to target or specify which ones they felt would be beneficial for implementation in the coming year and would result in an improved project delivery process for their Agency. The 2006 BMP Survey for traditional projects is included in Appendix A (page 92).

The implementation of BMP and the targeted practices were tracked and project delivery performance data was collected. It is anticipated that performance data will eventually demonstrate that as Best Management Practices are implemented, project delivery costs are reduced. However, this conclusion may not be accurate for all Agencies. An Agency may implement certain Best Management Practices that increase project costs, such as Green Building concepts (that may increase project costs while delivering higher performance projects). Other Agencies may elect to adopt Best Management Practices that increase project delivery costs but have other quality benefits such as shortened delivery schedules and improved communications with the public and clients. The results of these changes may take several years to observe.

For 2006, a CM@Risk survey was developed in conjunction with the City of Phoenix. Due to the City's extensive experience with this delivery process, they provided valuable input in the development of the survey. This survey was subsequently revised after a meeting with all the Agencies on October 5, 2006. The revised survey is included in Appendix A.

Pima County, the City of Phoenix, Maricopa Community Colleges, and the City of Tucson were the only other Agencies that submitted CM@Risk projects for the 2006 Study. The survey results are included in Table 4.3 (pages 50-52).

B. BEST MANAGEMENT PRACTICES FOR IMPROVED PERFORMANCE

The seven Agencies are actively committed and share the objective of reducing capital project delivery costs. In the first year of the study, 29

Best Managment Practices were identified related to planning, design, quality assurance, program, project and construction management, and consultant selection and use. For the 2006 Study, seven more practices were added to the survey, for a total of 36 Best Management Practices, and the survey was sent out to the Agencies. The survey results indicate that about 14 out of the 36 Best Management Practices were already in use, while others were only partially used or not used at all. The common practices in use are discussed in Section 4.D.

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

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

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

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

The City's Water Services Department states that due to security concerns the Department will not support:

- Having bid documents available online.
- Having bids submitted or accepted online.

C. TARGETED BEST MANAGEMENT PRACTICES FOR 2006

Pima County

Pima County has targeted Best Management Practice No. 2 for implementation, "Projects are well defined with respect to scope and budget, including obtaining tenant (or client) approval prior to the start of design." This target is to continue with the commitment to closely monitor the design, budget and project schedule. This is a goal to be implemented by the Water Management Department, Parks and Recreation, Department of Transportation, the Flood Control District, and Facilities Management Department.

Pima County has also targeted Best Management Practice No. 10, "Scope changes are limited to the early stages in design." This target involves keeping with Pima County's mandate

of requiring all departments to better control and manage the design process of its projects. This goal is to be implemented by all five departments within the Public Works Division.

The next goal is Best Management Practice 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.

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

Maricopa County Department of Transportation (MCDOT)

MDOT has targeted three Best Management Practices for implementation in 2006. These are:

- 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 Best Management Practices are directly related to Maricopa County's previously stated goals of improving its project delivery performance and enhancing its training program for project managers.

City of Tucson

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

- No. 11, "Approved scope changes are accompanied by budget and schedule modifications."
- No. 12, "A standardized Project Delivery Manual is used on all projects."
- No. 28, "A consultant rating system has been implemented that identifies the quality of each consultant's performance on previous projects."

Additionally, the City of Tucson's Department of Transportation has targeted three more Best Management Practices for implementation.

- No. 10, "Scope changes are limited to the early stages in design."
- No. 29, "Standard contracts for consulting services, with critical clauses (i.e. indemnification) are included in RFQ/RFPs."
- No. 33, "Earned value versus budgeted and actual expenditures is monitored during project delivery."

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

Table 4.1 lists the results of the survey and the targeted Best Management Practices for 2006 by the participating Agencies.

Table 4.1 - Implementation of Best Management Practices

Process Category	Ref	BMP	Pima County					Pinal County	Maricopa County	MCC	City of Phoenix			City of Tucson				City of Mesa	Comments
			WMD	PKS	DOT	FCD	FM				EAS	Streets	Water	Parks	DOT	Water	GSD		
Planning	1	Complete feasibility studies are done on projects prior to defining scope and budget.	2	2	3	3	3	3	4	5	2	3	3	4	3	2	2	2	Pinal C - Depends on system.
	2	Projects are well defined with respect to scope and budget, including obtaining tenant (or client) approval prior to the start of design.	3	3	3	4	3	4	3	5	2	4	3	5	4	3	3	4	
			2006 Target																
	3	The Agency has a prioritization system.	3	4	2	4	4	4	5	3	3	5	5	4	4	4	2	5	
	4	Program planning includes design and construction resource loading.	1	4	1	2	1	5	1	2	2	5	4	4	3	1	2	2	
	5	Program planning includes a Master Schedule that includes start and finish dates for each project.	4	5	1	2	5	4	1	4	4	4	5	5	3	3	3	4	MC - Preliminary target - decision not final.
									2006										
	6	All projects are shown on a Geographical Information System.	5	5	3	5	5	2	1	1	2	4	4	2	4	5	1	5	MC - Preliminary target - decision not final - All projects on GIS.
									2006										
Design	7	Designers are provided with a clear, precise, scope, schedule, and budget prior to design start.	3	5	4	3	4	2	3	4	2	4	3	5	3	2	3	5	MCC - Would be a "5" for majority of bldg & remodeling projects.
	8	Requirements for reliability, maintenance, and operation are defined prior to design initiation.	4	5	3	2	3	3	3	2	4	3	3	4	2	1	2	3	
	9	Successful designs are re-used and site adapted whenever possible.	3	5	2	3	2	4	1	1	2	3	4	4	4	4	1	2	
	10	Scope changes are limited to the early stages in design.	2	3	2	2	3	4	2	4	1	2	4	4	2	3	3	4	City of Tucson/DOT 2006 target.
			2006 Target												2006				
QA/QC	11	Approved scope changes are accompanied by budget and schedule modifications.	3	4	3	5	5	4	1	4	2	3	5	4	3	5	3	4	City of Tucson 2006 Target.
														2006 Target					
	12	A standardized Project Delivery Manual is used on all projects.	4	3	3	4	4	4	1	2	2	3	4	3	2	4	2	5	City of Tucson 2006 Target.
														2006 Target					
	13	Value Engineering Studies are performed on all projects with a value greater than $1 million.	2	4	2	3	2	2	3	4	3	2	3	2	3	1	1	4	MCC - By necessity.
	14	A formal Quality Management System is used to assure the quality of the design documents and of construction.	2	4	2	3	4	1	2	2	3	4	3	3	2	2	4	1	
	15	Post project reviews are performed and used to identify "lessons learned."	2	4	2	2	1	2	2	3	3	4	4	4	3	1	4	3	
			2006 Target																

Table 4.1 - Implementation of Best Management Practices

Process Category	Ref	BMP	Pima County					Pinal County	Maricopa County	MCC	City of Phoenix			City of Tucson				City of Mesa	Comments
			WMD	PKS	DOT	FCD	FM				EAS	Streets	Water	Parks	DOT	Water	GSD		
Construction Management	16	Change orders are classified by type.	4	2	3	1	5	1	5	5	5	5	5	2	4	2	2	2	
	17	A formal Dispute Resolution Process is included in all contracts.	4	5	3	5	5	3	5	3	4	4	1	5	4	5	4	5	MCC - Formal claims process is there - not dispute resolution.
	18	A team building process is used on all projects with a value greater than $5 millior.	4	4	4	5	3	4	5	1	2	2	5	4	4	3	1	3	
	19	The Construction Management team is involved in the project before the completion of design.	4	5	4	4	5 2006 Target	5	5	5	5	5	4	5	3	1	3	2	Pima C - Emphasize team approach to manage projects (similar to Vanir BMP #18, 19 and 26).
Project Management	20	A pre-qualification process is used on large, complex projects.	4	5	3	5	4	5	1	5	5	5	5	4	4	2	4	2	Pima C - A/E selection -100% - Const. - 5%
	21	Bid advertisements are available online.	5	5	5	5	5	1	5	4	4	3	5	5	4	1	5	5	
	22	Bid documents are available online.	5	2	1	5	1	1	5	2	2	1	1	4	4	1	1	1	
	23	Bids can be submitted/accepted online.	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	
	24	Formal training for project managers is provided on a regular basis.	3	3	3	4	3	1	1 2006	3	3	3	3	2	2	2	2	3	MC - Preliminary target - decision not final. Pima C - With DOT in lead - continue with PM Training: investigate certification of PMs.
	25	A standard Project Controls System is used on all projects.	1	3	2	3	5	1	2	5	2	4	5	2	2	2	4	1	Pinal C - A standard Project Controls System is NOT used on ALL projects. Pima C - Schedule and Estimate verification.
	26	There is a special project management team for small projects.	1	2	2	3	5	2	1	1	2	2	4	4	2	1	2	1	
	27	There are procedures in place to measure and ensure Project Manager performance and accountability.	5	3	2	3	5	1	3	3	3	4	3	4	2	3	1	3	Pima C - via CIP system.
	28	Standard contracts for consulting services, with critical clauses (i.e. indemnification) are included in RFQ/RFPs.	5	5	4	5	5	4	5	5	2	5	1	5	4 2006	4	4	5	City of Tucson/DOT target.
Consultant Selection	29	A consultant rating system has been implemented that identifies the quality of each consultant's performance on previous projects.	3	5	3	5	5	1	3	4	5	5	1	5 2006 Target	2	5	3	3	City of Tucson 2006 Target.

Table 4.1 - Implementation of Best Management Practices

Process Category	Ref	BMP	Pima County					Pinal County	Maricopa County	MCC	City of Phoenix			City of Tucson				City of Mesa	Comments
			WMD	PKS	DOT	FCD	FM				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 (including criteria for exemptions from formal Council/Board approval).	5	5	5	5	5	1	5	5	4	4	5	1	3	2	2	1	MCC - Have 60 firms in 17 disciplines as "on-call" annual services. COP - We're not sure we understand "rotating RFQ" process. I assume you mean construction projects and we do those projects using Job Order Contracts which is a "rotating RFQ process" of sorts.
	31	A financial system has been implemented that tracks expenditures by category, adequate to monitor project hard and soft costs during project delivery.	5	5	5	4	5	5	1	5	5	5	5	3	3	3	2	3	MCC - Have 60 firms in 17 disciplines as "on-call" annual services. COP - The City's SAP system captures actual expenditures through a variety of General Ledger account numbers.
	32	A Work Breakdown Structure (WBS) has been implemented to measure progress on project deliverables.	4	5	1	3	5	2	5	1	5	5	5	4	2	1	5		
	33	"Earned value" versus budgeted and actual expenditures is monitored during project delivery.	2	2	1	1	1	2	3	2	5	5	5	2	1 2006	1	2		City of Tucson/DOT target.
	34	Verification procedures have been implemented to ensure that PM training includes agency policies, procedures, forms, and standards of practice (scheduling, claims avoidance, risk analysis, etc).	5	3	1	3	1	3	1	3	4	4	3	2	2	2	2		
	35	Small projects are bundled whenever possible.	4	3	1	3	4	2	5	2	3	3	4		2	3	2		COP - The City uses Job Order Contracts to execute most small projects. State law provides a specific definition for a project which prohibits bundling or fragmenting projects for the JOC process. Our Street Transportation Dept. does bundle some of its projects that it executes using the Design/Bid/Build process.
	36	As-needed, rotating, or on-call contracts are implemented for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects.	5	4	4	5	4	5	5	5	4	4	5		4	5	4		

D. COMMON BEST MANAGEMENT PRACTICES

Reviewing the survey results for 2006 indicates there are 14 Best Management Practices that most of the participating Agencies rated as partially implemented or fully implemented (at least a four or a five rating). However, there were no Best Management Practices that all agencies routinely implement on all projects. See Table 4.2.

Most agencies rated No. 3, "The Agency has a prioritization system," as a practice that was partially or fully implemented for the majority of the Agencies. However, Maricopa Community Colleges and the General Services Department (GSD) of the City of Tucson rated it a "2," indicating that the practice was only implemented in some cases.

No. 5, "The Program Planning includes a master schedule that includes start and finish dates for each project," was listed as partially or fully implemented by most Agencies. However, Pima County DOT, Maricopa County, and Maricopa Community Colleges indicated that the Best Management Practice was not implemented at all on their projects. Recognizing the importance of this practice, Maricopa County has targeted it for implementation in 2006.

No. 6, "All projects are shown on a Geographical Information System," was rated as partially or fully implemented by the majority of the Agencies. However, Maricopa County and the GS Department of the City of Tucson rated the Best Management Practice as not implemented. Maricopa County has recognized the importance of this practice and has targeted it for implementation in 2006.

No. 11, "Approved scope changes are accompanied by budget and schedule modifications," was rated by most Agencies as partially or fully implemented. Maricopa County indicated that this Best Management Practice was not implemented on its projects. Acknowledging the importance of this practice, the City of Tucson targeted it for implementation in 2006.

No. 16, "Change Orders are classified by type," was recognized by most Agencies as an important Best Management Practice and was rated partially or fully implemented by most Agencies. Pima County's Flood Control Department and the GS Department of the City of Tucson rated the practice as not implemented.

No. 17, "A formal Dispute Resolution Process is included in all contracts," received one of the highest implementation ratings by the Agencies, except for the City of Phoenix's Water Services Department, which rated the practice as not implemented.

No. 18, "A team building process is used on all projects with a value of greater than $5 million," was rated by most Agencies as partially or fully implemented. Maricopa Community Colleges and the City of Tucson's GS Department rated the Best Management Practice as not implemented on its projects.

No. 19, "The Construction Management team is involved in the project before the completion of design"; this Best Management Practice was also rated very high by all the Agencies as partially or fully implemented. The City of Tucson's Water Services Department rated this practice as not implemented on its projects.

No. 20, "A pre-qualified process is used on large complex projects," was rated very high by most Agencies. Maricopa County rated this Best Management Practice as not implemented on its projects.

No. 21, "Bid advertisements are available online," was rated very high by most Agencies. Pinal County and the City of Tucson's Water Services Department indicated that this Best Management Practice was not implemented on their projects.

No. 28, "Standard contracts for consulting services with critical clauses (i.e., indemnification) are included in RFQ/RFPs" was one of the highest rated Best Management Practices. Only the City of Phoenix's Water Services Department rated this practice as not implemented on its projects. For 2006, the City of Tucson's DOT is targeting this practice for implementation.

No. 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)." While this Best Management Practice was not highly rated by most Agencies, Pima County's five departments indicated that this practice was fully

implemented on all their projects.

No. 36, "As-needed, rotating, or on-call contracts are implemented for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects." Most Agencies indicated that this Best Management Practice was partially or fully implemented on most of their projects.

Summary

There was no common Best Management Practice identified as fully implemented on all projects by all agencies essential for successful project delivery. The common practices listed in Table 4.2 appear to reflect the importance of certain practices from the perspective of the participant Agencies.

It is important to note that Best Management Practice No. 23, "Bids can be submitted/accepted online" received a score of "1" by all but one department. Discussion with the City of Tucson Procurement Department and the City of Phoenix indicated there are concerns related to the receipt of bids online due to issues with the reliability and security

E. CM@RISK PROJECTS- BEST MANAGEMENT PRACTICES SURVEY

For this year's study, a CM@Risk BMP survey was developed with the help of the City of Phoenix. The City of Phoenix currently has the most experience and knowledge using this alternative delivery process.

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

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

The results of the original CM@Risk survey are contained in Table 4.3.

Table 4.2 - Common Best Management Practices

Process Category	Ref	BMP	Pima County					Pinal County	Maricopa County	MCC	City of Phoenix			City of Tucson				City of Mesa
			WMD	PKS	DOT	FCD	FM				EAS	Streets	Water	Parks	DOT	Water	GSD	
Planning	3	The Agency has a prioritization system.	3	4	2	4	4	4	5	3	3	5	5	4	4	4	2	5
	5	Program planning includes a Master Schedule that includes start and finish dates for each project.	4	5	1	2	5	4	1 2006	4	4	4	5	5	3	3	3	4
	6	All projects are shown on a Geographical Information System.	5	5	3	5	5	2	1 2006	1	2	4	4	2	4	5	1	5
QA/QC	11	Approved scope changes are accompanied by budget and schedule modifications.	3	4	3	5	5	4	1	4	2	3	5	4 2006 Target	3	5	3	4
Construction Management	16	Change orders are classified by type.	4	2	3	1	5	1	5	5	5	5	5	2	4	2	2	2
	17	A formal Dispute Resolution Process is included in all contracts.	4	5	3	5	5	3	5	3	4	4	1	5	4	5	4	5
	18	A team building process is used on all projects with a value greater than $5 million.	4	4	4	5	3	4	5	1	2	2	5	4	4	3	1	3
	19	The Construction Management team is involved in the project before the completion of design.	4 2006 Target	5	4	4	5	5	5	5	5	5	4	5	3	1	3	2
Project Management	20	A pre-qualification process is used on large, complex projects.	4	5	3	5	4	5	1	5	5	5	5	4	4	2	4	2
	21	Bid advertisements are available online.	5	5	5	5	5	1	5	4	4	3	5	5	4	1	5	5
	23	Bids can be submitted/accepted online.	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1
	28	Standard contracts for consulting services, with critical clauses (i.e. indemnification) are included in RFQ/RFPs.	5	5	4	5	5	4	5	5	2	5	1	5	4 2006	4	4	5
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).	5	5	5	5	5	1	5	5			5	1	3	2	2	1
	36	As-needed, rotating, or on-call contracts are implemented for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects.	5	4	4	5	4	5	5	5			5		4	5	4	

Ref
BMP
WMD
PkS
DOT
FCD
FM
EAS
Streets
Water
Parks
DOT
Water
GSD

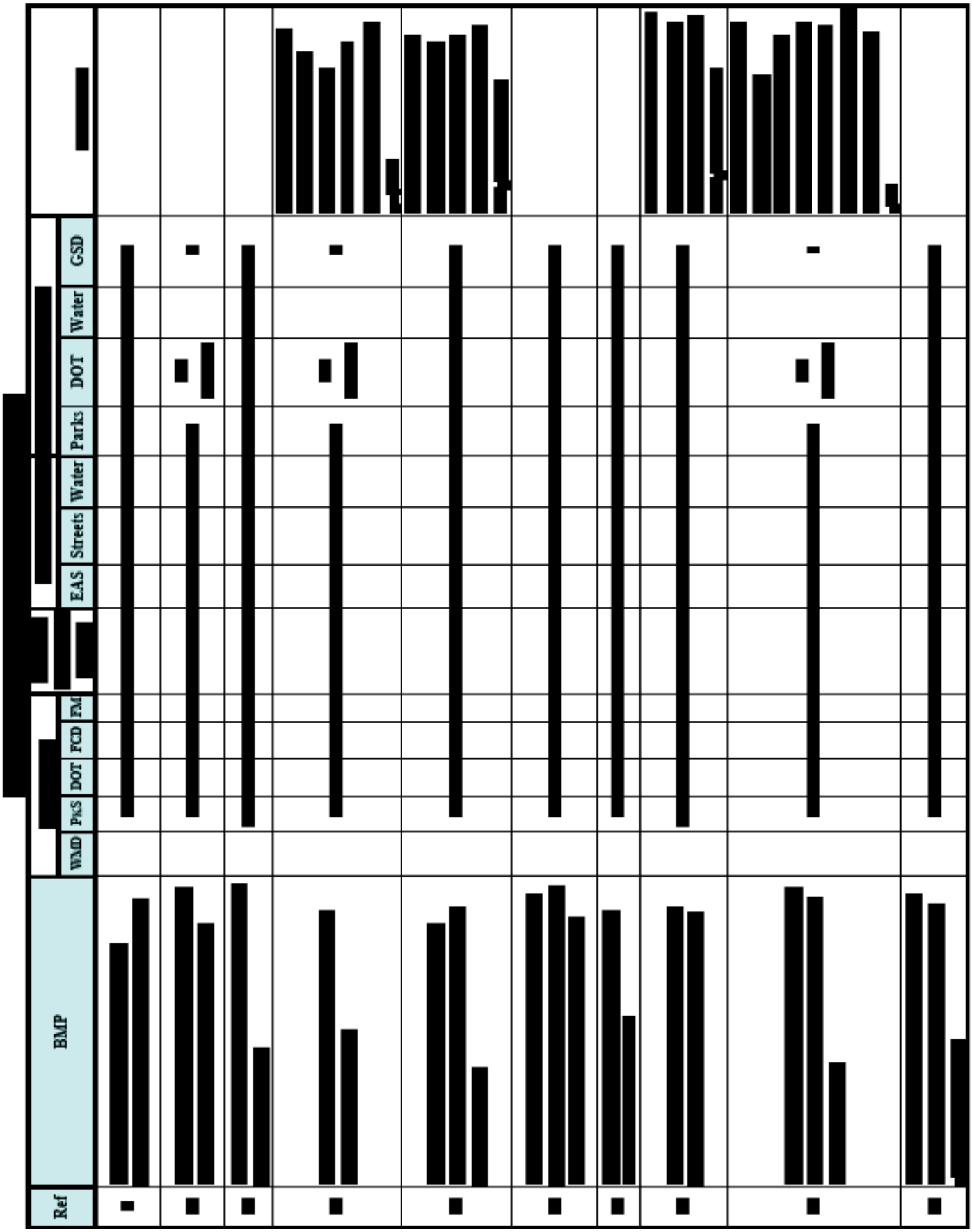

Ref
BMP
WMD
PkS
DOT
FCD
FM
EAS
Streets
Water
Parks
DOT
Water
GSD

Table 4.3 - CM@Risk BMP Survey Results

Ref	BMP	Pima County					Maricopa Community Colleges	City of Phoenix			City of Tucson				Comments
		WMD	PKS	DOT	FCD	FM		EAS	Streets	Water	Parks	DOT	Water	GSD	
19	The Contractor's Allowance (Contingency) is defined and agreed-to by the Client.		2				4	5			5	N/R		4	
20	The Owner's Allowance (Contingency) is defined.		1				5	5			5	No response		5	
21	On Federally funded projects, a Labor Compliance representative is invited to address the Federal Labor standards and requirements.		N/R				N/A	5			5	No response		5	MCC - Not applicable
22	Proposed Change Orders are carefully evaluated for payment and funding source (Owner or Contractor Allowance).		4				5	5			5	No response		5	
23	The Pre-Submittal Conference includes the CM@Risk Contractor and Architect.		1				See comment	5			N/A	No response		1	MCC - Need to define "Pre-Submittal" (of what…???) COT/Parks - Don't understand this Best Management Practices.
24	The ability of the CM@Risk Contractor to self-perform work is critically evaluated.		3				4	5			5	No response		3	
25	On horizontal work, the Contractor self-performs 40% of the work.		1				N/A	5			5	No response		N/A	MCC - Not applicable for our projects. COT/GSD - Not applicable - we don't do horizontal work.
26	An accurate plan holder's list is maintained.		1				4	5			5	No response		3	
27	Project Managers receive training on Alternative Delivery Methods.		1				3	5			5	3		2	
28	Project Managers receive financial and technical training.		1				5	4			5	3		1	
29	A clear protocol is established for resolving issues during project close-out (a written program that establishes the documentation and communication chain between the team members).		3				3	3			5	No response		2	

Chapter 5
PERFORMANCE BENCHMARKING

VANIR
CONSTRUCTION
MANAGEMENT, INC.

CHAPTER 5

Performance Benchmarking

A. GUIDING PRINCIPLES

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

The intent of the data gathering process was to identify and collect all costs that are spent to deliver capital projects. While there are at least five identifiable phases in the delivery of capital projects, costs are not usually tracked, coded, or divided by these phases. Therefore, an attempt was made to collect all delivery costs for the purpose of this study, but only if the costs were able to be separated into the planning, design, and bid/award phase as well as monies spent during construction and close-out phases.

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

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

In this year's study, the team revised the performance questionnaire to reduce errors in data collection and to facilitate input into the database. For traditionally delivered projects, the performance questionnaires developed allowed an Agency to provide labor soft costs as "actual" or "projected." The CM@Risk performance questionnaire was developed along similar lines. The performance questionnaires were revised in this manner to account for the fact that some Agencies could not provide actual costs for their internal agency labor expenses.

The project information submitted by the Agencies was uploaded to the project database for both Traditional and CM@Risk projects, following the guidelines established in the 2005 report:

- Costs - All projects included in the study have a total construction cost exceeding $100,000. Projects less than $100,000 were excluded from the study.
- Completion Date - Projects included in the study were completed after July 1, 2000. The four projects completed in 1999 were excluded from the analysis, but maintained in the database. The database software allows projects to be sorted and/or filtered by completion date for specific analyses.
- Representative Projects - The Study Team reviewed and corrected or eliminated all projects that had the potential to be outliers in the regression analysis. Projects included in the database are those types and classifications that appear in the agencies' current and future Capital Improvement Programs.
- Project Delivery Method - All projects included in the database were delivered

using either the Traditional design-bid-build or the CM@Risk delivery method.

B. TRADITIONAL PERFORMANCE QUESTIONNAIRE

The Traditional Performance Questionnaire is shown in Appendix A (page 78). Highlights of the questionnaire are as follows:

- A number of new drop-down menus are provided to make data input easier for the team. Under all of these drop-down menus, the team member simply selects the appropriate data for the project.
- Under "Project Type," the projects being studied are listed. These are the same project types listed in the Project Distribution Matrix (see Table 5.1, page 57).
- Under the New/Rehab box, a similar drop-down menu is installed that allows for selection of whether the project is a new or rehab project.
- A "Complexity Index" was used to account for possible influence(s) in the project's complexity on the performance data. A new drop-down menu in this area allows the users to select between a "Simple," "Normal" or "Complex" project.
- In the Justification box, the Agencies were requested to provide justification for their indicated complexity index.
- Project costs included two delivery phases: Planning/Design and Construction Management. In the "Planning/Design Phase", the planning, design and bid and award costs are included. While it would be desirable to segregate the cost of design, planning and bid/award function, this was not possible due to data available from the agencies. 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 Agency can select from either "actual" or "projection" (fee) costs.
- The total cost of each phase might include some costs other than labor, such as "art fees." It is the intent of the study to collect all project delivery costs and to have them reflected in the performance curves.
- For 2006, it was decided to request that each agency provide change order information in the following categories:

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

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

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

C. CM@RISK PERFORMANCE QUESTIONNAIRES

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

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

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

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

Under the hard cost of the construction, it was decided to provide a line for the agreed GMP, with contingency. A separate line is provided for the amount of contingency used by the Contractor, the Owner's Contingency, and any excess Change Order cost above the indicated contingencies.

D. DATA COLLECTION

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

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

- The Traditional performance questionnaire was improved to increase the reliability of the data. The questionnaire was revised to make the input of the data easier and to reduce errors by the Data Gathering Team. This change also facilitated the input of the data by the Project Team into the database.
- A new CM@Risk performance questionnaire was developed to include projects using this alternative delivery method in the study. Two CM@Risk questionnaires were developed in this effort as explained above. We currently have 24 CM@Risk projects in the database.
- The study continued to collect additional project data to increase the population of the database. Last year's study examined 224 projects. This year the database has expanded to 274 projects. There are currently 15 outliers in the database (which are not included in the curves or the analysis).

- The Project Team reviewed the data submitted in 2005 to correct any error input by the Data Gathering Team or the Project Team.

- Last year Maricopa County's Flood Control District (FCD) submitted two projects. Therefore, in this year's study, it was decided to expand the categories to include Flood Control Projects. The City of Tucson, Pima County and Maricopa County's FCDs have submitted several projects in this category. As a result, the 2006 Study contains five categories and 16 different project types.

- For 2006, the Agencies were also directed to include change order costs whenever possible and to categorize according to their origin. The study was not able to produce any meaningful information at this time, due to the limited information in this area.

E. DISTRIBUTION OF PROJECTS

Table 5.1 summarizes the final project distribution for Traditional projects. The table shows the wide distribution of projects. As indicated at the start of the study, the addition of more projects to each classification increases the statistical credibility of the study and the associated regression curves. The number of projects increased from the 224 projects in the 2005 Study, to 274 in this year's study.

Table 5.2, "Consultant's Usage Summary"details the cost of design, construction management and project delivery costs by Agency. It also includes the use of in-house staff versus outside consultants for these three phases.

Table 5.3, "Project Count and Project Delivery by Completion Year", summarizes the 274 projects contained in the study by project completion year and shows the trends in average Total Construction Cost (TCC) values, median TCC values, design, construction management, and overall project delivery percentage costs.

F. DEVELOPEMENT OF PERFORMANCE GRAPHS - TRADITIONAL PROJECTS

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

	2005	2006	Difference
Municipal	40	44	4
Parks	48	51	3
Pipes and Plants	55	67	12
Streets	81	103	22
Flood Control	0	9	9
Total	224	274	50

An examination of the regression curves shows a high correlation for Streets (widening). The design percentage versus TCC for Streets (Widening) has indicates a R2 value of 0.8345, for Construction Management versus TCC, R2 = 0.2258, and for Project Delivery versus TCC, R2 = .8942.

The results are only slightly different from the 2005 Study results which indicating a high correlation in this classification. The high R2 suggest that agencies may be using consistent procedures in delivering these projects and that the curves may be used with more confidence to predict soft costs on future projects.

The project performance data is summarized for design, construction management, and total project delivery versus as a percentage of total construction cost (TCC) for each of the 16 classifications.

Table 5.1

Project Distribution Matrix (Traditional)

	City of Phoenix	City of Tucson	Maricopa County	Maricopa Community Colleges	Pima County	Pinal County	Total
Flood Control	3	3	1	0	2	0	**9**
Detention Channels / Structural	3	3	1	0	2	0	**9**
Municipal Facilities	4	15	0	2	21	2	**44**
Community Bldg./Rec. Center/CC/Gym	1	10	0	1	8	0	**20**
Libraries	0	2	0	0	3	0	**5**
Office - (TIs)	0	0	0	1	5	0	**6**
Police / Fire Station	3	3	0	0	5	2	**13**
Parks	18	6	8	0	19	0	**51**
Park Development/Additions	10	5	6	0	11	0	**32**
Restrooms	8	1	2	0	0	0	**11**
Sports Lighting Projects	0	0	0	0	8	0	**8**
Pipes & Plants	49	4	4	0	10	0	**67**
Gravity Pipes	11	0	4	0	6	0	**21**
Pressure Pipes	17	4	0	0	0	0	**21**
Treatment Plants	21	0	0	0	4	0	**25**
Streets	14	16	34	0	28	11	**103**
Bridges - (Retrofits & New)	3	0	6	0	2	0	**11**
New Construction	0	0	3	0	2	0	**5**
Reconstruction	8	15	2	0	4	11	**40**
Signals & ITS[1]	2	1	11	0	11	0	**25**
Widening	1	0	12	0	9	0	**22**
Total	**88**	**44**	**47**	**2**	**80**	**13**	**274**

[1]ITS - Intelligent Transportation Systems

Table 5.2

Consultant's Usage Summary Report - All Projects

Agency Name	DESIGN					CONSTRUCTION MANAGEMENT					PROJECT DELIVERY				
	In-House		Consultants		Total as % of TCC	In-House		Consultants		Total as % of TCC	In-House		Consultants		Total as % of TCC
	($M)	% of DES	($M)	% of DES		($M)	% of CM	($M)	% of CM		($M)	% of PD	($M)	% of PD	
Agency A	16.5	35.5%	29.9	64.5%	16.6%	29.5	23.9%	93.7	76.1%	14.7%	45.9	27.1%	123.6	72.9%	31.3%
Agency B	9.2	34.9%	17.2	65.1%	24.4%	6.5	30.2%	15.0	69.8%	13.4%	15.7	32.8%	32.2	67.2%	37.7%
Agency C	5.4	31.9%	11.5	68.1%	15.9%	10.7	90.6%	1.1	9.4%	11.5%	16.1	56.1%	12.6	43.9%	27.4%
Agency D	5.4	12.9%	36.9	87.1%	16.2%	18.2	32.3%	38.1	67.7%	17.1%	23.7	24.0%	75.0	76.0%	33.3%
Agency E	0.6	5.1%	1.2	94.9%	9.3%	1.7	80.8%	0.4	19.2%	15.5%	1.8	52.5%	1.6	47.5%	24.8%
Agency F	0.4	9.0%	3.6	91.0%	13.1%	0.6	68.9%	0.3	31.1%	4.5%	0.9	19.6%	3.8	80.4%	17.6%
Overall	36.9	26.9%	100.2	73.1%	17.5%	67.2	31.1%	148.6	68.9%	14.2%	104.1	29.5%	248.8	70.5%	31.7%

Table 5.3
Project Count and Project Delivery

2006 Project Count and Project Delivery By Completion Year											
Year Comp.	Project Type						Project Delivery Data				
	Mun. Fac.	Parks	Pipe Sys.	Streets	Flood Cntl	Total	Average TCC ($M)	Median TCC ($M)	Design %	CM %	PD %
1999	1	0	3	0	0	4	$ 2.11	$ 2.03	16%	23%	39%
2000	4	3	1	11	0	19	$ 2.99	$ 1.48	13%	16%	29%
2001	1	4	4	10	1	20	$ 2.68	$ 0.52	12%	13%	25%
2002	9	13	11	15	1	49	$ 4.56	$ 1.39	17%	12%	29%
2003	5	5	11	20	0	41	$ 4.28	$ 1.89	20%	15%	35%
2004	6	9	16	19	3	53	$ 2.67	$ 0.92	21%	14%	35%
2005	15	15	11	8	3	52	$ 3.90	$ 1.16	16%	13%	29%
2006	3	2	10	20	1	36	$ 6.01	$ 1.52	17%	18%	35%
Total	44	51	67	103	9	274	$ 3.94	$ 1.35	18%	14%	32%

G. PERFORMANCE GRAPHS DEVELOPMENT- CM@RISK PROJECTS

Table 5.4 summarizes the final project distribution for CM@Risk projects. Since most agencies provided projected or estimated data for their CM@Risk projects, only project delivery percentage versus TCC regression curves could be developed. Out of the four curves generated, Municipal Facilities and Parks showed reasonable correlation, given the limited number of projects (seven for Municipal and seven for Parks). For Pipes and Plants (four projects), the project delivery percentage versus TCC showed a R2 = 0.7962, and for Streets (three projects), the R2 = .9937. In order to have a statistical credible curve, at least eight projects are needed. The high correlation of these graphs should be viewed as preliminary until more projects populate the database.

One additional graph was developed depicting the "Total paid vs. Contractor" compared to the agreed "Guaranteed Maximum Price". The curve shows the percentage growth of the amount paid to the Contractor above the original agreed amount (GMP) for increasing project cost.

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

Table 5.4

Project Distribution Matrix (CM@Risk)

	City of Phoenix	City of Tucson	Maricopa Community Colleges	Pima County	Total
Flood Control	1	0	0	0	**1**
Detention Channels / Structural	1	0	0	0	**1**
Municipal Facilities	7	0	2	0	**9**
Community Bldg./Rec. Center/CC/Gym	4	0	2	0	**6**
Libraries	0	0	0	0	**0**
Offices (TIs)	0	0	0	0	**0**
Police / Fire Station	3	0	0	0	**3**
Parks	5	2	0	0	**7**
Park Development/Additions	5	2	0	0	**7**
Restrooms	0	0	0	0	**0**
Sports Lighting Projects	0	0	0	0	**0**
Pipes & Plants	4	0	0	0	**4**
Gravity Pipes	2	0	0	0	**2**
Pressure Pipes	2	0	0	0	**2**
Treatment Plants	0	0	0	0	**0**
Streets	0	0	0	3	**3**
Bridges - (Retrofits & New)	0	0	0	0	**0**
New Construction	0	0	0	0	**0**
Reconstruction	0	0	0	0	**0**
Signals & ITS	0	0	0	3	**3**
Widening	0	0	0	0	**0**
Total	**17**	**2**	**2**	**3**	**24**

Chapter 6
ONLINE FORUM

CHAPTER 6 Online Forum

A. USE OF ONLINE FORUM

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

1. Once question is received, every team member who has knowledge of the issue should respond to all on the email listed with solutions. To send the response to all on the email list – respondents hit the "reply to all" button.

2. The Study Team (consultant) is copied on all questions and responses.

3. The question or the issue is stated briefly on the subject line and it should briefly describe the issue.

4. If the individual is not familiar with the subject matter, he/she should respond with "No comment." In this manner, all team members, including the initiating member, will be aware that the email was received by all.

5. The Study Team (consultant) will post all questions or issues and responses in the yearly Benchmarking Study Report.

B. ONLINE QUESTIONS

The following questions have been posed since the start of the Arizona Benchmarking Study.

1. **Budgeting for Mobilization (10/19/05). Will Public Agencies consider the cost of contractor mobilization and demobilization during their planning sessions? Is there a policy place to address these costs?**

   In response to these questions, Pima County's Wastewater Management Department (WMD) stated that it considers this cost in the initial estimates for a project, but no formal policy was in place. The City of Tucson DOT stated that most of the time the department estimated a cost based on its experience; however, the number varied based on the Contractor. The number or percentage was difficult to estimate due to the varied number of Contractors and their different bidding philosophies. Some Contractors would "front-end load" the costs to have increased funds at the start of a project, and others would "low-ball" the cost because they knew they could expect future work from the client.

   Therefore, it appears that while there are examples of project managers managing individual projects to hold costs in-line, there is no overall project management policy in place to define these costs.

2. **Blue Stake (3/6/06). Pima County requested information on whether the County blue stakes its storm drains.**

   This was an internal Pima County question but it was sent to all team members for their input. The response received indicated that for all Pima County areas where DOT is the sole owner, Pima County is responsible for blue

staking. This includes traffic and street lights, sensors, conduits, irrigation lines, box culverts and pipe culverts.

3. **Travel Policy (4/11/06). Pima County requested information on the other Agencies' travel policies regarding expenditures for out-of-state travel and the dollar limits imposed.**

   The responses indicated that some Agencies were following the Federal General Services Administration (GSA) travel policies and reimbursement rates for various cities and states, while others had their own in-house travel policies. Most policies appeared to be consistent with the Pima County travel policy, that travel was approved by a supervisor higher up in the chain and expenses were limited based on the state's accounting office guidelines.

4. **Higher Design Professional Fees for CM@Risk Projects (4/12/06).**

   Maricopa Community Colleges (MCC) used the Online Forum to post the question of whether other Agencies using the CM@Risk delivery process experienced higher than expected A/E fees.

   Since MCC's question related to Architectural fees for CM@Risk projects and most of the Agencies (with the exception of the City of Phoenix) have very little experience with this type of delivery method, only general responses were received.

   Most Agencies are waiting until their CM@Risk experience increases. Currently, most Agencies are more concerned with the escalation in the cost of construction due to the increases in labor and materials. They are waiting to see what the increases mean to their planning process.

5. **Will your project managers use Earned Value? What is your opinion of the use of Earned Value as a tool to monitor budgets and schedules (6/7/06)?**

   While most participating Agencies indicated that they were aware of the Earned Value concept, most Agencies stated that they were not using this process to track projects. The exception was with Maricopa County's Department of Transportation (MCDOT).

   MCDOT indicated that it has tried to use Earned Value but the results were mixed. The issue is that MCDOT financial and project cost reporting systems were not sufficiently aligned to provide meaningful data. This is being corrected.

6. **Project Manager/Designer Issues (9/06).** In September 2006, four questions related to the role of the PM and Designer in management of CIP projects were submitted to the Online Forum. These four questions and responses are summarized in Table 6.1.

7a. Right-Of-Way Issues (9/06). In September 2006, four questions related to Intergovernmental Agreement (IGA), Right-of-Way (ROW) issues, Utility Relocations, Environmental Planning, and Project Manager training were submitted. These four issues and responses are summarized in Table 6.2.

7b. Pima County's response to the four online issues discussed in 7a. (11/9/06).

Pima County Public Works recognized the potential impact that these four issues could have on their project delivery program, developed and implemented a number of practices to minimize their effect.

For example, Pima County's Department of

Transportation (DOT), Natural Resources, Parks and Recreation, and the Wastewater Management initiated a number of procedures, policies and/or Best Management Practices to address the issues.

It is apparent from the information provided by the departments that the timely approval of Intergovernmental Agreements (IGA) had their greatest affect on Pima County's DOT. To address this issue, Pima County DOT identified key personnel and their position, identified the personnel and departments to be contacted, the documents to be created, the IGA approval chain, training sessions, and a description of the obstacles inherent in the IGA approval process.

The Department of Natural Resources, Parks and Recreation addressed the IGA issue by implementing five Best Management Practices that stressed communication with the team members, maintaining a heightened awareness of the project schedule, implementing a Work Breakdown Structure (WBS), and utilizing a standard Project Controls System and a Project Delivery Manual on all projects. The Wastewater Management Department did not comment on this issue.

The practices and procedures developed by the departments are detailed in Table 6.3, page 67.

TABLE 6.1- Online Discussion of PM/Designer Issues

ISSUE	Pima County - Parks	Vanir CM	Tucson DOT	Tucson Procurement	Maricopa Community Colleges	City of Phoenix
	Carlo DiPilato	Bob Wyllie	Andy Dinauer	Jennifer Gillaspie	Arlen Solochek	Wylie Bearup
1. Should PM/CM contracts exclude the PM/CM from competing for the design contract and should the Design contract exclude the designer from competing for the PM/CM contract?	Not in favor of having the PM/CM responsible for design.	Designers do not produce detailed estimates. Designers may be lenient on E&O issues.	Not in favor of having the PM/CM responsible for design.	PM/CM contract should preclude the PM/CM from design and the Design contract should preclude the designer from competing for the PM/CM work.	Project Manager should be an independent entity.	Participation should be restricted so that the PM has objectivity to do the job effectively.
	Improving in-house PM skills through training should be a priority.		Concerned about designer concealing E&O issues if doing the PM.			PM proposing on design is not precluded.
	Consultant PMs are not familiar with in-house processes and procedures and must be paid while learning them.		Consultant PMs are not familiar with in-house processes and procedures and must be paid while learning them.			
			Suggest working with other agencies to share workforce during peak workloads.			
2. Design contracts do not require adherence to a negotiated schedule.	Design firms appear not to have PM expertise and are generally not familiar with in-house processes and procedures.	Design phase schedules should be monitored by a third party, not by the designer.	Suggest establishing a Post-Design Services Consultant Performance Evaluation.	Contracts should be modified to require adherence to a schedule. Liquidated Damages (LDs) are appropriate.	Contracts with designers should include a negotiated schedule.	When a design contract is negotiated, deliverables and a schedule of deliverables is negotiated and included in the contract. This does not always prevent delays.
3. Planning/Design is the one phase that we have the most difficulty adhering to schedule. We need designers to focus on delivering quality documents on time.	Design phase management by a third party may be appropriate.				The PM should be assisting with the management of schedule adherence.	We are not sure that holding a designer to a strict schedule is always a good thing.
	Modify design contracts to make consultants accountable for delays.					In CM@Risk projects, a delay by the designer impacts the CM@Risk contractor. This makes for a little extra pressure on the designer to meet the schedule.
	Past performance should be considered when selecting a design consultant.					
4. The PM is responsible for making sure the plans are reviewed. Outside reviewers are relied upon. It seems inappropriate for the design firms to select which firms review their plans.	Agree! This appears to invite conflict of interest. Also, selection criteria should be developed for qualified review consultants.	New ideas and VE items come from open minds, not the original designer. Designer has no incentive to bring a project in on time and on budget.	Agree that plan reviewer should have no relationship or be selected by the designer.	Agree that plan reviewer should not be selected by the designer.	An independent review is best and the PM can often provide this service.	An unbiased review of documents is critical. Reviews by professional registrants is preferred.

Table 6.2 Online Discussion of Utility Relocations, IGAs, Environmental Permitting, and ROW Issues

ISSUES	Tucson - DOT Mario	Pima - Wastewater Mgmt. Glen Peterson	Phoenix - Water Services Madeline Goddard	Maricopa County Mike Ellegood	Pima - DOT Lee Olson	Tucson Luis Lara
Utility Relocations	Utilities provide written clearance or an agreement to perform work in conjunction with the project contractor before any major project is advertised for bid. If a utility relocation (or a relocation done in error) delays a contractor's progress, TDOT bills the utility company in question for any and all delay damages awarded to the contractor.					Work with utility companies early in the process and comply with their requirements.
IGAs	Has not been an issue for Tucson DOT.			Two knowledgeable and respected individuals are assigned full time to drafting and delivering IGAs. MOUs are developed prior to the formal IGA to expedite understanding between the parties. Recommend a general agreement be entered into so that design development can be started.	A standardized process is used wherein the PM works with the Government Relations office and the County Attorney. IGA training is offered each spring. An IGA handbook has been developed and is updated annually. Delays occur usually only when PM underestimates the time required or when the attorney negotiations get stalled.	Delays consistently occur due to the number of players. Improved communications, standardizing agreements, and a commitment to timely responses by both parties would improve the process.
Environmental Permitting	Four on-call contracts have been awarded for consulting services related to environmental/cultural resources. An ADOT staff member was included on the selection panel which led to improved relationships, processes and timelines.	PMs have been issued a comprehensive checklist and matrix to determine what is needed. Environmental permitting is also included in a CIP PM Manual which has been developed.	The Office of Environmental Programs coordinates clearances, etc. and trains the PMs. A comprehensive list of permits and requirements is posted on the intranet. A project resource information system is also on the intranet.			Identify possible environmental issues early. Employ a list of on-call consultants that can be mobilized quickly to address the issues.

Table 6.2 Online Discussion of Utility Relocations, IGAs, Environmental Permitting, and ROW Issues

ISSUES	Tucson - DOT Mario	Pima - Wastewater Mgmt. Glen Peterson	Phoenix - Water Services Madeline Goddard	Maricopa County Mike Ellegood	Pima - DOT Lee Olson	Tucson Luis Lara
ROW Issues	TDOT requires signed right-of-entry before beginning a construction project. It would be preferable to secure all ROW before construction start, but this can add months to a project.	The Real Property Department and Wastewater Department have monthly meetings and share monthly reports on the status of issues.	The Real Estate Division acquires all easements and ROWs. The Water Services Dept. has a project coordinator that serves as the liaison, tracking and reporting to PM's on a monthly basis.	Internal ROW Dept. acquires all rights of way for all public works projects. We are trying to freeze the footprint of acquisition at 40% design, but this is yet untested. Monthly reporting of ROW progress is required of PM's with ROW Dept. verification.		
How do you ensure that your PMs have complete and current training? Are there continuing education requirements? Are there performance metrics applied to PMs?		PM training utilizes an ASCE program. PMs from each department attended 3 all day workshops (Boot camp I) in Fall 2005. Boot camp II was offered in February 2006. No annual training requirement has been established.	The Dept. provides training through the Planning Research & PM Division. Monthly and quarterly training is offered on an intranet website. Additionally, EASD offers alternative delivery training and the Office of Environmental Programs offers training on 404/regulatory requirements. Performance is measured in individual evaluations for PMs.	Utilizes PSMJ training and Boot camps.		No formal training for PMs is in place. HR offers some PM training. Most training is internal sharing of information. No performance metrics are in place.

Table 6.3 - Pima County BMPs to Address Online Forum Issues

Issue	Department of Transportation	Natural Resources, Parks & Recreation Department	Wastewater Management Department (WMD)
IGAs	Designated two positions in the Directors Office (DO) act as the central point of contact for DOT's "Key IGA Players" between themselves and the County Attorney's office (in Pima County all IGAs are approved as to final form by the County Attorneys office).	Each project has a communication plan developed with the assistance of team members outlining project roles and responsibilities.	
	Key Players (defined as anyone, PM or other Department employee who has the ultimate program responsibility for the funding or activities designated in the respective IGA). Key players are responsible to contact the Government Relations Office in the DO and advise they have a pending need for an IGA and provide IGA details.	Project schedules, key milestones, responsibilities displayed within each division so everyone is aware of deadlines.	
	A suspense file is started (both electronic and hard copy) and the information is entered into the bi-monthly "IGA Report", which contains all IGAs that are not yet final. This report runs on a calendar year basis with all records for executed IGAs purged each January. This report is updated daily and/or as any activity takes place on the respective IGA, thus providing a chronological file history of the negotiations and steps towards timely execution.	A Work Breakdown Structure (WBS) has been implemented to measure progress on project deliverables.	
	The County Attorney/Key Player/Government Relations Manager communicate, negotiate and move the IGA to final form (some take just six weeks, some two years, the average is three to six months). This process values and puts the "Key Player" forward as the IGAs content expert for the project details while Government Relations and the County Attorney insure all legal and operational approval steps before the Board of Supervisors/Procurement/Accounting of the IGA are followed.	A standard Project Controls System is used on all projects.	
	IGA training is offered each spring to all Public Works employees in a two-hour workshop which covers all aspects of IGA approvals. It is delivered by the DOT/County Attorney/Procurement staff. An "IGA Handbook" is the central guiding process document used in the training; it is updated annually reflecting form and/or IGA process changes. As of May 2006, 190 employees with IGA responsibilities have attended these spring workshops.	A standardized Project Delivery Manual is used on all projects	

Table 6.3 - Pima County BMPs to Address Online Forum Issues

Issue	Department of Transportation	Natural Resources, Parks & Recreation Department	Wastewater Management Department (WMD)
IGAs	While the IGA program's goal is to provide the Procurement Department with 100% "camera ready documents", error rates or changes to what was considered "final" have run around 2% annually or one to two documents needing additional tweaking for a 98% annual success rate. Two obstacles are inherent and recurring to the process leading to "untimely IGAs" those being: (1) Key Players or external partners not anticipating the time it takes to execute an IGA and not initiating the process soon enough and, (2) Respective Attorney negotiations regarding legal codicils.		
Environmental Permitting		Each project has a communication plan developed with assistance of team members outlining project roles and responsibilities.	For WMD environmental permitting is usually a critical component for all of our projects, either to operate a treatment facility or to build/put in service a conveyance line. Those needed for treatment plant operations (APP, AZPDES) are initiated at the beginning of a Project, worked on by WMD's permit staff, and monitored by the PM during the course of the project. Those needed for conveyance operations (APP) are initiated and signed-off prior to the project going to construction with developers responsible for their lines and WMD for its own. As these are critical components for project success, we watch these closely. For the other environmental permits MS4, COE404, Floodplain Use, the PM coordinates based on identified need that occurs at the beginning of the project. We have one individual that focuses on Floodplain and 404 issues as the MS4 are usually specific to each project.
		Project schedules, key milestones, responsibilities are displayed within each division so everyone is aware of deadlines.	
		A standard Project Controls System is used on all projects	
		A standardized Project Delivery Manual is used on all projects	
Utility Relocations	Project Scope Development (Stages I & II) - utilities, along with other stakeholders, are included in the concept development meetings. These meetings are concentrated mostly at the beginning of the process to identify and review problems, deficiencies and to develop the basic aspects of the project. The scope and major design issues will be determined in Stages I & II.	A Work Breakdown Structure (WBS) has been implemented to measure progress on project deliverables.	

Table 6.3 - Pima County BMPs to Address Online Forum Issues

Issue	Department of Transportation	Natural Resources, Parks & Recreation Department	Wastewater Management Department (WMD)
Utility Relocations	Development of Plans, Specs & Estimate (Stage III) - Meet with utilities, along with other stake holders, to review DCR. Proceed with project design. Hold utility meeting, request potholing. Begin water & sewer plan design.	A standard Project Controls System is used on all projects.	
	Development of Plans, Specs & Estimate (Stage IV) - Continue design. Conduct utility meeting, submit plans to utility companies for relocation.	A standardized Project Delivery Manual is used on all projects	
	Development of Plans, Specs & Estimate (Stage V) - Prepare final plans for procurement. Complete utility relocations.		
Right-of-Way	Project Scope Development (Stages I & II) - Real Property, along with other stakeholders, are included in the concept development meetings. These meetings are concentrated mostly at the beginning of the process to identify and review problems and deficiencies and develop the basic aspects of the project. Begin preliminary right-of-way plans.	A Work Breakdown Structure (WBS) has been implemented to measure progress on project deliverables.	WMD does have right-of way requirements for our projects, either to operate a treatment facility or to build/put in service a conveyance line. Again, these requirements are identified at the beginning of a project and we have a RLS coordinate with real property and legal (condemnation) on our needs. The treatment needs fit with our permit requirements and are a focus when we expand a treatment facility. We are currently identifying all property around our treatment facilities to identify any additional setback requirements. As we develop future projects, we will identify right-of-way needs and put together a map and listing of parcels that will be provided to Real Property. Additionally, we have a regular monthly meeting with Real Property (who provides us with acquisition information) and discusses efforts to meet our construction needs.
	Development of Plans, Specs & Estimate (Stage III) - Meet with Real Property, along with other stake holders, to review DCR. Proceed with project design. Hold right-of-way meeting. Review right-of-way plans and legal descriptions.	A standard Project Controls System is used on all projects.	
	Development of Plans, Specs & Estimate (Stage IV) - Continue design. Stake right-of-way. Submit legal descriptions and parcel maps.	A standardized Project Delivery Manual is used on all projects	
	Development of Plans, Specs & Estimate (Stage V) - Prepare final plans for procurement. Complete right-of-way acquisition necessary for construction.		

Chapter 7
CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 7 Conclusion and Recommendations

A. PROCESS BENCHMARKING- RECOMMENDED BMPs

Improvement of their project delivery performance was a major goal for most Agencies this year. Through the selection and implementation of certain Best Management Practices, the Agencies wanted to enhance their department's performance. Major changes have been made or will be made to Maricopa and Pima County's organizational structure as a direct result of their evaluation and execution of certain Best Management Practices. Other Agencies have also targeted specific Best Management Practices to improve their operations, with the ultimate goal of reducing project delivery costs.

During the past year, the Agencies have had the opportunity to look at what other Agencies are doing and what works for them. The Agencies will use this experience to make changes and improve project delivery practices and processes. By looking at how the various Agencies approach the project delivery processes, it appears they all work in much the same way. The difference is in the degree in which the Agency or Department has elected to perform oversight of a project or projects.

Use of the Online Forum has increased during the study period. Ten different topics have been discussed this year, from questions on Agency policies related to travel allowances, to fees for professional services. Based on the forum discussion in the past three months, it appears that agencies are starting to openly share their experiences and proposed solutions to the questions posed.

Traditionally Delivered Projects

The 2006 BMP survey for traditionally delivered (design-bid-build) projects found that out of the 36 Best Management Practices contained in the survey, 14 practices were found to be common to all Agencies. However, not one practice was found to be used by all Agencies across the board.

The only Best Management Practice that almost all agencies agreed could not be targeted for implemented at this time was No. 23, "Bids can be submitted/accepted online." Most agencies found this practice was difficult to plan due to concerns related to security, internet access and reliability. Other agency comments on this subject related the lack of original signatures on bid documents and fairness to smaller firms lacking internet capability.

The common Best Management Practices are listed in Table 4.2 (page 49).

CM@Risk Projects

While a preliminary survey was completed, it appears to be incomplete and perhaps unclear. A new survey has been developed and will be completed as part of the 2007 study. The results of the preliminary survey are contained in Table 4.3 (page 50-52).

B. PERFORMANCE BENCHMARKING

Additional projects and date will make the study curves and analyses more reliable. Until at least 8 to 10 projects are provided by each agency in each classification, the curves included in this study should be used with caution and only with full consideration of particular project timelines, site conditions, and complexities. The curves should not be used at this time as as the sole source in guiding budget for future projects.

Traditionally Delivered Projects

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

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

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

CM@Risk Projects

Since most agencies provided projected or estimated data for their CM@Risk projects, only Project Delivery percentage versus TCC regression curves could be developed. Out of the four curves generated, high correlation was observed in the Pipes and Plants and the Streets projects. However, this information should be considered preliminary.

The Study Team observed that additional data collection and review of existing data could significantly improve the study's outcome. The benefit that the agencies can gain from the study's results are to use the performance curves as comparative rather than predictive tools. The best use of these curves, with the current data, is to compare an Agency's performance to industry trends.

C. STUDY QUALIFICATIONS AND CHARACTERISTICS

Clearly, additional project data will improve the results of this study and the ability for an agency to predict resource requirements needed to deliver a Capital Improvement Project. The current performance curves are an improvement over the 2005 Study results, however further data collection will enhance the credibility of these models and help in the objective of having a usable predictive tool.

As part of the 2006 study the Project Team began collecting data on change orders for traditional projects. Peformance data on projects delivered using the CM@Risk method and was also collected for the first time.

D. NEXT STEPS

1. This study is building the foundation of a continuous benchmarking assessment and improvement process. Additional project data will improve the performance curves resulting in predictive tools for both design-bid-build and CM@Risk projects in future studies.

2. The agencies are all moving toward implementing certain Best Management Practices to improve their delivery performance. The Study Team will review the agencies' progress in this area and their implementation approach to these practices in future studies.

3. The Study Team will continue to review the Agencies' data collection processes to ensure that accurate information (consistent with the guidelines established in the study parameters) is received. The CM@Risk data received will

be reviewed to ascertain that all Agencies are providing data consistent with the agreed format and guidelines.

4. The Project Team will continue to share experiences and questions through online discussions and presentations. This forum has been found to be an effective method to synergize the team and promote a collaborative effort.

ACKNOWLEDGEMENTS

VANIR
CONSTRUCTION
MANAGEMENT, INC.

Acknowledgements

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APPENDIX A

VANIR
CONSTRUCTION
MANAGEMENT, INC.

TRADITIONAL PERFORMANCE QUESTIONNAIRE

PROJECT DATA FORM

Agency: | **Proj. Name:**

Project Type:

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

Justification:

Description:

Comments:

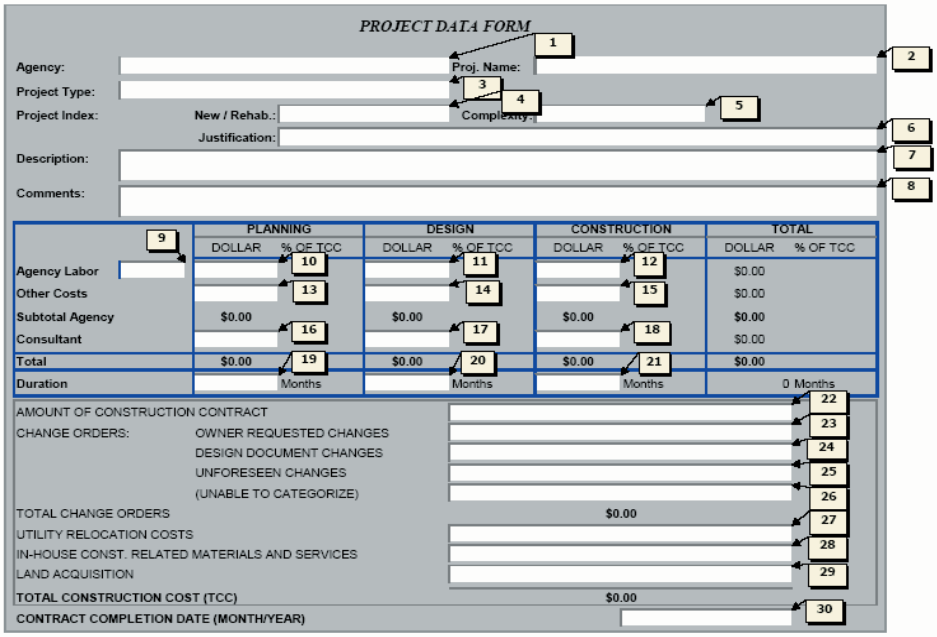
	PLANNING		DESIGN		CONSTRUCTION		TOTAL	
	DOLLAR	% OF TCC	DOLLAR	% OF TCC	DOLLAR	% OF TCC	DOLLAR	% OF TCC
Agency Labor							$0.00	
Other Costs							$0.00	
Subtotal Agency	**$0.00**		**$0.00**		**$0.00**		**$0.00**	
Consultant							$0.00	
Total	**$0.00**		**$0.00**		**$0.00**		**$0.00**	
Duration	Months		Months		Months		0 Months	

AMOUNT OF CONSTRUCTION CONTRACT		
CHANGE ORDERS:	OWNER REQUESTED CHANGES	
	DESIGN DOCUMENT CHANGES	
	UNFORESEEN 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 PERFORMANCE QUESTIONNAIRE-INSTRUCTIONS

The first section contains item 1 to 8 which are used to capture ***General Information*** about the project:



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

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

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).

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

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.

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

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

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."

Items 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.
- Continue 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 has been done to relocate utilities. (if applicable).

Item 28: 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 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 PERFORMANCE QUESTIONNAIRE-ONE PHASE

PROJECT DATA FORM

Agency:	
Project Name:	
Project Type:	
Project Index: New / Rehab.:	
Complexity:	
Justification:	
Description:	
Comments:	

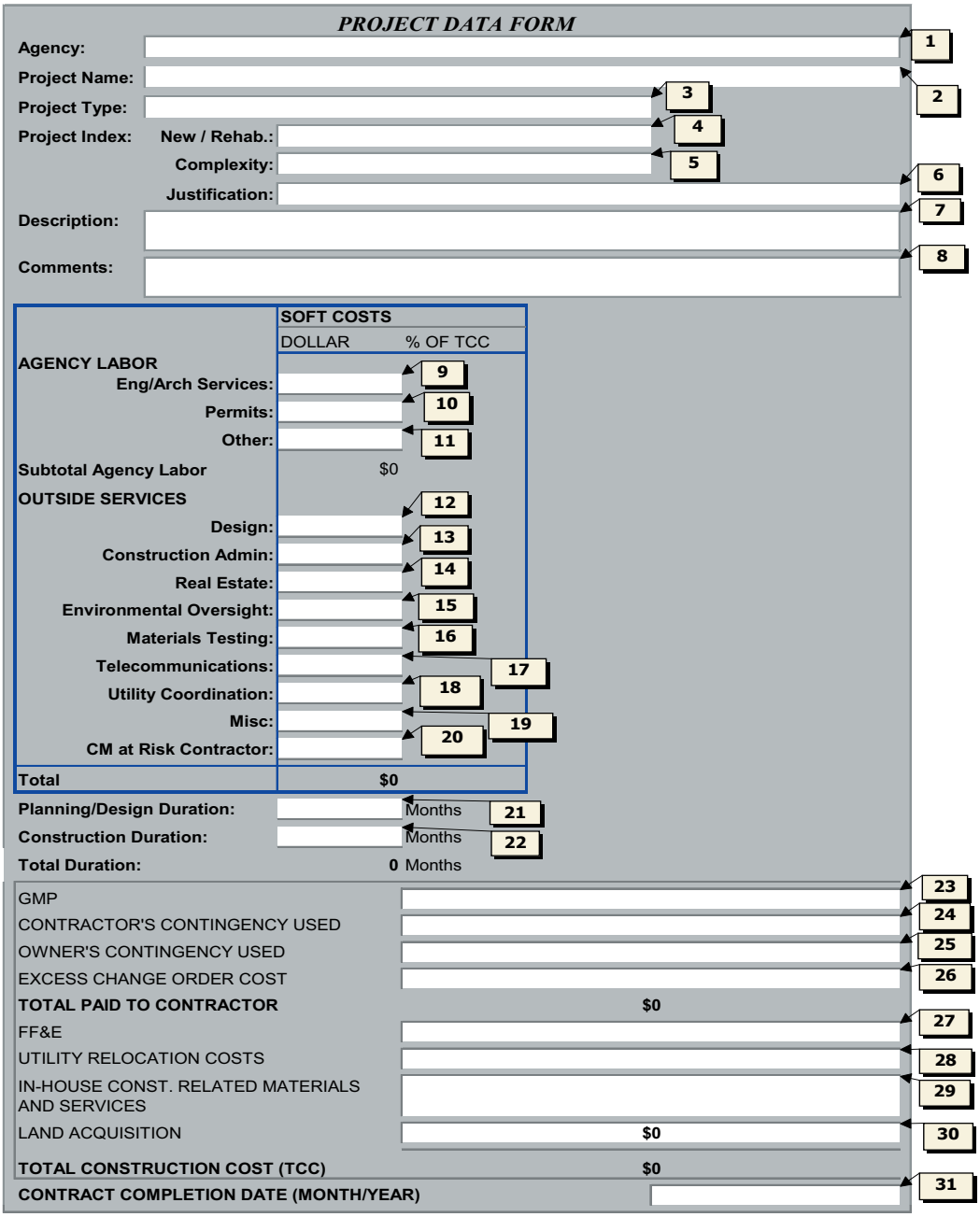
	SOFT COSTS	
	DOLLAR	% OF TCC
AGENCY LABOR		
Eng/Arch Services:		
Permits:		
Other:		
Subtotal Agency Labor	$0	
OUTSIDE SERVICES		
Design:		
Construction Admin:		
Real Estate:		
Environmental Oversight:		
Materials Testing:		
Telecommunications:		
Utility Coordination:		
Misc:		
CM at Risk Contractor:		
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	
LAND ACQUISITION	**$0**
TOTAL CONSTRUCTION COST (TCC)	**$0**
CONTRACT COMPLETION DATE (MONTH/YEAR)	

CM@RISK - ONE PHASE - INSTRUCTIONS

In this first section, items 1 through 8 are used to capture general information about the project.



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

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

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).

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

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

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

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

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.

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.

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

11. 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.

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.

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).

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

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

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

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

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

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

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

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

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

22. Construction Duration – Total construction duration in months.

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

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

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

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

27. FF&E - Total costs related to FF&E.

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

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.

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

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

CM@RISK PERFORMANCE QUESTIONNAIRE - TWO PHASE

PROJECT DATA FORM

Agency:

Project Name:

Project Type:

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

Complexity:

Justification:

Description:

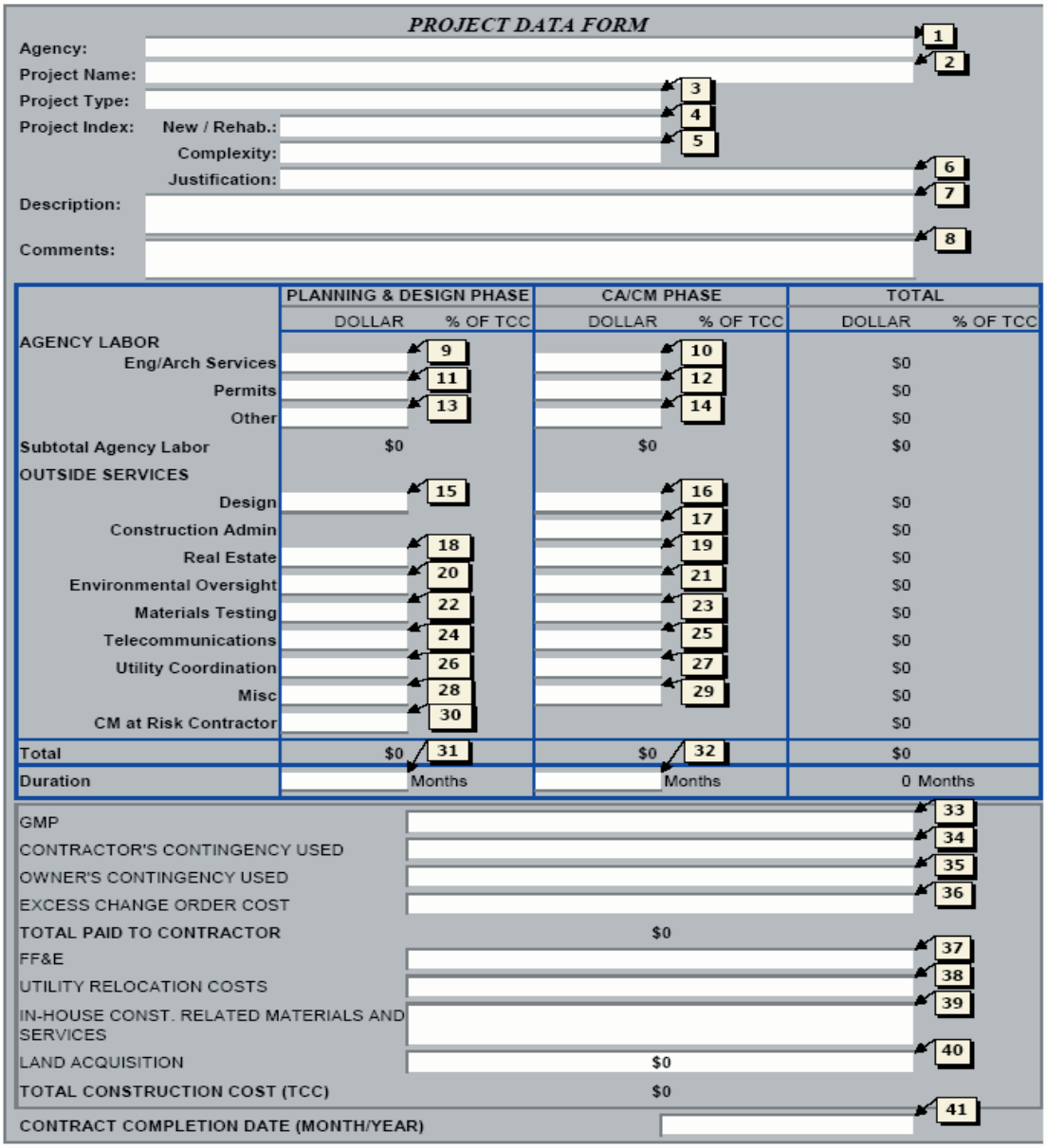
Comments:

	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	**$0**
TOTAL CONSTRUCTION COST (TCC)	**$0**

CONTRACT COMPLETION DATE (MONTH/YEAR)

In this first section, items 1 through 8 are used to capture general information about the project.



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		$0	
Real Estate	18		19		$0	
Environmental Oversight	20		21		$0	
Materials Testing	22		23		$0	
Telecommunications	24		25		$0	
Utility Coordination	26		27		$0	
Misc	28		29		$0	
CM at Risk Contractor	30				$0	
Total	$0	31	$0	32	$0	
Duration	Months		Months		0 Months	

GMP 33
CONTRACTOR'S CONTINGENCY USED 34
OWNER'S CONTINGENCY USED 35
EXCESS CHANGE ORDER COST 36
TOTAL PAID TO CONTRACTOR $0
FF&E 37
UTILITY RELOCATION COSTS 38
IN-HOUSE CONST. RELATED MATERIALS AND SERVICES 39
LAND ACQUISITION 40 $0
TOTAL CONSTRUCTION COST (TCC) $0
CONTRACT COMPLETION DATE (MONTH/YEAR) 41

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

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

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).

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

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.

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

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

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

Items 20 and 21: Environmental Oversight – This is the amount paid to any consultant to perform environmental oversight and/or remediation on the project.

Items 22 and 23: Material Testing – This is the cost paid to any Material Testing consulting firm.

Items 24 and 25: Telecommunications – This is the cost paid to any telecommunications consultant for installation and engineering services.

Items 26 and 27: Utility Coordination – This is the cost paid to any consultant to perform utility coordination if not done in-house.

Items 28 and 29: Misc. – Any other Consultant soft costs not captured above.

Items 30: CM@Risk Contractor – This is the cost paid to the CM@Risk Contractor for his pre-construction services (design phase).

Items 31: Planning and Design Duration – Total duration of these phases in months.

Items 32: 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 33 to 41.

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

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

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

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

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

37. FF&E - Total costs related to FF&E.

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

39. 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.

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

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

Arizona Benchmarking Team
Best Management Practices Survey

Name: _____

Agency: _____

Date: _____

Please rate the following questions on a scale of 1 to 5. A rating of "1" indicates that the process/procedure is not done and a rating of "5" indicates that the process/procedure is implemented on every project.	Scale				
1. Complete feasibility studies are done on projects prior to defining scope and budget.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
2. 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
3. The Agency has a prioritization system.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
4. Program planning includes design and construction resource loading.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
5. Program planning includes a Master Schedule that includes start and finish dates for each project.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
6. All projects shown on a Geographical Information System.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
7. Designers are provided with a clear, precise, scope, schedule, and budget prior to design start.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
8. Requirements for reliability, maintenance, and operation are defined prior to design initiation.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
9. Successful designs are re-used and site adapted whenever possible.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
10. Scope changes are limited to the early stages in design.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
11. Approved scope changes are accompanied by budget and schedule modifications.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
12. A standardized Project Delivery Manual is used on all projects.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
13. Value Engineering Studies are performed on all projects with a value greater than $1 million.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
14. A formal Quality Management System is used to assure the quality of the design documents and of construction.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

15. Post project reviews are performed and used to identify "lessons learned."	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
16. Change orders are classified by type.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
17. A formal Dispute Resolution Process is included in all contracts.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
18. A team building process is used on all projects with a value greater than $5 million.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
19. The Construction Management Team is involved in the project before the completion of design.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
20. A pre-qualification process is used on large, complex projects.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
21. Bid advertisements are available online.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
22. Bid documents are available online.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
23. Bids can be submitted/accepted online.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
24. Formal training for project managers is provided on a regular basis.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
25. A standard Project Controls System is used on all projects.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
26. There is a special project management team for small projects.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
27. There are procedures in place to measure and ensure Project Manager performance and accountability.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
28. Standard contracts for consulting services, with critical clauses (i.e. indemnification) are included in RFQ/RFPs.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
29. 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
30. 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
31. 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
32. A Work Breakdown Structure (WBS) has been implemented to measure progress on project deliverables.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

33. "Earned value" versus budgeted and actual expenditures is monitored during project delivery.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 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).	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
35. Small projects are bundled whenever possible.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 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.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Thank you for completing the survey.

Arizona Benchmarking Team
CM@Risk
Survey of Best Management Practices

Name: _____
Agency: _____
Date: _____

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

8. Due diligence is performed on the selected CM@Risk Contractor including verifying client references.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
9. The CM@Risk Contractor and the Architect are selected at the same time.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
10. An accurate plan holder's list is maintained.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
11. Evaluate the ability of the CM@Risk Contractor to self-perform work.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
12. Provide that the CM@Risk Contractor must self-perform at least 45% of the work on "horizontal" projects.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Contractor Quality Assurance					
13. The GMP is provided at the 90%-95% Construction Documents Phase. (This will make subcontractor pricing more reliable.)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
14. Provide that the CM@Risk Contractor selects **major** subcontractors based on qualifications or a combination of qualification and price.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
15. The CM@Risk Contract contains provisions requiring the Contractor to provide a resource loaded work plan for pre-construction tasks.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
16. Owner approval is obtained on the CM@Risk Contractor's Subcontractor Plan. (The subcontractors to be used, scope of work, etc.).	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
17. Provide that major subcontractors are selected early so that they participate in the design process.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
18. Require that the CM@Risk Contractor make recommendations for long-lead procurement items, to expedite the project or to save costs.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
19. Require that the CM@Risk Contractor provide a narrative discussing his evaluation and approach to his critical path work as part of the selection process.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
GMP and Contingencies					
20. The Contractor's GMP is evaluated for price and scope.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
21. The Contractor's Contingency is identified and agreed-to by the Owner.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
22. The Owner's Contingency is defined.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

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

Revised November 2006

Thank you for completing the survey.

APPENDIX B


Page
Monument Valley
Kayenta
Colorado River
North Rim
89
160
GRAND CANYON
NATIONAL PARK
South Rim
64
ARIZONA
Kingman
40
Williams
Bullhead
City
Flagstaff
Winslow
40
Verde River
MOGOLLON RIM
Sedona
Holbrook
61
Cottonwood
Camp Verde
Lake Havasu City
Show Low
Prescott
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17
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Wickenburg
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Colorado River
Phoenix
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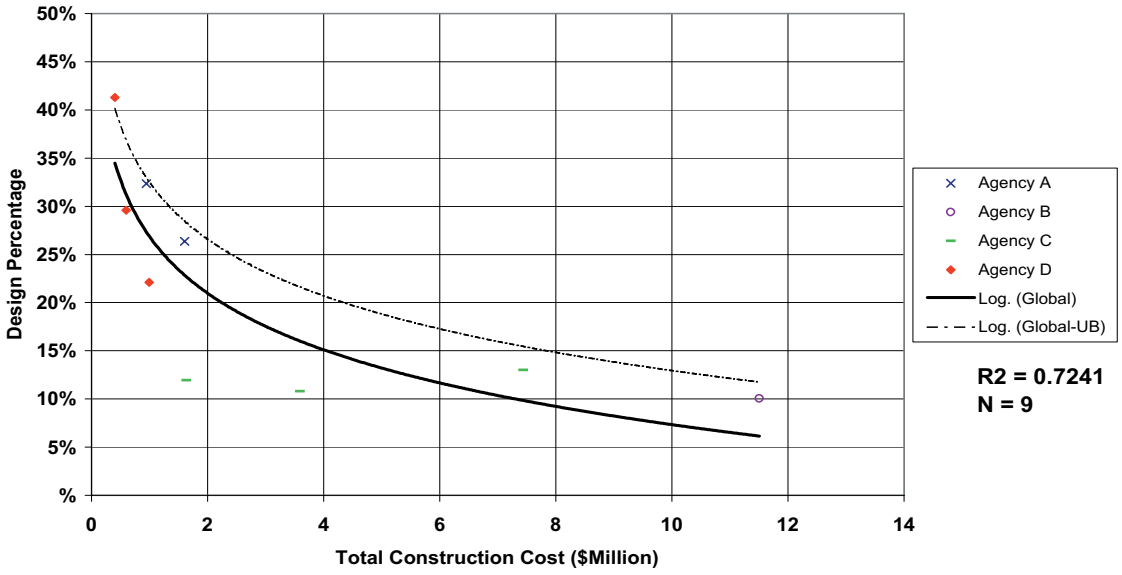
Mesa
Tempe
Globe
60
Casa
Grande
Florence
Gila River
Gila River
Safford
8
Gila Bend
Coolidge
Yuma
10
Ajo
Tucson
10
Wilcox
Benson
19
Tombstone
Bisbee
Douglas


VANIR
CONSTRUCTION
MANAGEMENT, INC.

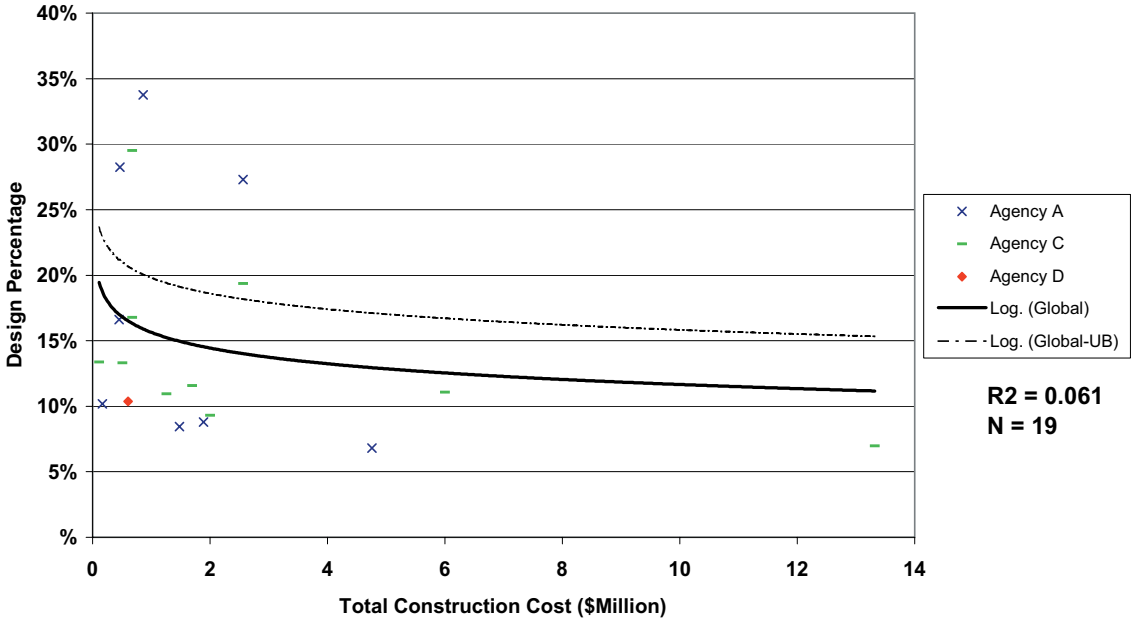
Flood Control - Detention Channels / Structural

Design Percentage Versus Total Construction Cost



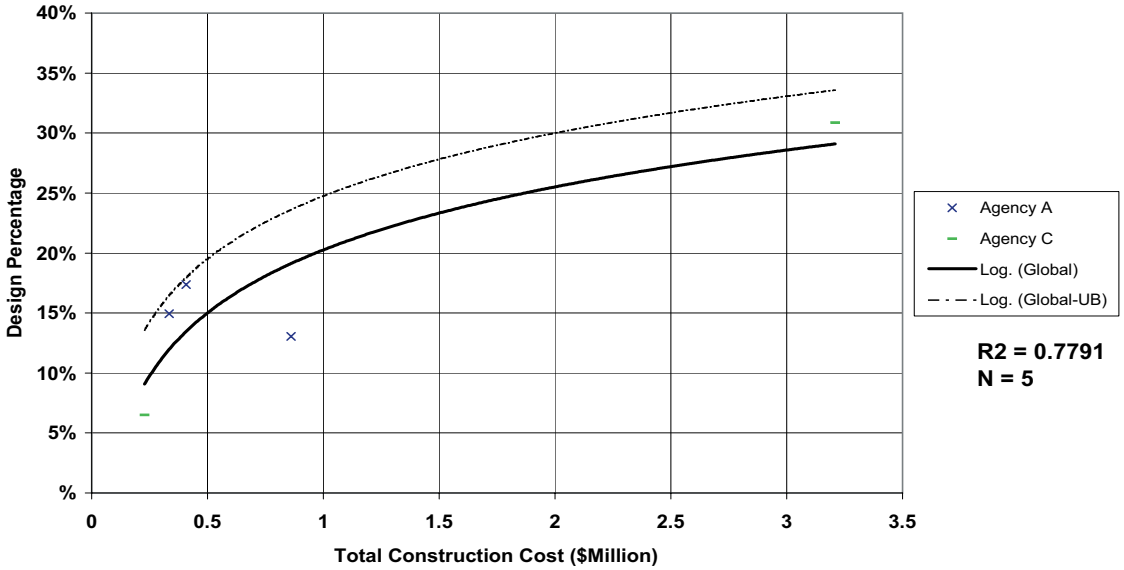
Municipal Facilities - Community Bldg./Rec. Center/CC/Gym

Design Percentage Versus Total Construction Cost



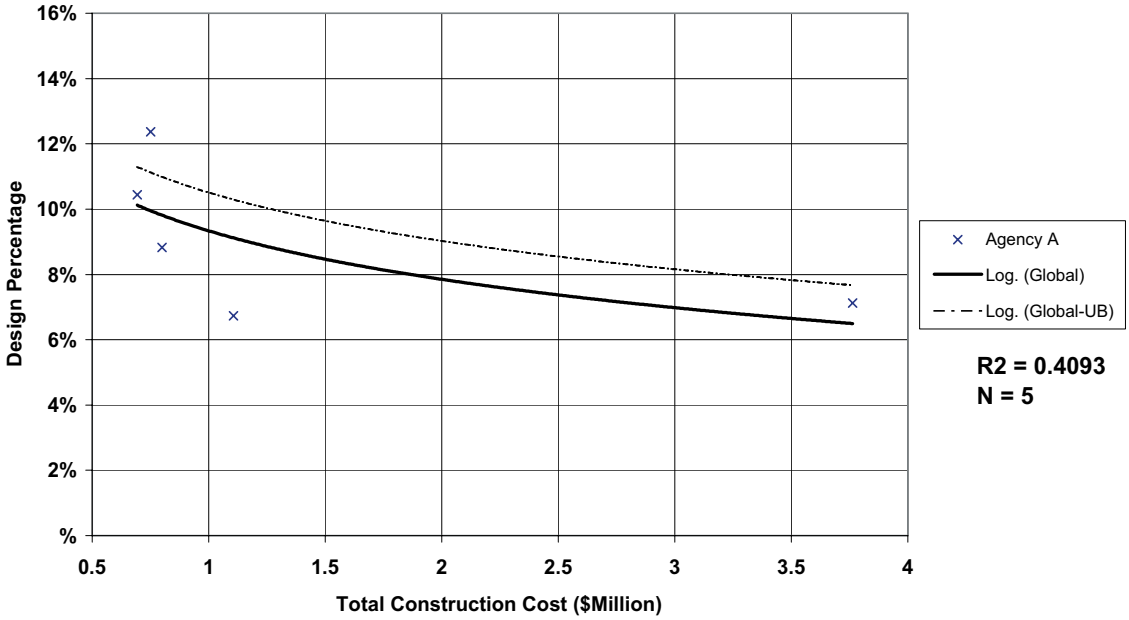
Municipal Facilities - Libraries

Design Percentage Versus Total Construction Cost



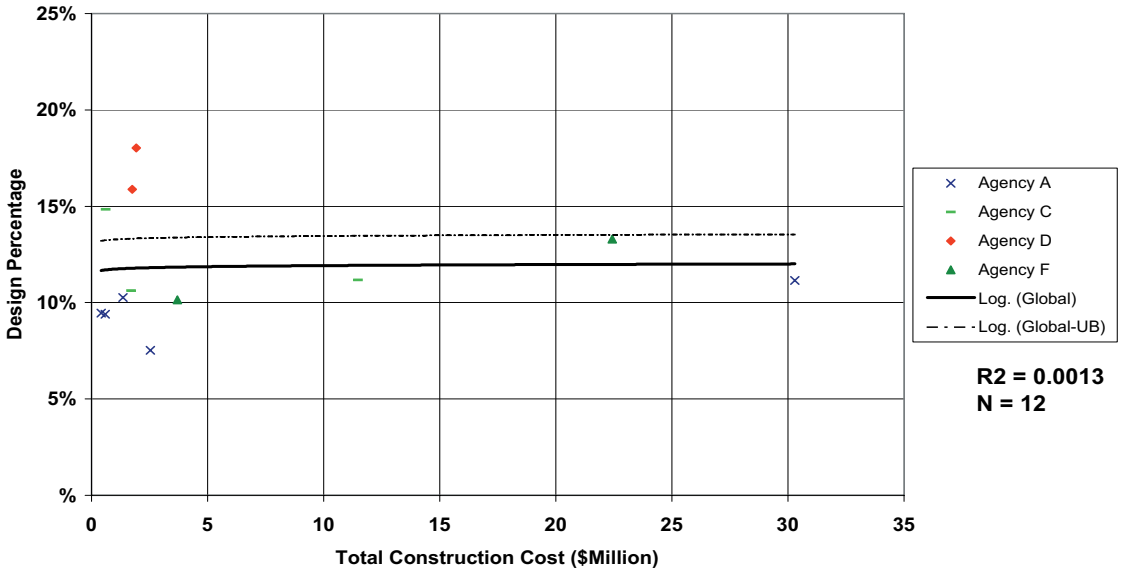
Municipal Facilities - Office - (TIs)

Design Percentage Versus Total Construction Cost



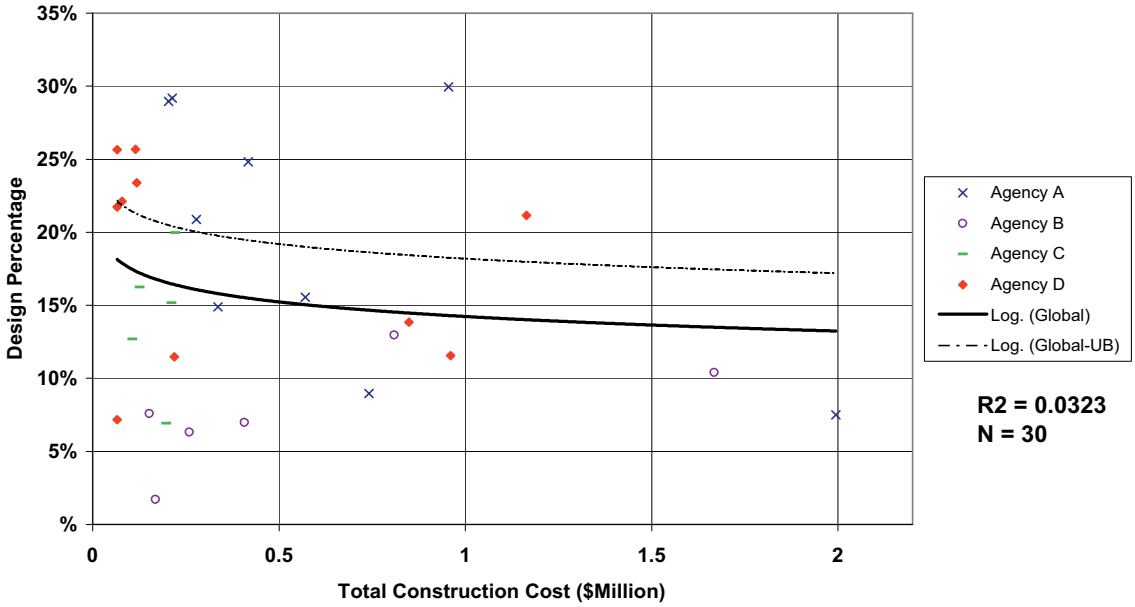
Municipal Facilities - Police / Fire Station

Design Percentage Versus Total Construction Cost



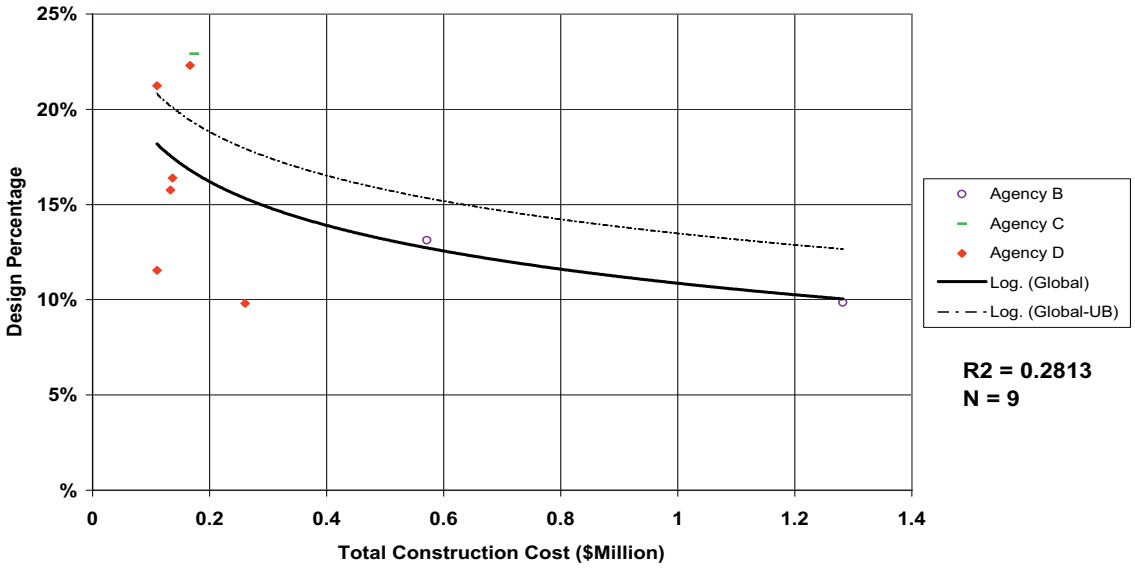
Parks - Park Development/Additions

Design Percentage Versus Total Construction Cost



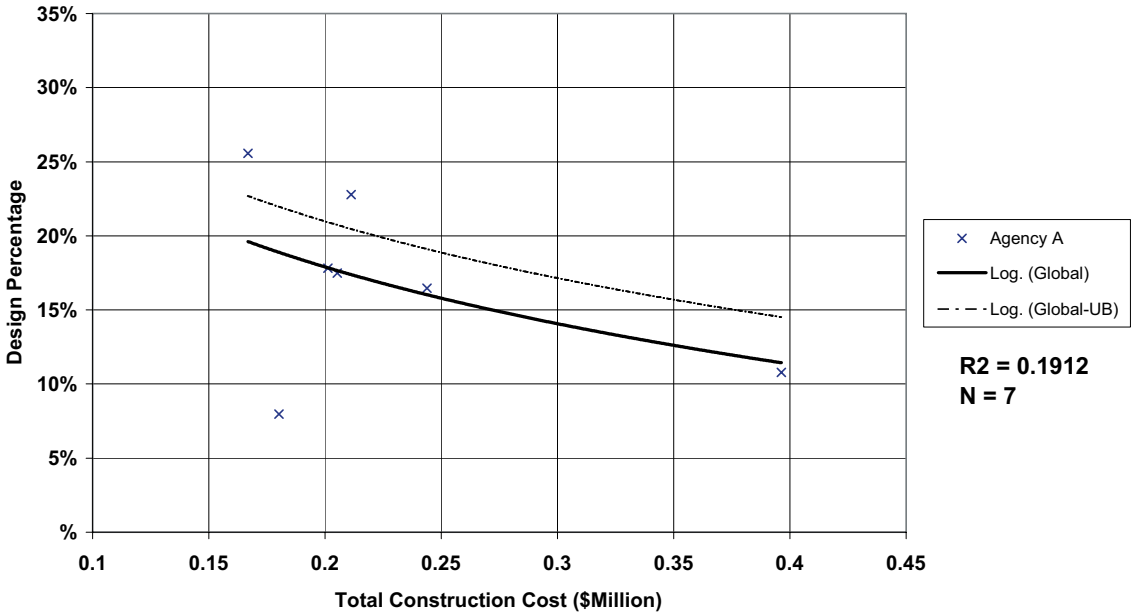
Parks - Restrooms

Design Percentage Versus Total Construction Cost



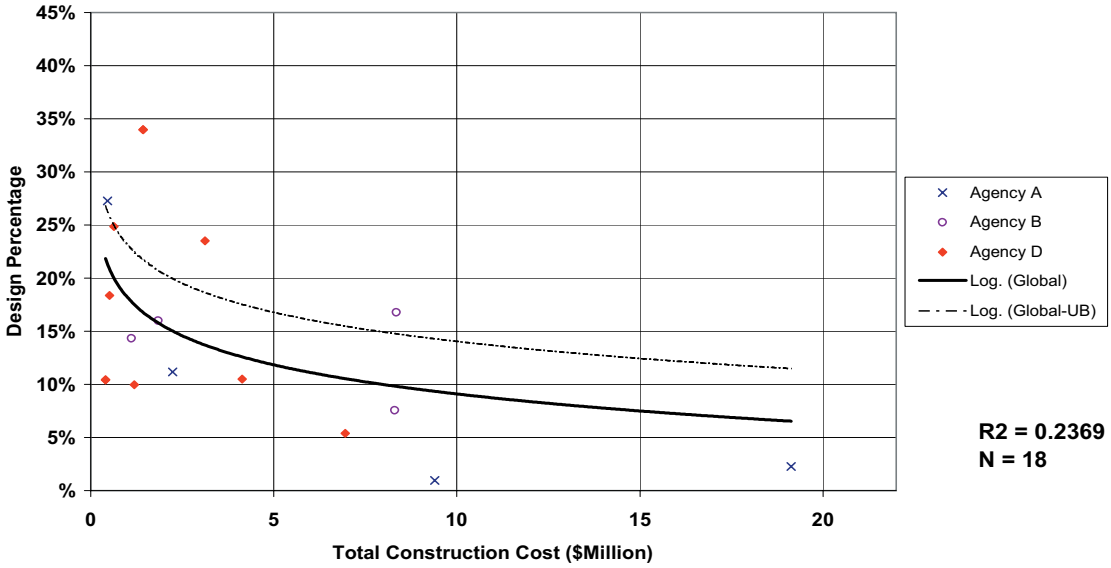
Parks - Sports Lighting Projects

Design Percentage Versus Total Construction Cost



Pipes & Plants - Gravity Pipes

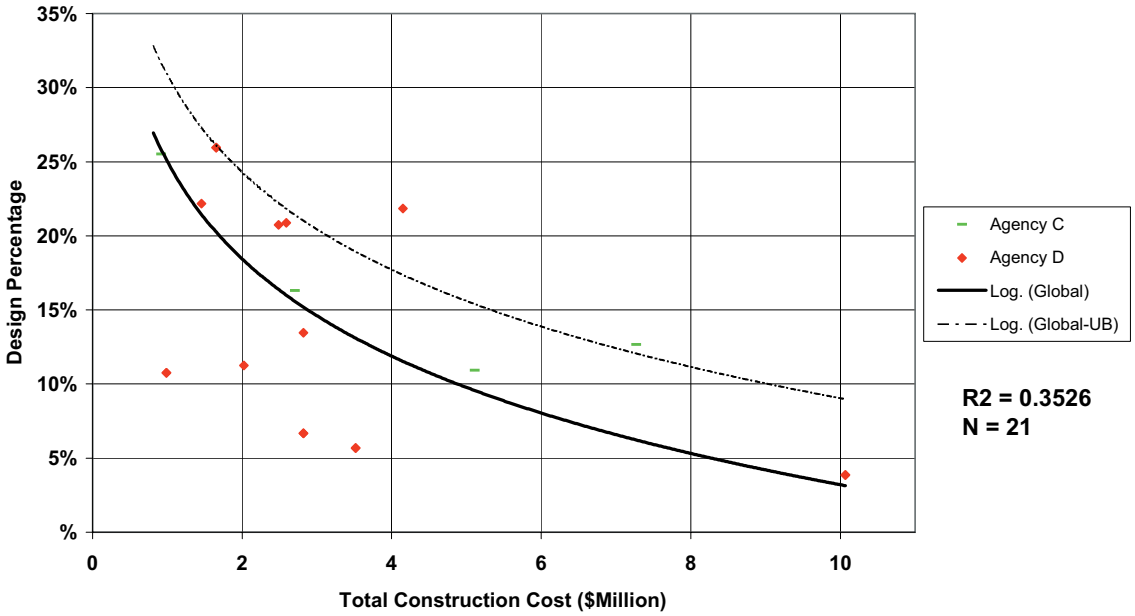
Design Percentage Versus Total Construction Cost



R2 = 0.2369
N = 18

Pipes & Plants - Pressure Pipes

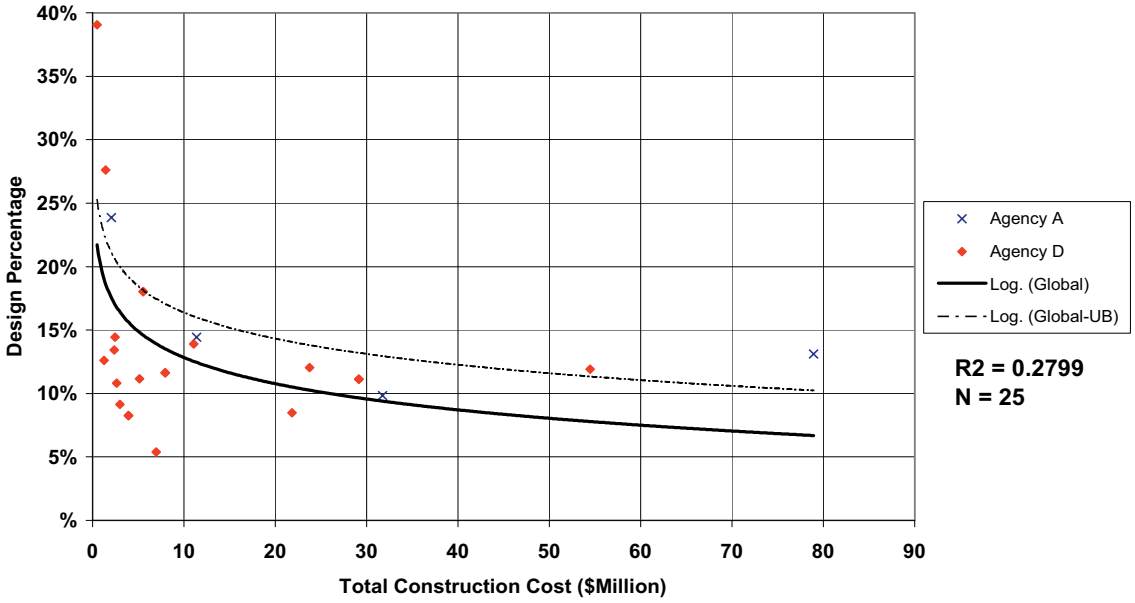
Design Percentage Versus Total Construction Cost



R2 = 0.3526
N = 21

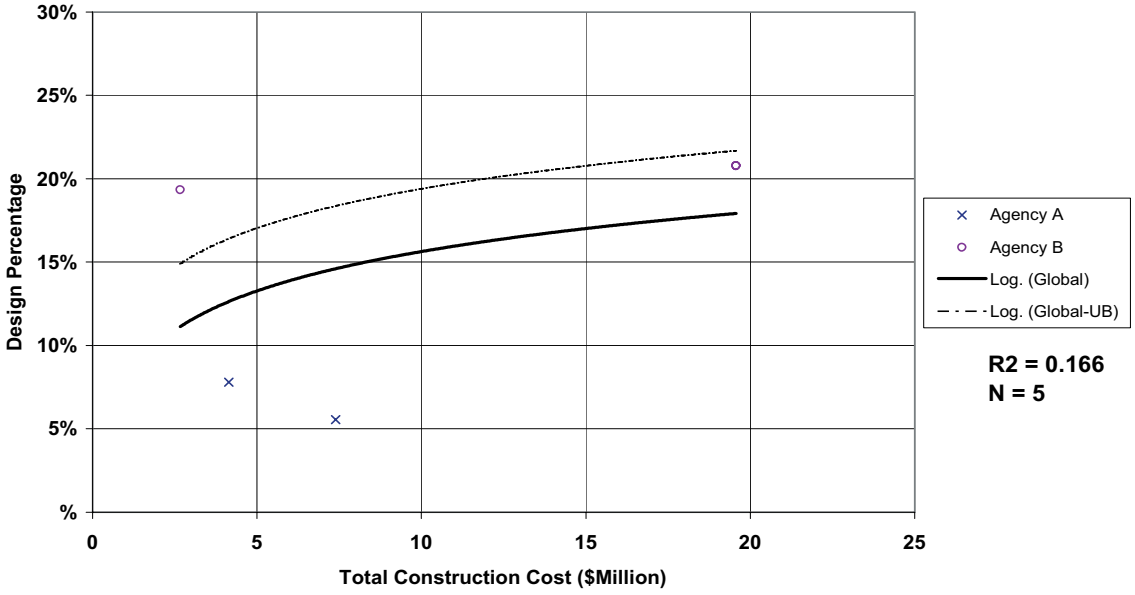
Pipes & Plants - Treatment Plants

Design Percentage Versus Total Construction Cost



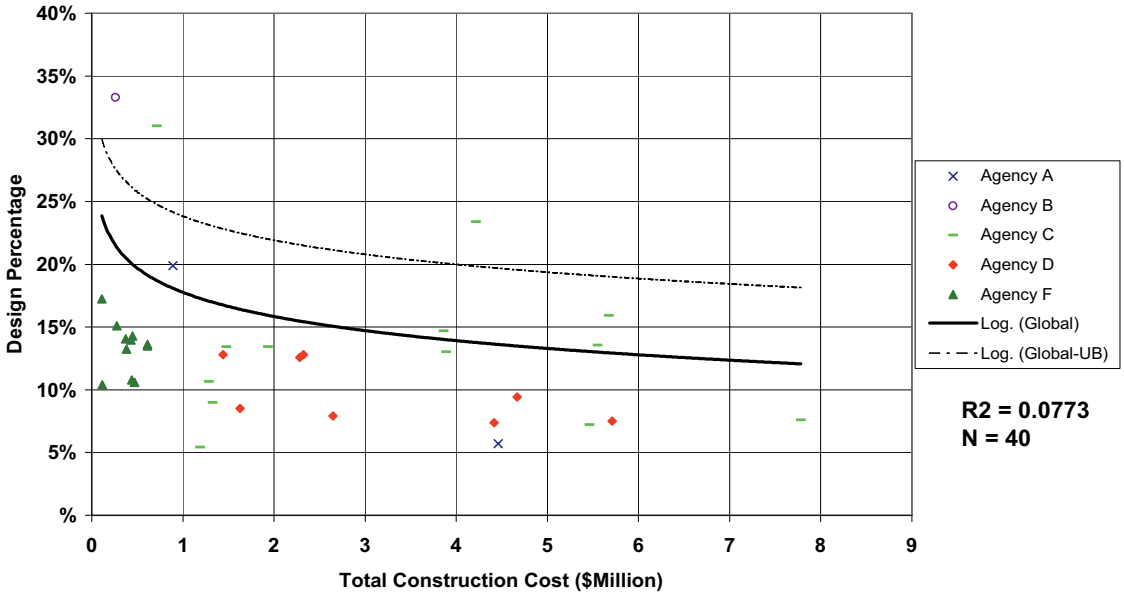
Streets - New Construction

Design Percentage Versus Total Construction Cost



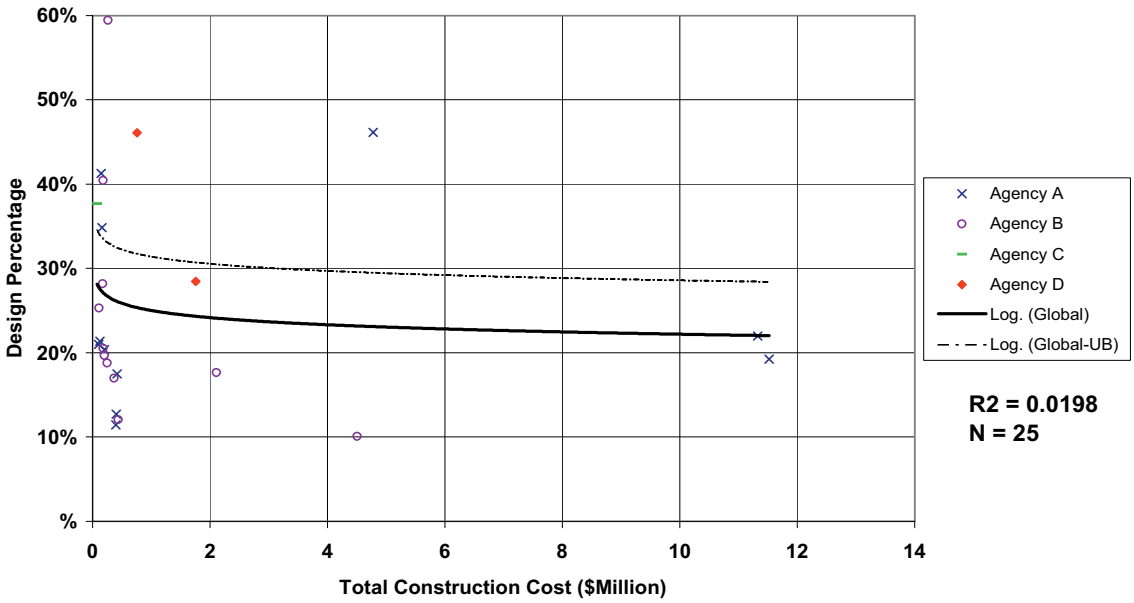
Streets - Reconstruction

Design Percentage Versus Total Construction Cost



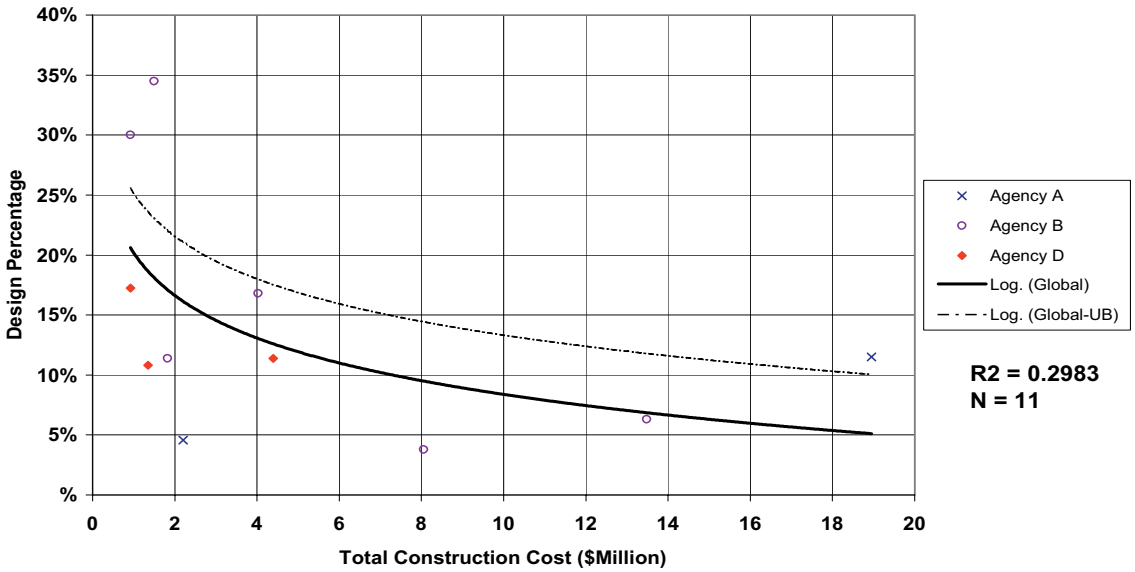
Streets - Signals & ITS

Design Percentage Versus Total Construction Cost



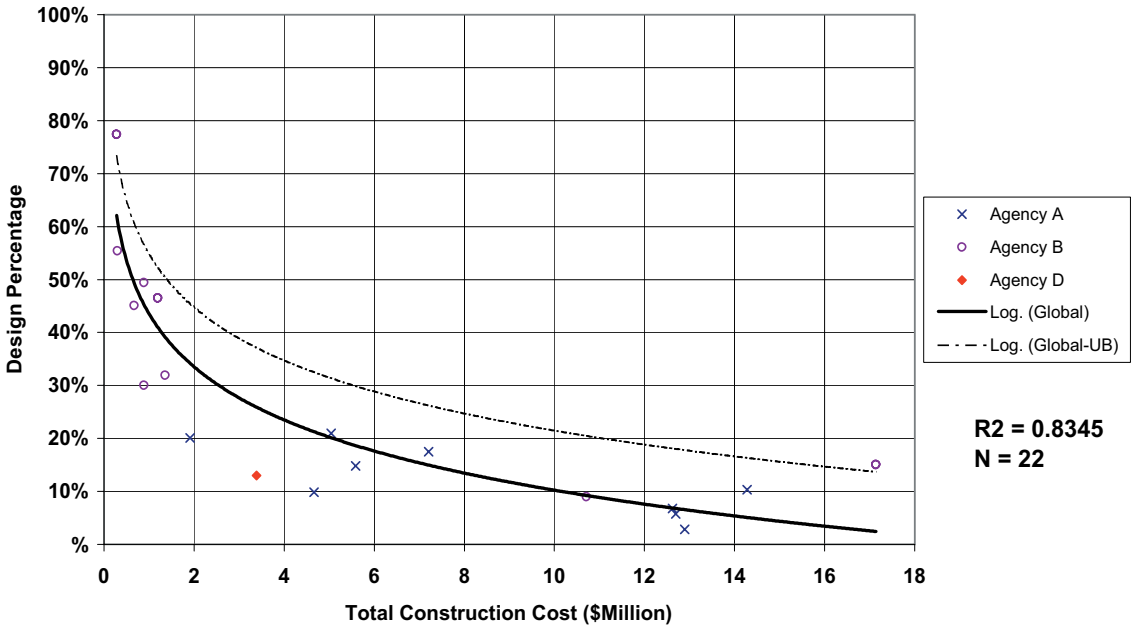
Streets - Bridges - (Retrofits & New)

Design Percentage Versus Total Construction Cost



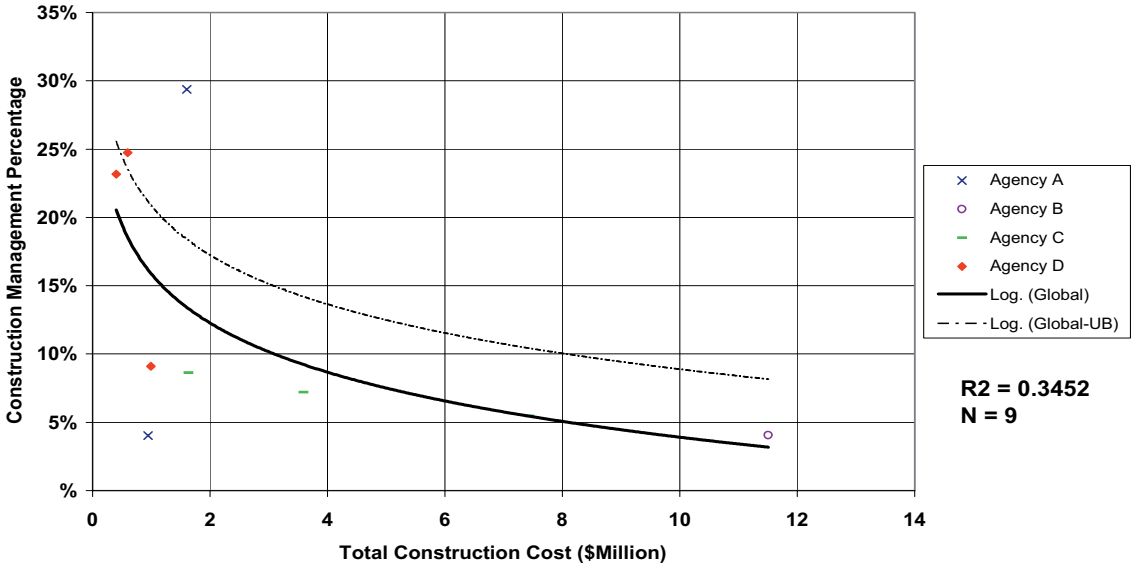
Streets - Widening

Design Percentage Versus Total Construction Cost



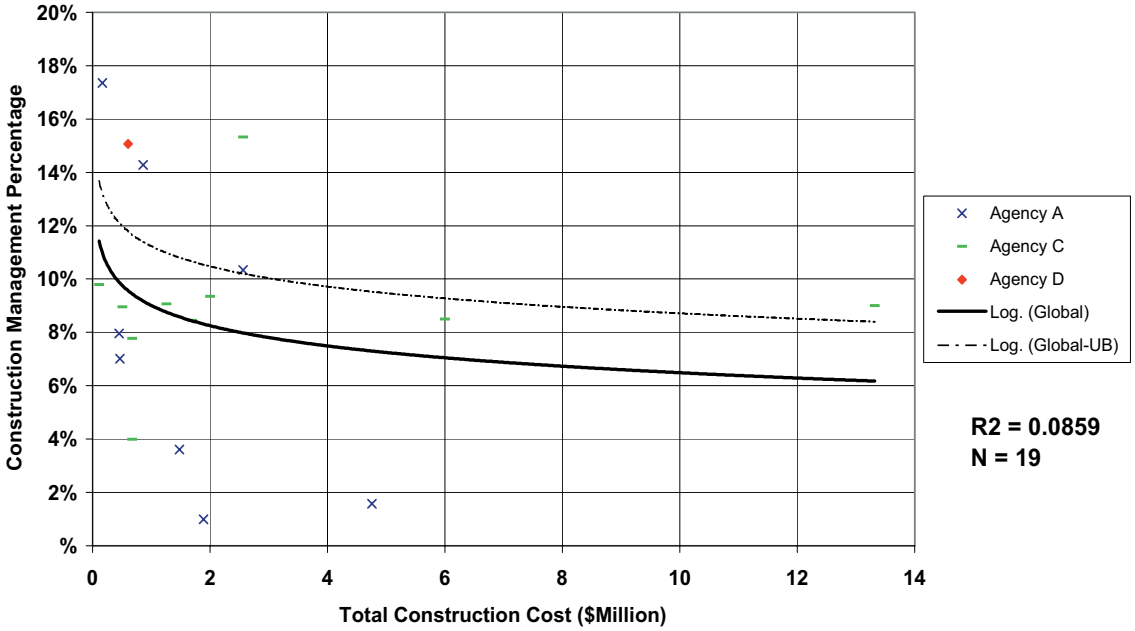
Flood Control - Detention Channels / Structural

Construction Management Percentage Versus Total Construction Cost



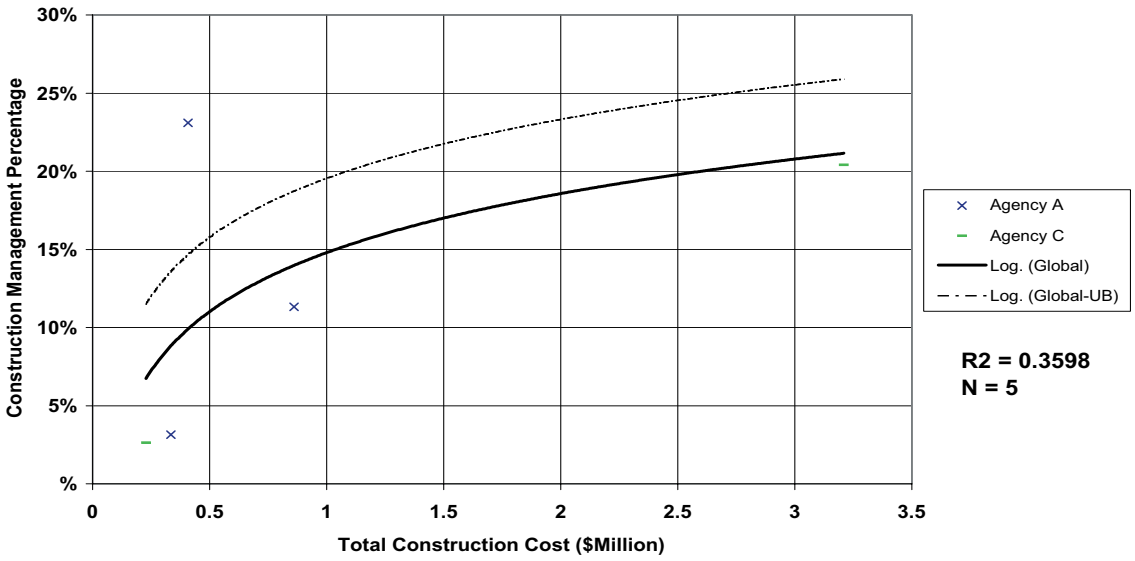
Municipal Facilities - Community Bldg./Rec. Center/CC/Gym

Construction Management Percentage Versus Total Construction Cost



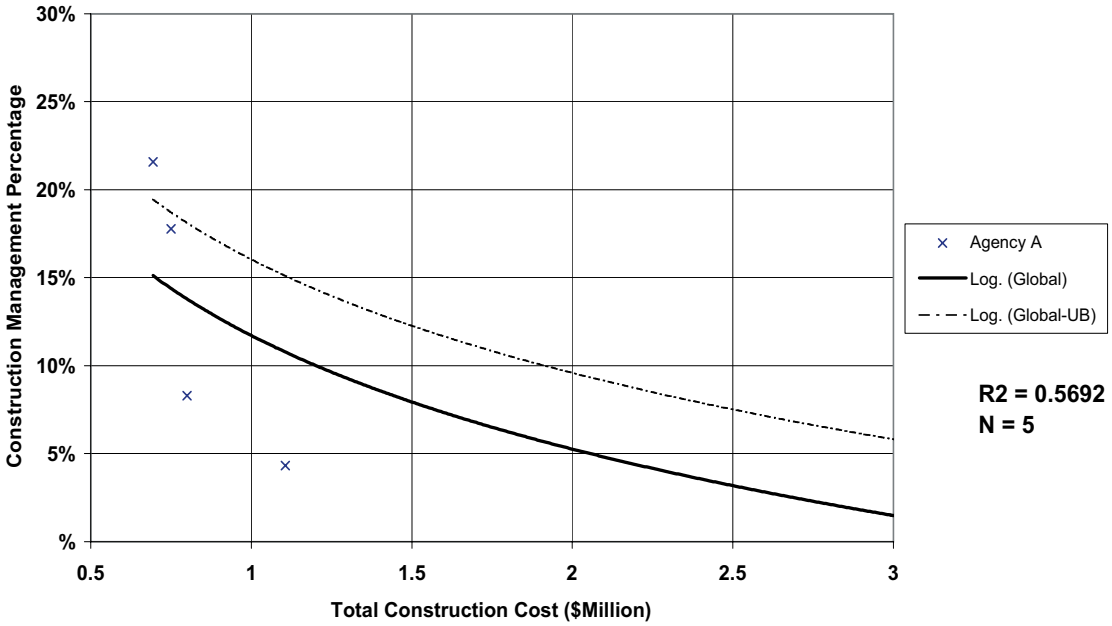
Municipal Facilities - Libraries

Construction Management Percentage Versus Total Construction Cost



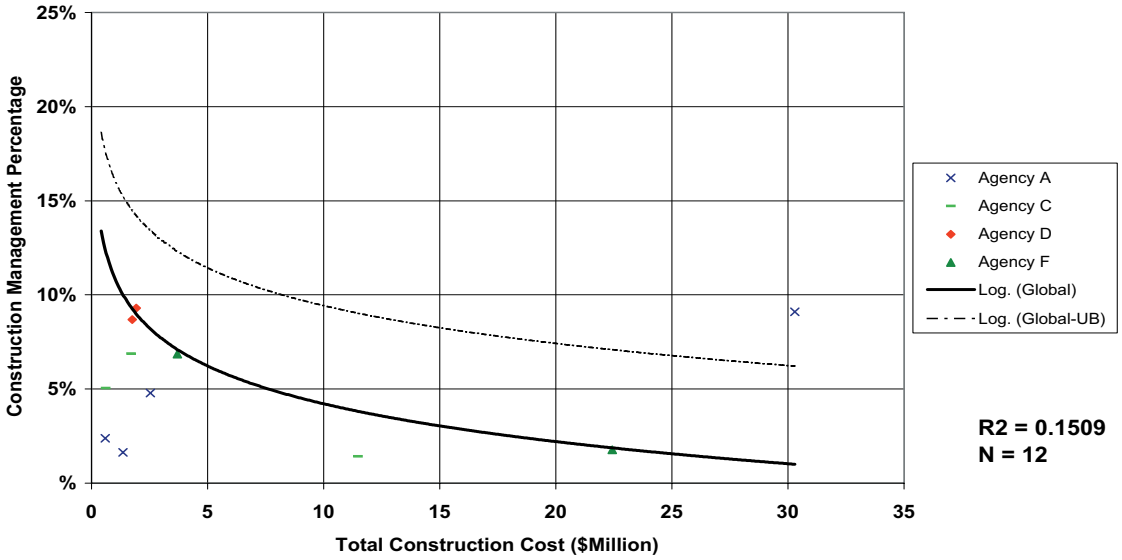
Municipal Facilities - Office - (TIs)

Construction Management Percentage Versus Total Construction Cost



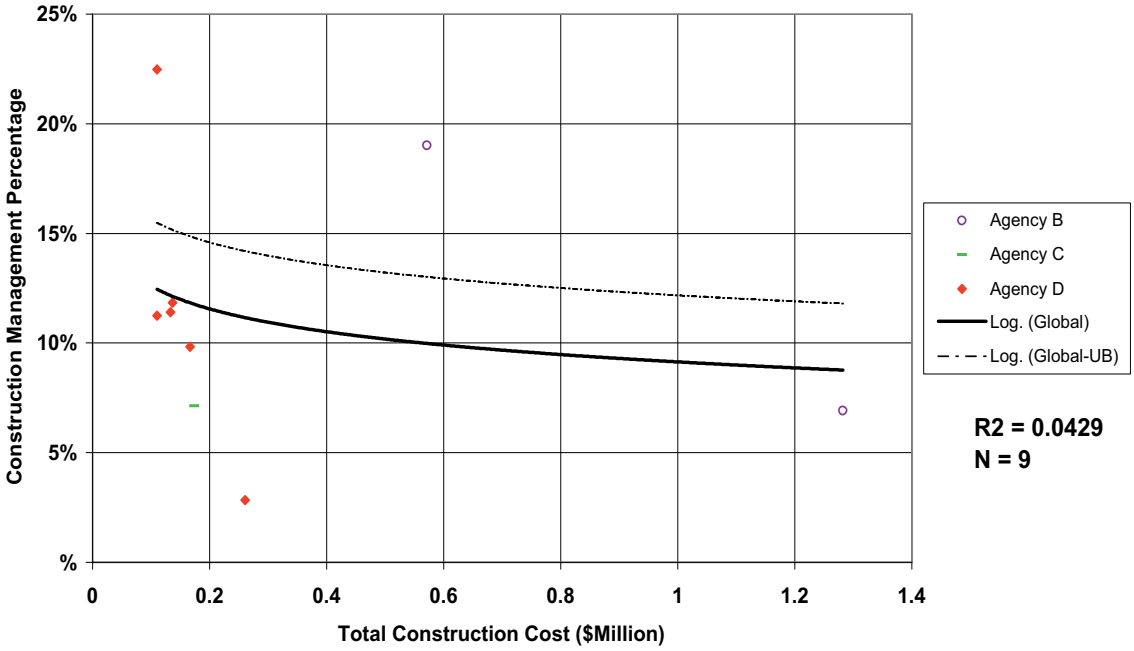
Municipal Facilities - Police / Fire Station

Construction Management Percentage Versus Total Construction Cost



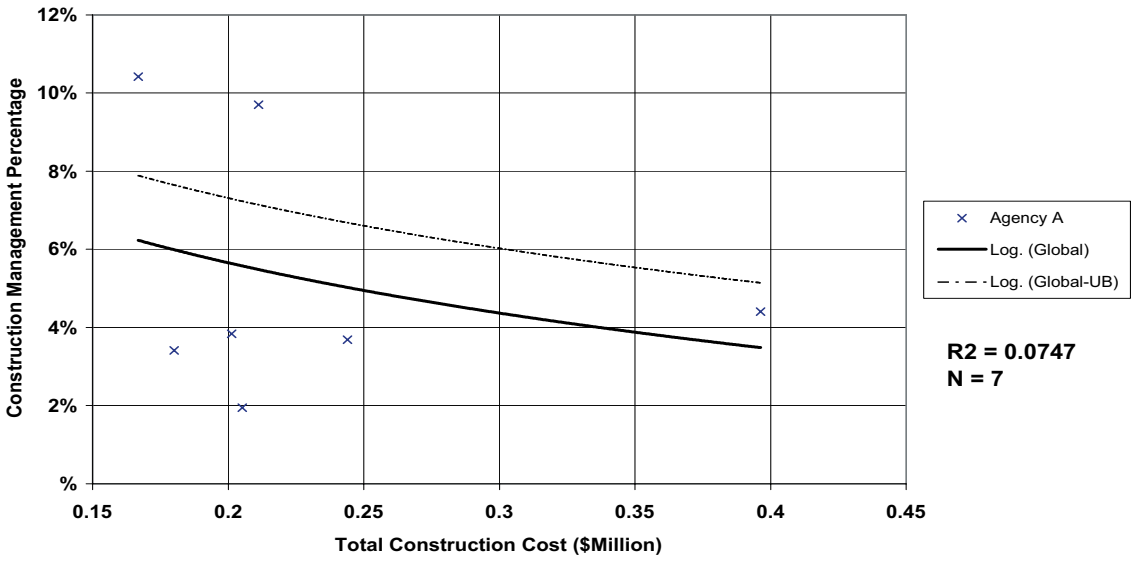
Parks - Restrooms

Construction Management Percentage Versus Total Construction Cost



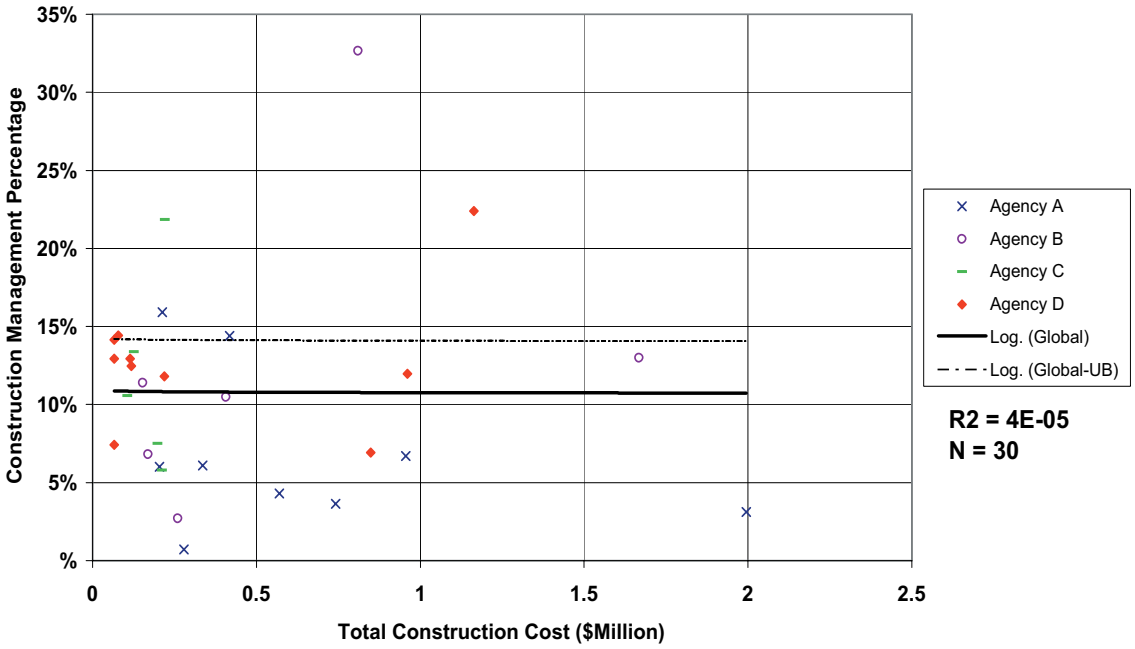
Parks - Sports Lighting Projects

Construction Management Percentage Versus Total Construction Cost



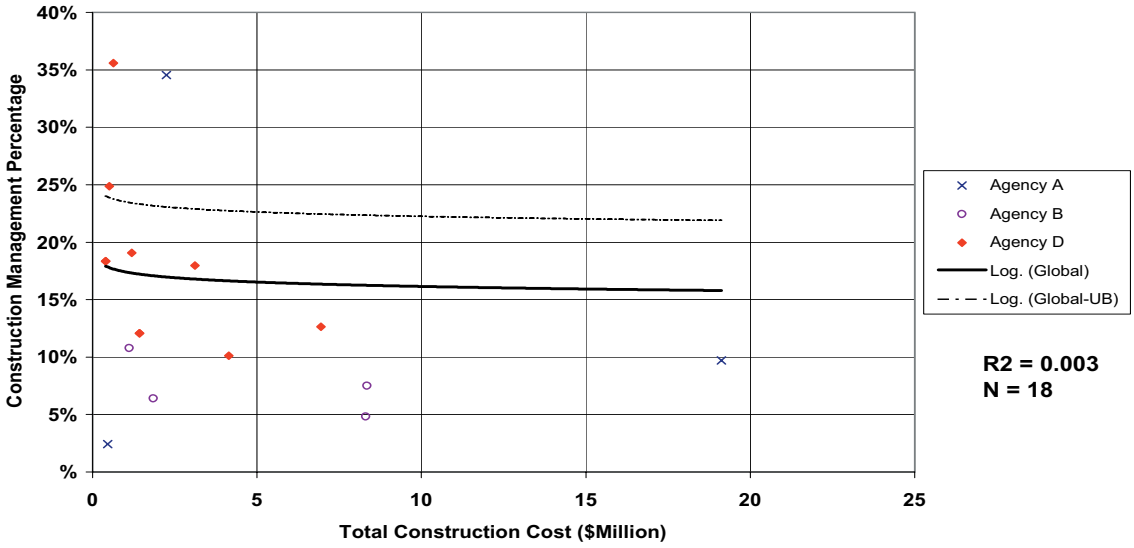
Parks - Park Development/Additions

Construction Management Percentage Versus Total Construction Cost



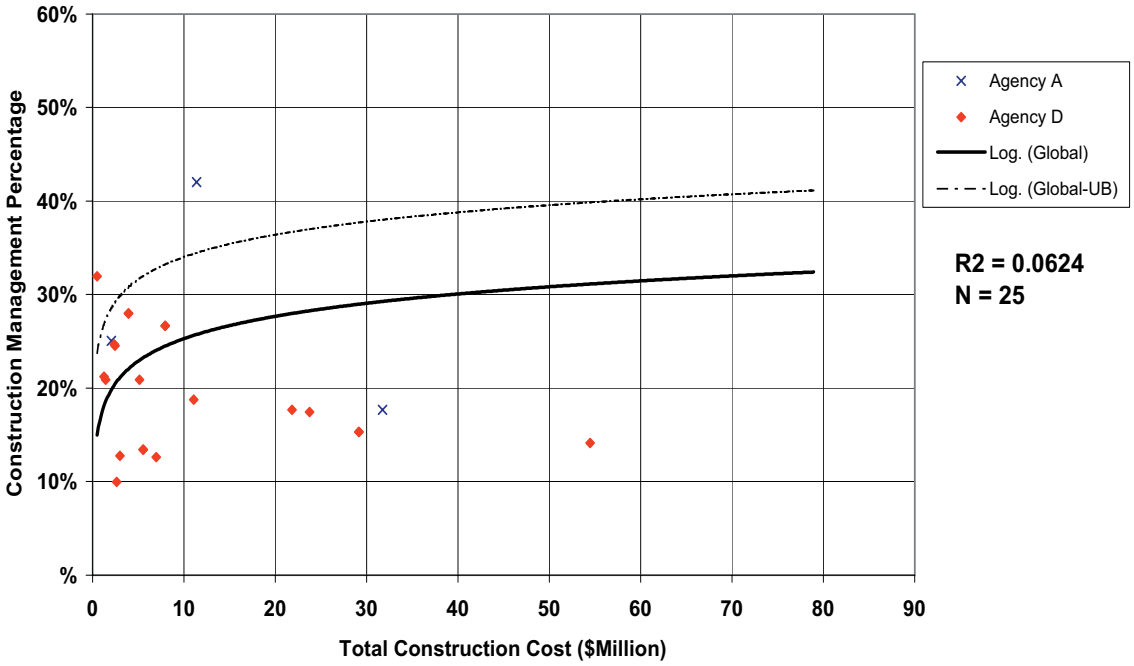
Pipes & Plants - Gravity Pipes

Construction Management Percentage Versus Total Construction Cost



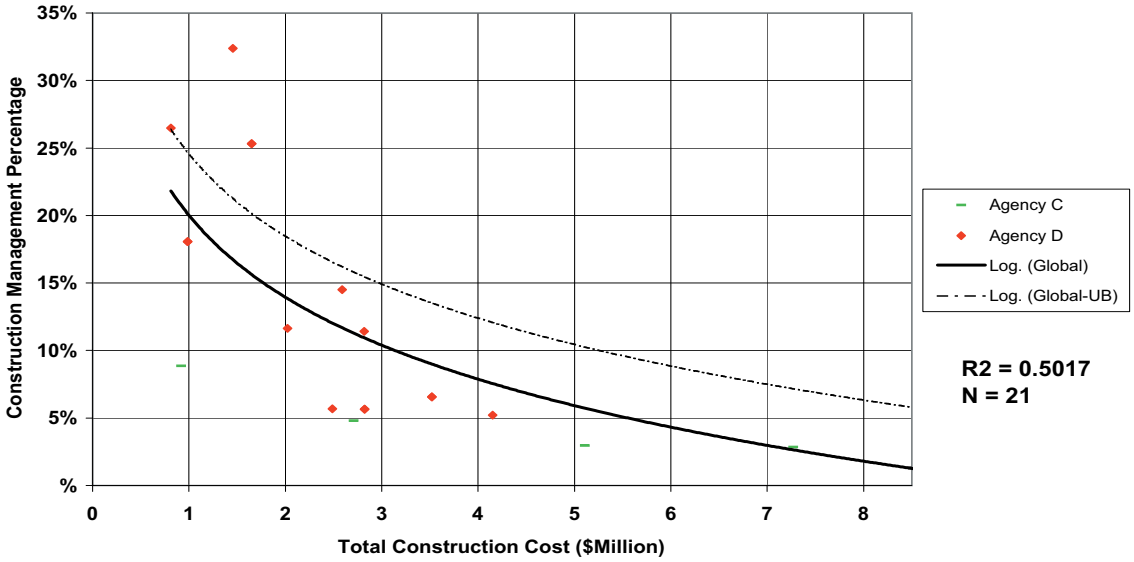
Pipes & Plants - Treatment Plants

Construction Management Percentage Versus Total Construction Cost



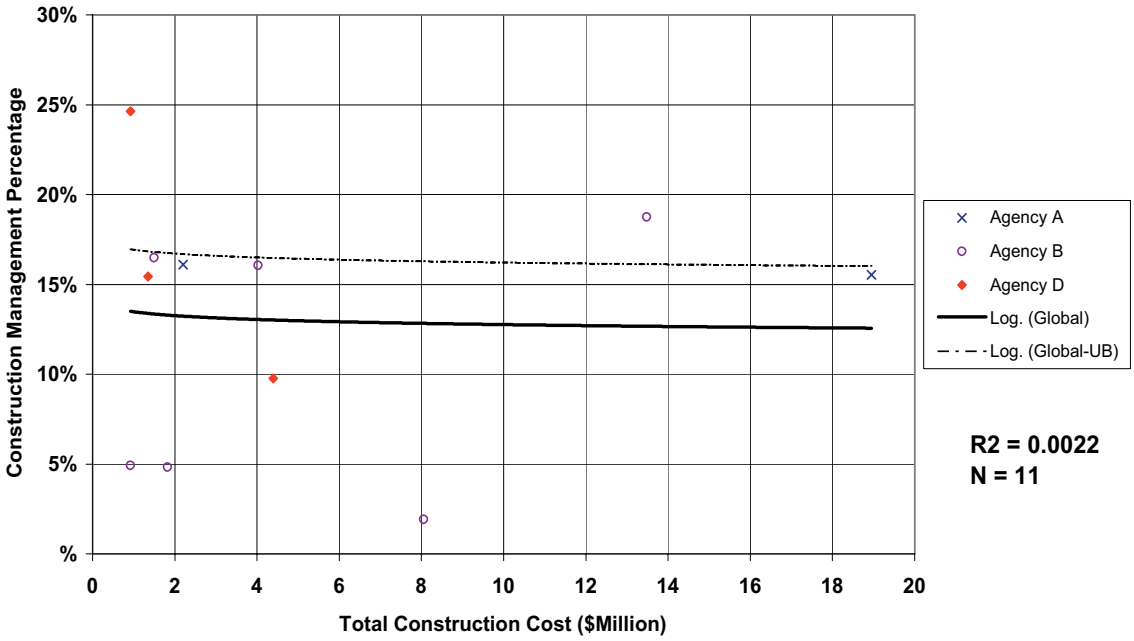
Pipes & Plants - Pressure Pipes

Construction Management Percentage Versus Total Construction Cost



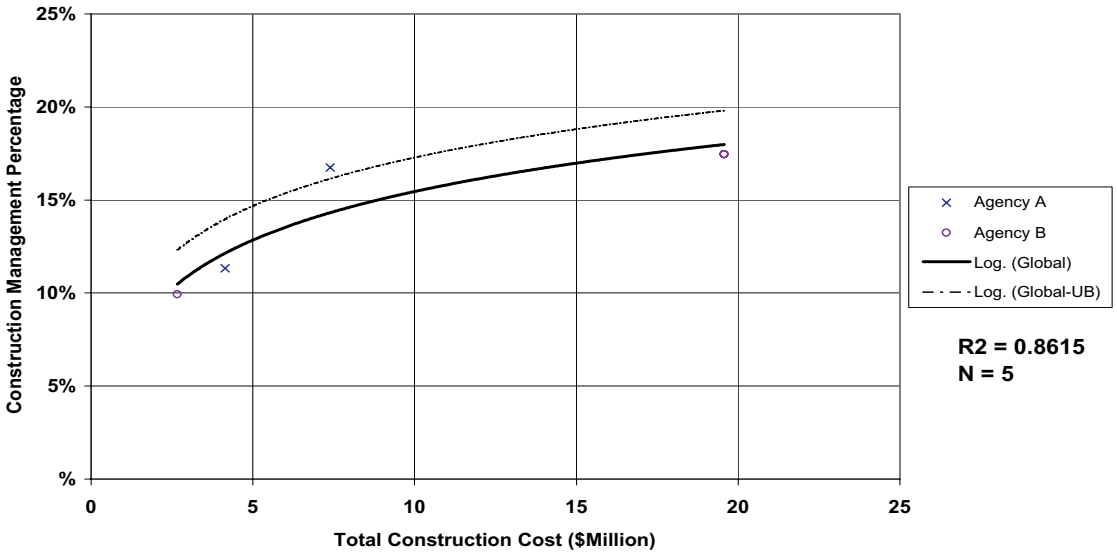
Streets - Bridges - (Retrofits & New)

Construction Management Percentage Versus Total Construction Cost



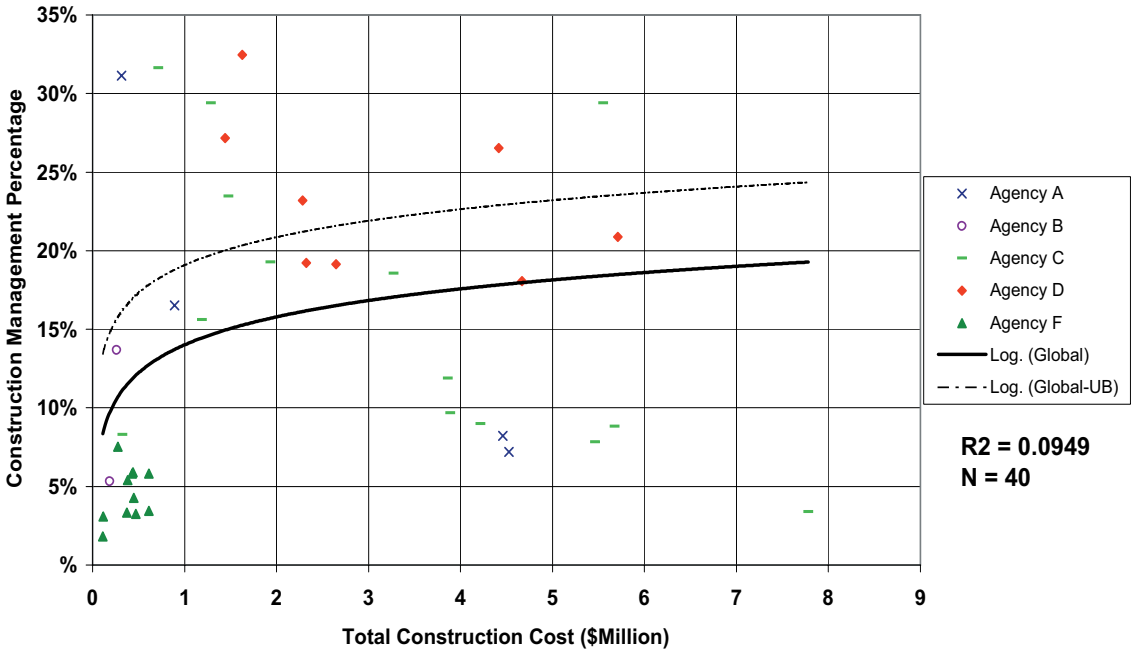
Streets - New Construction

Construction Management Percentage Versus Total Construction Cost



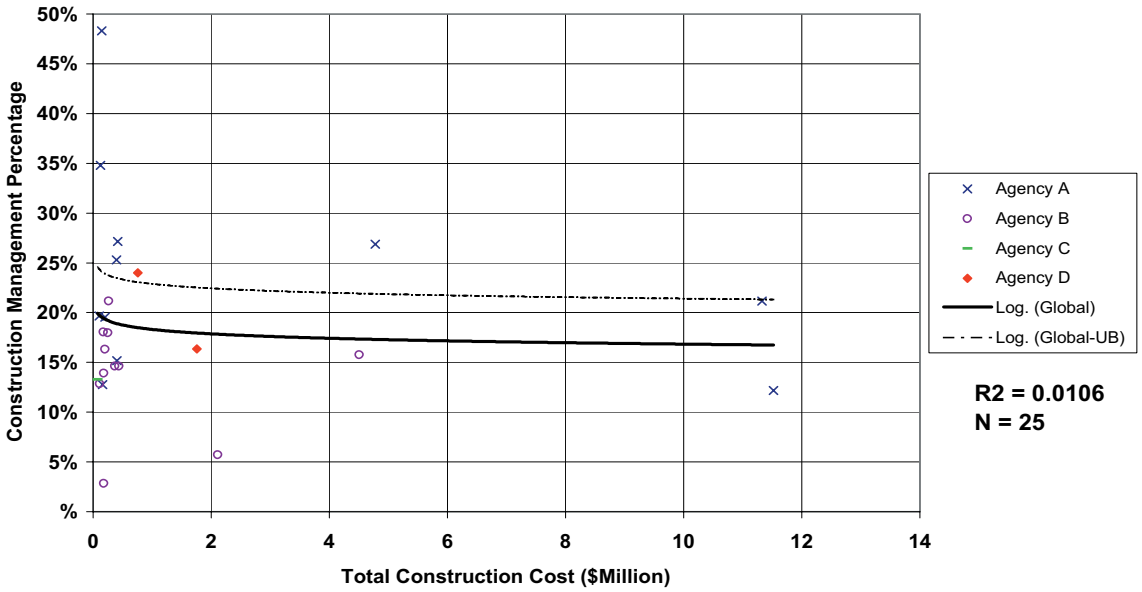
Streets - Reconstruction

Construction Management Percentage Versus Total Construction Cost



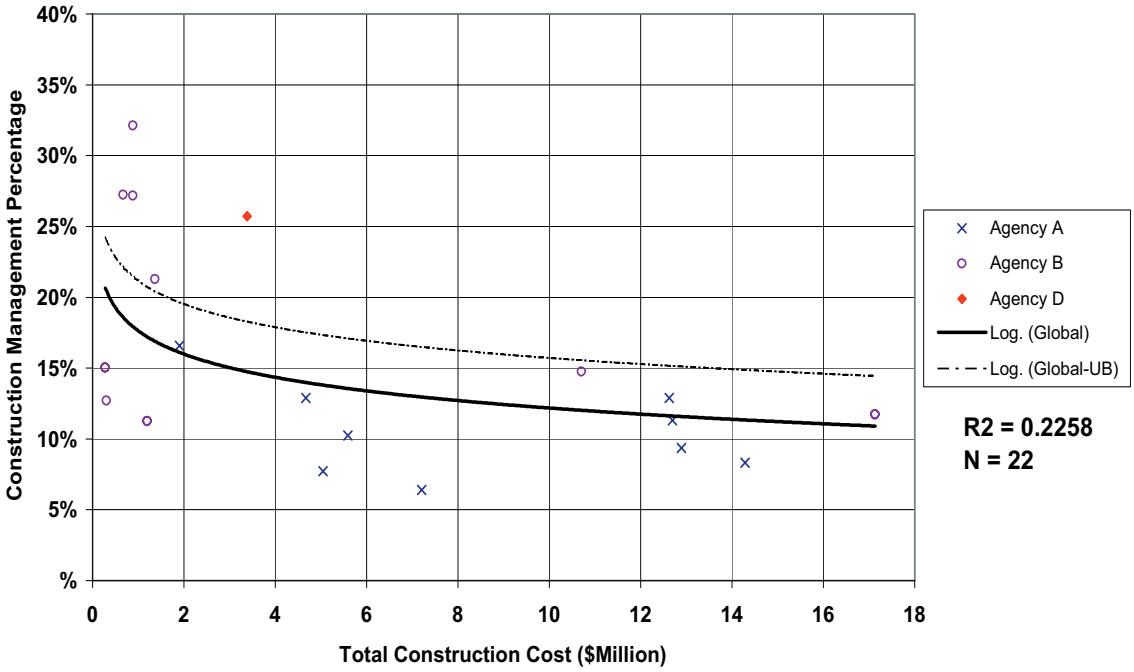
Streets - Signals & ITS

Construction Management Percentage Versus Total Construction Cost



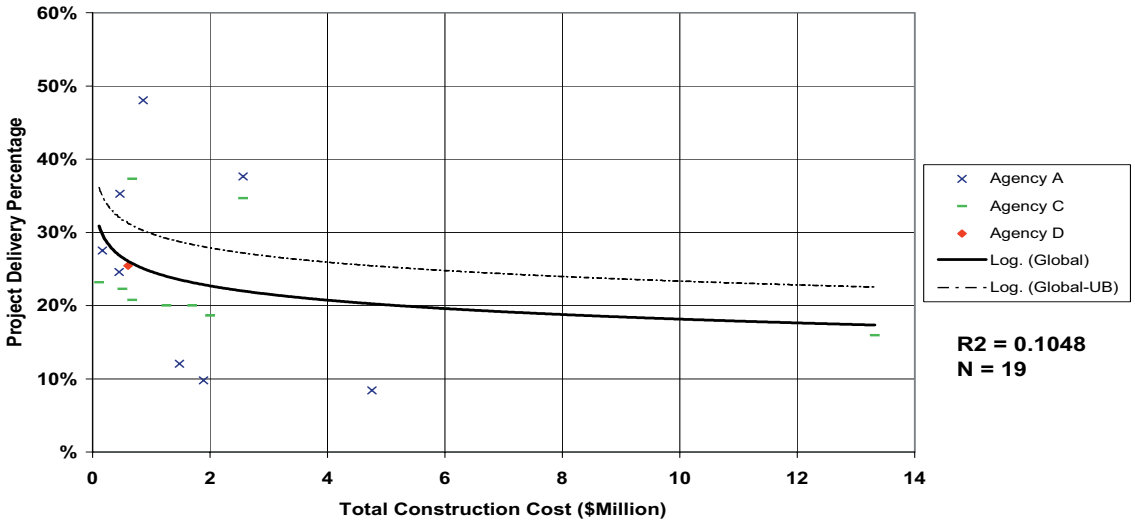
Streets - Widening

Construction Management Percentage Versus Total Construction Cost



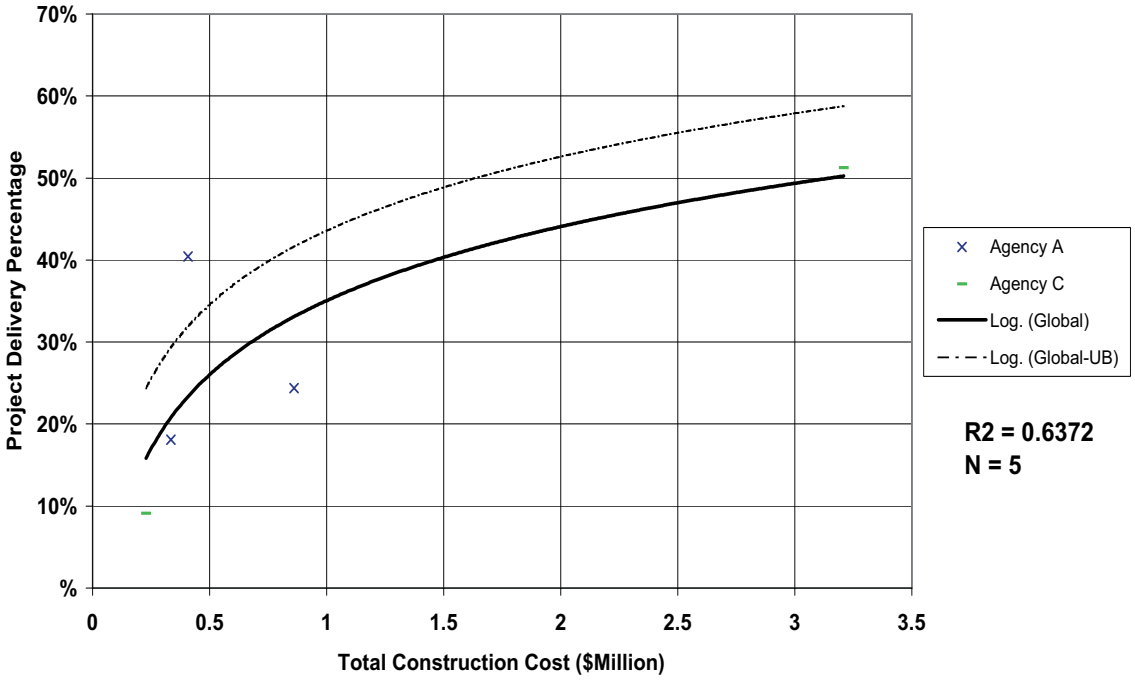
Municipal Facilities - Community Bldg./Rec. Center/CC/Gym

Project Delivery Percentage Versus Total Construction Cost



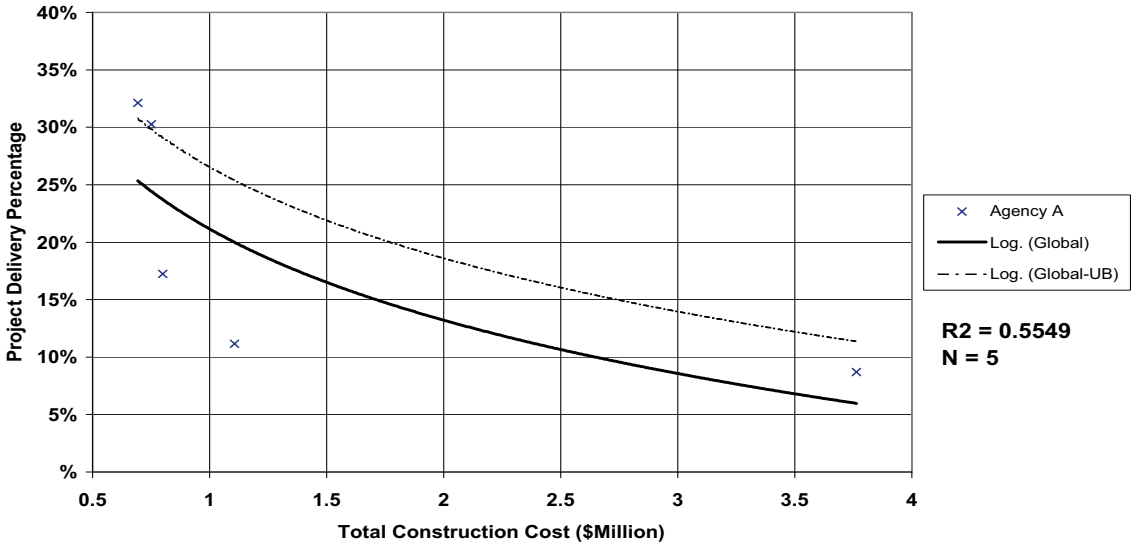
Municipal Facilities - Libraries

Project Delivery Percentage Versus Total Construction Cost



Municipal Facilities - Office - (TIs)

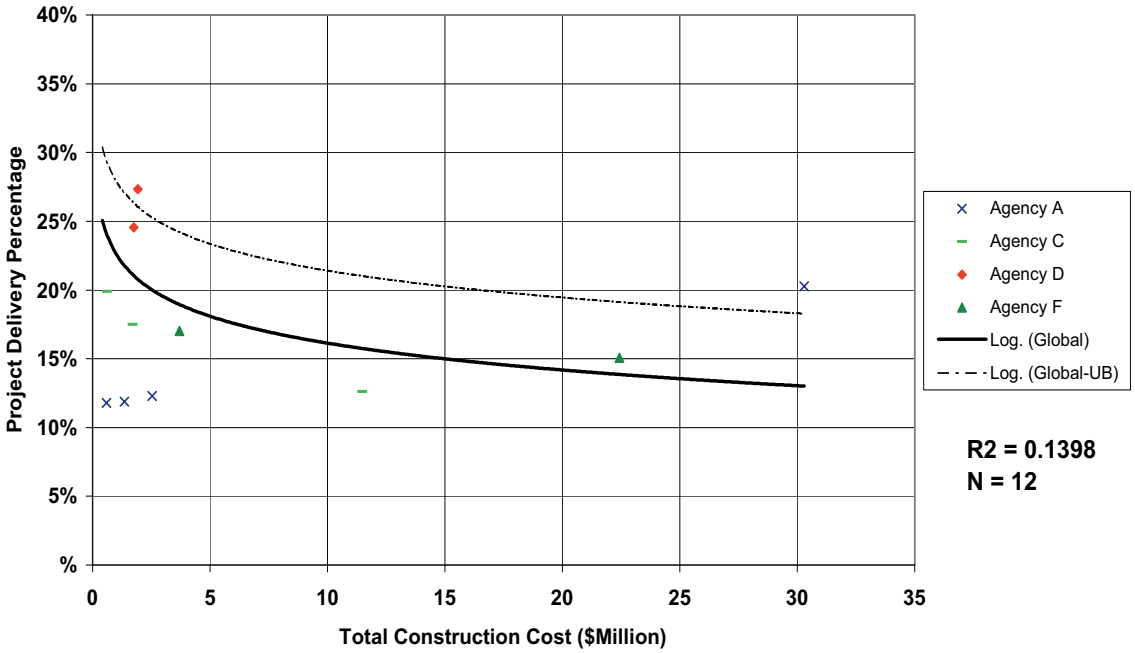
Project Delivery Percentage Versus Total Construction Cost



R2 = 0.5549
N = 5

Municipal Facilities - Police / Fire Station

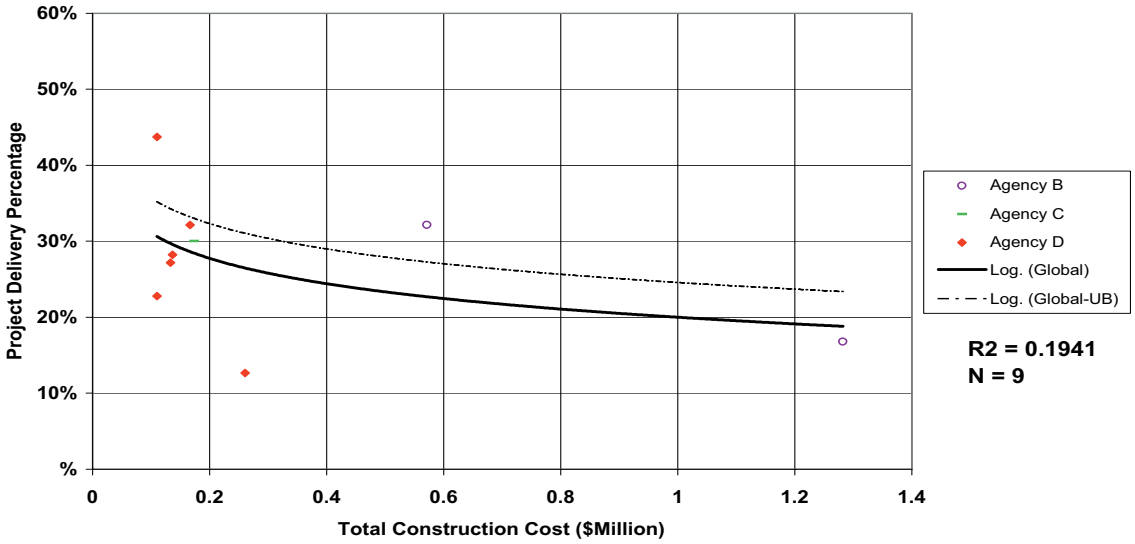
Project Delivery Percentage Versus Total Construction Cost



R2 = 0.1398
N = 12

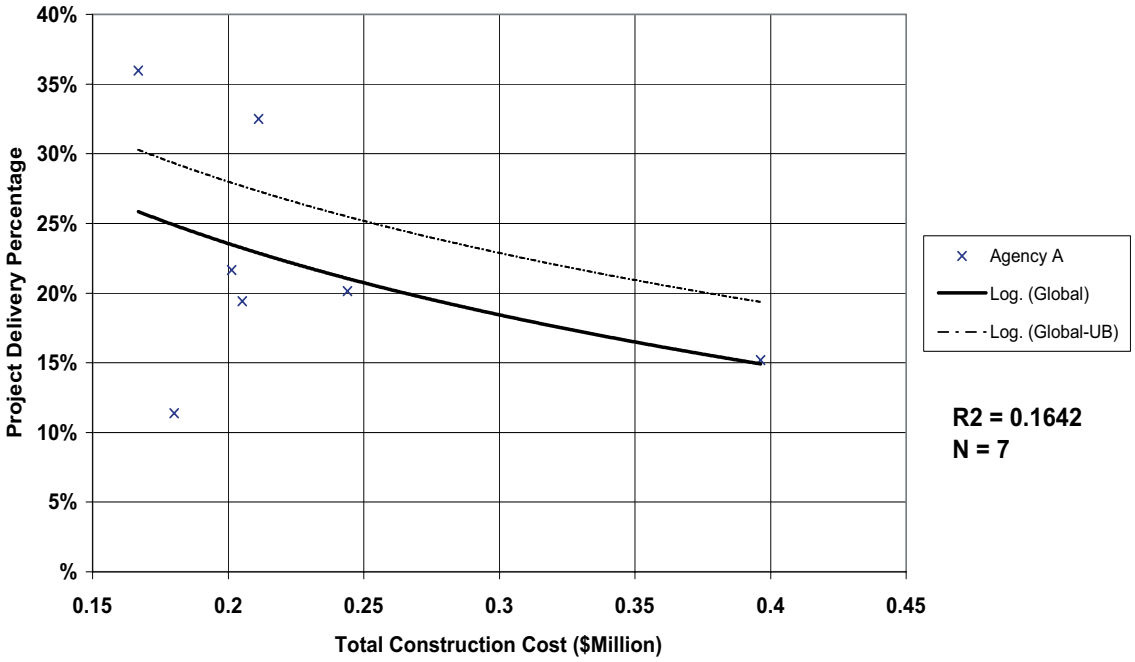
Parks - Restrooms

Project Delivery Percentage Versus Total Construction Cost



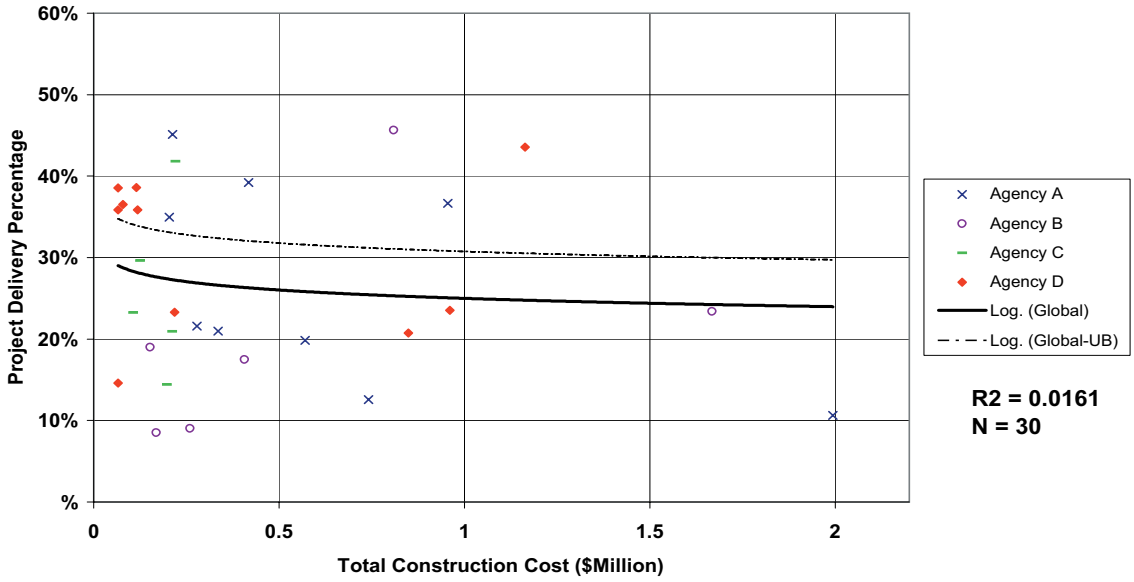
Parks - Sports Lighting Projects

Project Delivery Percentage Versus Total Construction Cost



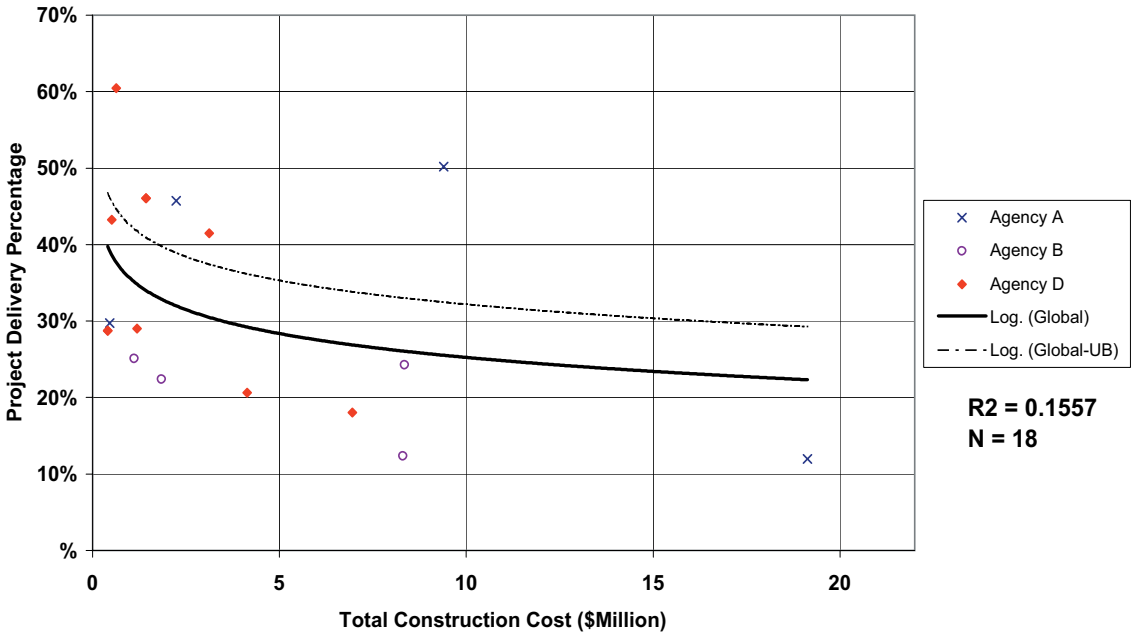
Parks - Park Development/Additions

Project Delivery Percentage Versus Total Construction Cost



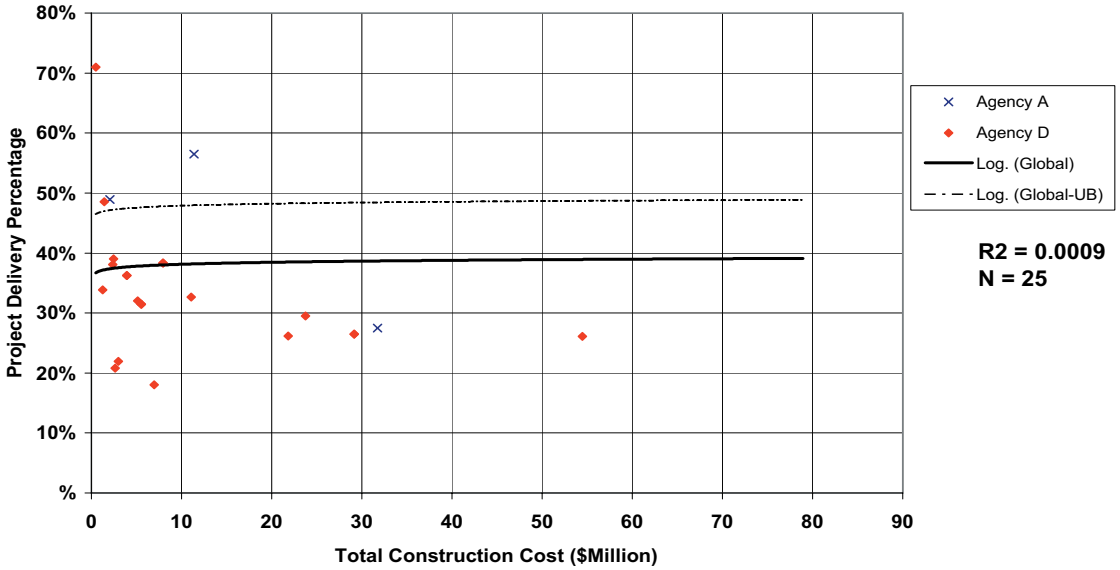
Pipes & Plants - Gravity Pipes

Project Delivery Percentage Versus Total Construction Cost



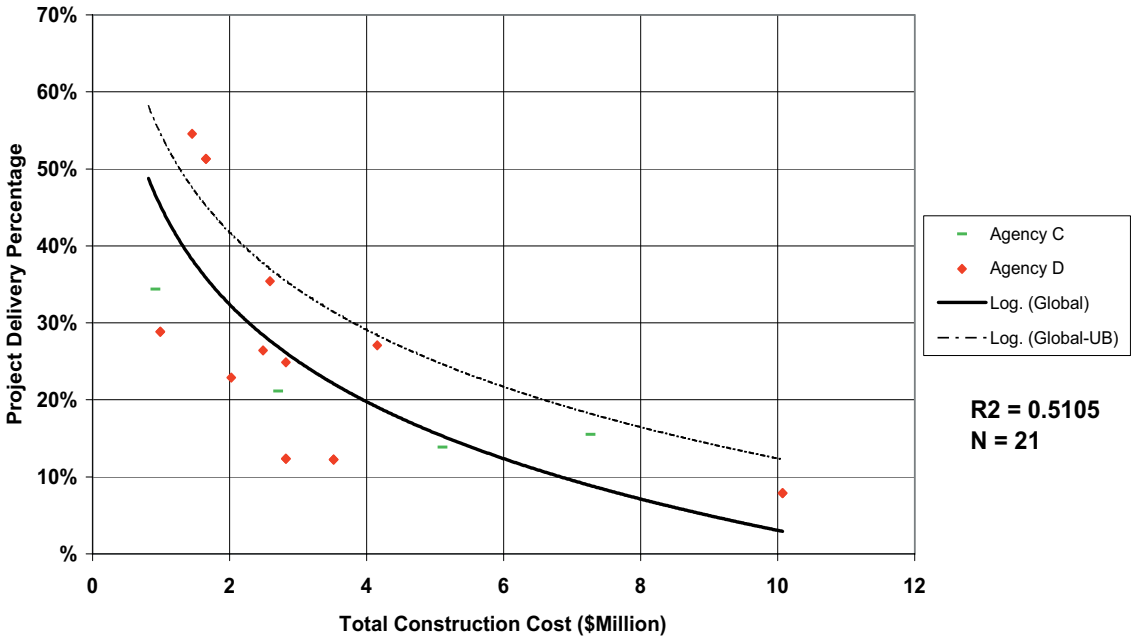
Pipes & Plants - Treatment Plants

Project Delivery Percentage Versus Total Construction Cost



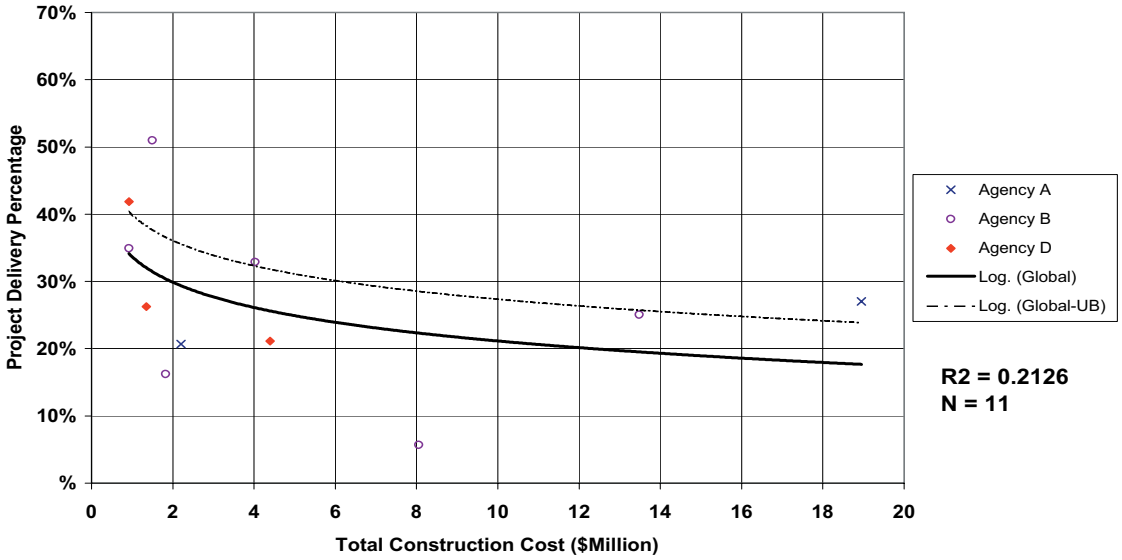
Pipes & Plants - Pressure Pipes

Project Delivery Percentage Versus Total Construction Cost



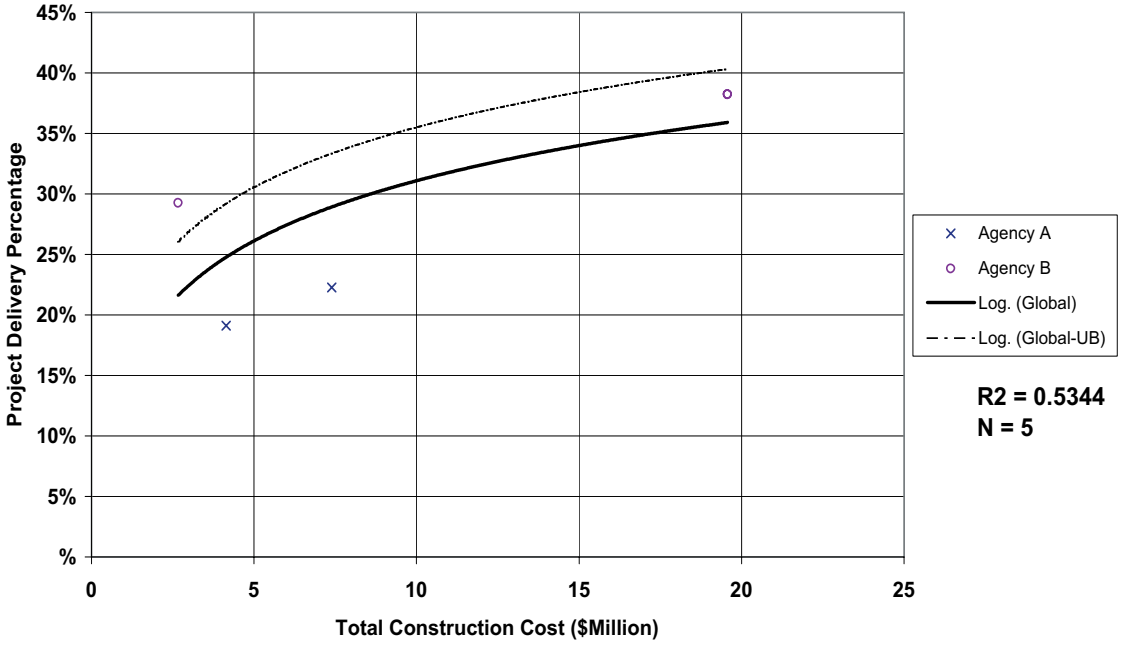
Streets - Bridges - (Retrofits & New)

Project Delivery Percentage Versus Total Construction Cost



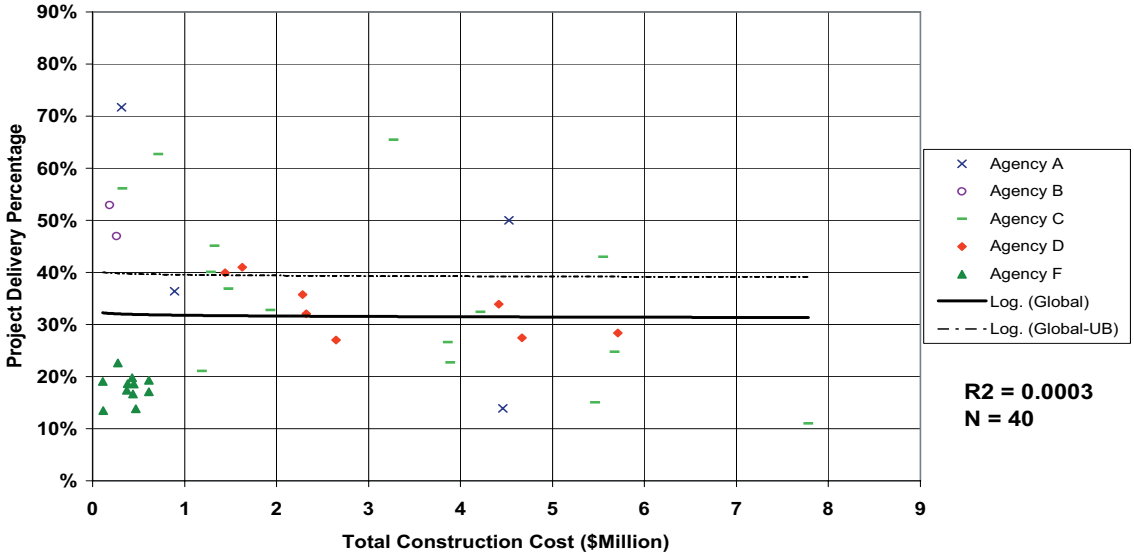
Streets - New Construction

Project Delivery Percentage Versus Total Construction Cost



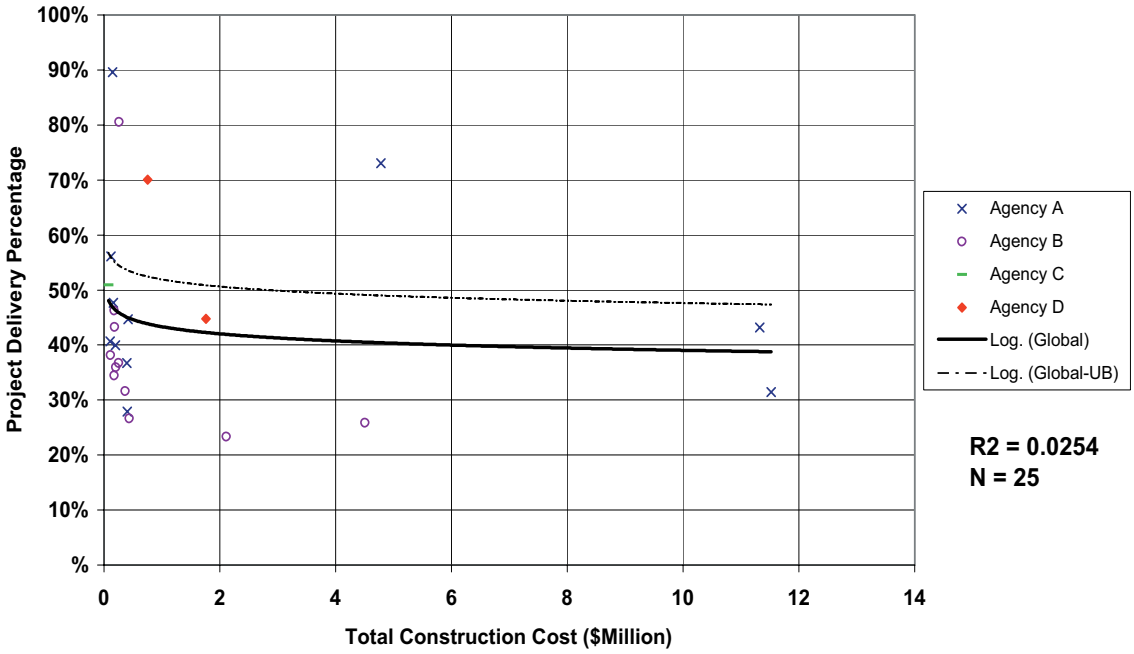
Streets - Reconstruction

Project Delivery Percentage Versus Total Construction Cost



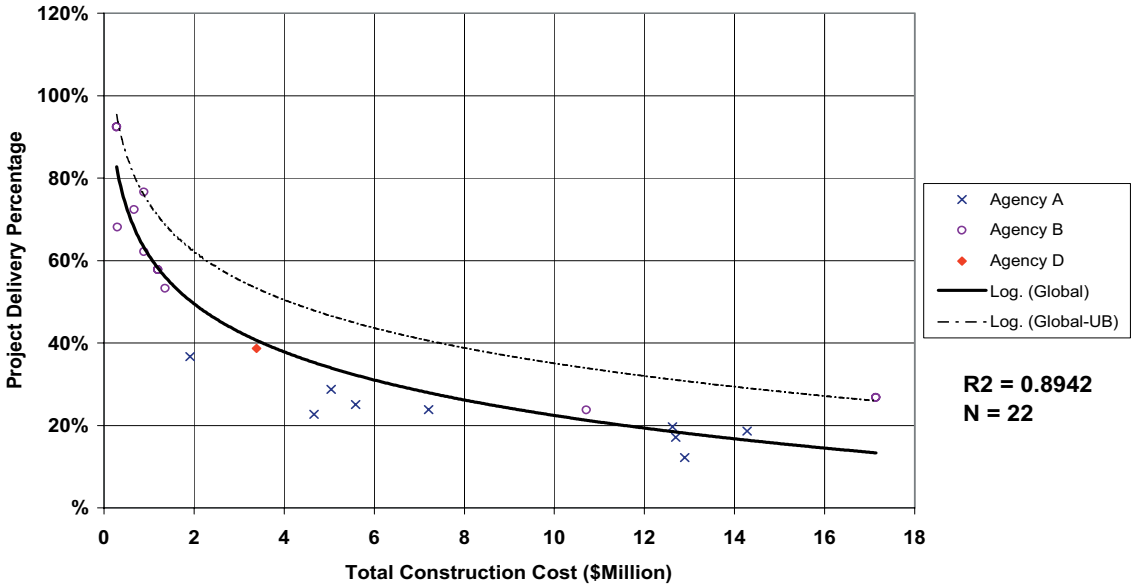
Streets - Signals & ITS

Project Delivery Percentage Versus Total Construction Cost



Streets - Widening

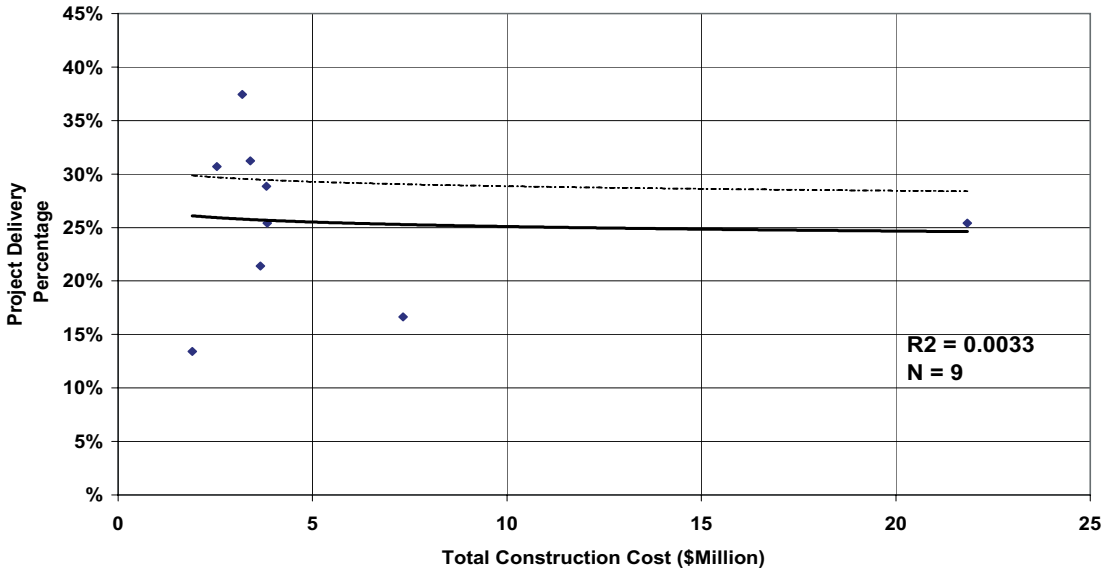
Project Delivery Percentage Versus Total Construction Cost



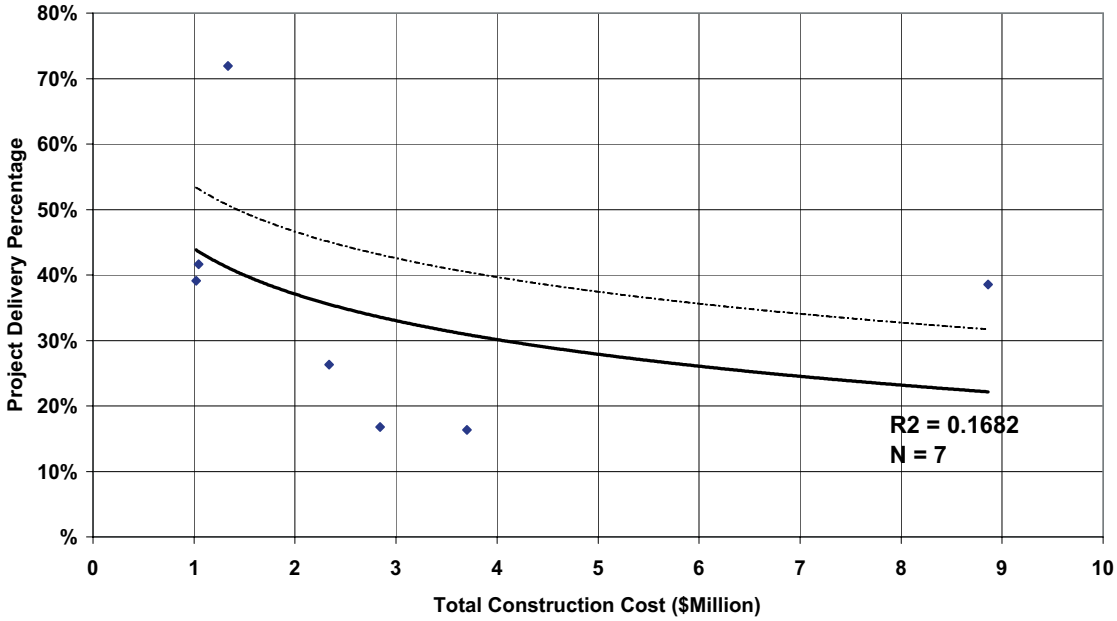
APPENDIX C

VANIR
CONSTRUCTION
MANAGEMENT, INC.

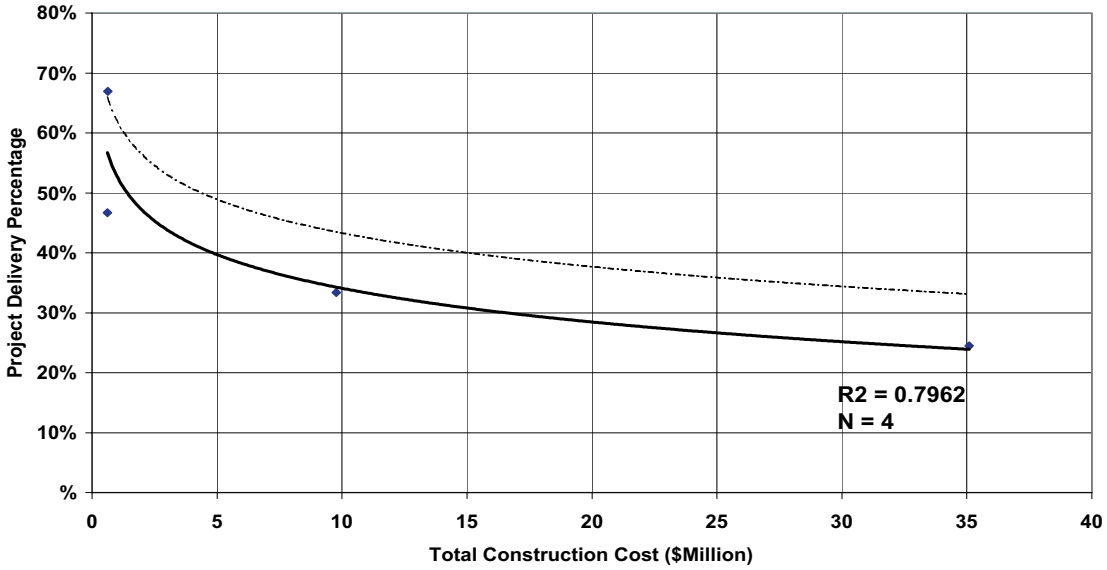
Municipal Facilities - All Classifications
CM@Risk Projects
Project Delivery Percentage Versus Total Construction Cost



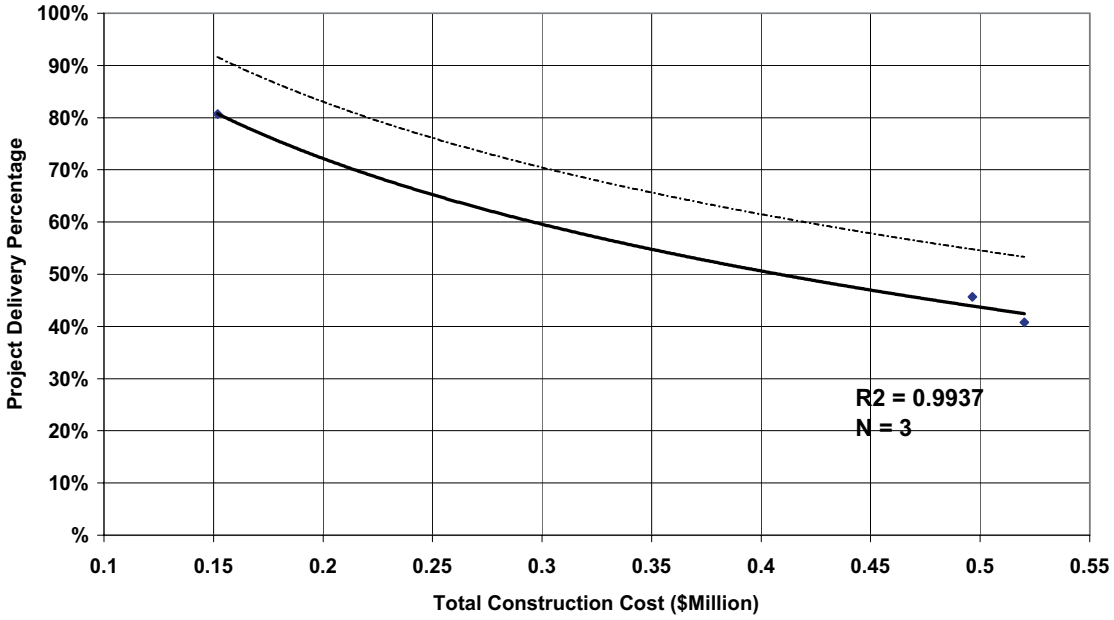
Parks - All Classifications
CM@Risk Projects
Project Delivery Percentage Versus Total Construction Cost

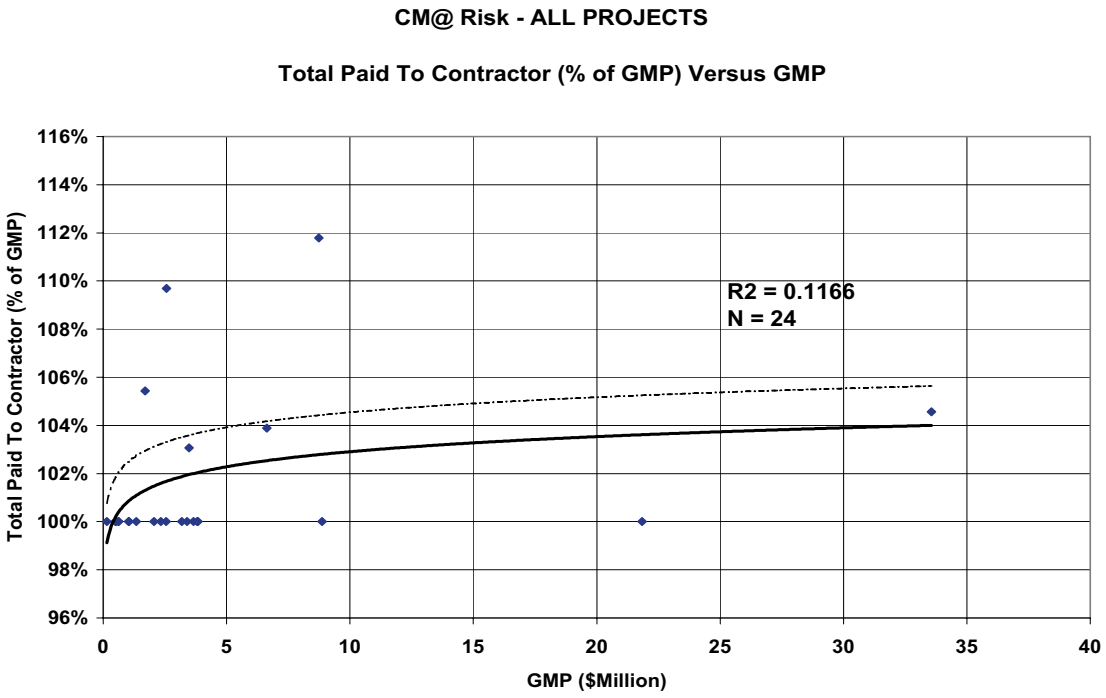


Pipes & Plants - All Classifications
CM@Risk Projects
Project Delivery Percentage Versus Total Construction Cost



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




CM@ Risk - ALL PROJECTS
Total Paid To Contractor (% of GMP) Versus GMP
Total Paid To Contractor (% of GMP)
GMP ($Million)
R2 = 0.1166
N = 24
116%
114%
112%
110%
108%
106%
104%
102%
100%
98%
96%
0
5
10
15
20
25
30
35
40

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