

California Multi-Agency CIP Benchmarking Study

Annual Report - Update 2003



Department of
PUBLICWORKS
CITY OF SACRAMENTO



OAKLAND
PUBLIC WORKS AGENCY

CITY OF
SAN JOSE
CAPITAL OF SILICON VALLEY



CITY OF
LONG BEACH



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Chapter 1

Executive Summary



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CHAPTER 1 Executive Summary

A. INTRODUCTION

Municipal agencies have become increasingly concerned that the condition of their infrastructure reflects the condition and quality of life within their respective communities. At the same time, the practice of funding public projects by borrowing money through the sale of municipal bonds provides incentive to use the funds with extraordinary care and efficiency. To that end, the intent of this study continues to be: To improve the public project delivery process.

Over the next three years, seven of the largest cities in California will continue with their Capital Improvement Programs and will award nearly \$6 billion in public works infrastructure construction contracts. These municipalities are building roads and transportation systems, sewer and water infrastructure, municipal facilities, libraries, parks and recreation facilities, animal shelters, fire stations, bridges, seismic retrofits, bikeways, storm drains, and other facilities.

Other significant costs - over and above the \$6 billion for construction - are required to deliver these projects. The costs associated with the project delivery process - which involves planning, design, environmental documentation, value engineering, permits, construction management, inspection, testing, and startup - are influenced by many factors. These factors include project size and complexity, whether it is new construction or rehabilitation, the internal organization of the agency, and the many tasks included in the process of delivering the project.

Update 2003 of the *California Multi-Agency CIP Benchmarking Study* gives government decision-makers a critically-needed tool: a means of more accurately anticipating the true costs of public projects based upon an in-depth study of over 500 projects. Additionally, *Update 2003* provides insight relative to improving the delivery process through the use of Best Management Practices and continued agency collaboration.

Background

In October 2001, the City of Los Angeles, Department of Public Works, Bureau of Engineering initiated a benchmarking study with five other larger cities in California. This unprecedented study required the cooperative effort of individuals responsible for the development and implementation of Capital Improvement Projects (CIP). These cities and their representatives joined together to form the California Multi-Agency CIP Benchmarking Study Team. After working together for two years, this team has shown that it is possible - and beneficial - for cities to collaborate, pool their knowledge and experience with the factors that influence project delivery costs, then benchmark their project delivery processes to learn from each other's successes.

The objective of the *California Multi-Agency CIP Benchmarking Study* was to provide a general analysis of the efficiency of capital project delivery systems within various agencies in California. The analysis was based on the observed performance and the processes related to the development of public works projects implemented in the previous five years.

The first year (2002) of the *California Multi-Agency CIP Benchmarking Study* was the beginning of a planned cooperative and continuous effort that could eventually include other California agencies. The study initially involved six agencies with a seventh (City of Oakland) joining the team in 2003. The following agencies participated in the second year of the study:

- City of Long Beach, Department of Public Works
- City of Los Angeles, Department of Public Works/Bureau of Engineering
- City of Oakland, Public Works Agency
- City of Sacramento, Department of Public Works
- City of San Diego, Engineering & Capital Projects
- City & County of San Francisco, Department of Public Works / Bureau of Engineering / Bureau of Architecture / Bureau of Construction Management
- City of San Jose, Department of Public Works

Process and Performance Benchmarking

This document, *Update 2003*, is the result of the first two years of collaboration among these seven agencies. The study examined process benchmarks, focusing on business processes (the approach to managing Capital Improvement Projects in the individual agencies).

Twenty-four recommended Best Management Practices were identified in the first edition of this study to deliver high quality projects faster and at lower cost. The Benchmarking Study Team also identified 15 common Best Management Practices that are currently used by most participants in the study. *Update 2003* documented the current and planned implementation of the Best

Management Practices by each agency as the first step in the actual linking of improved processes to performance.

Update 2003 also examined performance benchmarking which involved an analysis of cost and schedule project data from the participating agencies. The agencies provided data for 525 Capital Improvement Projects, of which 453 complied with the 2003 criteria and were used to update the performance models with an objective of improving the reliability of the results.

The *California Multi-Agency CIP Benchmarking Study* is intended to be a continuing effort. Future updates are expected to refine and improve the conclusions and recommendations as additional project data are collected. Annual updates of this report are planned.

B. STUDY METHODOLOGY

Update 2003 was conducted in four stages:

1. One focus of the first stage of *Update 2003* was to improve process benchmarking by reviewing the level at which agencies implemented the study's recommended Best Management Practices. Two new recommended Best Management Practices were added in *Update 2003*.
2. Performance benchmarking data collection criteria were updated in the second stage of this year's study. The Study Team reviewed and modified general criteria for performance data collection (project selection, categories, and performance curves format) based on the availability of information and agencies' expectations.
3. The third stage of the study emphasized performance data enhancement, data compilation into the project database, and development and optimization of performance curves (graphs that relate the cost of construction to

the various costs of project delivery). Performance data on a total of 453 projects with a total construction value of over \$830 million were used to develop the performance benchmarking curves (graphs) for 14 different classifications in four project types (municipal facilities, streets, pipe systems, and parks) showing design, construction management, overall project delivery, and change orders costs as a percentage of total construction costs.

4. The fourth stage of *Update 2003* consisted of review and discussion of performance and process benchmarking outcomes.

C. CONCLUSIONS OF PROCESS BENCHMARKING: BEST MANAGEMENT PRACTICES

In the original study, team members identified, discussed, and evaluated 98 processes associated with the effective delivery of capital projects. *Update 2003* studied the practical implementation of these processes and introduced two new Best Management Practices. Table A indicates the implementation status and planning of the Best Management Practices so that implementation can eventually be tracked against anticipated performance improvements.

In addition, through their BMP and process improvement discussions, the Project Team identified certain improvements in contract documents which may be critical to process improvement:

- **Standardized Indemnification Language**
Standardized indemnification language, in which risk is reasonably apportioned to the parties most able to control it, would allow design professionals and their insurers know what to expect and would expedite agreements.

- **Standardized Document Ownership Language**

The development of standard document ownership language and clauses would let design professionals know what to expect and would expedite agreements.

The implementation of these process improvements is outside of the immediate control of the project delivery team. A plan for implementation of these and other process improvements will be developed as a part of the next generation of this report.

D. CONCLUSIONS OF PERFORMANCE BENCHMARKING

The following performance benchmarking conclusions are based upon the Study Team's analysis of project data:

- The percentage of design costs decreased with increasing size of the projects. Design costs averaged 17% of the total construction cost for 453 representative projects completed after 1997, each with total construction cost greater than \$100,000.
- The ratio of costs for construction management decreased as total construction costs increased. Construction management averaged 16% of the total construction cost for 453 representative projects completed after 1997 and greater than \$100,000 total construction cost.
- Based on the performance data, total project delivery cost (total design cost and construction management cost) for 453 projects greater than \$100,000 total construction cost averaged 33% of the total construction cost.

**TABLE A – IMPLEMENTATION OF RECOMMENDED AND
COMMON BEST MANAGEMENT PRACTICES**

Process Category	Ref.*	Best Management Practice	LA	LB	OK	SC	SD	SF	SJ	Notes
Planning	RECOMMENDED	1.b. Complete Feasibility Studies on projects prior to defining budget and scope	2004	✓	✓	✓	PI 2004	✓	PI	LB: When applicable SD: Result of Multi-Agency Benchmarking SF: When applicable SJ: Some exceptions
		1.d. Have a Board/Council project prioritization system	2004	N/I	N/I	PI	2004	N/I	N/I	SD: Result of Multi-Agency Benchmarking SC: Done for Transp. Will do for Facilities in 2004
		1.e. Provide resource loading for projects listed in the CIP for design and construction	✓	2004	✓	2004	2004	N/I	N/I	SD: Result of Multi-Agency BM SJ: Staffing model (including Consultants submitted to Budget)
	COMMON	1.a. Capital projects are well defined with respect to scope and budget at the end of the planning phase	✓	✓	2004	✓	PI 2005	✓	✓	SD: Some Divisions only
		1.f. There is a Master Schedule attached to the CIP that identifies start and finish dates for projects	✓	2004	N/I	✓	N/I	2004	2004	
		1.i. Projects shown on a Geographical Information System	✓	✓	2004	✓	2004	2004	2004	LB: Infrastructure only
Design	RECOMMENDED	2.b. Provide a clear, precise scope to designers prior to design start	✓	✓	✓	✓	2004	✓	✓	
		2.f. Define requirements for reliability, maintenance, and operation prior to design start	✓	2004	N/I	2004	PI	✓	✓	SD: Some Divisions only (Rest N/I)
		2.i. Adapt successful designs to project sites, whenever possible (e.g. fire stations, gymnasiums, etc.)	✓	✓	✓	✓	PI	✓	✓	SD: Some Divisions only, where applicable
	COMMON	N/A Train in-house staff to use Green Building Standards	✓	2004	2004	✓	✓	✓	PI	SF: When applicable
		2.d. Designers are required to provide a work plan or design schedule prior to design start	✓	✓	✓	✓	✓	✓	✓	SD: Pre-Design and scope agreement study part of P3
		2.g. Designs are done on 2D CAD systems	✓	✓	✓	✓	✓	✓	✓	

Instructions:

✓: Has been implemented

PI: Partially Implemented

yyyy: Will be implemented in calendar year "yyyy"

N/I: No plans to implement at this time

*Reference to Process Questionnaire in Appendix C of 2002 Report.

Legend:

LA: Los Angeles

LB: Long Beach

OK: Oakland

SC: Sacramento

SD: San Diego

SF: San Francisco

SJ: San Jose

**TABLE A – IMPLEMENTATION OF RECOMMENDED AND
COMMON BEST MANAGEMENT PRACTICES**

Process Category	Ref.*	Best Management Practice	LA	LB	OK	SC	SD	SF	SJ	Notes
Assurance / Quality Control			✓	2004	2005	2004	PI	✓	✓	SC: Started in 2003 SD: incorporated into PM training manual and standard primavera schedule template/descriptions. Details available, as needed.
	3.I.a.	Develop and use a standardized Project Delivery Manual								
	3.II.b.	Perform a formal Value Engineering Study for projects larger than \$1,000,000	✓	✓	N/I	✓	✓	✓	2004	LA: For projects > \$1 million LB: On an as-needed basis SC: For projects > \$5 million SF: On an as-needed basis SJ: For projects > \$5 million
	3.III.a.	Use a formal Quality Management System	✓	2004	N/I	PI	PI 2005	2004	2004	SD: Some Divisions only
	3.III.b.	Perform and use Post Project Reviews for lessons learned		2004	✓	PI	✓	✓	2004	SF: On selected projects SD: On selected projects
	3.I.d.	Agency uses standard forms for RFI's, Change Orders, Pay Applications, Field Clarifications, Minutes of Meetings, etc.	✓	✓	✓	✓	✓	✓	✓	
	3.III.g.	Inspectors are trained and, when required, certified	✓	✓	✓	✓	✓	✓	✓	

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**TABLE A – IMPLEMENTATION OF RECOMMENDED AND
COMMON BEST MANAGEMENT PRACTICES**

Process Category	Ref.*	Best Management Practice	LA	LB	OK	SC	SD	SF	SJ	Notes
Construction Management	4.I.a.	Delegate authority to the City Engineer / Public Works Director to approve change orders to the contingency amount	✓	✓	✓	2004	✓	✓	✓	SF: At Bureau level SJ: Individual C.O. < \$100,000
	4.I.g.	Set aside 15% for construction change order contingency	✓	✓	N/I	N/I	✓	N/I	✓	OAK: Up to 10% SD: 10% or 5% Contingency (depends on value). Field Orders 5% SF: Difficult to sell to client & Board SJ: 5% for new, 10% for buildings and underground, 15% for renovations
	4.I.m.	Classify types of changes	✓	N/I	✓	✓	PI	✓	2004	SD: Only for scope changes versus other types
	4.II.a.	Include a formal Dispute Resolution Procedure in all contract agreements	✓	N/I	✓	✓	✓	✓	✓	
	4.III.a.	Use a team building process for projects greater than \$5 million.	✓	✓	N/I	✓	✓	✓	✓	LB/SD: As-needed SF: As-needed SJ: Formal process for projects > \$10 million
	4.IV.a.	Involve the Construction Management Team before completion of design	2003	2004	✓	PI	✓	✓	✓	SD: Some Divisions only
	N/A	Delegate authority for Change Order approval to the departments, in order to reduce paperwork	✓	✓	N/I	N/I	✓	✓	✓	
	N/A	Establish award limits for construction to support award by the director without a Board approval	N/I	N/I	N/I	N/I	✓	✓	✓	SF: For own projects SD: For budgeted projects less than \$1,000,000
	N/A	Establish a pre-qualification process for contractors for large complex projects	2004	N/I	N/I	✓	✓	PI	2004	
	N/A	Make bid documents available online	2004	2004	N/I	N/I	PI	N/I	PI	SD: System options being evaluated
	4.I.d.	A formal change order process is in place, which defines all forms and methods necessary to finalize change orders	✓	✓	✓	✓	✓	✓	✓	
	4.I.f.	A change order contingency is set aside at the start of the project.	✓	✓	✓	✓	✓	✓	✓	

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*Reference to Process Questionnaire in Appendix C of 2002 Report.

**TABLE A – IMPLEMENTATION OF RECOMMENDED AND
COMMON BEST MANAGEMENT PRACTICES**

Process Category	Ref.*	Best Management Practice	LA	LB	OK	SC	SD	SF	SJ	Notes
Project Management	RECOMMENDED	5.1.f. Assign a client representative to every project	✓	✓	✓	✓	PI	✓	✓	SD: Some Divisions only
		5.11.a. Provide formal training for Project Managers on a regular basis	✓	2004	✓	2003	✓	✓	✓	
		N/A Create in-house project management team for small projects	2005	2004	N/I	2003	PI	N/I	✓	
	COMMON	5.1.d. A Project Manager is assigned to every project	✓	✓	✓	✓	✓	✓	✓	
		5.1.e. Project Manager has "cradle to grave" involvement	✓	✓	✓	✓	✓	✓	✓	
		5.111.a. A standard Project Control System has been adopted by the Agency and is in use on all projects	✓	2004	N/I	PI	✓	✓	2004	SD: Project controls incorporated into Primavera schedule
Consultant Selection and Use	RECOMMENDED	6.e. Delegate authority to the PW Director/City Engineer to approve consultant contracts under \$250,000, when a formal RFP selection process is used	N/I	N/I	N/I	N/I	✓	✓	N/I	
		6.g. Implement and use a consultant rating system that identifies quality of consultant performance	✓	2004	✓	2004	✓	N/I	2004	
	COMMON	6.h. The consultant selection process is qualification based	✓	✓	✓	✓	✓	✓	✓	
		6.c. A Standard Consultant contract is included in the RFQ/RFP with a standard indemnification clause	✓	✓	✓	✓	PI	✓	✓	SD: Some Divisions only
		6.f. An Annual RFQ/RFP solicitation is used to develop an on-call list of pre-approved consultants	✓	✓	✓	✓	✓	✓	✓	LA: Every 3 years SD: Every year OAK: Bi-annual SF: Every 3 years SC: Every 3 years SJ: Every 2 years

Instructions:

✓: Has been implemented

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*Reference to Process Questionnaire in Appendix C of 2002 Report.

Relating the costs of change orders to the total construction cost was difficult to quantify. Future updates of the *California Multi-Agency CIP Benchmarking Study* will investigate the possibility of categorizing change orders in two groups: "Scope Changes" and "All Others". This categorization should lead to better correlations and more intuitive trends.

The additional project duration data provided for *Update 2003* led to much better duration models. These improved models were significantly more realistic than last year's report, and were used to develop a tabulation of duration data for *Update 2003*.

Table B shows various project delivery costs for Capital Improvement Projects with known construction values. This table was improved in *Update 2003* in that, in some areas, it is a more reliable predictive tool due to additional representative data and improved correlations.

E. LESSONS LEARNED

- Additional data collection is still warranted. In *Update 2003*, where significant additional data were provided, some of the statistical correlations improved significantly. In future benchmarking studies, more data collection in all categories should improve correlation coefficients and make performance models more effective for prediction.
- Critical review of 2003 data indicated that the performance models would be significantly improved by eliminating "non-representative" projects. These are the projects that appear as anomalies in the performance models and are proven not to represent agencies' standard project delivery procedures.
- Implementing the recommended Best Management Practices is essential if agencies are to improve their processes. The CIP Benchmarking Team should monitor agencies' progress to implement these practices and compare performance results to study the actual effectiveness of such practices.
- Team presentations and online discussions proved to be effective tools to communicate and share experiences.

TABLE B – CIP DELIVERY COSTS *

PROJECT TYPE CLASSIFICATION	Total Construction Cost (TCC)	Design Cost (% of TCC)	Construction Management Cost (% of TCC)	Total Project Delivery Cost (% of TCC)
Municipal Facilities				
Libraries	TCC < \$0.5M	43% - 48%	32% - 37%	75% - 83%
	\$0.5M < TCC < \$ 3M	28% - 33%	21% - 26%	49% - 57%
	TCC > \$3M	15% - 20%	11% - 16%	26% - 34%
Police/ Fire Station	TCC < \$0.5M	26% - 30%	12% - 14%	38% - 43%
	\$0.5M < TCC < \$ 3M	21% - 25%	11% - 13%	32% - 37%
	TCC > \$3M	17% - 21%	10% - 12%	27% - 32%
Community Building / Recreation Center / Children Center / Gymnasium	TCC < \$0.5M	24% - 29%	12% - 14%	37% - 42%
	\$0.5M < TCC < \$ 3M	20% - 25%	10% - 13%	31% - 36%
	TCC > \$3M	17% - 21%	9% - 11%	26% - 31%
Streets				
Widening / New / Grade Separation	TCC < \$0.5M	25% - 30%	16% - 18%	41% - 46%
	\$0.5M < TCC < \$ 3M	19% - 24%	12% - 15%	32% - 37%
	TCC > \$3M	15% - 19%	9% - 12%	24% - 29%
Bridge / Retrofit / Seismic	TCC < \$0.5M	41% - 49%	25% - 29%	65% - 77%
	\$0.5M < TCC < \$ 3M	30% - 38%	19% - 23%	48% - 60%
	TCC > \$3M	20% - 28%	14% - 18%	34% - 45%
Renovation / Resurfacing	TCC < \$0.5M	15% - 18%	19% - 22%	34% - 39%
	\$0.5M < TCC < \$ 3M	11% - 14%	13% - 16%	23% - 28%
	TCC > \$3M	7% - 10%	7% - 10%	14% - 18%
Bike / Pedestrian / Curb Ramps	TCC < \$0.5M	17% - 24%	20% - 30%	35% - 51%
	\$0.5M < TCC < \$ 3M	16% - 23%	16% - 27%	33% - 49%
	TCC > \$3M	N/A	N/A	N/A
Signals	TCC < \$0.5M	15% - 19%	21% - 28%	37% - 44%
	\$0.5M < TCC < \$ 3M	10% - 14%	12% - 18%	22% - 30%
	TCC > \$3M	N/A	N/A	N/A
Pipes				
Gravity System (Storm Drains, Sewers)	TCC < \$0.5M	27% - 34%	21% - 26%	48% - 59%
	\$0.5M < TCC < \$ 3M	15% - 22%	15% - 20%	29% - 40%
	TCC > \$3M	4% - 11%	9% - 14%	13% - 23%
Pressure Systems	TCC < \$0.5M	17% - 21%	18% - 21%	35% - 40%
	\$0.5M < TCC < \$ 3M	12% - 16%	11% - 14%	23% - 28%
	TCC > \$3M	N/A	N/A	N/A
Pump Station	TCC < \$0.5M	22% - 26%	30% - 34%	51% - 59%
	\$0.5M < TCC < \$ 3M	17% - 22%	21% - 26%	39% - 46%
	TCC > \$3M	13% - 18%	14% - 19%	28% - 35%
Parks				
Playgrounds	TCC < \$0.5M	17% - 20%	19% - 22%	36% - 40%
	\$0.5M < TCC < \$ 3M	15% - 18%	11% - 14%	25% - 30%
	TCC > \$3M	N/A	N/A	N/A
Sports fields	TCC < \$0.5M	17% - 21%	12% - 15%	29% - 35%
	\$0.5M < TCC < \$ 3M	16% - 20%	13% - 15%	29% - 35%
	TCC > \$3M	N/A	N/A	N/A
Restrooms (N/A – Counter-intuitive)	TCC < \$0.5M	27% - 32%	30% - 43%	57% - 73%
	\$0.5M < TCC < \$ 3M	N/A	N/A	N/A
	TCC > \$3M	N/A	N/A	N/A

* The values in this table provide an overall summary of the performance benchmarking results. Caution is necessary in using this information as a predictive tool, particularly **shaded values** ($R^2 \leq 0.1$).

Chapter 2

Introduction



Department of
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CITY OF SACRAMENTO



CITY OF
SAN JOSE
CAPITAL OF SILICON VALLEY



2 Introduction

A. STUDY BACKGROUND

The City of Los Angeles, Department of Public Works/Bureau of Engineering initiated the *California Multi-Agency CIP Benchmarking Study* with five other larger California municipal agencies in October of 2001. These agencies recognized this event as an opportunity to improve the efficiency of delivering Capital Improvement Projects throughout California. They took the unprecedented step of sharing costs and procedures related to the delivery of public works projects implemented during the previous five years. Their *CIP Benchmarking Study* was widely recognized for the innovative work that it represents. (See below)

- The 2002 *California Multi-Agency CIP Benchmarking Study* was presented to the American Public Works National Congress (Conference) in Kansas City, Missouri on September 24, 2002.
- The City of Los Angeles, Quality and Productivity Commission recognized the Bureau of Engineering's efforts on this study with a Productivity Award in May of 2003.
- The study received Honorable Mention from the League of California Cities as a candidate for the prestigious Helen Putnam Award for Excellence program, recognizing its innovative approach to reducing costs through multi-agency collaboration.
- In June 2003, the City of Los Angeles presented the study to a group of Washington agencies including King County Department of Natural Resources, Wastewater Treatment Division, King County Department of Transportation, Metro Transit Division, and the City of Seattle.
- The City of San Diego used the trend line for design costs on Municipal Facilities. The line appeared to be high for the City of San Diego. In their research using the 2002 Benchmarking report data, the City determined that all libraries had significantly longer durations that inflated the soft costs of project delivery. San Diego found that the longer durations were caused by lags in State grants and private donations, and/or incremental CIP funding from other fund sources. Hard cost escalation was also a factor given the longer duration to get the projects out to bid. San Diego is now considering a \$312 million financing plan that will pay for a massive overhaul of the city's library system, and provide for more predictable project funding and delivery.
- The City of San Jose is using the performance models from the 2002 report as performance targets for project delivery. They are also committed to enhancing the benchmarking database so that it becomes a more credible predictive tool.

Update 2003 began with a meeting of the Project Team on October 2, 2002, in Long Beach, California. The City of Oakland joined the six original study participants in 2003. The Project Team now represents seven of the largest communities in California.

The Project Team met quarterly (February, April, and July) to continue the second year of the CIP Benchmarking Study. During this year's efforts, the Project Team:

- Reviewed and evaluated the implementation of 98 Best Management Practices.
- Enhanced the performance benchmarking database with data from 286 new projects. The database currently contains information on 525 Capital Improvement Projects, of which 453 fit 2003 performance guidelines and are included in *Update 2003* (valued at \$830 million). Twenty-five of the 525 projects were smaller than \$100,000; 13 were completed before 1997; and 34 were identified as non-representative projects and were excluded from the 2003 analysis.
- Prepared *Update 2003* to report the findings of the second year of the CIP Benchmarking Study.
- Develop an improved “Predictive Tool” using the new, larger pool of project data that also excluded non-representative projects.
- Collect data on additional project types and classifications.
- Begin the process of linking processes to performance.
- Conduct a comparison between in-house delivery and usage of consultants.
- Improve user interface with the database to facilitate reporting.

B. STUDY OBJECTIVES

The purpose of the first year of the study was to analyze and benchmark how capital improvement projects are delivered within California. The analysis included the study of both the *processes* used to deliver the projects and the actual *performance* results.

The primary objective of *Update 2003* focused on project delivery **process** improvement and emphasized Best Management Practices implementation. Specifically, the Project Team began a series of presentations to share BMP information.

Performance objectives were identified for *Update 2003*, as follows:

- Collect additional data to increase the number of projects included in the database to improve the statistical credibility of the results.
- Improve the models by identifying and correcting missing data and errors.

C. PARTICIPANTS

The City of Los Angeles, Department of Public Works, Bureau of Engineering facilitated the *Update 2003* benchmarking study and sponsored a Study Team of expert staff that was responsible for logistics, management, and execution of the 2003 study. The following agencies contributed to the study.

- City of Long Beach, Department of Public Works
- City of Los Angeles, Department of Public Works/Bureau of Engineering
- City of Oakland, Public Works Agency
- City of Sacramento, Department of Public Works
- City of San Diego, Engineering & Capital Projects
- City and County of San Francisco, Department of Public Works / Bureau of Engineering / Bureau of Architecture / Bureau of Construction Management
- City of San Jose, Department of Public Works

The Project Team has now worked together for almost two years to plan and implement the benchmarking study.

D. REPORT STRUCTURE

Update 2003 is organized as follows:

- This introductory chapter (Chapter 2) provides a brief explanation of the project history, objectives, and project participants.
- Chapter 3 provides a profile of each of the participating agencies, including descriptions of their city and agency structure, and their capital improvement programs for FY 2002-03 through FY 2004-05.
- Chapter 4 identifies common and recommended Best Management Practices, based on process benchmarking, and discusses process study findings.
- Chapter 5 describes performance benchmarking and explains the basis for project selection and data definition. Performance graphs that have been generated from the project database (Appendix B) are also reviewed and discussed within Chapter 5.
- Chapter 6 contains the conclusions and recommendations based on the process benchmarking results in Chapter 4 and the performance benchmarking graphs that are presented in Appendix B and discussed in Chapter 5.

Chapter 3

Participating Agencies



Department of
PUBLICWORKS
CITY OF SACRAMENTO



CITY OF
SAN JOSE
CAPITAL OF SILICON VALLEY



CHAPTER 3 Participating Agencies

A. INTRODUCTION

This section of the report updates information on the six agencies that participated in the California Multi-Agency CIP Benchmarking Study - 2002 and provides information on the seventh agency (City of Oakland) that joined the study for *Update 2003*.

Each agency's summary includes City Description, Agency Description, and CIP project information that has been updated for the next three years (FY 02-03 through FY 04-05). The City of Oakland has also provided information for fiscal year 2001-2002 for comparison with the other agencies.

"In-house Project Delivery Services" (Table C) was updated to include the City of Oakland. The Fact Sheet (Table D) was updated for FY 02-03 through FY 04-05.

The agencies' operations and approaches to project delivery are very similar. They generally have a "strong project management" approach with a project manager responsible for budgets, schedules, and quality management from the beginning of a project to the end. The City of Long Beach had initiated this "strong project management" approach during the 2002 study, and is now implementing it successfully.

Collectively, the seven participating cities expect to award nearly \$6 billion in public works capital improvement project contracts over the next three years.

B. DESCRIPTION OF PARTICIPATING AGENCIES



I. City of Long Beach

POPULATION	461,522
AREA	50 square miles
WEBSITE ADDRESS	http://www.long-beach.gov

FORM OF GOVERNMENT

Long Beach has a Council-Manager form of government as provided by Charter effective July 5, 1921. The current City Charter became effective in 1980. The Mayor, City Auditor, City Prosecutor, and City Attorney are elected by the people every four years. Nine City Council members representing nine districts are elected by the people to four-year terms. Members of commissions are appointed by the Mayor, subject to the approval of the City Council. Most other officials and employees of the City are subject to the civil service provisions of the Charter.

DEPARTMENT OF PUBLIC WORKS - Bureau of Engineering

The Bureau of Engineering is responsible for the design and construction of all public facilities, streets, sewers, and storm drains. The Bureau is also responsible for the engineering features and standards of all privately developed subdivisions, tracts, and construction of public improvements in the City's right-of-way. The head of the Bureau is the City Engineer.

Bureau personnel work on the expansion and modernization of over 860 miles of streets, the design and construction of marinas, airport facilities, parking structures, bridge rehabilitations, and other public works projects. Recent past projects include the Emergency Communications and Operations Center, Lakewood Boulevard Widening, and the seismic retrofit of the historic Rancho Los Cerritos.

The Bureau employs over 90 employees in many different disciplines including engineering, architecture, surveying, drafting, and construction management.

PROJECT MANAGEMENT/DELIVERY

The Bureau uses a strong project management delivery system in which the projects are assigned to a project manager who is responsible for the budget and schedule from planning through project closeout. Project funding is usually generated from a variety of funding sources. The three groups/divisions within the Bureau have a philosophical approach to a design-bid-build project delivery system with the objective of using a mix of in-house and consultant contracts to provide design and construction management.

CONSTRUCTION CONTRACTS/CAPITAL IMPROVEMENT PROGRAM

Construction contracts to be awarded for Fiscal Year 2002-03 through Fiscal Year 2004-05:

Program	Total Projects	Total Cost
Airport	12	\$24,000,000
Community Development	2	\$9,000,000
Parks, Recreation and Marine	32	\$46,000,000
Public Facilities	29	\$81,000,000
Public Thoroughfares	22	\$ 63,000,000
Storm Drains	1	\$4,000,000
Tidela	16	\$8,000,000
Total	114	\$ 235,000,000



II. City of Los Angeles

POPULATION	3,694,820
AREA	469 square miles
WEBSITE ADDRESS	http://eng.lacity.org

FORM OF GOVERNMENT

Los Angeles has a Mayor-Council-Commission form of government as provided by the Free holders' Charter effective July 1, 1925. The current City Charter became effective on July 1, 2000. The people elect the Mayor, City Controller, and City Attorney every four years. Fifteen City Council members representing fifteen districts are elected to four-year terms. Members of commissions are appointed by the Mayor, subject to the approval of the City Council. With few exceptions, all other officials and employees of the City are subject to the civil service provisions of the Charter.

DEPARTMENT OF PUBLIC WORKS - Bureau of Engineering

The Bureau of Engineering is responsible for the design and construction of all public facilities, streets, sewers, and storm drains. The Bureau is also responsible for the engineering features and standards of all privately developed subdivisions, tracts, and construction of public improvements in the City's right-of-way. The head of the Bureau is the City Engineer.

Bureau personnel work on the expansion and modernization of over 7,400 miles of streets, 1,000 miles of storm drains, 6,500 miles of sewer lines, the design and construction of police and fire stations, libraries, parking structures, wastewater treatment plants, bridges, and other public works projects. Recent past projects include the Convention Center Expansion, renovation of the Central Library, and the seismic retrofit of City Hall.

The Bureau employs over 1,000 employees in many different disciplines including engineering, architecture, surveying, drafting, real estate, environmental, and construction management.

PROJECT MANAGEMENT/DELIVERY

The Bureau uses a strong project management delivery system in which projects are assigned to a project manager who is responsible for the budget and schedule from planning through project closeout. Project funding is usually generated from special funds including bonds, user fees, and grants. The 33 groups/divisions within the Bureau use a design-bid-construct project delivery system with the objective of using in-house resources to provide design and construction management. Consultants are used to supplement in-house resources when necessary.

CONSTRUCTION CONTRACTS/CAPITAL IMPROVEMENT PROGRAM

Construction contracts to be awarded for Fiscal Year 2002-03 through Fiscal Year 2004-05 include:

Program	Total Projects	Total Cost
Animal Bond	8	\$84,200,000
Bridge Improvement Program	28	\$66,600,000
Fire Bond	21	\$183,800,000
Library Bond	10	\$38,200,000
Municipal Facilities	20	\$44,700,000
Recreation Facilities (Prop. K)	44	\$56,100,000
Seismic Bond	2	\$16,800,000
Storm-water Program	40	\$18,600,000
Street Program	44	\$127,800,000
Wastewater Program	133	\$224,800,000
Proposition Q	6	\$124,200,000
Total	356	\$985,800,000



III. City of Oakland

POPULATION	399,484
AREA	66.25 SQUARE MILES
WEBSITE ADDRESS	www.oaklandpw.com

The City of Oakland was founded May 4th, 1852. In 1930, adoption of Charter amendments divided Oakland into seven Council districts and provided for a Council-Manager form of government. Council Members, Mayor, City Auditor, and City Attorney are elected by the people every four years. Most other officials and employees of the City are subject to the Civil Service provisions of the Charter.

PUBLIC WORKS AGENCY

The Public Works Agency mission is to provide for the design, construction, management and maintenance of the City's infrastructure, including streets, sidewalks and pathways; creeks sewers and storm drains; buildings and structures; vehicles and equipment; street lights and traffic signals. In addition, the Agency is responsible for related activities such as community clean-up (especially along public rights of way), graffiti abatement and facilitating environmental compliance. The goal of the Public Works Agency is to provide top quality, professional, effective and timely delivery of services to residents, businesses and City departments to assure utmost customer satisfaction.

The Agency is structured as follows: Director's Office, Administration, Design & Construction Services Department, and Maintenance Services Department.

PROJECT MANAGEMENT/DELIVERY

Project Delivery is the responsibility of the Design and Construction Services Department constituted by the following Divisions: Administrative Services; Environmental Services; Project Management; Engineering Design; Transportation Services; Electrical Services; and Construction & Field Services.

The Project Management Division provides comprehensive project management services for projects originating in other City Departments, including budgeting, scheduling, defining scope, coordinating design and construction activities, community engagement, and coordination with the client and other stakeholders. Clients are typically departments and agencies external to PWA. The types of projects include building renovations (libraries, fire stations, etc.), seismic retrofits, ADA improvements, tenant improvements, streetscape, and landscape improvements.

The Engineering Design Division manages several programs within Public Works. These include the Sanitary Sewer Rehabilitation Program, Street Improvement Program, and Storm Drainage Program. In addition, the Division provides professional engineering services and project management services on a wide variety of technical projects for public infrastructure and to support the Community Economic Development Agency, City Manager, City Attorney, Council and others.

The Transportation Services Division manages traffic engineering, transportation planning, parking and funding programs for the City. Staff closely works with other city agencies, council offices,

residents, business owners and developers to address traffic related matters and assure timely implementation of worthy transportation projects increasing mobility, enhancing vehicular and pedestrian safety as well as improving air quality. The staff advocates City's interest on transportation matters at regional, state, and federal agencies and assures that transportation projects benefiting Oakland are funded and implemented in a timely manner.

The Electrical Services Division designs street lighting improvements; provides maintenance for 35,200 street lights; manages and installs street lights for the Utility Undergrounding Projects; provides design review and coordination for Private Jobs (P-Jobs), Port of Oakland Projects, Caltrans Projects, and Alameda County Projects. In addition, The Electrical Division designs new traffic signal improvements; provides maintenance for 591 traffic signalized intersections; provides 24 hour trouble call response for traffic signals; and provides support and construction for major maintenance programs and projects.

The Construction & Field Services Division provides the following services: The Capital Projects Section provides construction management and inspection services for capital projects such as: public street, sanitary sewer, and storm drain improvements; renovation and new construction of city-owned buildings including earthquake-damaged buildings, fire stations, libraries, parking facilities and park and recreation facilities; new traffic signals and street lights. The Field Surveying Section provides initial surveys, construction stakeout, and boundary surveys of city-owned facilities and easements and maintains the network of vertical and horizontal benchmarks and monuments. The Testing Laboratory provides quality control and testing of materials utilized in capital improvement projects. The testing lab also supports the street-paving program of the Maintenance Department.

CONSTRUCTION CONTRACTS/CAPITAL IMPROVEMENT PROGRAM

Capital Improvement Program for Fiscal Year 2003-04 through Fiscal Year 2004-05:
Funding Summary by Source:

Source	Year		
	2002-03	2003-04	2004-05
Department of Transportation	\$110,000	\$0	\$3,000,000
Measure B [ACTIA] (Local Trans. Sales Tax)	\$7,787,500	\$13,419,000	\$7,004,000
Measure B [Bike & Pedestrian] (Local Trans. Sales Tax)	\$0	\$900,000	\$900,000
Measure DD	\$0	\$7,000,000	\$13,000,000
Multi-Purpose Reserve	\$0	\$7,219,067	\$7,729,410
Municipal Improvement Capital	\$27,223,000	\$2,200,000	\$2,300,000
Sewer Service	\$9,890,000	\$11,909,000	\$10,482,000
State Grant	\$733,600	\$350,000	\$0
Metro. Transportation, Commission	\$325,000	\$0	\$0
Public Works Grants	\$2,870,000	\$0	\$0
Equipment	\$2,614,000	\$0	\$0
State Gas Tax	\$700,000	\$0	\$0
Radio	\$500,000	\$0	\$0
Misc. Grants	\$85,000	\$0	\$0
Grand Total	\$52,838,100	\$42,997,067	\$44,415,410



IV. City of Sacramento

POPULATION 418,700

AREA 98 square miles

WEBSITE ADDRESS <http://www.pw.cityofsacramento.com>

FORM OF GOVERNMENT

Sacramento's City Council-City Manager form of government was adopted in 1920. The City Charter was also adopted in 1920. The City Council consists of a Mayor elected by the people and Council members, elected to represent the eight separate Council districts in the City. Elected members serve four-year terms and elections are staggered every two years in even numbered years. Members of Boards and Commissions are appointed by the Mayor, subject to the approval of the City Council. The City Manager, City Treasurer, City Attorney, and City Clerk are appointed by the City Council with all other exempt managers appointed by the City Manager. All other officials and employees of the City are subject to the civil service provisions of the Charter.

DEPARTMENT OF PUBLIC WORKS - Project Delivery Division

The Project Delivery Division is responsible for the design and construction of public buildings, facilities, and transportation projects. The division is managed by the Project Delivery Manager, who reports to the Director of Public Works.

Division personnel work on the expansion and modernization of 1,290 miles of streets, the design and construction of police and fire stations, libraries, parking structures, community centers, bridges, freeway interchanges, and other public works projects. Recent past and current projects include the Joe Serna, Jr. Environmental Protection Agency Headquarters Building, South Natomas Community Center and Library, the extension of Seventh Street, and the Arena Boulevard Interchange at Interstate 5.

The Division has about 100 employees in many different disciplines including civil engineering, electrical engineering, mechanical engineering, architecture, surveying, drafting, and construction management. Accounting and administrative staff provide support.

PROJECT MANAGEMENT/DELIVERY

The Division uses a strong project management delivery system in which the projects are assigned to a project manager who is responsible for the budget and schedule. Projects are managed by the Funding & Priorities Section during the planning phase. When the projects have been fully scoped and funded, other project managers are assigned that are responsible from design through construction and project closeout. Funding for projects is usually generated from transportation funds, grants, fees, bonds, redevelopment funds, and the City's General Fund. The Division uses private consultants to supplement in-house resources to provide design and construction management services.

CONSTRUCTION CONTRACTS/CAPITAL IMPROVEMENT PROGRAM

Construction contracts to be awarded for Fiscal Years 2002-03 through 2004-05:

Program	Total Projects	Total Cost
Public Facilities	130	\$190,000,000
Transportation	89	\$54,000,000
Total	219	\$244,000,000



V. City of San Diego

POPULATION	1,277,168
AREA	342 square miles
WEBSITE ADDRESS	http://www.sandiego.gov

FORM OF GOVERNMENT

The City of San Diego, the second largest city in the state and the seventh largest city in the nation, was incorporated on March 27, 1850. In 1931 the Charter by the Board of Freeholder's was adopted by the voters and, although it has undergone many modifications, is still in effect today. The City utilizes a Mayor-Council-Manager form of government with only the Mayor and City Attorney elected city-wide by the people every four years. Eight City Council members are elected by the people in their respective districts to serve four-year terms. The Council selects a City Manager who is responsible for the administration of most City departments. Officials and employees of the City are subject to the civil service provisions of the Charter, with the exception of unclassified management and a few unrepresented employee classifications.

ENGINEERING AND CAPITAL PROJECTS DEPARTMENT

The Engineering & Capital Projects (E&CP) Department provides capital improvement project (CIP) services for the various operating departments throughout the City, including the Transportation Department, Fire, Park & Recreation, and others. In this role, the E&CP Department is responsible for the design, project management, and construction management for a vast majority of public facility capital improvement projects (CIP). This work includes such projects as streets, bridges, bikeways, storm drains, and municipal buildings as well as the replacement of water and sewer mains throughout the City.

The Department is split into four divisions with three project management/design divisions (including Transportation Engineering, Water & Sewer Design, and Architectural Engineering and Contract Services) and one (1) support division (Field Engineering). The Director of the E&CP Department is the City Engineer. The E&CP Department employs approximately over 470 employees in many different disciplines under this structure, including engineering, architecture, surveying, drafting, environmental, materials testing, and construction management.

The E&CP Department staff, on behalf of the client departments, is responsible for the expansion and modernization of over 3,820 miles of streets and alleys, 769 miles of storm drains and channels, approximately 2,900 miles of sewer mains, and 3,139 miles of water mains as well as all the fire, library, and park facilities. Recent major projects include the Convention Center Expansion, expansion of Qualcomm Stadium, the construction of State Route 56, and the new downtown Ballpark.

PROJECT MANAGEMENT/DELIVERY

E&CP uses a "central point of contact" project delivery system in which the projects are assigned to a project manager within a design division who is then responsible for the management, budget, and schedule from the beginning of design phase (in some cases planning) through project closeout.

Engineering is performed by either in-house staff from within the project manager's division or through the use of outside consultants, depending on the complexity and availability of resources.

Most projects make use of in-house resources for design services. The project manager also utilizes the resources of the supporting divisions' staff for such services as surveys, contract procurement, construction management, and inspection. Funding is initially identified for a project by the client department during the planning process, and is generated from a variety of sources from tax revenue to special funds including bonds, user fees, and grants. The three project management/design divisions within the department most commonly use the design-bid-build project delivery system but are beginning to utilize alternative forms of project delivery including design-build methods and task order contracts.

CONSTRUCTION CONTRACTS/CAPITAL IMPROVEMENTS PROGRAM

Capital Improvements Program for Fiscal Years 2002-03 through 2004-05:

Program	FY02-03	FY03-04	FY04-05
Community & Economic	\$ 8,656,376.00	\$ 17,391,215.00	\$ 13,903,290.00
Development Services	\$ 75,000.00	\$ 179,400.00	-
Engineering & Capital Projects	\$ 534,837.00	\$ 1,918,304.00	\$ 37,963,642.00
Environmental Services	\$ 10,185,360.00	\$ 9,612,000.00	\$ 5,663,000.00
General Services	\$ 292,961.00	\$ 2,066,000.00	\$ 1,000,000.00
Information Technology & Comm	\$ 940.00	-	\$ 1,900,000.00
Library	\$ 8,209,915.00	\$ 42,236,410.00	\$ 86,466,632.00
Metropolitan Wastewater	\$ 123,398,302.00	\$ 137,326,082.00	\$ 164,628,735.00
Park & Recreation	\$ 22,367,396.00	\$ 25,272,583.00	\$ 16,566,754.00
Planning	\$ 1,840,983.00	\$ 112,300.00	-
Police	\$ 2,866,124.00	\$ 5,993,563.00	\$ 8,011,093.00
QUALCOMM Stadium	\$ 4,665,896.00	\$ 625,400.00	\$ 625,400.00
Real Estate Assets	\$ 9,846.00	\$ 1,300,000.00	\$ 400,000.00
San Diego Fire-Rescue	\$ 2,205,793.00	\$ 16,283,183.00	\$ 9,101,382.00
Special Projects	\$ 54,802,557.00	\$ 3,350,000.00	-
Transportation	\$ 75,759,189.00	\$ 86,986,441.00	\$ 73,979,189.00
Water	\$ 120,430,363.00	\$ 62,506,782.00	\$ 87,260,948.00
Grand Total	\$ 436,301,838.00	\$ 413,159,663.00	\$ 507,470,065.00



VI. City and County of San Francisco

POPULATION	801,377
AREA	46.7 square miles
WEBSITE ADDRESS	http://www.sfdpw.com

FORM OF GOVERNMENT

The City and County of San Francisco is a consolidated city and county with boundaries that are prescribed by the laws of the State of California and the City Charter. The first City Charter was established on April 15, 1850. The current City Charter was adopted November 6, 2001. The local government consists of a legislative branch consisting of an 11-member Board of Supervisors, and an executive branch consisting of a Mayor. Each member of the Board is elected by district and serves a four-year term, but may not serve for more than two successive terms. The Mayor is the chief executive officer and official representative of the City and County who is elected at a general election and serves a four-year term, but may not serve for more than two successive terms. Voters elect the City Attorney every four years. The Controller and City Administrator are appointed by the Mayor every ten and five years, respectively. Commissions and department heads are generally appointed by the Mayor and confirmed by the Board of Supervisors. With few exceptions, all other officials and employees of San Francisco are subject to the civil service provisions of the Charter.

DEPARTMENT OF PUBLIC WORKS

The Deputy Director for Engineering, who also holds the title of City Engineer, is in charge of four bureaus in the Department of Public Works: Bureau of Engineering, Bureau of Architecture, Bureau of Construction Management, and Bureau of Street Use and Mapping. The first three bureaus, referred to as the Tri-bureaus, work on capital projects while the Bureau of Street Use and Mapping regulates the use of city streets and private development of infrastructure.

The Tri-bureaus are responsible for the planning, design, and construction of public streets and infrastructure. These services are provided for client departments who do not have technical capabilities or contracting authority. These include the Police, Fire, Health and Recreation and Park departments as well as many other City agencies.

Tri-bureau personnel work on street renovation, sewer replacement and enlargement, traffic signals, parks and playgrounds, libraries, police and fire stations, health facility, treatment plant and pump stations, and other public works projects.

The Tri-bureau has 431 authorized positions of which over 350 are filled. These positions cover many different disciplines including engineering, architecture, surveying, drafting, environmental, and construction management.

PROJECT MANAGEMENT/DELIVERY

The Tri-bureaus use a strong project management delivery system in which the projects are assigned to a project manager who is responsible for the budget and schedule from planning through project closeout. Project funding is usually generated from special funds including general obligation and revenue bonds, sales tax revenues, and grants. The Tri-bureaus have a philosophical approach to design-bid-construct project delivery with the objective of using in-house resources whenever possible to provide design and construction management. Consultants are used to supplement in-house resources when necessary.

CONSTRUCTION CONTRACTS/CAPITAL IMPROVEMENT PROGRAM

Capital Improvements Program for Fiscal Year 2002-03 through Fiscal Year 2004-05:

Program	Total Cost
Criminal Justice	\$184,000,000
Health Care Facilities	\$271,000,000
Libraries	\$57,000,000
Parks and Recreational	\$330,000,000
Sewers and Water	\$60,000,000
Streets and Bridges	\$142,000,000
Other Major Bond Programs	\$320,000,000
Total	\$1,364,000,000



VII. City of San Jose

POPULATION	918,800
AREA	177 square miles
WEBSITE ADDRESS	http://www.ci.san-jose.ca.us/

FORM OF GOVERNMENT

San Jose has a Mayor-Council-City Manager form of government as provided by City Charter. The current City Charter became effective in May 1965. The Mayor is elected by the people every four years. The people elect 10 City Council members representing 10 districts for four-year overlapping terms. The City Charter limits the Mayor and Council members from serving more than two consecutive terms. The City Attorney, Redevelopment Director, City Auditor, City Clerk and Independent Police Auditor are appointed by Mayor and Council. Department directors, assistant and deputy directors serve at-will. Other employees of the City are subject to the civil service provisions of the Charter.

DEPARTMENT OF PUBLIC WORKS

MISSION: Plan, design, and construct public facilities and infrastructure systems to enhance the quality of life for the residents of San Jose.

The Public Works Department has the primary responsibility to deliver facilities and infrastructure that meet the needs of the residents of San Jose and that comply with the standards and requirements established in the engineering guidelines and the City's Master Plans. The Department achieves its goals through planning, design, and construction of the City's capital projects, and also through the plan review and permit process to regulate and facilitate private development projects. The Director of Public Works/City Engineer manages the Department.

Department personnel work on the expansion and modernization of over 2,434 miles of streets, 926 miles of storm drains, 2,169 miles of sewer lines, 3,500 acres of parks and the design and construction of recreation facilities, police and fire stations, libraries, municipal buildings, bridges, and other public works projects. Recently completed projects include the Runway 30L Reconstruction and the Federal Inspection Facility at the Norman Y. Mineta SJA, the West Valley Branch Library, 4th and San Fernando Parking Garage, and various parks improvement projects.

The Department employs over 380 employees in many different disciplines including engineering, architecture, landscape architecture, surveying, drafting, real estate, and construction management. Major projects currently underway include a new Civic Center, the Alameda and Berryessa Branch Libraries and the Bailey Avenue extension to SR 101. Major programs include the \$228 million Parks Bond, \$211 million Branch Library Facilities Bond, the \$159 million Fire, Police Stations and Facilities Bond and the \$691 million Airport Security and Traffic Relief Act Bond.

PROJECT MANAGEMENT/DELIVERY

The Department has a focus of "on time, on budget" and reports performance measures in the categories of timeliness, cost, quality, and customer satisfaction in the annual Operating Budget. Project management is a team effort in which the projects are assigned to a client partner and a DPW project manager. The client provides scope and funding and the project manager is responsible for the budget and schedule. The project manager is involved with design and problem resolution but passes construction management responsibilities to a construction manager from the same division.

Project funding is the responsibility of the client department and may be generated from special taxes, bonds, in-lieu fees, and grants. The seven divisions (not including Administration) within the Department use a design-bid-build system for project delivery. Design has shifted from mostly in-house to over 70% consultant design, often using master agreements for multiple projects. This has taken place in order to meet a large increase in workload from approximately \$1.291 billion in bond funds and the new Civic Center. However, since reduced revenues are forecast for state and local governments, more projects will be designed in-house over the next year. Construction management remains largely in-house, augmented with consultants for special assignments.

CONSTRUCTION CONTRACTS/CAPITAL IMPROVEMENT PROGRAM

Major construction contracts scheduled for award in Fiscal Year 2002-03 through Fiscal Year 2004-05 (design and construction management included, rounded to \$1,000,000):

Program	Total Projects	Total Cost
Public Safety Bond	20	\$116,000,000
Library Bond	21	\$104,000,000
Parks/Recreation Facilities	62	\$140,000,000
Airport Master Plan	54	\$521,000,000
Civic Center	1	\$210,000,000
Wastewater Program	26	\$91,000,000
Storm Drainage	5	\$4,000,000
Traffic	92	\$195,000,000
Total	281	\$1,381,000,000

C. SIMILARITIES AND DIFFERENCES

I. Agencies Summaries

Update 2003 agency information is consistent with the first year of the study. All seven agencies are similar in structure. The diversity of projects types and sizes planned for the next three years provide opportunities to continue this benchmarking study and gain valuable information in future years.

II. Available In-House Project Delivery Services

Table C summarizes the agencies' project delivery services that are available in-house. There has been no change in the available in-house project delivery services, compared to last year. Note that the information on the new participating agency (City of Oakland) is provided. City of Los Angeles is still the only agency that provides in-house geotechnical services.

III. Fact Sheets

TABLE D – FACT SHEET

Agency	Total CIP Value* Planned for FY 2002-03 Through FY 2004-05 (Million Dollars)	Number of Full-Time Employees ** (Authorized Positions)
Long Beach, Department of Public Works	235	90
Los Angeles, Department of Public Works/Bureau of Engineering	986	700
Oakland, Public Works Agency	140	95
Sacramento, Department of Public Works	244	98
San Diego, Engineering & Capital Projects	1,357	470
San Francisco, Department of Public Works / Bureau of Engineering / Bureau of Construction Management / Bureau of Architecture	1,364	431
San Jose, Department of Public Works	1,381	380

* Total project budget for the projects awarded during FY 2002-03 Through FY 2004-05

** Staff involved with delivery of Capital Improvement Projects

Chapter 4

Process Benchmarking



Department of
PUBLICWORKS
CITY OF SACRAMENTO



CITY OF
SAN JOSE
CAPITAL OF SILICON VALLEY



Process Benchmarking

A. GUIDING PRINCIPLES

Executive level technical staff from seven major cities (the Project Team) shared and openly discussed the effectiveness of their capital project delivery methods during the study. This Project Team identified, discussed, and evaluated 98 processes associated with the effective delivery of capital projects.

The participating agencies then met to identify "Recommended Best Management Practices." They used their collective experience, as well as benchmarking outcomes, to identify the processes that they believed would improve the delivery of capital projects. The agencies used an intuitive consensus approach to determine which processes should be recommended as Best Management Practices (Table E).

B. IMPLEMENTATION OF BEST MANAGEMENT PRACTICES

While the 2002 report identified 15 Common Best Management Practices and 24 Recommended Best Management Practices, the second year of the study began tracking the actual implementation of these Best Management Practices.

An important focus of *Update 2003* was to improve the project delivery process by committing to the implementation of the Best Management Practices identified in the 2002 report. After several months of process improvement information sharing, a survey of the participating agencies was undertaken. The survey, shown in Table E, indicates the present status and intent of each agency to implement these Best Management Practices.

Two additional Best Management Practices were identified through *Update 2003* as follows:

■ Make Bid Documents Available Online

The cost of reproduction and distribution of bid documents is increasing and may be reduced by making the documents available online.

■ Create In-House Project Management Team for Small Projects

The 2002 study performance data suggested that project delivery costs were disproportionately high for projects with values of less than \$250,000. It is envisioned that utilizing a specialized in-house team to implement these projects would reduce costs.

The implementation of these additional Best Management Practices is also indicated in Table E.

C. ADDITIONAL IMPROVEMENTS

In addition to the specific Best Management Practices directly associated with project delivery, the Project Team identified certain improvements in contract documents that may improve the project delivery process:

■ Standardized Indemnification Clauses

Standardized indemnification language, in which risk is reasonably apportioned to the parties most able to control it, would allow design professionals and their insurers know what to expect and would expedite agreements.

**TABLE E – IMPLEMENTATION OF RECOMMENDED AND
COMMON BEST MANAGEMENT PRACTICES**

Process Category	Ref.*	Best Management Practice	LA	LB	OK	SC	SD	SF	SJ	Notes
Planning	RECOMMENDED	1.b. Complete Feasibility Studies on projects prior to defining budget and scope	2004	✓	✓	✓	PI 2004	✓	PI	LB: When applicable SD: Result of Multi-Agency Benchmarking SF: When applicable SJ: Some exceptions
		1.d. Have a Board/Council project prioritization system	2004	N/I	N/I	PI	2004	N/I	N/I	SD: Result of Multi-Agency Benchmarking SC: Done for Transp. Will do for Facilities in 2004
		1.e. Provide resource loading for projects listed in the CIP for design and construction	✓	2004	✓	2004	2004	N/I	N/I	SD: Result of Multi-Agency BM SJ: Staffing model (including Consultants submitted to Budget)
	COMMON	1.a. Capital projects are well defined with respect to scope and budget at the end of the planning phase	✓	✓	2004	✓	PI 2005	✓	✓	SD: Some Divisions only
		1.f. There is a Master Schedule attached to the CIP that identifies start and finish dates for projects	✓	2004	N/I	✓	N/I	2004	2004	
		1.i. Projects shown on a Geographical Information System	✓	✓	2004	✓	2004	2004	2004	LB: Infrastructure only
Design	RECOMMENDED	2.b. Provide a clear, precise scope to designers prior to design start	✓	✓	✓	✓	2004	✓	✓	
		2.f. Define requirements for reliability, maintenance, and operation prior to design start	✓	2004	N/I	2004	PI	✓	✓	SD: Some Divisions only (Rest N/I)
		2.i. Adapt successful designs to project sites, whenever possible (e.g. fire stations, gymnasiums, etc.)	✓	✓	✓	✓	PI	✓	✓	SD: Some Divisions only, where applicable
	COMMON	N/A Train in-house staff to use Green Building Standards	✓	2004	2004	✓	✓	✓	PI	SF: When applicable
		2.d. Designers are required to provide a work plan or design schedule prior to design start	✓	✓	✓	✓	✓	✓	✓	SD: Pre-Design and scope agreement study part of P3
		2.g. Designs are done on 2D CAD systems	✓	✓	✓	✓	✓	✓	✓	

Instructions:

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PI: Partially Implemented

yyyy: Will be implemented in calendar year "yyyy"

N/I: No plans to implement at this time

*Reference to Process Questionnaire in Appendix C of 2002 Report.

Legend:

LA: Los Angeles

LB: Long Beach

OK: Oakland

SC: Sacramento

SD: San Diego

SF: San Francisco

SJ: San Jose

**TABLE E – IMPLEMENTATION OF RECOMMENDED AND
COMMON BEST MANAGEMENT PRACTICES**

Process Category	Ref.*	Best Management Practice	LA	LB	OK	SC	SD	SF	SJ	Notes
Quality Assurance / Quality Control		3.I.a. Develop and use a standardized Project Delivery Manual	✓	2004	2005	2004	PI	✓	✓	SC: Started in 2003 SD: incorporated into PM training manual and standard primavera schedule template/descriptions. Details available, as needed.
		3.II.b. Perform a formal Value Engineering Study for projects larger than \$1,000,000	✓	✓	N/I	✓	✓	✓	2004	LA: For projects > \$1 million LB: On an as-needed bases SC: For projects > \$5 million SF: On an as-needed basis SJ: For projects > \$5 million
		3.III.a. Use a formal Quality Management System	✓	2004	N/I	PI	PI 2005	2004	2004	SD: Some Divisions only
		3.III.b. Perform and use Post Project Reviews for lessons learned	2004	2004	✓	PI	✓	✓	2004	SF: On selected projects SD: On selected projects
		3.I.d. Agency uses standard forms for RFI's, Change Orders, Pay Applications, Field Clarifications, Minutes of Meetings, etc.	✓	✓	✓	✓	✓	✓	✓	
		3.III.g. Inspectors are trained and, when required, certified	✓	✓	✓	✓	✓	✓	✓	
		RECOMMENDED								
		COMMON								

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**TABLE E – IMPLEMENTATION OF RECOMMENDED AND
COMMON BEST MANAGEMENT PRACTICES**

Process Category	Ref.*	Best Management Practice	LA	LB	OK	SC	SD	SF	SJ	Notes
Construction Management	4.I.a.	Delegate authority to the City Engineer / Public Works Director to approve change orders to the contingency amount	✓	✓	✓	2004	✓	✓	✓	SF: At Bureau level SJ: Individual C.O. < \$100,000
	4.I.g.	Set aside 15% for construction change order contingency	✓	✓	N/I	N/I	✓	N/I	✓	OAK: Up to 10% SD: 10% or 5% Contingency (depends on value). Field Orders 5% SF: Difficult to sell to client & Board SJ: 5% for new, 10% for buildings and underground, 15% for renovations
	4.I.m.	Classify types of changes	✓	N/I	✓	✓	PI	✓	2004	SD: Only for scope changes versus other types
	4.II.a.	Include a formal Dispute Resolution Procedure in all contract agreements	✓	N/I	✓	✓	✓	✓	✓	
	4.III.a.	Use a team building process for projects greater than \$5 million.	✓	✓	N/I	✓	✓	✓	✓	LB/SD: As-needed SF: As-needed SJ: Formal process for projects > \$10 million
	4.IV.a.	Involve the Construction Management Team before completion of design	2003	2004	✓	PI	✓	✓	✓	SD: Some Divisions only
	N/A	Delegate authority for Change Order approval to the departments, in order to reduce paperwork	✓	✓	N/I	N/I	✓	✓	✓	
	N/A	Establish award limits for construction to support award by the director without a Board approval	N/I	N/I	N/I	N/I	✓	✓	✓	SF: For own projects SD: For budgeted projects less than \$1,000,000
	N/A	Establish a pre-qualification process for contractors for large complex projects	2004	N/I	N/I	✓	✓	PI	2004	
	N/A	Make bid documents available online	2004	2004	N/I	N/I	PI	N/I	PI	SD: System options being evaluated
COMMON	4.I.d.	A formal change order process is in place, which defines all forms and methods necessary to finalize change orders	✓	✓	✓	✓	✓	✓	✓	
	4.I.f.	A change order contingency is set aside at the start of the project.	✓	✓	✓	✓	✓	✓	✓	

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**TABLE E – IMPLEMENTATION OF RECOMMENDED AND
COMMON BEST MANAGEMENT PRACTICES**

Process Category	Ref.*	Best Management Practice	LA	LB	OK	SC	SD	SF	SJ	Notes
Project Management	RECOMMENDED		✓	✓	✓	✓	PI	✓	✓	SD: Some Divisions only
	5.I.f.	Assign a client representative to every project	✓	✓	✓	✓	PI	✓	✓	
	5.II.a	Provide formal training for Project Managers on a regular basis	✓	2004	✓	2003	✓	✓	✓	
	N/A	Create in-house project management team for small projects	2005	2004	N/I	2003	PI	N/I	✓	
	5.1.d.	A Project Manager is assigned to every project	✓	✓	✓	✓	✓	✓	✓	
	5.1.e.	Project Manager has "cradle to grave" involvement	✓	✓	✓	✓	✓	✓	✓	
Consultant Selection and Use	5.III.a.	A standard Project Control System has been adopted by the Agency and is in use on all projects	✓	2004	N/I	PI	✓	✓	2004	SD: Project controls incorporated into Primavera schedule
	6.e.	Delegate authority to the PW Director/City Engineer to approve consultant contracts under \$250,000, when a formal RFP selection process is used	N/I	N/I	N/I	N/I	✓	✓	N/I	
	6.g.	Implement and use a consultant rating system that identifies quality of consultant performance	✓	2004	✓	2004	✓	N/I	2004	
	6.h.	The consultant selection process is qualification based	✓	✓	✓	✓	✓	✓	✓	
	6.c.	A Standard Consultant contract is included in the RFQ/RFP with a standard indemnification clause	✓	✓	✓	✓	PI	✓	✓	SD: Some Divisions only
	6.f.	An Annual RFQ/RFP solicitation is used to develop an on-call list of pre-approved consultants	✓	✓	✓	✓	✓	✓	✓	LA: Every 3 years OAK: Bi-annual SC: Every 3 years SD: Every year SF: Every 3 years SJ: Every 2 years

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■ **Standardized Document Ownership Language**

The development of standard document ownership language would let design professionals know what to expect and would expedite agreements.

The implementation of these improvements are outside of the direct control of the Project Team. A plan for implementation of these and other process improvements will be developed as a part of the next update of this report.

D. DISCUSSION ITEMS FOR THE IMPROVEMENT OF PROCESSES

The Project Team's approach to improving project delivery processes and emphasizing Best Management Practice implementation relied on the collective wisdom and experience of project delivery executives from the seven participating agencies. Specifically, members of the Project Team shared processes that were effective in their communities as follows:

- **Strategic Project Prioritization.** The City of Sacramento, Department of Public Works presented its Transportation Programming Guide which provided an objective approach to prioritizing projects based on need.
- **Asset Management.** The City of Los Angeles, Bureau of Engineering presented an approach to developing condition assessments of major facilities.
- **Estimating Procedures.** The City of San Jose, Department of Public Works presented a cost estimating approach that spans from concept phase to completion of the final construction documents.
- **Front-End Documents.** The City and County of San Francisco, Department of Public Works presented an approach to standardizing electronically formatted "front end" bid documents.
- **Pre-Qualification.** The City of Los Angeles, Bureau of Engineering presented an approach to pre-qualify contractors for design-bid-build projects.

In addition, the Project Team discussed streetscape design, sustainable design standards, electronic bid-document distribution, management of liquidated damages, standard indemnification clauses, and design document ownership.

E. ONLINE DISCUSSIONS AND COMMUNICATION

Update 2003 also provided a basis for online discussions and correspondence among Project Team members. Agency members posted their questions on an email distribution list and other members responded, based on experiences with their own agency practices. This was acknowledged as an efficient and effective communication method and continues to play an important role in development of "a continuous forum for communication to enable agency representatives to network with one another" (2002 report: Page 9).

The following questions have initiated interesting online discussions that have been elaborated on in the Project Team meetings:

- **Construction Contract Bid & Award process and schedule and contractors insurance requirements.** San Diego, 10/09/02: This discussion was initiated by the City of San Diego noting the particular problem contractors appeared to have procuring the insurance required by the contract documents between the Notice of Award and the intended Notice to Proceed.
- **Whether or not Clients' Department costs were included in the delivery costs provided for this benchmarking study.** San Jose, 10/15/02: This discussion was initiated by San Jose to question the accuracy of the project

delivery cost data. Specifically of concern was determining if the pre-construction planning and other costs expended by the user agency was captured and what means was used to capture the effort or costs expended. The conclusion from four of the agencies was that Owner Department costs were not being captured in project delivery costs. Most owner departments have separate operating budgets.

- **ADA Compliance for conversion of streets to pedestrian malls.** San Francisco, 01/30/03: This discussion was initiated by San Francisco in order to prompt an exchange of ideas regarding design standards, costs and extent of the implementation of ADA in pedestrian mall conversions.
- **Organization of Public Works department.** Sacramento, 02/03: This request was initiated by the City of Sacramento in order to assist in evaluating the structure and composition of its Public Works Department.
- **Review of agencies' indemnification clauses for consultants' services.** Oakland, 02/05/03: This conversation was initiated by Oakland and arose out of the delays incurred in getting design contracts fully executed due to objections from consultants to language allocating apparently excessive responsibility to the consultant. The Project Team agreed that standard, less onerous indemnification language among the agencies could alleviate the problem. Development of suggested language may be taken on as a task in a future update of the study.
- **Mandating LEED Certification and Green Design adherence and implementation of Green Design guidelines.** San Francisco, 02/10/03: This discussion revolved around the concept of avoiding excessive delays and costs that agencies had experienced in the pursuit of independent outside certification of projects prior to going to bid. One concept discussed was in-house certification. Discussion among the Project Team is continuing.
- **Issuance of Construction project plans and specification online, as well as / instead of paper sets.** Los Angeles, 02/13/03: None of the agencies currently distribute bid documents online even though the practice would result in the substantial reduction of document reproduction costs. During the discussions it was found that the City of Seattle does distribute bid documents online. This discussion will continue.
- **Agencies' typical cost per mile for sewer construction and review of similarities and differences.** City of Oakland, 02/21/03: The unit price of sewer construction was discussed in depth as well as the factors contributing to the wide variations between agencies. It was agreed that variations were to be expected and that developing comparative data might be done outside of the scope of this team because the variations were related more to construction circumstances rather than project delivery processes.
- **Recruitment of geotechnical engineers, their minimum qualifications, salaries, and job descriptions in various agencies.** San Francisco, 03/11/03: It was determined that Los Angeles was the only one of the seven agencies that had in-house geotechnical resources. Discussion on this topic continues.
- **Monetary limits for award of competitively bid projects by Bureau of Engineering, Public Works Board, or City Council.** San Jose, 03/26/03: This topic was discussed in detail and two tables were developed as follows (Tables F-1 and F-2):

**TABLE F-1: AWARD OF COMPETITIVELY BID PROJECTS
(Construction)**

Participating Agency	Award is made by:			
	Public Works Board	Director of Public Works	City Manager	City Council
Long Beach			< 100,000	≥ \$100,000
Los Angeles	ALL			
Oakland			< 50,000	≥ \$50,000
Sacramento			< 100,000	≥ \$100,000
San Diego			< \$1,000,000	≥ \$1,000,000
San Francisco		ALL		
San Jose		< 100,000	< 100,000	≥ \$100,000

**TABLE F-2: AWARD OF CONTRACTS
(Professional/Personal Services)**

Participating Agency	Award is made by:				
	City Engineer	Public Works Board	Director of Public Works	City Manager	City Council
Long Beach				< \$100,000	≥ \$100,000
Los Angeles	< \$25,000	≥ \$25,000			
Oakland				< \$15,000	≥ \$15,000
Sacramento				< \$100,000	≥ \$100,000
San Diego	< \$15,000			\$15,000-\$250,000	≥ \$250,000
San Francisco			ALL		
San Jose				< \$100,000	≥ \$100,000

- **Removal of utilities markings after streets construction completion.** Long Beach, 03/31/03: The marks on City property remaining after construction was completed are an eyesore. Other communities had adopted ordinances or contract specifications requiring the cleanup and removal of the utility marking.
- **DBE participation for Design - Build projects.** San Diego, 04/16/03: This discussion related to how DBE participation on design-build projects might be required as compared to those projects bid the conventional design-bid-build method. Some agencies had no formal requirements when design-build was utilized. Others had the same requirements as design-bid-build.

- **Review of the City's Infrastructure Report Card.** Los Angeles, 05/01/03.
- **Policies and procedures to employ MBE/DBE/WBE.** San Diego, 05/01/03.
- **Environmental documents and permits costs, evaluation time, responsible party, mechanism to assure effectiveness and adherence to schedule, sequencing with design, etc.** San Diego, 06/04/03: The City of San Diego initiated this discussion to get feedback on what other agencies were experiencing in costs for CEQA compliance activities and what their processes were. Some agencies use consultants exclusively, others have the environmental permit process handled outside of the division responsible for project delivery, and yet others handle the environmental permits within the delivery team.
- **Standards and design guidelines for public safety capital programs.** San Jose, 06/10/03: Agencies discussed experiences to acquire design and PM/CM services to construct fire, police and 911 facilities. The group received fire design standards from Los Angeles and architectural program requirements from San Francisco. San Jose is developing its own standards for the public safety bond program.
- **Federal wage rates versus California wage rates for Federally-funded projects.** San Francisco, 06/10/03: The discussion was about the lengthy administrative process to comply with the Federal wage rates requirements. It centered around the burdensome requirement for attaching the latest Federal and California wage rates in the bid package. All responding agencies do this; however, San Jose does not include the California wage rates but rather indicates to the bidders where they can obtain a copy of that information.

In addition to providing an online forum for sharing information, the study also created networking opportunities whereby off-line one-on-one conversations took place between agencies on issues of mutual interest.

F. SPECIAL STUDIES

The Project Team decided that a special study would be conducted every year, consistent with the objective of improving processes. The special study for this year was to review the use of consultants and to compare that to the overall project delivery costs for all agencies to identify areas of improvement. Table G summarizes the use of consultants compared with project delivery percentages for all agencies. This report is a part of the project database and is updated instantly as additional project data are compiled.

The Project Team proposed the following special studies for future years of study:

- Investigate projects with delivery costs greater than 50% and relate to process improvement.
- Categorize Change Orders into "Scope Changes" and "All Others."
- Review and benchmark project permits and fees.
- Benchmark projects' unit costs (e.g. cost per mile of street widening projects).
- Identify and include Design-Build projects in the study.
- Identify and review projects with contingency allowances.

TABLE G – CONSULTANTS USAGE AND PROJECT DELIVERY PERCENTAGES

AGENCY*	DESIGN						CONSTRUCTION MANAGEMENT						PROJECT DELIVERY					
	In-House			Consultants			In-House			Consultants			In-House			Consultants		
	(\$)	% of DES	(\$)	% of DES	Total % of TCC**		(\$)	% of CM	(\$)	% of CM	Total % of TCC**		(\$)	% of PD	(\$)	% of PD	Total % of TCC**	
Agency A	10,460,919	67.0%	5,159,068	33.0%	21.9%		11,406,408	97.8%	260,246	2.2%	18.8%		21,867,327	80.1%	5,419,314	19.9%	40.7%	
Agency B	4,745,525	38.5%	7,583,591	61.5%	14.1%		4,709,425	51.3%	4,477,194	48.7%	11.3%		9,454,950	43.9%	12,060,785	56.1%	25.3%	
Agency C	19,739,762	81.4%	4,501,409	18.6%	13.7%		18,710,779	91.5%	1,729,186	8.5%	13.5%		38,450,540	86.1%	6,230,595	13.9%	27.2%	
Agency D	27,568,063	59.2%	18,985,183	40.8%	20.2%		37,067,970	93.2%	2,724,096	6.8%	16.8%		64,636,033	74.9%	21,709,279	25.1%	37.0%	
Agency E	1,771,320	51.3%	1,683,309	48.7%	12.5%		2,127,134	94.3%	128,089	5.7%	15.3%		3,898,454	68.3%	1,811,398	31.7%	27.9%	
Agency F	8,985,089	73.3%	3,268,807	26.7%	19.0%		10,086,549	94.2%	625,322	5.8%	18.1%		19,071,639	83.0%	3,894,129	17.0%	37.1%	
Agency G	5,752,018	60.7%	3,729,801	39.3%	16.7%		5,544,153	99.6%	25,000	0.4%	13.5%		11,296,171	75.1%	3,754,801	24.9%	30.1%	
OVERALL	79,022,696	63.8%	44,911,168	36.2%	17.2%		89,652,417	90.0%	9,969,133	10.0%	15.5%		168,675,113	75.5%	54,880,301	24.5%	32.8%	

* Project Delivery percentages as of TCC (DES, CM, PD) are "Averages" of individual project percentages. TCC=Total Construction Cost (Including all Change Orders, City Forces, and Utilities Relocation).

Chapter 5

Performance Benchmarking



Department of
PUBLICWORKS
CITY OF SACRAMENTO



OAKLAND
PUBLIC WORKS AGENCY

CITY OF
SAN JOSE
CAPITAL OF SILICON VALLEY



Performance Benchmarking

A. GUIDING PRINCIPLES

Performance benchmarking consisted of collecting documented project costs and comparing the actual project delivery costs with total construction costs.

Update 2003 began with an improvement to the project performance questionnaire that was modified to collect completion dates as well as project delivery costs. The questionnaires were uploaded into the project database using a Visual Basic code, as in the previous study year. In addition to 2002 report guidelines, the following applied to *Update 2003* performance benchmarking:

- **Costs.** All projects included in this study have a total construction cost exceeding \$100,000. (Projects less than \$100,000 in value are included in the database, but not included in the study.)
- **Completion Date.** Projects included in the study were completed after January 1997. Projects with earlier completion dates were excluded from the analysis, but still maintained in the database. The database software allows that projects may be sorted and/or filtered by completion dates for specific analyses.
- **Representative Projects.** All of the selected projects are "representative of the agencies' processes." The Project Team identified, reviewed, and corrected or eliminated all projects that had the potential to be outliers in the regression analysis.
- **Project Delivery Method.** All selected projects were delivered through traditional Design-Bid-Build delivery method. Projects delivered using Design-Build and delivery

methods other than Design-Bid-Build are categorically different and are not included in this study (or the database) at this time.

B. ADDITIONAL DATA COLLECTION AND DATABASE IMPROVEMENTS

Participating agencies provided project information by responding to the performance questionnaire. The Study Team compiled the data into the project database to develop new performance models. The curves were developed from data collected over the two study years from projects completed between 1997 and 2002.

However, as noted in the 2002 report, the performance models become more credible as the database grows and improves. Therefore, the Project Team set the *Update 2003* objectives for improving the database as follows:

- **Collect additional data to increase the number of projects included in the database.** Through an intense effort, the seven agencies were able to increase the total number of projects included in the study from 239 to 453, excluding non-representative projects. (The total value of the projects included in *Update 2003* is over \$830 million.)
- **Improve the data by correcting errors and providing missing data.** The Project Team reviewed the data included in the 2002 report and found that some of the inspection costs had not been captured in the construction management delivery analysis. These costs were captured and included in *Update 2003*.

Previously the database did not distinguish between projects that experienced no change orders and projects for which change order data was not available. In both instances a change order value of zero was simply included in the database for these projects. The costs for these projects have since been reviewed in detail and corrections were made to distinguish between projects with "zero" change orders and projects for which change order data were not available.

The duration data for design and construction management phases were reviewed and corrected. Further, the Project Team found that a tabulated analysis was more useful than regression curves.

- Outliers Identification. An outliers identification model was developed and implemented. The Project Team reviewed these projects for abnormal attributes. The project data were corrected or eliminated from the database, as appropriate. Appendix C provides details of the outliers identification technique.
- Collect data on additional project types and classifications. The Project Team expanded the project "types" to include Parks with sub-classifications of Playgrounds, Sport Fields, and Restrooms.
- Begin the process of linking processes to performance. In order to begin to facilitate future linking of implemented Best Management Practices to performance data, the Project Team perfected all project completion

dates and developed a sorting function within the software. The team also agreed that the five-year performance data source window would roll forward each year with the intent of eventually being able to measure the effect of the implementation of the BMPs on delivery performance.

- Conduct a comparison between in-house delivery and usage of consultants. The Study Team initiated an analysis that compared delivery costs on projects where consultant usage amounted to more than 50% of the costs of project delivery. A study of in-house project management costs, when consultant is the primary deliverer of project, will also be included.
- Improvements to the database. New database features include categorization by date and update year, inclusion/exclusion of mutually approved outliers, and additional instant reports and tables developed in *Update 2003* (Access reports, Word consolidated graphs report, Excel tabulation of R² and predictive table).

C. DISTRIBUTION OF PROJECTS

- Total Number of Records in the Project Database. Table H summarizes the total number of projects included in the database. While the database contains 525 projects, 453 fit the study criteria. As a result, column (d) of Table H was the basis for the performance graphs.

**TABLE H – PROJECTS INCLUDED IN CALBM DATABASE
(2002 and 2003 data)**

Update Year	TCC ≤ \$100,000 (a)	Completion Date < 1997 (b)	Non-Representative (c)	Corresponding Update 2003 Guidelines (d)= (e)-(a)-(b)-(c)	Total (e)
2002	25	7	9	198	239
2003	0	6	25	255	286
Total	25	13	34	453	525

**Basis for Update
2003**

- **Identification of Non-Representative Projects.** The Study Team utilized an outlier identification process to enhance the credibility of the final performance trends' capacity to serve as a predictive tool. A three-step process was followed:

1. A statistical model was developed which reviewed all project data and identified anomalies. A list of outliers (data outside of a defined interval) was identified that contained 75 projects.
2. The projects (data) identified as anomalies in Step 1 (above) were reviewed in detail by the contributing agency for necessary corrections or for exclusion from the performance model database.
3. As a result of Step 2, it was found that only 34 of the 75 statistical outliers were non-representative projects. These were generally the projects whose total delivery costs were greater than 50% or less than 15% of total construction cost. The 34 non-representative projects were excluded from this study.

In addition, all 25 projects smaller than \$100,000 and 13 projects outside of the 5-year window were excluded from this analysis.

- **Updated Projects Distribution Matrix.** Table I summarizes the final project distribution (453 projects). The table shows large diversity in the number of projects, which are widely distributed throughout the different classifications.

D. PERFORMANCE GRAPH DEVELOPMENT

Project performance data are available in the project database as a "Project Listing" report. Performance data were compiled into a Microsoft Access database. A Visual Basic program exchanges performance data with Microsoft Excel to develop and review performance curves (Appendix B-II, Pages B-31 to B-104).

Study participants used the database to review and evaluate numerous benchmarking models and lessons learned from the data trends.

The following are some examples of the models available in the database:

- Change order costs versus design cost, construction management cost, or total delivery cost.
- Project delivery costs versus consultant usage.
- Effects of consultant usage on total change order costs.
- Construction management cost versus design cost.

The database is designed to facilitate additional data collection and instant development of the performance graphs.

E. DISCUSSION

Table J summarizes the correlation coefficients for all performance models. In consideration of the large amount of data, the team decided to study performance models at the "Project Classification" level and therefore performance models were not developed at "Project Type" level. The table is also enhanced over last year (see Page 60 of the 2002 report) and shows R^2 values for project delivery, change order, and duration models at the classification level.

TABLE I – PROJECT DISTRIBUTION MATRIX

Project Type	Agency	Long Beach	Los Angeles	Oakland	Sacramento	San Diego	San Francisco	San Jose	Total All Agencies
Municipal Facilities		2	30	11	7	7	14	16	87
Libraries		0	15	3	1	2	2	2	25
Police / Fire Station		1	9	6	1	2	9	3	31
Community Building / Recreation Center/ Children Center / Gymnasium		1	6	2	5	3	3	11	31
Streets		26	17	15	35	18	45	23	179
Widening / New / Grade Separation		1	3	1	11	2	3	1	22
Bridges (Retrofit / Seismic)		0	14	0	1	3	3	2	23
Renovation / Resurfacing		13	0	4	9	2	19	6	53
Bike / Pedestrian / Curb Ramps		6	0	3	7	3	6	3	28
Signals		6	0	7	7	8	14	11	53
Pipe Systems		0	43	9	0	38	33	12	135
Gravity System (Storm Drains, Sewers)		0	31	8	0	20	21	12	92
Pressure Systems		0	0	0	0	15	6	0	21
Pump Stations		0	12	1	0	3	6	0	22
Parks		4	1	6	0	7	21	13	52
Playgrounds		1	0	3	0	1	18	11	34
Sport fields		1	1	3	0	3	1	1	10
Restrooms		2	0	0	0	3	2	1	8
Total All Types		32	91	41	42	70	113	64	453

While the number of projects has been almost doubled compared to the 2002 report, in some cases, correlation coefficients have not improved significantly. Limited improvement is noted in "Police/Fire Stations," "Renovation / Resurfacing," and "Signals" for the design models and "Widening / New / Grade Separation," "Bridges," and "Signals" for construction management models.

The decrease in R^2 values for most of the models is an indication of poor correlation and the Study Team is not recommending these models for use as "Predictive Tools." This outcome sheds light on areas of data improvement in future updates, as discussed below.

Appendix B provides all performance models. The following discussion summarizes the results of analyzing these performance models and comparing them with their equivalents in the 2002 report (Pages D-31 to D-74):

Curve Group I - Design Cost / Construction Cost Versus Construction Cost:

Design models, in general, have intuitively acceptable trends. The exceptions are bike/pedestrian/curb ramps and all parks classifications (playgrounds, restrooms, and sports fields).

Significant improvement is observed for the renovation/resurfacing model, compared to the 2002 report. This improvement also corresponds with the improved correlation coefficient ($R^2=0.0955$). While this is still a very small correlation coefficient, it has increased 330% compared to last year.

In general, design models still require significant additional data collection for consideration as predictive tools. The outliers identification technique that was applied to project delivery models could be a useful tool to identify anomalies in design models, as well. This was, however, considered a premature analysis at this time considering the small number and non-uniform distribution of

project data in various categories. It is envisioned that an appropriate number of projects will be included in future updates (at least seven projects per agency, per classification) to facilitate a more reliable analysis of statistical outliers.

Curve Group II - Construction Management Cost / Construction Cost Versus Construction Cost:

Observations of construction management models were generally similar to design models. The changes, compared to the 2002 report, were less significant than the design models, with the exception of community buildings. A significant improvement was observed in the widening / new / grade separation classification. While the number of projects was increased by only one (after eliminating non-representative projects), the correlation coefficient improved from near zero to 0.2081. This significant improvement was due in part to additional data and in part to eliminating six non-representative projects (three in the 2002 report and three in this study).

The observed improvement of the construction management model for widening / new / grade separation classification emphasizes the importance of additional data collection and, specifically, the significance of eliminating non-representative projects. It is hoped that in future updates similar improvements will be observed for all performance models.

Curve Group III - Project Delivery Cost / Construction Cost Versus Construction Cost:

Project delivery models, which represent the consolidation of design and construction management models exhibited behaviors similar to the other two curve groups. Since these models were the basis of outlier identification technique, they generally possessed higher correlation coefficients.

Generally, in all three performance models, the Bike/pedestrian/curb ramps classification and all Parks classifications exhibited very low correlations and non-intuitive trends. The low correlation for the Parks project type is due to the very small number of projects. This is because Parks is a new project type in this year's study. For the Bike/pedestrian/curb ramps classification, no conclusions can be made at this time. If additional data and a more critical review of the current data reveal a similar trend in future studies, it would imply that the cost of delivering of such projects is independent of their total construction cost.

Table K provides a tabulated summary of the project delivery performance models. This table is for reference only and is not yet useful as a predictive tool. Areas with values shown in "unshaded" type are the most reliable parts of this predictive tool and may be cautiously used as a guideline.

*Curve Group IV - Change Order Cost /
Construction Cost Versus Construction Cost:*

Similar to the 2002 report, no conclusions can be made based on Change Order models due to a lack of correlation. Successful application of change order models depends upon appropriately categorizing change orders. The Project Team concluded that change orders should be categorized as "Scope Changes" and "All Others." This is a task to be performed in future benchmarking studies.

*Curve Group V - Total Project Duration
Versus Construction Cost:*

Performance models for project duration have improved, compared to the 2002 report. This improvement is partially due to additional data collection and compilation. It is also due, in part, to the review of the 2002 report data and the incorporation of necessary modifications.

The general trend is intuitive for all project classifications. As the size of the project increases, the total duration also increases. The change in duration becomes less significant for larger projects. Streets graphs generally present better correlation coefficients than other project classifications. Association of these high R^2 s with the large number of data points is an indication of the models' reliability and usefulness as comparative tools. With little improvement (additional data and/or eliminating outliers), the duration models for Streets classifications can become useful predictive as well as comparative tools. The duration performance models for the other project classifications also appear useful and could be even more promising with additional data.

In general, duration performance models have good trends and correlations. Exceptions are Municipal Facilities - Libraries, Streets - Renovation / Resurfacing, Pipe Systems - Pressure Systems, and Pipe Systems - Pump Stations, with low correlations. The last two classifications also exhibited counter-intuitive trends, indicating the need for additional data collection. In reference to the Parks project type, the models' reliability can be significantly improved by additional data collection. A tabulation of duration models outcomes is provided in Table L. With additional data and other improvements, this table may be used as a predictive tool in the future.

TABLE J – PERFORMANCE GRAPHS R² RESULTS

Project Type Classification	Design % vs TCC*	Construction Management % vs TCC*	Project Delivery % vs TCC*	Change Order % vs TCC*	Total Duration % vs TCC*
Municipal Facilities					
Libraries	0.4915	0.2249	0.4552	0.0082	0.0692
Police/ Fire Station	0.2273	0.0496	0.2485	0.0456	0.3402
Community Building / Recreation Center/ Children Center / Gymnasium	0.0997	0.0826	0.1689	0.0208	0.2446
Streets					
Widening / New / Grade Separation	0.1772	0.2081	0.348	0.0081	0.438
Bridge (Retrofit / Seismic)	0.2376	0.2912	0.3187	0.0531	0.3344
Renovation / Resurfacing	0.0955	0.2311	0.3031	0.0349	0.1031
Bike / Pedestrian / Curb Ramps	0.0009	0.0069	0.0014	0.3703	0.6751
Signals	0.0939	0.1291	0.2265	0.0142	0.5621
Pipe Systems					
Gravity System (Storm Drains, Sewers)	0.2233	0.1544	0.2497	0.0235	0.2161
Pressure Systems	0.1056	0.2161	0.2565	0.2863	0.007
Pump Station	0.0857	0.2809	0.2545	0.0358	0.0351
Parks					
Playgrounds	0.0188	0.1974	0.1462	0.0216	0.3886
Sports fields	0.0021	0.0015	0.0002	0.3536	0.1739
Restrooms	0.0604	0.2565	0.2372	0.8947	0.4402

* TCC=Total Construction Cost (Including all Change Orders)

TABLE K – CIP DELIVERY COSTS *

PROJECT TYPE CLASSIFICATION	Total Construction Cost (TCC)	Design Cost (% of TCC)	Construction Management Cost (% of TCC)	Total Project Delivery Cost (% of TCC)
Municipal Facilities				
Libraries	TCC < \$0.5M	43% - 48%	32% - 37%	75% - 83%
	\$0.5M < TCC < \$ 3M	28% - 33%	21% - 26%	49% - 57%
	TCC > \$3M	15% - 20%	11% - 16%	26% - 34%
Police/ Fire Station	TCC < \$0.5M	26% - 30%	12% - 14%	38% - 43%
	\$0.5M < TCC < \$ 3M	21% - 25%	11% - 13%	32% - 37%
	TCC > \$3M	17% - 21%	10% - 12%	27% - 32%
Community Building / Recreation Center / Children Center / Gymnasium	TCC < \$0.5M	24% - 29%	12% - 14%	37% - 42%
	\$0.5M < TCC < \$ 3M	20% - 25%	10% - 13%	31% - 36%
	TCC > \$3M	17% - 21%	9% - 11%	26% - 31%
Streets				
Widening / New / Grade Separation	TCC < \$0.5M	25% - 30%	16% - 18%	41% - 46%
	\$0.5M < TCC < \$ 3M	19% - 24%	12% - 15%	32% - 37%
	TCC > \$3M	15% - 19%	9% - 12%	24% - 29%
Bridge / Retrofit / Seismic	TCC < \$0.5M	41% - 49%	25% - 29%	65% - 77%
	\$0.5M < TCC < \$ 3M	30% - 38%	19% - 23%	48% - 60%
	TCC > \$3M	20% - 28%	14% - 18%	34% - 45%
Renovation / Resurfacing	TCC < \$0.5M	15% - 18%	19% - 22%	34% - 39%
	\$0.5M < TCC < \$ 3M	11% - 14%	13% - 16%	23% - 28%
	TCC > \$3M	7% - 10%	7% - 10%	14% - 18%
Bike / Pedestrian / Curb Ramps	TCC < \$0.5M	17% - 24%	20% - 30%	35% - 51%
	\$0.5M < TCC < \$ 3M	16% - 23%	16% - 27%	33% - 49%
	TCC > \$3M	N/A	N/A	N/A
Signals	TCC < \$0.5M	15% - 19%	21% - 28%	37% - 44%
	\$0.5M < TCC < \$ 3M	10% - 14%	12% - 18%	22% - 30%
	TCC > \$3M	N/A	N/A	N/A
Pipes				
Gravity System (Storm Drains, Sewers)	TCC < \$0.5M	27% - 34%	21% - 26%	48% - 59%
	\$0.5M < TCC < \$ 3M	15% - 22%	15% - 20%	29% - 40%
	TCC > \$3M	4% - 11%	9% - 14%	13% - 23%
Pressure Systems	TCC < \$0.5M	17% - 21%	18% - 21%	35% - 40%
	\$0.5M < TCC < \$ 3M	12% - 16%	11% - 14%	23% - 28%
	TCC > \$3M	N/A	N/A	N/A
Pump Station	TCC < \$0.5M	22% - 26%	30% - 34%	51% - 59%
	\$0.5M < TCC < \$ 3M	17% - 22%	21% - 26%	39% - 46%
	TCC > \$3M	13% - 18%	14% - 19%	28% - 35%
Parks				
Playgrounds	TCC < \$0.5M	17% - 20%	19% - 22%	36% - 40%
	\$0.5M < TCC < \$ 3M	15% - 18%	11% - 14%	25% - 30%
	TCC > \$3M	N/A	N/A	N/A
Sports fields	TCC < \$0.5M	17% - 21%	12% - 15%	29% - 35%
	\$0.5M < TCC < \$ 3M	16% - 20%	13% - 15%	29% - 35%
	TCC > \$3M	N/A	N/A	N/A
Restrooms (N/A – Counter-intuitive)	TCC < \$0.5M	27% - 32%	30% - 43%	57% - 73%
	\$0.5M < TCC < \$ 3M	N/A	N/A	N/A
	TCC > \$3M	N/A	N/A	N/A

* The values in this table provide an overall summary of the performance benchmarking results. Caution is necessary in using this information as a predictive tool, particularly **shaded values** ($R^2 \leq 0.1$).

TABLE L – CIP PROJECT DURATION

Project Type Classification	Estimated Total Duration (Months)*	# of Projects
Municipal Facilities		
Libraries	35-46	25
Police/ Fire Station	37-56	30
Community Building / Recreation Center / Children Center / Gymnasium	27-38	31
Streets		
Widening / New / Grade Separation	34-56	21
Bridge / Retrofit / Seismic	37-51	22
Renovation / Resurfacing	26-33	50
Bike / Pedestrian / Curb Ramps	22-34	26
Signals	36-52	49
Pipes		
Gravity System (Storm Drains, Sewers)	49-78	91
Pressure Systems	53-48	21
Pump Station	34-47	10
Parks		
Playgrounds	25-37	34
Sports fields	35-50	9
Restrooms	49-68	8

* (a) Caution is necessary in using this information as a predictive tool, particularly shaded values ($R^2 \leq 0.1$).
(b) Project duration is defined as the time between conceptual design until substantial completion of the project.

Chapter 6

Conclusions and Recommendations



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- Benchmarking

Conclusions and Recommendations

A. PROCESS BENCHMARKING - RECOMMENDED BEST MANAGEMENT PRACTICES

Process benchmarking concentrated on four areas:

- The agencies' level of implementation of recommended Best Management Practices was a priority. With few exceptions, Best Management Practices have been or are planned to be implemented by next year. The agencies' belief in the importance of these processes and their intentions to implement them is a significant indication of the agencies' belief in collaboration and commitment to the principles put forth in the 2002 report.
- Two new recommended Best Management Practices were identified as a result of team discussions and added to the implementation plan.
- Online discussions were found to be valuable during this benchmarking study. Sixteen different process-related topics were discussed among the Project Team members demonstrating the agencies' belief that sharing their experiences can improve project delivery processes.
- Special studies, conducted as a part of current and future updates, are an important aspect of successful benchmarking. These studies will assist the team to better understand benchmarking outcomes by expanding the search for influences on the data and performance models. The special study contained in *Update 2003* involved a review of the role and use of consultants in the delivery of capi-

tal improvement projects. Six special studies are identified for consideration in future benchmarking efforts.

B. PERFORMANCE BENCHMARKING

Most performance models exhibited very similar trends compared to models contained in the 2002 report. Some of the 2002 report performance models that did not demonstrate intuitive trends had significantly better trends after inclusion of additional data. However, correlation coefficients did not appear to improve in many models. This could be attributed to the diversity of the agencies' processes. They also could be related to application of different criteria to the data collection process. A critical review of agencies' data collection processes is the first priority of the next year of study. This will hopefully identify areas of discrepancy and improve the performance models.

C. STUDY QUALIFICATIONS AND CHARACTERISTICS

The 2002 *California Multi-Agency CIP Benchmarking Study* developed a solid and beneficial foundation for process and performance benchmarking. The second year of study builds on this effort. *Update 2003* shows that additional project data made significant improvements to some of the models as compared to the 2002 study.

The statistical analysis included in the 2002 report had recommended that project data from the project *classification* level should not be bundled and analyzed at the project *type* level.

This recommendation was implemented in *Update 2003* after significant enhancement of the project data pool. All performance models were developed at the project classification level in this study.

The Study Team observed that additional data collection and review of existing data can significantly improve study outcomes. Areas of anomaly and discrepancy were quickly identified using the database tools. Necessary corrections were incorporated and the data quality and accuracy were significantly improved.

In conclusion, the above discussion suggests the following:

- Individual agencies can benefit from using the current 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.
- Additional project data will improve the results of this study and its ability to predict resource requirements needed to deliver a Capital Improvement Project. The current performance curves are an improvement compared to the 2002 report graphs. However, additional data collection can further improve credibility of these models and aid progress towards the objective of having a predictive tool.
- Similar to the 2002 study, the Project Team did not categorize change orders based on their source (Unforeseen and Changed Conditions, Design Changes, Owner-Initiated, Commissioning/Optimization, Miscellaneous). In this study, the Project Team discussed the possibility of studying categorization of change orders by "Scope Changes" and "All Others." This categorization may provide more realistic change orders models.
- As was the case in the initial year of the study, *Update 2003* found that agencies' multipliers remained similar and that it was still reasonable to use "Costs" as the comparative basis, instead of "Hours."

D. NEXT STEPS

- **Identify agencies' goals for process improvement.** All agencies showed an interest in implementing some or all of the Best Management Practices in the near future. An essential step in future studies is to review agencies' progress in this area and their approach to improving their processes based on the lessons learned in this benchmarking study.
- **Review of agencies data collection processes.** Figures 1a through 1c analyze changes in the design performance model for Libraries. In this example, individual agencies were performing much more similarly to one another in the 2002 study (Figure 1a - regression curves of Agencies A and D are very close to the global regression curve). In this year's study, however, the agencies' models show more differences in the cost of designing a CIP project (Figure 1b - Agencies D and G, the main contributors to this study, have trends significantly different from each other). Even though individual agencies' models have improved (compare R^2 values between Figures 1a and 1c), the combined model exhibits lower correlation due to agencies' differences (Figure 1c - the Global curve).
- **Additional data collection for performance benchmarking.** Performance benchmarking results will be improved with collection of additional projects data and exclusion of non-representative projects, as was the case in *Update 2003*. An improvement in the correlation coefficient of an individual agency's model indicates the agency's consistency in project delivery processes. An improvement

of the global model correlation coefficient would better verify agencies' similarities and/or differences.

Update 2003 data indicate that projects were not delivered at similar costs. Answers to the following three questions would clarify the reason for these differences:

1. *Are agencies' project delivery processes significantly different?* The *Multi-Agency Benchmarking Study of 2002* found that "the agencies' operations and approaches to project delivery are strikingly similar"¹ and the agencies processes are not known to have changed significantly since that report. Therefore, the differences in costs must be explained otherwise.
2. *Are agencies' collecting projects data differently?* The Project Team plans to review agencies' data collection procedures to assure consistency. The Project Team considers this a high priority for the continued study.
3. *Are all agencies' providing data on similar projects?* The fresher data included in *Update 2003* may reflect information on substantially different CIP projects between the participating agencies (e.g. one city may be doing mostly retrofits; others may be doing mostly new projects). Implementation of projects indices and development of the associated models as the study continues will determine the influence of project differences.

- **Continue forum discussions and agencies presentations.** The Project Team will continue to share experiences and questions through online discussions and presentations. This was found to be an effective method to improve processes and facilitate efficient delivery of Capital Improvement Projects.

¹ *California Multi-Agency CIP Benchmarking Study*, 2002 Report, Page 11.

Figure 1a

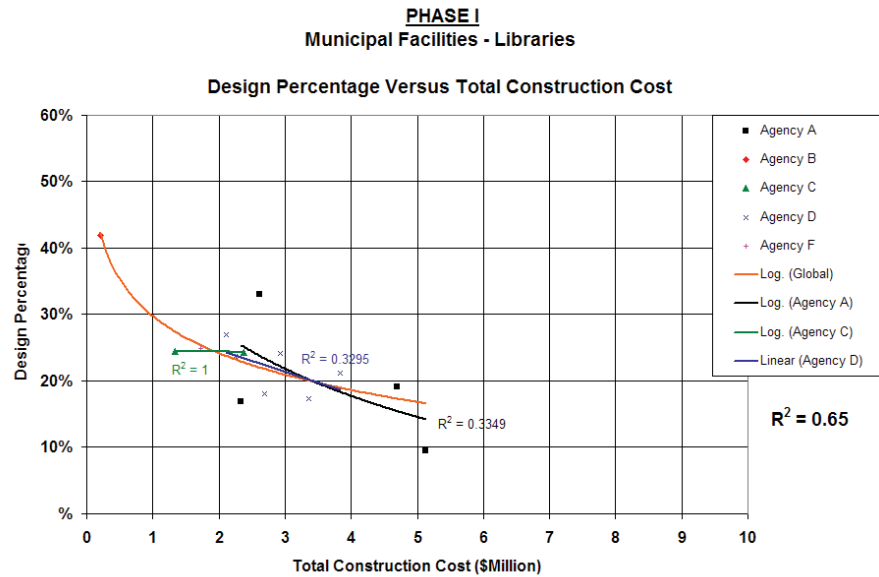


Figure 1b

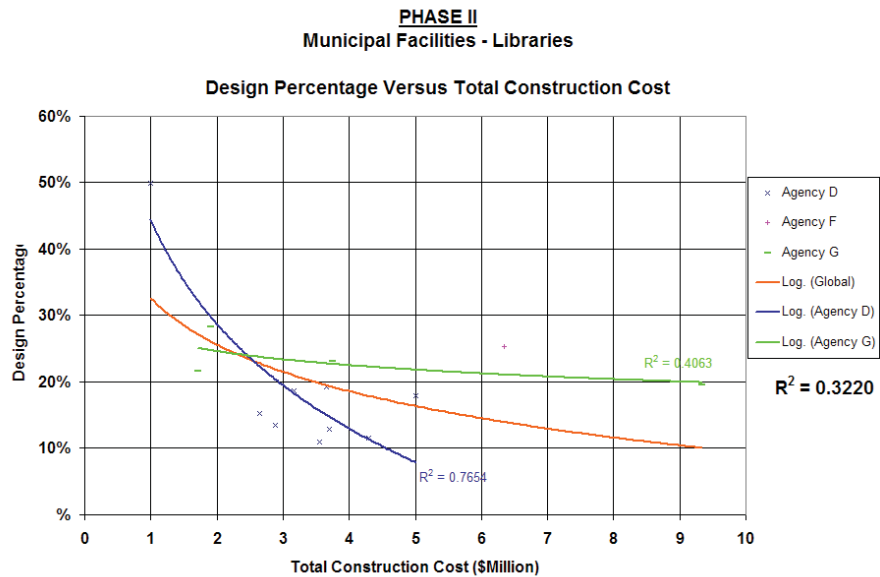
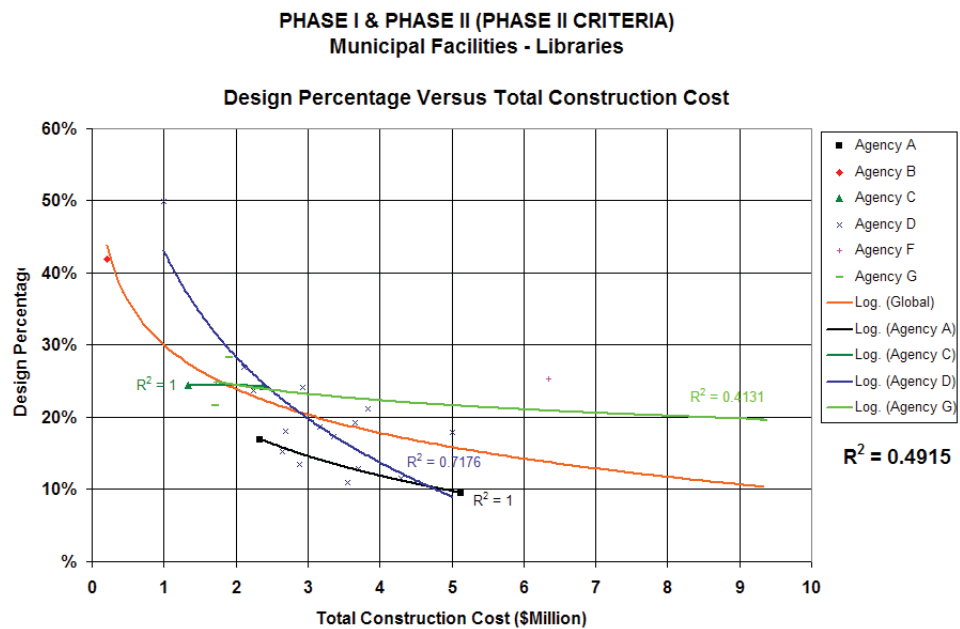


Figure 1c



Acknowledgments



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alfredo.iraheta@ci.sj.ca.us

A p p e n d i x A

Administrative Information



Department of
PUBLICWORKS
CITY OF SACRAMENTO



CITY OF
SAN JOSE
CAPITAL OF SILICON VALLEY



Recommendations

Administrative Information

**CALIFORNIA MULTI-AGENCY
CIP BENCHMARKING STUDY
AGENCIES MULTIPLIERS/ADMIN ITEMS MATRIX**

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)
City of Long Beach Department of Public Works	38.60%	19.40%	4.40%	11.90%	72.70%	147.00%	YES
City of Los Angeles Department of Public Works/ Bureau of Engineering	15.76%	18.67%	26.07%	26.28%	57.94%	144.72%	YES
City of Oakland Public Works Agency	38.17%	21.93%	23.19%	9.95%	13.63%	116.96%	NO
City of Sacramento Department of Public Works	30.00%	18.70%	27.82%	5.76%	66.41%	216.43%	YES
City of San Diego Public Buildings & Parks / Field	27.70%	15.50%	12.00%	33.10%	4.00%	92.40%	NO
Transportation & Drainage Design / Field	27.70%	14.70%	47.90%	39.40%	4.60%	134.20%	
Water / Wastewater Facilities / Field	27.50%	13.50%	11.90%	53.60%	4.30%	110.80%	
City and County of San Francisco Department of Public Works / Bureau of Engineering / Bureau of Construction Management / Bureau of Architecture	19.43%	23.78%	16.60% ⁽²⁾	36.02%	75.77%	155.00%	NO
City of San Jose Department of Public Works	26.79%	25.00%	40.86%	13.00%	INCLUDED	148.00%	NO

(1) This value may be different from the summation of the overhead values. The compounding formula is different for different agencies.
(2) Not included in the Indirect rate because it is not charged to these projects

**CALIFORNIA MULTI-AGENCY
CIP BENCHMARKING STUDY
AGENCIES MULTIPLIERS/ADMIN ITEMS MATRIX**

FRINGE BENEFITS						
City of Long Beach	City of Los Angeles	City of Oakland	City of Sacramento	City of San Diego	City and County of San Francisco	City of San Jose
<ul style="list-style-type: none"> Deferred comp (city contribution) FICA Medicare Health, dental, life insurance Payroll Admin Retirement pension Worker's Comp 	<ul style="list-style-type: none"> Dental Insurance Employee Assistance Health Insurance Hiring Hall Fringe Life Insurance Medicare Pensions (Fire/Police Sworn) Retirement (Civilians) Social Security Unemployment Insurance Union Sponsored Benefits Unused Sick/Vacation Payout Worker's Compensation (PST) (457 Retirement Plan) 	<ul style="list-style-type: none"> Retirement Health Insurance Retiree Medical Workers Compensation Dental Insurance Disability Insurance Unemployment Insurance Life Insurance Vision Care Uniform Allowance Professional Development 	<ul style="list-style-type: none"> \$45 Transportation Allowance 80% Reimbursed Transit Pass City-Paid Employee PERS Disability Insurance Contribution Life Insurance Contribution Medical/Dental Ins Contribution 	<ul style="list-style-type: none"> FICA/Medicare Insurance Flex Benefits Plan LT Disability Retirement Risk Management Admin Unemployment Insurance Unused Sick Leave Workers Comp Insurance 	<ul style="list-style-type: none"> Dependent Coverage Flexible Benefit Package Health Services – City Match Long-Term Disability Insurance Retirement Pick-Up Social Security – Medicare Social Security (OASDI) Unemployment Insurance 	<ul style="list-style-type: none"> Concern Dental Insurance Health Insurance Legal Life Insurance Medicare Retirement Salary Continuation SSN Unemployment Uniform Unused Sick / Vacation Payout Vision Insurance

**CALIFORNIA MULTI-AGENCY
CIP BENCHMARKING STUDY
AGENCIES MULTIPLIERS/ADMIN ITEMS MATRIX**

COMPENSATED TIME OFF					
City of Long Beach	City of Los Angeles	City of Oakland	City of Sacramento	City of San Diego	City and County of San Francisco
<ul style="list-style-type: none"> • Bereavement • Holiday • Jury Duty • Sick leave • Union leave • Vacation 	<ul style="list-style-type: none"> • Bereavement Leave • Family Illness • Floating Holiday • Holiday • Injury on Duty • Jury Duty • Military Leave • Preventive Medicine • Sick Leave • Vacation • Workers' Compensation 	<ul style="list-style-type: none"> • Vacation • Sick Leave • Other Paid Leave 	<ul style="list-style-type: none"> • 10 Days Mgmt Leave • 10 Vacation Days • 12 Sick Days • 12 to 14 Holidays 	<ul style="list-style-type: none"> • Accident Prevention Mtgs. • Annual Leave/Pay in Lieu • Annual Leave/Sick Family • Annual Leave/Sick Personal • Annual Leave/Vacation • Cash Bonus • City Civil Service Exams • City Health Wellness Program • City Job Interviews • City Medical Exams • Comp Time Hours Taken • Court Leave - Jury Duty • Court Leave - Witness Duty • Discretionary Leave • Exceptional Performance Pay - EPP • Floating Holidays • Grievance Processing • Holiday Credit on Day Off • Holidays - Scheduled • Industrial Leave • In-Service Training • Labor Relations Meeting • Seminars and Conferences • Sick Leave Old/Personal • Termination Pay • Voluntary Leave - Paid 	<ul style="list-style-type: none"> • Associated mandatory fringe benefits • Compensatory time off • Holiday pay • Sick pay • Vacation
					<ul style="list-style-type: none"> • Disability Leave • Executive Leave • Funeral Leave • Holiday Leave • Jury Duty • Military Leave • Paid Time Off • Personal Leave • Sick Leave • Vacation • Witness Leave

**CALIFORNIA MULTI-AGENCY
CIP BENCHMARKING STUDY
AGENCIES MULTIPLIERS/ADMIN ITEMS MATRIX**

CITY OVERHEAD					
City of Long Beach	City of Los Angeles	City of Oakland	City of Sacramento	City of San Diego	City and County of San Francisco
<ul style="list-style-type: none"> • City Attorney • City Auditor • City Clerk • City Manager Legislative • Financial Management 	<ul style="list-style-type: none"> • Building Leases (GSD & Spec. Funds) • Building Use Allowance • Computer Assets Depreciation (Items costing \$5,000 & above) • Communications Lease (Telephone bill) • Equipment Use Allowance (Items costing \$5,000 & above) • Equipment Exp. Under \$5,000 (Computers & equipment costing under \$5,000) • Emergency Operations Expenses • Natural Gas Utility (GSD) • Insurance on bond financed assets • General City Purposes • Liability Claims • Petroleum Products (GSD) • Vehicle Depreciation • Water & Electricity 	<ul style="list-style-type: none"> • Rent • City Attorney • Financial Services • Treasury • Accounting • Stores • City Manager • City Auditor • Personnel • City Clerk • Information Technology 	City Wide Support Functions such as: <ul style="list-style-type: none"> • Accounting • Budget • Central Copy/Stores • City Attorney • City Clerk • City Computer Support • City Manager • Etc. • Finance • IT Administration • Payroll • Procurement • Revenue • Telecommunications 	Departmental Support Costs: <ul style="list-style-type: none"> • Citizens Assistance • City Attorney • City Auditor & Comptroller • City Clerk • City Manager • City • Treasurer • Citywide Dept (includes Liability claims) • Financial Management • Intergovernmental Relations • Personnel • Purchasing 	<ul style="list-style-type: none"> • Board of Supervisors - Budget Analyst • Building Repair • Building Use Allowance • City Attorney • Civil Service Commission • Controller's Office - Administration • Controller's Office - Audits • Controller's Office - Operations • Controller's Office - PPSP • General City Responsibility • Health Services - General Fund • Human Resources • ISD - General Fund subsidy • Mayor's Budget Office • Purchasing - Central Shops • Purchasing - Repro/Mail • Real Estate Worker's Compensation
					City of San Jose Support Services including: <ul style="list-style-type: none"> • Building Occupancy • Cafeteria • City Attorney • City Auditor • City Clerk • City-wide Programs • Civil Service Commission • Departments of City Manager <ul style="list-style-type: none"> ○ Budget Office ○ Economic Development ○ Emergency Services ○ Employee Relations ○ Equality Assurance ○ Quest Partnership • Equipment Use • Finance • General Services • Human Resources • Independent Police Auditor • Information Technology • Mayor & Council Planning Commission

**CALIFORNIA MULTI-AGENCY
CIP BENCHMARKING STUDY
AGENCIES MULTIPLIERS/ADMIN ITEMS MATRIX**

DEPARTMENT OVERHEAD					
City of Long Beach	City of Los Angeles	City of Oakland	City of Sacramento	City of San Diego	City and County of San Francisco
<ul style="list-style-type: none"> Accounting Budget Management Contract processing Council correspondence Personnel Admin 	<ul style="list-style-type: none"> Accounting staff Budget staff Clerical Staff/word processing staff serving the entire department Department Management (Gen. Mgr & Asst. Gen Mgrs.) Inventory staff Payroll staff Personnel & training staff Systems Staff Vehicle maintenance staff (Police & Fire only) Warehouse/inventory / stores staff 	Design & Construction Services Department: <ul style="list-style-type: none"> Electrical Services Project Management Construction Management Transportation Services Environmental Services Facility Planning & Development 	<ul style="list-style-type: none"> Public Works Administration Public Works Advanced Computer Support 	<ul style="list-style-type: none"> Depreciation of Buildings Depreciation of Equipment Indirect capital outlay Indirect data processing Indirect salaries and fringe (DD'S, Eng. Admin) Indirect supplies/services Indirect utilities Operation/Maintenance/Rent of Buildings 	<ul style="list-style-type: none"> Accounting Claims Computer Services Contract Administration Deputy Director's Office Director's Office DPW Training Finance & Budget Health & Safety Personnel & Payroll Public Affairs
					City of San Jose DPW Administrative Support including: <ul style="list-style-type: none"> Administration Division Department-wide management tasks such as budget and HR performed by Division managers that is applied to direct labor only Director's Office Engineering Services support Real Estate Division support

**CALIFORNIA MULTI-AGENCY
CIP BENCHMARKING STUDY
AGENCIES MULTIPLIERS/ADMIN ITEMS MATRIX**

AGENCY OVERHEAD					
City of Long Beach	City of Los Angeles	City of Oakland	City of Sacramento	City of San Diego	City and County of San Francisco
<ul style="list-style-type: none"> • Building rent • Consultants • Fleet services • Phones • Salaries and wages • Technology services 	<ul style="list-style-type: none"> • City Engineer • Deputies • Division Heads • Secretaries/Clerical • Section Supervisors • Senior Engineers 	<ul style="list-style-type: none"> • Contract Administration • Training • Fiscal Services • Personnel Support • MIS • Director's Office 	<ul style="list-style-type: none"> • Division OH Benefits • Division OH Operational Services and Supplies • Division OH Salary 	<ul style="list-style-type: none"> • Assoc. Analyst • Asst. to Director • Director • Exec. Secretary • Sr. Analyst • Sr. Engineer 	<ul style="list-style-type: none"> • Management staff salaries • Clerical staff salaries • Administrative staff salaries • IS support staff salaries • Temporary salaries • Premium/standby pay • Overtime • Associated mandatory fringe benefits • Travel • Training • Membership dues • Entertainment & promotions • Professional services • Rent • Use of employee cars • Local field expenses • Postage • Building maintenance services • Office equipment rental/maintenance • Security services • Materials & Supplies • Professional registration reimbursements • Equipment • Repair of radio equipment • Telephone services • Workers Compensation • Human Rights Commission services • Medical services • Vehicle maintenance • Vehicle fuel • Administer prevailing wage rates • Mail service • Reproduction • Light, heat & power • GIS support cost • Sewer service charge
					<ul style="list-style-type: none"> • NONE

A p p e n d i x B

Performance Benchmarking



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CITY OF SACRAMENTO



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CAPITAL OF SILICON VALLEY



CURVES GROUP 1

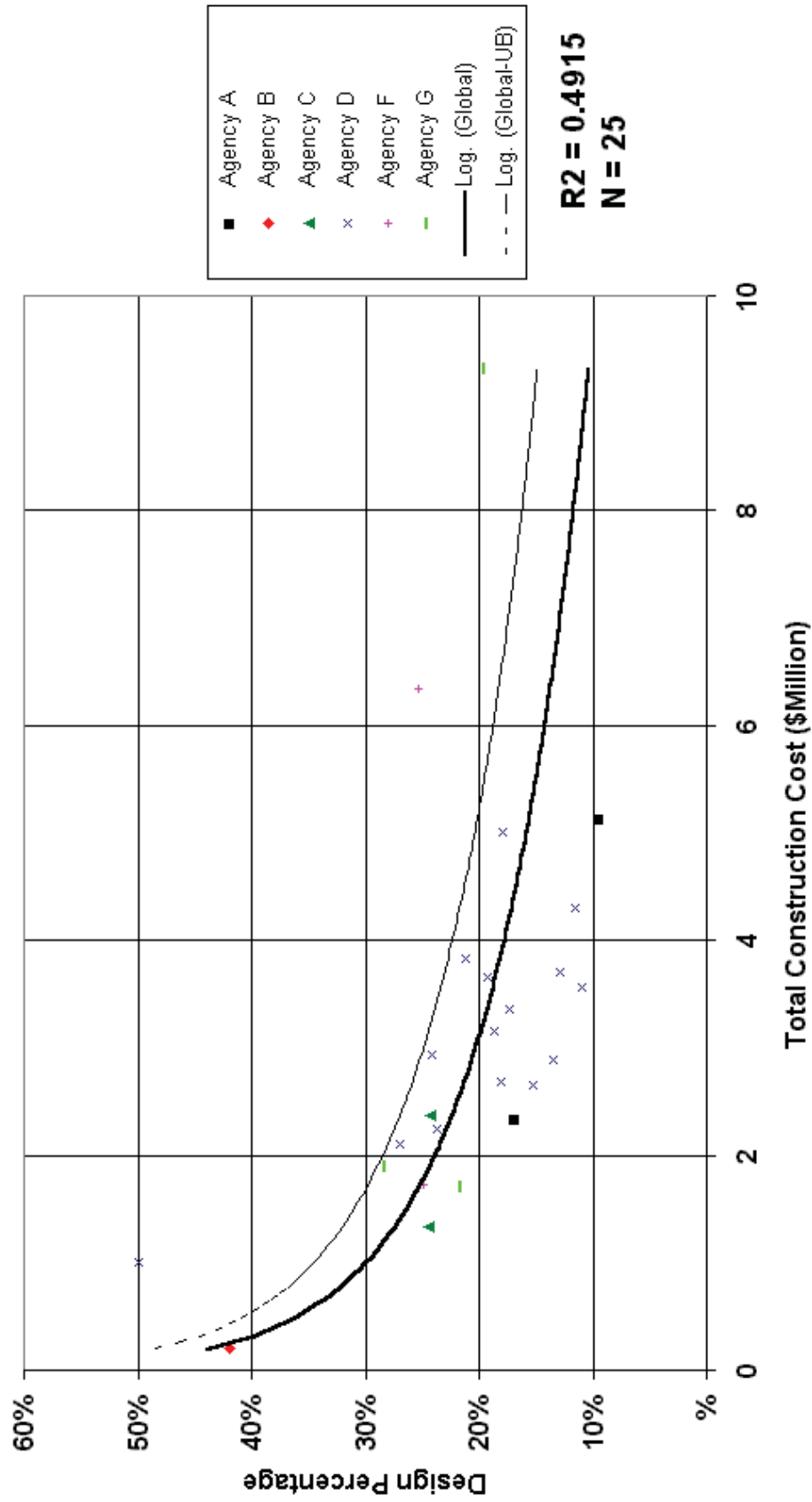
Design Cost / Construction Cost

Versus

Total Construction Cost

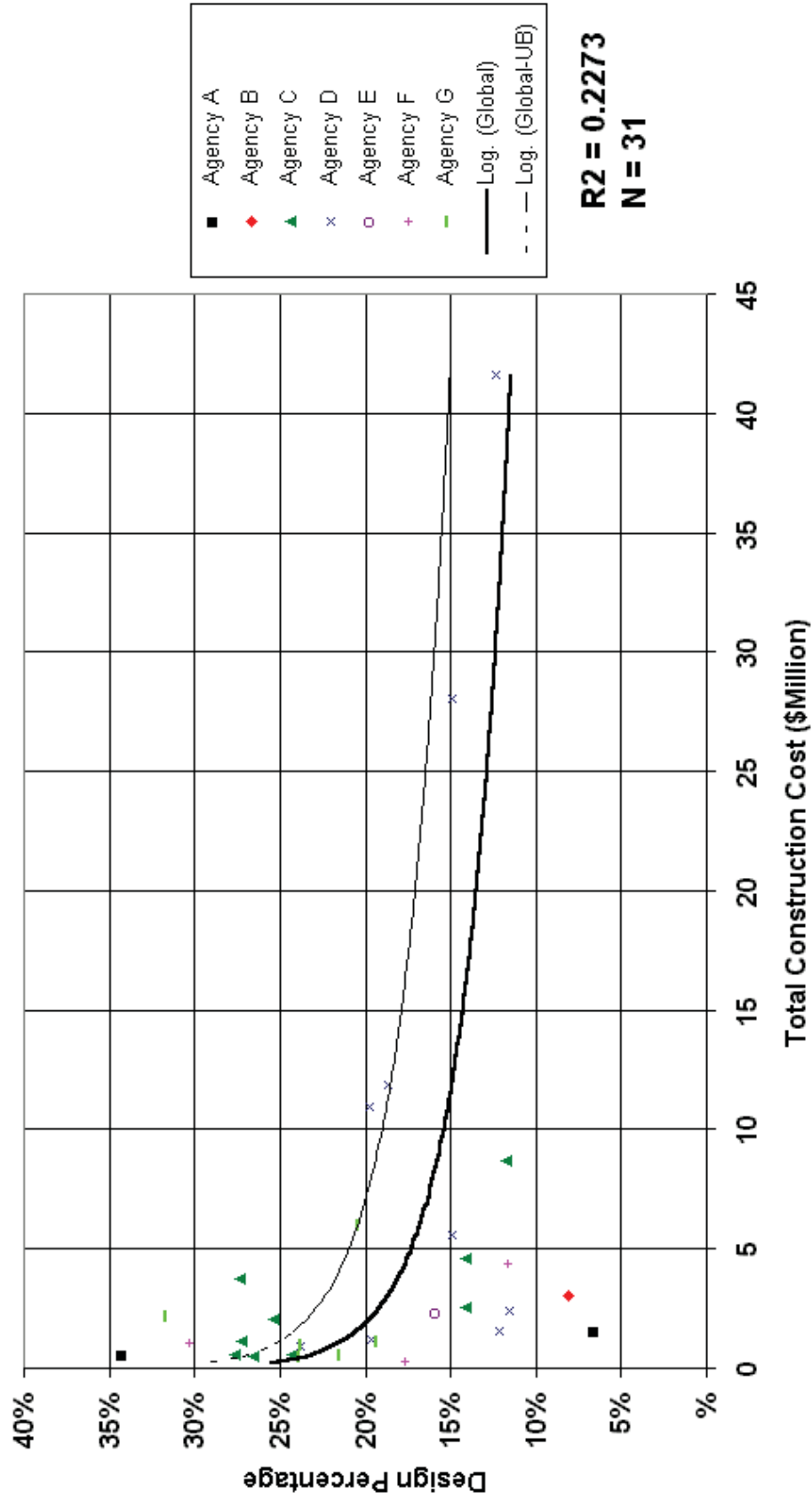
Municipal Facilities - Libraries

Design Percentage Versus Total Construction Cost



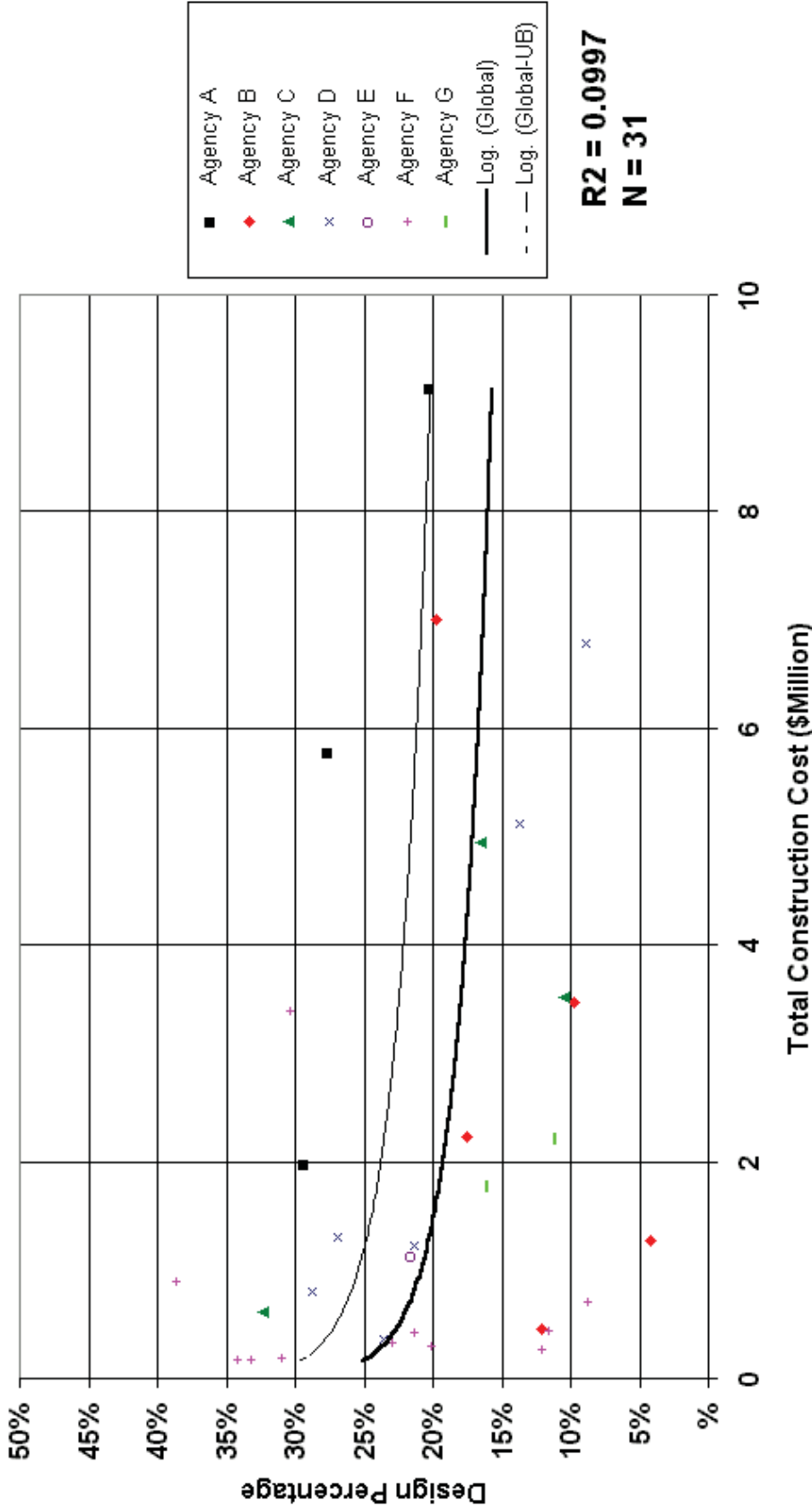
Municipal Facilities - Police / Fire Station

Design Percentage Versus Total Construction Cost



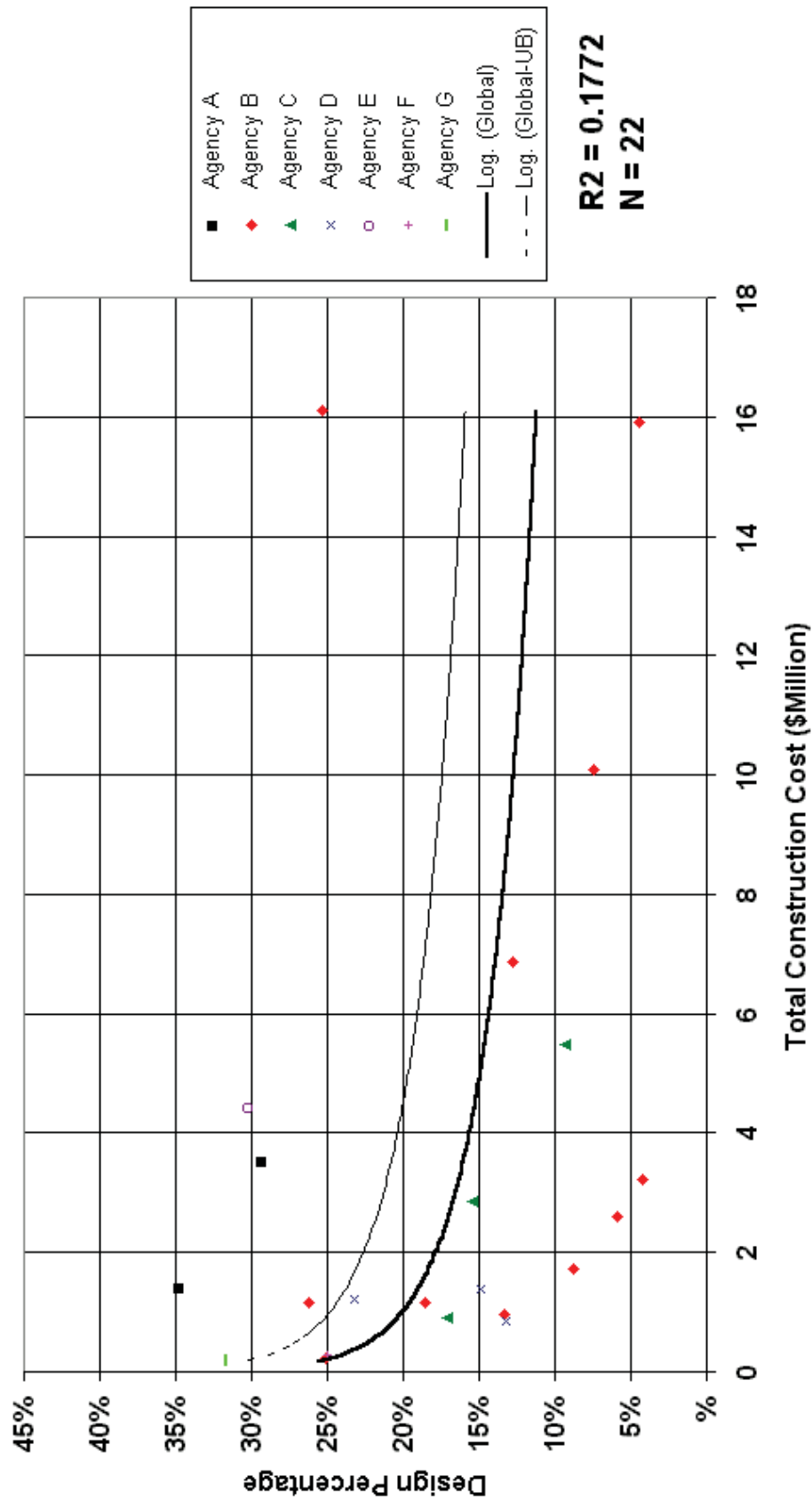
Municipal Facilities - Community Bldg./Rec. Center/CC/Gym

Design Percentage Versus Total Construction Cost



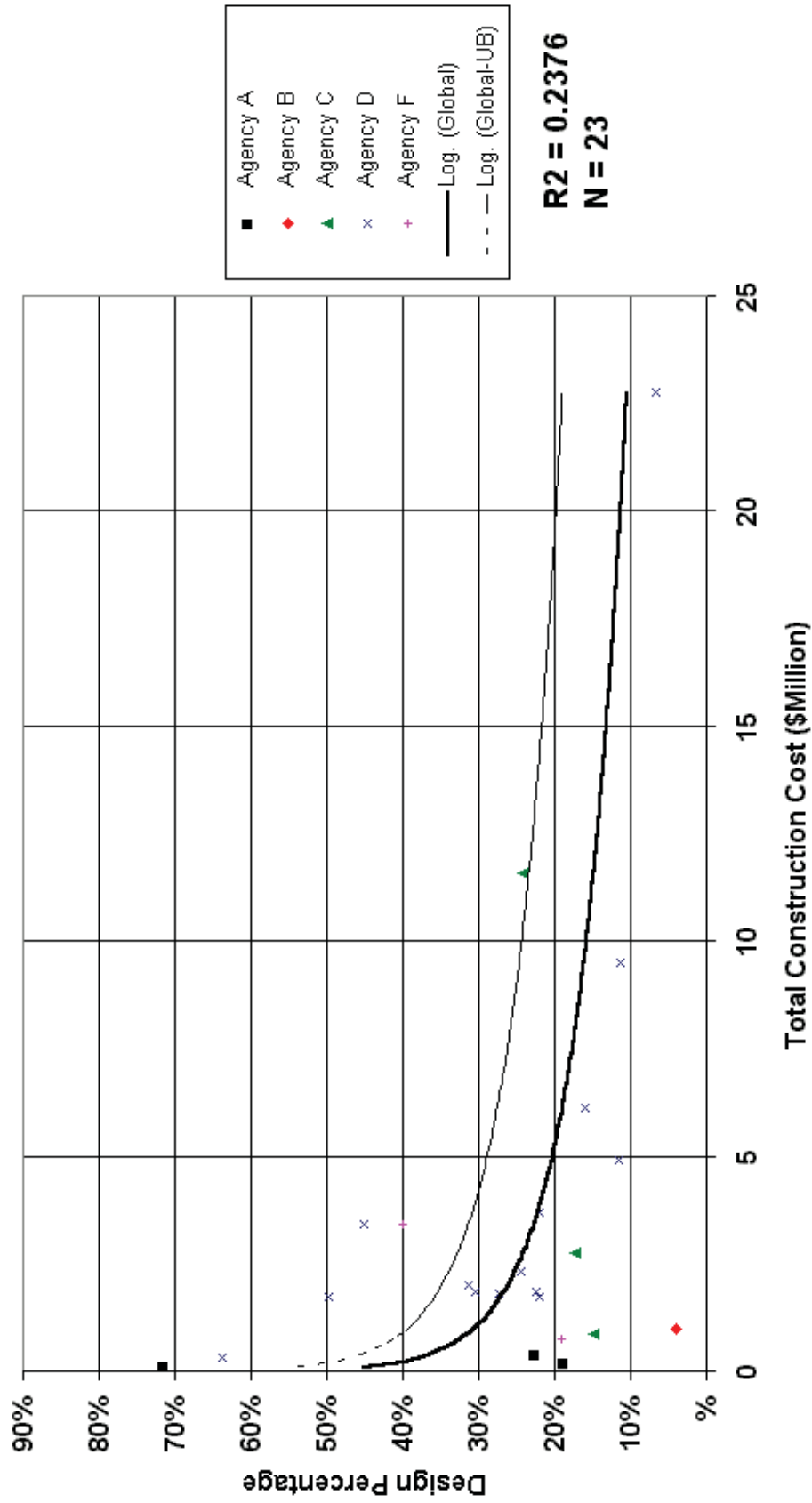
Streets - Widening / New / Grade Separation

Design Percentage Versus Total Construction Cost



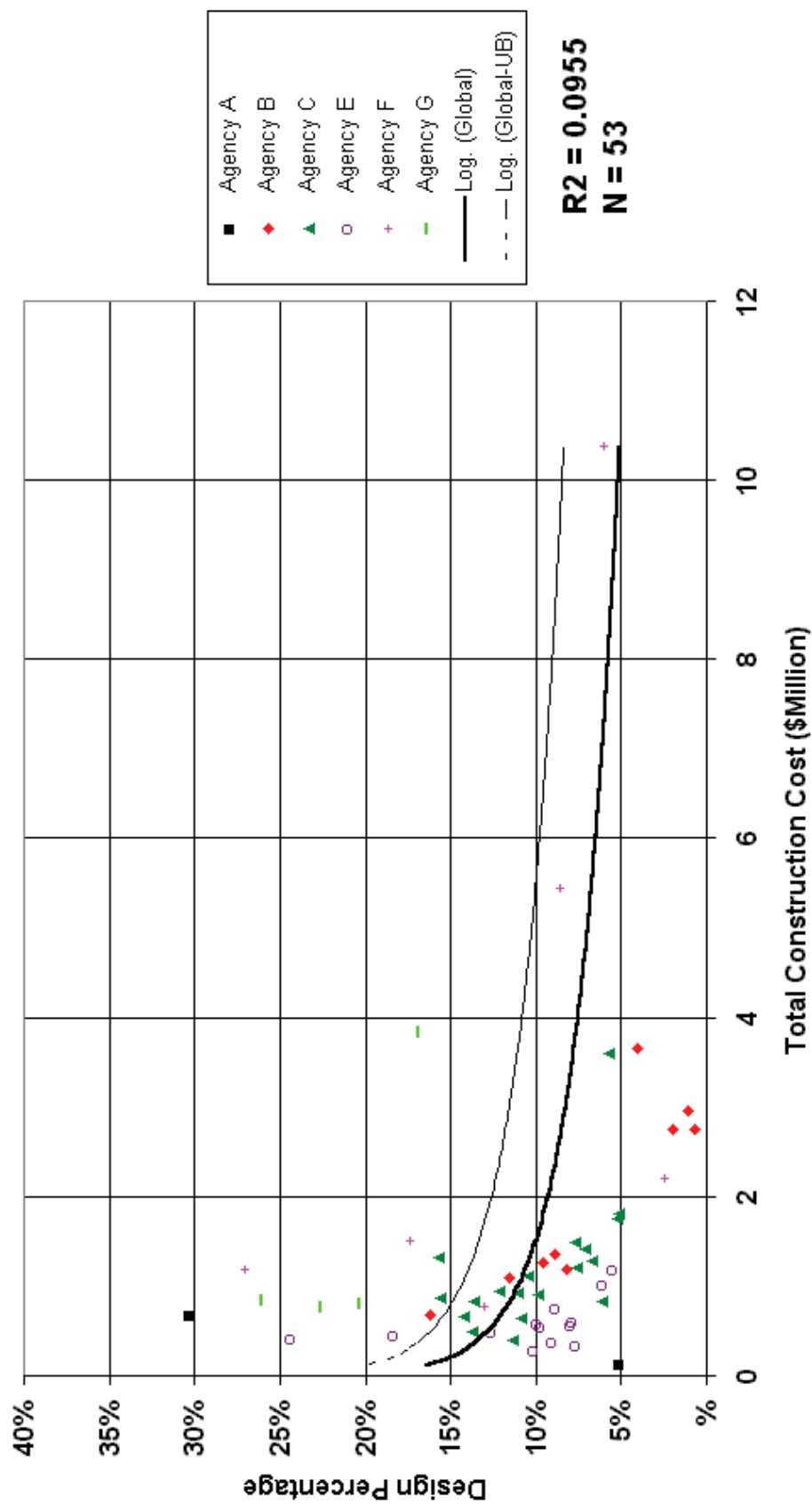
Streets - Bridges (Retrofit / Seismic)

Design Percentage Versus Total Construction Cost



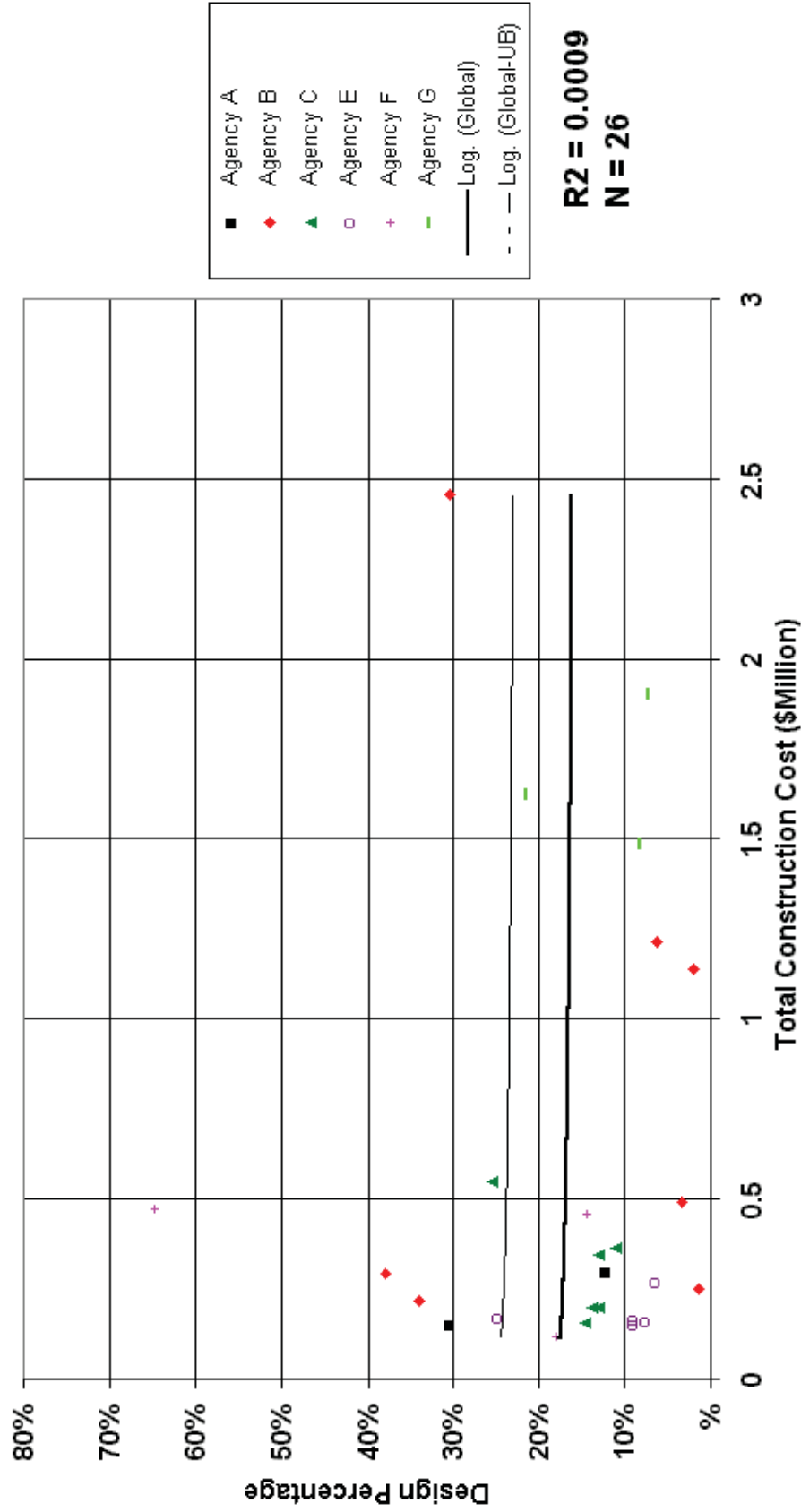
Streets - Renovation / Resurfacing

Design Percentage Versus Total Construction Cost



Streets - Bike / Pedestrian / Curb Ramps*

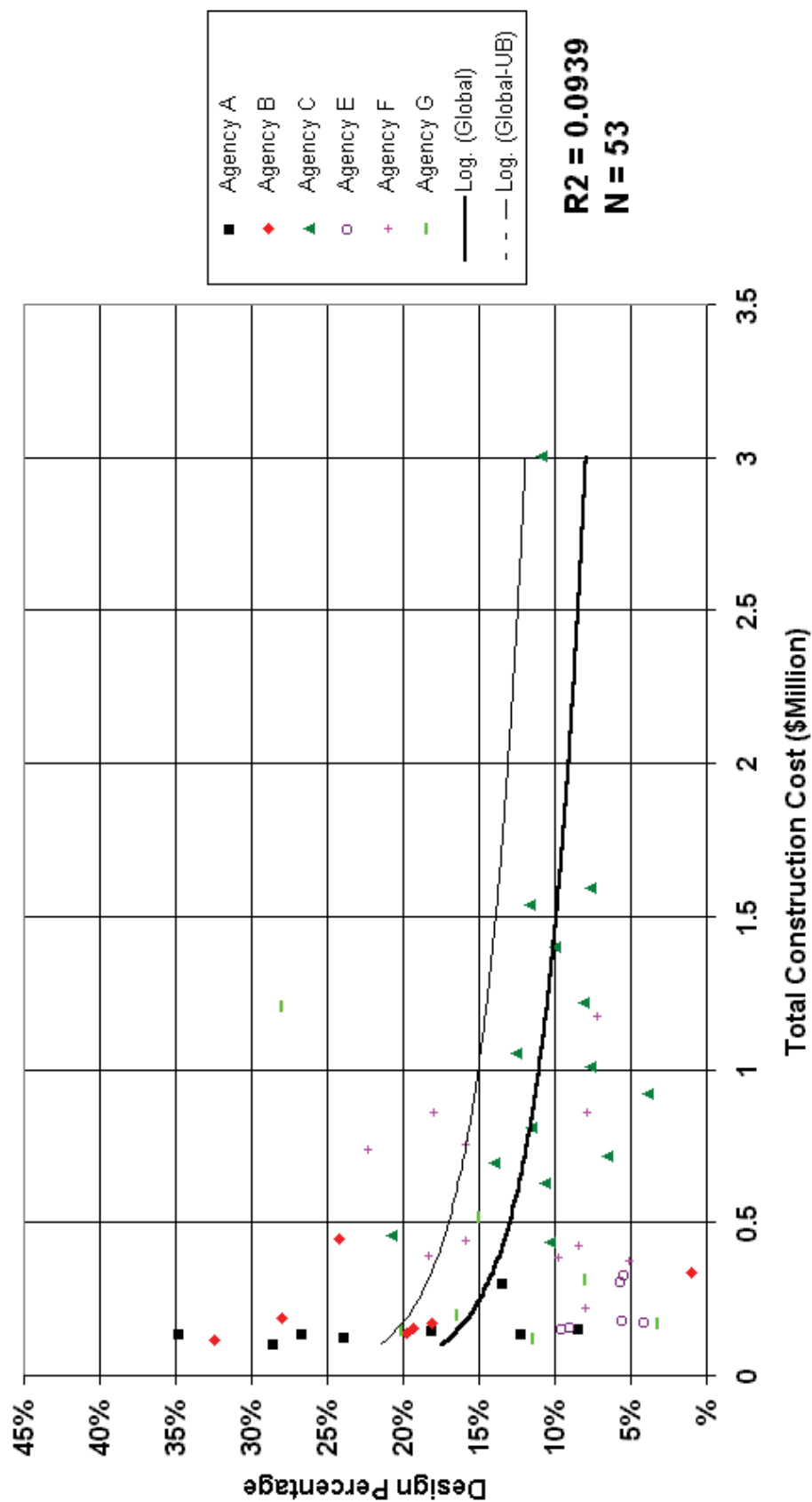
Design Percentage Versus Total Construction Cost



* 2 bike projects had zero design costs and are excluded from this model

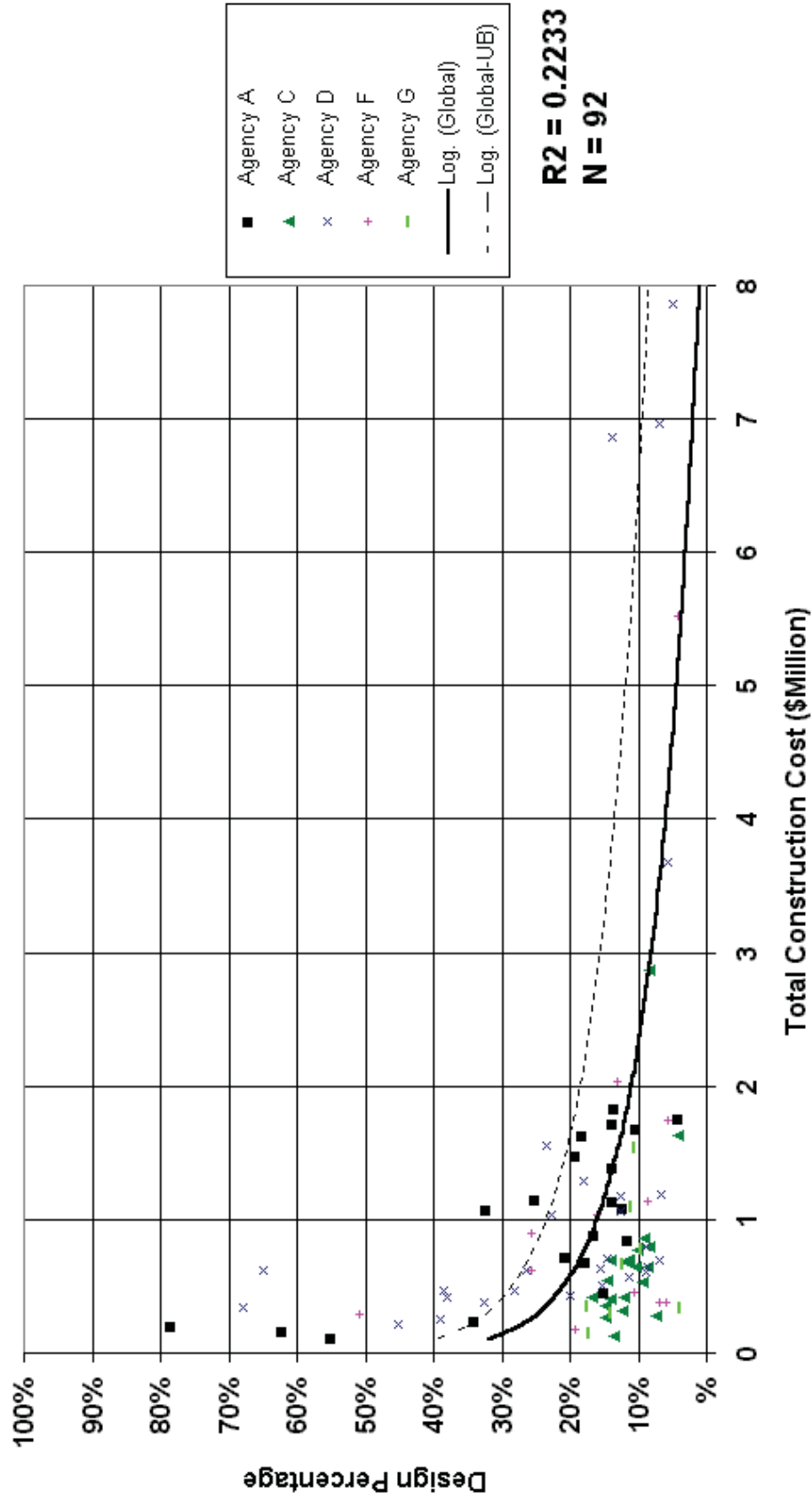
Streets - Signals

Design Percentage Versus Total Construction Cost



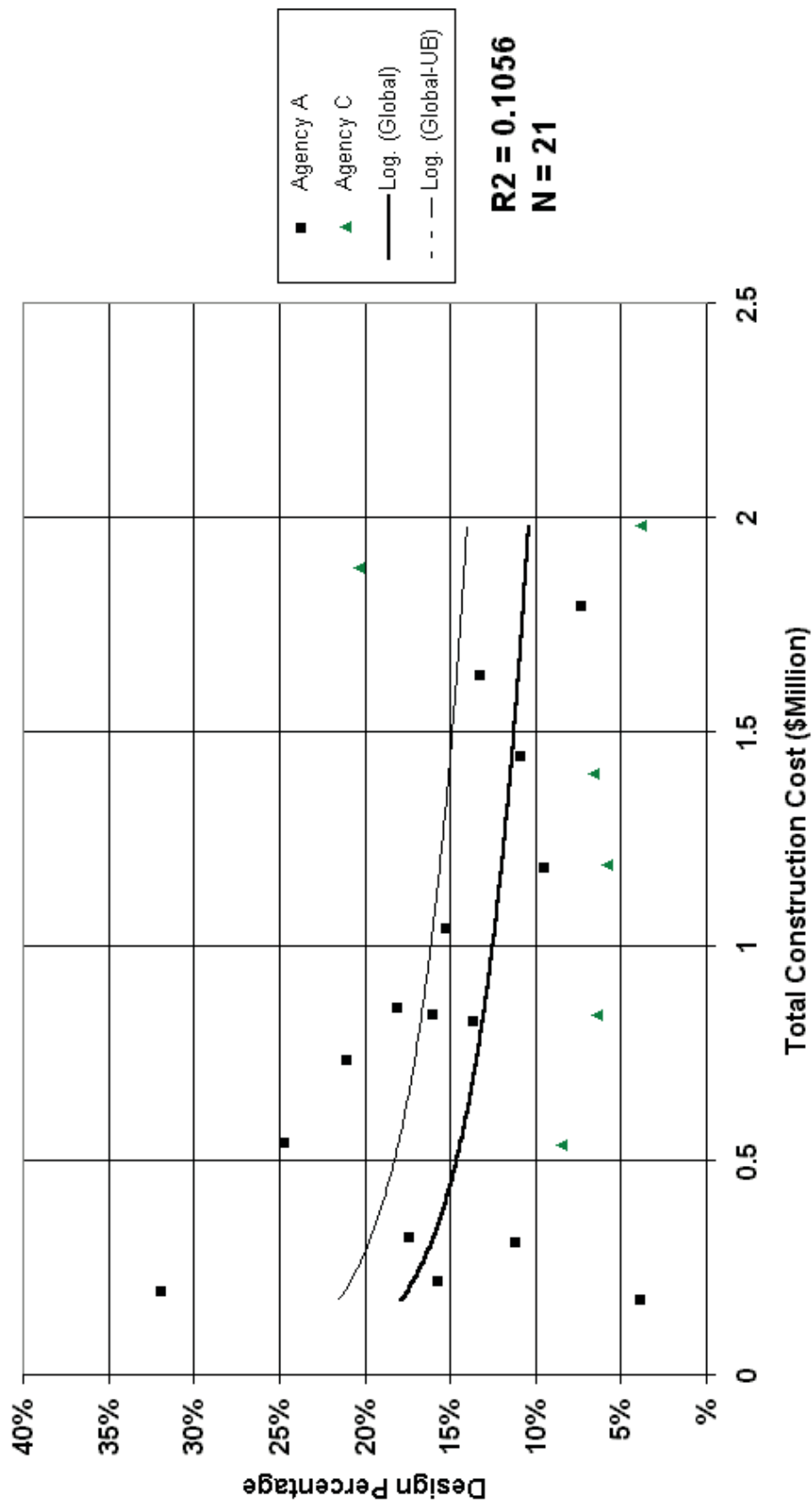
Pipe Systems - Gravity System (Storm Drains, Sewers)

Design Percentage Versus Total Construction Cost



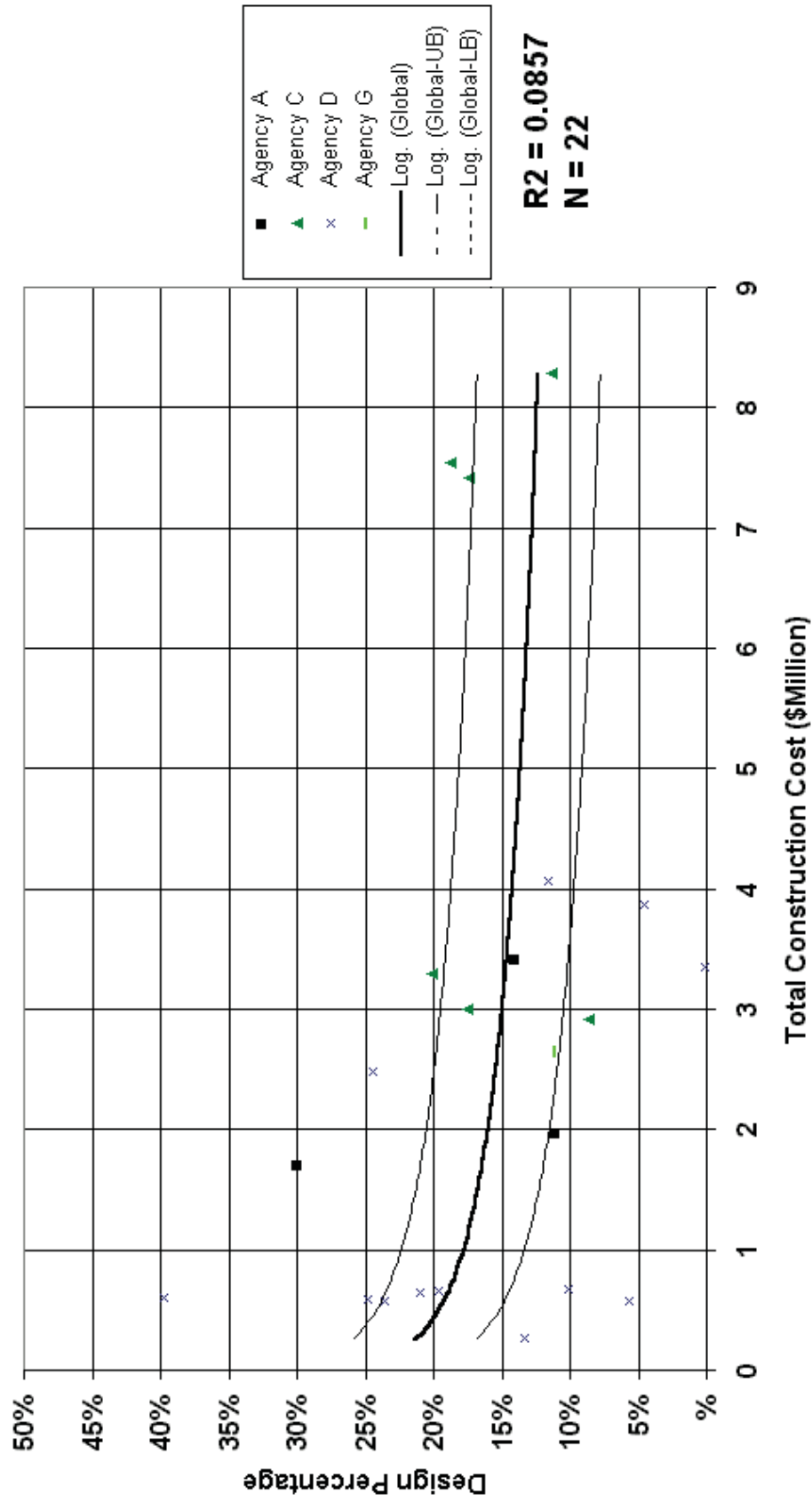
Pipe Systems - Pressure Systems

Design Percentage Versus Total Construction Cost



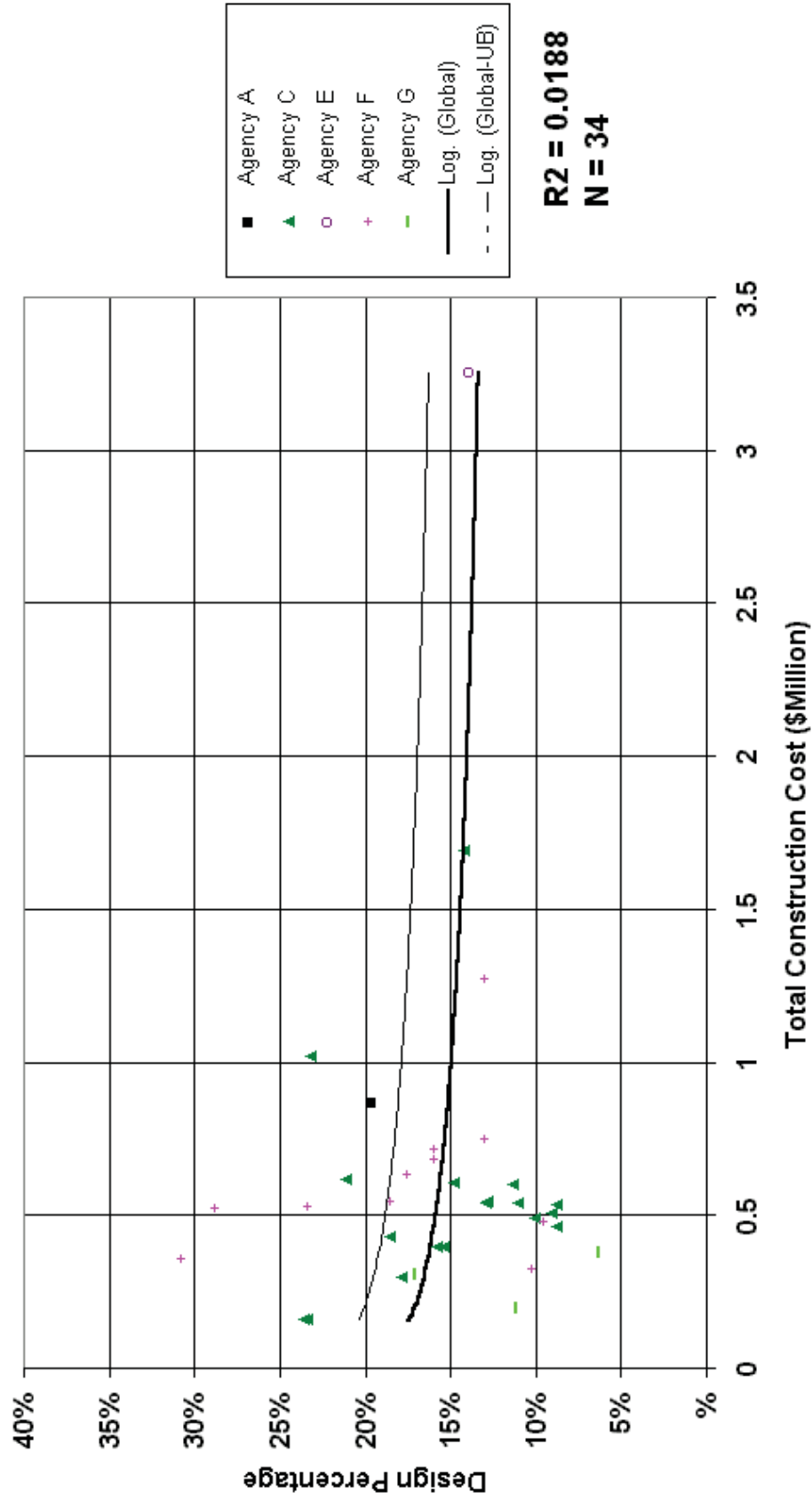
Pipe Systems - Pump Stations

Design Percentage Versus Total Construction Cost



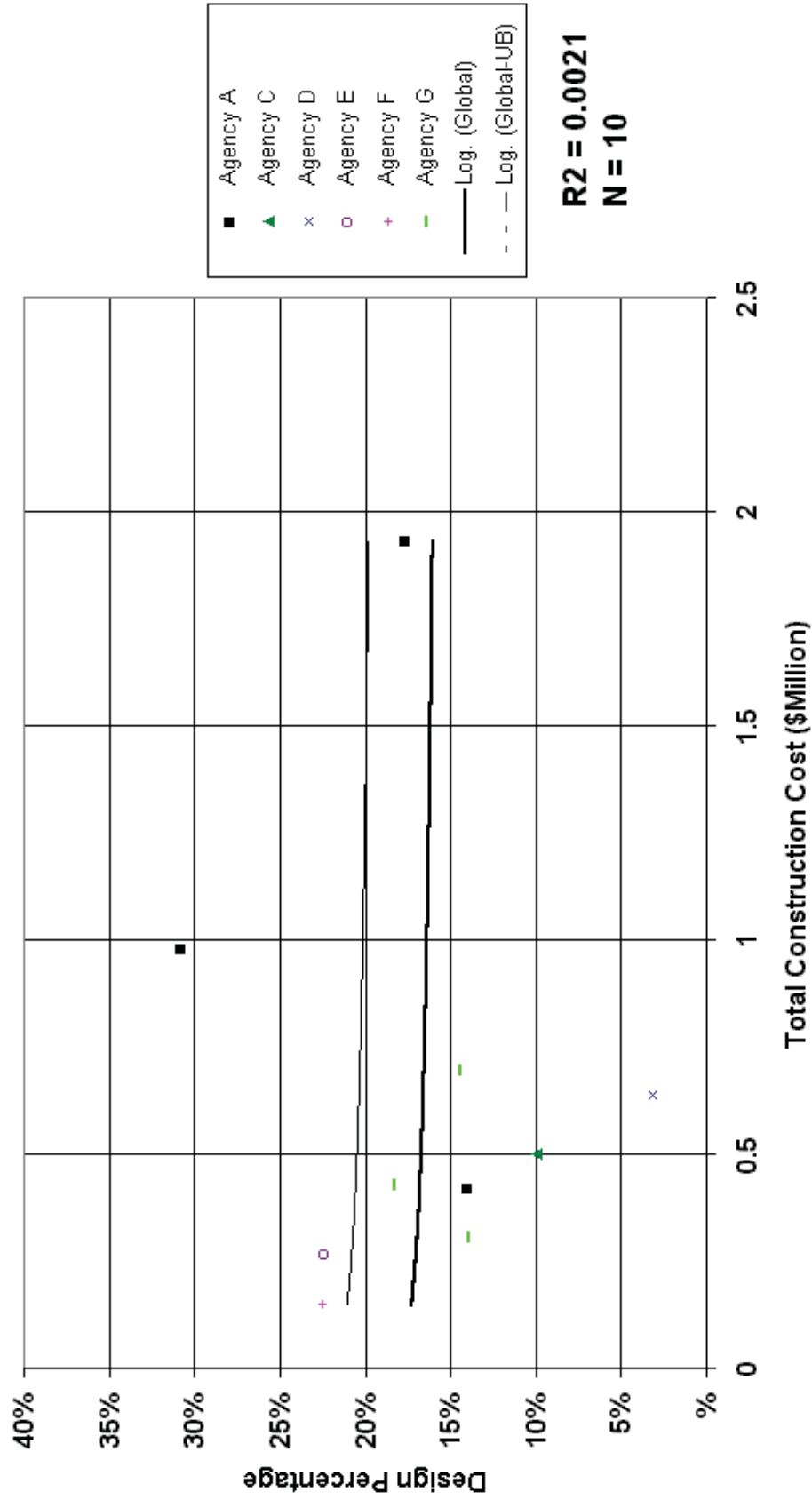
Parks - Playgrounds

Design Percentage Versus Total Construction Cost



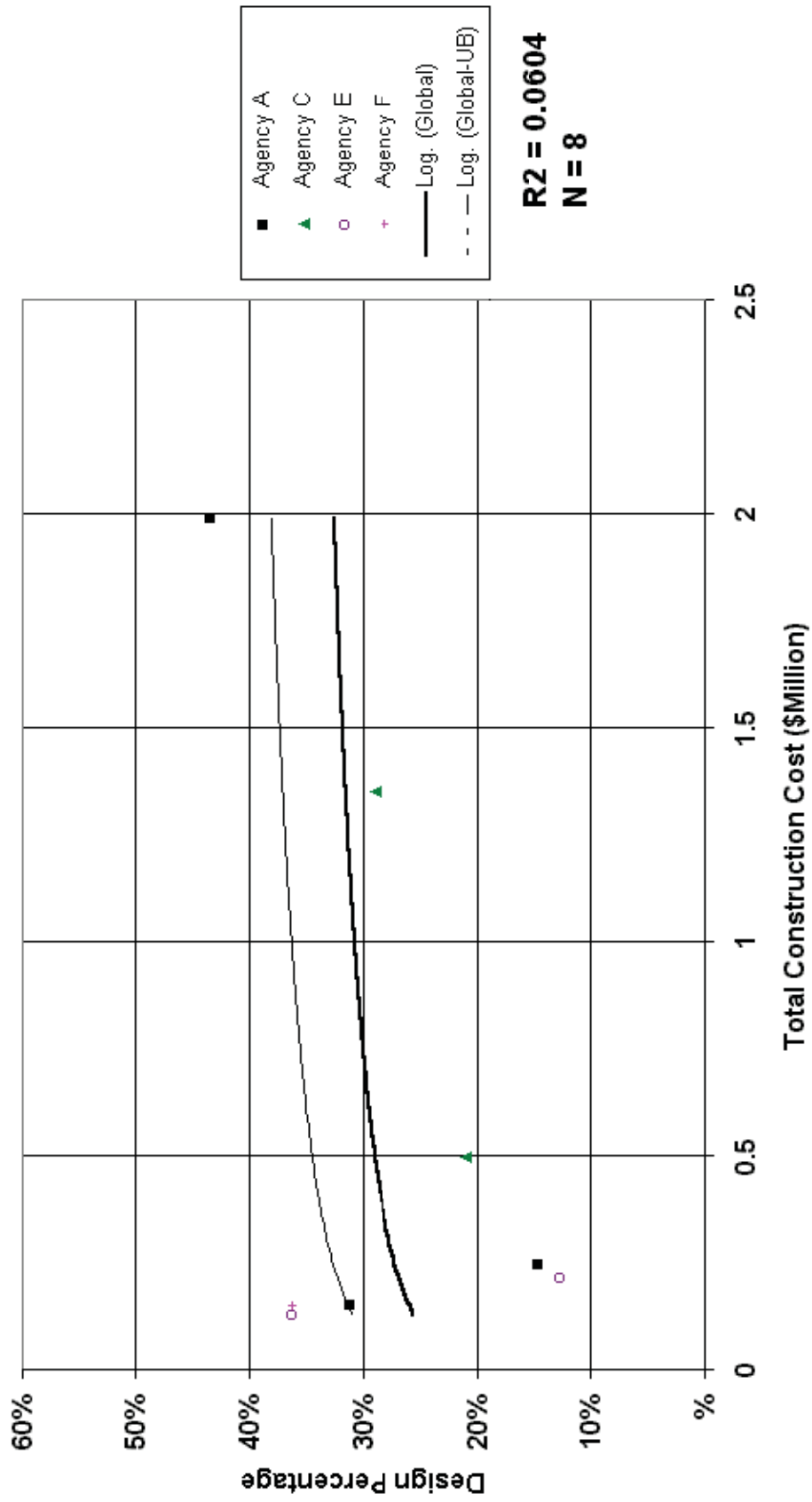
Parks - Sportfields

Design Percentage Versus Total Construction Cost



Parks - Restrooms

Design Percentage Versus Total Construction Cost



CURVES GROUP 2

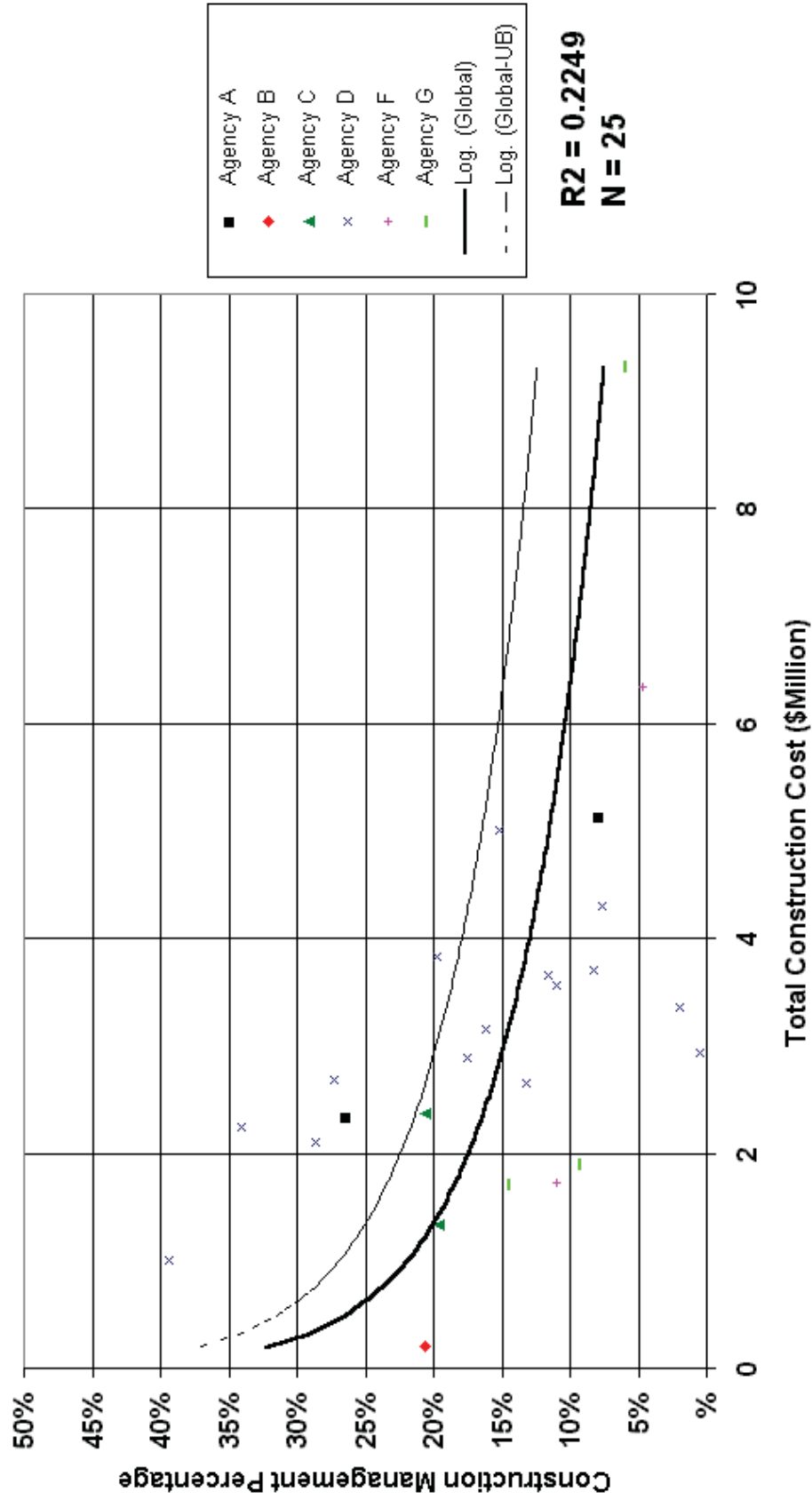
Construction Management Cost /
Construction Cost

Versus

Total Construction Cost

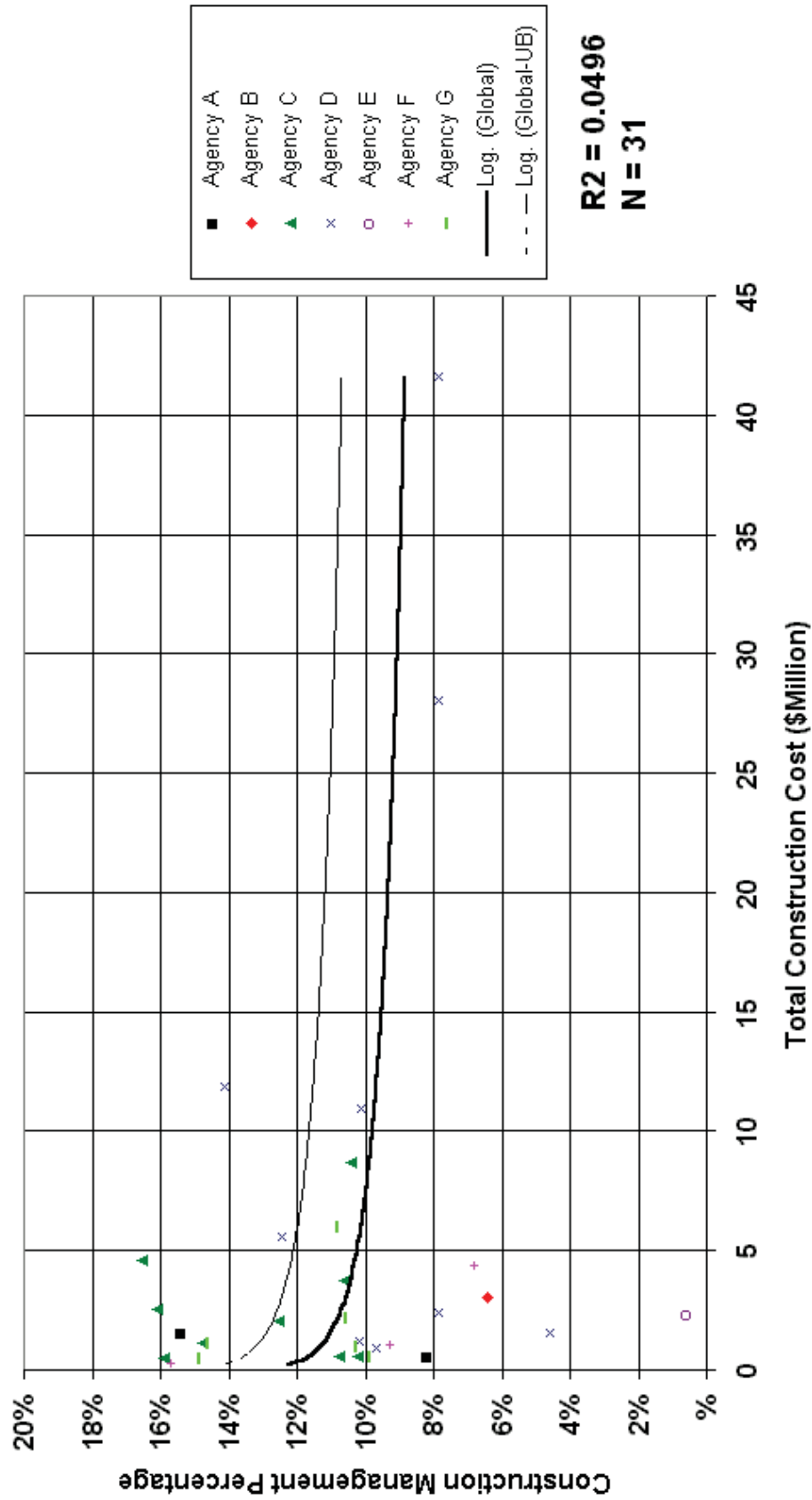
Municipal Facilities - Libraries

Construction Management Percentage Versus Total Construction Cost



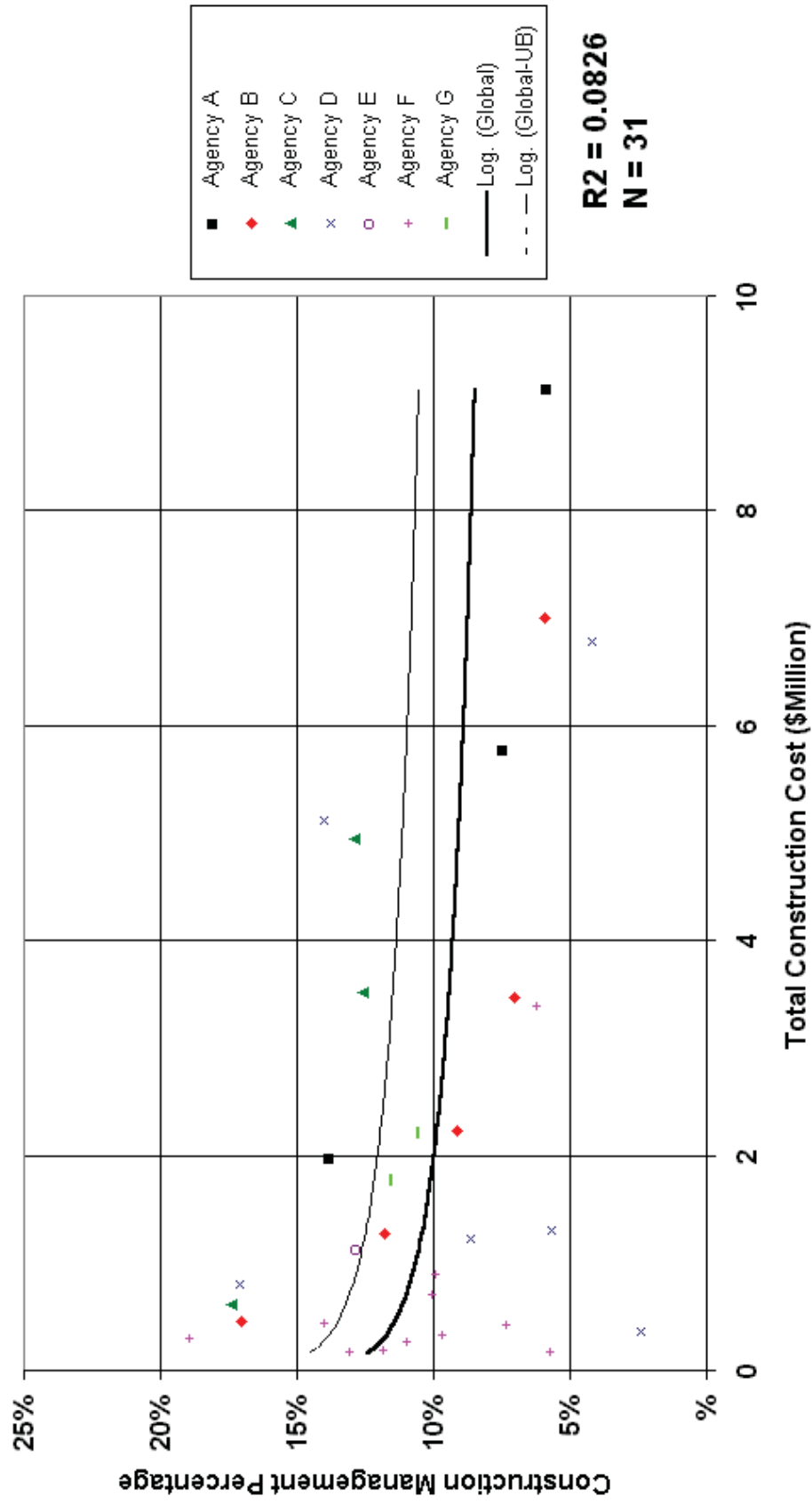
Municipal Facilities - Police / Fire Station

Construction Management Percentage Versus Total Construction Cost



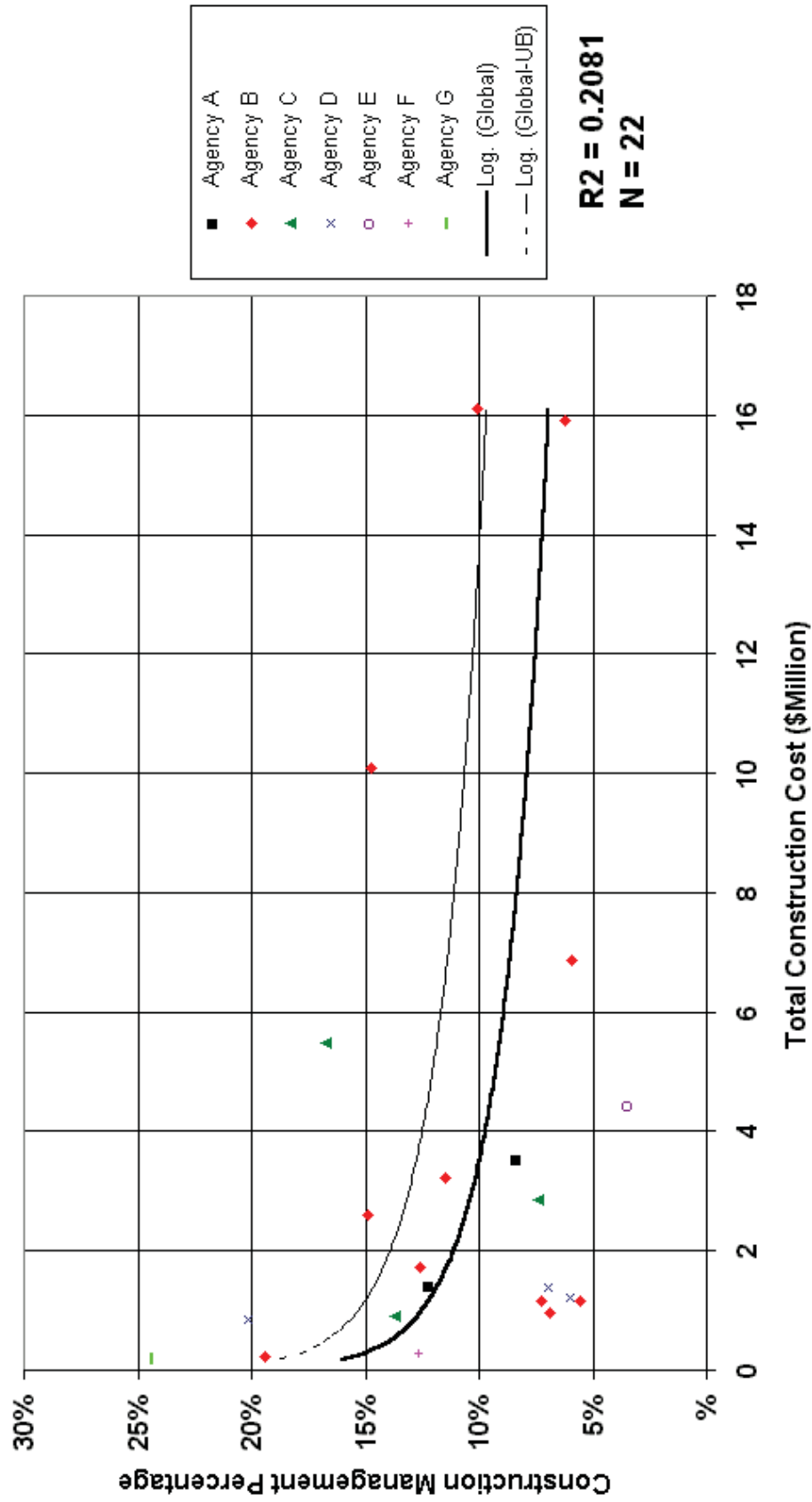
Municipal Facilities - Community Bldg./Rec. Center/CC/Gym

Construction Management Percentage Versus Total Construction Cost



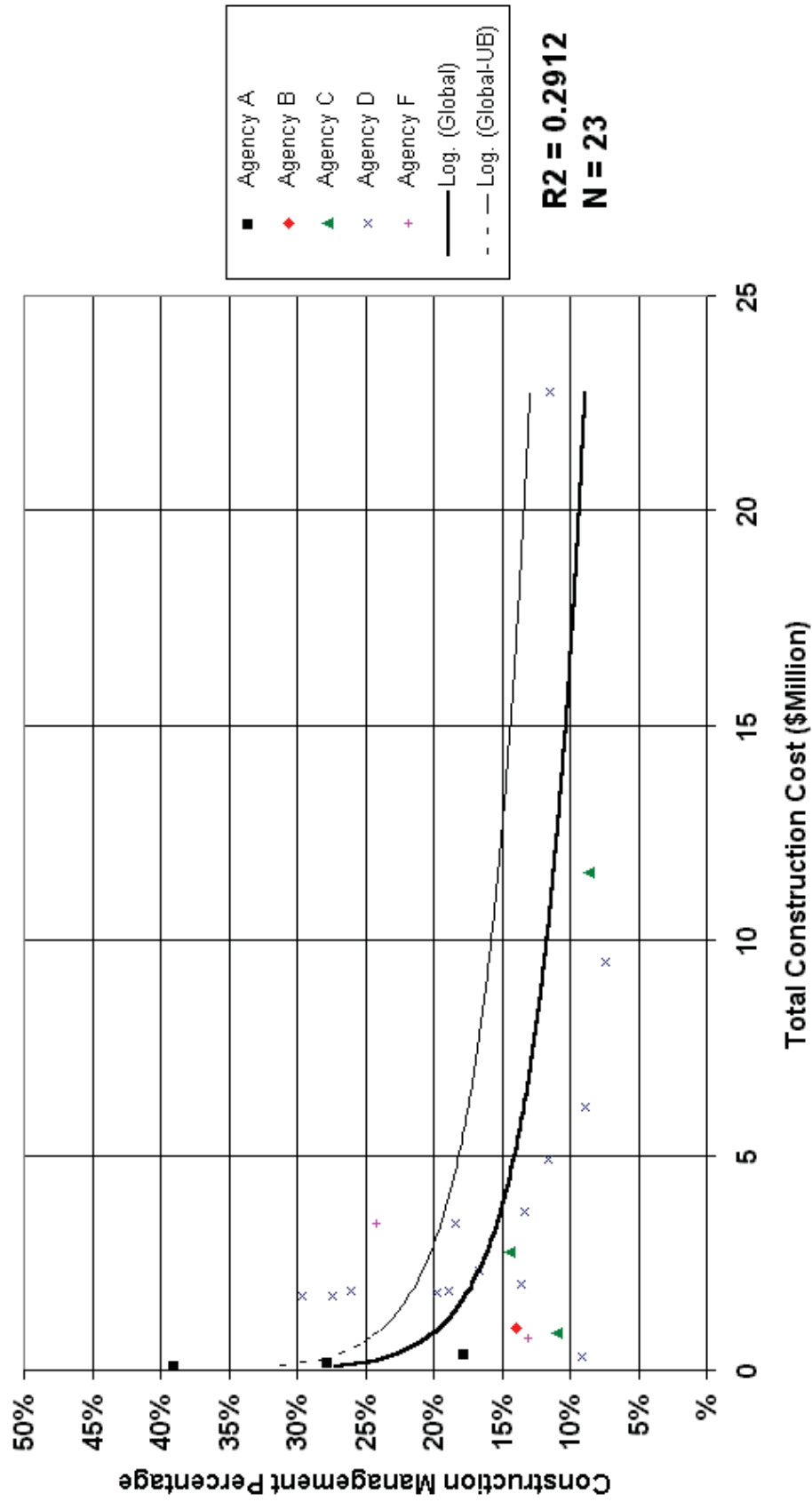
Streets - Widening / New / Grade Separation

Construction Management Percentage Versus Total Construction Cost



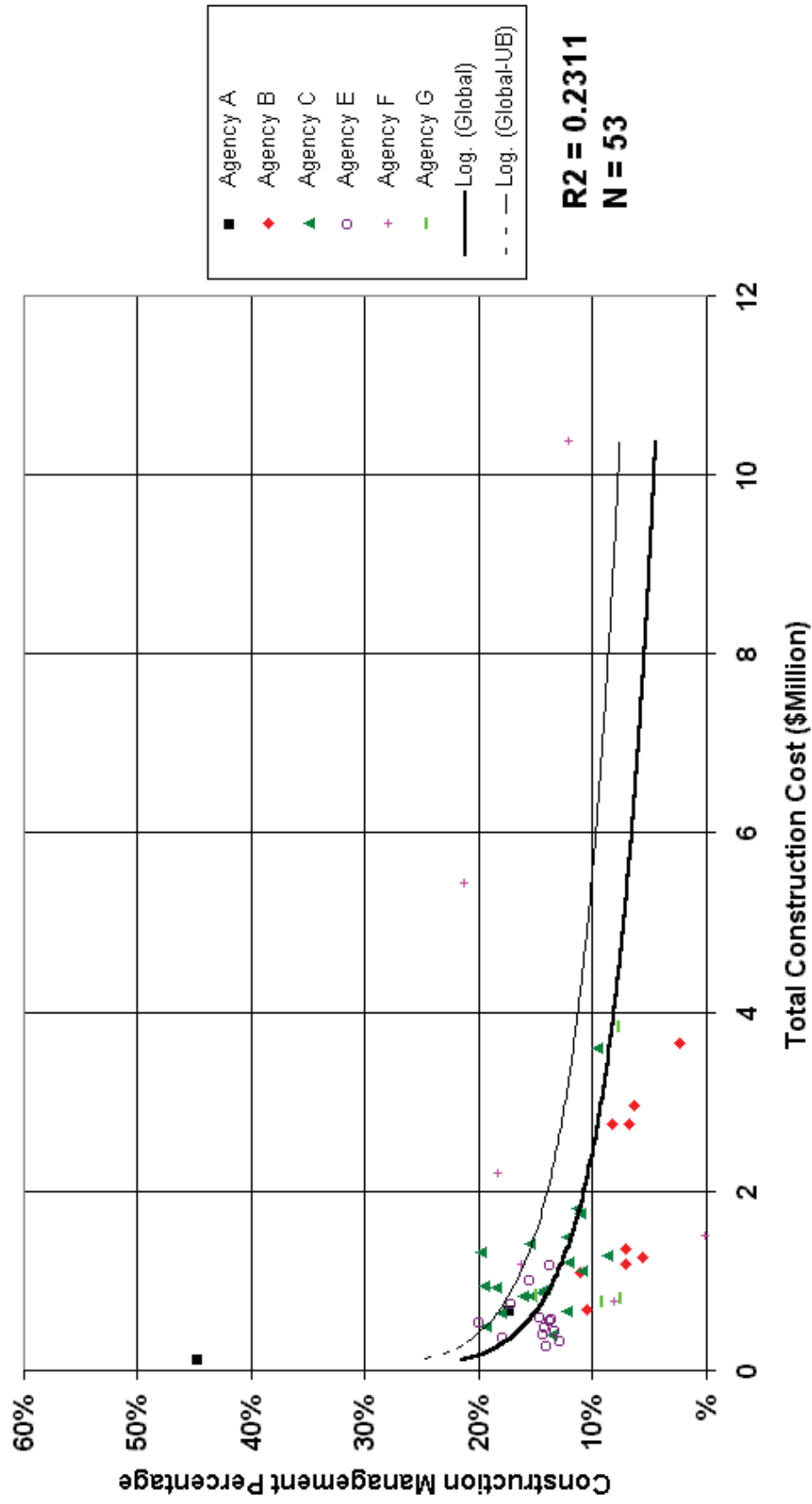
Streets - Bridges (Retrofit / Seismic)

Construction Management Percentage Versus Total Construction Cost



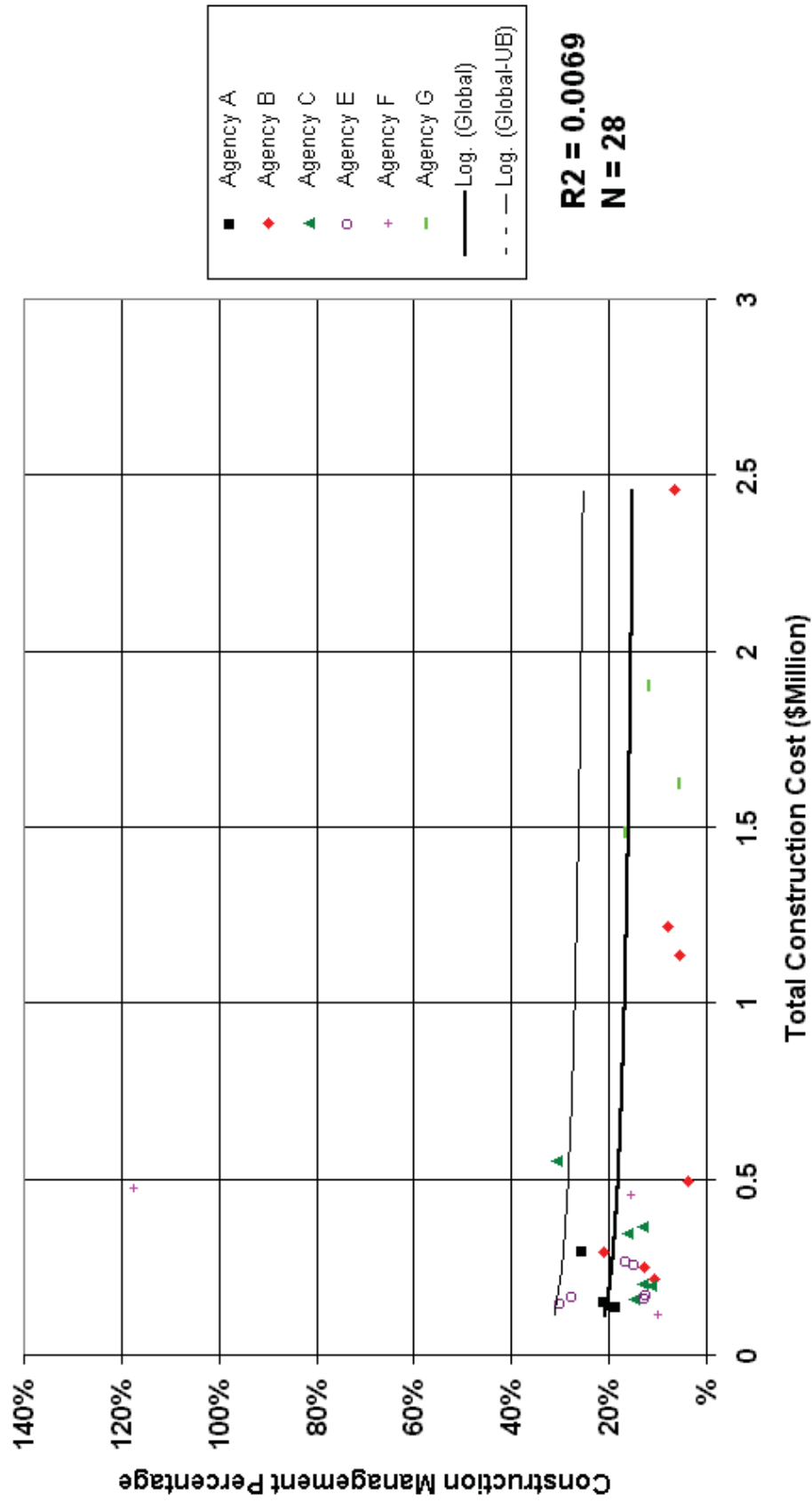
Streets - Renovation / Resurfacing

Construction Management Percentage Versus Total Construction Cost



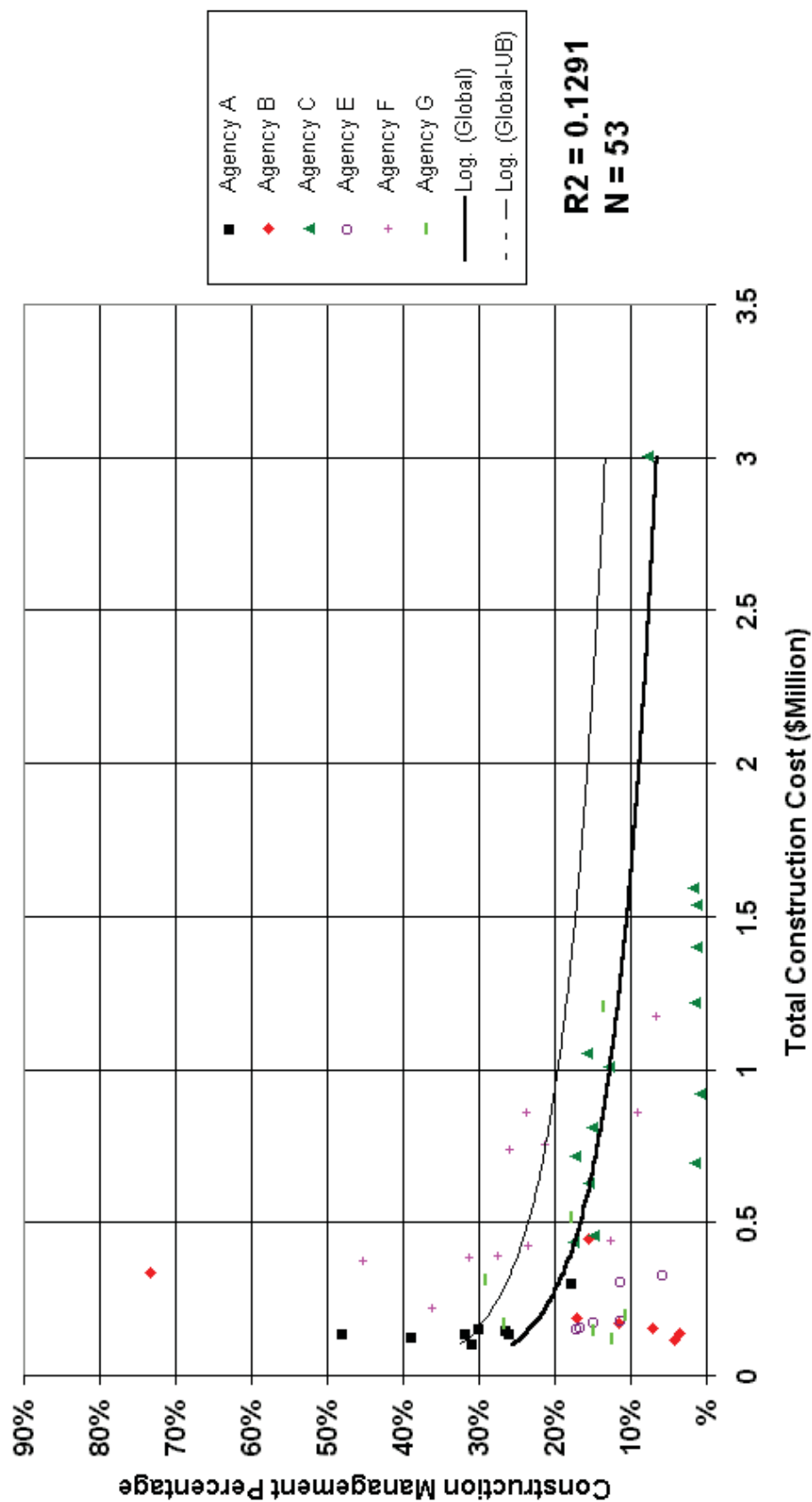
Streets - Bike / Pedestrian / Curb Ramps

Construction Management Percentage Versus Total Construction Cost



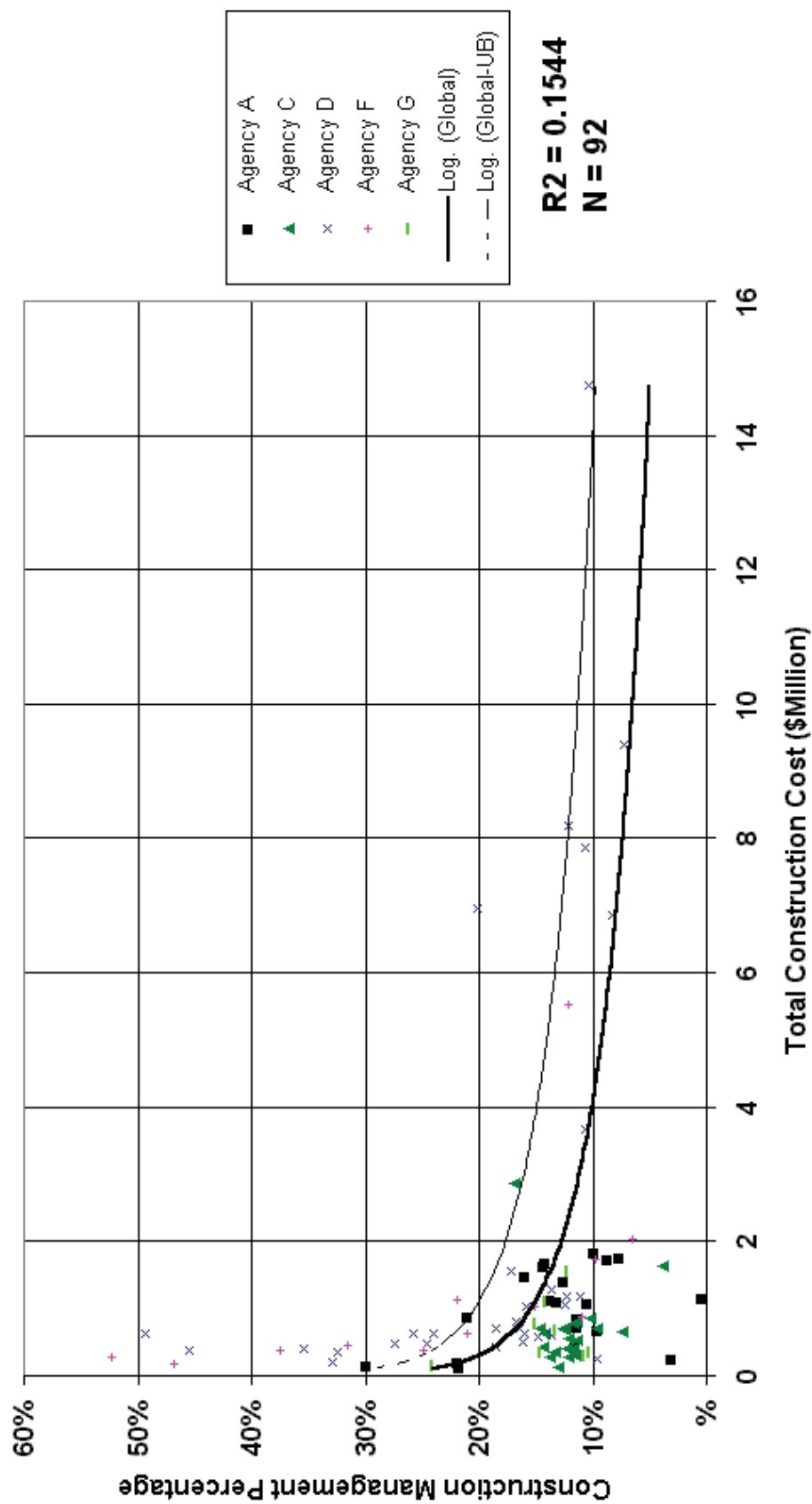
Streets - Signals

Construction Management Percentage Versus Total Construction Cost



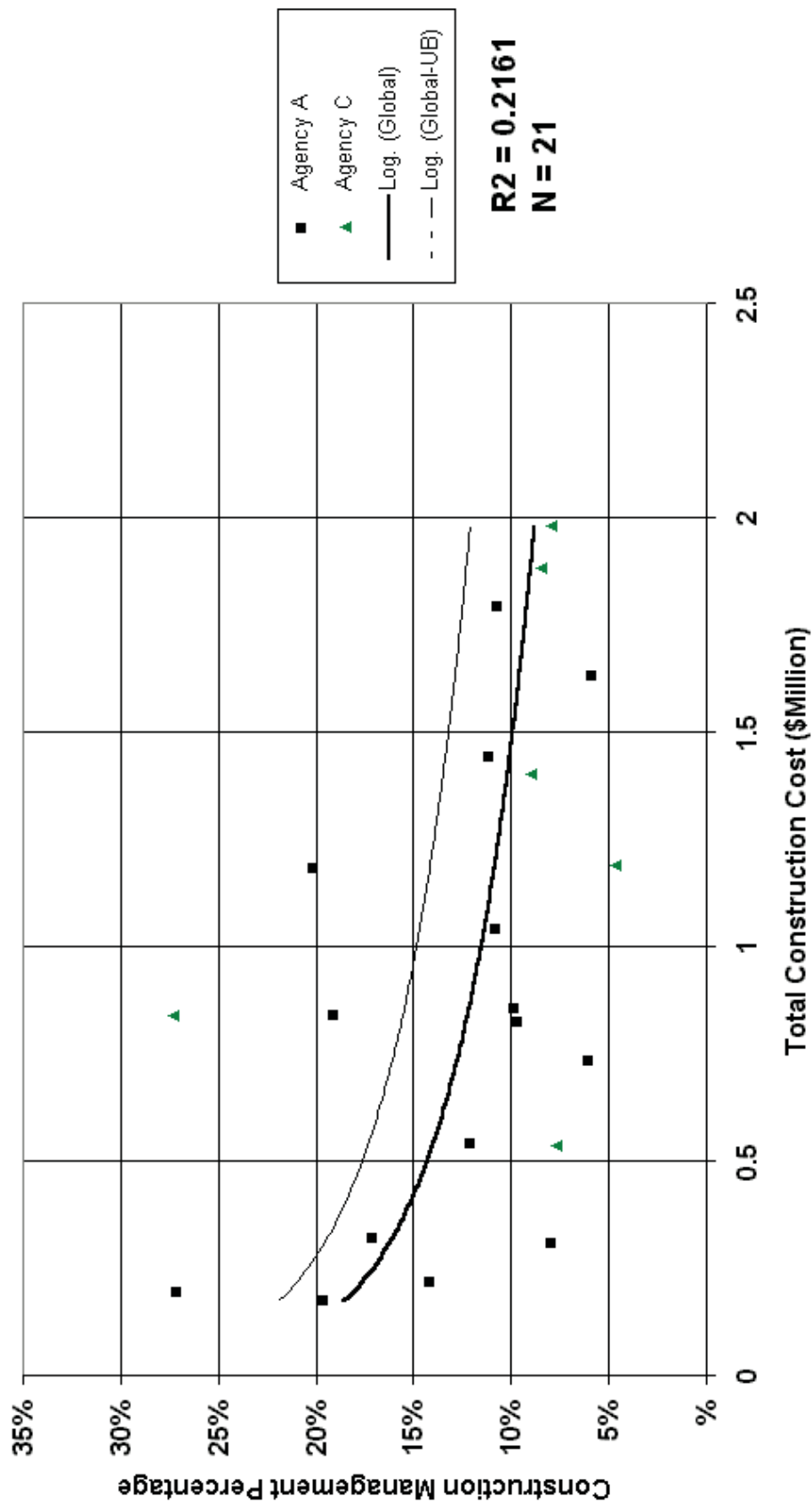
Pipe Systems - Gravity System (Storm Drains, Sewers)

Construction Management Percentage Versus Total Construction Cost



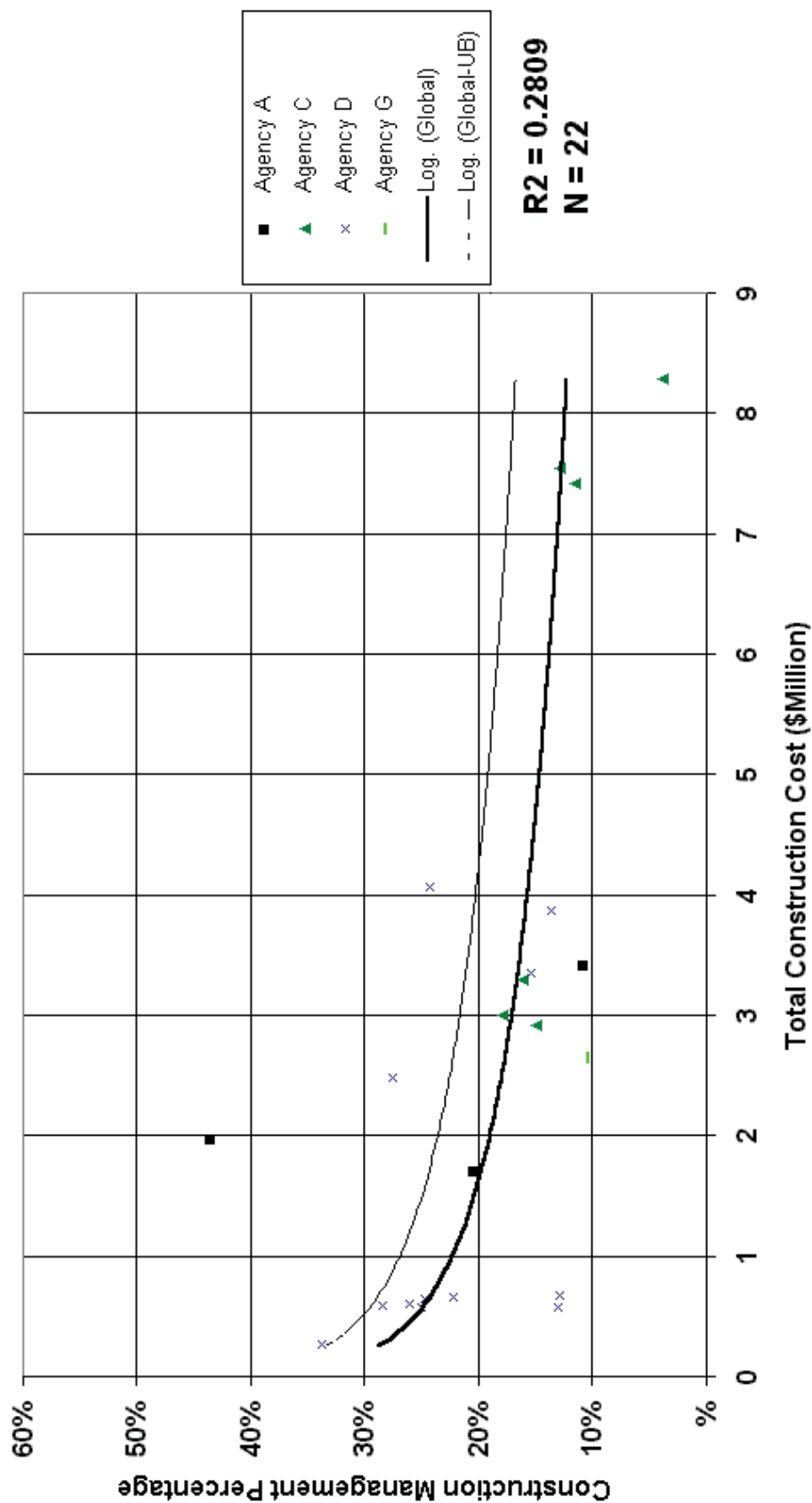
Pipe Systems - Pressure Systems

Construction Management Percentage Versus Total Construction Cost



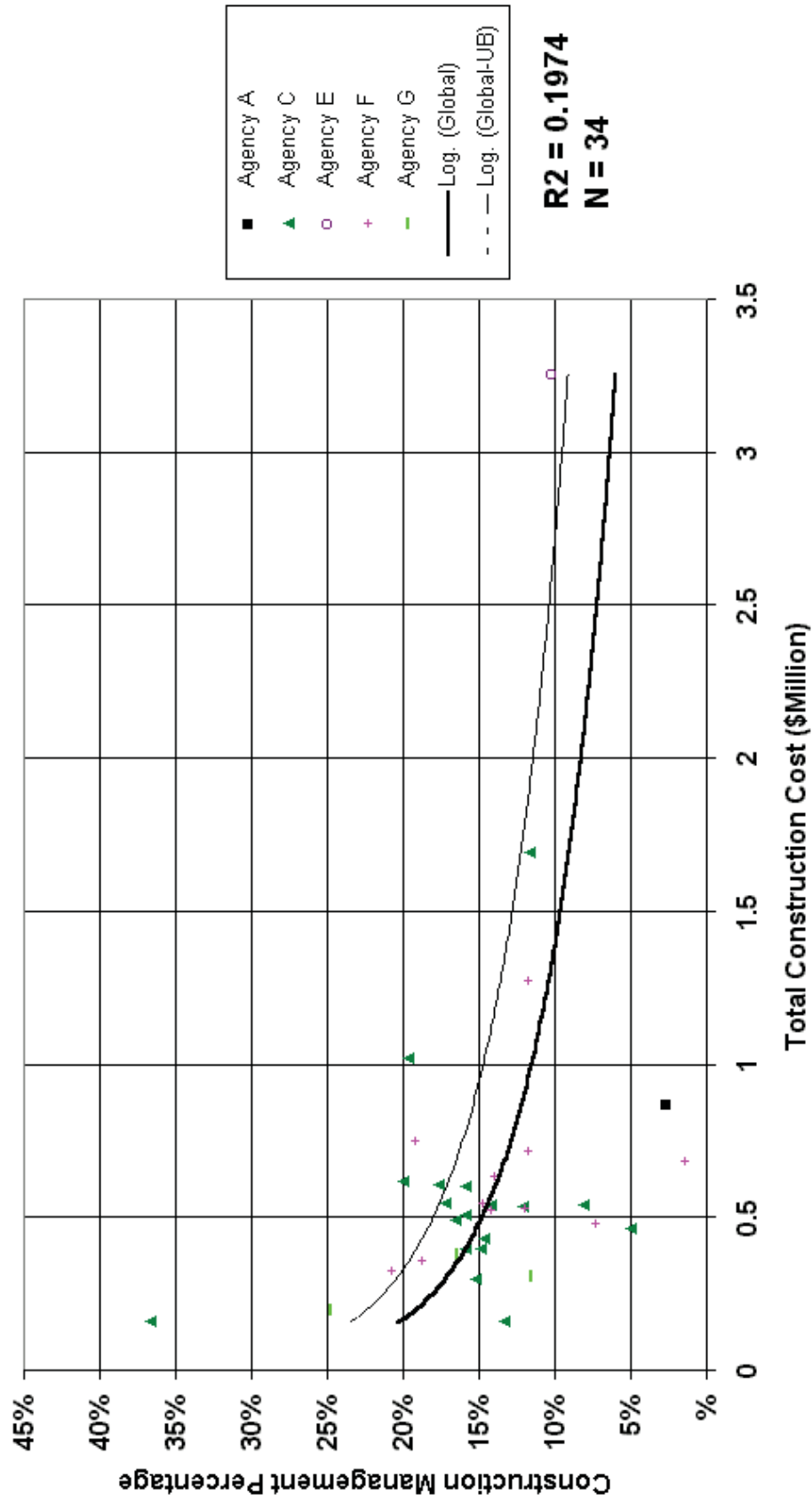
Pipe Systems - Pump Stations

Construction Management Percentage Versus Total Construction Cost



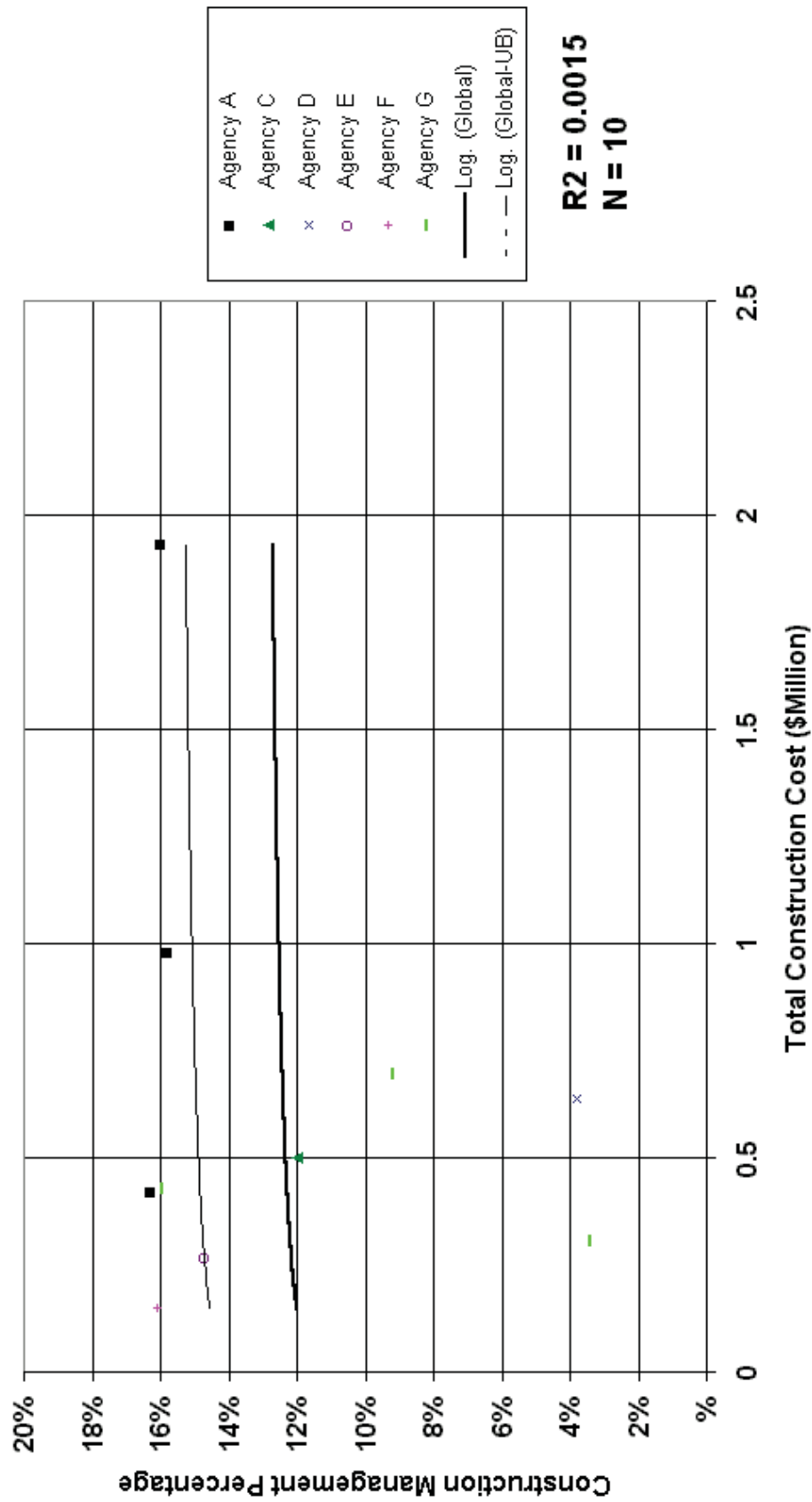
Parks - Playgrounds

Construction Management Percentage Versus Total Construction Cost



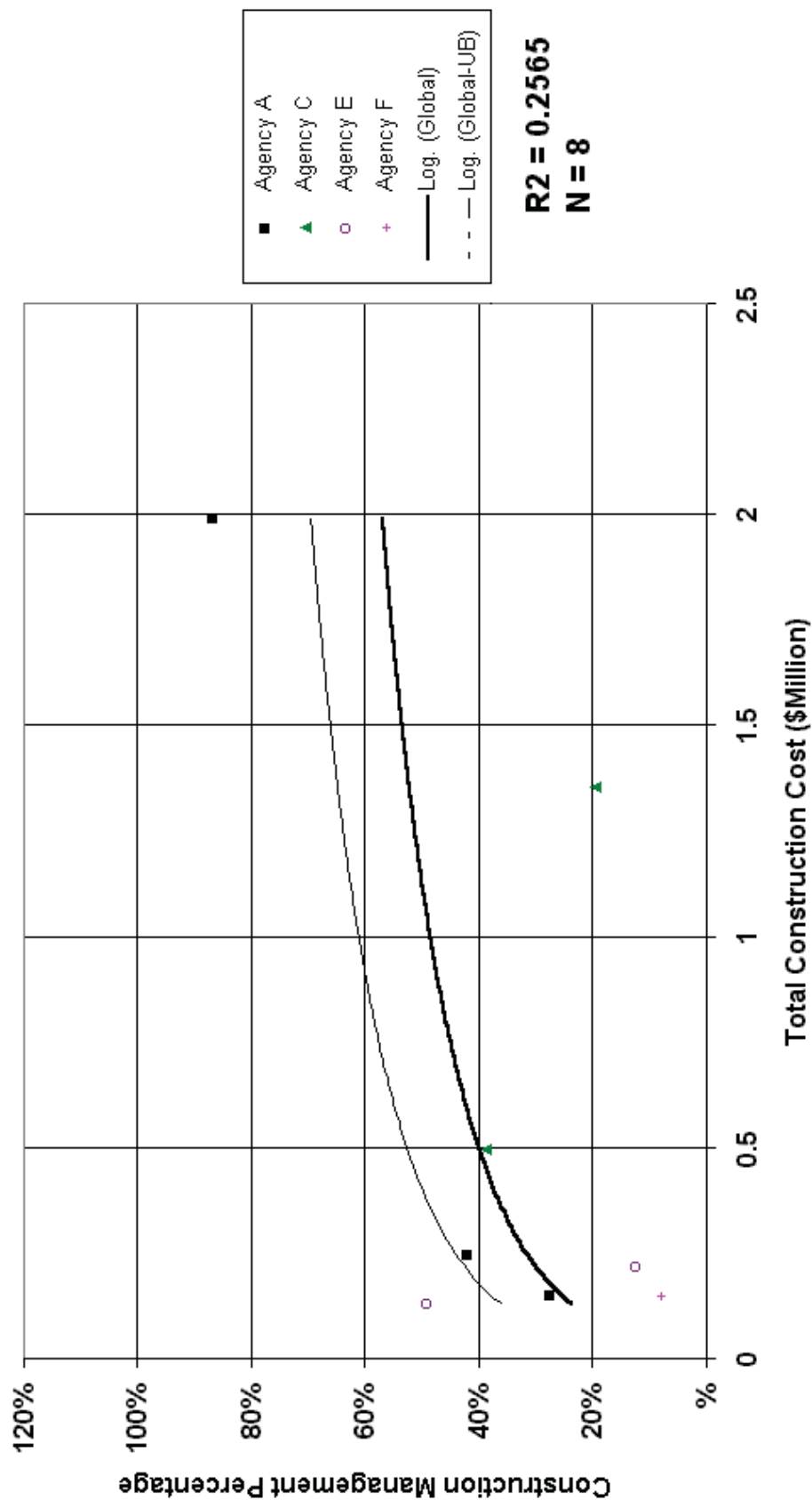
Parks - Sportfields

Construction Management Percentage Versus Total Construction Cost



Parks - Restrooms

Construction Management Percentage Versus Total Construction Cost



CURVES GROUP 3

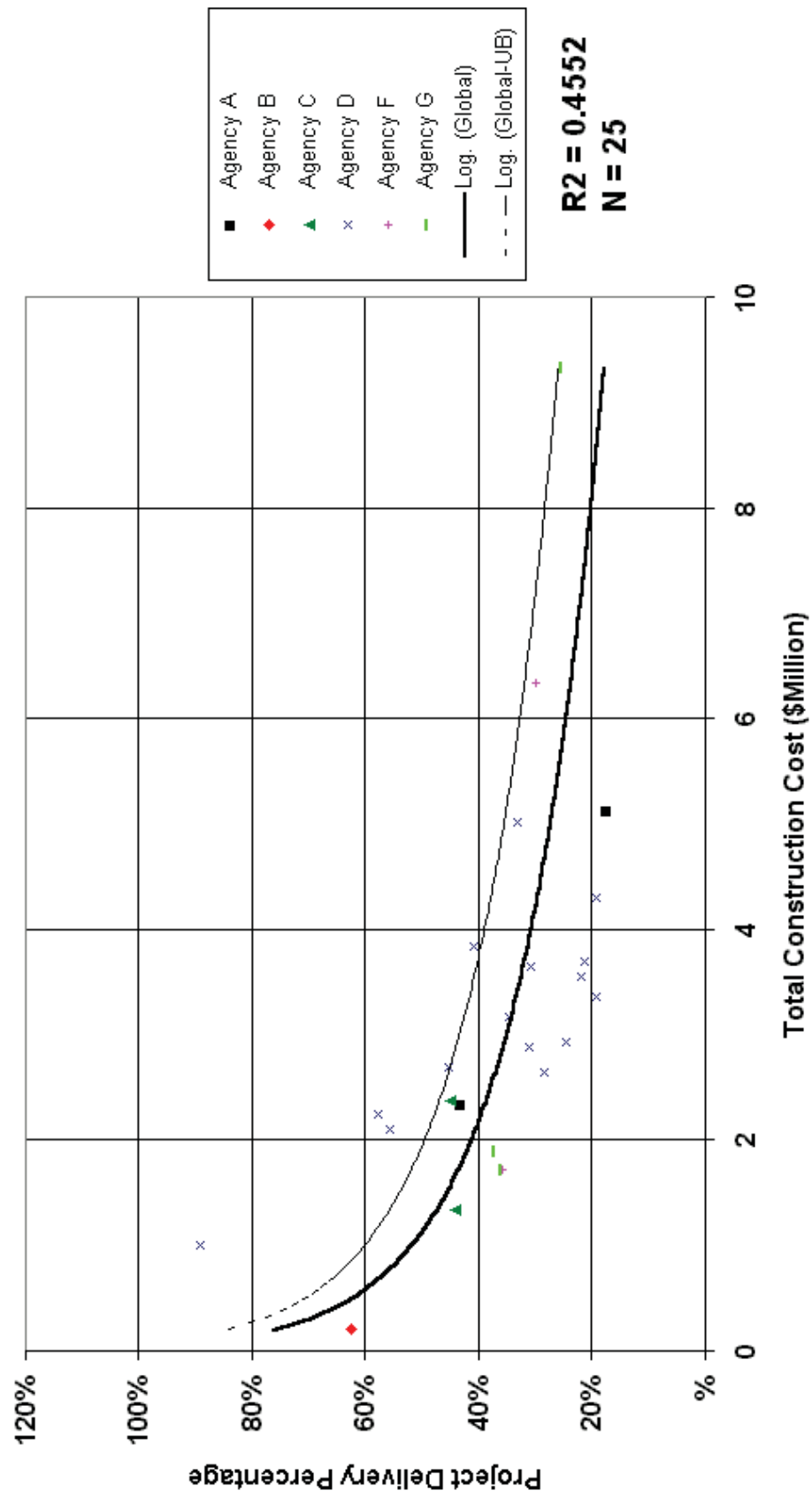
Delivery Cost / Construction Cost

Versus

Total Construction Cost

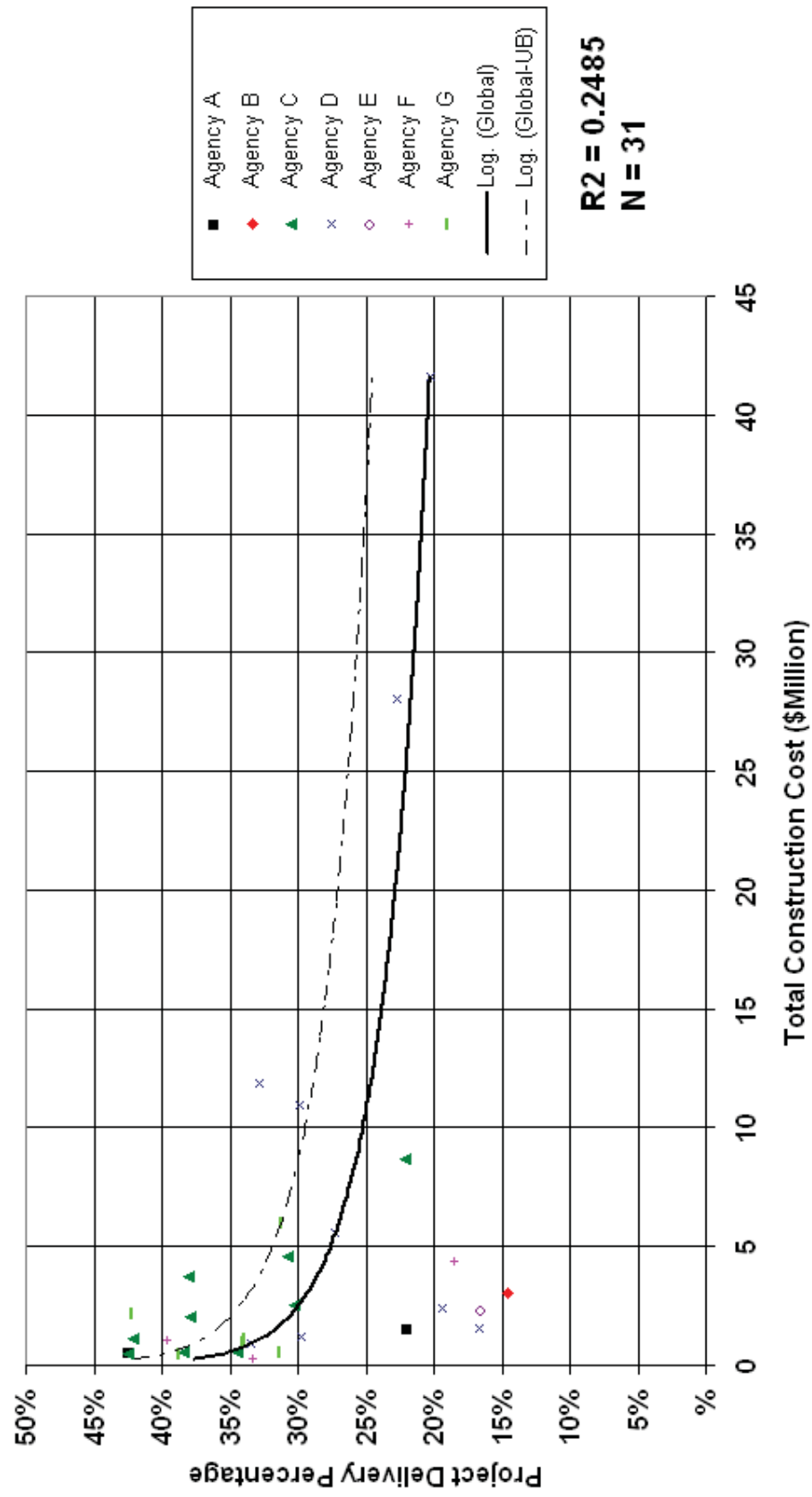
Municipal Facilities - Libraries

Project Delivery Percentage Versus Total Construction Cost



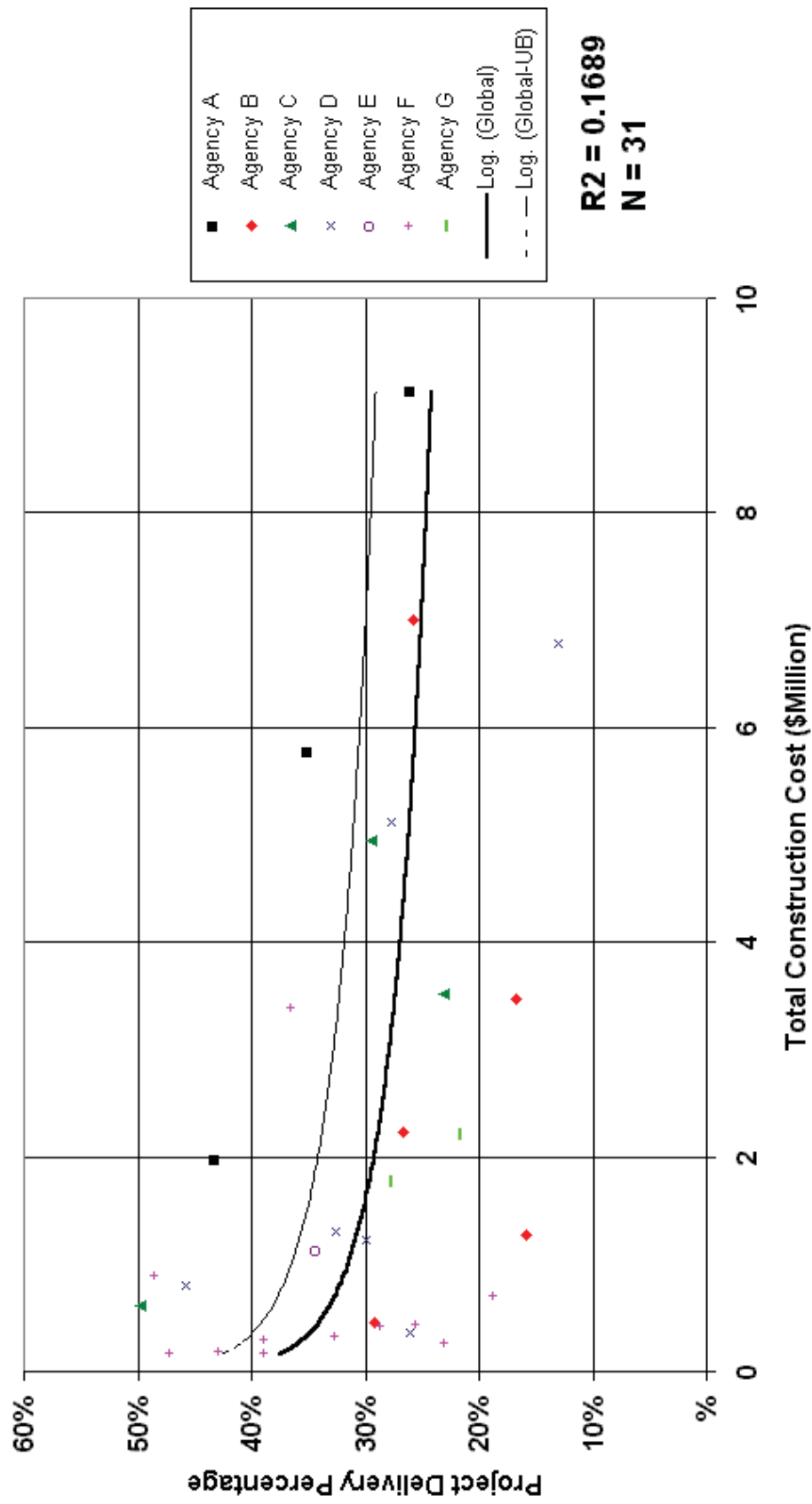
Municipal Facilities - Police / Fire Station

Project Delivery Percentage Versus Total Construction Cost



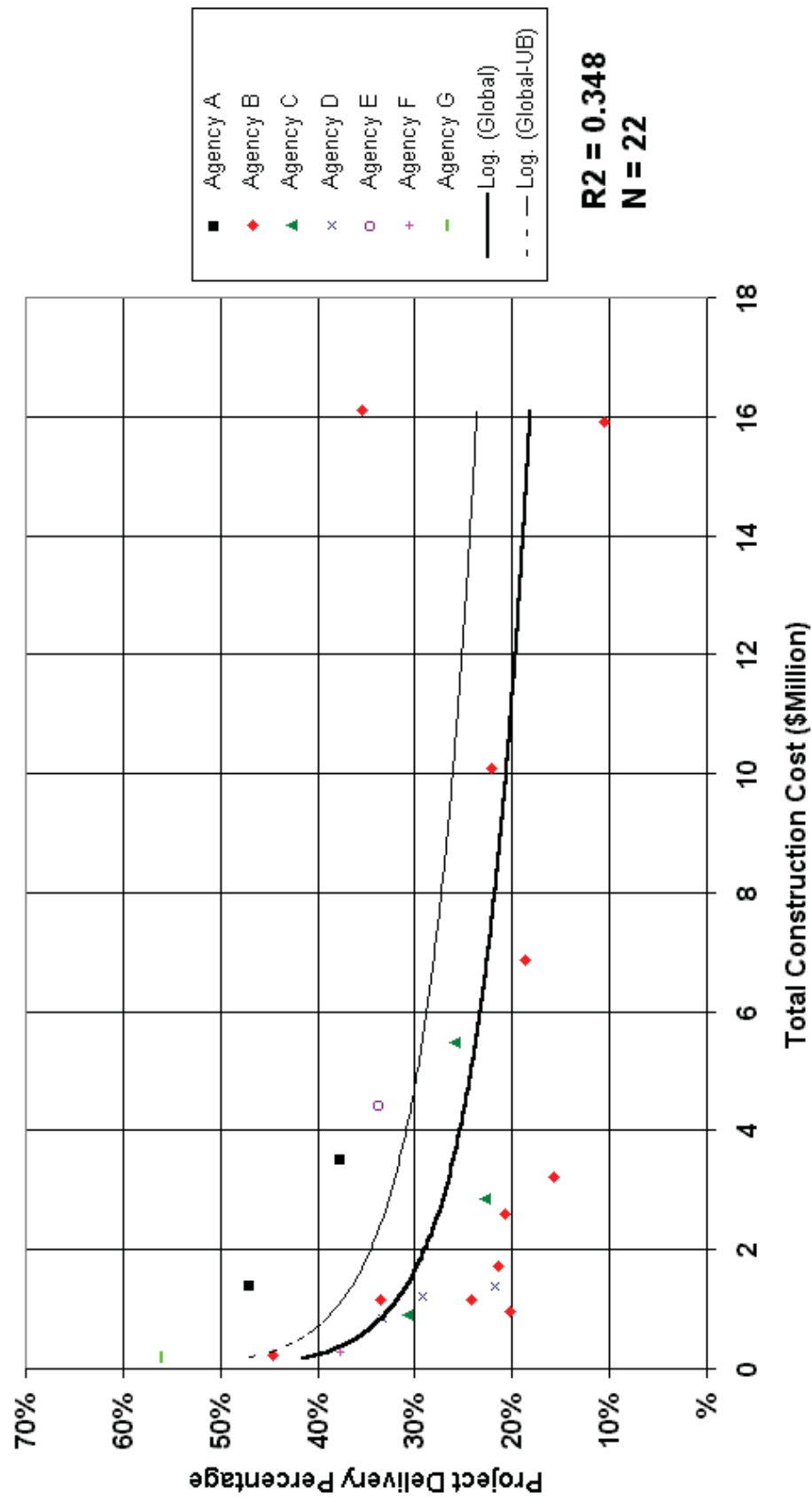
Municipal Facilities - Community Bldg./Rec. Center/CC/Gym

Project Delivery Percentage Versus Total Construction Cost



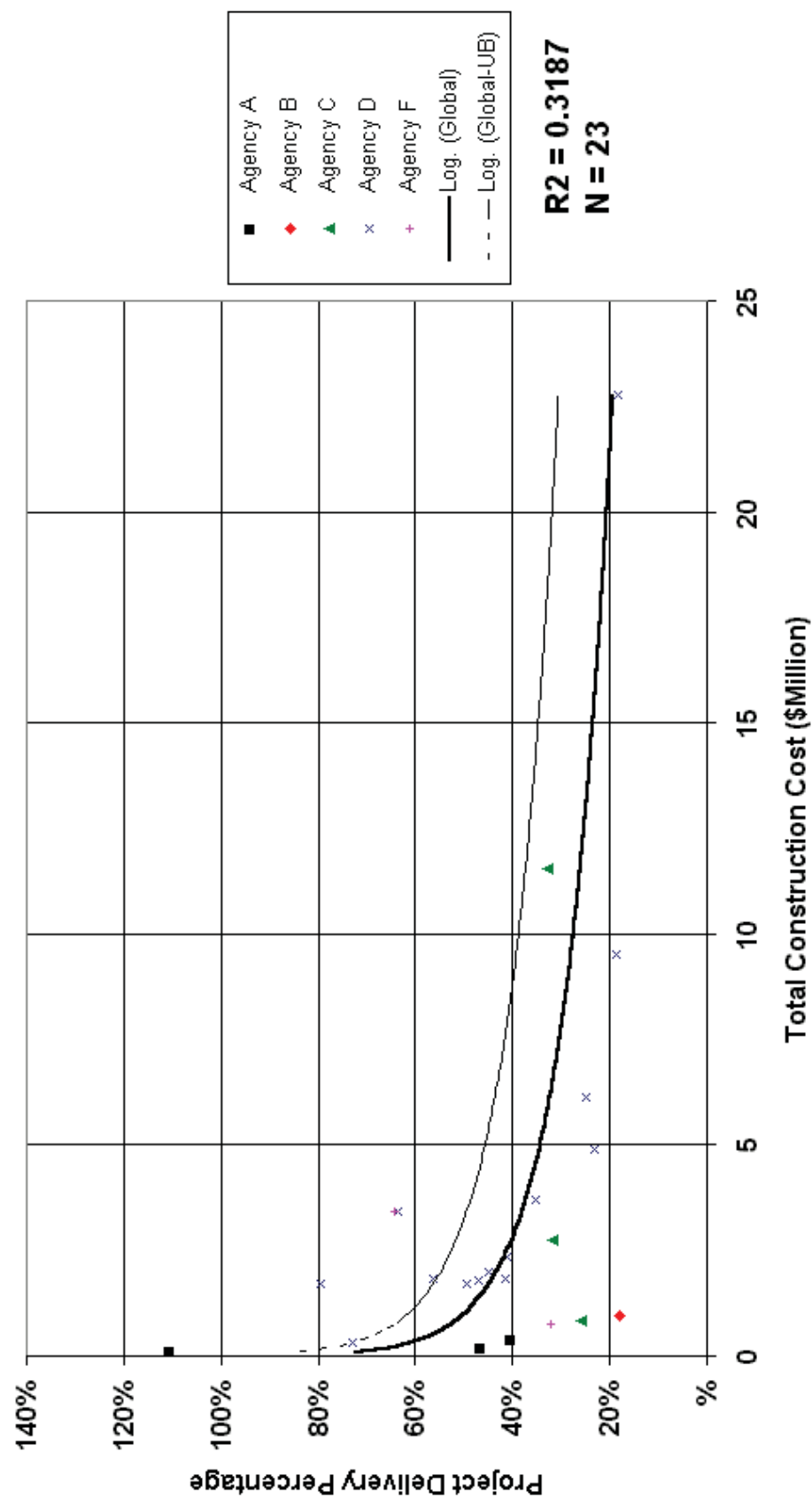
Streets - Widening / New / Grade Separation

Project Delivery Percentage Versus Total Construction Cost



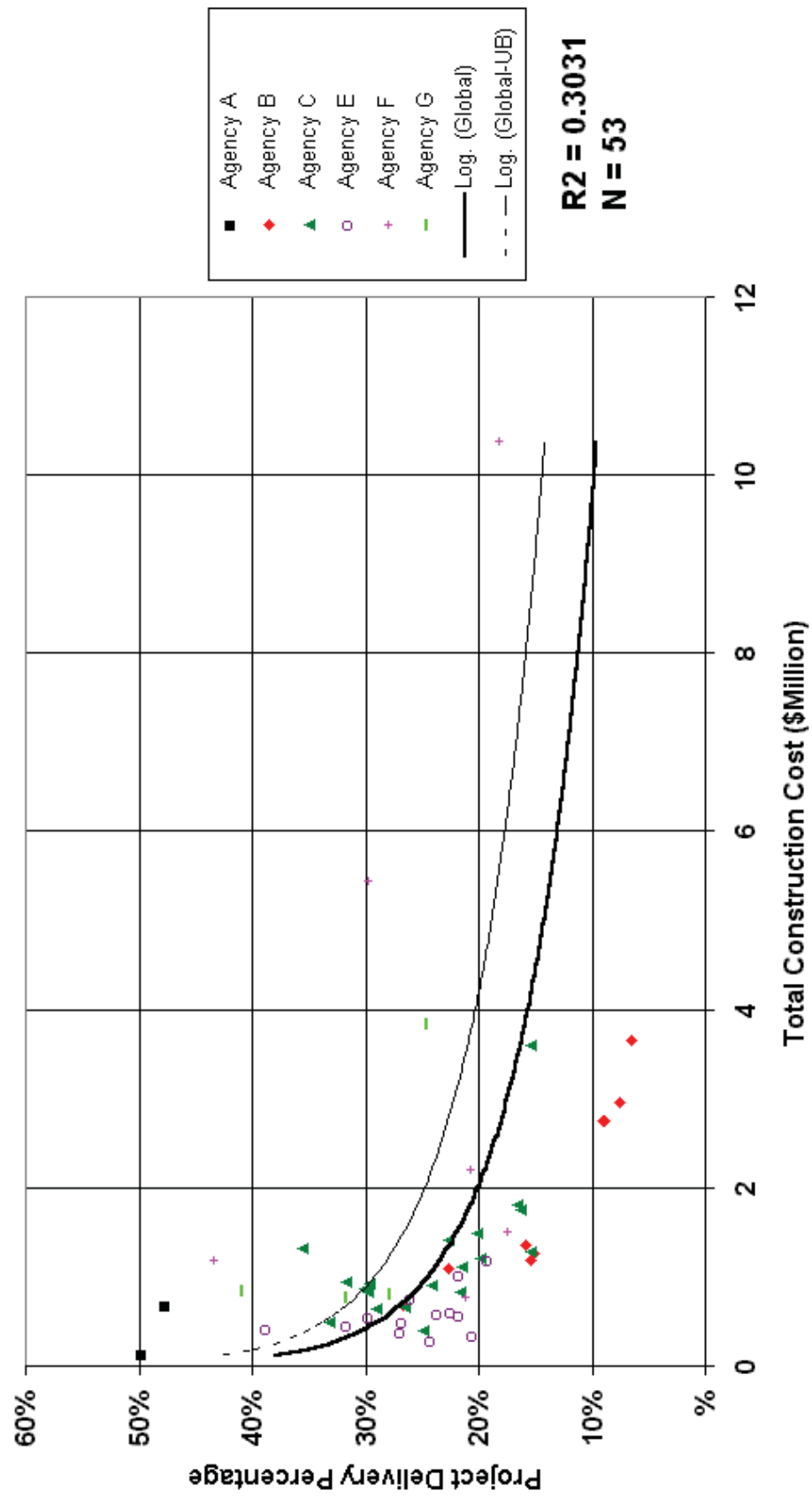
Streets - Bridges (Retrofit / Seismic)

Project Delivery Percentage Versus Total Construction Cost



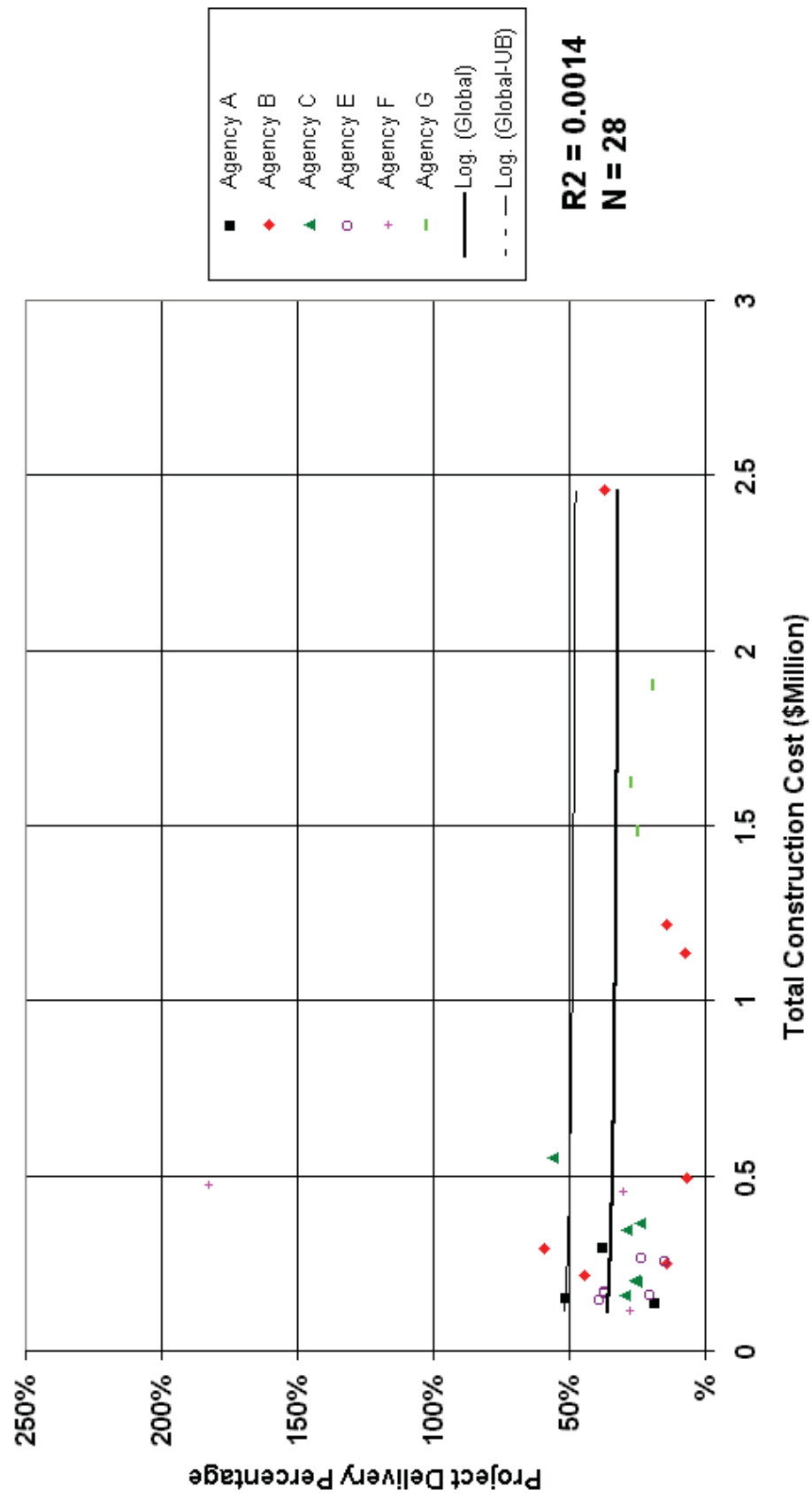
Streets - Renovation / Resurfacing

Project Delivery Percentage Versus Total Construction Cost



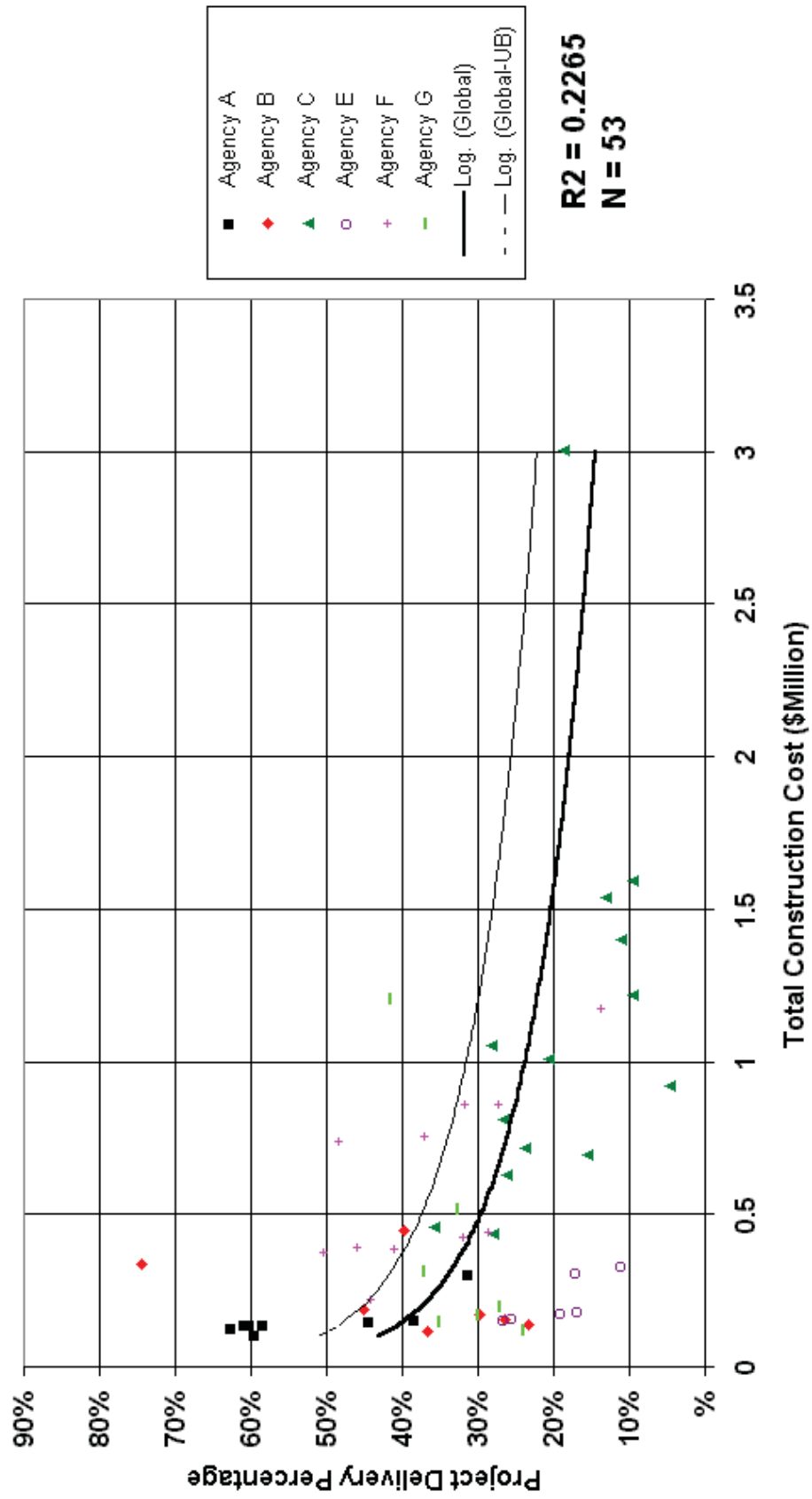
Streets - Bike / Pedestrian / Curb Ramps

Project Delivery Percentage Versus Total Construction Cost



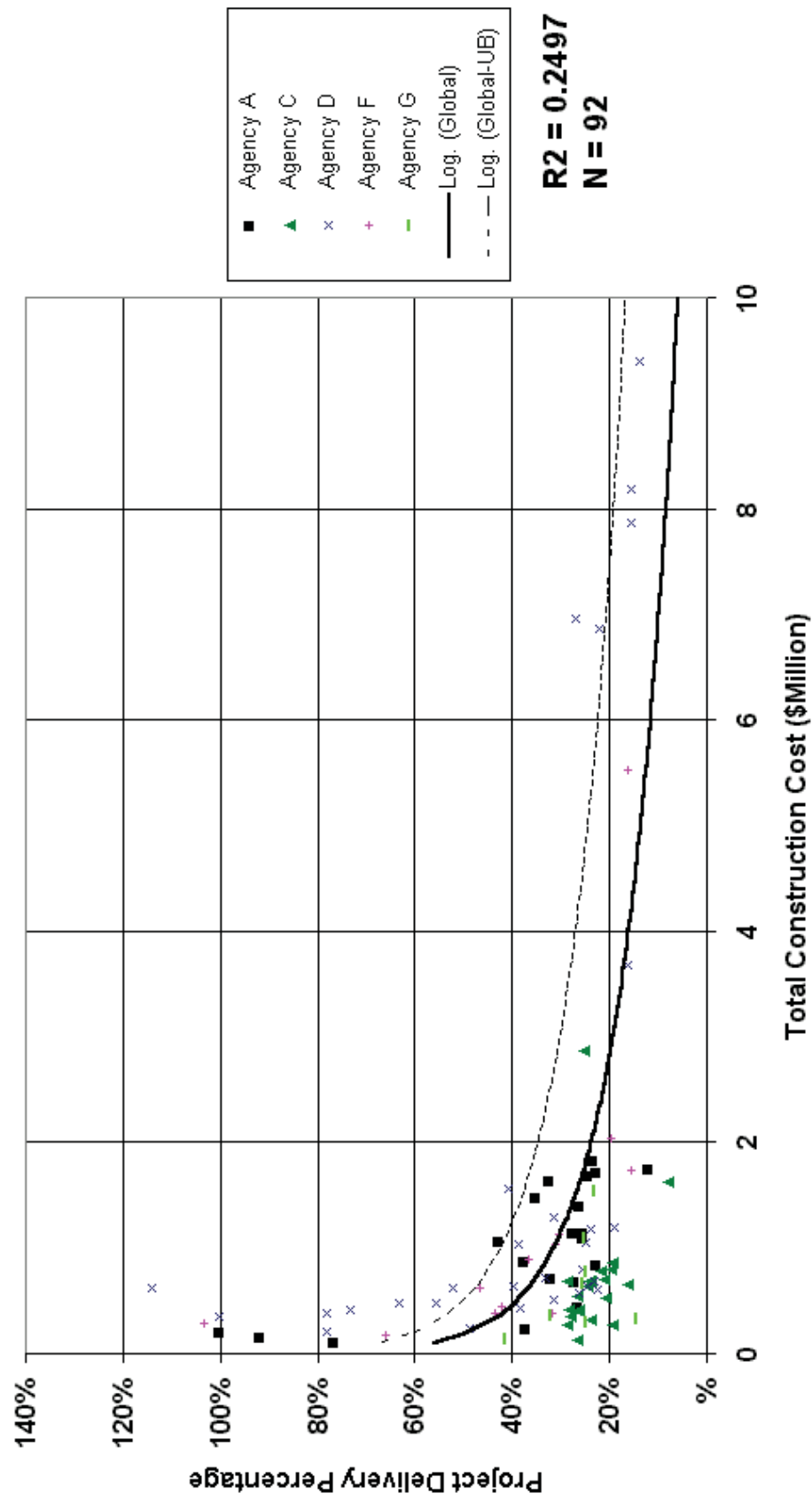
Streets - Signals

Project Delivery Percentage Versus Total Construction Cost



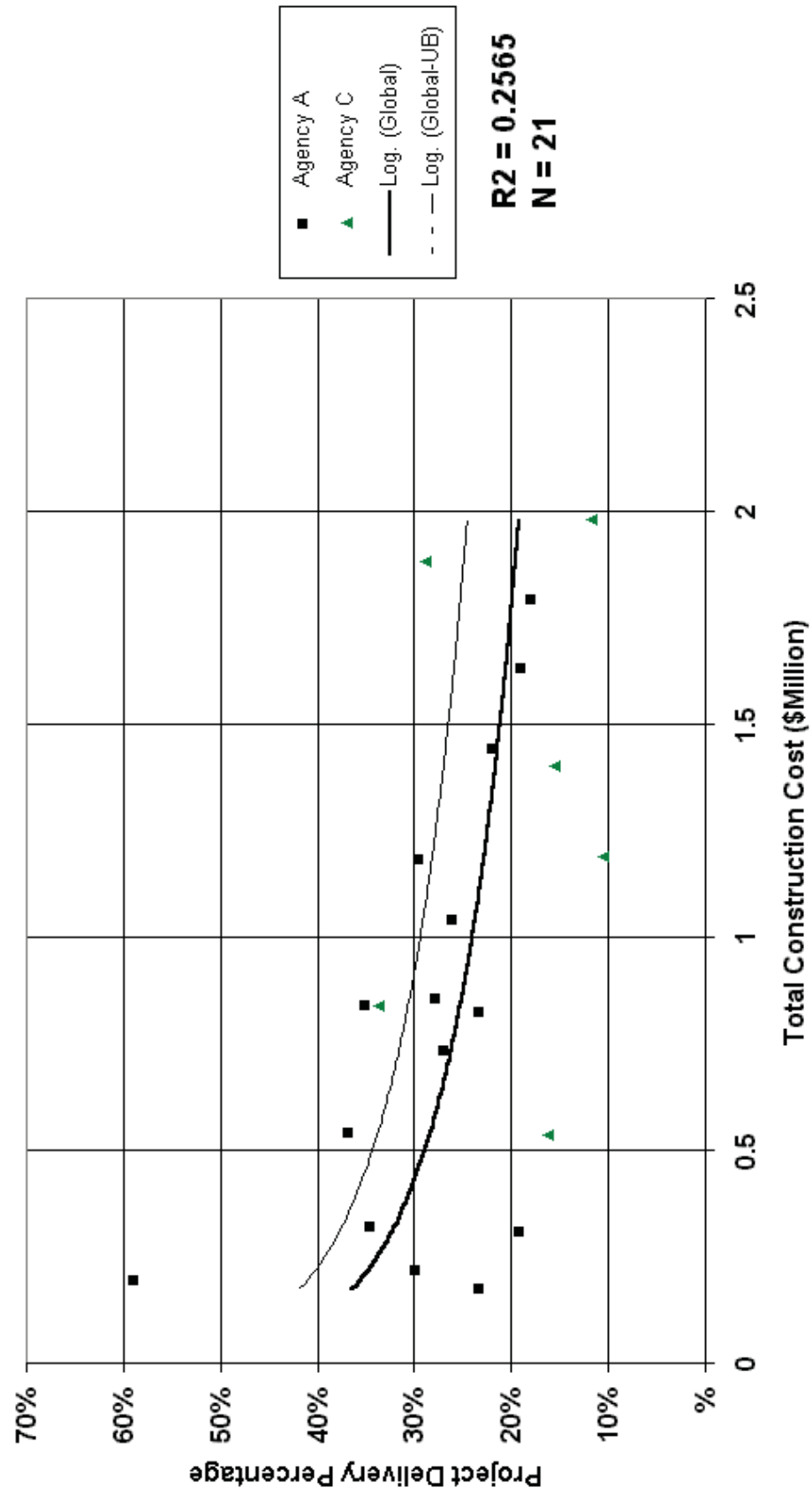
Pipe Systems - Gravity System (Storm Drains, Sewers)

Project Delivery Percentage Versus Total Construction Cost



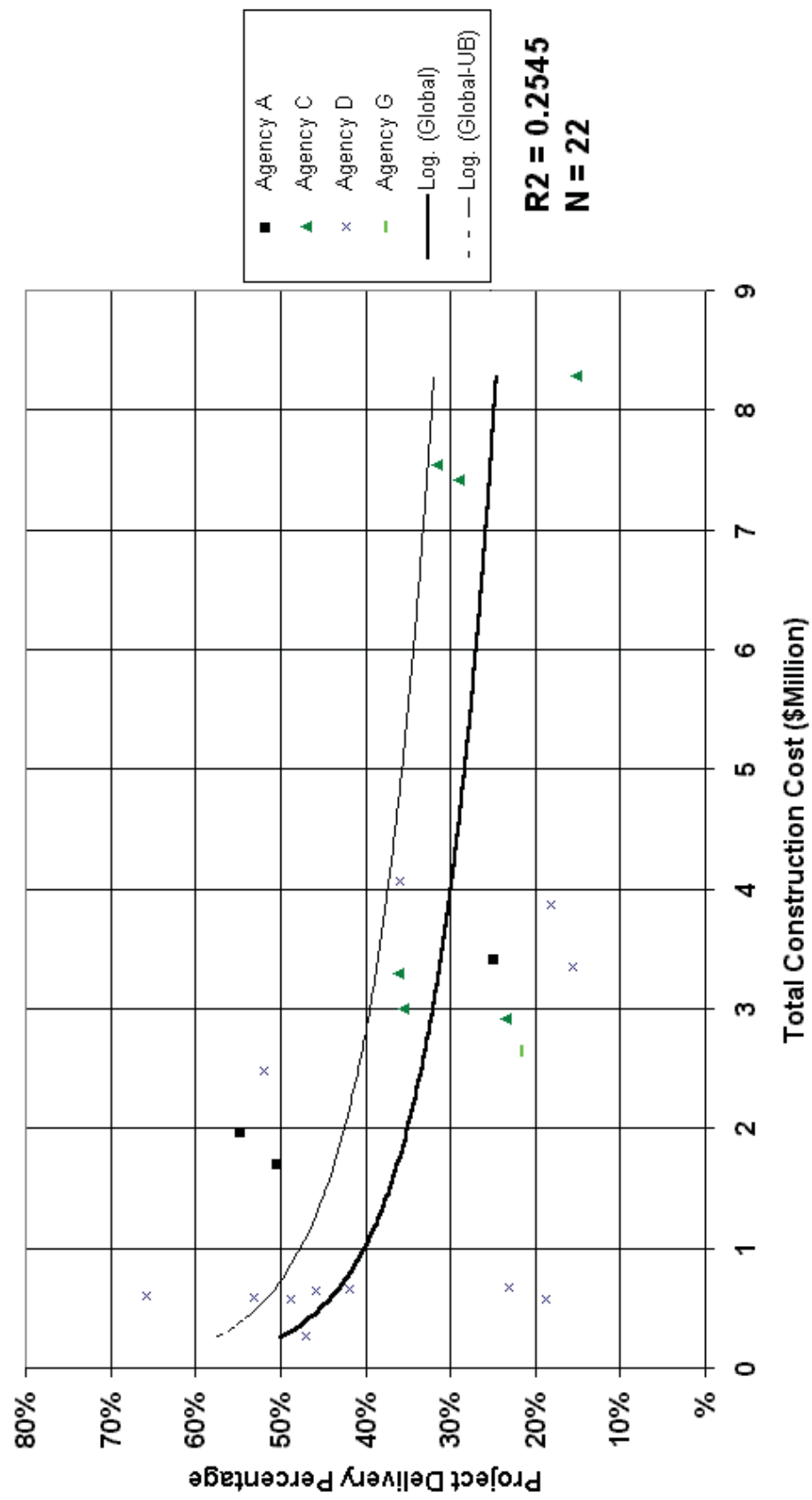
Pipe Systems - Pressure Systems

Project Delivery Percentage Versus Total Construction Cost



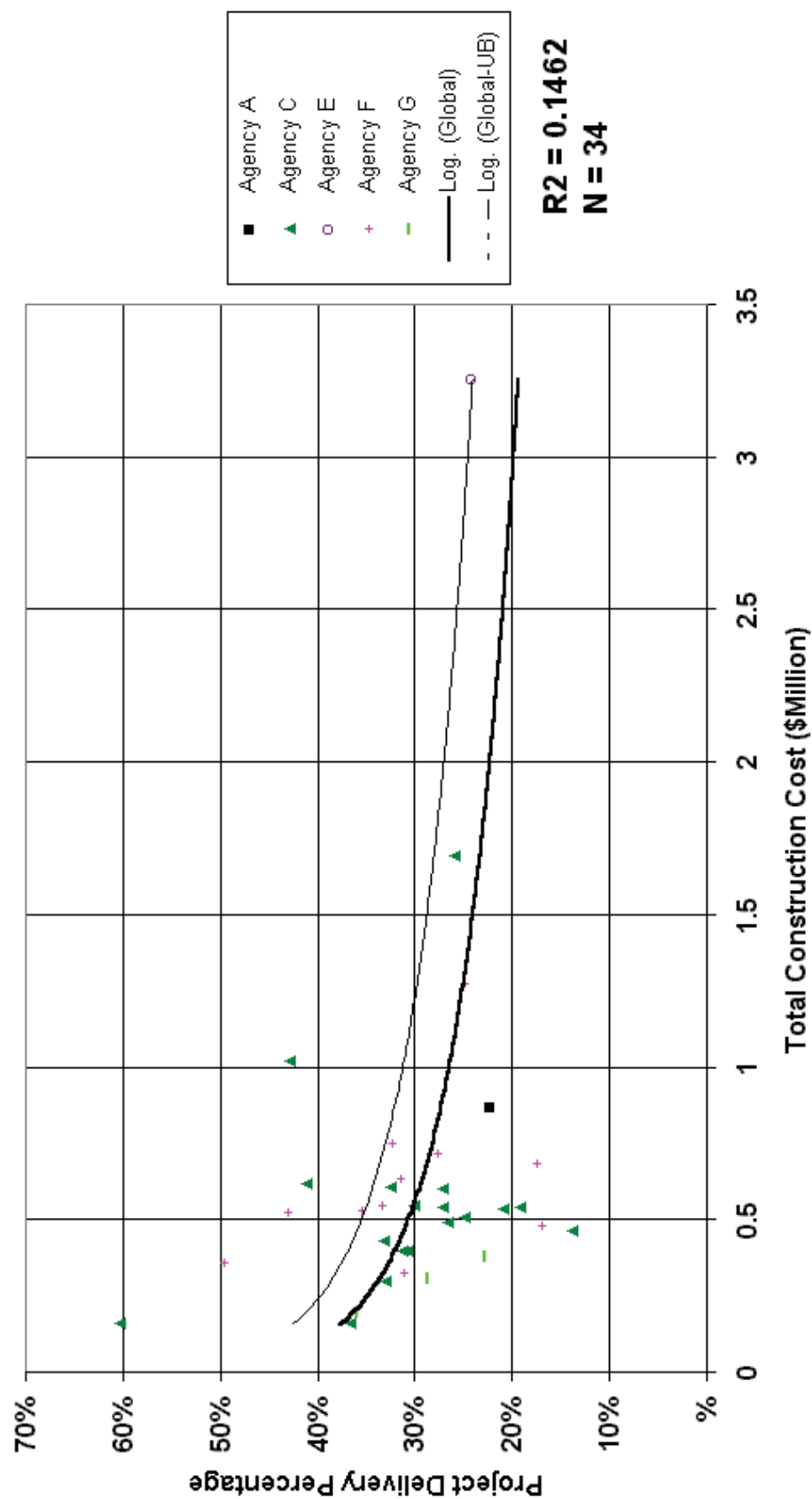
Pipe Systems - Pump Stations

Project Delivery Percentage Versus Total Construction Cost



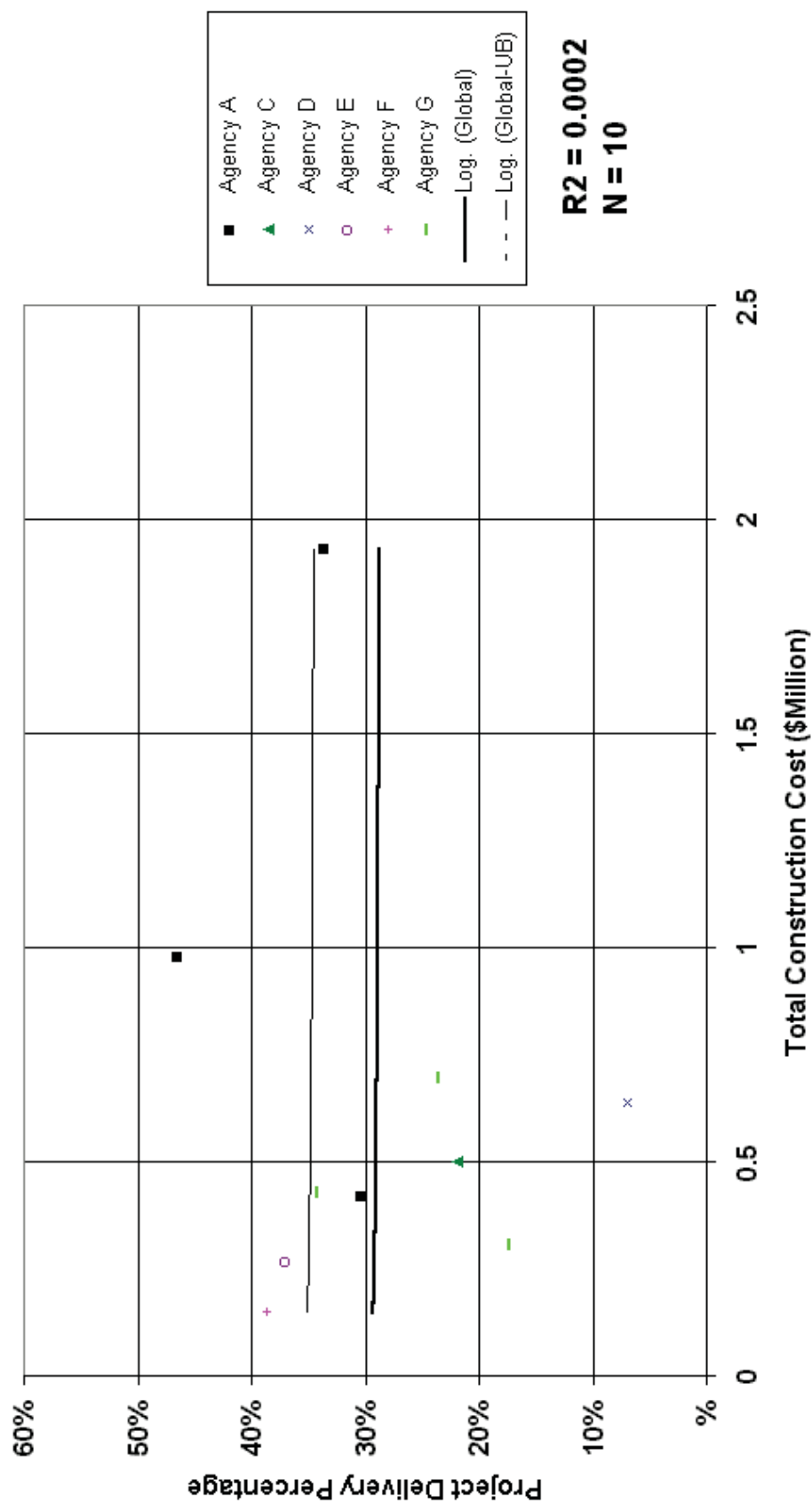
Parks - Playgrounds

Project Delivery Percentage Versus Total Construction Cost



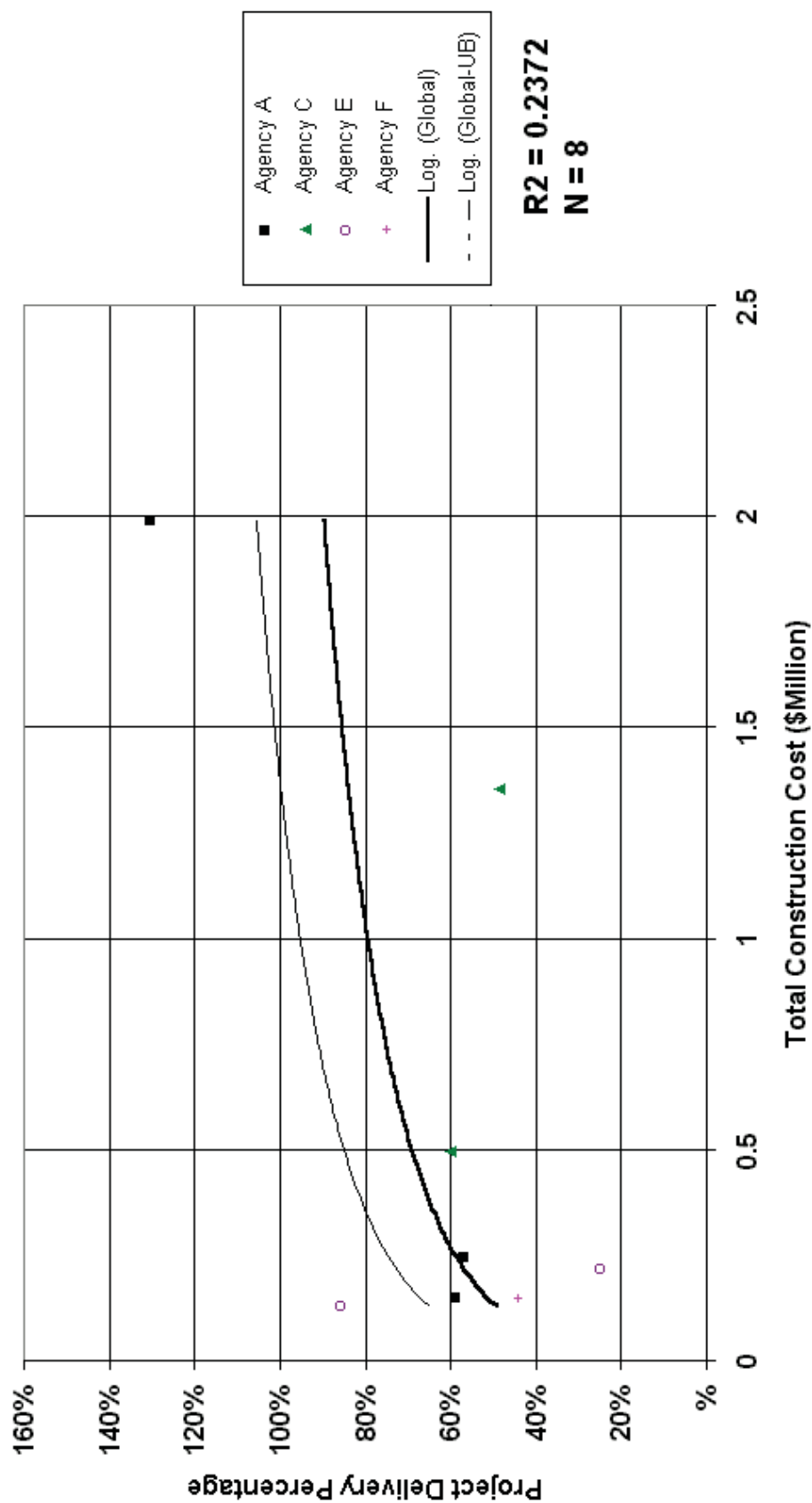
Parks - Sportfields

Project Delivery Percentage Versus Total Construction Cost



Parks - Restrooms

Project Delivery Percentage Versus Total Construction Cost



CURVES GROUP 4

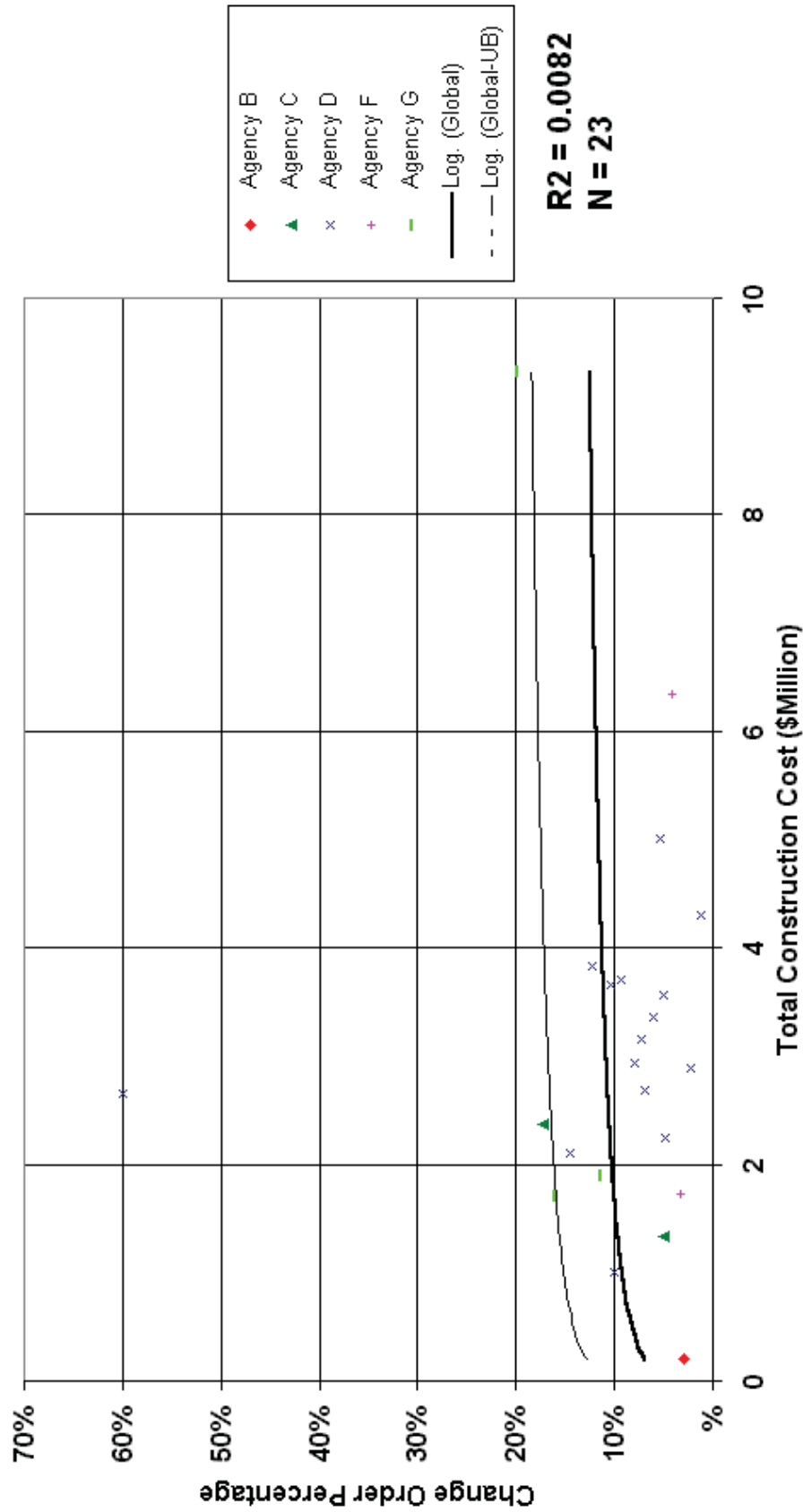
Change Order Cost / Construction Cost

Versus

Total Construction Cost

Municipal Facilities - Libraries*

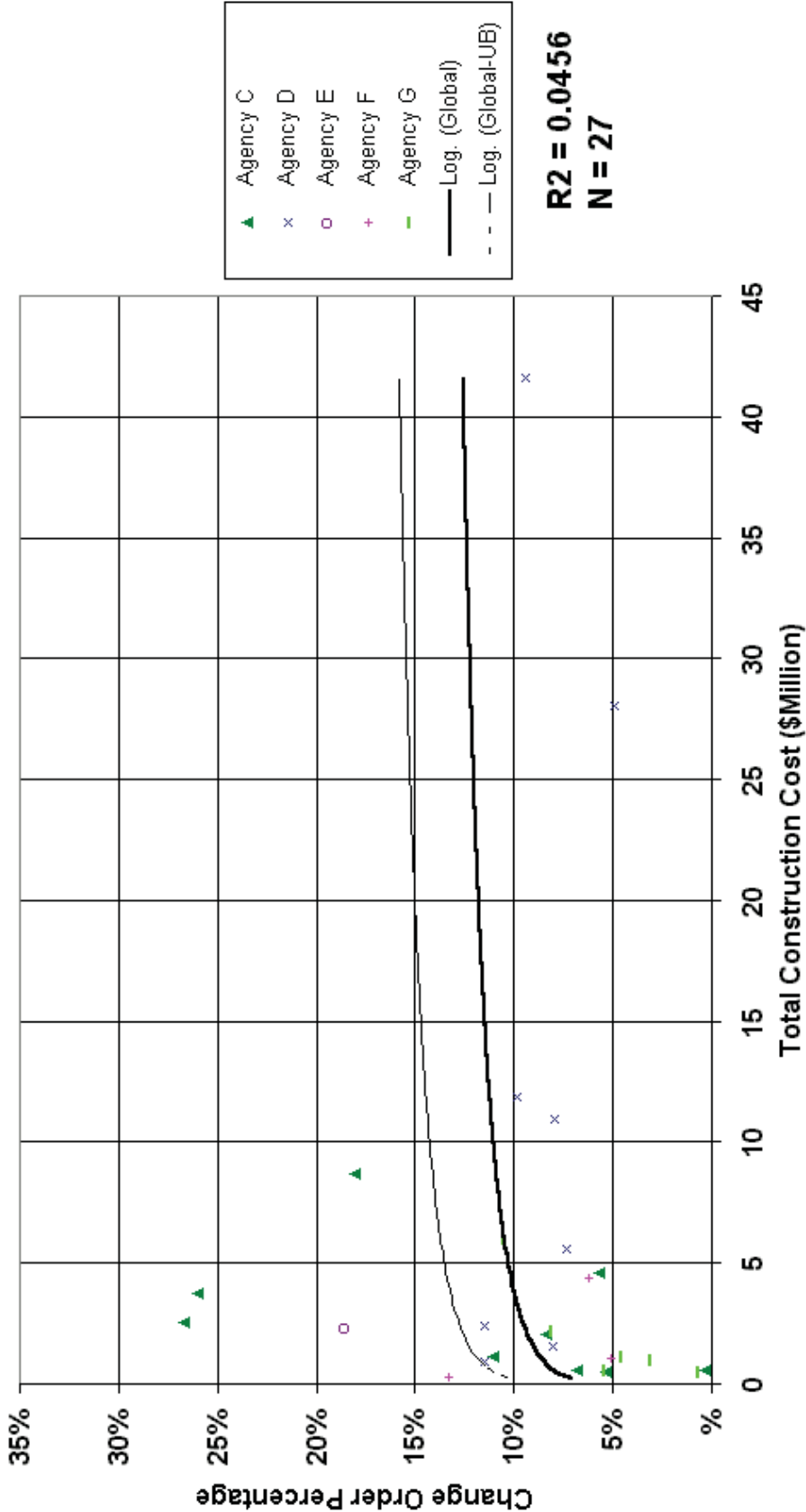
Change Order Percentage Versus Total Construction Cost



* Change Order costs were not available for 2 Library projects and they are not included in this graph.

Municipal Facilities - Police / Fire Station*

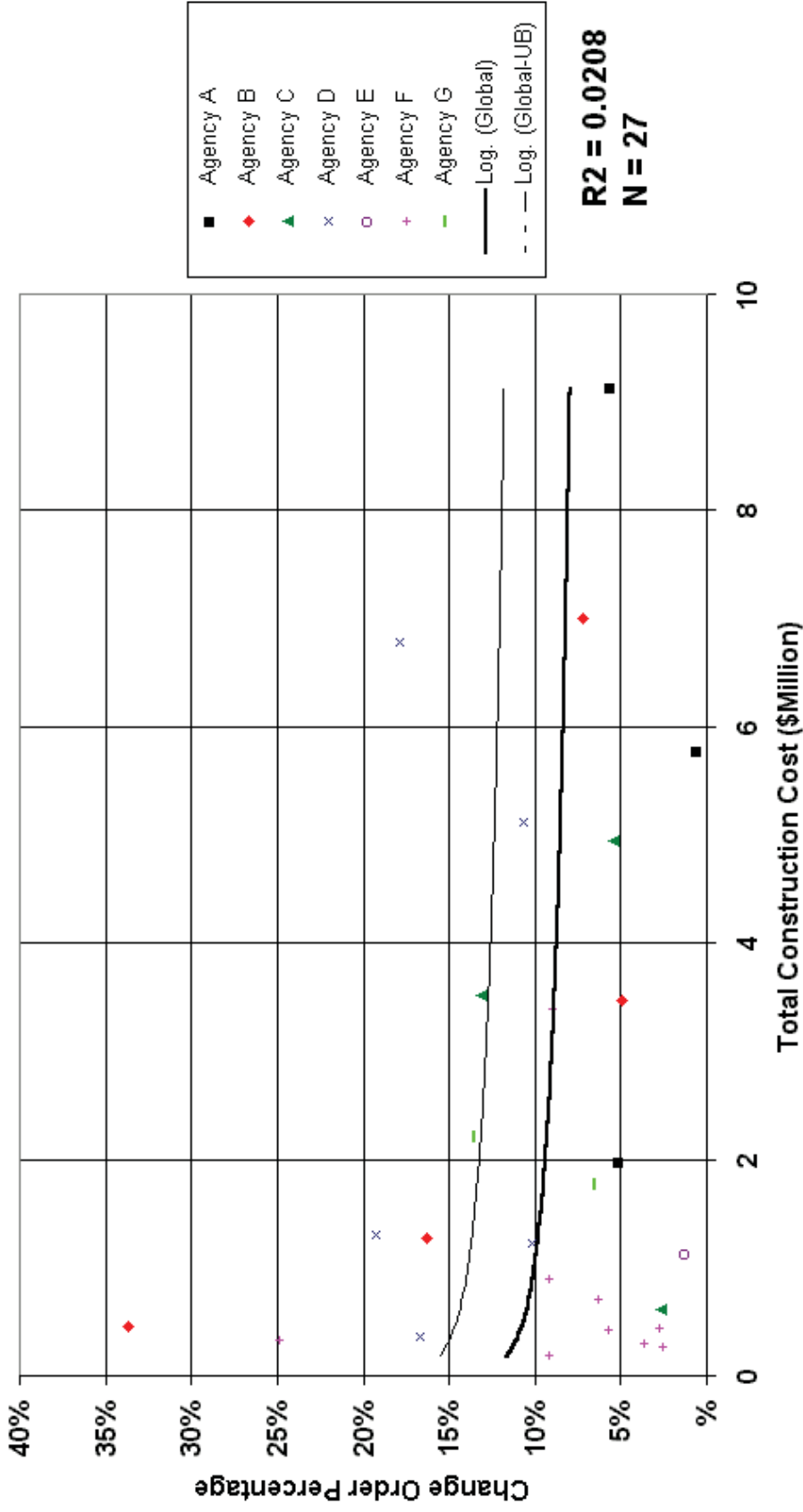
Change Order Percentage Versus Total Construction Cost



* Change Order costs were not available for 4 Police/Fire Station projects and they are not included in this graph.

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

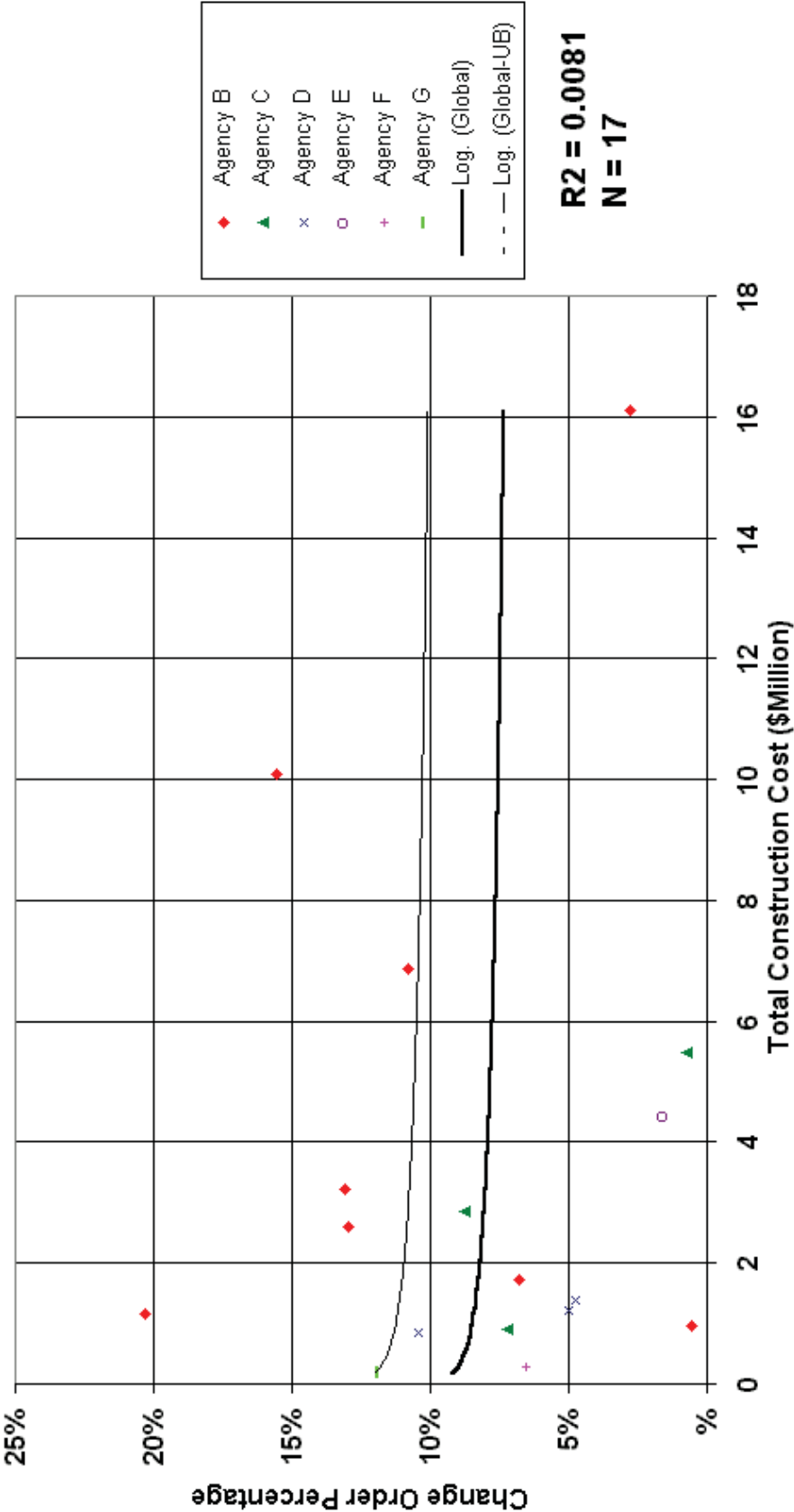
Change Order Percentage Versus Total Construction Cost



* Change Order costs were not available for 4 Community Building projects and they are not included in this graph.

Streets - Widening / New / Grade Separation*

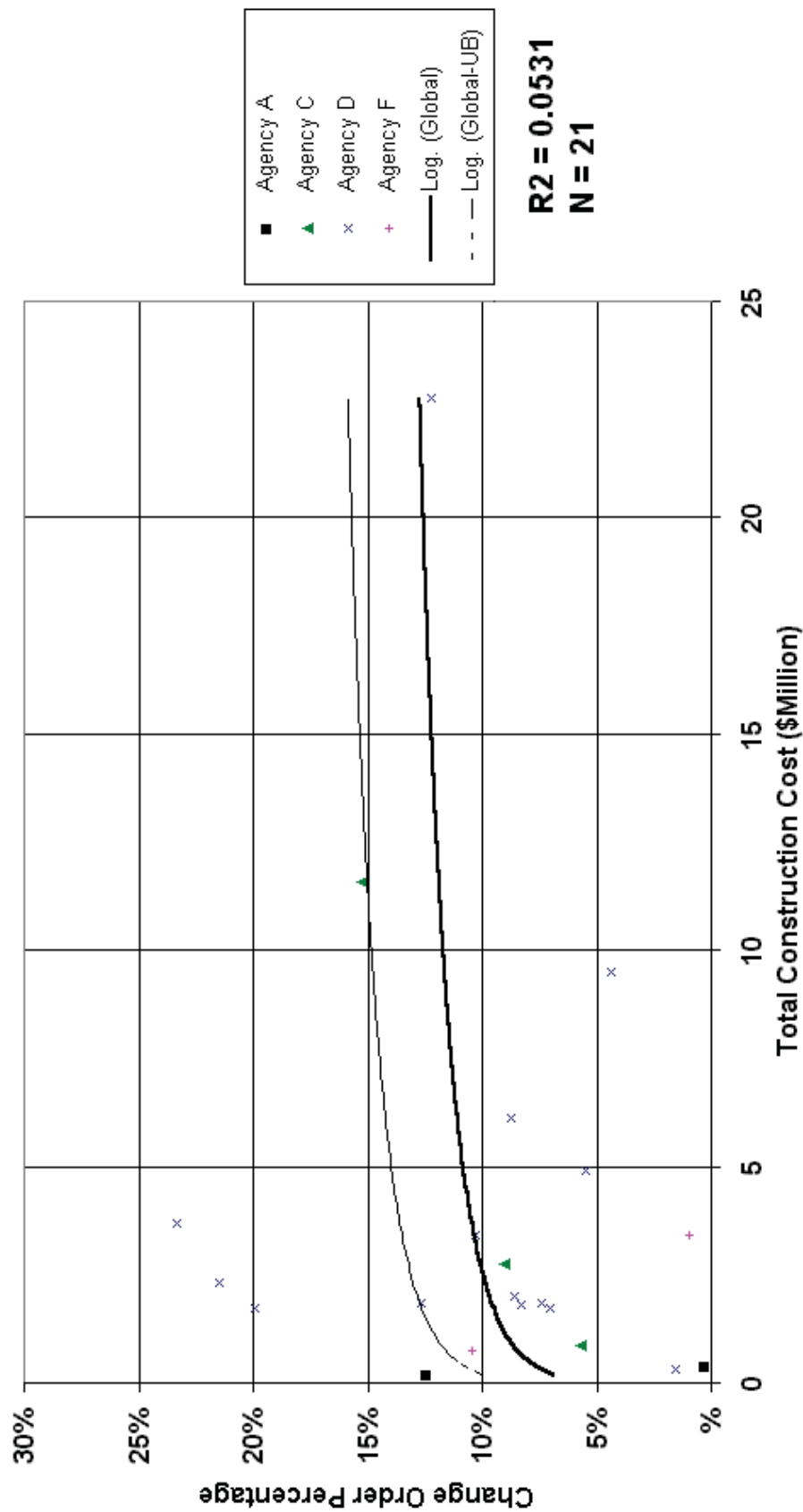
Change Order Percentage Versus Total Construction Cost



* Change Order costs were not available for 5 Widening projects and they are not included in this graph.

Streets - Bridges (Retrofit / Seismic)*

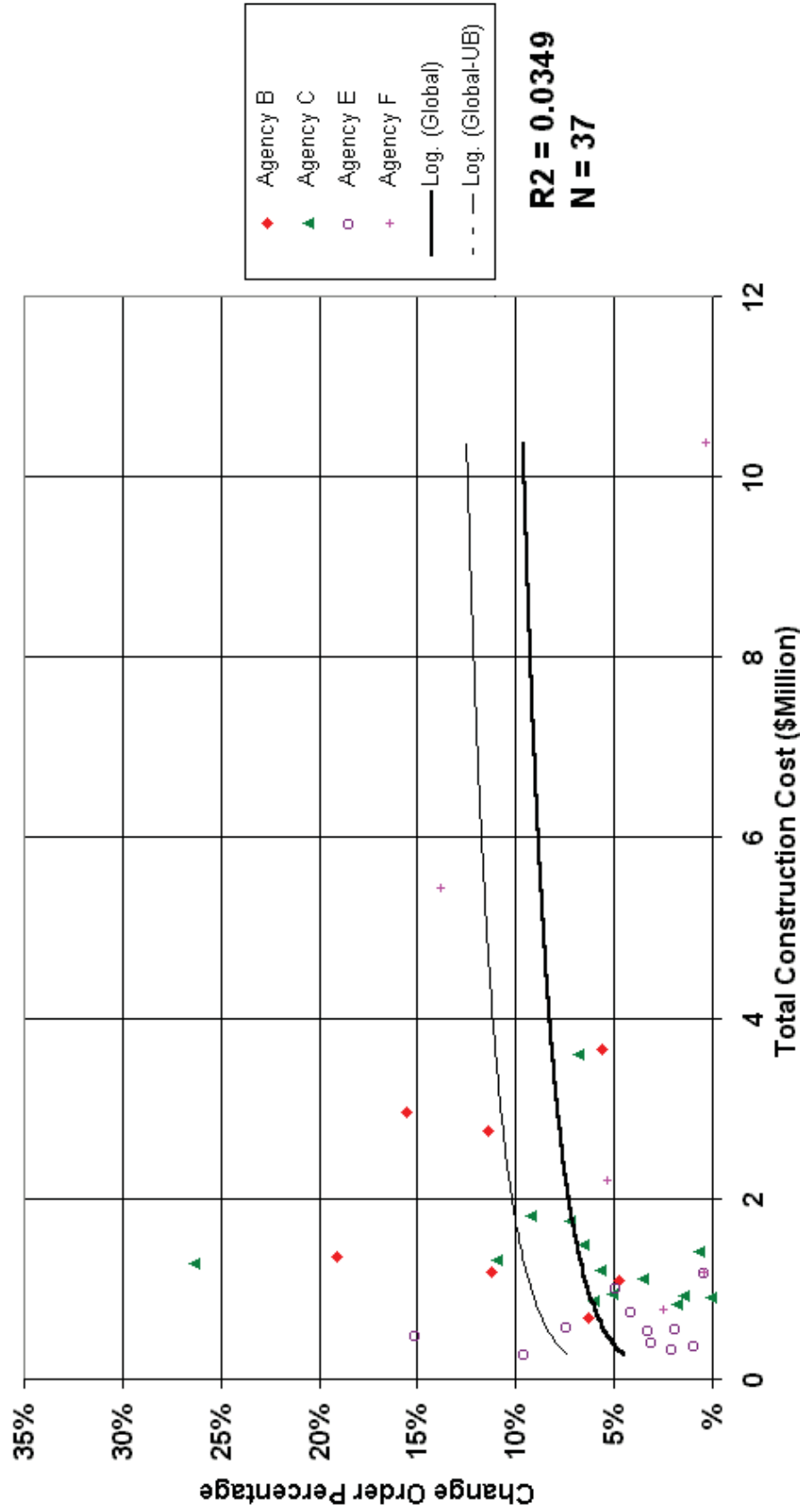
Change Order Percentage Versus Total Construction Cost



* Change Order costs were not available for 2 Bridge projects and they are not included in this graph.

Streets - Renovation / Resurfacing*

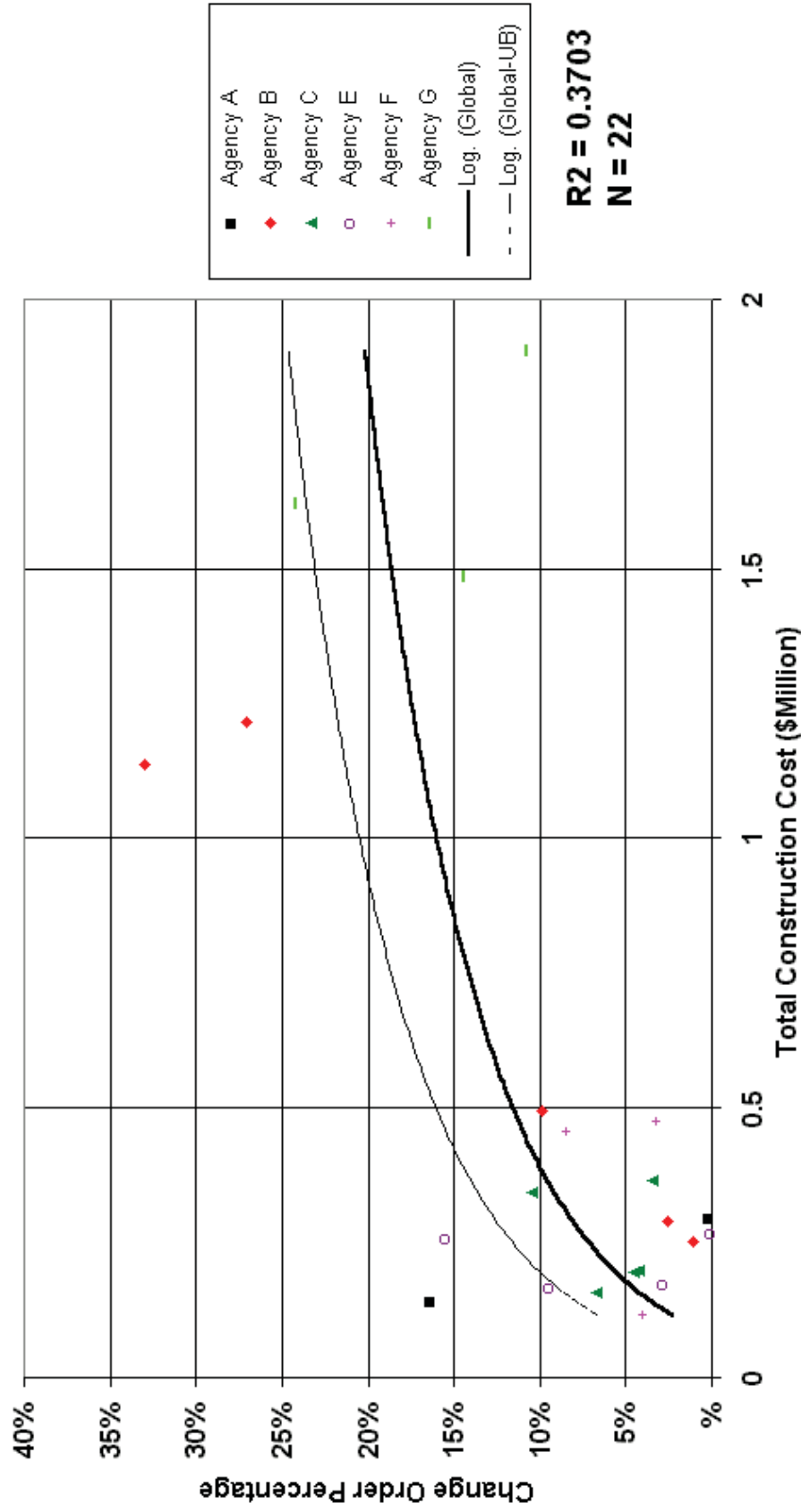
Change Order Percentage Versus Total Construction Cost



* Change Order costs were not available for 15 Renovation projects and they are not included in this graph.

Streets - Bike / Pedestrian / Curb Ramps*

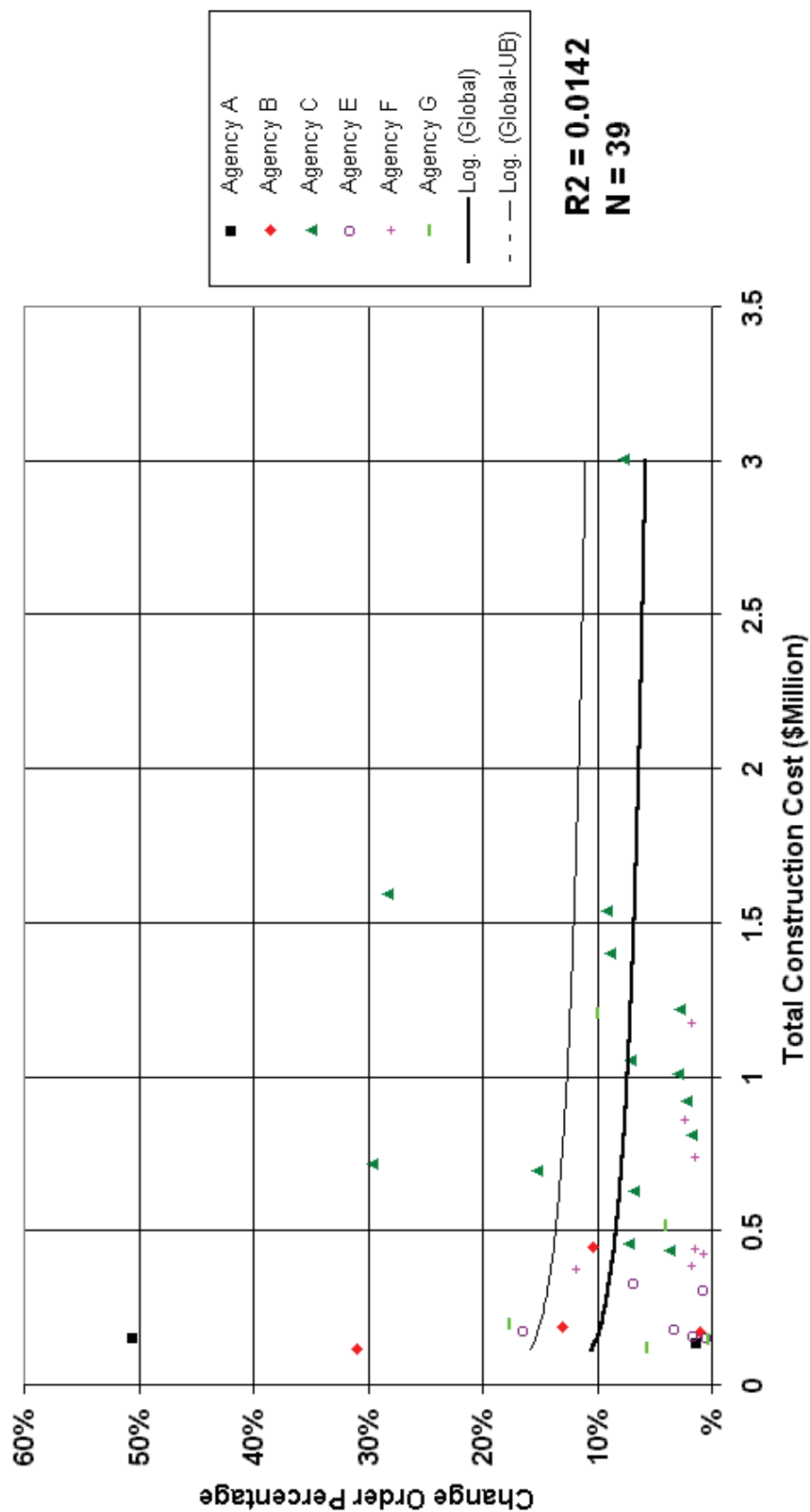
Change Order Percentage Versus Total Construction Cost



* Change Order costs were not available for 6 Bike projects and they are not included in this graph.

Streets - Signals*

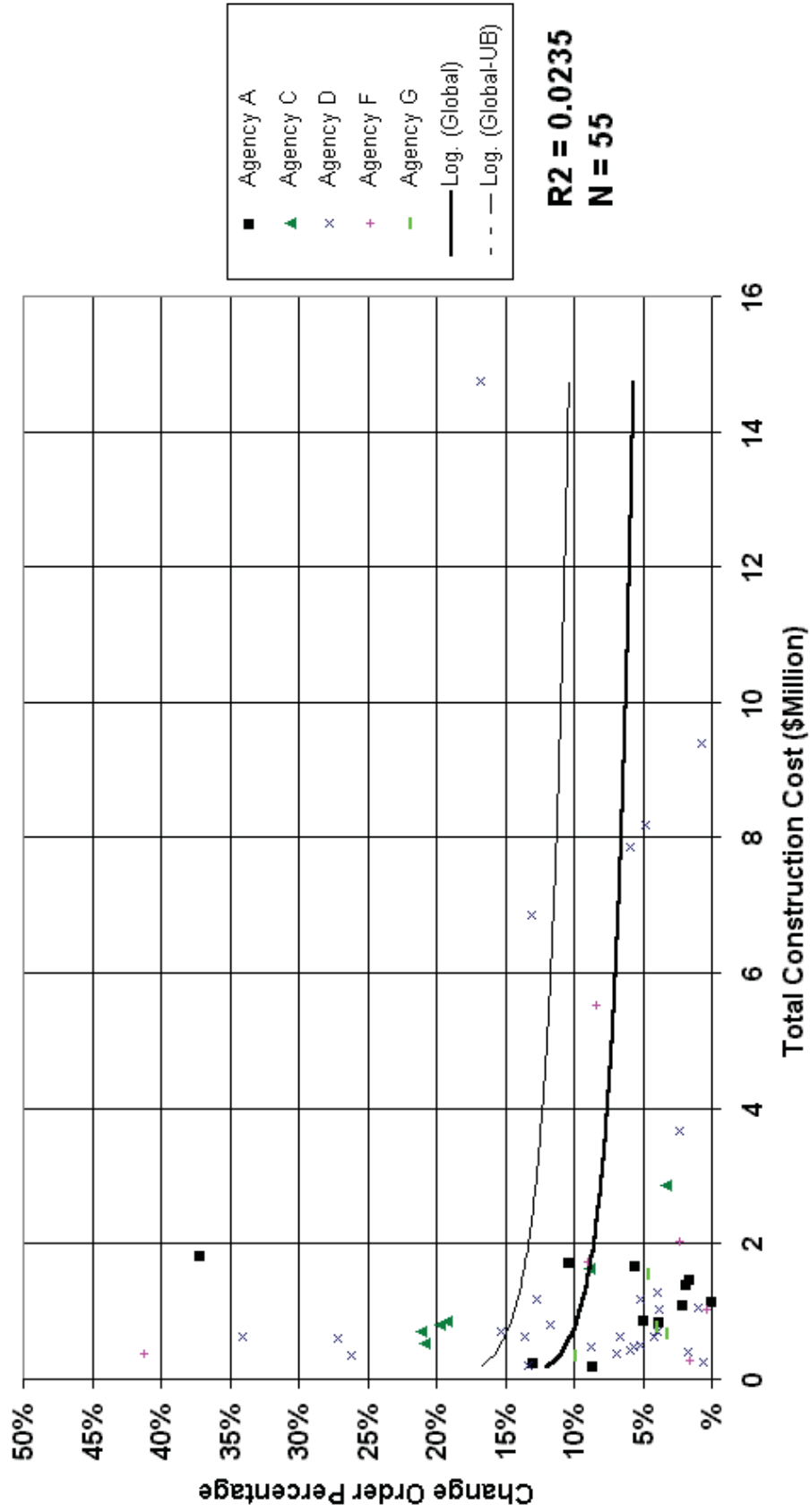
Change Order Percentage Versus Total Construction Cost



* Change Order costs were not available for 14 Signal projects and they are not included in this graph.

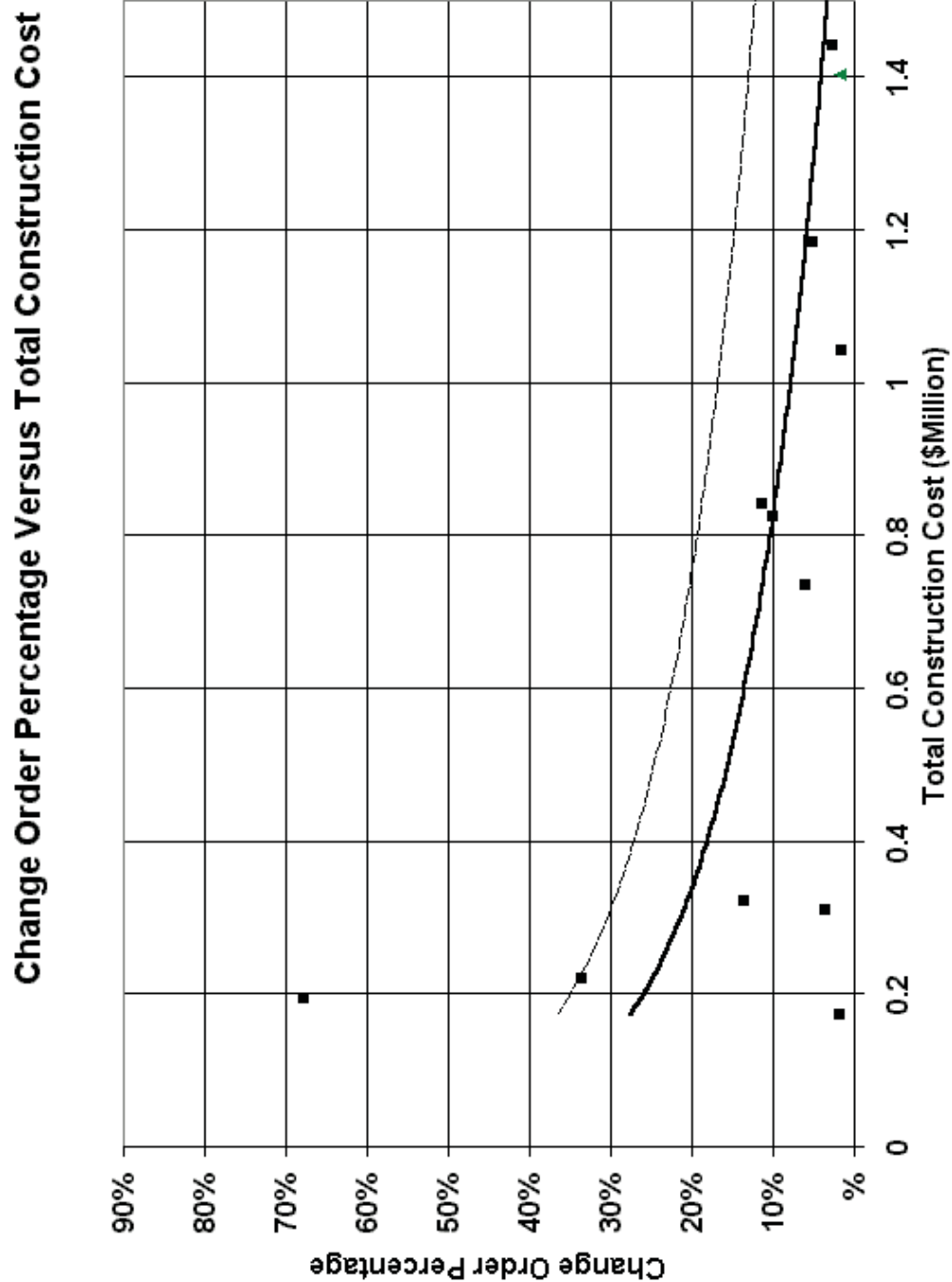
Pipe Systems - Gravity System (Storm Drains, Sewers)*

Change Order Percentage Versus Total Construction Cost



* Change Order costs were not available for 37 Gravity System projects and they are not included in this graph.

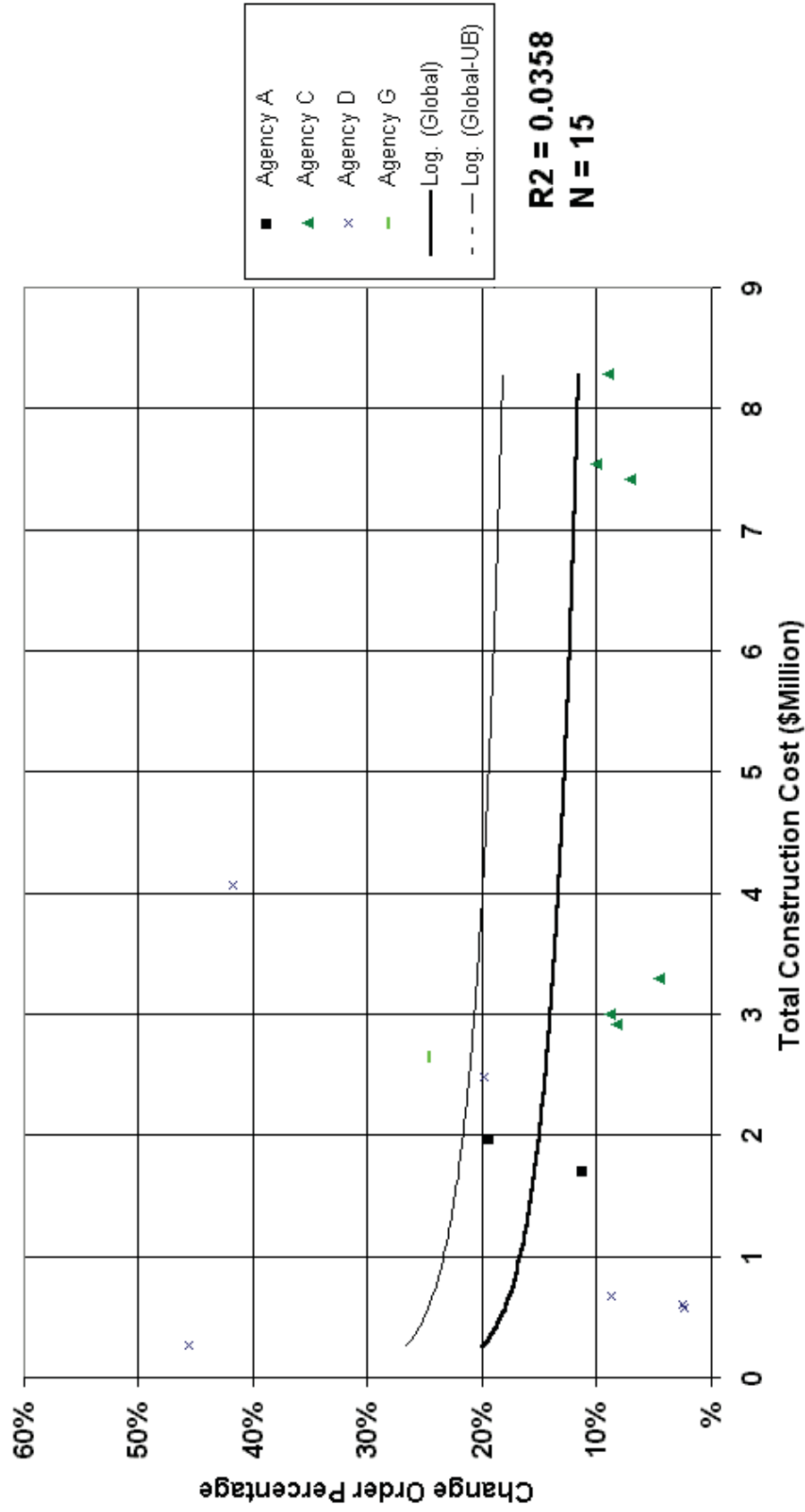
Pipe Systems - Pressure Systems*



* Change Order costs were not available for 7 Pressure System projects and they are not included in this graph.

Pipe Systems - Pump Stations*

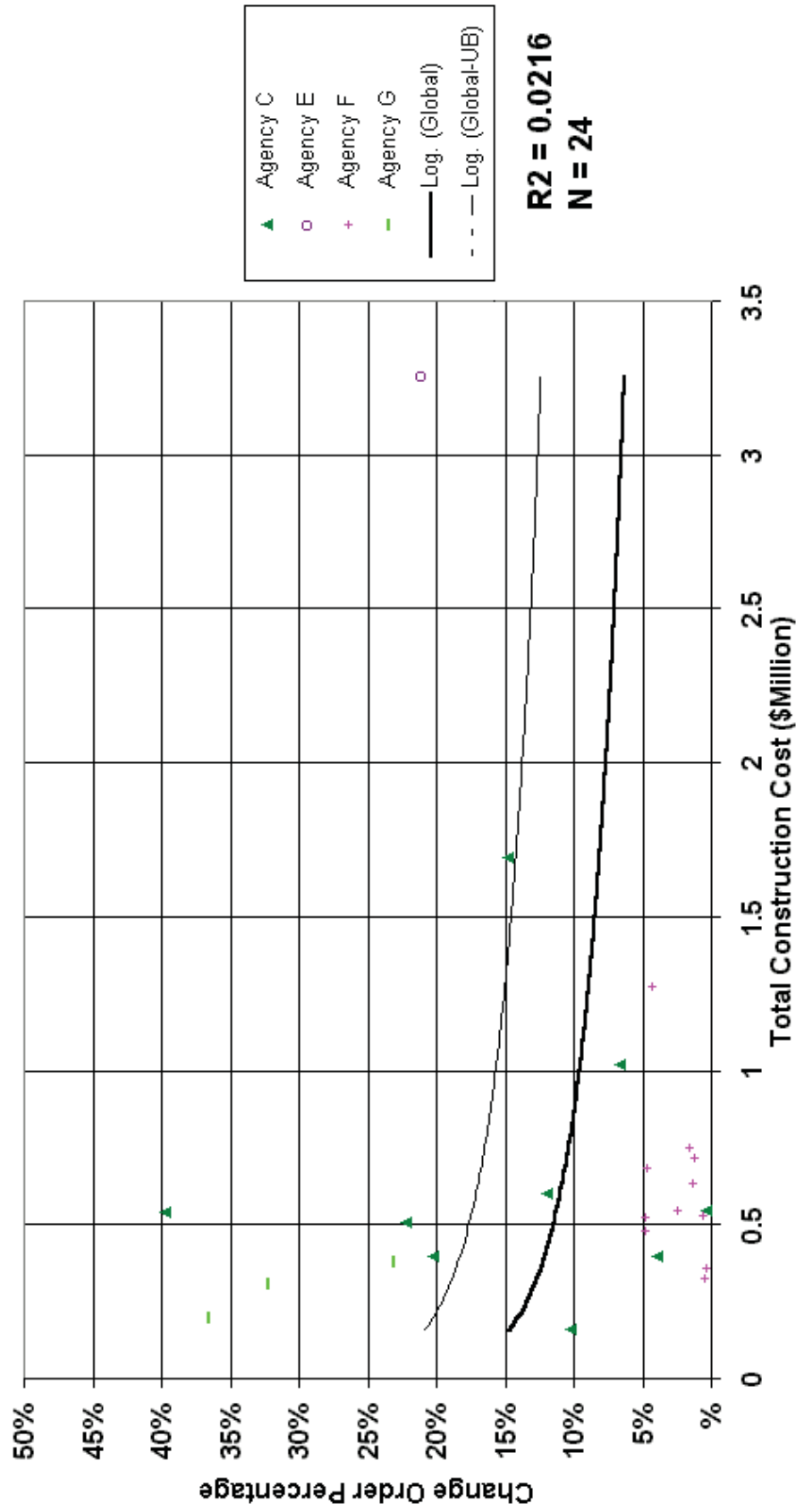
Change Order Percentage Versus Total Construction Cost



* Change Order costs were not available for 7 Pump Station projects and they are not included in this graph.

Parks - Playgrounds*

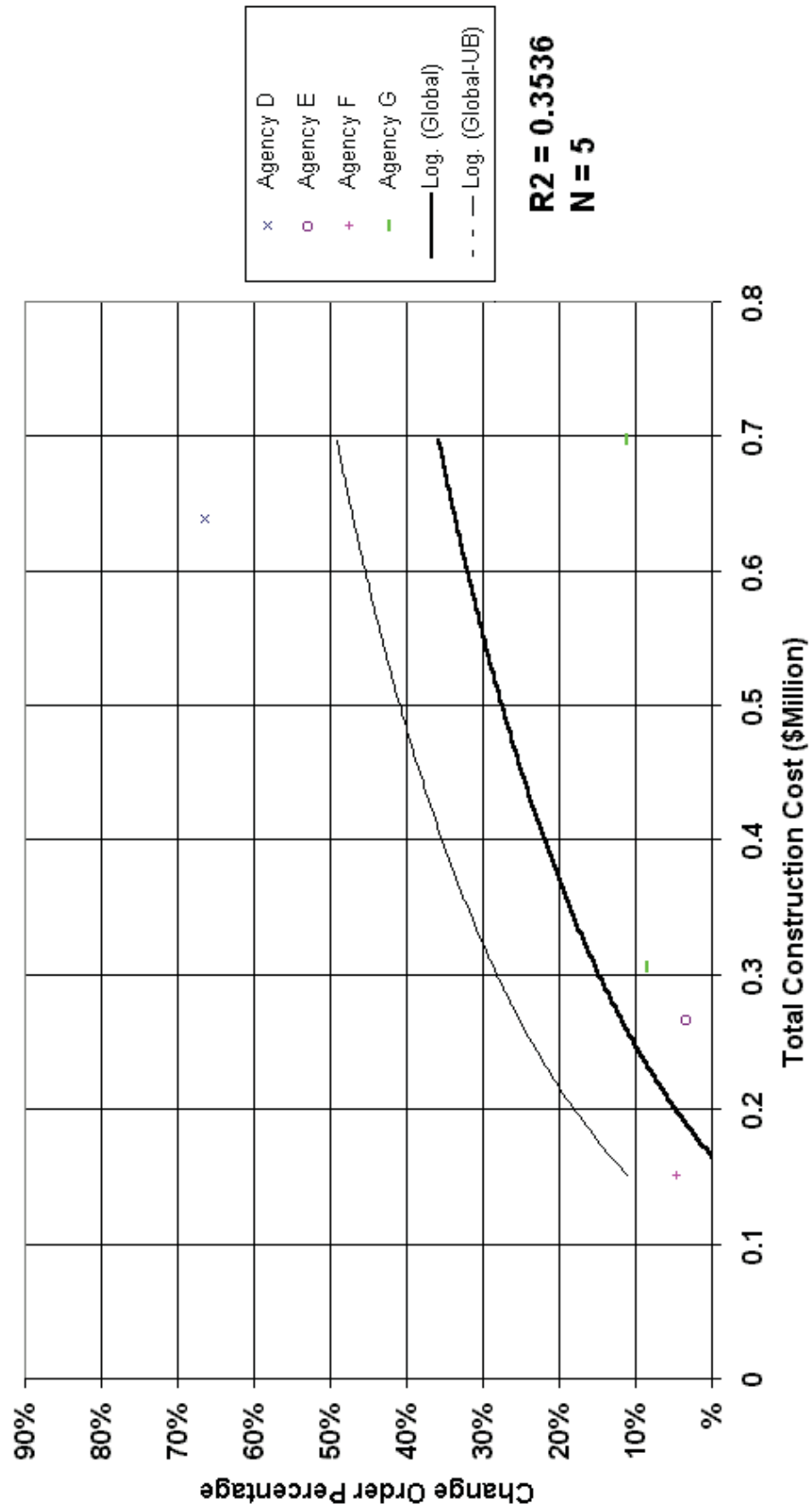
Change Order Percentage Versus Total Construction Cost



* Change Order costs were not available for 10 Playground projects and they are not included in this graph.

Parks - Sportfields*

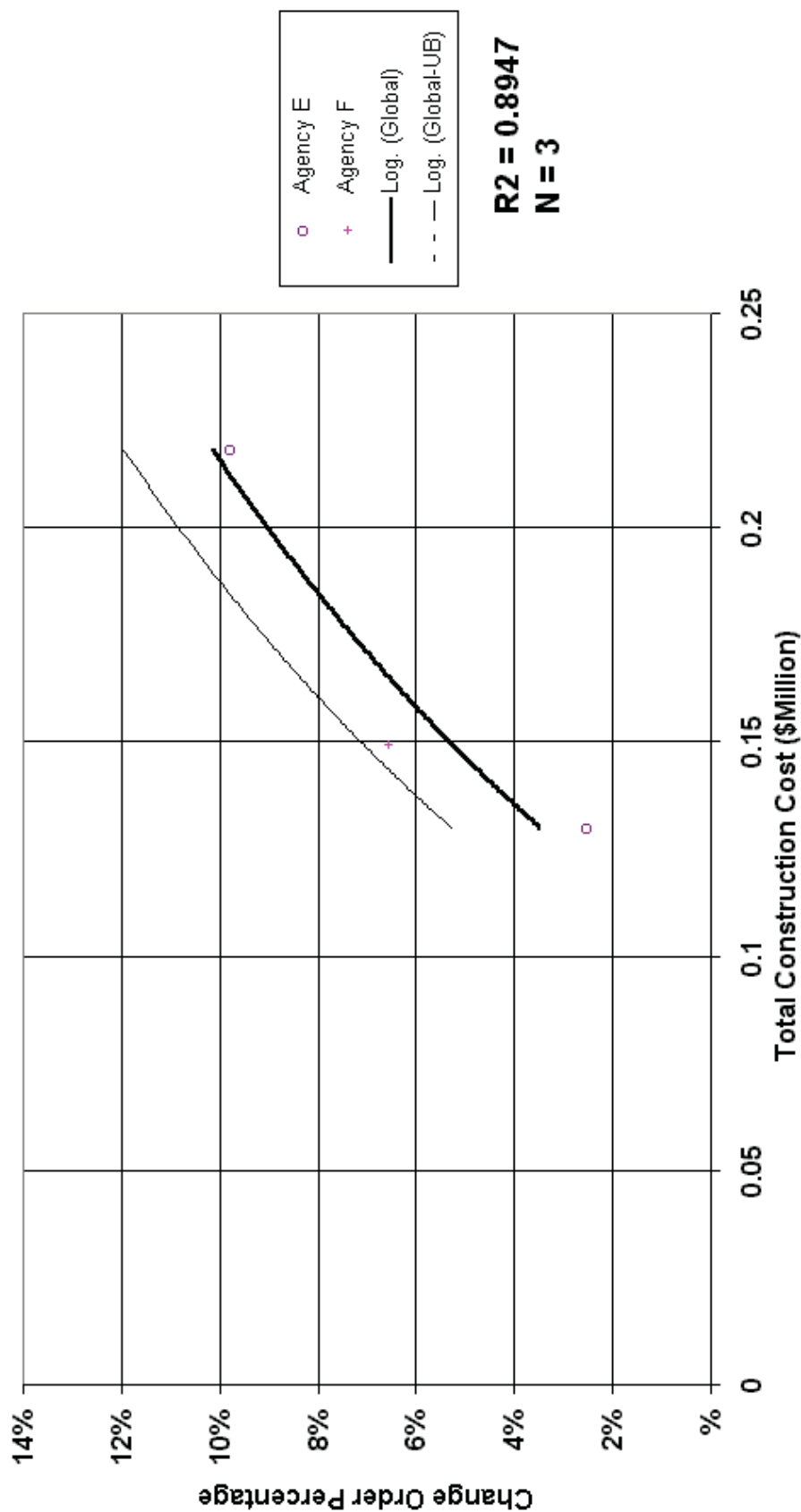
Change Order Percentage Versus Total Construction Cost



* Change Order costs were not available for 5 Sportfield projects and they are not included in this graph.

Parks - Restrooms*

Change Order Percentage Versus Total Construction Cost



* Change Order costs were not available for 5 Restroom projects and they are not included in this graph.

CURVES GROUP 5

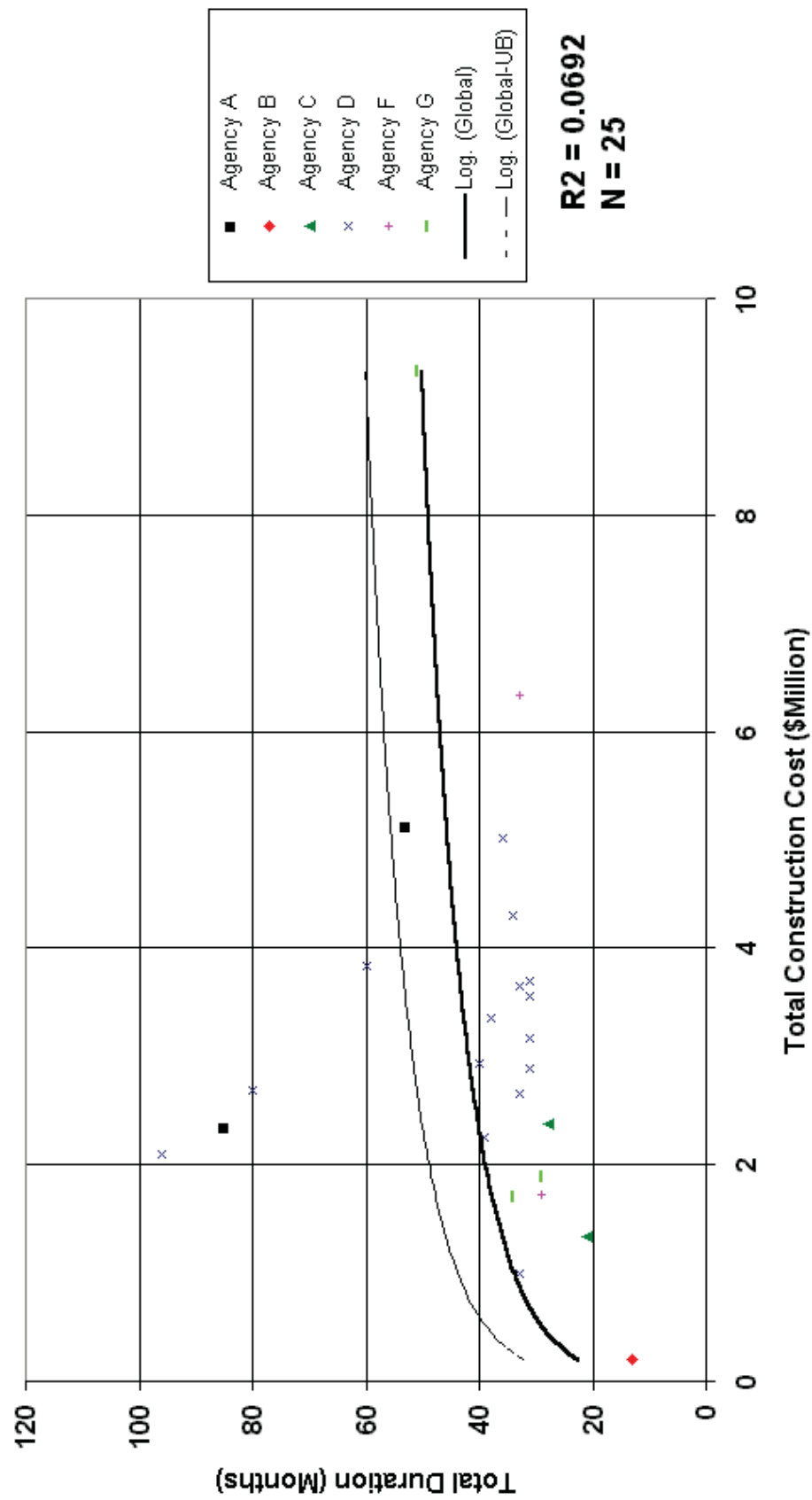
Change Order Cost / Construction Cost

Versus

Total Construction Cost

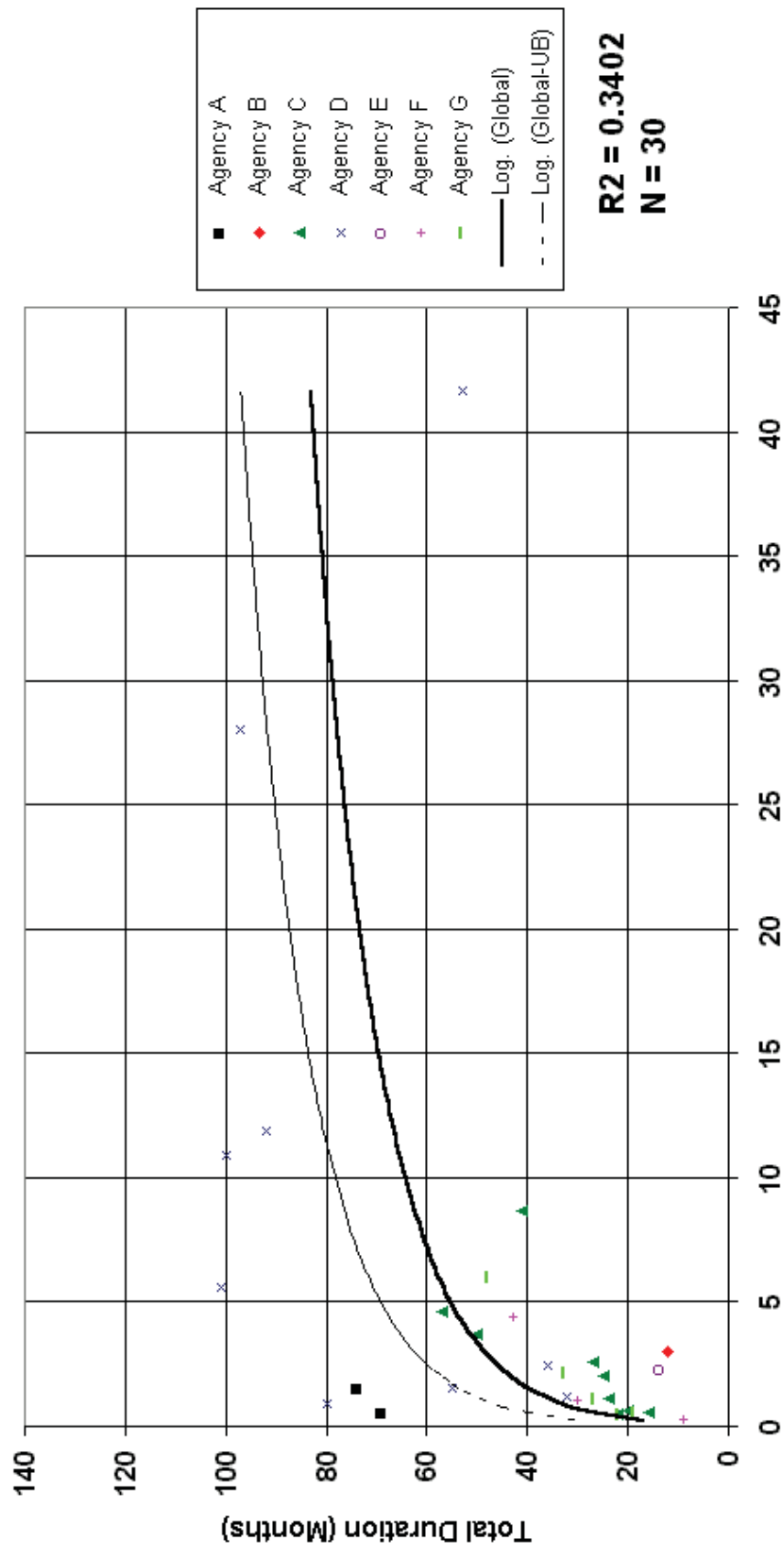
Municipal Facilities - Libraries

Total Duration (Months) Versus Total Construction Cost



Municipal Facilities - Police / Fire Station*

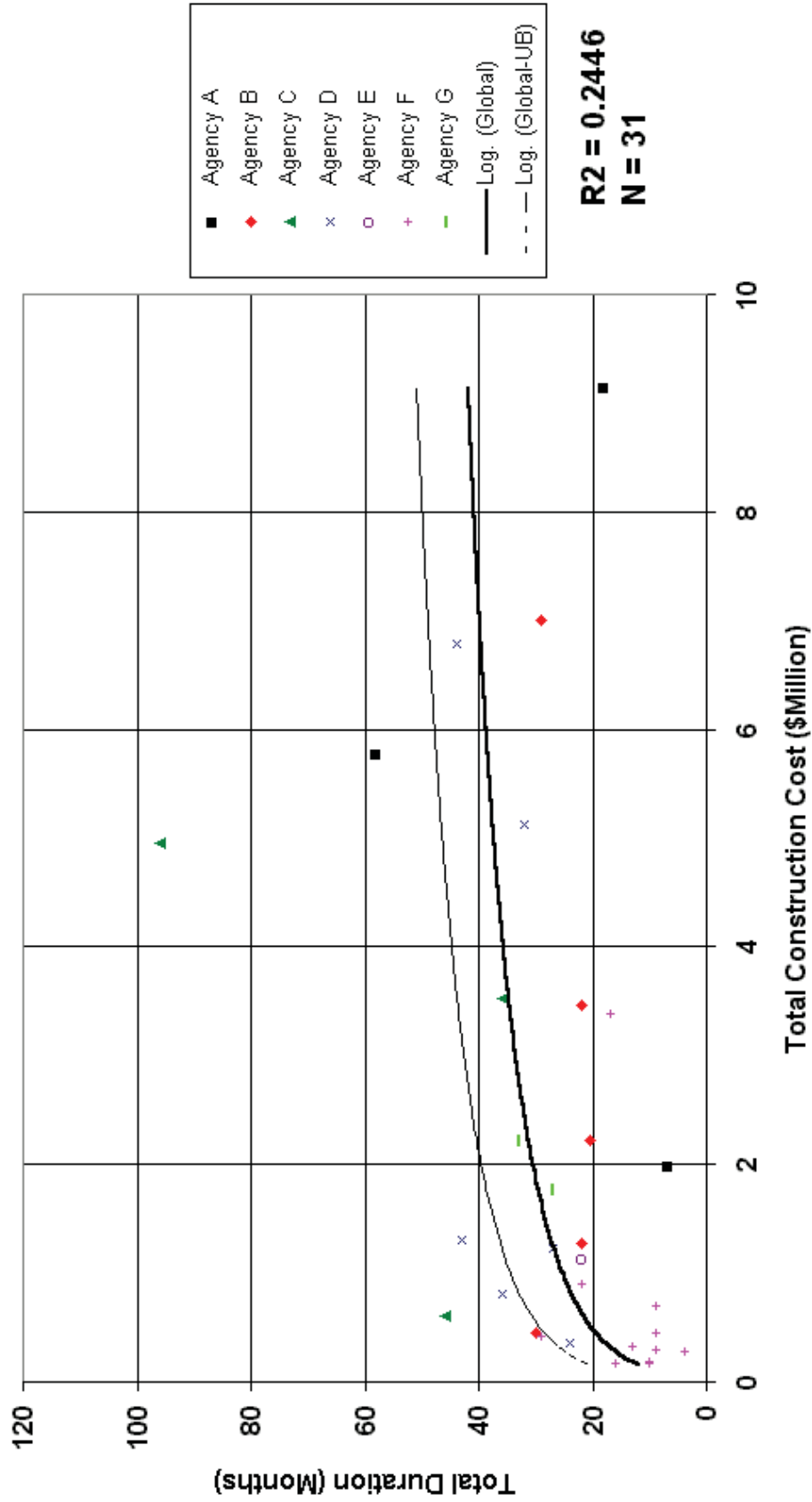
Total Duration (Months) Versus Total Construction Cost



* Durations were not available for 1 Police/Fire Station projects and it is not included in this graph.

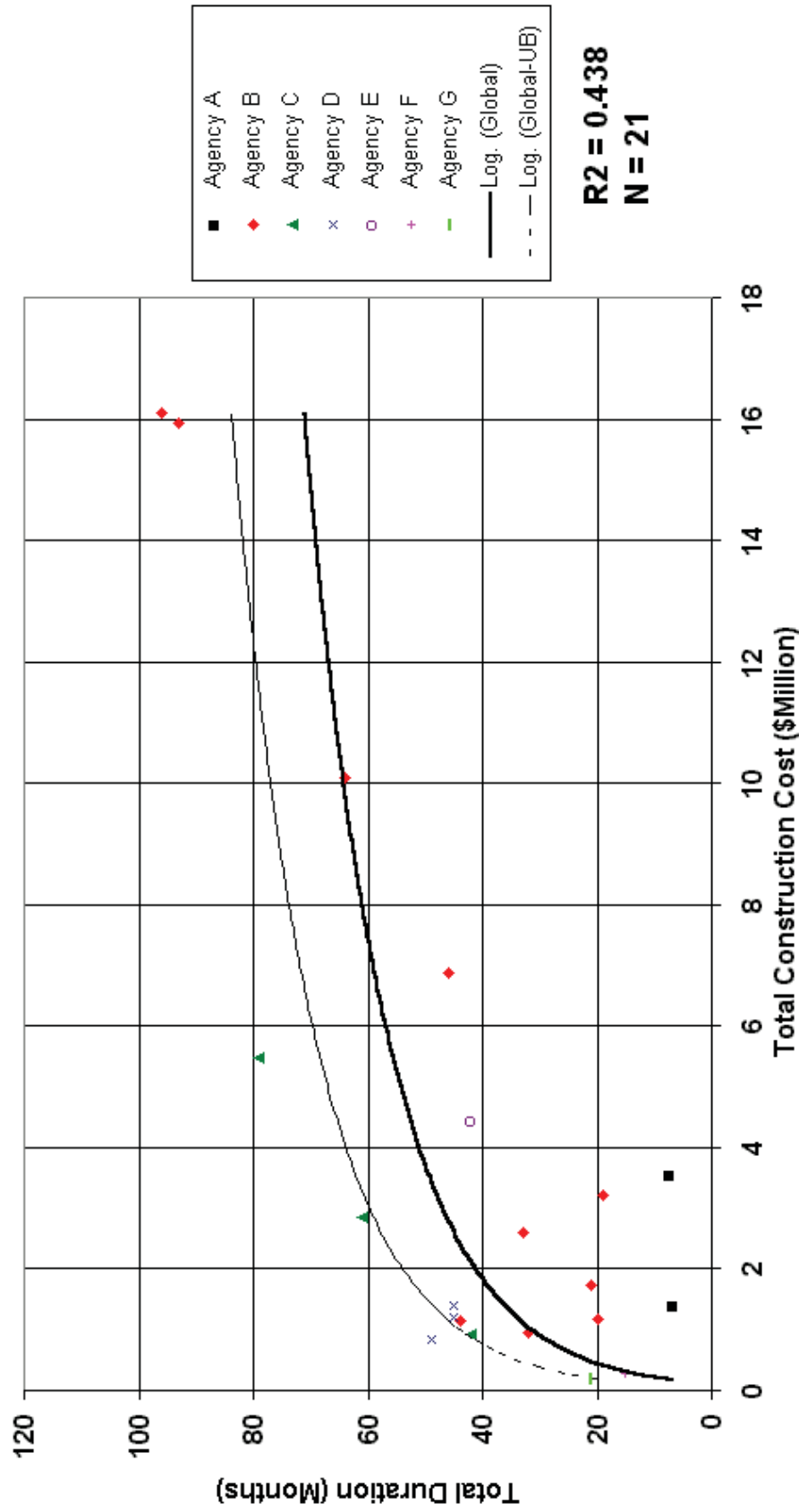
Municipal Facilities - Community Bldg./Rec. Center/CC/Gym

Total Duration (Months) Versus Total Construction Cost



Streets - Widening / New / Grade Separation*

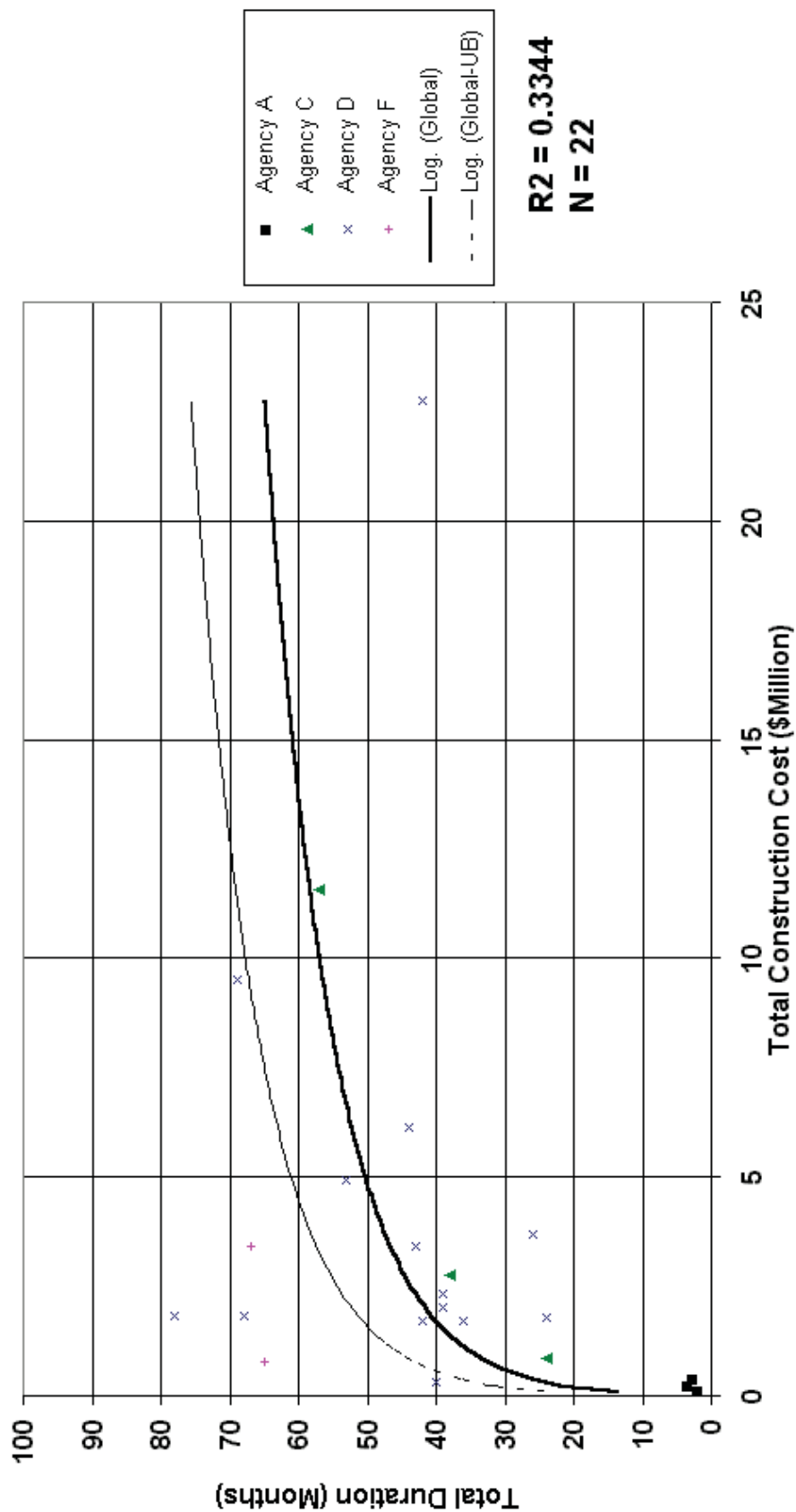
Total Duration (Months) Versus Total Construction Cost



* Durations were not available for 1 Widening project and they are not included in this graph.

Streets - Bridges (Retrofit / Seismic)*

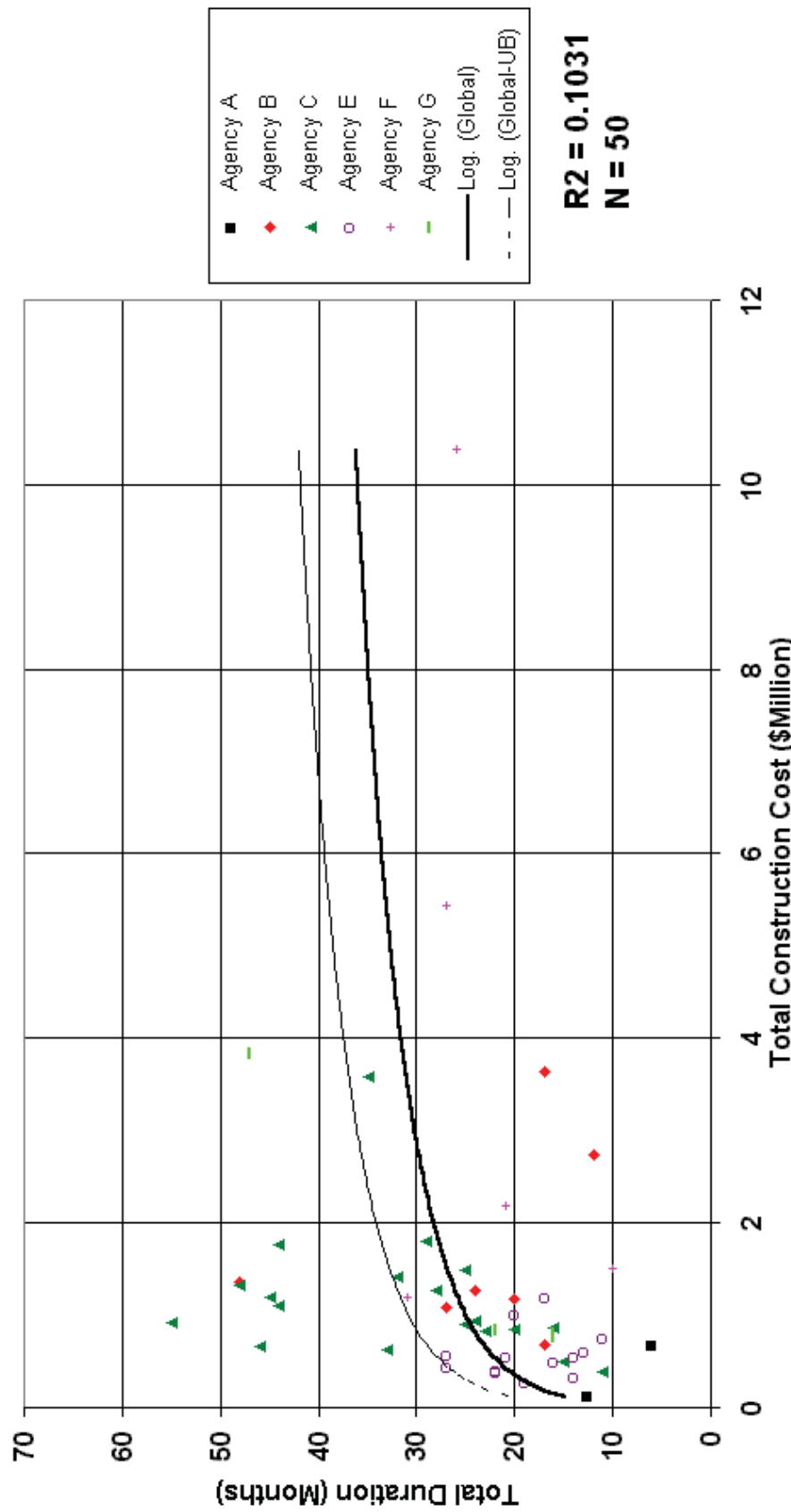
Total Duration (Months) Versus Total Construction Cost



* Durations were not available for 1 Bridge project and it is not included in this graph.

Streets - Renovation / Resurfacing*

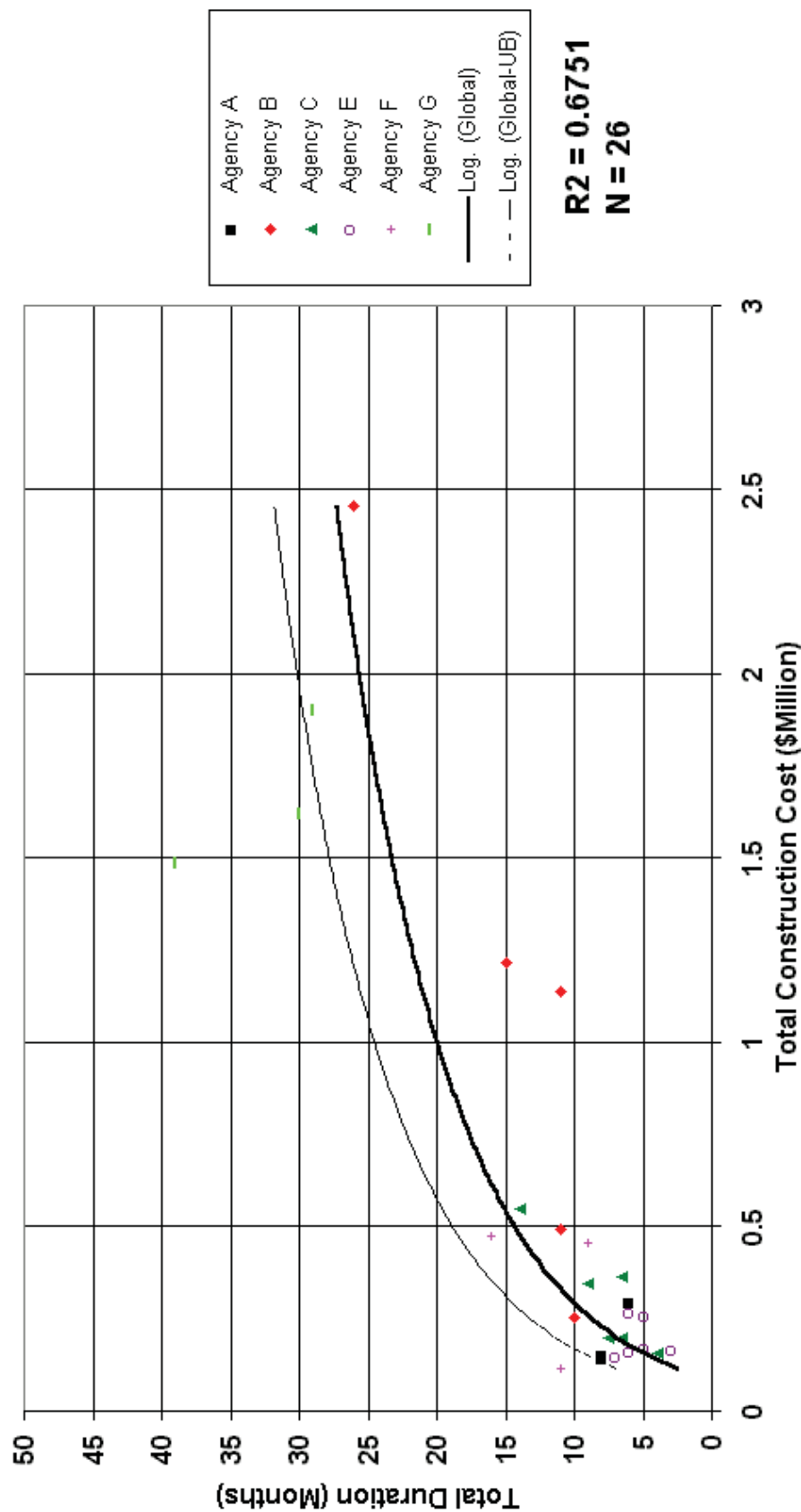
Total Duration (Months) Versus Total Construction Cost



* Durations were not available for 3 Renovation projects and they are not included in this graph.

Streets - Bike / Pedestrian / Curb Ramps*

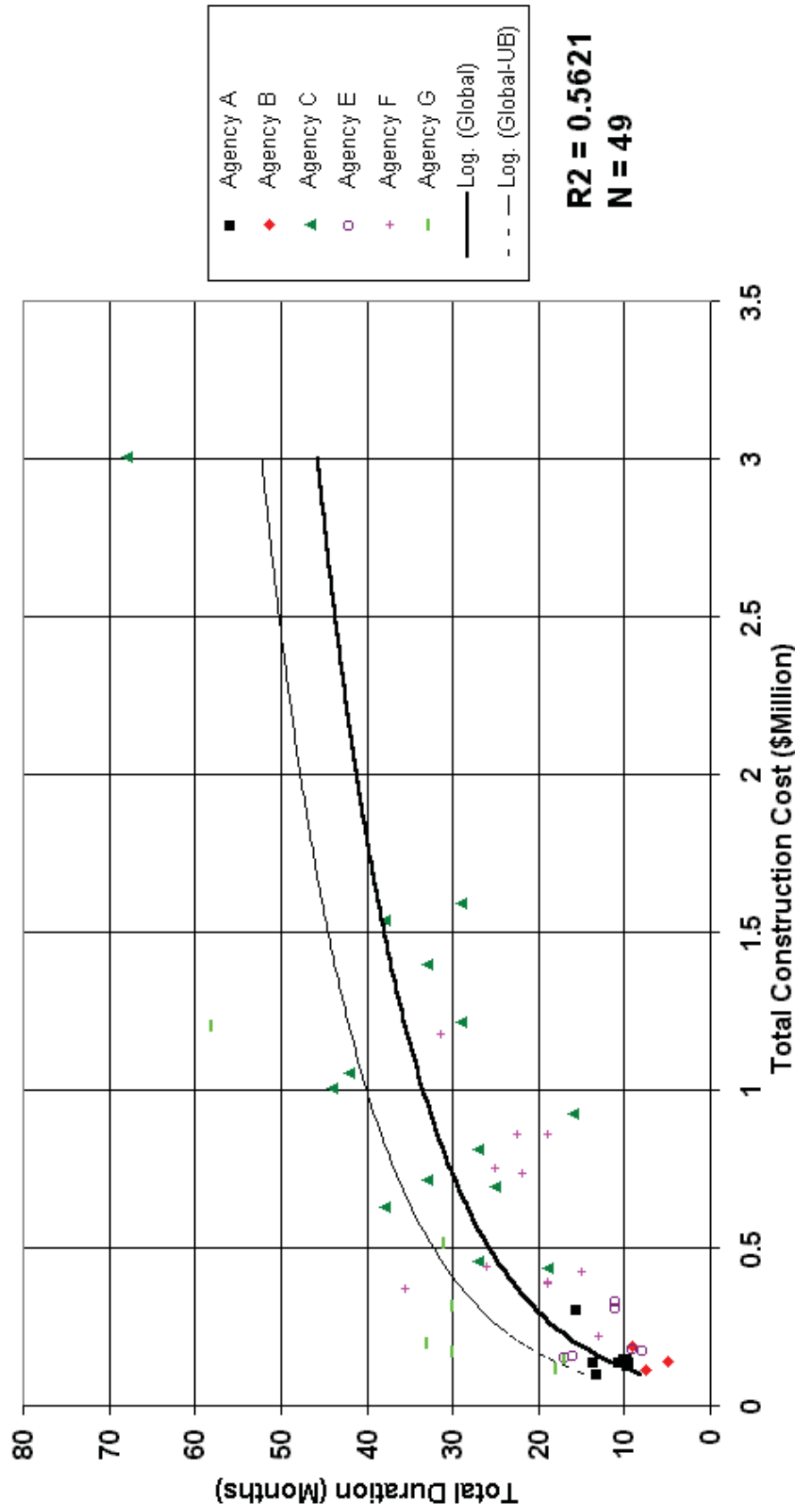
Total Duration (Months) Versus Total Construction Cost



* Durations were not available for 2 Bike projects and they are not included in this graph.

Streets - Signals*

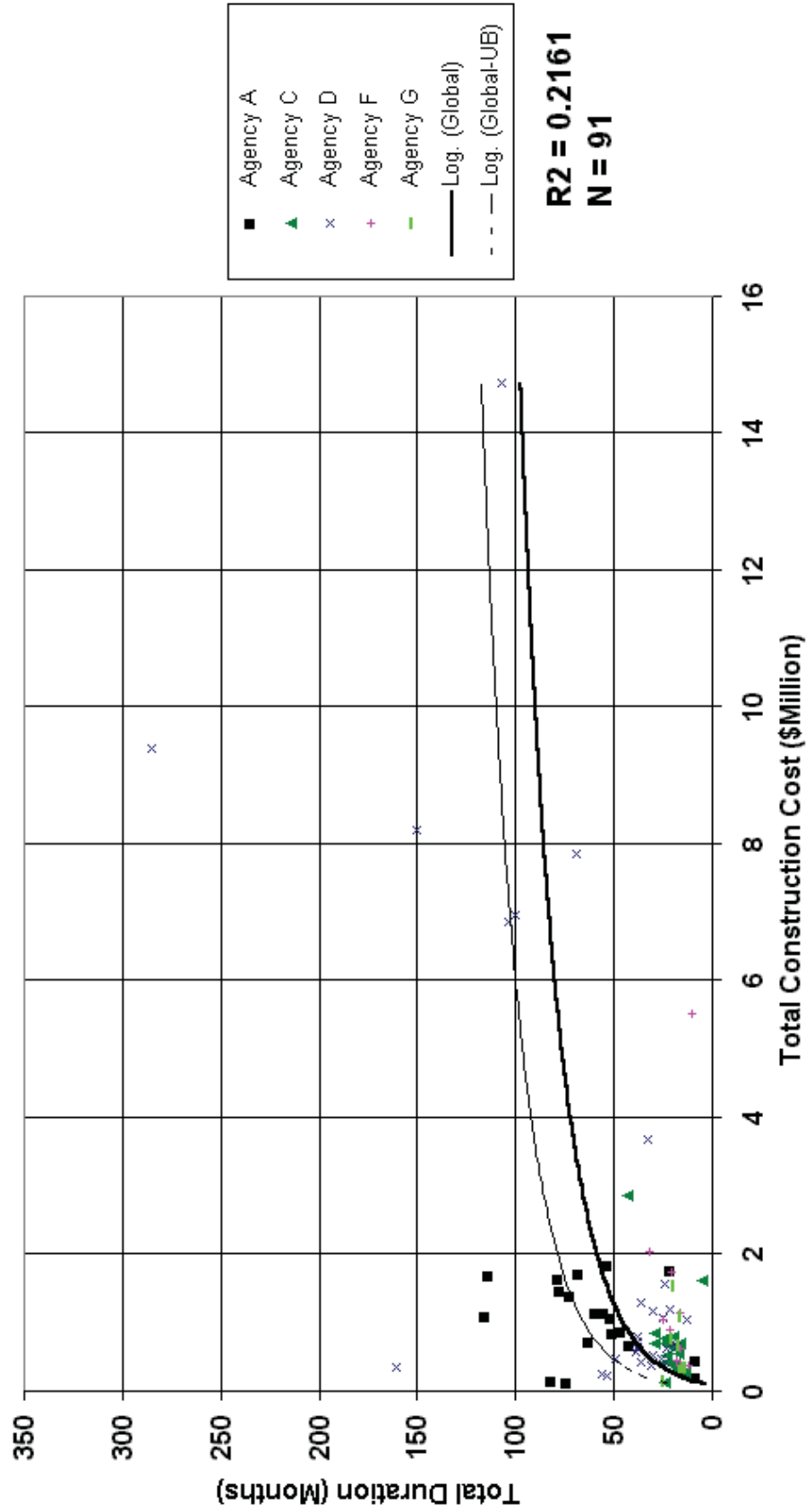
Total Duration (Months) Versus Total Construction Cost



* Durations were not available for 4 Signal projects and they are not included in this graph.

Pipe Systems - Gravity System (Storm Drains, Sewers)*

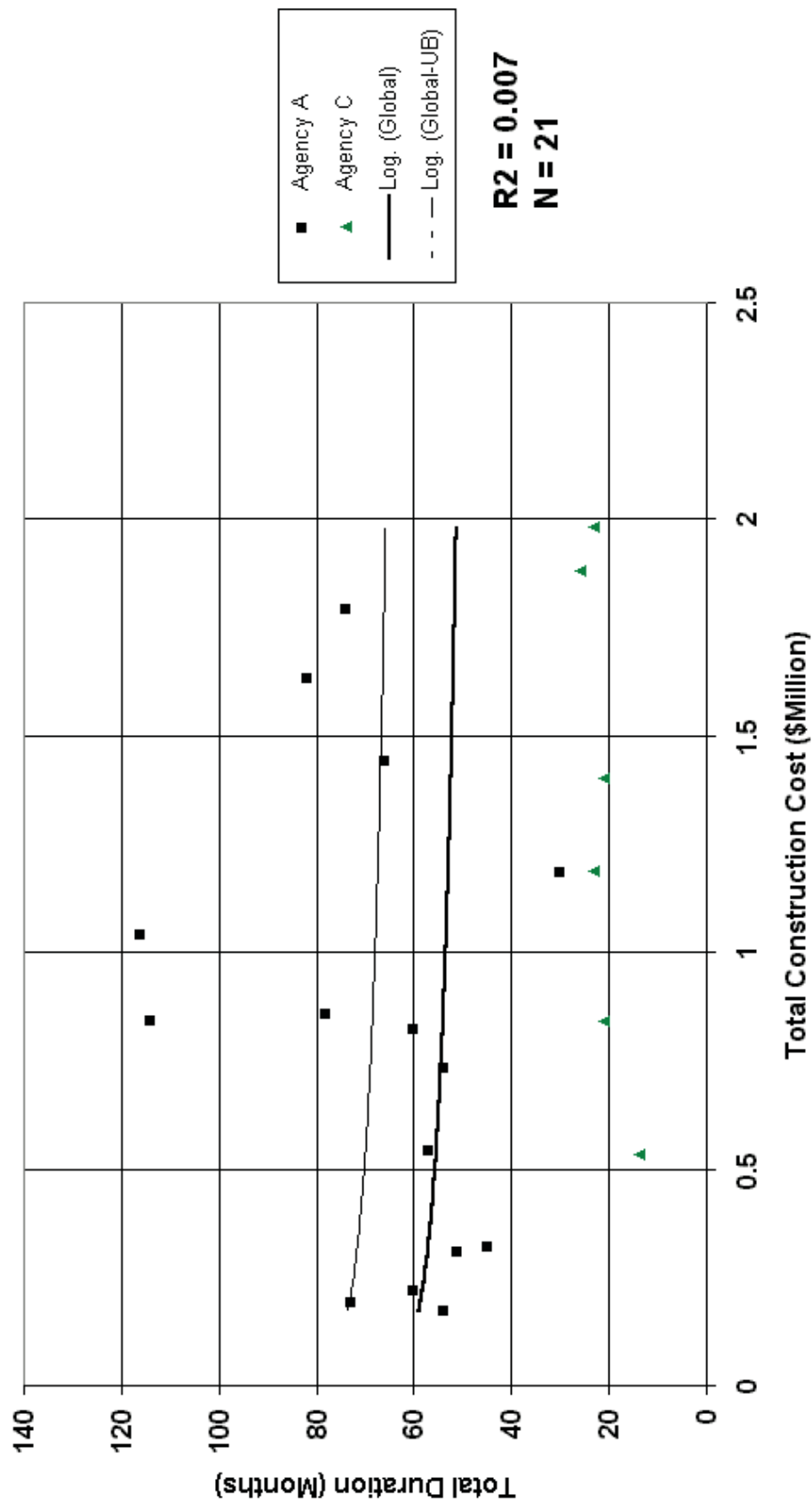
Total Duration (Months) Versus Total Construction Cost



* Durations were not available for 1 Gravity System project and it is not included in this graph.

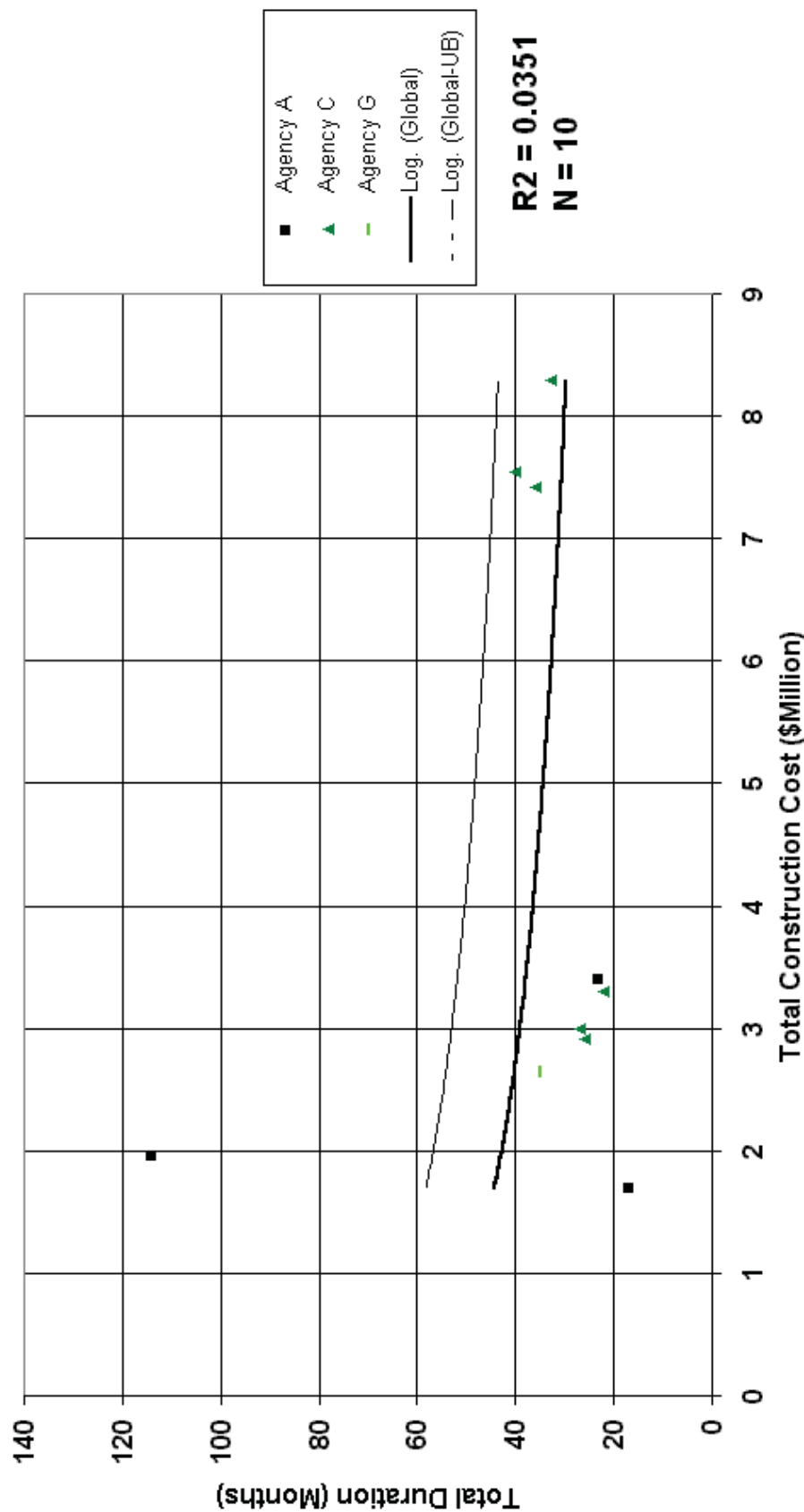
Pipe Systems - Pressure Systems

Total Duration (Months) Versus Total Construction Cost



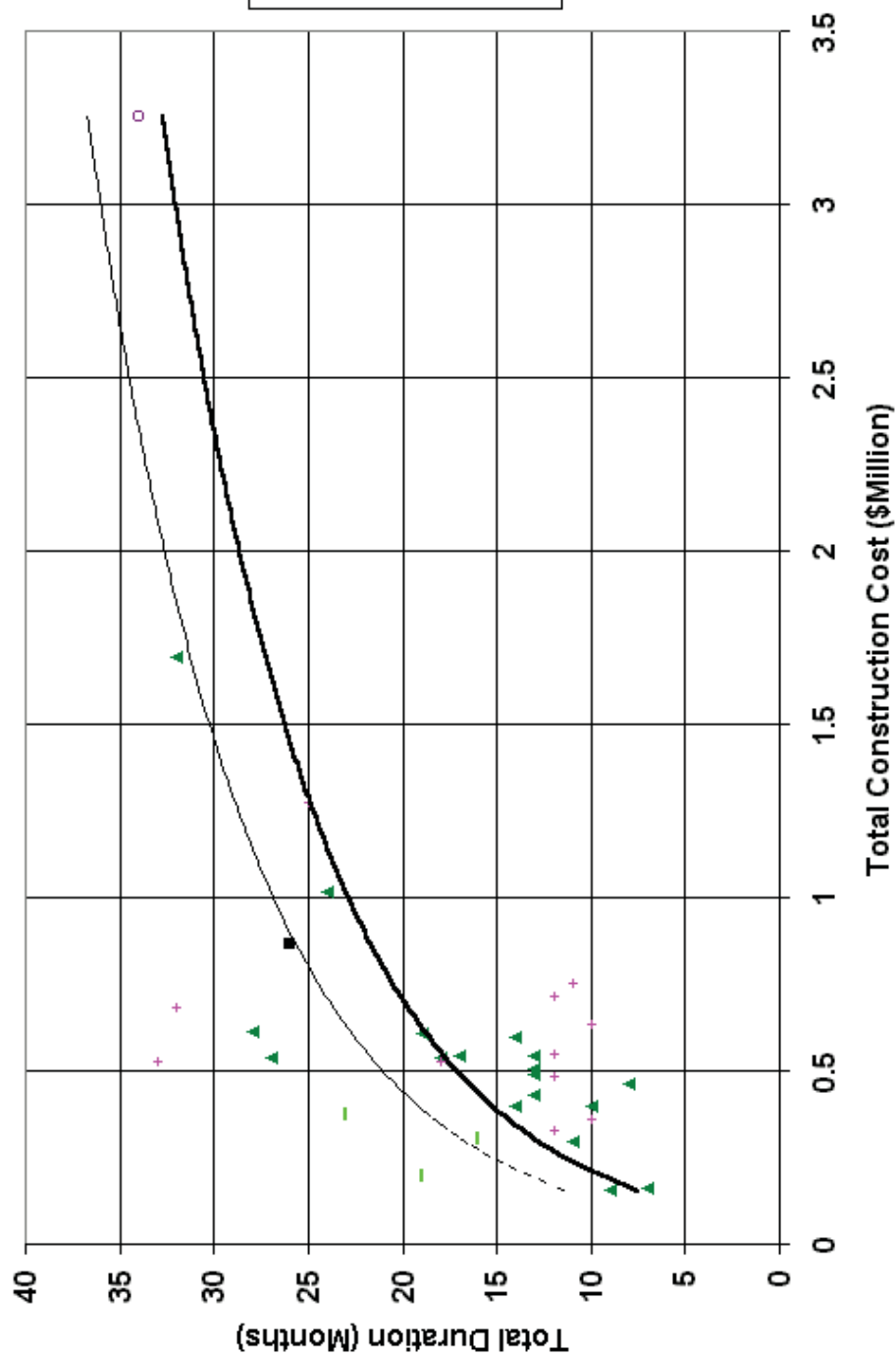
Pipe Systems - Pump Stations*

Total Duration (Months) Versus Total Construction Cost



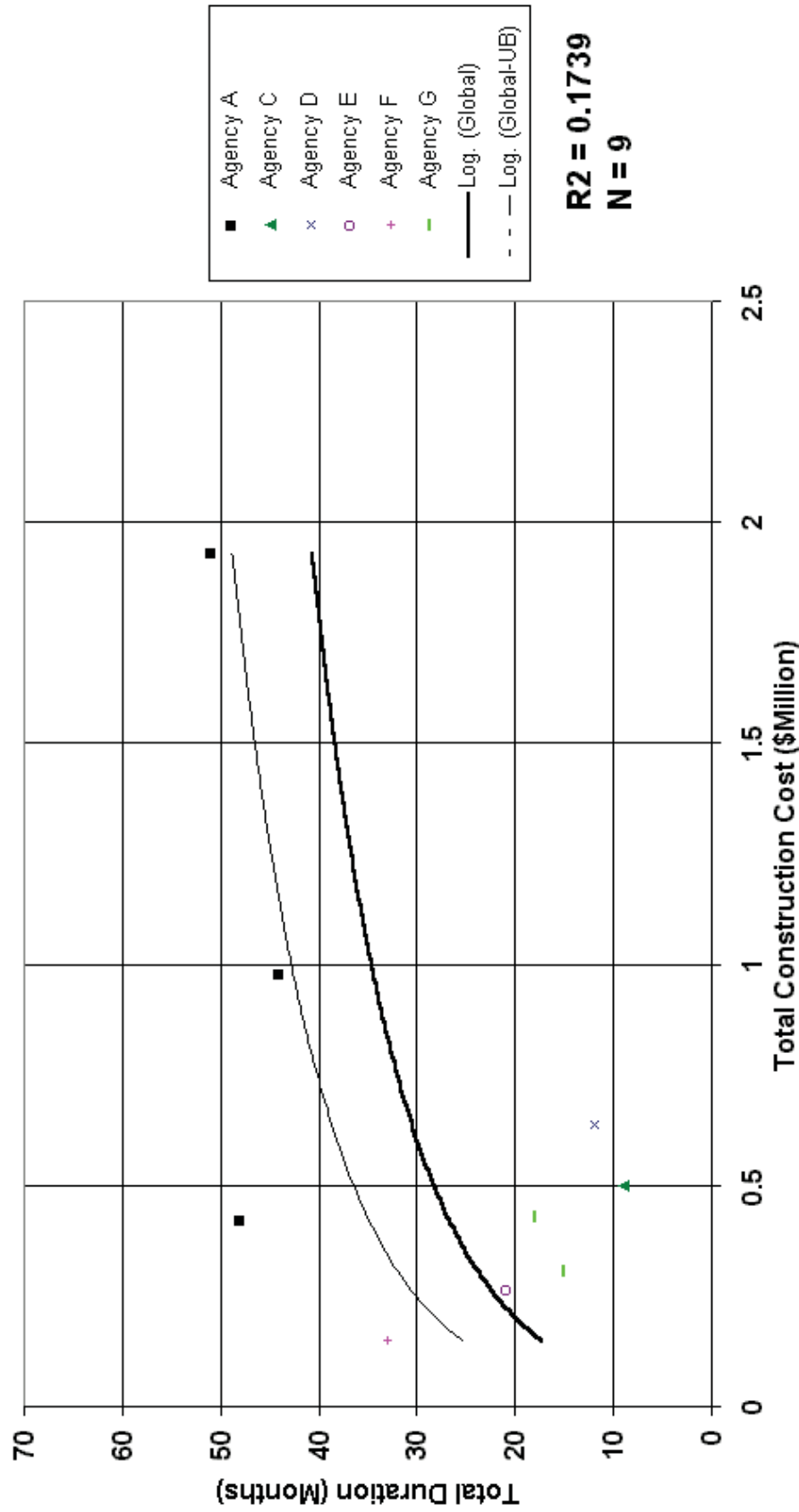
Parks - Playgrounds

Total Duration (Months) Versus Total Construction Cost



Parks - Sportfields*

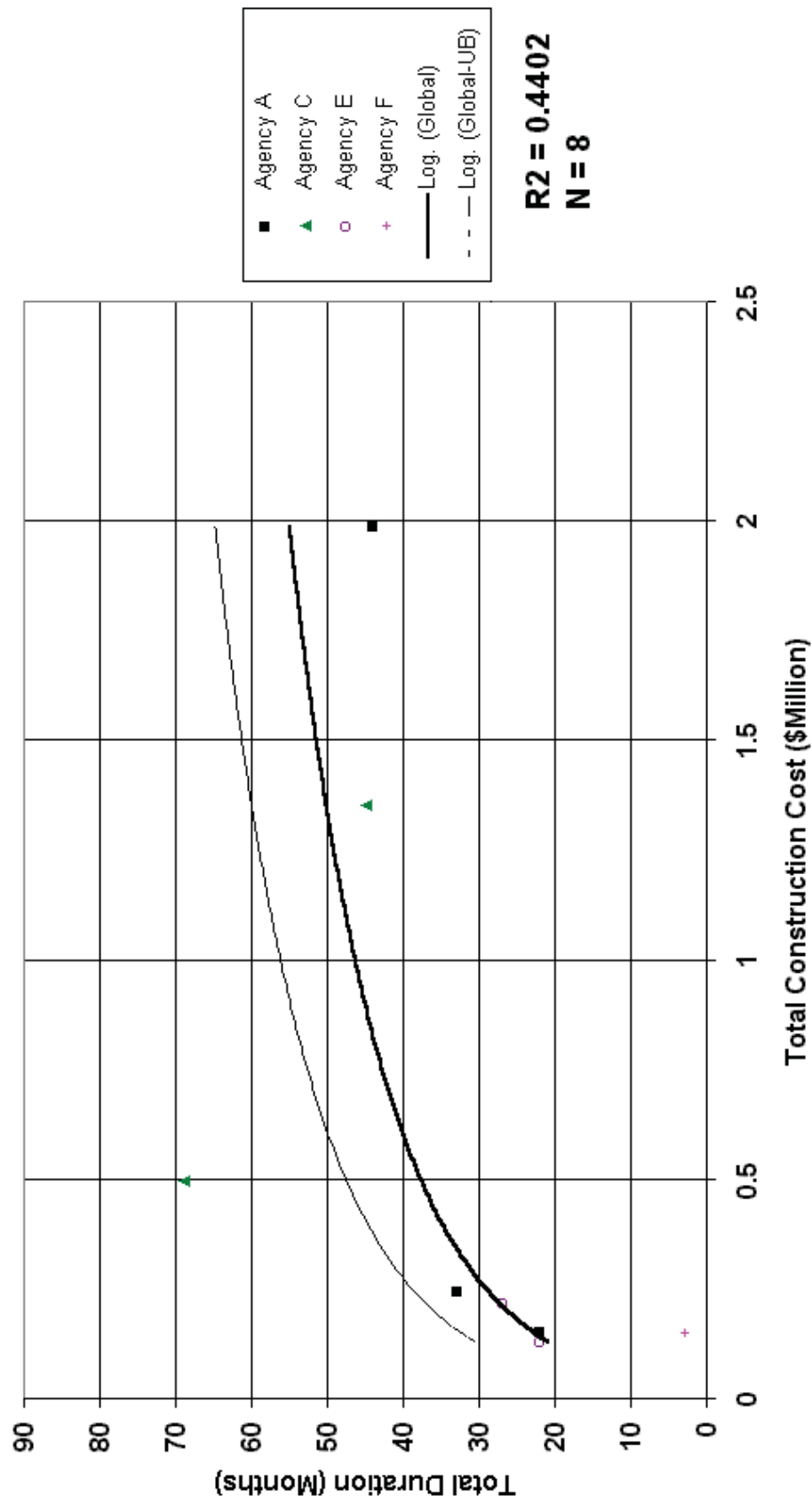
Total Duration (Months) Versus Total Construction Cost



* Durations were not available for 1 Sportfield project

Parks - Restrooms

Total Duration (Months) Versus Total Construction Cost



A p p e n d i x C

Outliers Identification



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Outliers Identification

Outliers, in a regression model, are considered to be the data points that are "too far" from the regression curve. The classic criteria to find statistical outliers are based on the following rule of thumb²:

Point Distance from trend-line $\notin [Q_1 - 1.5(Q_3 - Q_1), Q_3 + 1.5(Q_3 - Q_1)] \Rightarrow$ outlier point

Where: $Q_i = i^{\text{th}}$ Quartile of the data set.

Alternatively, Confidence Interval (CI) may be used to improve the correlation coefficient more effectively. In this technique, a confidence interval around the regression curve is defined and all the points outside this range are considered as outliers (see Figure C-1).

Selection of the confidence interval is based on the trade-off between the number of data points that can be set aside and the improvement that can be achieved. The more data points that are excluded, the more the R^2 will improve. However, the model becomes unrealistic if too many data points are excluded.

It is noteworthy that, in this study, outliers' identification was merely a tool to identify projects with too high or too low project delivery costs, compared to the general trend. This provides a tool to distinguish the projects that have the potential to be abnormal (not-representative) projects. Under no circumstances should statistical outliers be used as the basis of project elimination without other justification.

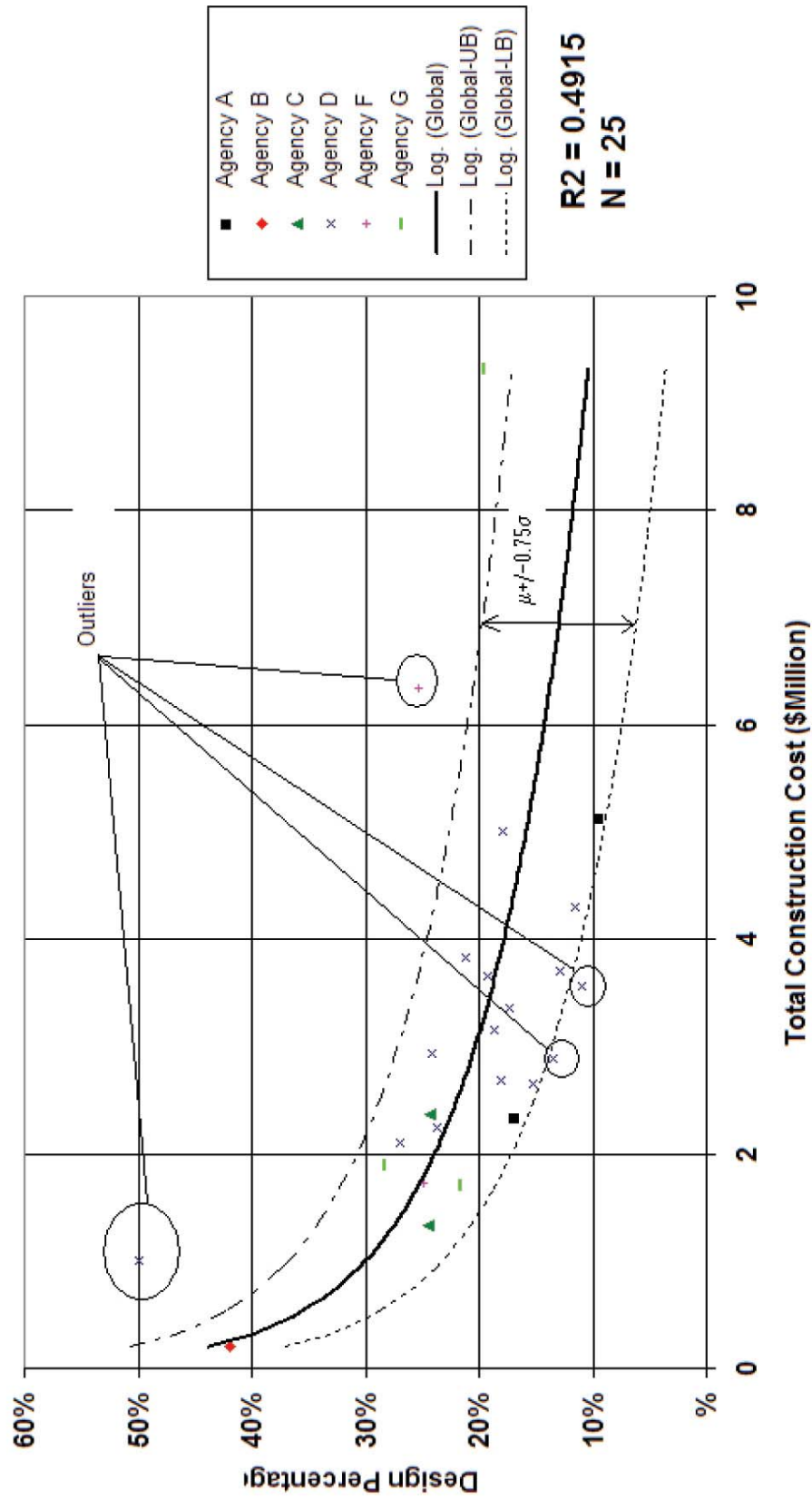
Subsequently, selection of the CI is arbitrary and is defined based on acceptability of maximum and minimum project delivery costs. For example, practical experience has shown that a project with more than 50% project delivery cost has the potential to be a non-representative project. Therefore the upper bound curve should not go beyond 50% in Figure C-1. The team reviewed all performance curves and it was found that, in general, a 51% confidence interval ($m + 0.75s$) identifies the acceptable range in all graphs. In other words, the projects beyond $[m - 0.75s, m + 0.75s]$ are worth reviewing for possible abnormal behavior (i.e. non-standard delivery process).

A computer program was developed to apply this outliers identification technique to all total project delivery performance models. A list of all outliers (75 projects) was shared with the Project Team, 34 of which were found to be abnormal projects. The abnormal (non-representative) projects were all projects with total project delivery higher than 50% or smaller than 15%.

² See Appendix B-II of Phase I report for details of this technique.

Figure C-1. Municipal Facilities - Libraries

Design Percentage Versus Total Construction Cost



A p p e n d i x D

Mult-Agency Benchmarking Database (Update 2003)



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Multi-Agency Benchmarking Database (Update 2003)

A benchmarking database was originally designed for the 2002 California Multi-Agency benchmarking study. This database (CALBM) was modified and improved for the specific purposes of the Update 2003 study.

Upon execution of the database program, the Multi-Agency logo appears on the monitor, as shown in Figure D-1.

The user has the option of opening a form for data entry / review or benchmarking models development or opening a report:

- Project data form, as shown in Figure D-2, can be used to review all project data that are provided by various agencies and to add new project data.
- Curves form is a tool to develop instantaneous performance models based on the criteria that are selected from the form options. For example, Figure D-4 is the performance model that was developed based on the portions selected in Figure D-3. This form is the most useful feature of the database and was the main tool to perform performance benchmarking in both 2002 and 2003 benchmarking studies.

Figure D-1. CALBM Database View

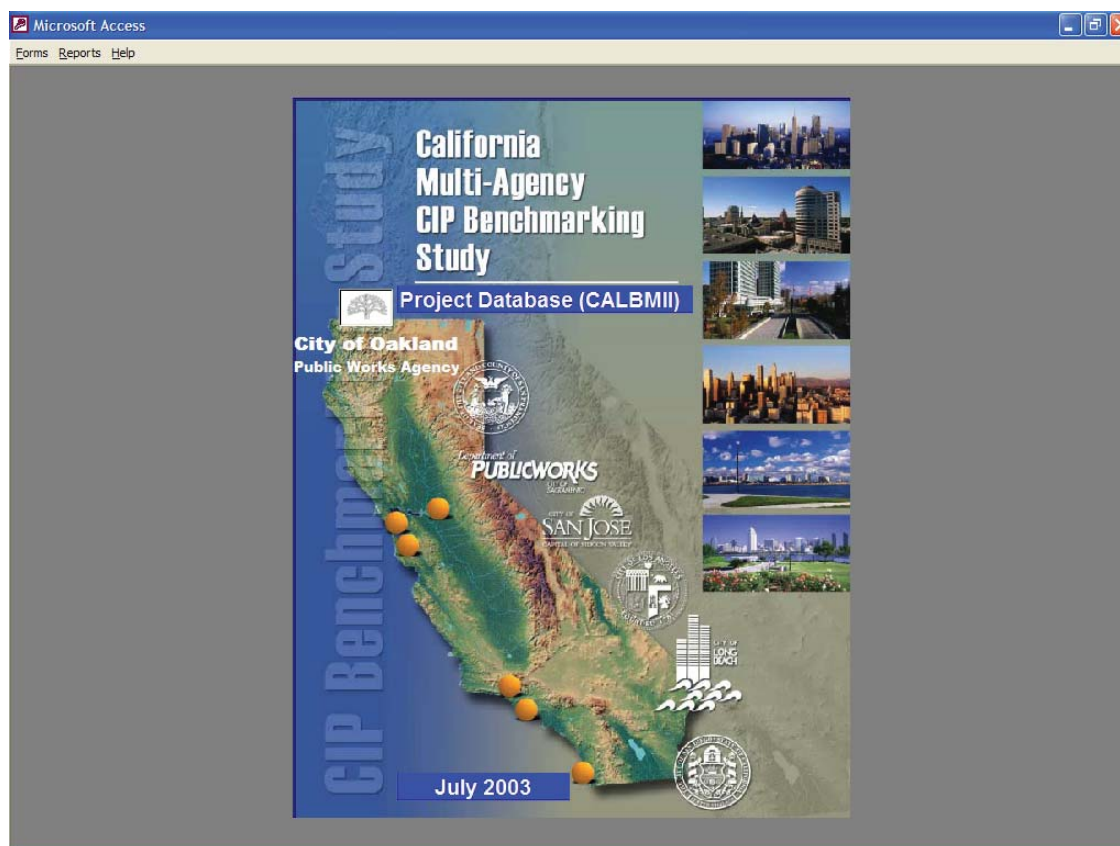


Figure D-2. Project Data Form

PROJECT DATA FORM

Agency: Project Name:

Project Type:

Project Index: Complexity:

Justification:

Description:

Comments:

	PLANNING		DESIGN		CONSTRUCTION		TOTAL	
	DOLLAR	% OF TCC*	DOLLAR	% OF TCC*	DOLLAR	% OF TCC*	DOLLAR	% OF TCC*
Agency Labor	\$0	0.0%	\$279,560	5.5%	\$448,186	8.8%	\$727,746	14.2%
Other Costs	\$0	0.0%	\$0	0.0%	\$267,624	5.2%	\$267,624	5.2%
Subtotal Agency	\$0	0.0%	\$279,560	5.5%	\$715,810	14.0%	\$995,370	19.4%
Consultants	\$0	0.0%	\$419,235	8.2%	\$0	0.0%	\$419,235	8.2%
TOTAL	\$0	0.0%	\$698,795	13.7%	\$715,810	14.0%	\$1,414,605	27.6%
Duration	0 Months		17 Months		15 Months		32 Months	

AMOUNT OF CONSTRUCTION CONTRACT

COST OF CHANGE ORDERS

UTILITY RELOCATION COSTS

CITY FORCES CONSTRUCTION

*TOTAL CONSTRUCTION COST (TCC)

CONTRACT COMPLETION DATE (MONTH YEAR)

Record: 1 of 525

July 2003

Figure D-3. Curves Form

Curves : Form

Project Name:

X Values Source:

Y Values Source:

Filter Projects By:

- ☐ NO FILTER (ALL PROJECTS)
- ☒ Agency Name
- ☒ Projects Type
- ☒ Classification

Projects Categorization (Graph Legend)

- ☐ ALL PROJECTS
- ☒ Agency Names
- ☐ Projects Types
- ☐ Projects Classifications
- ☐ Phase ☐ Year

Regression Options

- ☐ Linear ☒ Logarithmic
- ☐ Power ☐ Exponential
- ☐ Polynomial

Graphs Format

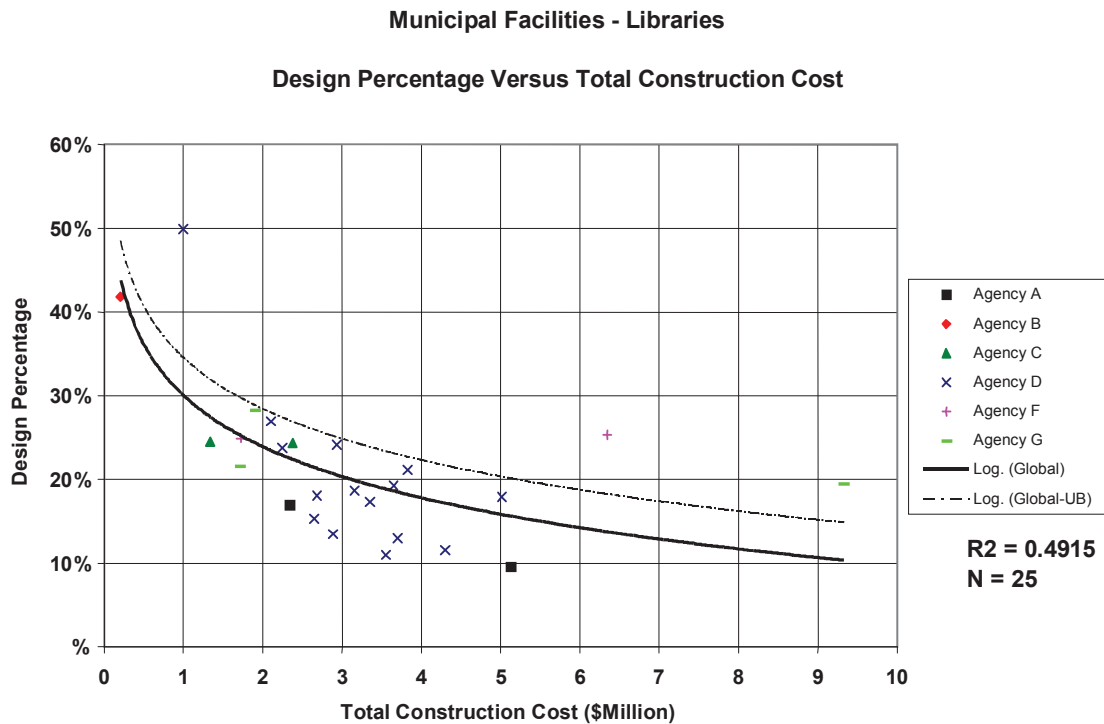
- ☒ Color ☐ B/W
- Scale:
- X-Axis:
- Y-Axis:

Output

☒ View ☐ Print ☐ Save

July 2003

Figure D-4. Performance Model: Output of Figure D-3



- Numerous reports are available as shown in Figure D-5. These reports get updated instantly as additional data are added to the database. Many of the CALBM reports are used in both 2002 and 2003 studies reports. Figure D-6 shows the Consultants usage summary report, as an example.

Detail explanation of the CALBM database is provided in the project manual which is provided as a "README" file in the enclosed copy of the database.

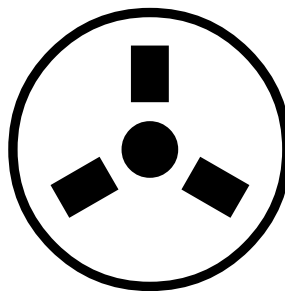


Figure D-5. Various Reports Available in the CALBM Database

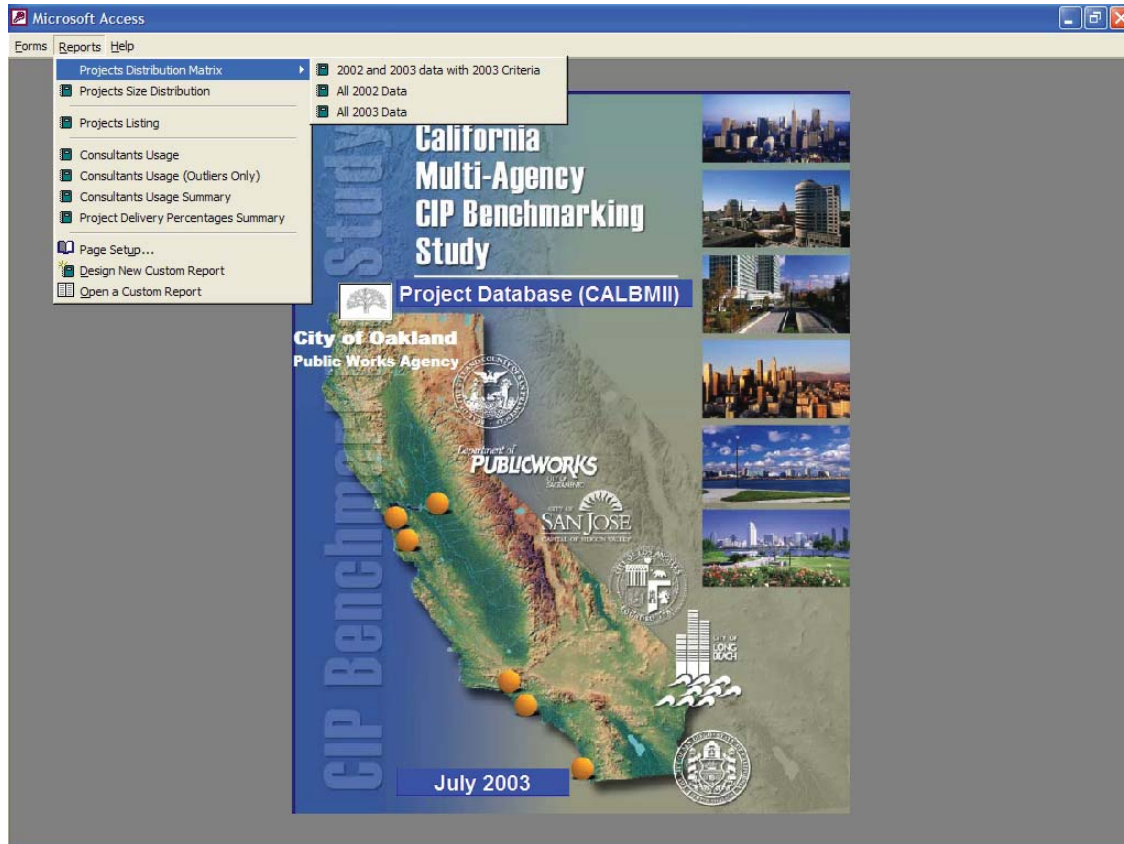


FIGURE D-6. SAMPLE DATABASE REPORT: CONSULTANTS USAGE SUMMARY REPORT

AGENCY*	DESIGN					CONSTRUCTION MANAGEMENT					PROJECT DELIVERY				
	In-House		Consultants		Total % of TCC**	In-House		Consultants		Total % of TCC**	In-House		Consultants		Total % of TCC**
	(\$)	% of DES	(\$)	% of DES		(\$)	% of CM	(\$)	% of CM		(\$)	% of PD	(\$)	% of PD	
Agency A	10,460,919	67.0%	5,159,068	33.0%	21.9%	11,406,408	97.8%	260,246	2.2%	18.8%	21,867,327	80.1%	5,419,314	19.9%	40.7%
Agency B	4,745,525	38.5%	7,583,591	61.5%	14.1%	4,709,425	51.3%	4,477,194	48.7%	11.3%	9,454,950	43.9%	12,060,785	56.1%	25.3%
Agency C	19,739,762	81.4%	4,501,409	18.6%	13.7%	18,710,779	91.5%	1,729,186	8.5%	13.5%	38,450,540	86.1%	6,230,595	13.9%	27.2%
Agency D	27,568,063	59.2%	18,985,183	40.8%	20.2%	37,067,970	93.2%	2,724,096	6.8%	16.8%	64,636,033	74.9%	21,709,279	25.1%	37.0%
Agency E	1,771,320	51.3%	1,683,309	48.7%	12.5%	2,127,134	94.3%	128,089	5.7%	15.3%	3,898,454	68.3%	1,811,398	31.7%	27.9%
Agency F	8,985,089	73.3%	3,268,807	26.7%	19.0%	10,086,549	94.2%	625,322	5.8%	18.1%	19,071,639	83.0%	3,894,129	17.0%	37.1%
Agency G	5,752,018	60.7%	3,729,801	39.3%	16.7%	5,544,153	99.6%	25,000	0.4%	13.5%	11,296,171	75.1%	3,754,801	24.9%	30.1%
OVERALL	79,022,696	63.8%	44,911,168	36.2%	17.2%	89,652,417	90.0%	9,969,133	10.0%	15.5%	168,675,113	75.5%	54,880,301	24.5%	32.8%

* Project Delivery percentages as of TCC (DES, CM, PD) are "Averages" of individual project percentages. TCC=Total Construction Cost (Including all Change Orders, City Forces, and Utilities Relocation).

Participating Agencies:



- City of Long Beach, Department of Public Works



- City of Los Angeles, Department of Public Works/
Bureau of Engineering



- City of Oakland, Public Works Agency



- City of Sacramento, Department of Public Works



- City of San Diego, Engineering & Capital Projects



- City & County of San Francisco, Department of Public Works/
Bureau of Engineering/ Bureau of Construction Management/
Bureau of Architecture



- City of San Jose, Department of Public Works