CIP Benchmarking Study

California Multi-Agency CIP Benchmarking Study

Annual Report - Update 2007

Department of PUBLIC WORKS
CITY OF SACRAMENTO

OAKLAND
PUBLIC WORKS AGENCY

CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

CITY OF LONG BEACH

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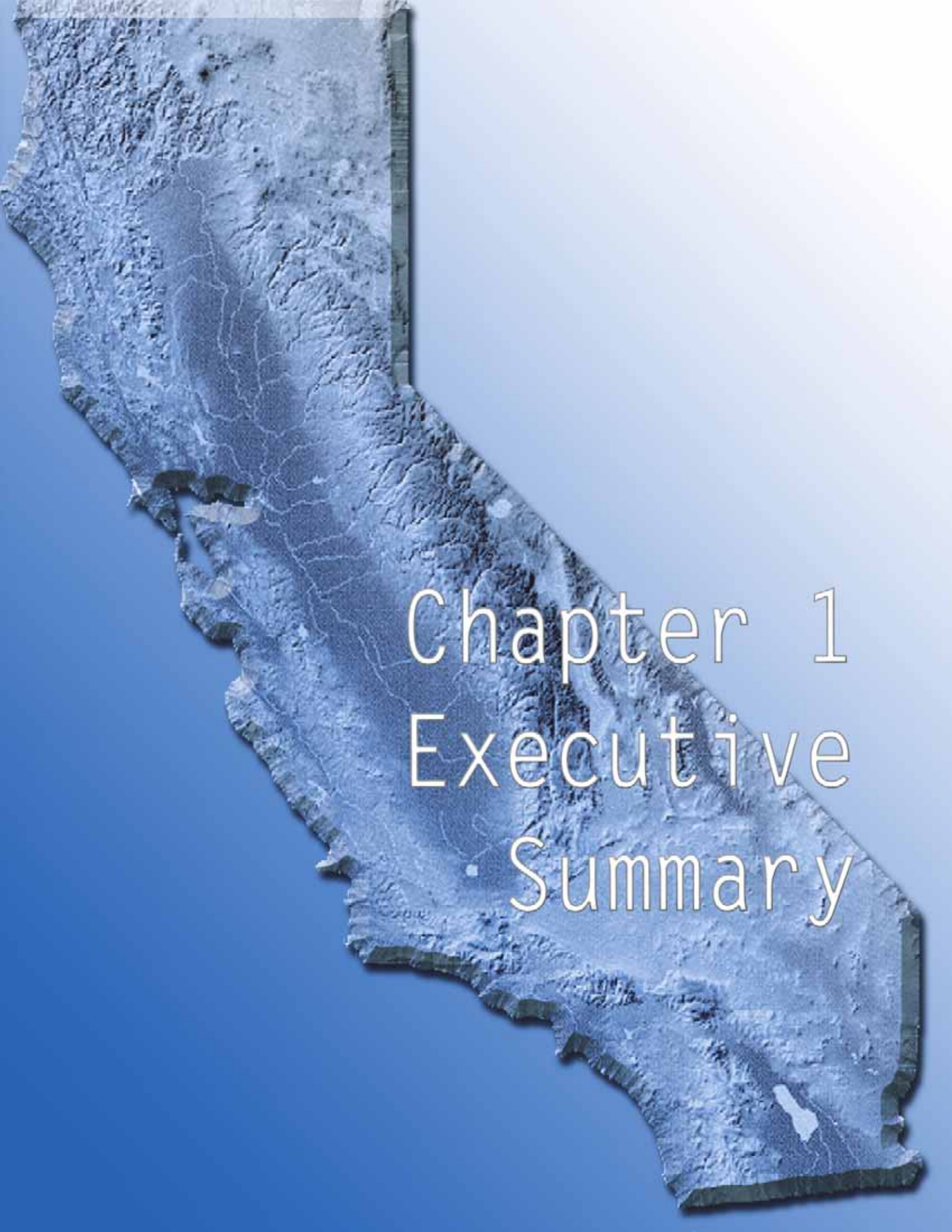

Chapter 1 Executive Summary

CIP Benchmarking Study

CHAPTER 1 Executive Summary

A. INTRODUCTION

For the sixth consecutive year, the California Multi-Agency CIP Benchmarking Study has continued its unparalleled effort to share the collective Capital Improvement Project implementation experiences of the seven largest cities in California. Although many of the individuals participating in the Study may have changed over time, in testimony to their effectiveness, the processes employed by the Study have guided its continued efficacies throughout the life of this effort. This ability to thrive in the face of an evolving Study Team mirrors one of the objectives of the Study itself; the ability for Agencies to thrive in the face of an evolving work force through continuous improvement and the implementation of Best Management Practices (BMPs).

Since the participating Cities of Long Beach, Los Angeles, Oakland, Sacramento, San Diego, San Jose and the City and County of San Francisco first initiated these efforts, they have experienced significant enhancements in both Capital Project delivery process and efficacy. To that end, interest within the industry has been piqued. As a result, other benchmarking efforts, both large and small, have continued to spring up in various parts of the country. We applaud these efforts and look forward to a time when more agencies are sharing their best ideas for the benefit of all and owners can turn to one another to gather insight on how to address challenges that might be new to them, but which others have already faced. In *Update 2007,* the Project Team continued to pursue on-going tasks, as well as new ones:

- Continue to improve the quality of the performance data and the functionality of the database.
- Examine project delivery data and perform analyses to understand what drives performance.
- Track the adoption of BMPs.
- Create new BMPs targeted to address commonly held problem areas.
- Continue sharing information with one another through the online discussion forum.
- Perform special studies on topics of interest.

B. PERFORMANCE BENCHMARKING

Performance benchmarking involves collecting documented project costs and creating data models of the component costs of project delivery versus the total construction cost. Project delivery costs are defined as the sum of all agency and consultant costs associated with project planning, design, bid, award, construction management, and closeout activities.

The *Update 2007* performance curves have been developed from data on projects completed on or after January 1, 2002. Outlier projects have been identified and eliminated. The remaining

698 projects used in the analyses were all delivered using the design-bid-build delivery method and each has a total construction cost of greater than $100,000.

Performance Data Analyses

The *Update 2007* performance data, shown in **Table 1-1**, indicate that for projects with completion dates in 2002 to 2004, the trend of project delivery costs increased, then flattened between 2004 and 2006. The median value is the value at which 50% of the values are above and 50% of the values are below.

In *Update 2006*, the Project Team noted that trends in project delivery cost are driven by a combination of factors, including improved cost data capture and reporting, increased implementation of BMPs, and increased requirements from their own agencies. Drivers investigated in *Update 2007* were differences in project delivery costs among project sizes and types, and the distribution of projects in the database among those sizes and types.

As indicated in **Table 1-1**, project size (measured as median total construction cost), decreased slightly between 2002 and 2005 and increased slightly in 2006. Project delivery costs (as a percentage of total construction costs) are influenced by economies of scale and exhibit an inverse relationship with total construction cost (see the regression curves in **Appendix B**). Thus, project delivery costs (as a percentage of construction costs) are generally lower on larger projects than they are on smaller projects.

The influence of project distribution among project types on project delivery costs was also evaluated. **Table 1-2** shows project delivery costs by each of the four project types in the Study.

Table 1-1 Project Delivery Costs by Project Completion Year (As % of Total Construction Cost)

Year	Design	Construction Management	Project Delivery (Total)	Median Total Construction Cost ($M)
2002	18%	16%	34%	$0.7
2003	20%	17%	37%	$0.5
2004	23%	17%	40%	$0.6
2005	22%	17%	39%	$0.6
2006	22%	18%	40%	$0.8
Average	**21%**	**17%**	**38%**	**$0.6**

Table 1-2 Project Delivery Costs by Project Type (As % of Total Construction Cost)

Type	Design	Construction Management	Project Delivery (Total)	Median Total Construction Cost ($M)	Number of Projects (N)
Municipal Facilities	21%	15%	36%	$2.90	127
Parks	20%	18%	38%	$0.41	102
Pipes	18%	17%	35%	$0.69	256
Streets	24%	17%	41%	$0.45	213
Average	**21%**	**17%**	**38%**	**$0.60**	**698**

The Pipes project type has the lowest average project delivery cost. If a larger proportion of Pipes projects were in the dataset, the average project delivery cost of the whole dataset would be driven down. Streets projects have the highest average project delivery cost among the project types, and make up nearly as much of the dataset as Pipes projects. Thus, the influence of low project delivery cost from Pipes projects is probably balanced by the influence of high project delivery cost from Streets projects on the overall dataset.

The Project Team observed that the relatively high average project delivery cost of Streets projects is probably due to increasing cost influences of right-of-way acquisition, community outreach requirements, environmental mitigation requirements, and the smaller median total construction cost of these projects. It is expected that as data collection methods and full BMP implementation improve, project delivery costs will decline.

Project delivery performance and consultant usage by agency are presented in **Table 1-3**. The table indicates that the majority of design and construction management efforts are completed in-house by the participating agencies. There does not appear to be a close relationship between the level of in-house effort and project delivery costs.

Table 1-3 Project Delivery Performance and Consultant Usage by Agency

AGENCY	DESIGN					CONSTRUCTION MANAGEMENT					PROJECT DELIVERY					TCC	
	In-House		Consultants			In-House		Consultants			In-House		Consultants				
	($M)	% of Design[1]	($M)	% of Design	Total % of TCC[2,3]	($M)	% of CM	($M)	% of CM	Total % of TCC	($M)	% of PD	($M)	% of PD	Total % of TCC	Average	Median
Agency A	$14.5	74%	$5.2	26%	22%	$14.3	97%	$0.4	3%	15%	$28.8	84%	$5.6	16%	37%	$1.2	$0.7
Agency B	$5.7	61%	$3.6	39%	17%	$4.9	67%	$2.4	33%	11%	$10.6	64%	$6.0	36%	28%	$0.8	$0.3
Agency C	$23.9	85%	$4.2	15%	19%	$20.9	96%	$0.9	4%	17%	$44.8	90%	$5.0	10%	36%	$1.7	$0.7
Agency D	$37.1	59%	$25.8	41%	21%	$56.6	93%	$4.5	7%	20%	$93.7	76%	$30.3	24%	41%	$2.5	$1.4
Agency E	$3.4	28%	$8.8	72%	20%	$5.8	69%	$2.6	31%	15%	$9.2	45%	$11.4	55%	34%	$2.0	$0.5
Agency F	$23.8	60%	$15.6	40%	22%	$22.2	90%	$2.4	10%	20%	$46.1	72%	$18.0	28%	41%	$1.1	$0.4
Agency G	$9.2	65%	$5.0	35%	21%	$7.6	100%	$0.0	0%	14%	$16.8	77%	$5.0	23%	36%	$0.8	$0.5
OVERALL	$117.6	63%	$68.2	37%	21%	$132.3	91%	$13.2	9%	17%	$249.9	86%	$81.4	25%	38%	$1.5	$0.6

Notes:

[1] In-House and Consultant costs are expressed as percentages of total agency Design, CM (Construction Management), and PD (Project Delivery) costs.

[2] Total Construction Cost (TCC) is the sum of construction contract award, change orders, utility relocation cost, and city forces construction cost.

[3] Design, CM, and PD costs are expressed as percentages of TCC and are unweighted, arithmetic averages of projects by agency.

Typically, the regression analyses for individual projects result in an inverse relationship between project delivery cost (as a percentage of total construction cost) and the total construction cost. The trend shown in **Table 1-3** is that project delivery costs averaged by agency increase with both average and median total construction cost. This is not necessarily contradictory. Careful investigation using regression analyses reveals that project delivery costs are more closely related to the total number of projects submitted by Project Type than to the average or median total construction cost. Therefore, when using the summary project delivery percentages, it is important to know the makeup of the database with respect to the distribution of projects by type. See **Table 3-5** in **Chapter 3 Performance Benchmarking** for a summary of the project count by project type.

Performance curves produced for this Study are data regressions, demonstrating how close of a relationship exists between the dependent variable (y-axis) and the independent variable (x-axis). A best-fit logarithmic curve is calculated using the least-squares method in Excel®, and a R^2 value is displayed. The R^2 value, also called the coefficient of determination, is a value between 1 and 0, with a value approaching 0 indicating a poor model and a value approaching 1 indicating a close relationship.

P-values were also calculated for each regression, indicating the regression's suitability for predicting new values. The p-value indicates whether there are enough data points for the regression results to be statistically-significant. A statistically-significant model can be used to predict new values. For the purposes of this Study, a p-value below 0.10 was selected to indicate a statistically-significant result.

As indicated in **Table 1-4,** data were collected and analyzed at the level of four project types and fourteen project classifications. The performance models resulting from the analyses are summarized in **Table 1-4** and the performance curves are in **Appendix B**.

In addition to regressions of design, construction management, and project delivery costs versus TCC, regressions of change orders as a percentage of TCC versus TCC were updated. Individual regressions were produced for each of the four project types. Please see these regression models in **Appendix B.**

The results were similar to those from the Update 2005 and Update 2006 analyses, with very low R^2 values. Also, there is more data scatter associated with smaller projects than with larger ones. In the *Update 2007* analyses, change orders averaged 10 percent of TCC for the municipal facilities and streets project types. Change orders averaged 4 to 10 percent for the pipes project type and for the parks project type.

Table 1-4 Summary of Performance Models

PROJECT TYPE Project Classification	Range of TCC	N (Count of Projects)	Des. (% of TCC)	CM (% of TCC)	PD (% of TCC)
Grand Total		**698**			
Municipal Facilities		**127**			
Libraries		**42**			
	$2M<TCC<$3.5M	16	18% to 26%	17% to 28%	34% to 50%
	$3.5M<TCC<$4M	15	17% to 24%	15% to 21%	32% to 42%
	$4M<TCC<$9.5M	11	14% to 23%	5% to 19%	18% to 40%
Police/Fire Station		**27**			
	$0.2M<TCC<$1M	9	26% to 43%	15% to 21%	43% to 60%
	$1M<TCC<$15M	13	14% to 35%	14% to 20%	27% to 53%
	$15M<TCC<$33M	5	10% to 22%	13% to 18%	24% to 37%
Community Bldg/Rec Ctr/ Child Care/Gym		**58**			
	$0.2M<TCC<$1M	23	23% to 35%	15% to 21%	54% to 37%
	$1M<TCC<$2M	18	21% to 31%	14% to 20%	36% to 47%
	$2M<TCC<$8.5M	17	17% to 29%	13% to 19%	30% to 44%
Streets		**213**			
Widening/New/Grade Separation		**26**			
	$0.2M<TCC<$0.6M	9	33% to 48%	14% to 20%	45% to 64%
	$0.6M<TCC<$2M	9	26% to 43%	13% to 19%	39% to 57%
	$2M<TCC<$17.5M	8	17% to 37%	12% to 18%	27% to 52%
Bridge		**13**			
	$0.1M<TCC<$0.3M	5	70% to 120%	17% to 22%	85% to 135%
	$0.3M<TCC<$1.8M	4	34% to 100%	16% to 21%	50% to 115%
	$1.8M<TCC<$12M	4	1% to 67%	15% to 20%	10% to 80%
Reconstruction		**50**			
	$0.1M<TCC<$0.5M	14	23% to 33%	19% to 30%	41% to 58%
	$0.5M<TCC<$1M	21	22% to 30%	17% to 29%	39% to 53%
	$1M<TCC<$11.5M	15	18% to 28%	13% to 27%	31% to 51%
Bike/Pedestrian/Streetscape		**55**			
	$0.2M<TCC<$0.3M	22	27% to 45%	18% to 24%	45% to 65%
	$0.3M<TCC<$0.5M	12	23% to 37%	17% to 22%	40% to 56%
	$0.5M<TCC<$2.2M	21	12% to 33%	15% to 21%	26% to 52%

Notes: TCC = Total Construction Cost; Des. = Design Cost; CM = Construction Management Cost; and PD = Project Delivery Cost. The project delivery percentages indicated are the ranges between the logarithmic regression curve and upper bound of the 50 percent confidence interval for the respective ranges of TCC values. Values of project delivery percentages are not the sum of Design and Construction Management percentages; they are the result of regression analyses of data points using the least-squares method. Caution and review of the report text are urged in using this information. Refer to **Appendix B** for the corresponding regression curves, R^2 values, and N values for more details. Highlighted values indicate those for which R^2 values were particularly low, below 0.10.

Table 1-4 Summary of Performance Models (cont'd)

PROJECT TYPE / Project Classification	Range of TCC	N (Count of Projects)	Des. (% of TCC)	CM (% of TCC)	PD (% of TCC)
Grand Total		**698**			
Streets		**127**			
Signals		**69**			
	$0.1M<TCC<$0.2M	25	18% to 26%	19% to 25%	37% to 45%
	$0.2M<TCC<$0.5M	27	16% to 25%	19% to 25%	36% to 44%
	$0.5M<TCC<$3M	17	17% to 24%	19% to 25%	35% to 43%
Pipes		**256**			
Gravity System		**218**			
	$0.1M<TCC<$0.5M	70	20% to 30%	18% to 26%	37% to 55%
	$0.5M<TCC<$1M	72	16% to 26%	17% to 24%	35% to 47%
	$1M<TCC<$10M	76	10% to 25%	14% to 23%	24% to 44%
Pressure Systems		**25**			
	$0.1M<TCC<$0.4M	7	15% to 23%	14% to 23%	29% to 45%
	$0.4M<TCC<$0.7M	8	14% to 21%	12% to 18%	26% to 37%
	$0.7M<TCC<$2.3M	10	13% to 19%	7% to 16%	20% to 34%
Pump Station		**13**			
	$0.2M<TCC<$0.8M	3	17% to 21%	12% to 17%	27% to 35%
	$0.8M<TCC<$4M	6	15% to 19%	12% to 17%	27% to 35%
	$4M<TCC<$22M	4	14% to 18%	12% to 17%	27% to 35%
Parks		**102**			
Playgrounds		**80**			
	$0.1M<TCC<$0.3M	27	22% to 29%	18% to 27%	40% to 53%
	$0.3M<TCC<$0.5M	25	20% to 27%	17% to 25%	36% to 47%
	$0.5M<TCC<$6M	28	15% to 26%	10% to 23%	25% to 45%
Sportfields		**9**			
	$0.3M<TCC<$0.5M	3	13% to 21%	17% to 23%	31% to 38%
	$0.5M<TCC<$1M	3	15% to 25%	14% to 22%	32% to 39%
	$1M<TCC<$6.5M	3	19% to 33%	8% to 19%	33% to 42%
Restrooms		**13**			
	$0.1M<TCC<$0.2M	5	17% to 24%	26% to 33%	45% to 54%
	$0.2M<TCC<$0.3M	5	19% to 26%	26% to 33%	46% to 55%
	$0.3M<TCC<$1.5M	3	20% to 30%	26% to 33%	47% to 58%

Notes: TCC = Total Construction Cost; Des. = Design Cost; CM = Construction Management Cost; and PD = Project Delivery Cost. The project delivery percentages indicated are the ranges between the logarithmic regression curve and upper bound of the 50 percent confidence interval for the respective ranges of TCC values. Values of project delivery percentages are not the sum of Design and Construction Management percentages; they are the result of regression analyses of data points using the least-squares method. Caution and review of the report text are urged in using this information. Refer to **Appendix B** for the corresponding regression curves, R^2 values, and N values for more details. Highlighted values indicate those for which R^2 values were particularly low, below 0.10.

The table and best-fit curves provide an average of the data that can be used as a starting point for budgeting an entire program of projects. Caution and use of professional judgment to consider unique project attributes is suggested if the best-fit curve is used to budget an individual project.

Special Studies

The Project Team selected three topics for Special Study this year: Alternative Project Delivery Methods, Construction Cost Unit Pricing, and Regional and Chronological Adjustments.

I. Alternative Project Delivery Methods

Two agencies delivered presentations during a quarterly Project Team meeting on their experiences with the Construction Manager (CM) At-Risk and Design-Build delivery methods in the form of case studies. A summary of the method, each agency's experience, advantages, and disadvantages were discussed.

II. Construction Cost Unit Pricing

The Project Team was interested in exploring this issue to better understand how unit price differences among the agencies is driven by real cost inflation versus local market conditions. Additionally, they were seeking guidance on estimating costs for similar capital facilities.

The results indicate that of the factors that drive the cost of construction for library projects (e.g., market conditions, building materials, ancillary facilities, special finishes, gross area), the gross area is clearly the most influential. Regression curves of total construction cost versus gross area for library projects produced results with significantly higher R^2 values than those of total construction cost versus cost per square foot, indicating that as much as 73% ($R^2 = 0.73$) of the variability in library total construction cost is explained by the gross area of the building. There are a number of existing resources available to agencies to develop construction cost estimates, and the importance of utilizing professional cost estimators familiar with local market influences (whether internal or external) cannot be overemphasized.

III. Special Study: Regional and Chronological Adjustments

In planning for *Update 2007,* the Project Team wished to study the influence of adjusting cost data for regional and chronological differences. The Study Team presented some information on regional and city price indexing, including historical trends and future projections.

An examination of the types of cost data collected in this Study indicated that while some adjustments of construction cost data could be made using available indices, adjustments to project delivery costs would be difficult. Data in this Study are not collected at a level of detail to support such adjustments.

C. BEST MANAGEMENT PRACTICES

At the start of the Study, the agencies examined over 100 practices used in project delivery. They included practices that they did not already commonly use, but believed should be implemented as BMPs. Practices are also added annually by the agencies to address specific challenges they encounter or to reflect new learnings by the participants. Agency implementation of the selected practices has been and will continue to be tracked during the lifetime of the Study. These BMPs are believed

to directly influence the cost of either design or construction management and, ultimately, project delivery efficiency. The agencies have continued to pursue the full implementation of BMPs. As of *Update 2007*, the agencies have fully implemented nearly 70 percent of all BMPs.

To support the linking of BMPs to performance improvements, BMP implementation has been tracked and project completion dates have been collected on the Performance Questionnaire.

The Project Team selected the following five areas of project delivery as heavily influencing project delivery costs:

- ROW Procurement
- Environmental Process
- Permitting
- Utility Relocations
- Project Management Training

The Project Team agreed that developing and implementing BMPs related to improving performance in these areas will improve overall project delivery efficiency.

In *Update 2007*, the Project Team added six new BMPs to the BMP implementation tracking list. The BMPs were developed addressing issues in the areas of permitting and environmental regulation compliance. These BMPs were:

- **1.g 2007:** Make an early determination on which environmental documents are required and incorporate them into the schedule.
- **2.o 2007:** Obtain independent cost estimates (outside of the designer) during the design process, inclusive of local market influences on complex projects.
- **3.III.k 2007:** Establish a Utility Coordinating Committee with members from public and private entities.
- **3.III.l 2007:** Designate a responsible person or group and establish a process of notifications and milestones for utility relocations.
- **5.III.h 2007:** Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments.
- **5.IV.b 2007:** Have a coordinator with expertise in the environmental process within the department delivering the engineering/capital project.

BMPs in the other areas will be discussed and developed during future Study phases.

It is anticipated that the performance data will eventually demonstrate that as BMPs were implemented, project delivery costs were reduced. However, it is recognized that "processes" become effective "practices" only after a learning curve and full implementation on projects. Therefore, obtaining empirical evidence of this trend is expected to take several years.

D. ONLINE DISCUSSION FORUM

The following discussion topics are summarized in Chapter 5 Online Discussion Forum.

- Consultant Contract Indemnification Clauses

- LEED Policy
- Professional Services Procurement Process
- Handicapped Parking
- Consultant Performance Targets for Change Orders
- Bid Rejection and Negotiation
- Consultant Rating Systems
- Criteria and Standards for Right Turn Lanes
- Prevailing Wages
- Sidewalk Repairs
- Construction Cost Estimating by Consultants

An archive of the full discussion forum is posted confidentially on the Study website for access by the participants.

E. CONCLUSIONS

I. Performance Benchmarking

In *Update 2006*, the Project Team noted that trends in project delivery cost are driven by a combination of factors, including improved cost data capture and reporting, increased implementation of BMPs, and increased requirements from their own agencies.

In *Update 2007*, the participating agencies have continued to contribute project delivery cost data and the Study Team has continued to analyze the data in different ways in order to understand the drivers of performance.

- Project delivery costs (as a percentage of total construction cost) by project type in the *Update 2007* analysis were:

Municipal Facilities	36%
Parks	38%
Pipes	35%
Streets	41%

- Trends in project delivery costs in this Study are influenced by project size (measured as median total construction cost) and project type.

- The influence of project size on project delivery costs is once again demonstrated by the inverse relationships shown on the regression curves in **Appendix B Performance Curves.**

- The Special Study on construction cost unit pricing for library projects showed that of the factors that drive the cost of construction for libraries, the gross area is clearly the most influential. As much as 73% of the variability in library total construction cost is explained by the gross area of the building.

- The Special Study on alternative project delivery methods showed that there are a number of advantages and disadvantages to the use of each method. The agency's needs and individual project characteristics should be used to select the best method.

- The Special Study on regional and chronological adjustments showed that these types of adjustments are not practical for the Study dataset at this time.

II. Best Management Practices

The agencies have continued to fully implement selected BMPs. As of *Update 2007*, the agencies have fully implemented more than 70 percent of all BMPs.

The Project Team selected the following five areas of project delivery as heavily influencing project delivery costs:

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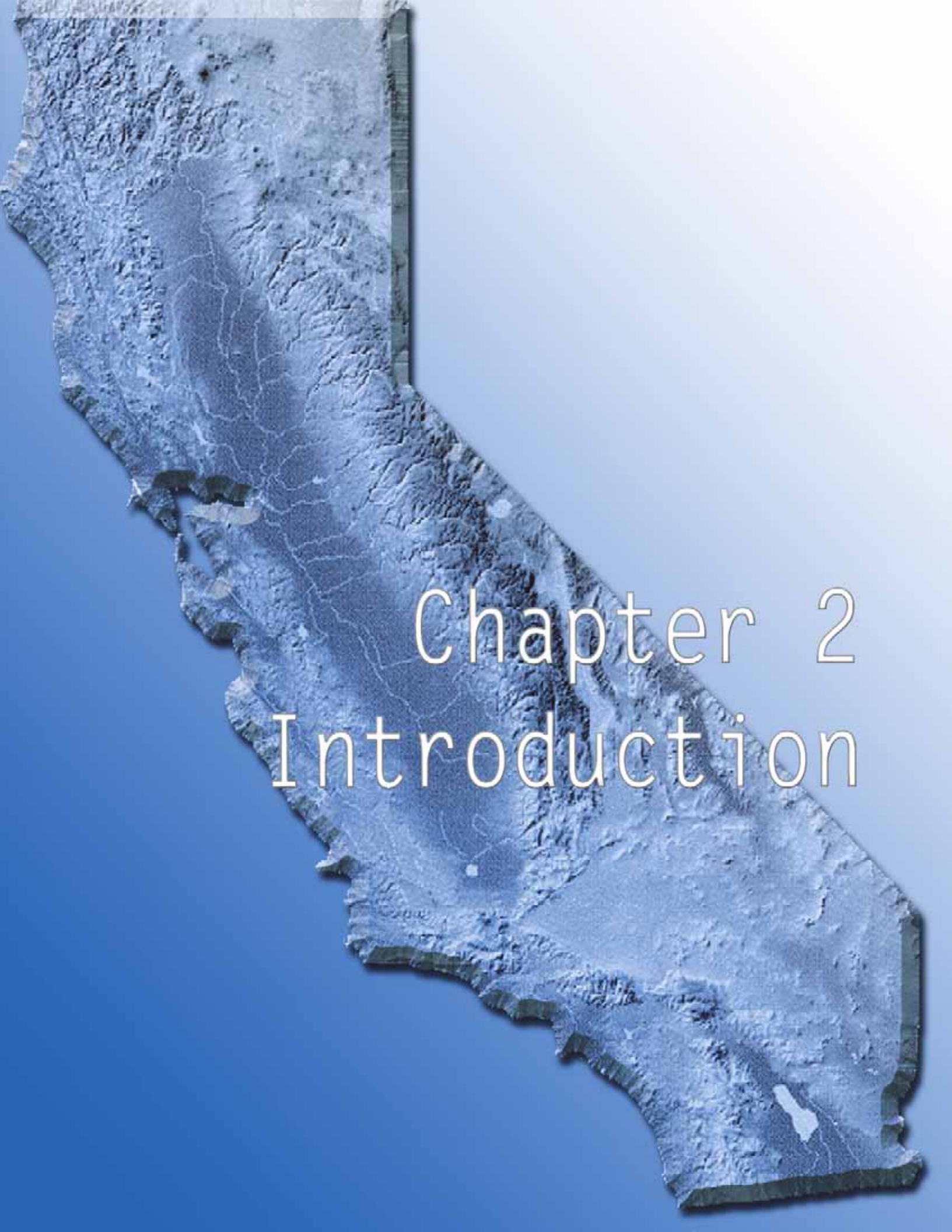
III. Online Discussion Forum

The Online Discussion Forum is becoming an increasingly important feature for *Study* participants, with active exchanges occurring frequently and important issues addressed with changes to policy, approach, or BMP implementation. Participants will continue sharing information through the Online Discussion Forum and during the quarterly meetings, and presenting the more interesting results to the public through the Study reports. The continued sharing of challenges and solutions through the Online Discussion Forum remains a remarkable advantage to all participants.



Chapter 2
Introduction

CIP Benchmarking Study

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For the sixth consecutive year, the *California Multi-Agency CIP Benchmarking Study* has continued its unparalleled effort to share the collective Capital Improvement Project implementation experiences of the seven largest cities in California. Although many of the individuals participating in the *Study* may have changed over time, in testimony to their effectiveness, the processes employed by the *Study* have guided its continued efficacies throughout the life of this effort. This ability to thrive in the face of an evolving *Study* Team mirrors one of the objectives of the *Study* itself; the ability for Agencies to thrive in the face of an evolving work force through continuous improvement and the implementation of Best Management Practices (BMPs).

Since the participating Cities of Long Beach, Los Angeles, Oakland, Sacramento, San Diego, and San Jose and the City and County of San Francisco first initiated these efforts, they have experienced significant enhancements in both capital project delivery process and efficacy. To that end, interest within the industry has been piqued. As a result, other benchmarking efforts, both large and small, have continued to spring up in various parts of the country. We applaud these efforts and look forward to a time when more agencies are sharing their best ideas for the benefit of all and owners can turn to one another to gather insight on how to address challenges that might be new to them, but which others have already faced.

In *Update 2007,* the Project Team has continued to pursue on-going tasks, as well as new ones:

- Continue to improve the quality of the performance data and the functionality of the database.
- Examine project delivery data and perform analyses to understand what drives performance.
- Track the adoption of BMPs.
- Create new BMPs targeted to address commonly held problem areas.
- Continue sharing information with one another through the online discussion forum.
- Perform special studies on topics of interest.

A. BACKGROUND

In October 2001, the City of Los Angeles, Department of Public Works, Bureau of Engineering initiated the *Study* with several of the largest cities in California. These cities joined together to form the Project Team for the *Study*. After working together for six years, this team agrees that they benefit from collaborating and pooling their project delivery knowledge and experience.

The *Study* initially involved six agencies, with a seventh joining the team in 2003. The participating agencies currently include:

- 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 General Services, Department of Transportation, and Department of Utilities
- City of San Diego, Engineering and Capital Projects Department
- City and County of San Francisco, Department of Public Works, Bureau of Engineering, Bureau of Architecture, and Bureau of Construction Management
- City of San Jose, Department of Public Works and City Manager's Office

Table 2-1 summarizes some of general characteristics of the participating agencies and/or of specific departments.

Table 2-1 Agencies' Overall Information

Information	Population	Area (sq. mi.)	Website	Government Form
Long Beach	492,912	50	http://www.longbeach.gov	Council-Manager-Charter
Los Angeles	4,018,080	469	http://eng.lacity.org	Mayor-Council
Oakland	399,484	66	http://www.oaklandpw.com and www.oaklandnet.com	Mayor-Council-Administrator
Sacramento	457,514	98	http://www.cityofsacramento.org	Council-Manager
Dept. of General Services				
Dept. of Transportation				
Dept. of Utilities				
San Diego	1,305,736	342	http://www.sandiego.gov	Mayor-Council
San Francisco	801,377	47	http://www.sfdpw.com	Mayor-Board of Supervisors (11 members)
San Jose	974,000	178	http://www.sanjoseca.gov	Mayor-Council-Manager

Upon initiation of the *Study*, it was agreed that published data provided by *Study* participants should remain anonymous in order to create a positive, non-competitive team environment, conducive to meeting the *Study*'s goals. Therefore, no projects are identified by name in this document or in the project database and agencies are referred to by an alias (such as "Agency A") when anonymity is appropriate.

B. BENEFITS OF PARTICIPATION

The participating agencies have been very supportive of the *Study* efforts over the years. The *Study* is possible only because the agencies believe they are benefiting from their continued participation.

The agencies have expressed the benefits they experience in a variety of ways, including the following:

- The City of San Jose has benefited by having ready access to the performance data and BMPs of the largest cities in California. This has assisted their decision-making process regarding policy and procedural improvements, especially with regard to newer topics that impact capital project delivery such as LEED/Green Building initiatives and alternative contracting methods (i.e. design-build). San Jose also offers: "What is great is that we learn new things at every meeting that lead to ways we can challenge ourselves to improve our processes and procedures. The online forum has also proved to be a very valuable tool between meetings and has generated some very informative discussions on a broad range of topics."

- The City and County of San Francisco has benefited from participating in the benchmarking studies in many ways. "The results of the *Study* have validated our agency's performance when we underwent a recent management audit by the City Controller. Reviewing the BMPs adopted by the various agencies has encouraged us to consider new and better ways to deliver our services. Formal contacts through the online discussion forum and informal contacts have allowed us to share information about public works practices and processes and to learn from one another."

- The City of Los Angeles commented that "the discussion forum has been especially useful in analyzing certain aspects of the way we do business in the City of Los Angeles. It allows us to get input on specific topics from other major California cities and benefit from their particular experiences, to find out how the other major cities conduct their business, and we are able to receive feedback on our ideas from the other municipalities. It also allows the City of Los Angeles to share our experience and business practices with other major cities, and helps to make our practices and policies more consistent with cities throughout the state. As an example, the City of Los Angeles is exploring the use of Design Build, which would be a new method of project delivery

for us. By utilizing the discussion forum and gathering the ideas and experiences from other Cities on the Benchmarking Team, we were able to get much of the information we needed to make the decision to proceed with this concept, and have established a Design Build Task Force within the City to move the process forward."

- The City of Long Beach offers this comment: "The environment in which cities are planning, designing, and constructing their capital improvement programs has been in a state of constant change over the past few years. Rapid increases in construction costs, more stringent environmental regulations along with the political desire to be more 'green', and the ever present budget shortfalls are just a few of the challenges being faced by cities in California. Participation in the statewide benchmarking process has allowed the City of Long Beach to normalize its project delivery performance against this ever-changing environment, and to learn from the other participants how they are overcoming these challenges."

- According to the City of Sacramento, "the benefits of our continued participation in the *Study* have increased geometrically each year we have participated. Our data collection and tracking has evolved to mirror the Study format, making it much easier for us to directly correlate the results of our work and effort with that of our industry peers. As we continue to implement new BMPs each year, our project management and delivery standards have improved greatly over where we were just a few years ago. We have also found that the online discussion forum is an invaluable resource when we are researching a new policy or practice, as all of the participating agencies are very generous in sharing their own knowledge, standards, and practices."

- The City of San Diego has benefited from participation in the Study in several ways. The database developed for the various project types provides the City with a better understanding of the cost to deliver projects, schedules, and the ability to identify trends earlier. The comparison of City projects to the other agencies has helped define where the City is doing well and where improvement could be made. The discussion of BMPs helps provide a framework and examples of how to implement needed improvements. Online discussions between agencies result in immediate feedback for issues that come up from time to time. These online discussions provide the ability to discuss specific project tasks, specifications, and miscellaneous requirements.

- The City of Oakland presented the benchmarking Study results to the Public Works Committee and received positive feedback from the Councilmembers. A Councilmember who had been concerned about the high costs of project delivery stated how appreciative he was of having a better understanding

of the true cost to deliver projects, and a better appreciation for the hidden but necessary costs. They add that "the Study helps us educate the public, elected officials and our clients on the costs associated in delivering capital projects. In addition, the Study has allowed us to share our experiences and challenges with other major California Cities, to work as a group to develop new strategies and BMPs, and to ultimately improve our delivery of capital projects for the City."

C. STUDY FOCUS

In this year's Study, special attention was given to developing new BMPs in the areas of permitting and environmental regulation compliance. These BMPs were all developed with the belief they will improve the efficiency of capital project delivery.

During the quarterly Project Team meetings, time was set aside to discuss the challenges the participants encounter in the capital project delivery process and to brainstorm ways to effectively address those challenges. New BMPs were then developed and added to the implementation list.

Please see **Chapter 4 Best Management Practices** for more detail on the results of this effort.

D. STUDY GOALS

The Study Methodology is described in detail in the first Study report (published in 2002) and modifications to it have been documented in subsequent Study reports. In *Update 2007*, the agencies made progress on several goals:

1. **Improve the quality of the performance data and the functionality of the database**. The agencies continued their efforts to capture complete project delivery costs and increase the number of projects in the database. Performance curves were developed for projects falling into 14 classifications among 4 project types. Regressions were done for design, construction management, and overall project delivery costs as a function of total construction cost (TCC). Agencies verified or corrected randomly-selected project data and made presentations on their data collection process. A statistical outlier analysis was also performed.

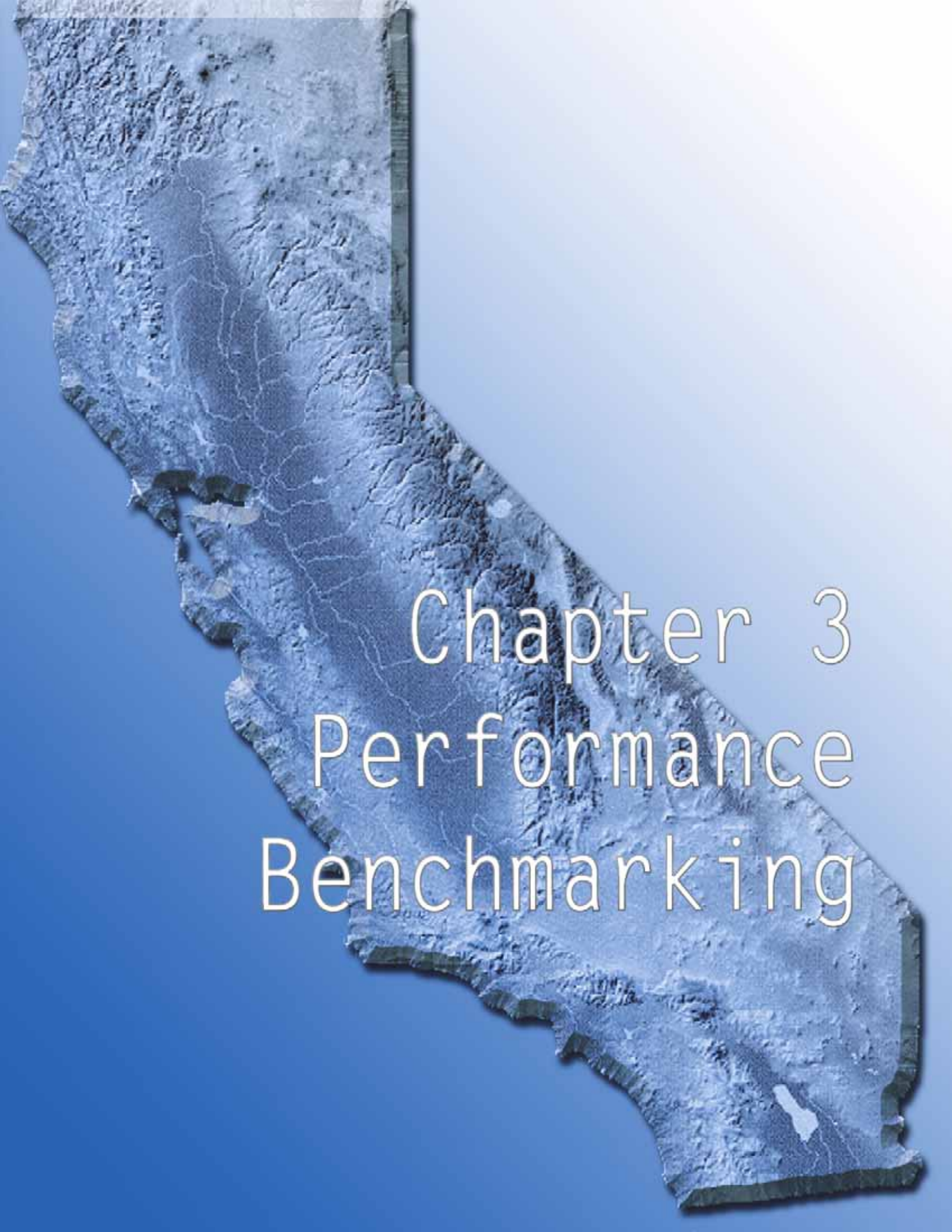
2. **Track the adoption of Best Management Practices (BMPs).** The Study Team continued to track the implementation of BMPs in order to link these practices to capital project performance improvement over time, in order to encourage their implementation and to support linking BMPs to changes in performance.

3. **Create new BMPs targeted to address commonly held problem areas.** The Project Team continued to discuss common challenges and share ideas for addressing those challenges during the quarterly

meetings as well as in the online discussion forum. New BMPs were adopted by the Project Team for implementation and added to the implementation list.

4. **Continue sharing information with one another through the online discussion forum.** The Project Team uses the discussion forum to share information; survey one another on current processes and policies; and collaborate on implementing new processes and policies.

5. **Perform special studies on topics of interest.** This year's special studies were on alternative project delivery methods, construction cost unit pricing, and using regional and chronological adjustments for cost data.



Chapter 3
Performance Benchmarking

CIP Benchmarking Study

CHAPTER 3 Performance Benchmarking

Performance benchmarking involves collecting documented project costs and plotting the component costs of project delivery against the total construction cost (TCC). All of the actual project costs are collected by the agencies using a Performance Questionnaire created in Microsoft Excel®. Data are then compiled from the questionnaires in Excel® using a Visual Basic for Applications (VBA) code and transferred into the database, where the data is reviewed and vetted. A copy of the current Performance Questionnaire can be found in **Appendix A.**

A. STUDY CRITERIA

The following criteria applied to *Update 2007* performance benchmarking analyses:

- **Total Construction Cost** – TCC is the sum of the awarded construction contract, net change orders, utility relocation, and construction by agency forces. TCC does not include, land acquisition, environmental monitoring and mitigation, design, or construction management costs. All projects included in the analyses have a TCC exceeding $100,000.
- **Completion Date** – Projects included in the *Study* analyses were completed on or after January 1, 2002. Projects with earlier completion dates were kept in the database, but excluded from the analyses.
- **Outlier Elimination** – Statistical outliers were identified using the statistical method described in the *Update 2004* report. The total project delivery cost of each project in the database was evaluated against all other projects in the same classification. Potential outliers were then excluded from the analyses only if the respective agency confirmed that the project delivery process was not representative of the procedures normally used to deliver projects. Projects confirmed as outliers by the agencies were kept in the database, but excluded from the analyses.
- **Project Delivery Method** – All projects in this *Study* were delivered through the traditional Design-Bid-Build delivery method. Projects delivered using other methods are not included in this *Study* at this time.
- **Change Order Classification** – To support meaningful change order analyses, the Project Team reported change orders in accordance with predetermined change order classifications. These classifications are:

1. Changed/Unforeseen Condition.
2. Changes to Bid Documents
3. Client-Initiated Changes

Project Classifications – Fourteen project classifications grouped into four project types are used in this *Study*. The project types and classifications are shown in **Table 3-1.**

B. DATA COLLECTION AND CONFIRMATION

The agencies are commited to providing accurate, complete project delivery cost data to support the development of performance models. Project delivery costs are defined as the sum of all agency and consultant costs associated with project planning, design, bid, award, construction management, and closeout activities. Examples of specific activities included in project delivery are presented in **Table 3-2.** Each agency delivered a presentation describing how it completes the project delivery cost data portion of the Perfomance Questionnaire. The presentations were shared with the Project Team during a quarterly workshop. The goal of these presentations was to confirm that the agencies were completing the questionnaires with comparable, complete, and accurate values. The agencies have found that preparing the presentation and discussing the methods used helps to clarify points of confusion or inconsistency.

Each agency was also asked to verify data for 5 randomly-selected projects that were submitted in previous *Study* phases. The confirmations were collected, the required corrections made, and the results of the confirmation were shared with the agencies.

Table 3-1 Project Types and Classifications

Project Types	Classifications
Municipal Facilities	▪ Libraries ▪ Police and Fire Stations ▪ Community Centers, Recreation Centers, Child Care Facilities, Gymnasiums
Streets	▪ Widening, New, and Grade Separation ▪ Bridges ▪ Reconstruction ▪ Bike Ways, Pedestrian Ways, and Streetscapes ▪ Signals
Pipe Systems	▪ Gravity Systems ▪ Pressure Systems ▪ Pump Stations
Parks	▪ Playgrounds ▪ Sportfields ▪ Restrooms

In the course of data confirmation, each Agency provided an explanation for changes resulting in greater than 1 percent change in project delivery cost. Many of the deviations were explained by changes in project cost accounting systems and by submission of data prior to complete closure of project financial elements.

Because the number of projects corrected is a small proportion of the entire database, the overall impact of the revisions upon the analyses was inconsequential. This exercise did, however, reaffirm the need to continue improving the data collection and reporting process on all reported project data.

C. PERFORMANCE DATABASE

Table 3-3 summarizes the number of projects included in the database and in the analyses. The database now contains 1,160 projects in total. Following the application of the *Study* criteria previously described, 698 projects fit the *Study* criteria and were included in the analyses.

The participating agencies use fully-burdened costs for project delivery tasks because agencies' overhead multipliers are similar. They have also agreed that land acquisition costs and environmental impact mitigation costs should be excluded from the TCC cost calculation.

As previously indicated, there are 4 project types (Municipal Facilities, Streets, Pipe Systems, and Parks) and 14 project classifications included in this *Study*. **Table 3-4** summarizes the distribution of projects included in the *Update 2007* analyses.

In the *Study 2002* report, it was recommended that at least 10 projects per classification and a minimum data set of 2,000 projects distributed evenly among classifications, ranges of TCC, and agencies are necessary to achieve statistically-significant results. There is still some progress to be made on this requirement.

The agencies acknowledged that it is vital to the success of the *Study* to continue increasing the size of the data set, thereby increasing the confidence, consistency, and reliability of results.

D. OVERHEAD RATES

Based upon the results of an evaluation performed in the *Update 2004,* the *Study* Team agreed that normalization of the cost data for differences in overhead rates was not necessary at this time. Please see the *Update 2004* report for more details on the overhead rate analyses and **Appendix C Indirect Rates** of this report for a summary of overhead rates.

E. PERFORMANCE DATA ANALYSES

Table 3-5 summarizes characteristics of the projects included in the analyses by project completion year and shows trends in the average TCC values, median TCC values, design costs, construction management costs, and overall project delivery costs. The median value is the value at which 50% of the values are above and 50% of the values are below.

The *Update 2007* performance data, shown in **Table 3-5**, indicate that for projects with completion dates in 2002 to 2004, the trend of project delivery costs increased then flattened between 2004 and 2006.

Table 3 -2 Project Cost Categories

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

Table 3 -2 Project Cost Categories (cont'd)

Category and Phase	Description
Bid and Award	▪ Prepare advertisement for bids ▪ Perform prequalification of bidders ▪ Manage the pre-bid conference ▪ Perform the bid evaluations ▪ Prepare the recommendation for award ▪ Obtain approval of contract award from Board/Council ▪ Prepare the notice to proceed ▪ Monitor and control project costs
2) Construction Management Costs:	All costs associated with construction management, including closeout costs, are included in this category. Construction management costs consist of direct labor, other agency costs, and consultant usage. Construction management may include the following:
Construction	▪ Hold pre-construction conference ▪ Review and approve schedule and schedule updates ▪ Perform on-site management ▪ Review shop drawings, samples, and submittals ▪ Perform testing and inspection ▪ Process payment requests ▪ Review, and negotiate change orders ▪ Prepare monthly reports to owner and agencies ▪ Respond to requests for information ▪ Develop and implement a project communications plan ▪ Perform document control ▪ Manage claims ▪ Perform final inspections and develop/track punch list
Closeout Phase	▪ Commission facilities and equipment ▪ Train maintenance and operation ▪ personnel ▪ Document and track warranty and guarantee information ▪ Plan move-in ▪ File notices (occupancy, completion, etc.) ▪ Check and file as-built documents ▪ Monitor and control project costs
3) Total Project Delivery Costs:	This is the total cost of delivering a capital improvement project, equal to the sum of the design cost and construction management costs indicated above.

Table 3 -2 Project Cost Categories (cont'd)

Category and Phase	Description
4) Change Order Cost:	Please see the update 2005 Report for details as the following types of change orders: ▪ Changed/unforeseen conditions ▪ Changes to Bid Documents ▪ Client-Initiated changes
5) Construction Cost:	This is the direct construction cost, including all change orders during the construction phase (from the issuance of Notice to Proceed to Notice of Acceptance). The following costs are associated with construction and are included in the TCC: ▪ Direct actual construction ▪ Total amount of positive change orders throughout construction ▪ Fixtures, furnishing, and equipment (FFE) ▪ Utilities relocation ▪ Work performed by the agency's staff and other agencies' staff

Table 3 -3 Growth of Database

Study Phase[1]	Submitted	Deleted		Increase	Excluded		Net
	(a) Total	(b) TCC <$100K	(c) Non-Representative	(d)=(a)-(b)-(c)	(e) Project Completion Date <2002	(g) Outliers	Projects in Analyses (h)=(d)-(e)-(f)-(g)
I	237	25	41	171	121	14	36
II	285	0	34	251	161	21	69
III	262	0	27	235	20	48	167
IV	170	17	20	133	5	36	92
V	182	0	1	181	8	22	151
VI	189	0	0	189	0	6	183
Total	**1,325**	**42**	**123**	**1160**	**315**	**147**	**698**

Note:
[1] Study Phase indicates action taken on the count of projects corresponding to Study Years I = 2002, II = 2003, III = 2004, IV = 2005, V = 2006, and VI = 2007.
[2]Projects that do not fit Study criteria for project classifications and minimum TCC of $100K were removed from the database.

Table 3 -4 Projects Distribution Matrix

Agency	Long Beach	Los Angeles	Oakland	Sacra-mento	San Diego	San Francisco	San Jose	Total
Municipal Facilities	**8**	**55**	**8**	**10**	**6**	**13**	**27**	**127**
Libraries	0	33	0	0	2	1	6	42
Police/Fire Station	3	8	1	2	4	6	3	27
Comm./Rec. Center/ Child Care/Gym	5	14	7	8	0	6	18	58
Streets	**14**	**11**	**39**	**40**	**37**	**24**	**48**	**213**
Widening/New/Grade Separation	1	1	1	3	8	2	10	26
Bridges	0	7	0	0	4	1	1	13
Reconstruction	9	3	14	5	5	6	8	50
Bike/Pedestrian/ Streetscape	2	0	13	17	7	7	9	55
Signals	2	0	11	15	13	8	20	69
Pipe Systems	**2**	**83**	**25**	**32**	**54**	**32**	**28**	**256**
Gravity System	2	82	25	25	35	25	24	218
Pressure Systems	0	0	0	3	17	3	2	25
Pump Stations	0	1	0	4	2	4	2	13
Parks	**4**	**4**	**12**	**1**	**3**	**15**	**63**	**102**
Playgrounds	3	2	10	0	0	13	52	80
Sportfields	0	2	1	1	1	0	4	9
Restrooms	1	0	1	0	2	2	7	13
Total	**28**	**153**	**84**	**83**	**100**	**84**	**166**	**698**

Notes: Count is of projects included in *Update 2007* analyses.

Table 3-5 Project Count and Project Delivery by Completion Year

Project Completion Date	Count by Project Type					Project Delivery Data				
	Municipal Facilities	Streets	Pipes	Parks	Total	Average TCC ($M)	Median TCC ($M)	Design Cost (% of TCC)	Construction Management Cost (% of TCC)	Project Delivery Cost (% of TCC)
2002	30	43	65	8	**146**	$1.8	$0.7	18%	16%	34%
2003	26	45	45	47	**163**	$1.1	$0.5	20%	17%	37%
2004	19	34	28	21	**102**	$1.1	$0.6	23%	17%	40%
2005	22	56	68	17	**163**	$1.6	$0.6	22%	17%	39%
2006	30	**35**	**49**	**9**	**123**	$1.6	$0.8	22%	18%	40%
Total	**127**	**213**	**255**	**102**	**697**	**$1.5**	**$0.6**	**21%**	**17%**	**38%**

Note:
[1]One project in the *Update 2007* analyses with a project completion date in 2007 is not included in this table.

In Update 2006, the Project Team noted that trends in project delivery cost are driven by a combination of factors, including improved cost data capture and reporting, increased implementation of BMPs, and increased requirements from their own agencies.

Drivers investigated in *Update 2007* were differences in project delivery costs among project sizes and types, and the distribution of projects in the database among those sizes and types.

As indicated in **Table 3-5**, project size (measured as median total construction cost), decreased slightly between 2002 and 2005 and increased slightly in 2006. Project delivery costs (as a percentage of total construction costs) are influenced by economies of scale and exhibit an inverse relationship with total construction cost (see the regression curves in **Appendix B)**. Thus, project delivery costs are generally lower on larger projects than they are on smaller projects.

The influence of project distribution among project types on project delivery costs was also evaluated. **Table 3-6** shows project delivery costs by each of the four project types in the *Study.*

Table 3-6 Project Delivery Costs by Project Type (As % of Total Construction Cost)

Type	Design	Construction Management	Project Delivery (Total)	Median Total Construction Cost ($M)	Number of Projects (N)
Municipal Facilities	21%	15%	36%	$2.90	127
Parks	20%	18%	38%	$0.40	102
Pipes	18%	17%	35%	$0.70	256
Streets	24%	17%	41%	$0.40	213
Average	**21%**	**17%**	**38%**	**$0.60**	**698**

The Pipes project type has the lowest average project delivery cost. If a larger proportion of Pipes projects were in the dataset, the average project delivery cost of the whole dataset would be driven down. Streets projects have the highest average project delivery cost among the project types, and make up nearly as much of the dataset as Pipes projects. Thus, the influence of low project delivery cost from Pipes projects is probably balanced by the influence of high project delivery cost from Streets projects on the overall dataset.

The Project Team observed that the relatively high average project delivery cost of Streets projects is probably due to increasing cost influences of right-of-way acquisition, community outreach requirements, environmental mitigation requirements, and the smaller median total construction cost of these projects. It is expected that as data collection methods and full BMP implementation improve, project delivery costs will decline.

Project delivery performance and consultant usage by agency are presented in **Table 3-7.** The table indicates that the majority of design and construction management efforts are completed in-house by the participating agencies. There does not appear to be a close relationship between the level of in-house effort and project delivery costs.

Table 3 -7 Project Delivery Performance and Consultant Usage by Agency

AGENCY	DESIGN					CONSTRUCTION MANAGEMENT					PROJECT DELIVERY					TCC	
	In-House		Consultants			In-House		Consultants			In-House		Consultants				
	($M)	% of Design[1]	($M)	% of Design	Total % of TCC[2,3]	($M)	% of CM	($M)	% of CM	Total % of TCC	($M)	% of PD	($M)	% of PD	Total % of TCC	Average	Median
Agency A	$14.5	74%	$5.2	26%	22%	$14.3	97%	$0.4	3%	15%	$28.8	84%	$5.6	16%	37%	$1.2	$0.7
Agency B	$5.7	61%	$3.6	39%	17%	$4.9	67%	$2.4	33%	11%	$10.6	64%	$6.0	36%	28%	$0.8	$0.3
Agency C	$23.9	85%	$4.2	15%	19%	$20.9	96%	$0.9	4%	17%	$44.8	90%	$5.0	10%	36%	$1.7	$0.7
Agency D	$37.1	59%	$25.8	41%	21%	$56.6	93%	$4.5	7%	20%	$93.7	76%	$30.3	24%	41%	$2.5	$1.4
Agency E	$3.4	28%	$8.8	72%	20%	$5.8	69%	$2.6	31%	15%	$9.2	45%	$11.4	55%	34%	$2.0	$0.5
Agency F	$23.8	60%	$15.6	40%	22%	$22.2	90%	$2.4	10%	20%	$46.1	72%	$18.0	28%	41%	$1.1	$0.4
Agency G	$9.2	65%	$5.0	35%	21%	$7.6	100%	$0.0	0%	14%	$16.8	77%	$5.0	23%	36%	$0.8	$0.5
OVERALL	$117.6	63%	$68.2	37%	21%	$132.3	91%	$13.2	9%	17%	$249.9	86%	$81.4	25%	38%	$1.5	$0.6
OVERALL	$117.6	63%	$68.2	37%	21%	$132.3	91%	$13.2	9%	17%	$250.0	75%	$81.3	25%	38%	$1.5	$0.6

Notes:

[1] In-House and Consultant costs are expressed as percentages of total agency Design, CM (Construction Management), and PD (Project Delivery) costs.

[2] Total Construction Cost (TCC) is the sum of construction contract award, change orders, utility relocation cost, and city forces construction cost.

[3] Design, CM, and PD costs are expressed as percentages of TCC and are unweighted, arithmetic averages of projects by agency.

Typically, the regression analyses for individual projects result in an inverse relationship between project delivery cost (as a percentage of TCC) and the TCC. The trend shown in **Table 3-7** is that project delivery costs averaged by agency increase with both average and median TCC. This is not necessarily contradictory. Careful investigation using regression analyses reveals that project delivery costs are more closely related to the total number of projects submitted by Project Type than to the average or median TCC. Therefore, when using the summary project delivery percentages, it is important to know the makeup of the database with respect to the distribution of projects by type.

I. Definitions

Performance curves produced for this *Study* are regressions of data, demonstrating how close of a relationship exists between the dependent variable (y-axis) and the independent variable (x-axis). For instance, a regression curve of design cost as a percentage of TCC versus TCC would be prepared to evaluate how much of the variability in design cost is due to the TCC value.

The regression trendline provides a running average of project delivery cost for each TCC that can be used as a starting point for budgeting an entire program of projects. Caution and use of professional judgment is required if using the regression trendline to budget an individual project.

Confidence Interval

The upper bound of the 50 percent confidence interval is displayed on each of the regression curves. The upper and lower bounds of the confidence interval indicates the level of certainty in a data set, and how likely it is that a random sample from the data set will fall within the interval. The wider the distance between the upper and lower bounds of a confidence interval, the less certainty in the model and greater the need to collect more data before drawing conclusions from the data set.

Coefficient of Determination

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

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

Statistical Significance

To evaluate the statistical significance of the result obtained, the regression analyses included a calculation of p-values. Whereas the R^2 value is a descriptive statistic (i.e., describes the current set of data), the p-value is a predictive statistic. It indicates whether there are enough data points to arrive at statistically-significant results and could be used to predict new values. The selection of a desirable p-value is subjective, though 0.10 or 0.05 is usually used as the maximum desirable value. For the purposes of this *Study*, a critical p-value of 0.10 was

selected. Thus, any result where p ≤ 0.10 indicates a statistically-significant result. There is no difference between a p-value slightly below 0.10 as one that is far below 0.10. Both results are considered to have equal statistical significance.

For regressions resulting in a p-value above 0.10, additional projects should be added to the database to improve the result. Please see the *Study* 2002 report for additional detail on the connection between the number of projects and p-values.

For each of the regressions, the R^2 value and p-value should be considered separately. A high R^2 value does not mean the result is statistically-significant, and vice-versa.

II. Results

The results of the regression analyses are presented in **Table 3-8** and Appendix B. In **Table 3-8**, the ranges of design, construction management, and project delivery costs as percentages of TCC shown are for the best-fit logarithmic trendline (i.e., performance model), not the range of corresponding data points.

The shape of most of the best-fit curves is consistent with what is intuitively expected. The dependent variable (i.e., design, construction management, or project delivery) has higher average values and greater scatter at the low values of TCC. This decrease in both average value and variability as TCC increases characterize the inverse relationship.

Because the R^2 values and, in many cases, the number of relevant data points are relatively low, the reader is cautioned that this table is to be used as a reference and not for prediction of performance. Readers are urged to review the curves in **Appendix B** in conjunction with using this table.

Regressions for some dependent variables (design, construction management, and project delivery cost) for the Restrooms, Sportfields, and Pump Stations classifications show a flat or direct (i.e., not inverse) relationship between the dependent variable and TCC. That is, as the TCC increased, the trendline sloped upwards. The relatively low number of data points overall, high scatter, and clustering of nearly all data points in the low end of the TCC range on each curve contribute to the trend.

The results of the analyses show that the R^2 values for regressions are improving in many cases with continued additions of data to the database and repetition of the outlier analyses.

The agencies theorized that one of the reasons R^2 values varied significantly by project type and classification is that there are differences in how different types of projects are delivered. Pipe and Municipal Facilities projects, for instance, were probably better-defined at the beginning of a project and thus allow for the design effort to be more focused. This would lead to more consistent performance and therefore higher R^2 values. They also observed that Construction Management exhibited higher variability in relative cost than Design for the same project types and classifications. This is probably due to the stronger influence of project-specific factors on the Construction Management costs than on Design costs.

In addition to regressions of design, construction management, and project

Table 3 -8 Summary of Performance Models

PROJECT TYPE / Project Classification	Range of TCC	N (Count of Projects)	Des. (% of TCC)	CM (% of TCC)	PD (% of TCC)
Grand Total		**698**			
Municipal Facilities		**127**			
Libraries		**42**			
	$2M<TCC<$3.5M	16	18% to 26%	17% to 28%	34% to 50%
	$3.5M<TCC<$4M	15	17% to 24%	15% to 21%	32% to 42%
	$4M<TCC<$9.5M	11	14% to 23%	5% to 19%	18% to 40%
Police/Fire Station		**27**			
	$0.2M<TCC<$1M	9	26% to 43%	15% to 21%	43% to 60%
	$1M<TCC<$15M	13	14% to 35%	14% to 20%	27% to 53%
	$15M<TCC<$33M	5	10% to 22%	13% to 18%	24% to 37%
Community Bldg/Rec Ctr/ Child Care/Gym		**58**			
	$0.2M<TCC<$1M	23	23% to 35%	15% to 21%	54% to 37%
	$1M<TCC<$2M	18	21% to 31%	14% to 20%	36% to 47%
	$2M<TCC<$8.5M	17	17% to 29%	13% to 19%	30% to 44%
Streets		**213**			
Widening/New/Grade Separation		**26**			
	$0.2M<TCC<$0.6M	9	33% to 48%	14% to 20%	45% to 64%
	$0.6M<TCC<$2M	9	26% to 43%	13% to 19%	39% to 57%
	$2M<TCC<$17.5M	8	17% to 37%	12% to 18%	27% to 52%
Bridge		**13**			
	$0.1M<TCC<$0.3M	5	70% to 120%	17% to 22%	85% to 135%
	$0.3M<TCC<$1.8M	4	34% to 100%	16% to 21%	50% to 115%
	$1.8M<TCC<$12M	4	1% to 67%	15% to 20%	10% to 80%
Reconstruction		**50**			
	$0.1M<TCC<$0.5M	14	23% to 33%	19% to 30%	41% to 58%
	$0.5M<TCC<$1M	21	22% to 30%	17% to 29%	39% to 53%
	$1M<TCC<$11.5M	15	18% to 28%	13% to 27%	31% to 51%
Bike/Pedestrian/Streetscape		**55**			
	$0.2M<TCC<$0.3M	22	27% to 45%	18% to 24%	45% to 65%
	$0.3M<TCC<$0.5M	12	23% to 37%	17% to 22%	40% to 56%
	$0.5M<TCC<$2.2M	21	12% to 33%	15% to 21%	26% to 52%

Notes: TCC = Total Construction Cost; Des. = Design Cost; CM = Construction Management Cost; and PD = Project Delivery Cost. The project delivery percentages indicated are the ranges between the logarithmic regression curve and upper bound of the 50 percent confidence interval for the respective ranges of TCC values. Values of project delivery percentages are not the sum of Design and Construction Management percentages; they are the result of regression analyses of data points using the least-squares method. Caution and review of the report text are urged in using this information. Refer to **Appendix B** for the corresponding regression curves, R^2 values, and N values for more details. Highlighted values indicate those for which R^2 values were particularly low, below 0.10.

Table 3 -8 Summary of Performance Models (cont'd)

PROJECT TYPE / Project Classification	Range of TCC	N (Count of Projects)	Des. (% of TCC)	CM (% of TCC)	PD (% of TCC)
Grand Total		**698**			
Streets		**127**			
Signals		**69**			
	$0.1M<TCC<$0.2M	25	18% to 26%	19% to 25%	37% to 45%
	$0.2M<TCC<$0.5M	27	16% to 25%	19% to 25%	36% to 44%
	$0.5M<TCC<$3M	17	17% to 24%	19% to 25%	35% to 43%
Pipes		**256**			
Gravity System		**218**			
	$0.1M<TCC<$0.5M	70	20% to 30%	18% to 26%	37% to 55%
	$0.5M<TCC<$1M	72	16% to 26%	17% to 24%	35% to 47%
	$1M<TCC<$10M	76	10% to 25%	14% to 23%	24% to 44%
Pressure Systems		**25**			
	$0.1M<TCC<$0.4M	7	15% to 23%	14% to 23%	29% to 45%
	$0.4M<TCC<$0.7M	8	14% to 21%	12% to 18%	26% to 37%
	$0.7M<TCC<$2.3M	10	13% to 19%	7% to 16%	20% to 34%
Pump Station		**13**			
	$0.2M<TCC<$0.8M	3	17% to 21%	12% to 17%	27% to 35%
	$0.8M<TCC<$4M	6	15% to 19%	12% to 17%	27% to 35%
	$4M<TCC<$22M	4	14% to 18%	12% to 17%	27% to 35%
Parks		**102**			
Playgrounds		**80**			
	$0.1M<TCC<$0.3M	27	22% to 29%	18% to 27%	40% to 53%
	$0.3M<TCC<$0.5M	25	20% to 27%	17% to 25%	36% to 47%
	$0.5M<TCC<$6M	28	15% to 26%	10% to 23%	25% to 45%
Sportfields		**9**			
	$0.3M<TCC<$0.5M	3	13% to 21%	17% to 23%	31% to 38%
	$0.5M<TCC<$1M	3	15% to 25%	14% to 22%	32% to 39%
	$1M<TCC<$6.5M	3	19% to 33%	8% to 19%	33% to 42%
Restrooms		**13**			
	$0.1M<TCC<$0.2M	5	17% to 24%	26% to 33%	45% to 54%
	$0.2M<TCC<$0.3M	5	19% to 26%	26% to 33%	46% to 55%
	$0.3M<TCC<$1.5M	3	20% to 30%	26% to 33%	47% to 58%

Notes: TCC = Total Construction Cost; Des. = Design Cost; CM = Construction Management Cost; and PD = Project Delivery Cost. The project delivery percentages indicated are the ranges between the logarithmic regression curve and upper bound of the 50 percent confidence interval for the respective ranges of TCC values. Values of project delivery percentages are not the sum of Design and Construction Management percentages; they are the result of regression analyses of data points using the least-squares method. Caution and review of the report text are urged in using this information. Refer to **Appendix B** for the corresponding regression curves, R^2 values, and N values for more details. Highlighted values indicate those for which R^2 values were particularly low, below 0.10.

delivery costs versus TCC, regressions of change orders as a percentage of TCC versus TCC were updated. Individual regressions were produced for each of the four project types. Please see these regression models in Appendix B.

The results were similar to those from the Update 2005 and Update 2006 analyses, with very low R^2 values. Also, there is more data scatter associated with smaller projects than with larger ones. In the *Update 2007* analyses, change orders averaged 10 percent of TCC for the municipal facilities and streets project types. Change orders averaged 4 to 10 percent for the pipes project type and for the parks project type.

The results of statistical significance tests indicate that additional data points are required for most of the performance models. A table summarizing the calculated p-values is included in Appendix B. Additional data points for models with p-values above 0.10 should improve (reduce) the p-value. For those models with p-values>0.10, the model should not be used alone to predict delivery costs for individual projects.

Increasing the size of the project database will continue to be a challenge since the *Study* criteria for project completion date rolls forward with each *Study* phase. In addition, the agencies also struggle to identify as many projects as possible that meet the rest of the *Study* criteria. The Project Team will identify and evaluate ways to address this issue as the *Study* continues in future phases.

F. SPECIAL STUDY: ALTERNATIVE PROJECT DELIVERY METHODS

The Project Team selected Alternative Project Delivery Methods as an area of Special *Study* in *Update 2007*. Two agencies delivered presentations during a quarterly Project Team meeting on their experiences with the Construction Manager (CM) At-Risk and Design-Build delivery methods in the form of case studies.

The City of Oakland presented information on its experience with CM At-Risk. The City of Oakland has used this method on two projects since the time it was allowed by ordinance in 2001.

The primary difference between this and traditional project delivery is that the CM's scope of work included involvement during design phase to provide feedback on constructability, schedule, and materials. The CM then prepares a bid for construction and, after negotiation, is selected as the general contractor during construction. It was noted that Owners may choose to act as or hire another CM to represent the Owner during construction.

The construction management fee associated with this project delivery method averaged about 15 percent of the construction bid. In the City of Oakland, the CM may not self-perform any construction work and must subcontract the construction itself. Change orders without time extensions were only approved for subcontractors' cost items. If a time extension was allowed, the CM's fee was increased based on the appropriate bid line item from the General Conditions. If the value of a change order exceeded 20 percent of the original contract, the CM's mark-up on costs was also added.

According to the City of Oakland, the advantages of the CM At-Risk project delivery method included:

- The project was phased using separate bid packages, enabling early starts on some components.
- Having a CM under contract during design allowed the design to be improved through early input.
- Shorter overall schedule compared to traditional design-bid-build process, in which the bid process can be lengthy.
- An improved final product was achieved by selecting CM based upon qualifications, not solely low bid.
- Better change order and overall cost control with more clear, firm price.
- Better relationship with CM who will then become the contractor on the project.
- Less risk overall to Owner than traditional design-bid-build, but more than design-build.

The City of San Diego delivered a case study presentation on its experience with the design-build project delivery method. They have two design-build projects currently underway. In this project delivery method, the Owner prepares "bridging documents" at the level of approximately 30 percent design completion. The design-builder then completes the design and construction simultaneously, allowing for feedback from construction activities to improve the design. The City of San Diego approved the use of design-build based upon the presumption that this delivery method would reduce the overall project duration, reduce costs, and increase the utilization of minority-owned businesses.

In actual implementation, the City of San Diego found that the project schedule does not seem to be shortened, but that the advantages include:

- Reduced cost escalation by obtaining construction bids earlier during high inflation environments
- Cost savings due to implementation of value engineering recommendations, and reductions in change orders and claims
- Increased utilization of minority-owned businesses
- Risk of errors in final design and risk in schedule slippage (in design, permitting, and construction) are the responsibility of the design-builder
- Better control of materials and substitutions
- Stronger partnership between the design-builder and City relationships, with proactive resolution of issues by the design-builder
- Reduced costs, schedule duration, and paperwork by City Staff

The City of San Diego shared the following concerns with this project delivery method:

- Too much or too little detail in bridging documents
- Inadequate contract duration allowed
- Inadequate time for Value Engineering and time to award contract
- Owner shares in risk when they approve design-builder plans and specifications
- Claims by the Owner due to design-builder errors or omissions
- Claims by the design-builder due to changes after approval of plans

G. SPECIAL STUDY: CONSTRUCTION COST UNIT PRICING

The Project Team was interested in exploring this issue to better understand how unit price differences among the agencies is driven by real cost inflation versus local market conditions. Additionally, they were seeking guidance on estimating costs for similar capital facilities.

This special study was on library projects because all of the agencies were able to provide recent data for projects in this classification and projects in this classification are fairly similar amongst agencies

The agencies provided data on these projects that included: construction costs, gross area of construction, award dates, change order amounts, and descriptions of the project. The *Study* Team adjusted all construction cost data using the appropriate Engineering News Record (ENR)'s 20-City Construction Cost Index (CCI) and performed regressions of cost per square foot versus gross area as well as TCC versus gross area. The results indicate that of the factors that drive the cost of construction (e.g., market conditions, building materials, ancillary facilities, special finishes, gross area), the gross area is clearly the most influential.

Regression curves of TCC versus gross area produced results with significantly higher R^2 values than those of cost per square foot, indicating that as much as 73% ($R^2 = 0.73$) of the variability in library TCC is explained by the gross area of the building. The R^2 value for regressions based on unadjusted data was about 0.66, indicating that only a small portion of the variability in TCC was driven by regional (local market) or chronological (escalation) factors. Unit costs were highly variable, most falling within $250/sqare foot and $450/ square foot. Since few projects were LEED (Leadership in Energy and Environmental Design) certified, no trend was observed in these data with regard to LEED certification. There are a number of existing resources available to agencies to develop construction cost estimates, and the importance of utilizing professional cost estimators familiar with local market influences (whether internal or external) cannot be overemphasized.

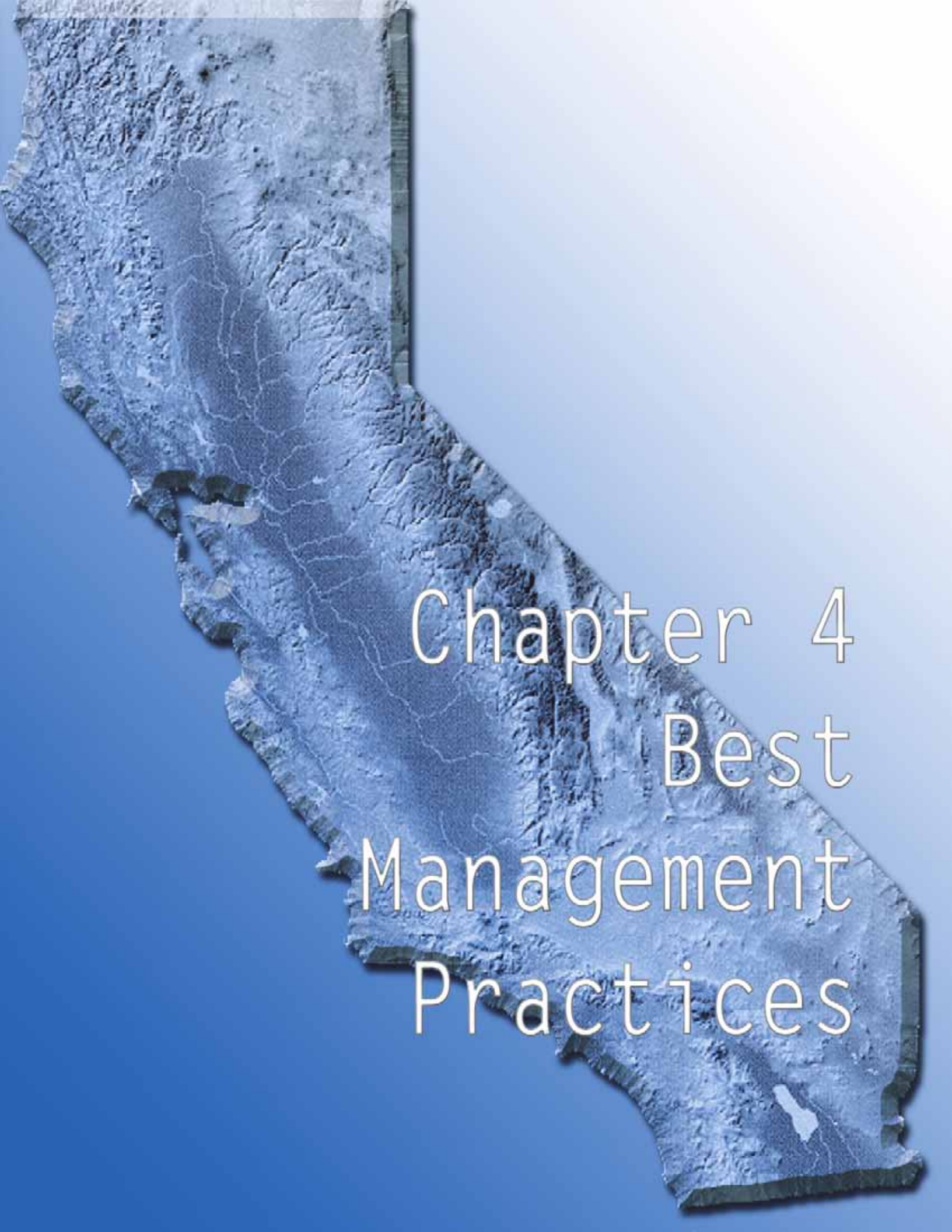
H. SPECIAL STUDY: REGIONAL AND CHRONOLOGICAL ADJUSTMENTS

In planning for *Update 2007*, the Project Team wished to study the influence of adjusting cost data for regional and chronological differences. The *Study* Team presented some information on regional and city price indexing, including historical trends and future projections.

ENR has indices available to adjust for regional differences among 20 cities in the United States, as well as chronological data, using their CCI, Building Cost Index (BCI), and Skilled Labor Index (SLI). An examination of the types of cost data collected in this *Study* indicated that while some adjustments of construction cost data could be made using the 20-City CCIs, adjustments to project delivery costs would be difficult. Data in this *Study* are not collected at a level of detail to support such adjustments.

I. CONSTRUCTION CONTRACT AWARD DATA

Design costs and construction award amounts for bid awards made by the participating agencies were collected for the period approximately covering July 1, 2005 to June 30, 2006. This was done so that the *Study* Team could anticipate the number of projects that would be submitted in future *Study* phases. Only projects that were expected to meet *Study* criteria were provided by the agencies. Together, the agencies awarded 177 projects with a total construction value of $680 million in the subject period. These projects meet *Study* criteria and the agencies anticipate adding them to the database in future years. The project sizes ranged from $100,000 in construction to nearly $74 million.



Chapter 4 Best Management Practices

CIP Benchmarking Study

CHAPTER 4 Best Management Practices

At the start of the Study, the agencies examined over 100 practices used in project delivery. They selected those practices to include in this Study that they did not already commonly use, but believed should be implemented as BMPs. Practices are also added annually by the agencies to address specific challenges they encounter or reflect new learnings by the participants. Agency implementation of these selected practices has been and will continue to be tracked during the Study. Seven new BMPs were added to the list this year. These BMPs are believed to directly influence the cost of either design or construction management and, ultimately, project delivery efficiency.

A. NEW BEST MANAGEMENT PRACTICES

In *Update 2007*, the Project Team added six new BMPs to the BMP implementation tracking list. The BMPs were developed addressing issues in the areas of permitting and environmental regulation compliance. These BMPs were:

1.g 2007: Make an early determination on which environmental documents are required and incorporate them into the schedule.

2.o 2007: Obtain independent cost estimates (outside of the designer) during the design process, inclusive of local market influences on complex projects.

3.III.k 2007: Establish a Utility Coordinating Committee with members from public and private entities.

3.III.l 2007: Designate a responsible person or group and establish a process of notifications and milestones for utility relocations.

5.III.h 2007: Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments.

5.IV.b 2007: Have a coordinator with expertise in the environmental process within the department delivering the engineering/capital project.

These BMPs are believed to directly influence the cost of either design or construction management and, ultimately, project delivery efficiency. It is anticipated that full implementation of the BMPs in the implementation list will improve project delivery performance.

B. DESCRIPTION OF BEST MANAGEMENT PRACTICES

The Study 2002 report included descriptions of the BMPs that the Project Team felt were most critical to improving project delivery performance. These descriptions, presented in **Table 4-1,** have been updated to reflect changes in interpretation of those BMPs, as well as additions since 2002 to the BMP list.

Table 4 -1 Description of Best Management Practices

Category	Ref:*	BMP	Description
Planning	1.a.	Define capital projects well with respect to scope and budget including community and client approval at the end of the planning phase.	Changes in project scope or budget increase both total construction cost and the cost of project delivery. The later these changes occur in the life of the project, the greater the increase. Reaching and documenting consensus with the community and the client will reduce changes after the project delivery process begins._
	1.b.	Complete Feasibility Studies on projects prior to defining budget and scope.	Feasibility studies should be completed early in the process so that issues are identified and either resolved or accommodated within the final definition of scope, budget, and project delivery schedule. This will also reduce overall project delivery costs. Early feasibility studies are particularly important on complex projects and projects with a construction budget greater than $5 million.
	1.d.	Utilize a Board/Council project prioritization system.	Departments responsible for project delivery have limited resources. A Board/Council priority system and priority designation for each project will ensure that resources are directed to the community's highest priorities.
	1.e.	Resource load all CIP projects for design and construction.	The resources required to deliver projects according to the master CIP schedule mandated by the Board/Council should become part of the CIP. This will facilitate defining performance measures and ensure that there is a common understanding of the resources required to deliver the CIP.
	1.f.	Include a Master Schedule in the CIP that identifies start and finish dates for projects.	A master schedule can be used to define resource needs and performance measures.
	1.i.	Show projects on a Geographical Information System.	Entering and tracking planned projects into a GIS which is available to all private and public sector project planners will reduce the potential for conflicts and re-work.

Table 4 -1 Description of Best Management Practices (cont'd)

Category	Ref:*	BMP	Description
	1.g 2007	Make an early determination on which environmental document is required and incorporate into the schedule.	Completing the environmental assessment and permitting process influences project schedules and costs. Establish a checklist of potential environmental and permit requirements and examine each project scope against the list early in the planning process.
Design	2.b.	Provide a detailed clear, precise scope, schedule, and budget to designers prior to design start.	Design professionals will work more efficiently if given a clear scope when contracted to provide the design services. Clear scope and budget should be defined in advance and made a part of the design professional's contract if/when a consultant is used.
	2.f.	Define requirements for reliability, maintenance, and operation prior to design initiation.	Reliability, maintenance, operational requirements, and standard materials and equipment should be clearly defined in advance, approved by the user/client, and included in the design professional's contract when a consultant is used.
	2.i.	Adapt successful designs to project sites, whenever possible (e.g. fire stations, gymnasiums, etc).	Successful designs of fire stations, police facilities, maintenance facilities, pump stations, and many other projects should be re-used when possible. Site adaptations of successful designs may reduce design costs by half.
	2.k. 2003	Train in-house staff to use Green Building Standards.	Communities have a stake in the environment as well as in the cost of operating and maintaining public facilities. Utilizing "Green Building Standards" allows facilities to be built and operated with renewable resources and other environmentally sound practices.
	2.l. 2004	Limit Scope Changes to early stages of design.	It is well known within the industry that the later a change occurs in the construction process, the more costly the change is. Avoid, whenever possible, and changes after the Design Development phase of design.

Table 4 -1 Description of Best Management Practices (cont'd)

Category	Ref:*	BMP	Description
Design	2.m. 2004	Require scope changes during design to be accompanied by budget and schedule approvals.	All scope changes after the initial definition within the design agreement will affect project delivery cost and therefore should be documented. Documentation should include an understanding and acceptance/approval by all stakeholders of the cost and time implications of any changes.
	2.n. 2006	Implement a rotating Request for Quote process for contracting small projects to streamline the bidding and award process during construction. (Include criteria for exemptions from formal Council approval.)	Smaller projects cost more (as a percentage of construction cost) to deliver. One way of reducing the cost of project delivery on small projects is to shorten the bid and award process by setting a threshold amount under which the delivery team may solicit and receive quotes from qualified contractors and award contracts without getting Board/Council prior approval.
	2.o 2007	Obtain independent cost estimates (outside of the designer) during the design process, inclusive of local market influences on complex projects.	Having to re-design and re-bid a project on which bids come in over budget can significantly impact project delivery cost. Accurate estimates at the end of each design phase, performed by unbiased, independent, qualified professionals with an understanding of local market conditions will reduce the potential for receiving unexpected bids.
Quality Assurance / Quality Control	3.I.a.	Develop and use a standardized Project Delivery Manual.	Standardized procedures streamline project design, bidding, and construction processes. Standardized design management procedures will reduce scope creep and delays in construction document preparation. During construction, standard procedures will reduce response times on RFIs, and add overall clarity and efficiency to the construction management process. Having a standard manual will also reduce the time necessary for project documentation training.
	3.II.b.	Perform a formal Value Engineering Study for projects larger than $1 million.	Value Engineering identifies life cycle costs of design elements included in a project and certain alternatives. While the cost of the value engineering process may initially add costs to project delivery, overall project costs will be reduced.

Table 4 -1 Description of Best Management Practices (cont'd)

Category	Ref:*	BMP	Description
Quality Assurance / Quality Control	3.III.a.	Use a formal Quality Management System.	Quality management should include all activities from the preparation of design documents through the closeout of construction. (Constructability reviews, independent cost estimates, classification and auditing of change orders, etc.) The implementation and tracking of quality control should be formalized on a checklist to ensure application.
	3.III.b	Perform and use post-project reviews to identify lessons learned.	Project Managers should develop formal post project reviews and identify lessons learned. These documents should be made available to PM's on projects of a similar scope and nature. This BMP will make future project management and delivery more efficient and cost effective.
	3.III.k 2007	Establish a Utility Coordinating Committee with members from public and private entities.	Regular meetings of a committee will establish a forum for ideas to improve the utility relocation process and thus improve project progress. Meetings will also be an opportunity for problem projects (relocations) to be discussed.
	3.III.l 2007	Designate a responsible person or group and establish a process of notifications and milestones for utility relocations.	Identifying a utility relocation specialist within the project delivery team who is familiar with the procedures and contacts within the public and private utility entities will improve communication and problem solving during design and construction.

Table 4 -1 Description of Best Management Practices (cont'd)

Category	Ref:*	BMP	Description
Construction Management	4.I.a.	Delegate authority to the City Engineer/Public Works Director or other departments to approve change orders to the contingency amount.	Change order work should be authorized as soon as is practically possible in order to avoid potential delays to critical work. Scheduling a significant change order for review and authorization by the Board may delay project progress, even though it may be within the contingency amount allowed in the project budget. Authorization of the City Engineer/Public Works Director to approve changes within the contingency budgeted for changes will ensure that critical changes are acted on promptly and that delays are minimized.
	4.I.m.	Classify types of change orders.	Classification of change orders into categories such as changed conditions, unforeseen conditions, owner requests, or design changes for owner use improves understanding of the project and lessons learned from the data may improve project delivery on similar projects.
	4.II.a.	Include a formal Dispute Resolution Procedure in all contract agreements.	Construction is acknowledged as a dispute prone industry. As such, it makes sense to provide options in the contract documents to avoid litigation and to expedite disputes resolution using alternatives to litigation.
	4.III.a.	Use a team building process for projects greater than $5 million.	Partnering is a team-building process that has a proven record of improving working relationships and production, and reducing claims and disputes on construction projects. It is one of several team-building processes that should be used in the interest of reducing conflict and facilitating project delivery.

Table 4 -1 Description of Best Management Practices (cont'd)

Category	Ref:*	BMP	Description
Construction Management	4.IV.a.	Involve the Construction Management Team prior to completion of design.	Experienced contractors and construction managers should be included in the design process to make designs more constructible and lower cost. Construction managers and contractors are frequently more experienced about the products and/or equipment as well as construction methods that are readily available. Their contributions to selections and decisions during the design process will facilitate construction procurement, means and methods.
	4.V.a. 2003	Delegate authority below Council to make contract awards under $1 million.	The time and costs of scheduling and presenting a Council or Board item can be saved and project starts can be expedited if awards on projects with budgets under $1 million can be awarded administratively.
	4.V.b 2003	Establish a pre-qualification process for contractors on large, complex projects.	Prequalification helps screen contractors for prior performance on similar projects, safety and financial capability thus reducing risk and, ultimately, project delivery cost.
	4.V.c 2003	Make bid documents available online.	Making bid documents available on line will reduce agency printing costs. It may also increase bidder participation by making documents easily available to a larger pool of potential bidders and subcontractors.
Project Management	5.I.f.	Assign a client representative to every project.	Client (end user) representation during the life of the project will expedite decisions on submittals, substitutions, and changes. Their involvement will also help determine intent and streamline the commissioning and occupancy process.
	5.II.a	Provide formal training for Project Managers on a regular basis.	Project Managers come to projects with varying degrees of skill and familiarity with agency procedures. Orientation and training will improve their ability to deliver the project on the intended schedule. It is also important that updated training is available at least on an annual basis.

Table 4 -1 Description of Best Management Practices (cont'd)

Category	Ref:*	BMP	Description
Project Management	5.I.j 2003	Create in-house project management team for small projects.	It has been documented that the cost of project delivery of small projects is a higher percentage of the construction cost. Establishing a project management team that specializes in smaller projects may lead to economies such as grouping similar projects during permitting and bidding thus reducing project delivery cost.
	5.I.k 2004	Institutionalize Project Manager performance and accountability.	Recognize that professional project management requires specific education, training, and experience. Provide for PMI, CCM, or other formal training and certification and establish performance measures for project delivery personnel.
	5.II.d 2006	Implement verification procedures to ensure that PM training includes agency policies, procedures, forms, and standards of practice (scheduling, budgeting, claims avoidance, risk analysis, etc).	The success of a project is influenced significantly by the education and skills of the project manager. Agencies should verify that PM's know and use the tools available within an agency and that they are current with industry practices.
	5.III.a.	Adopt and use a Project Control System on all projects.	A web-based project control system will improve collaboration and documentation during the design and construction process. Questions, answers, proposals, and decisions can be expedited using a collaborative system.
	5.III.e 2006	Implement a financial system that tracks expenditures by category to monitor project hard and soft costs during project delivery.	It is recommended that a system that identifies actual expenditures against planned budgets be made available to project managers to be used as a performance measurement tool.
	5.III.f 2006	Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables.	Getting accurate data on the cost of project delivery depends upon being able to capture and classify expenses to the phases of construction on each project. Ideally, costs would be identified by each of five project delivery phases and coded to particular milestones or deliverables.

Table 4 -1 Description of Best Management Practices (cont'd)

Category	Ref:*	BMP	Description
Project Management	5.III.g 2006	Monitor "earned value" versus budgeted and actual expenditures during project delivery.	Soft costs "burn rate" should be proportionate to percent complete during the design and construction phases. Using a program which measures and relates soft cost expenses to earned values permits better tracking and control during project delivery.
	5.III.h 2007	Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments.	Prolonged ROW acquisition can be avoided if all stakeholders agree on milestones to complete the acquisitions. _
	5.IV.a 2006	Bundle small projects whenever possible.	Bundling small projects so that they are designed, bid, and constructed together will reduce project delivery cost proportionately._
	5.IV.b 2007	Have a coordinator with expertise in the environmental process within the department delivering the engineering/capital project.	Identifying an environmental specialist within the project delivery team who is familiar with procedures and contacts within the approving entities will reduce permit procurement time and costs.
Consultant Selection and Use	6.c.	Include a standard consultant contract in the RFQ/RFP with an indemnification clause.	The negotiation of the design contract can be expedited if the consultant understands and agrees to the conditions of the contract at the time a proposal is submitted.
	6.e.	Delegate authority to the Public Works Director/City Engineer to approve consultant contracts under $250,000 when a formal RFP selection process is used.	Authorization for the Public Works Director/City Engineer to award consulting contracts ensures earlier start of design and construction management activities and will reduce consultant selection process costs.
	6.g.	Implement and use a consultant rating system that identifies quality of consultant performance.	The performance of consultants should be tracked so that those who deliver quality services at reasonable costs can be adequately considered for future awards.
Consultant Selection and Use	6.m 2006	Implement as-needed, rotating, or on-call contracts for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects.	Establishing an on-call list of qualified consultants with expertise in a variety of design disciplines will expedite the start of the design process.

C. PROGRESS ON BEST MANAGEMENT PRACTICE IMPLEMENTATION

To support the linking of BMPs to performance improvements, BMP implementation has been tracked and project completion dates have been collected on the Performance Questionnaire. It is anticipated that the performance data will eventually demonstrate that as BMPs are implemented, project delivery costs were reduced. However, it is recognized that "processes" become effective "practices" only after a learning curve and full implementation on projects. Therefore, obtaining empirical evidence of this trend is expected to take several years.

In *Update 2007*, the agencies continued to exchange ideas regarding strategies for implementing various BMPs using both the networking opportunities at the quarterly meetings and the online discussion forum. BMPs targeted for future implementation and progress on actual BMP implementation since the last Study update are summarized below. The agencies have continued to pursue full implementation of BMPs. As of *Update 2007*, the agencies have fully implemented more than 70 percent of all BMPs.

I. City of Los Angeles

Implemented from June 2006 to May 2007:

- 1.g 2007 Make an early determination on which environmental document is required and incorporate into the schedule.
- 2.n. 2006 Implement a rotating Request for Quote process for contracting small projects to streamline the bidding and award process during construction. (Include criteria for exemptions from formal Council approval.)
- 3.III.l 2007 Designate a responsible person or group and establish a process of notifications and milestones for utility relocations.
- 5.IV.b 2007 Have a coordinator with expertise in the environmental process within the department delivering the engineering/capital project.

Targeted June 2007 Onward:

- 4.V.c 2003 Make bid documents available online.
- 5.III.f 2006 Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables.
- 5.III.g 2006 Monitor "earned value" versus budgeted and actual expenditures during project delivery.
- 5.III.h 2007 Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments.

II. City of Long Beach

Implemented from June 2006 to May 2007:

- 1.g 2007 Make an early determination on which environmental document is required and incorporate into the schedule.

- 5.III.e 2006 Implement a financial system that tracks expenditures by category to monitor project hard and soft costs during project delivery.

- 5.III.f 2006 Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables.

- 6.m 2006 Implement as-needed, rotating, or on-call contracts for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects.

Targeted June 2007 Onward:

- 3.I.a. Develop and use a standardized Project Delivery Manual.

- 3.III.a. Use a formal Quality Management System.

- 3.III.b Perform and use post-project reviews to identify lessons learned.

- 6.g. Implement and use a consultant rating system that identifies quality of consultant performance.

III. City of Oakland

Implemented from June 2006 to May 2007:

- 1.g 2007 Make an early determination on which environmental document is required and incorporate into the schedule.

- 3.I.a. Develop and use a standardized Project Delivery Manual.

- 3.III.k 2007 Establish a Utility Coordinating Committee with members from public and private entities.

- 5.II.d 2006 Implement verification procedures to ensure that PM training includes agency policies, procedures, forms, and standards of practice (scheduling, budgeting, claims avoidance, risk analysis, etc).

- 5.III.f 2006 Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables.

- 5.III.g 2006 Monitor "earned value" versus budgeted and actual expenditures during project delivery.

- 5.IV.a 2006 Bundle small projects whenever possible.

Targeted June 2007 Onward:

- 1.d. Utilize a Board/Council project prioritization system.

- 1.i. Show projects on a Geographical Information System.

- 2.m. 2004 Require scope changes during design to be accompanied by budget and schedule approvals.

- 2.n. 2006 Implement a rotating Request for Quote process for contracting small projects to streamline the bidding and award process during construction. (Include criteria for exemptions from formal Council approval.)

- 3.III.l 2007 Designate a responsible person or group and establish a process of notifications and milestones for utility relocations.

- 5.I.k 2004 Institutionalize Project Manager performance and accountability.

- .III.h 2007 Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments.

IV. City of Sacramento

Implemented from June 2006 to May 2007:

Department of General Services

- 1.e. Resource load all CIP projects for design and construction.

- 2.m. 2004 Require scope changes during design to be accompanied by budget and schedule approvals.

- 4.IV.a. Involve the Construction Management Team prior to completion of design.

- 5.I.k 2004 Institutionalize Project Manager performance and accountability.

- 5.III.e 2006 Implement a financial system that tracks expenditures by category to monitor project hard and soft costs during project delivery.

- 6.m 2006 Implement as-needed, rotating, or on-call contracts for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects.

Department of Transportation

- 1.g 2007 Make an early determination on which environmental document is required and incorporate into the schedule.

- 1.i. Show projects on a Geographical Information System.

- 3.I.a. Develop and use a standardized Project Delivery Manual.

- 3.III.k 2007 Establish a Utility Coordinating Committee with members from public and private entities.

- 5.II.a Provide formal training for Project Managers on a regular basis.

- 5.II.d 2006 Implement verification procedures to ensure that PM training includes agency policies, procedures, forms, and standards of practice (scheduling, budgeting, claims avoidance, risk analysis, etc).

- 5.III.e 2006 Implement a financial system that tracks expenditures by category to monitor project hard and soft costs during project delivery.

Department of Utilities

- 1.a. Define capital projects well with respect to scope and budget including community and client approval at the end of the planning phase.

- 1.b. Complete Feasibility Studies on projects prior to defining budget and scope.

Targeted June 2007 Onward:

Department of General Services

- 1.d. Utilize a Board/Council project prioritization system.

- 1.g 2007 Make an early determination on which environmental document is required and incorporate into the schedule.

- 2.f. Define requirements for reliability, maintenance, and operation prior to design initiation.

- 2.n. 2006 Implement a rotating Request for Quote process for contracting small projects to streamline the bidding and award process during construction. (Include criteria for exemptions from formal Council approval.)

- 5.III.f 2006 Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables.

- 5.III.g 2006 Monitor "earned value" versus budgeted and actual expenditures during project delivery.

Department of Transportation

- 3.III.l 2007 Designate a responsible person or group and establish a process of notifications and milestones for utility relocations.

- 4.V.c 2003 Make bid documents available online.

- 5.I.k 2004 Institutionalize Project Manager performance and accountability.

- 5.III.f 2006 Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables.

- 5.III.g 2006 Monitor "earned value" versus budgeted and actual expenditures during project delivery.

- 5.III.h 2007 Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments.

Department of Utilities

- 4.V.c 2003 Make bid documents available online.

- 5.III.e 2006 Implement a financial system that tracks expenditures by category to monitor project hard and soft costs during project delivery.

V. City of San Diego

Implemented from June 2006 to May 2007:

- 1.d. Utilize a Board/Council project prioritization system.
- 1.g 2007 Make an early determination on which environmental document is required and incorporate into the schedule.
- 2.n. 2006 Implement a rotating Request for Quote process for contracting small projects to streamline the bidding and award process during construction. (Include criteria for exemptions from formal Council approval.)
- 3.III.k 2007 Establish a Utility Coordinating Committee with members from public and private entities.
- 4.I.m. Classify types of change orders.
- 4.V.c 2003 Make bid documents available online.
- 5.IV.b 2007 Have a coordinator with expertise in the environmental process within the department delivering the engineering/ capital project.

Targeted June 2007 Onward:

- 1.e. Resource load all CIP projects for design and construction.
- 3.I.a. Develop and use a standardized Project Delivery Manual.
- 3.III.l 2007 Designate a responsible person or group and establish a process of notifications and milestones for utility relocations.
- 5.I.j 2003 Create in-house project management team for small projects.
- 5.I.k 2004 Institutionalize Project Manager performance and accountability.
- 5.III.e 2006 Implement a financial system that tracks expenditures by category to monitor project hard and soft costs during project delivery.
- 5.III.g 2006 Monitor “earned value” versus budgeted and actual expenditures during project delivery.

VI. City and County of San Francisco

Implemented from June 2006 to May 2007:

- 1.g 2007 Make an early determination on which environmental document is required and incorporate into the schedule.
- 2.n. 2006 Implement a rotating Request for Quote process for contracting small projects to streamline the bidding and award process during construction. (Include criteria for exemptions from formal Council approval.)
- 3.III.k 2007 Establish a Utility Coordinating Committee with members from public and private entities.
- 3.III.l 2007 Designate a responsible person or group and establish a process of notifications and milestones for utility relocations.
- 5.IV.b 2007 Have a coordinator with expertise in the environmental process within the department delivering the engineering/ capital project.

Targeted June 2007 Onward:

- .l. 2004 Limit Scope Changes to early stages of design.
- 2.m. 2004 Require scope changes during design to be accompanied by budget and schedule approvals.

VII. City of San Jose

Implemented from June 2006 to May 2007:

- 1.g 2007 Make an early determination on which environmental document is required and incorporate into the schedule.
- 4.I.m. Classify types of change orders.
- 5.III.h 2007 Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments.

Targeted June 2007 Onward:

- 3.III.a. Use a formal Quality Management System.
- 3.III.k 2007 Establish a Utility Coordinating Committee with members from public and private entities.
- 3.III.l 2007 Designate a responsible person or group and establish a process of notifications and milestones for utility relocations.
- 5.I.k 2004 Institutionalize Project Manager performance and accountability.
- 5.II.a Provide formal training for Project Managers on a regular basis.

- 5.II.d 2006 Implement verification procedures to ensure that PM training includes agency policies, procedures, forms, and standards of practice (scheduling, budgeting, claims avoidance, risk analysis, etc).

- 5.III.f 2006 Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables.

- 5.III.g 2006 Monitor "earned value" versus budgeted and actual expenditures during project delivery.

- 5.IV.b 2007 Have a coordinator with expertise in the environmental process within the

Targeted June 2007 Onward:

- 3.III.a. Use a formal Quality Management System.

- 3.III.k 2007 Establish a Utility Coordinating Committee with members from public and private entities.

- 3.III.l 2007 Designate a responsible person or group and establish a process of notifications and milestones for utility relocations.

- 5.I.k 2004 Institutionalize Project Manager performance and accountability.

- 5.II.a Provide formal training for Project Managers on a regular basis.

- 5.II.d 2006 Implement verification procedures to ensure that PM training includes agency policies, procedures, forms, and standards of practice (scheduling, budgeting, claims avoidance, risk analysis, etc).

- 5.III.f 2006 Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables.

- 5.III.g 2006 Monitor "earned value" versus budgeted and actual expenditures during project delivery.

- 5.IV.b 2007 Have a coordinator with expertise in the environmental process within the department delivering the engineering/capital project.

- 6.e. Delegate authority to the Public Works Director/City Engineer to approve consultant contracts under $250,000 when a formal RFP selection process is used.

- 6.g. Implement and use a consultant rating system that identifies quality of consultant performance.

Table 4-2 summarizes the BMPs that have been implemented by the participating agencies, as well as the planned implementation priorities.

Table 4 -2 Implementation of Best Management Practices

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Planning	1.a.	Define capital projects well with respect to scope and budget including community and client approval at the end of the planning phase.	✓	✓	✓	✓	✓	✓	TBD	✓	✓	SC DU: Community involved after project is better-defined, typically at 30% design. SD: Some Divisions only
	1.b.	Complete Feasibility Studies on projects prior to defining budget and scope.	✓	✓	✓	✓	✓	✓	TBD	✓	✓	LB: When applicable SC DU: Only on complex projects that require a Feasibility Study SD: Result of CIP Benchmarking SF: When applicable SJ: Some exceptions

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✓: Implemented
PI: Partially implemented
NI: No plans to implement at this time
TBD: To be determined
yyyy: Will be implemented in calendar year "yyyy"
* See Process Questionnaire in Appendix C of 2002 Report; year noted indicates this BMP was added later.

Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Planning	1.d.	Utilize a Board/Council project prioritization system.	✓	NI	PI, yyyy	PI, 2008	✓	TBD	✓	NI	NI	LA: Council allows Streets, Bridges and Stormwater programs a project priority system. SC DU: Getting closer to approved Asset Mgt system that would facilitate this BMP, but project drivers vary (permit requirements, projects in other departments, etc) SD: Result of CIP Benchmarking
	1.e.	Resource load all CIP projects for design and construction.	✓	TBD	✓	✓	✓	NI	PI, 2008	NI	✓	LB: Software in development. SC DU: Estimate drafting only. SD: Result of CIP Benchmarking

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Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Planning	1.f.	Include a Master Schedule in the CIP that identifies start and finish dates for projects.	✓	✓	✓	✓	✓	✓	TBD	NI	✓	LB: Software in development. SC DU: Completion date only estimated, not determined by scheduling analysis.
Planning	1.g 2007	Make an early determination on which environmental document is required and incorporate into the schedule.	✓	✓	✓	2008	✓	✓	✓	✓	✓	
	1.i.	Show projects on a Geographical Information System.	✓	✓	PI, 2008	✓	✓	✓	✓	✓	✓	LB: Infrastructure only

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Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Design	2.b.	Provide a detailed clear, precise scope, schedule, and budget to designers prior to design start.	✓	✓	✓	✓	✓	✓	TBD	✓	✓	SC DU: General scope only for simple projects.
	2.f.	Define requirements for reliability, maintenance, and operation prior to design initiation.	✓	✓	NI	PI, 2008	✓	NI	✓	✓	✓	SD: Some Divisions only
	2.i.	Adapt successful designs to project sites, whenever possible (e.g. fire stations, gymnasiums, etc).	✓	✓	✓	✓	✓	✓	NI	✓	✓	SC DU: This is key to low delivery costs. Std special provisions are updated continuously for lessons learned, new requirements, changing technology, etc. SD: Some Divisions only, where applicable

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yyyy: Will be implemented in calendar year "yyyy"
* See Process Questionnaire in Appendix C of 2002 Report; year noted indicates this BMP was added later.

Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Design	2.k. 2003	Train in-house staff to use Green Building Standards.	✓	TBD	✓	✓	NI	✓	✓	✓	✓	This BMP is intended to improve client satisfaction (quality) and may not reduce project delivery cost directly. SF: When applicable
	2.l. 2004	Limit Scope Changes to early stages of design.	✓	✓	✓	✓	✓	✓	✓	2008	✓	SC DU: Control and minimize, but difficult to eliminate, since clients and engineers come
	2.m. 2004	Require scope changes during design to be accompanied by budget and schedule approvals.	✓	✓	PI, 2008	✓	✓	NI	✓	2008	✓	

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Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Design	2.n. 2006	Implement a rotating Request for Quote process for contracting small projects to streamline the bidding and award process during construction. (Include criteria for exemptions from formal Council approval.)	✓	✓	PI, 2008	PI, 2008	NI	NI	✓	✓	✓	SC DT: Maintains on-call consultant list for various engineering, traffic, landscape, architecture, and geotechnical services. SF: As-needed job order contracting (JOC)
	2.o 2007	Obtain an independent cost estimate, inclusive of local market influences, on projects	TBD	PI, TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	

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TBD: To be determined
yyyy: Will be implemented in calendar year "yyyy"
* See Process Questionnaire in Appendix C of 2002 Report; year noted indicates this BMP was added later.

Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Quality Assurance/ Quality Control	3.I.a.	Develop and use a standardized Project Delivery Manual.	✓	PI, 2009	✓	✓	✓	✓	PI, 2009	✓	✓	SC DU: Badly needs updating. SD: incorporated into PM training manual and std Primavera schedule template/descr. Details available as needed.
	3.II.b.	Perform a formal Value Engineering Study for projects larger than $1 million.	✓	✓	NI	✓	✓	✓	✓	✓	✓	LA: For projects > $10M LB: As needed SC: As needed
	3.III.a.	Use a formal Quality Management System.	✓	PI, 2009	NI	✓	✓	NI	✓	✓	2008	SD: Some Divisions only

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Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Quality Assurance/ Quality Control	3.III.b	Perform and use post-project reviews to identify lessons learned.	✓	2009	✓	✓	✓	✓	✓	✓	✓	SC DU: For selected projects in one-on-one meetings with design and construction staff. Also includes feedback from client. Intended to promote candid discussion.
	3.III.k 2007	Establish a Utility Coordinating Committee with members from public and private entities.	PI	PI	✓	NI	✓	✓	✓	✓	2008	SC DGS: Not Applicable

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Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Quality Assurance/ Quality Control	3.III.I 2007	Designate a responsible person or group and establish a process of notifications and milestones for utility relocations.	✓	NI	2008	NI	2008	✓	2008	✓	2008	
Construction Management	4.I.a.	Delegate authority to the City Engineer/Public Works Director or other departments to approve change orders to the contingency amount.	✓	✓	✓	NI	NI	✓	✓	✓	✓	SD: Individual CO < $200,000 SF: At Bureau level SJ: Individual CO < $100,000
	4.I.m.	Classify types of change orders.	✓	✓	✓	✓	✓	✓	✓	✓	✓	LA: Draft Special Order prepared.
	4.II.a.	Include a formal Dispute Resolution Procedure in all contract agreements.	✓	NI	✓	✓	✓	NI	✓	✓	✓	SJ: For projects > $10 M

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Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Construction Management	4.III.a.	Use a team building process for projects greater than $5 million.	✓	✓	✓	✓	✓	NI	✓	✓	✓	LB: As-needed SD: As-needed SF: As-needed SJ: For projects > $10 M
	4.IV.a.	Involve the Construction Management Team prior to completion of design.	✓	✓	✓	✓	✓	✓	✓	✓	✓	SD: Some Divisions only
	4.V.a. 2003	Delegate authority below Council to make contract awards under $1 million.	✓	✓	NI	NI	NI	NI	✓	✓	✓	
	4.V.b 2003	Establish a pre-qualification process for contractors on large, complex projects.	✓	NI	✓	✓	NI	✓	✓	✓	✓	

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Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Construction Management	4.V.c 2003	Make bid documents available online.	2008	✓	TBD	✓	PI, 2008	PI, 2008	✓	TBD	✓	LA: Not enough bids to make this useful. Resistance from smaller contractors who do not use the internet to conduct business.
Project Management	5.I.f.	Assign a client representative to every project.	✓	✓	✓	✓	2008	✓	TBD	✓	✓	SD: Only for large projects
	5.I.j 2003	Create in-house project management team for small projects.	NI	NI	✓	✓	NI	NI	PI, 2008	NI	✓	SC DU: Not enough PMs to justify this. Don't want to restrict staff to small, less-rewarding projects. SD: Some Divisions only
	5.I.k 2004	Institutionalize Project Manager performance and accountability.	✓	2006	PI, 2008	✓	PI, 2008	NI	PI, 2009	TBD	PI, 2008	SC DU: There is interest but no definite plan. SD: Only non-standardized goals

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Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Project Management	5.II.a	Provide formal training for Project Managers on a regular basis.	✓	TBD	✓	✓	✓	NI	✓	✓	PI, 2008	LB: Program implementation put on hold due to budget cuts SD: Yearly PM academy, as funds allow
	5.II.d 2006	Implement verification procedures to ensure that PM training includes agency policies, procedures, forms, and standards of practice (scheduling, budgeting, claims avoidance, risk analysis, etc).	✓	TBD	✓	✓	✓	NI	TBD	TBD	2008	
	5.III.a.	Adopt and use a Project Control System on all projects.	✓	✓	✓	✓	✓	NI	✓	✓	✓	SD: Project controls incorporated into Primavera schedule

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PI: Partially implemented
NI: No plans to implement at this time
TBD: To be determined
yyyy: Will be implemented in calendar year "yyyy"
* See Process Questionnaire in Appendix C of 2002 Report; year noted indicates this BMP was added later.

Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Project Management	5.III.e 2006	Implement a financial system that tracks expenditures by category to monitor project hard and soft costs during project delivery.	✓	✓	✓	✓	✓	PI, 2007	2009	✓	✓	LA: UPRS, Reports, Page 3 SC DT: Will complete automated report system by 2006. SC DU: Intend to utilize SC DT's software if it proves to function well with our PM Database.
	5.III.f 2006	Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables.	2008	✓	✓	PI, 2009	PI, 2009	NI	✓	TBD	PI, 2008	SC DT: Working to/ Update: Provide Microsoft Project to all Project Managers and produce schedules with tasks/sub-task schedules

Key:
LA: Los Angeles; LB: Long Beach; OK: Oakland; SC: Sacramento (DGS: Department of General Services, DT: Department of Transportation, DU: Department of Utilities), SD: San Diego, SF: San Francisco, and SJ: San Jose
✓: Implemented
PI: Partially implemented
NI: No plans to implement at this time
TBD: To be determined
yyyy: Will be implemented in calendar year "yyyy"
* See Process Questionnaire in Appendix C of 2002 Report; year noted indicates this BMP was added later.

Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Project Management	5.III.g 2006	Monitor "earned value" versus budgeted and actual expenditures during project delivery.	2008	NI	✓	PI, 2008	PI, 2009	NI	PI, 2009	TBD	2008	
	5.III.h 2007	Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments.	PI, 2008	TBD	2008	NI	PI, 2008	PI, 2008	TBD	NI	✓	
	5.IV.a 2006	Bundle small projects whenever possible.	✓	NI	✓	✓	✓	✓	✓	✓	✓	

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Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Project Management	5.IV.b 2007	Have a coordinator with expertise in the environmental process within the department delivering the engineering/capital project.	✓	NI	NI	NI	NI	NI	✓	✓	PI, 2008	
Consultant Selection and Use	6.c.	Include a standard consultant contract in the RFQ/RFP with an indemnification clause.	✓	✓	✓	✓	✓	NI	✓	✓	✓	SD: Some Divisions only

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Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Consultant Selection and Use	6.e.	Delegate authority to the Public Works Director/City Engineer to approve consultant contracts under $250,000 when a formal RFP selection process is used.	NI	NI	NI	NI	NI	NI	✓	✓	2007	SC DU: Threshold is $100,000.
	6.g.	Implement and use a consultant rating system that identifies quality of consultant performance.	✓	2008	✓	✓	NI	✓	✓	✓	PI	SC DU: Track performance for those selected for "support services." SJ: Need to incorporate more post-project review.

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Table 4 -2 Implementation of Best Management Practices (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Consultant Selection and Use	6.m 2006	Implement as-needed, rotating, or on-call contracts for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects.	✓	✓	✓	✓	✓	✓	✓	✓	✓	

Key:
LA: Los Angeles; LB: Long Beach; OK: Oakland; SC: Sacramento (DGS: Department of General Services, DT: Department of Transportation, DU: Department of Utilities), SD: San Diego, SF: San Francisco, and SJ: San Jose
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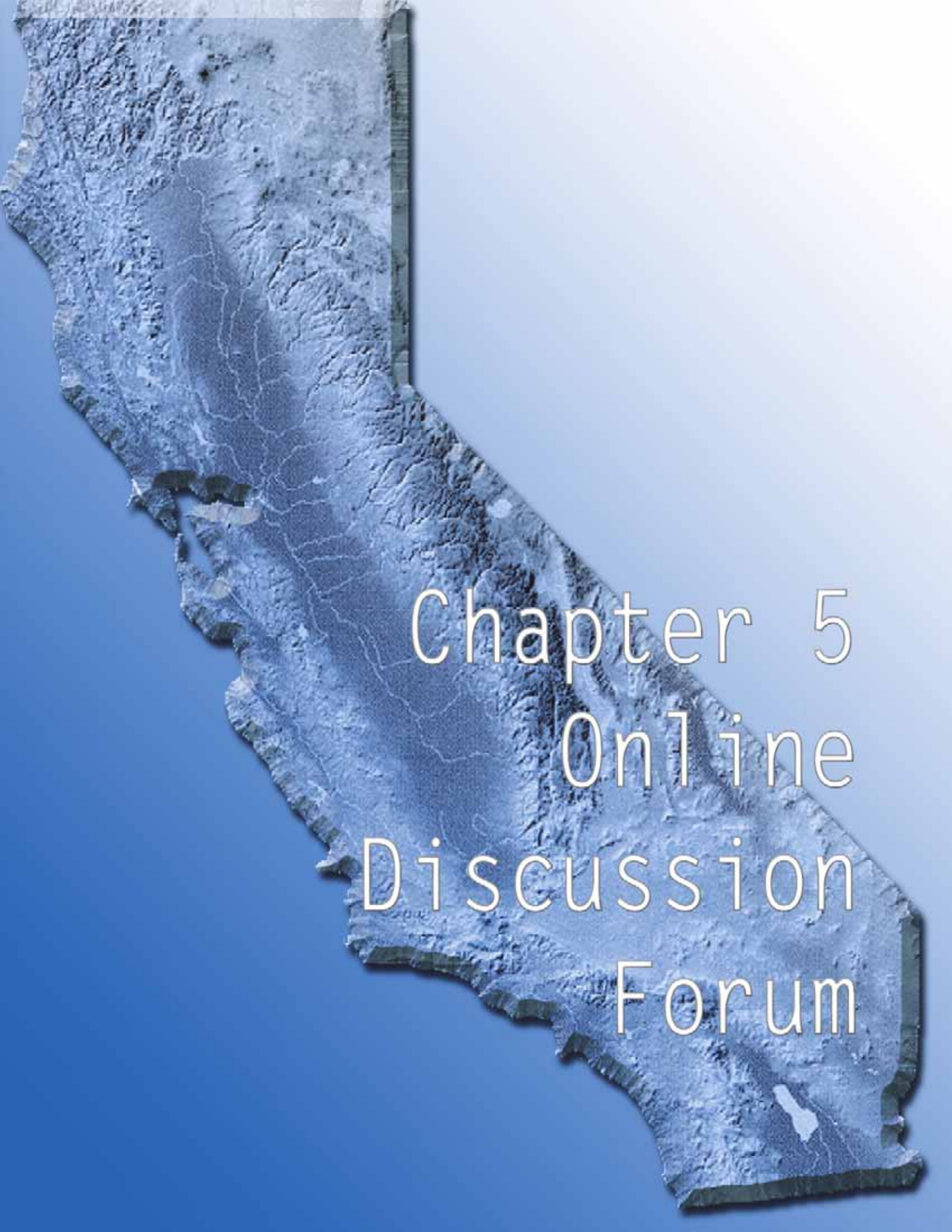


Chapter 5
Online Discussion Forum

CIP Benchmarking Study

CHAPTER 5 Online Discussion Forum

One of the benefits most appreciated by the Project Team is the ability to share issues or concerns in an established forum. Issues discussed in the online discussion forum in *Update 2007* include the following:

- Consultant Contract Indemnification Clauses
- LEED Policy
- Professional Services Procurement Process
- Handicapped Parking
- Consultant Performance Targets for Change Orders
- Bid Rejection and Negotiation
- Consultant Rating Systems
- Criteria and Standards for Right Turn Lanes
- Prevailing Wages
- Sidewalk Repairs
- Construction Cost Estimating by Consultants

A. CONSULTANT CONTRACT INDEMNIFICATION CLAUSES

The passage of Assembly Bill 573 (AB573) by the California Legislature stimulated discussions among the agencies about contract language regarding indemnification. In short, AB573 prohibits public agencies from requiring design professionals (defined as architects, landscape architects, engineers, and land surveyors) to be responsible for the negligence and errors of other parties. Liability for design professionals' own work remains unaltered.

The City of Oakland updated their indemnification clause as a result of AB573. The original clause required the consultant to indemnify the City for claims resulting in any way for work performed "in connection with the contract." The new language replaced that phrase with "arising out of, pertaining to, or relating to the negligence, recklessness, or willful misconduct of the consultant." The Project Team agreed that this approach to a revision appeared to best and clearly address the need to go from broad to narrow language for consultant contracts.

The City of San Diego had been experiencing contention between consultants and the City Attorney's interpretation of AB573. The City of San Diego's contract clause included the following language:

> "6.1 Indemnification. To the fullest extent permitted by law (including, without limitation, California Civil Code Section 2782.8), Design Professional shall defend (with legal counsel reasonably acceptable to the City), indemnify and hold harmless the City and its officers, agents, departments, officials, representatives and employees from and against all claims, losses, costs, damages, injuries (including, without limitation, injury to or

death of an employee of Design Professional or its Subcontractors), expense and liability of every kind, The provisions of this Article 6 are not limited by the provisions of Section 4.3 related to insurance.

6.2 Enforcement Costs. The Design Professional agrees to pay any and all costs the City incurs enforcing the indemnity and defense provisions set forth in Section 6.1."

The City of San Jose had and continues to use the following clause without issues from the consultant community:

"Section A. INDEMNIFICATIONS

Consultant shall defend, indemnify and hold harmless City, its officers, employees and agents against any claim, loss or liability arising out of or resulting in any way from work performed under this Agreement due to the willful or negligent acts (active or passive) or omissions by Consultant's officers, employees, or agents. The acceptance of said services and duties by City shall not operate as a waiver of such right of indemnification."

The City Attorney's Office and the Risk Manager for the City of Los Angeles reviewed AB 573 and agreed that their current standard indemnification language for personal services contracts did not require any changes. The language is:

"12.1 INDEMNIFICATION

Except for the active negligence or willful misconduct of CITY, or any of its Boards, Officers, Agents, Employees, Assigns and Successors in Interest, CONSULTANT undertakes and agrees to defend, indemnify and hold harmless CITY and any of its Boards, Officers, Agents, Employees, Assigns and Successors in Interest from and against all suits and causes of action, claims, losses, demands and expenses, including, but not limited to, attorney's fees and cost of litigation, damage or liability of any nature whatsoever, for death or injury to any person, including CONSULTANT's employees and agents, or damage or destruction of any property of either party hereto or of third parties, arising in any manner by reason of the negligent acts, errors, omissions or willful misconduct incident to the performance of this Contract on the part of CONSULTANT or its sub-consultants of any tier. The provisions of this paragraph shall survive termination of this Contract."

The City of Sacramento implemented new language related to indemnifications effective January 1, 2007. The main change was to liability language that the City of Sacramento now avoids placing on the consultant as follows:

"...provided that the foregoing indemnity does not apply to liability for damages for death or bodily injury to persons, injury to property, or other loss, damage or expense to the extent

> arising from (i) the sole negligence or willful misconduct of, or defects in design furnished by, City, its agents, servants, or independent contractors who are directly responsible to City, or (ii) the active negligence of the City."

Following the passage of AB573, San Francisco's City Attorney's Office crafted language that included a limitation on consultant liability as follows:

> "The Architect's indemnification obligations of claims involving 'Professional Liability' (claims involving acts, errors or omissions in the rendering of professional services) and 'Economic Loss Only' (claims involving economic loss which are not connected with bodily injury or physical damage to property) shall be limited to the extent of the Architect's negligence or other breach of duty."

The City of Long Beach made changes in their standard indemnity clause which narrowed the application of indemnification to those claims resulting from "any negligent act or omission of Consultant …..or anyone under Consultant's control."

B. LEED POLICY

The City of San Jose initiated a survey of the approaches taken by the participating agencies on LEED policy. Five of the seven participating agencies responded with information about their LEED policies. **Table 5-1** summarizes the agencies' responses to the first survey and **Table 5-2** summarizes the agencies' responses to a second survey.

Table 5 -1 City of San Jose's LEED Policy Survey – Part I

Questions	1. Do you have a Green Building Policy in place, and, if so, what is it?	2. If LEED certification is required, how is the budgeting for this handled?	3. If LEED certification is required are there any measures in place to make contractors comply with all submittal requirements within a certain time frame?	4. If you are following a system other than the USGBC, what is it? Was this developed in-house? What measures ensure that the requisite reviews and verification are taking place?
City of Oakland	Yes. We require LEED Silver certification for building projects with construction costs over $3 million.	No special funding is allocation fro green building projects. However, StopWaste.org of Alameda County often provides small grants and technical support on the green building projects.	The general LEED submittal requirements are included in Division 1 of our specifications. The contractor is required to provide a submittal schedule within 15 days of the Notice to Proceed.	We use the USGBC LEED Silver standard.
City of San Diego	Yes, we have a policy for LEED Certification and another regarding specific requirements for energy savings. We wanted to be sure the points for energy savings are always taken in the process.	With Design Build the Contractor/Architect is responsible, and on Design Bid Build projects we collect data from the contractor and our Consultant/Architect compiles the information. The budget is included in one of these contracts.	Not yet! The Design- Build projects with the LEED requirement have been relatively painless. The Design/Builder has taken and active interest, and discusses the progress at all the weekly meetings. The only Design- Bid- Build project to be completed so far with the LEED requirement took 8 or 9 months to get the data.	We are following the USGBC. It is the Project Manager's responsibility to see that the City's policies are incorporated into the project's design and construction documents.

Table 5 -1 City of San Jose's LEED Policy Survey – Part I (cont'd)

Questions	1. Do you have a Green Building Policy in place, and, if so, what is it?	2. If LEED certification is required, how is the budgeting for this handled?	3. If LEED certification is required are there any measures in place to make contractors comply with all submittal requirements within a certain time frame?	4. If you are following a system other than the USGBC, what is it? Was this developed in-house? What measures ensure that the requisite reviews and verification are taking place?
City and County of San Francisco	Yes, we have a Green Building Ordinance which was adopted in 2004.	Anticipated costs are included in the budget as line items.	Measures needed for construction are included in the Contract Documents.	We are using USGBC.
City of Long Beach	Our policy can be viewed at the following website: http://www.longbeach.gov/plan/pb/apd/green/default.asp	The cost is included in the overall project budget. We typically add between 15% and 20% to our projected construction cost to account for the LEED certification.	The bid specs require prior project experience with LEED criteria and that the contractor have on site at all times an experienced LEED project manager, engineer, or superintendent. The contractor must submit a LEED QC plan within 15 days of award and must submit updates to the plan with each pay request.	We are using USGBC.

Table 5 -1 City of San Jose's LEED Policy Survey – Part I (cont'd)

Questions	1. Do you have a Green Building Policy in place, and, if so, what is it?	2. If LEED certification is required, how is the budgeting for this handled?	3. If LEED certification is required are there any measures in place to make contractors comply with all submittal requirements within a certain time frame?	4. If you are following a system other than the USGBC, what is it? Was this developed in-house? What measures ensure that the requisite reviews and verification are taking place?
City of Los Angeles	A minimum level of LEED certification is required for all projects 7,500 square feet and larger. Council is currently considering raising the minimum level on City buildings to LEED Silver and creating a private sector Green Building Program.	All LEED costs are included in the project budget. On most projects, no differentiation is made between LEED or Non-LEED costs in project budgeting.	The specifications call for monthly progress submittals during construction. Our specifications do not contain a hard deadline for all final submittals. But we are looking at adding some type of hard time frame to our specifications to require a date beyond the end of construction (or commissioning) by which the contractor must submit all LEED documentation.	We are currently following the USGBC system.
City of Sacramento	All new City owned facilities 5,000 SF and larger have LEED Silver as a goal per resolution 2004-751	We do not have a separate line item budget for LEED, but a 2 to 4% line item has been proposed	Currently, all the City has are documents for design professionals to ensure that the plans and specs comply with LEED needs (see 150-PSA-LEED-Scope) and green guide specs which designers have the option to use	We are using LEED for in-house projects; our Development Services Department are developing incentives for private commercial development to use LEED and for private residential development to use Build It Green.

Table 5 -2 City of San Jose's LEED Policy Survey – Part II

Questions	1. How many projects have gone through the USGBC process and obtained LEED certification?	2. Have they encountered problems with document submittals, either from consultant or contractor? If so, on what percentage of projects? How did they resolve the situation?	3. Have they documented costs for projects that have gone through the process and if so, have they been able to quantify the percentage mark-up for a LEED certified or silver project?
City of Los Angeles	The City has 5 projects with final certification (3 certified, 1 gold, 1 platinum) and 44 others in process.	We have encountered problems with submittals. The most common problems have been obtaining timely documentation and confusion with who is responsible for certain documentation. Our Master Specification Committee is working on updating the standard specifications to fully incorporate LEED. One thing that we have done to minimize documentation problems is to require that the contractor make monthly progress submittals (to the CM) of LEED forms such as recycling content, materials purchases, etc, so that we can see that they are keeping them up to date. These are required prior to releasing the monthly progress payment. We also believe that the recent changes by USGBC to make the submittal forms available to be filled in online will significantly help reduce the difficulty of submitting the final package.	Our recent analysis of the likely points targeted for each level of LEED in City projects, based on our data and on the relative expense of each point on projects in the pipeline, leads us to project a cost of 4% over standard construction for Certified, 6% over standard construction for LEED Silver, 9% for LEED Gold and 17% for LEED Platinum. Of course costs will vary somewhat by project building type.
City of Sacramento	One	Yes. Submittals from consultants and contractor have been delayed. Problems not yet resolved.	Costs have not been accurately tracked. We are currently planning to use a 2-5% markup based on industry standards.

C. PROFESSIONAL SERVICES PROCUREMENT PROCESS

The City of Long Beach initiated a survey among the agencies related to the process of procuring professional services on public works projects. Most agencies responded that they have a documented process for procuring professional services. Detailed responses from the City of Los Angeles and the City of San Francisco are summarized in **Table 5-3**.

Table 5-3 City of Long Beach's
Survey on Professional Services Procurement Process

Questions	City of Los Angeles
1. Does your Agency have a formal RFP/RFQ process? If so, is it utilized agency-wide? If so, can you please forward a copy of the protocol? If not, how do you procure professional services (consultants)?	The City of Los Angeles maintains their current procedures in the Chapter 6 of the Department of Public Works, Bureau of Engineering (BOE)'s Project Delivery Manual. These procedures are not agency-wide.
2. Do line staff perform the RFQ/RFP process or is there separate staff for this type of procurement? Is management involved?	BOE's Project Award and Control Division (PACD) has standard RFQ/RFP and contract documents and provides the project managers with these documents. PACD provides assistance during the preparation of the RFQ/RFP process. However, it is the responsibility of the project manager to get all necessary approvals prior to issuing the RFQ/RFP. Management must approve and sign all Board Reports related to the RFQ/RFP process.
3. From the time you begin to prepare the RFP/RFQ to the time a contract is awarded, how much time has elapsed? Note the typical duration among the following categories: Document Preparation, Advertisement/RFI, Proposal Review/Short-list, Interviews, Contract Negotiations, Award of Contract, and Execution of Contract.	The flowchart for consultant procurement is being updated.
4. Does your Agency have a policy on outreach and advertisement? What are the minimum requirements and what is actually being done? Do you utilize the internet, either on your agency website or an external website?	A notice to advertise the RFQ/RFP is placed in the Daily Journal, for a minimum of one day. Normally, the notice to advertise is placed there for at least another day. We recommend that the notice be placed in at least one minority publication. The City of Los Angeles utilizes the Business Assistance Virtual Network (BAVN) from the Mayor's Office of Economic Development. BAVN not only lists opportunities with BOE, but other City of Los Angeles Departments and Bureaus as well. All RFQs and RFPs are uploaded to this site where interested consultants can download the request and all of its attachments. The RFQ or RFP is uploaded with North American Industry Classification System (NAICS) interest codes. All prime firms with a matching interest code receive an automatic email the next day informing them of a new opportunity matching their interests has been uploaded to www.labavn.org. BOE has found that this is one of the best ways to get the word out to interested consultants.

Table 5-3 City of Long Beach's Survey on Professional Services Procurement Process (cont'd)

Questions	City and County of San Francisco
1. Does your Agency have a formal RFP/RFQ process? If so, is it utilized agency-wide? If so, can you please forward a copy of the protocol? If not, how do you procure professional services (consultants)?	Yes. There are four consultant administration procedures used by our BOE. The procedures cover: (1) Request for Proposal, (2) Consultant Selection Process, (3) Managing Consultant Contracts, and (4) Consultant Performance Evaluation. The procedures were created by BOE for use by BOE. Other work units in the Department of Public Works don't have written procedures, but they follow fairly similar steps.
2. Do line staff perform the RFQ/RFP process or is there separate staff for this type of procurement? Is management involved?	There is a full time engineer working as a contract manager for our as-needed consultant contracts. This person prepares and advertises the RFPs, administers the selection process, negotiates contracts, and manages the issuance of task orders. The procurement of project-specific consultants is usually done by individual project managers and/or engineers. Management is involved in the decision to seek consultant services, reviewing draft RFPs, concurring with the selection, and reviewing and signing contracts.
3. From the time you begin to prepare the RFP/RFQ to the time a contract is awarded, how much time has elapsed? Note the typical duration among the following categories: Document Preparation, Advertisement/RFI, Proposal Review/Short-list, Interviews, Contract Negotiations, Award of Contract, and Execution of Contract.	Typical durations of procurement activities are: • Document Preparation: 1-5 months • Advertisement/Request for Information (RFI): 1 month • Proposal Review/Short-List: 1 month • Interviews: 2 weeks (including scheduling and notifications). Interviews are usually completed in one day. • Contract Negotiations: 1-3 months • Award of Contract: 2 weeks • Execution of Contract: 1 month The entire process can take from 6 to 12 months.
4. Does your Agency have a policy on outreach and advertisement? What are the minimum requirements and what is actually being done? Do you utilize the internet, either on your agency website or an external website?	Local law requires that San Francisco advertise RFPs in the "newspaper of general circulation". Annually the Board of Supervisors makes a determination of which newspaper it will be. In addition the Human Rights Commission (HRC) code requires that RFP's be posted in the City Purchaser's website. Not required but done as standard departmental practice is to advertise in the Small Business Exchange and 15 plan rooms and exchanges. Optionally, individual project or contract managers have also contacted consultants who have done work for us in the past as a prime or subconsultant and contacted DBEs (Disadvantaged Business Enterprises) listed in our HRC's DBE Directory

Table 5-3 City of Long Beach's
Survey on Professional Services Procurement Process (cont'd)

Questions	City of San Jose
1. Does your Agency have a formal RFP/RFQ process? If so, is it utilized agency-wide? If so, can you please forward a copy of the protocol? If not, how do you procure professional services (consultants)?	We have City-wide RFP manual that has recently been established and is currently in a rollout/training phase. It is more general in nature. Of more importance to the Public Works Department is our Council-approved "Qualifications Based Consultant Selection (QBCS) Policy." This governs our procurement of professional services for architectural, landscape architectural, engineering, environmental, land surveying, and construction management consultants.
2. Do line staff perform the RFQ/RFP process or is there separate staff for this type of procurement? Is management involved?	Generally, a project manager (mid-level management) handles the procurement, and higher-level management is involved as needed depending on the complexity and/or nature of the consulted service.
3. From the time you begin to prepare the RFP/RFQ to the time a contract is awarded, how much time has elapsed? Note the typical duration among the following categories: Document Preparation, Advertisement/RFI, Proposal Review/Short-list, Interviews, Contract Negotiations, Award of Contract, and Execution of Contract.	• Document Preparation (2-4 weeks), • Advertisement/RFI (2-4 weeks) • Proposal Review/Short-list (2-4 weeks) • Interviews (2 weeks) • Contract Negotiations (2-3 weeks) • Award of Contract (1-2 weeks) • Execution of Contract (1-2 weeks). Overall 3 – 5 months nominally.
4. Does your Agency have a policy on outreach and advertisement? What are the minimum requirements and what is actually being done? Do you utilize the internet, either on your agency website or an external website?	Outreach (with minimum requirements) is defined within the QBCS policy. Practice is fairly consistent with the QBCS policy with perhaps more outreach actually going on than is required for the minor process primarily because of some operational challenges with consultant list management. As defined in the QBCS policy, we definitely use the internet: our Agency's Bid Hotline

D. HANDICAPPED PARKING

The City of Long Beach initiated a discussion asking if any agencies had installed handicapped parking spaces that were only enforced during specified hours and then were available for general parking at other times. The City of Long Beach was exploring the idea of allowing certain handicapped spaces at a City ballpark to be open to general parking during times when the ball park was not in use.

The City of San Jose, the City of Oakland, and the City of Sacramento did not have any time-dependent handicapped parking spaces. However, the City of Oakland thought the idea would be a good one where certain businesses are closed at certain hours.

The City and County of San Francisco has one such installation in front of an auditorium. Handicapped parking is only in effect during evenings at that location.

The City of San Diego also did not have time-dependent handicapped parking but suggested that certain parking be designated as "general" except when an event warrants designation as temporary handicapped parking.

The City of Los Angeles Department of Transportation responded that there is no written authority that either allows or precludes indicating times of enforcement on handicapped parking stalls as long as all other criteria are met.

E. CONSULTANT PERFORMANCE TARGETS FOR CHANGE ORDERS

The City and County of San Francisco initiated a discussion on consultant performance measures on change orders during construction due to errors and omissions. They currently set a performance target of less than 3% of the construction award amount. They were interested in the other agencies sharing information on what level of change orders due to errors and omissions is acceptable. None of the participating agencies that responded uses such performance measures.

To support participation in this Study, the agencies categorize change orders into: Changed or Unforeseen Conditions, Errors and Omissions, or Changes in Scope. The City of Los Angeles does this as well as budget 10% of the construction award amount for total change orders. However, specific performance measures for any one category of changes are not set. The City of Los Angeles noted that the median percentage of change orders for the 59 contracts completed in 2004 was 6.5%. 61% of these were attributed to Changed or Unforeseen Conditions, 17% to Errors and Omissions, and 22% to Changes in Scope.

The City of San Jose doesn't have performance measures for change order rates. They do track the cost of change orders by the categories used in this Study and review them at special project completion meetings. In November 2002, the City of San Jose's Council approved an amendment to their Capital Project Contingency Policy that establishes the following standard contingency amounts at the time of award of a construction contract:

- 5% of the total contract amount for street, sidewalk, or park projects;
- 10% of the total contract amount for utilities or building projects; and

- 15% of the total contract amount for building renovation projects.

While this does not directly address the issue of change orders due to errors and omissions, it does demonstrate the City of San Jose's recognition of the inherent level of uncertainty associated with particular kinds of construction projects.

F. BID REJECTION AND NEGOTIATION

The City of Oakland initiated a discussion on avoiding project re-bidding and associated added costs. The City of Oakland may negotiate with any contractor (even those that did not bid) in two cases: when only one bid is received or when all bids are rejected because they exceed the City of Oakland's budget. This can only happen once all bids are rejected and authority is obtained from Council to waive competitive bidding and to negotiate. The City of Oakland requested input regarding other cities' practices for such situations.

The City of Los Angeles can negotiate the price of a bid when there is a single bidder. If there is more than one bid, the City of Los Angeles must award to the lowest responsive and responsible bidder; and the City of Los Angeles is not allowed to negotiate the price. The only other option is to reject all bids and re-bid the project.

Bids received by the City and County of San Francisco may be rejected if over budget or if non-responsive or if offered by non-responsible contractors. However, the rejection must be done by the oversight commission (if one exists) or by the Department of Public Works.

The City and County of San Francisco also offered a response to the question of whether they have to obtain authorization from the Council (Awarding Authority) to negotiate rejected bids due to non-responsiveness or bids that come in higher than the construction budget. The answer is found in their Administrative Code, Sec 6.23(C):

> SEC. 6.23. PUBLIC WORKS TO BE PERFORMED BY THE CITY; BIDS BY CITY DEPARTMENTS.
>
> (C) Execution Of Work By City Upon Rejection or Failure of Bids. When bids have been advertised pursuant to the required procedure and no responsive bid is received, or where only one responsive bid has been received, the department head, with the approval of the Mayor or the Mayor's designee, or the department head, with the approval of the board or commission to which he or she is responsible, may order the related work to be executed by the City and County in the most expeditious manner, provided however, that the cost of such work shall not exceed any bid price received for the same work.

The City of San Diego cannot negotiate the price of a bid, as it is not allowed per the charter, even in the event of receiving only one bid on a project. At the City of San Diego, a bid must either be accepted or rejected.

The City of San Jose hasn't recently rejected all bids due to non-responsiveness. If they did, their course of action would presumably

be situation-dependent and they do not have any written policy of code. Their charter does state that "if no bids are received, the Council may readvertise or 'have the project done.'" The case of no responsive bidders could be treated the same as having no bids at all, so they might pursue "having the project done" and thus find themselves in the position of negotiating.

The City of San Jose added that they have had some recent experience with receiving bids exceeding the Engineer's Estimate of construction cost or receiving only one bid. In general, if bids are significantly higher than the Engineer's Estimate, their practice has been to reject all bids, re-evaluate the scope, and re-bid. However, in some cases they have awarded to the lowest responsive bidder if further analyses of the project and bids support such a decision. In one case, the project was instead completed by City forces. In the case of the single bid (which happened to be 28% higher than the Engineer's Estimate), it was awarded to the bidder because of the contextual factors in the industry at the time of the bid opening.

The City of Long Beach may reject a non-responsive bidder, but then must award to the next lowest bidder. The only other option is to reject all bids and to re-bid the project.

The City of Sacramento's administrative policies and city codes allow the City Council to not utilize competitive bidding if "When upon a two-thirds vote of the City Council, it is determined that it is in the best interest of the City to suspend competitive bidding for any contract." Once this determination is made, and/or an action to reject all bids is made, it is typical to then negotiate with the low bidder or any of the bidders to obtain the best choice for the project. The code and administrative polices do provide guidelines for specific occasions of not applying competitive bidding; maintenance projects, emergency work, when no bids are received, or when the City Council rejects all bids.

G. CONSULTANT RATING SYSTEMS

One of the recommended BMPs involves the use of a consultant rating system. The City of Long Beach expressed an interest in how each agency approached this BMP.

The City of Los Angeles has an ordinance which requires that consultant performance be evaluated at the end of their contract by the Bureau of Contract Administration. The City and County of San Francisco recently developed procedures for consultant evaluation as an outcome of their participation in this Study. The City of Oakland also has a "Consultant Evaluation Form" which was presented to the Council as an informational item but is not included in any ordinance.

While the City of San Jose has no formal consultant evaluation program, comments related to performance are often discussed internally and occasionally included in Project Completion Reports.

H. CRITERIA AND STANDARDS FOR RIGHT TURN LANES

The City of Sacramento asked that each agency provide its criteria and design requirements for right hand turn lanes. Of specific interest were criteria, improvement drawings, widths and dimensions for right turn lanes, dual right turn lanes, and right turn lanes with "pork chop" shaped island.

The City and County of San Francisco responded with the following:

1. Double right turns: We have several hundred double right turns in the City and County of San Francisco. We recognize that they are not pedestrian-friendly, so we have been trying to eliminate ones that are not needed. We look at the Line of Sight (LOS) of the intersection and any particular issues at the location to determine whether the double right turns can be reduced to single right turns.

2. Curb radii: In residential areas we prefer tighter radii. The new Mission Bay development and the Rincon Hill development are using 15-foot radii. It is important to put truck turning templates on all curbs and to consider the size of trucks likely to turn there. We accepted the likelihood that large (60-foot wheel base) trucks will bump over the curb in Rincon Hill, but felt that it was not pedestrian friendly to design for such a wide radius when such trucks are not common. Similarly, 50-foot wheel base trucks are expected to take the entire roadway for a right turn, requiring traffic to back up to accommodate them. But we feel they are unusual enough not to warrant designing to fully accommodate them. We set back stop bars to accommodate 30-foot wheel base trucks without having them encroach into opposing traffic when making a right turn.

3. Lane widths: Lanes are normally at least 10 feet wide, but we have added some right turn pockets, which serve to get traffic out of the way of transit in the curb lane, which are only 9 feet wide.

The City of San Francisco indicated that the above were not official standards, but reflect recent practice.

The City of San Diego does not have standard designs for turn lanes, but notes that critical design criteria are storage length and site distance. For these criteria, the City of San Diego uses American Association of State Highway and Transportation Officials (AASHTO) and Caltrans requirements.

The City of San Jose responded that they currently use Caltrans standard vehicle design templates to determine the appropriate dimensions of right turn lanes including the placement of pork chop islands. Geometric design criteria that apply to each of the three right turn scenarios depend on a combination of design factors that include the width of sending lane, receiving lane, curb return radius, and the design vehicle to be accommodated. The City of San Jose does not currently have any existing dual right turn lanes within a city right-of-way.

I. PREVAILING WAGES

The City Manager's office of the City of San Jose initiated discussions related to when agencies were compelled, by policy, statute, or ordinance to pay prevailing wages on public works projects. A survey was sent out to each of the participating agencies. Results of this survey are summarized in **Table 5-4.**

Table 5-4 City of San Jose Prevailing Wage Survey

Agencies	1. Are prevailing wages required on all projects fully funded by your City?	2. Are prevailing wages required on all projects partially funded by your City?	3. Are prevailing wages required on all projects that are not funded by the City but are on land owned by the City?
City of Los Angeles	Yes	Yes	No, as long as the project is entirely privately funded and does not have City or government funding. If there is even partial funding from a public agency, then they must pay prevailing wage. This is State law.
City of San Francisco	Yes. Required by Administrative Code.	Yes. Required by Administrative Code.	Prevailing wages are not required although the developer may choose ro require it by contract. California Labor Code Section 1720 may kick in if the "equivalent of money" priciple applies because of tax credits or other financial benefits used by the developer.
City of Long Beach	Yes	Yes	No. Only if the property is being subsidized by the City in some manner to assist with funding for the project.

J. SIDEWALK REPAIRS

The City of Sacramento has a policy for repairing vertical sidewalk displacements greater than ¼-inch that requires property owners pay for removal and replacement of the sidewalk. The City of Sacramento was evaluating options to correct displacements, including grinding the displacement to provide a 1:12 bevel and solicited input from the other agencies by sending out the following questions:

1. In your City, who is responsible for the cost to repair sidewalk?
2. Do you have a policy which allows grinding or other method to correct sidewalk displacement? If yes, what is the policy?
3. Do you know of a machine that can actually cut away the concrete displacement, thus eliminating the grinding appearance?
4. If you allow grinding, have there been any complaints or concerns about this practice?

In the City of Los Angeles, by ordinance, the responsibility for repairs lies with the property owner in residential areas or the business in commercial zones. Exceptions are where there is negligence or fault by the City of Los Angeles or damage caused by a City of Los Angeles tree. Private parties are financially responsible, but certain City Council districts also offer a cost sharing program where private funds are matched with council discretionary funds as an incentive to improve a neighborhood.

In calendar year 2006, approximately 42,000 sidewalk repairs were made in the City of Los Angeles, which has 6,500 miles of streets. Citizens report sidewalk problems via a call to 3-1-1, email, or the internet. For faults associated with an accident, the City of Los Angeles strives to correct them within 24 hours. Immediate action on an obvious trip hazard involves an asphalt patch installed by field crews. Other repair needs are logged and grouped by neighborhood until they can be efficiently assigned to a crew. These repairs usually are made within a few weeks.

The City of San Jose's Department of Transportation is responsible for sidewalk repairs. Property Owners bear the cost of sidewalk repairs, however the City currently provides a cost reimbursement grant for 100% of the repair cost up to $500. The grant program will be eliminated during the next fiscal year and property owners will again be responsible for the entire repair cost. The City notifies property owners of the need to correct sidewalk deficiencies and if not accomplished within the mandated time, will impose a lien on the property for the City's cost to make repairs. The City has a policy that allows grinding or another method to correct sidewalk displacement. If, other than the vertical separation, the concrete is in sound condition (no spalling or cracking), the City will allow grinding up to 1-1/2" vertical separation.

In the past, the City has received complaints with the grinding process because it caused a lot of dust and the final product was a little rough. Contractors are now required to provide high level dust control and current equipment and techniques results in an acceptable finish. Some property owners still do not like the appearance of the exposed aggregates (which also occurs in the

"saw" method), but given the cost savings, they are pleased with the grinding option.

K. ENGINEER'S ESTIMATES OF CONSTRUCTION COST

The City of San Jose initiated discussion related to each agency's policy on pre-bid engineer's estimates. Specifically, they wanted to know if each agency was required to include an Engineer's Estimate of Construction Cost in the bid documents by Charter, Ordinance, or formally adopted policy. The City of San Jose had no requirement to include such an estimate. In fact, it has been suggested that Engineer's Estimates not be included to avoid influencing bid results. Responses were:

- The Cities of Oakland and Long Beach are not required to include Engineer's Estimates in bid packages.
- The City of Sacramento is not required, but elects to include the estimates for the purpose of providing prospective bidders an idea of the size of the project as a courtesy. The City of Sacramento has not found that an Engineer's estimate influences bids in most cases.
- The City of Los Angeles usually lists the Engineer's Estimate in the bid advertisements and with the bid results. This is not required by charter or policy. At the request of the Department of General Services, the Engineer's Estimate is not included in the bid advertisements or with the bid results for projects for the Department of General Services.
- The City and County of San Francisco's Administrative Code requires that formal estimates be prepared for projects estimated to cost in excess of a threshold amount, currently $114,000. However, there is no requirement to publish the estimate. As a matter of practice, the estimates are included to give contractors a sense of the magnitude of the work.

L. CONSTRUCTION COST ESTIMATING BY CONSULTANTS

The City of San Diego initiated a discussion regarding the accuracy of construction cost estimates prepared by their consultants. The reasons for the inaccurate estimates appear to have been primarily related to inflation and it was apparent that the cost consultants were not keeping up. The City of San Diego had considered writing language into contracts that stated that estimates must be within a stated range (+/-15% of the lowest construction bid) or the fee for the cost estimating service would not be paid. Prior to implementing such language, the City of San Diego referred the issue to the other agencies for comment.

The City of Long Beach replied that they are using an agreement which specifies under Section 13. Additional Costs and Redesign that if the consultant's failure to meet Standards in the Statement of Work causes the consultant to have to re-do the work, it is done at the consultant's cost. This section also specifies that if the lowest bid received on a construction project exceeds the consultant's estimate by more than 10%, the consultant may be required to modify plans/specs/construction docs at

no cost to the City of San Diego. Further, these revised documents would have to be submitted in time to allow the City of San Diego to receive new bids within 4 months of the date on which the original plans/specs were submitted by the consultant. In reality, when bids have come in higher than the engineer's estimate the City of San Diego generally creates alternates or deletes work and re-bids the project rather than have the consultant re-design the project.

In the City of Los Angeles, most estimates are done in-house. On projects designed in-house, the designer prepares the estimate based on unit prices that are monitored and updated by estimators in the Construction Management Division. A few of these may be done by outside consultants depending on the particular division's workload. For projects that are designed by consultants, the consultant usually prepares the cost estimate, especially for buildings. Third-party estimators are only considered for those projects that are designed by consultants.

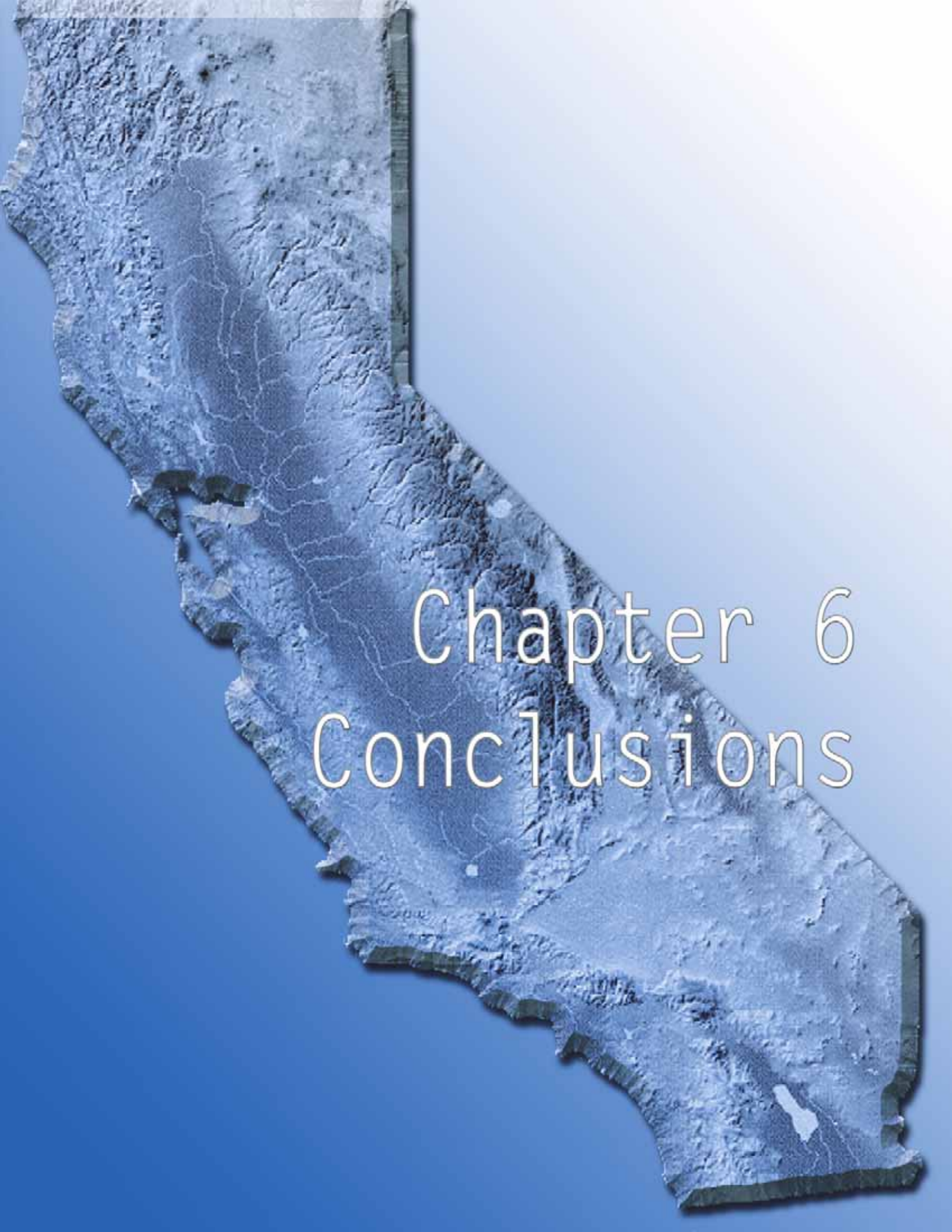
The City of Oakland's consultant contracts require the consultant to redesign or value engineer the project to fit the budget at no additional cost to the City of Oakland. There are no other penalties for design consultants when construction bids exceed the consultant's estimate.

The City of Sacramento shared an example of a large mechanical engineering project that received 5 bids, with the lowest at 34% above the engineer's estimate. The City of Sacramento then issued a RFQ to hire a contractor to act as a CM capacity during re-design. Construction cost estimates were adjusted with each stage of design submittal.

The City of San Jose placed language in some of its design consultant agreements, particularly for buildings (e.g., libraries and public safety facilities), that requires re-design at the consultant's cost if the actual costs exceed the estimate by 10%. Of course, the burden falls on the primary design consultant in the case where they use a cost-estimating sub-consultant.

Practically speaking, the City of San Jose has not been invoking this clause because in particular cases it has been felt that either: (a) volatility of market forces beyond the cost estimators control have contributed to actual costs exceeding the range, or (b) internal forces on the Owner's side (i.e., Owner-driven design modifications) have contributed to the cost fluctuation. Notwithstanding these issues, actual costs have been erratic, coming in both above and below the cost estimates without clear cause. The general trend is toward escalation.

This exchange resulted in the Project Team's consideration of BMP 2.o 2007: "Obtain independent cost estimates (outside of the designer) during the design process, inclusive of local market influences, on complex projects." This underscores the importance of utilizing a cost estimating professional in order to reduce the risk of inaccurate cost estimates, which can result in delays or even cancellation of important projects.



Chapter 6
Conclusions

CIP Benchmarking Study

CHAPTER 6 Conclusions

A. PERFORMANCE BENCHMARKING

In *Update 2006*, the Project Team noted that trends in project delivery cost are driven by a combination of factors, including improved cost data capture and reporting, increased implementation of BMPs, and increased requirements from their own agencies.

In *Update 2007*, the participating agencies have continued to contribute project delivery cost data and the Study Team has continued to analyze the data in different ways in order to understand the drivers of performance.

- Project delivery costs (as a percentage of total construction cost) by project type in the *Update 2007* analysis were:

  -Municipal Facilities 36%

  -Parks 38%

  -Pipes 35%

  -Streets 41%

- Trends in project delivery costs in this Study are influenced by project size (measured as median total construction cost) and project type.

- The influence of project size on project delivery costs is once again demonstrated by the inverse relationships shown on the regression curves in Appendix B Performance Curves.

- The Special Study on construction cost unit pricing for library projects showed that of the factors that drive the cost of construction for library, the gross area is clearly the most influential. As much as 73% of the variability in library total construction cost is explained by the gross area of the building.

- The Special Study on alternative project delivery methods showed that there are a number of advantages and disadvantages to the use of each method. The agency's needs and individual project characteristics should be used to select the best method.

- The Special Study on regional and chronological adjustments showed that these types of adjustments are not practical for the Study dataset at this time.

B. BEST MANAGEMENT PRACTICES

The agencies have continued to fully implement selected BMPs. As of *Update 2007*, the agencies have fully implemented more than 70 percent of all BMPs.

The Project Team selected the following five areas of project delivery as heavily influencing project delivery costs:

- ROW Procurement
- Environmental Process
- Permitting
- Utility Relocations
- Project Management Training

The Project Team agreed that developing and implementing BMPs related to improving performance in these areas will improve overall project delivery efficiency.

In *Update 2007*, the Project Team added six new BMPs to the BMP implementation tracking list. The BMPs were developed addressing issues in the areas of permitting and environmental regulation compliance. BMPs in the other areas will be discussed and developed during future Study phases. It is anticipated that the performance data will eventually demonstrate that as BMPs are implemented, project delivery costs were reduced. However, it is recognized that "processes" become effective "practices" only after a learning curve and full implementation on projects. Therefore, obtaining empirical evidence of this trend is expected to take several years.

C. ONLINE DISCUSSION FORUM

The Online Discussion Forum is becoming an increasingly important feature for Study participants, with active exchanges occurring frequently and important issues addressed with changes to policy, approach, or BMP implementation. Participants will continue sharing information through the Online Discussion Forum and during the quarterly meetings, and presenting the more interesting results to the public through the Study reports. The continued sharing of challenges and solutions through the Online Discussion Forum remains a remarkable advantage to all participants.

D. PLANNING FOR UPDATE 2008

Over the course of *Update 2007*, the Project Team identified a number of activities to consider including next year in Update 2008. These activities include:

- Check changes in consultant usage over time and by project type
- Evaluate trends in project delivery costs over time
- Examine trends in change order costs versus construction costs
- Evaluate the use of different performance models
- Review the project classifications used in this Study for appropriateness and relevance to the agencies

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The participation and contribution of the following individuals to the Study is gratefully acknowledged. This work would not have been possible without their contributions.

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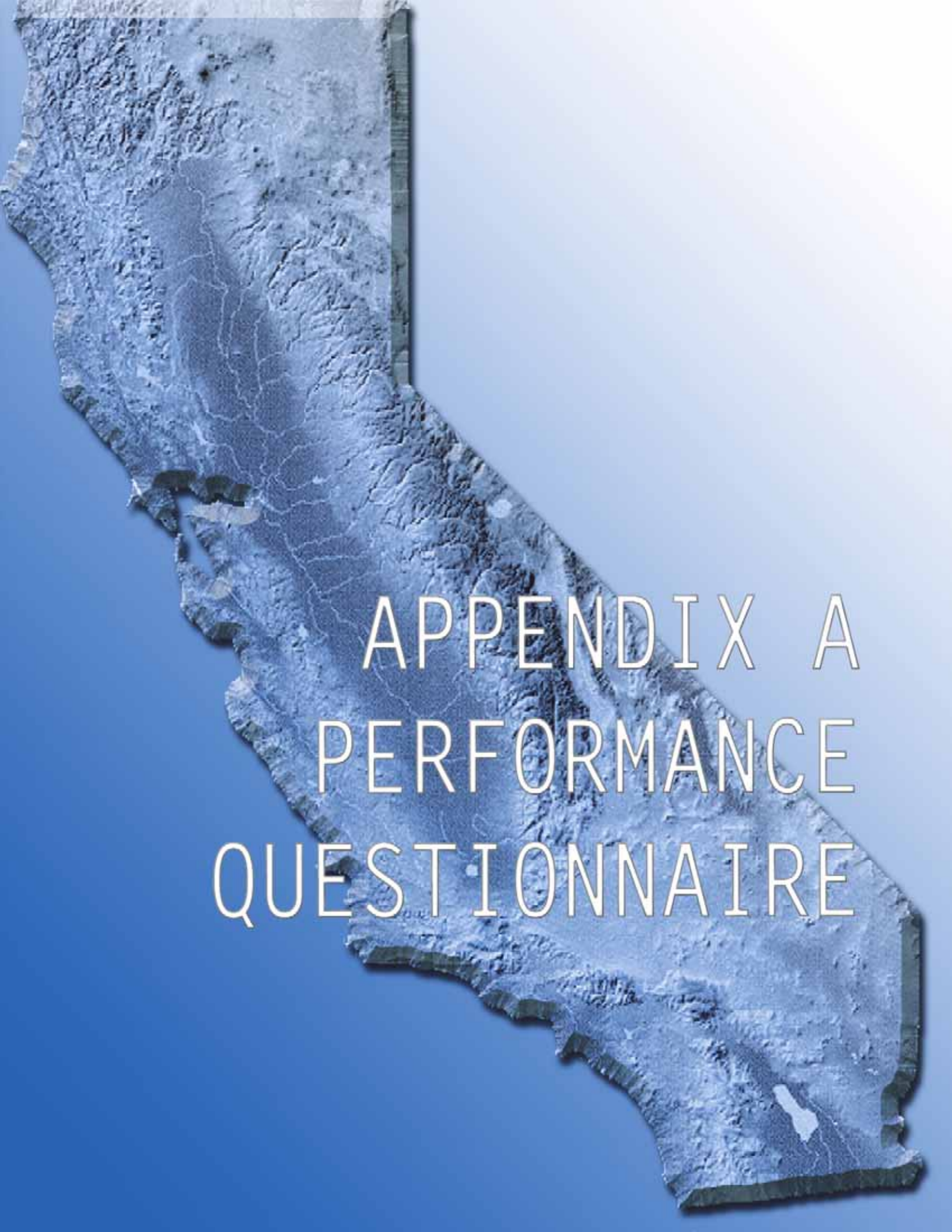
Update 2007 Project Team



APPENDIX A
PERFORMANCE QUESTIONNAIRE

CIP Benchmarking Study

APPENDIX A Performance Questionnaire

California Multi-Agency CIP
Benchmarking Study
PERFORMANCE QUESTIONNAIRE

Agency: | Project Name:

Project type:

New/Rehab Index: | ☐ LEED Green Building

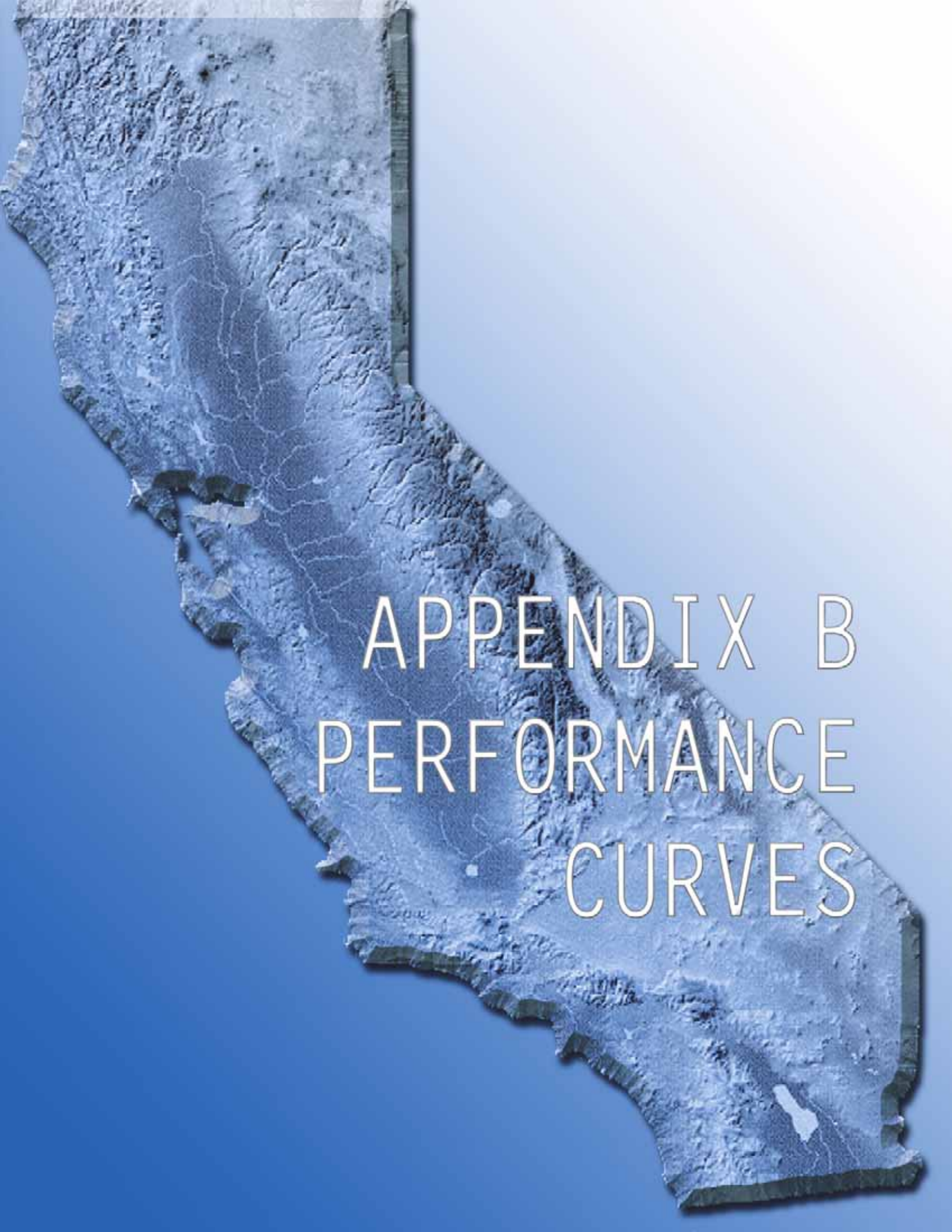
Description:

Comments:

	Planning		Design		Construction		Total	
	DOLLAR	% of TCC*	DOLLAR	% of TCC*	DOLLAR	% of TCC*	DOLLAR	% of TCC*
AGENCY LABOR								
AGENCY COSTS(1)								
Art Fees								
SUB-TOTAL AGENCY								
CONSULTANT								
TOTALS								
PHASE DURATION		Months		Months		Months		

AMOUNT OF CONSTRUCTION CONTRACT							
COST OF CHANGE ORDERS	Changed Conditions		Changed Bid Documents		Client-Initiated Changes:	Total Change Orders	$-
UTILITY RELOCATION COST							
CITY FORCES CONSTRUCTION							
TOTAL CONSTRUCTION COST (TCC)							
LAND ACQUISITION							
PROJECT COMPLETION DATE							
TOTAL PROJECT COST							$ -
NUMBER OF BIDS RECEIVED							

(1) Agency costs include other direct costs and can be listed underneath. This value is locked and it is calculated from its items (Rows 14 - 18)



APPENDIX B
PERFORMANCE CURVES

CIP Benchmarking Study

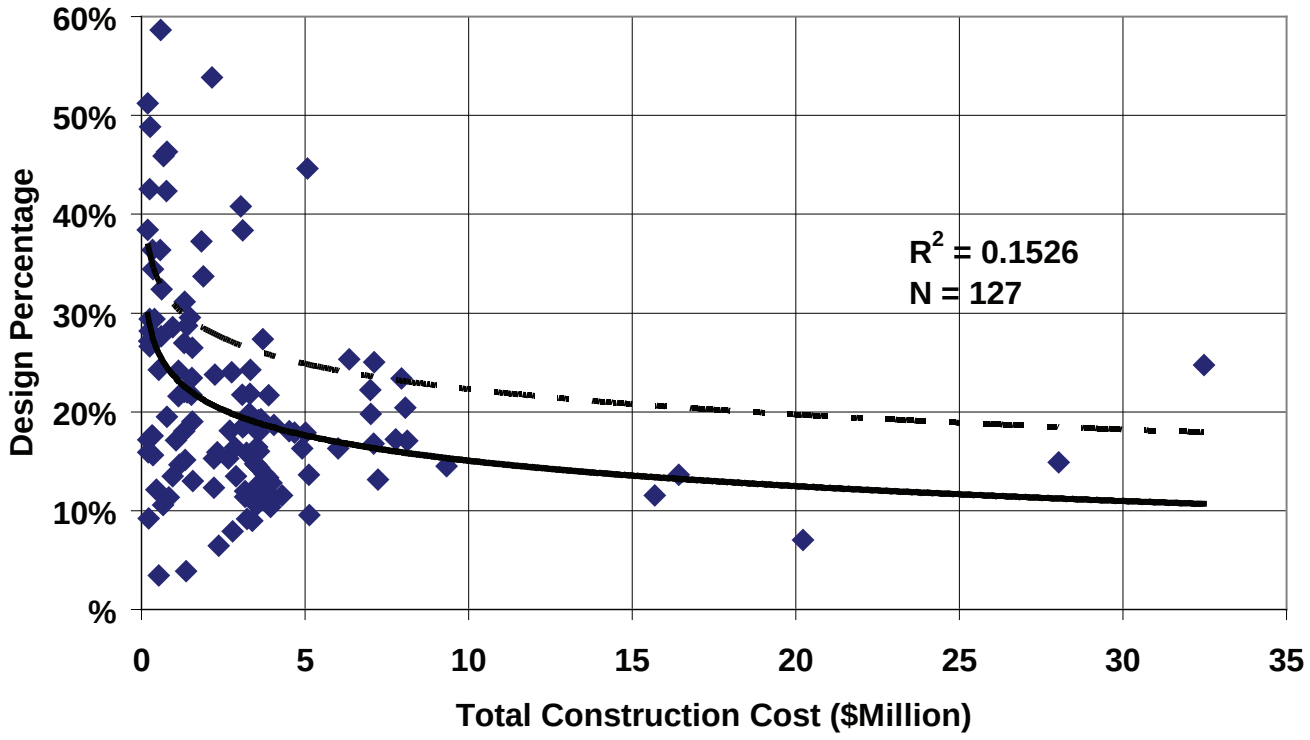
APPENDIX B

Performance Curves

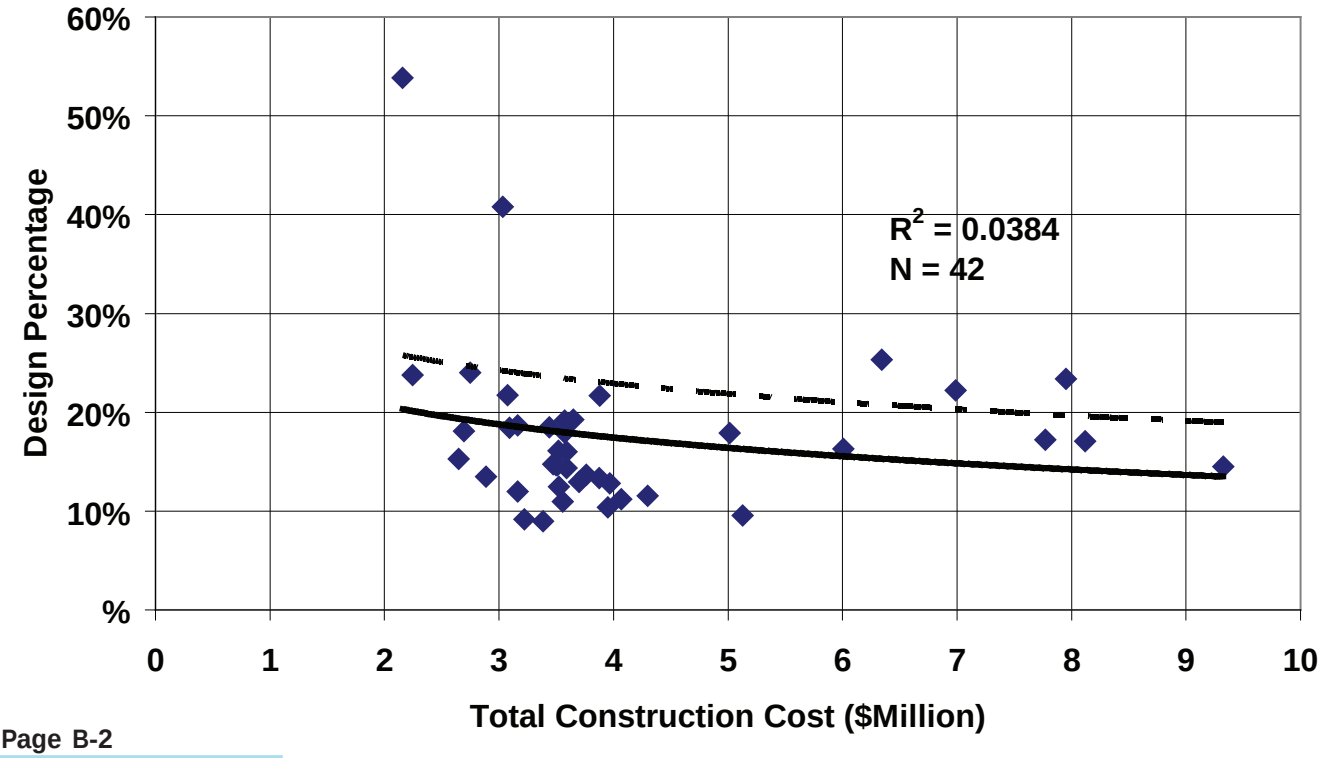
CURVES GROUP 1

Design as Percentage of
Total Consrtuction Cost
vs
Total Construction Cost

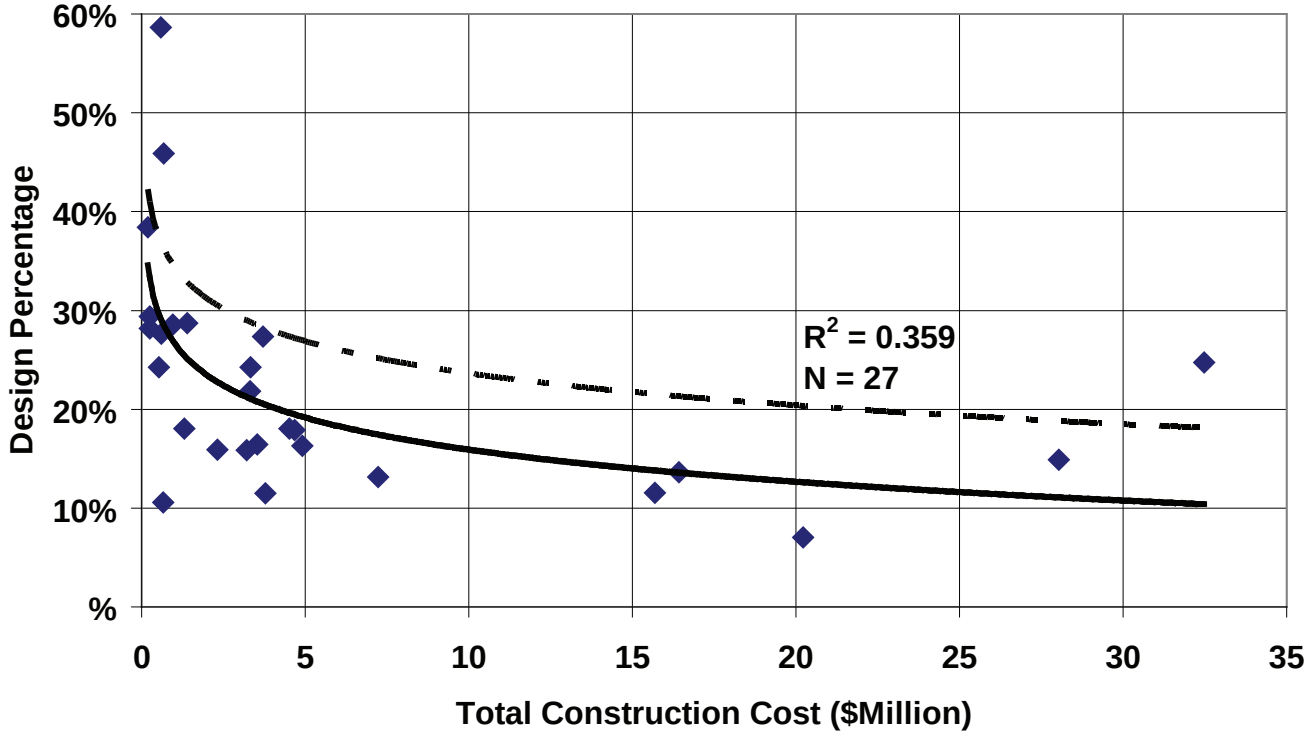
Municipal Facilities - All Classifications
Design Percentage Versus Total Construction Cost



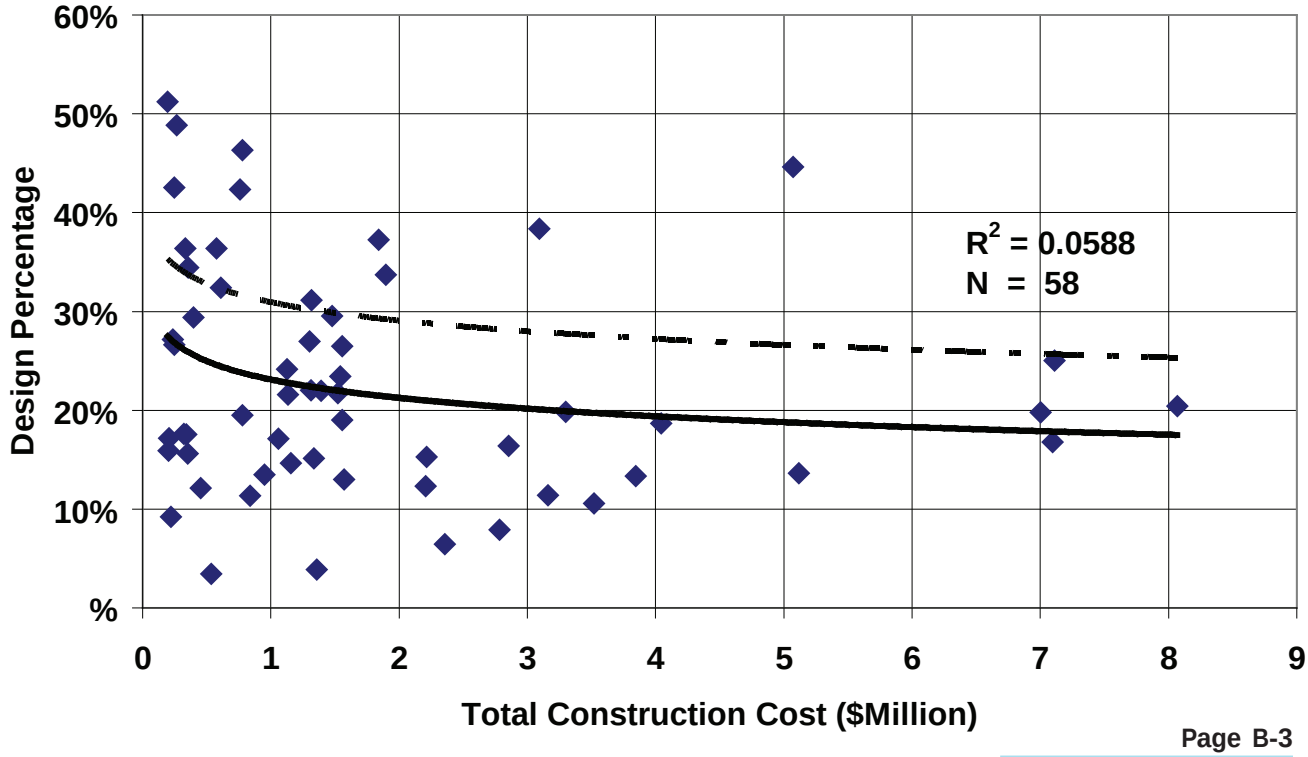
Municipal Facilities - Libraries
Design Percentage Versus Total Construction Cost



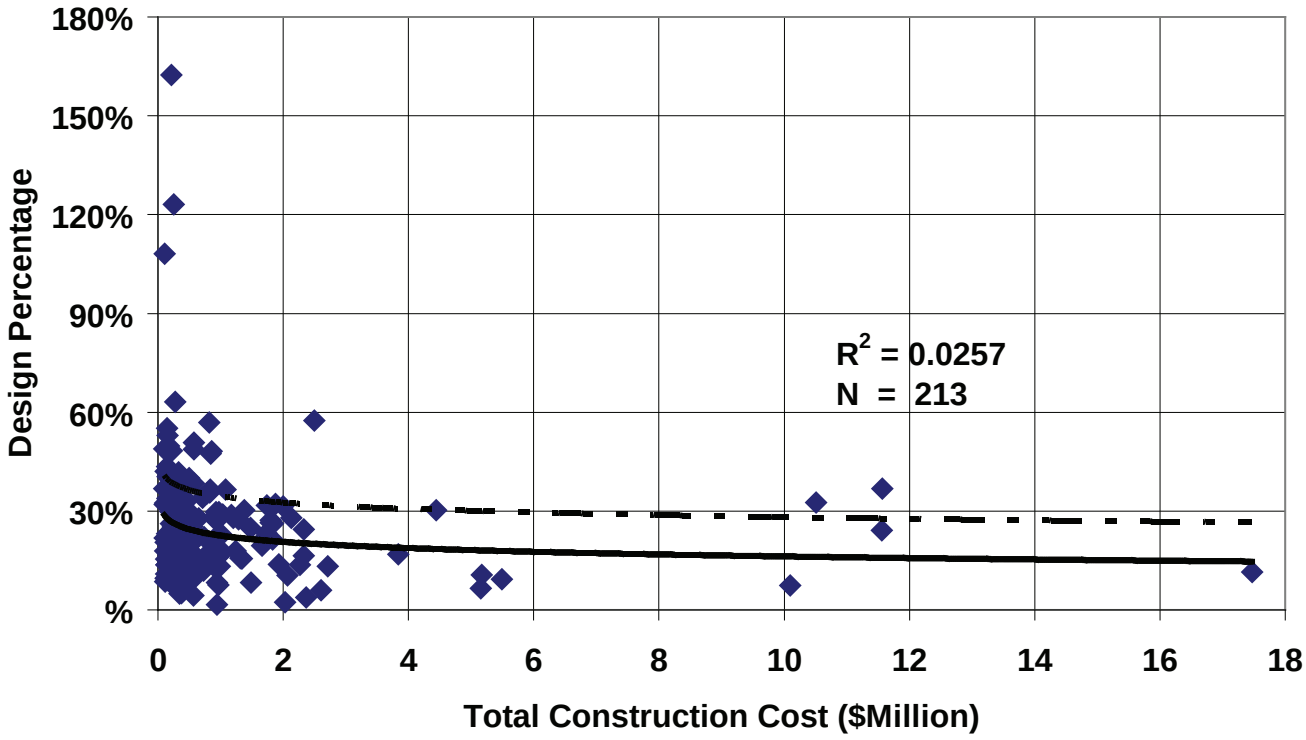
Municipal Facilities - Police/Fire Stations
Design Percentage Versus Total Construction Cost



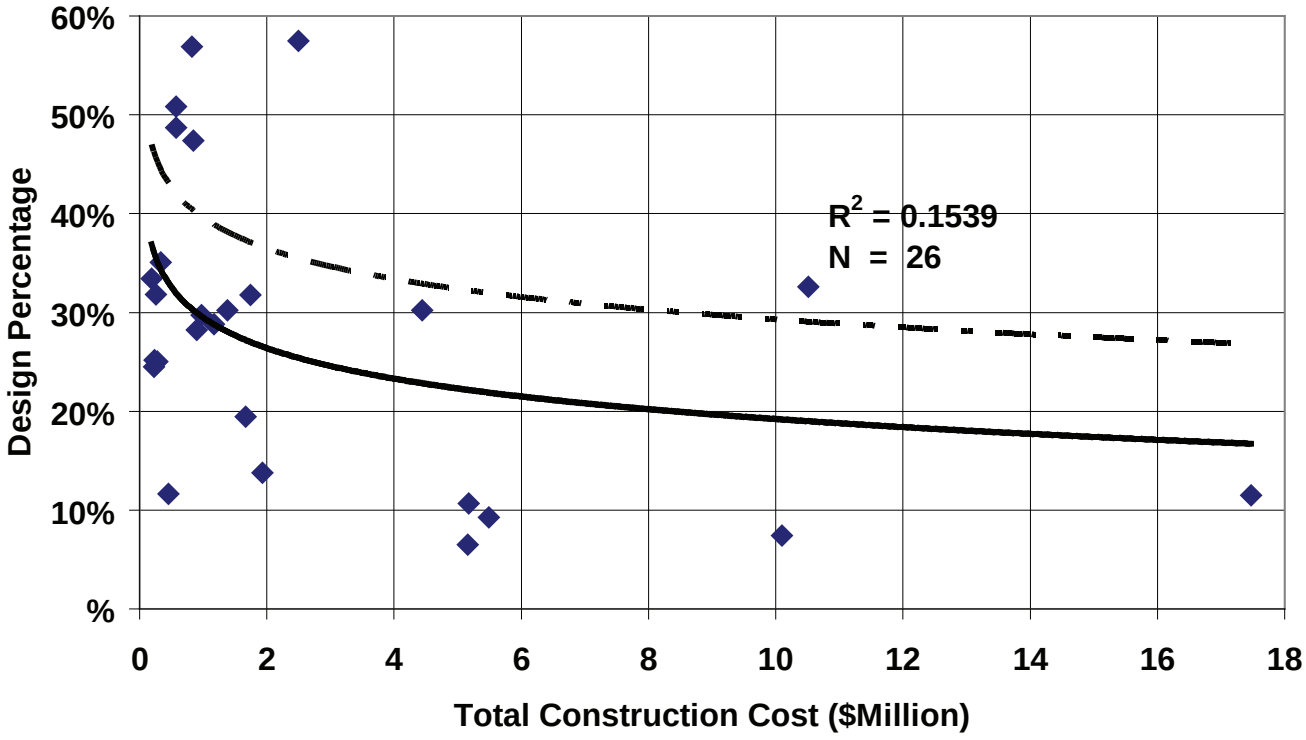
Municipal Facilities - Comm./Rec. Center/Child Care/Gyms
Design Percentage Versus Total Construction Cost



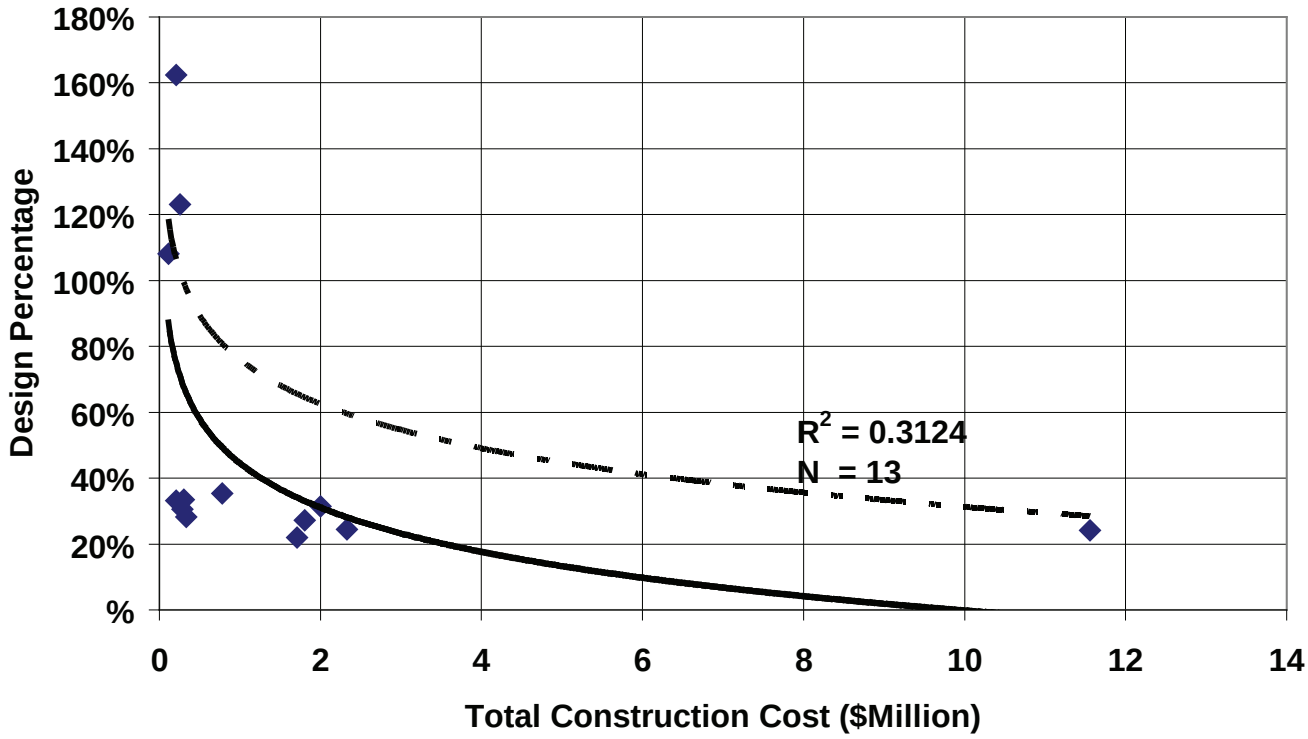
Streets - All Classifications
Design Percentage Versus Total Construction Cost



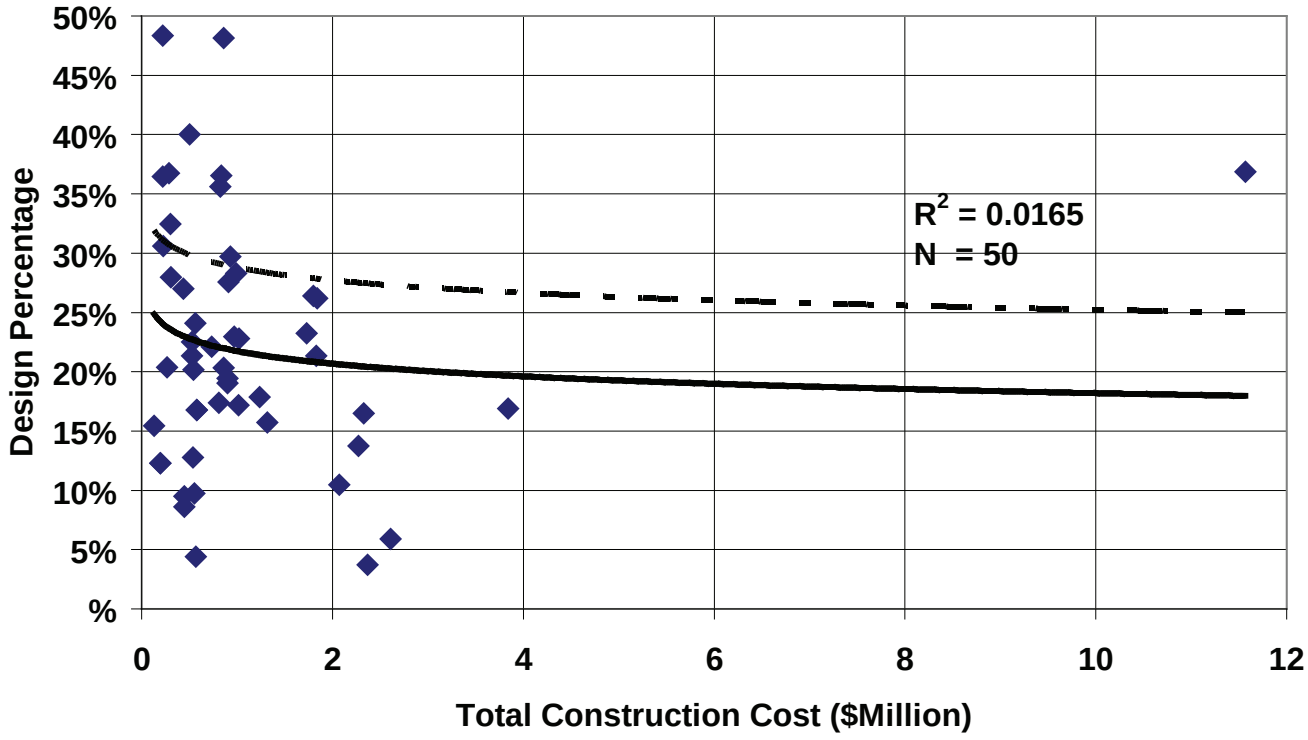
Streets - Widening/New/Grade Separations
Design Percentage Versus Total Construction Cost



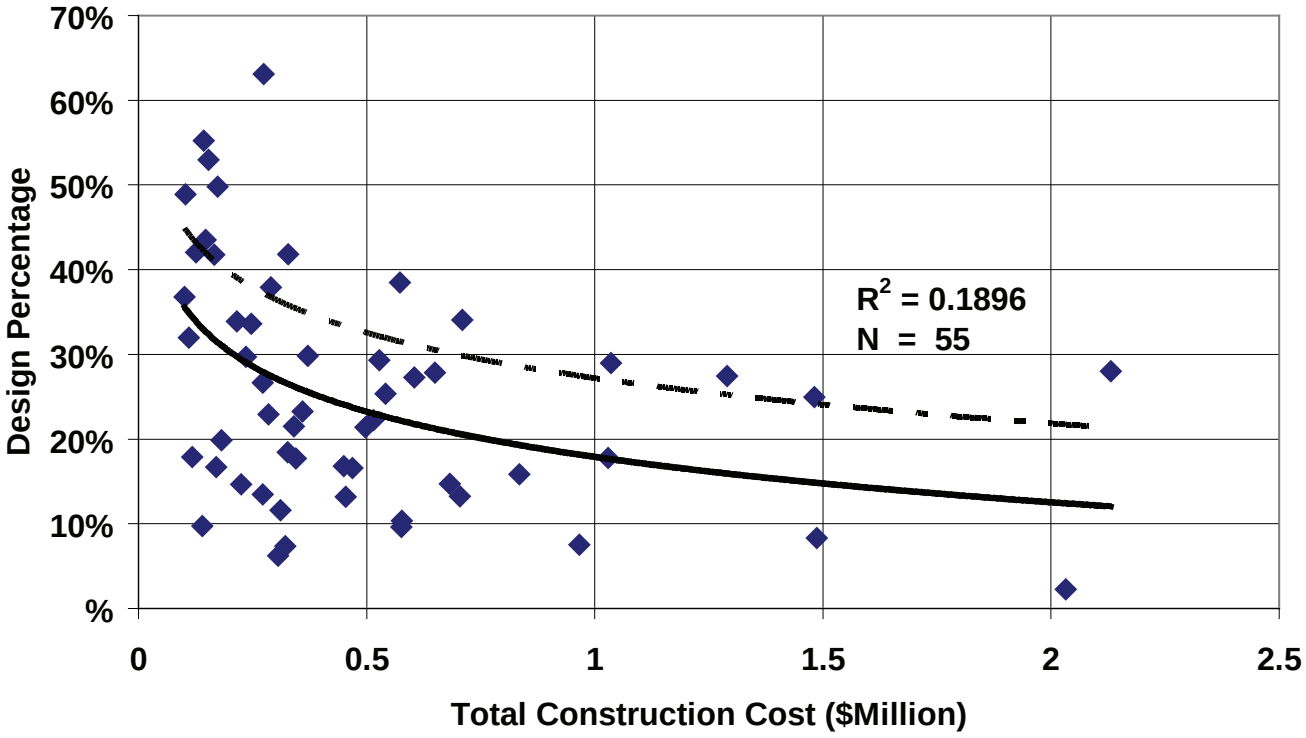
Streets - Bridges (New/Retrofit)
Design Percentage Versus Total Construction Cost



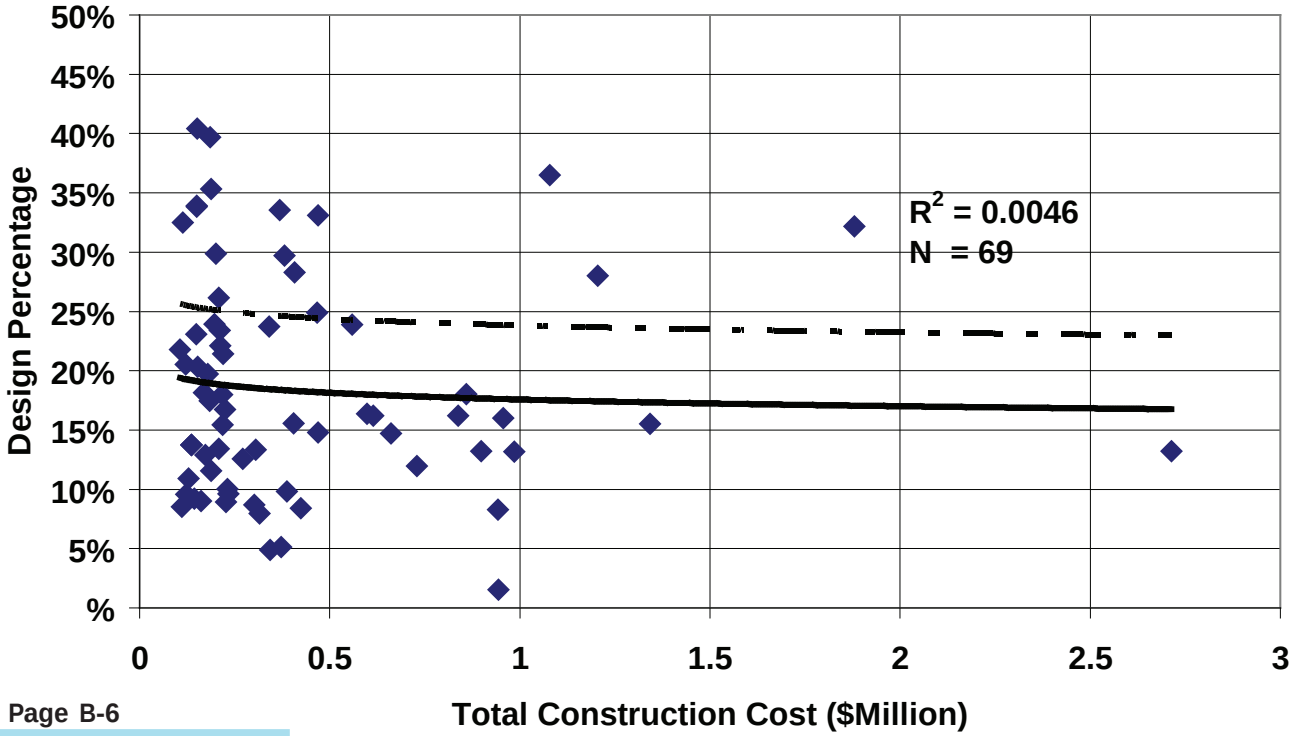
Streets - Reconstructions
Design Percentage Versus Total Construction Cost



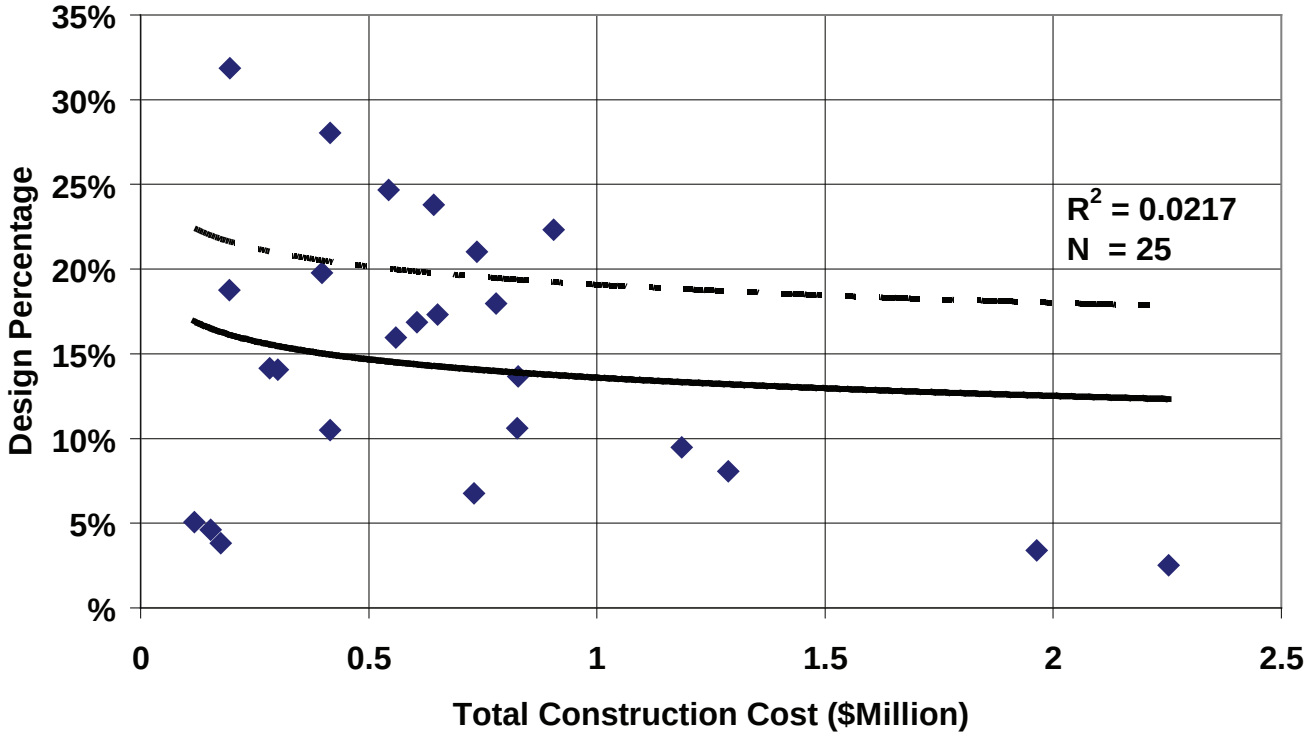
Streets - Bike/Pedestrian/Streetscapes
Design Percentage Versus Total Construction Cost



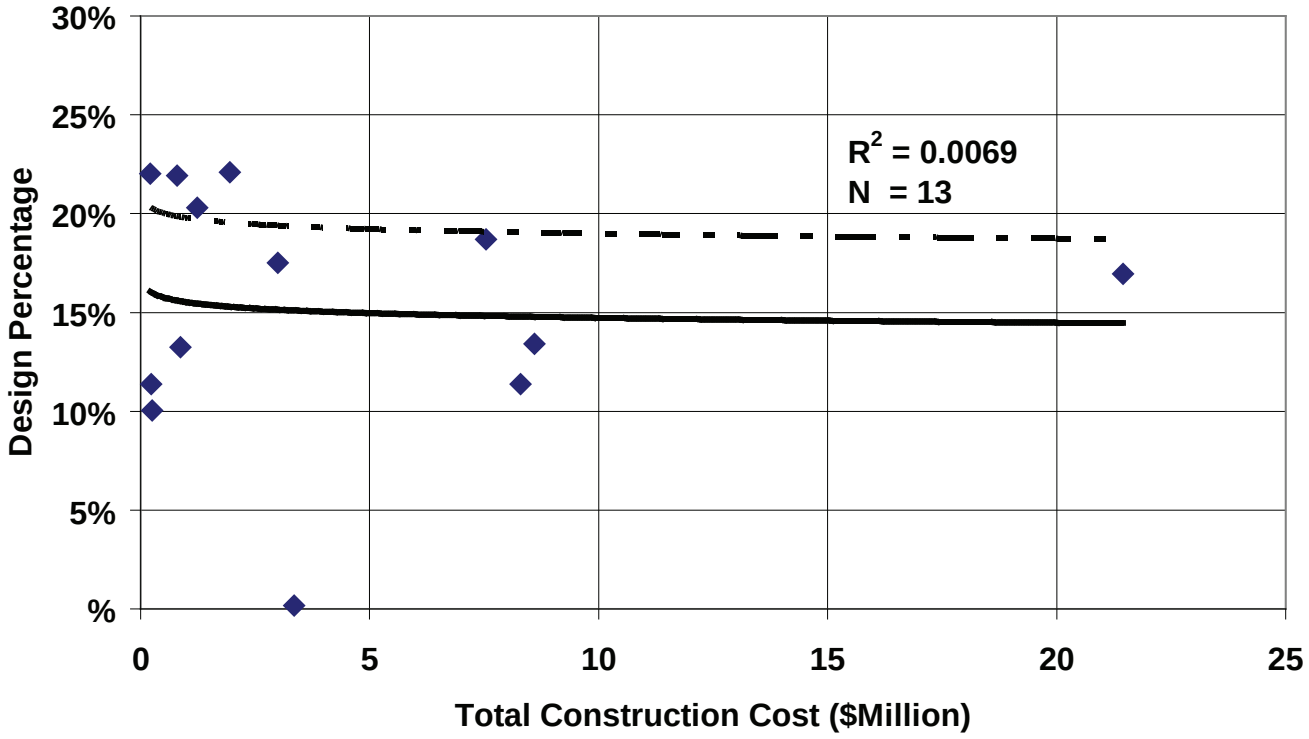
Streets - Signals
Design Percentage Versus Total Construction Cost



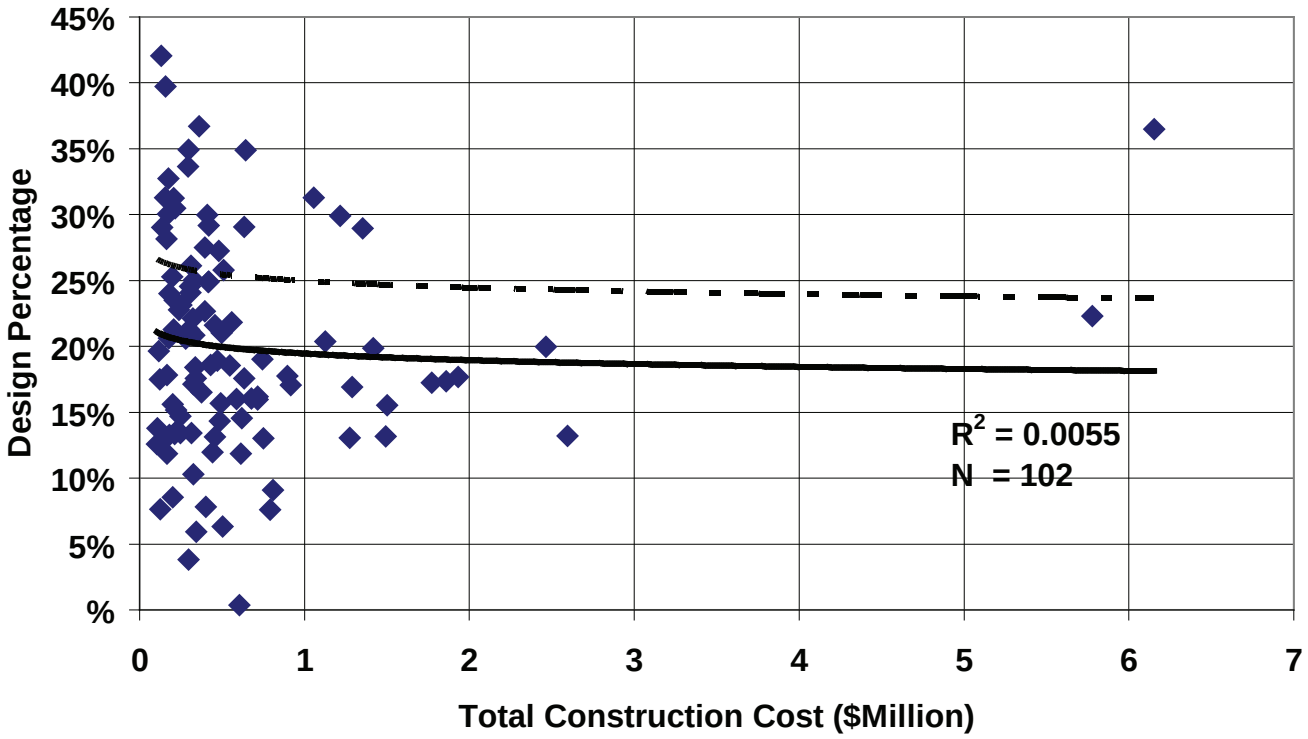
Pipe Systems - Pressure Systems
Design Percentage Versus Total Construction Cost



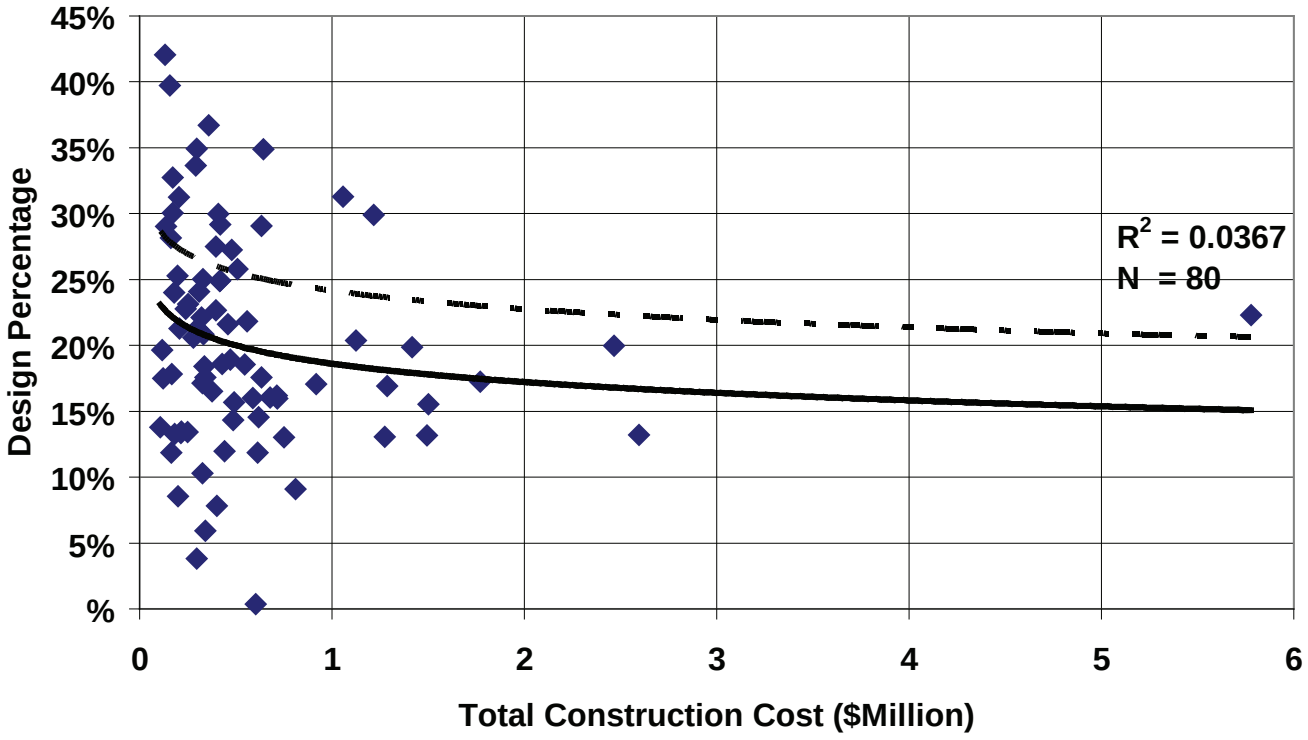
Pipe Systems - Pump Stations
Design Percentage Versus Total Construction Cost



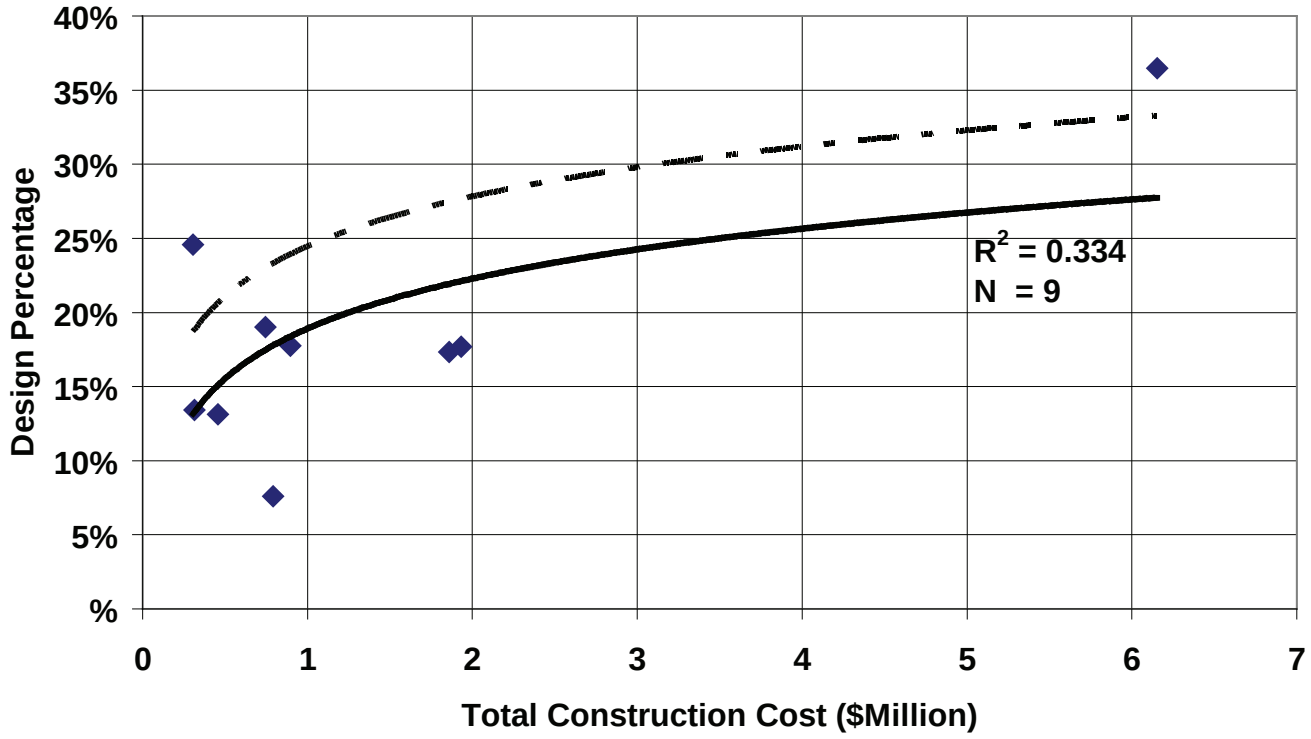
Parks - All Classifications
Design Percentage Versus Total Construction Cost



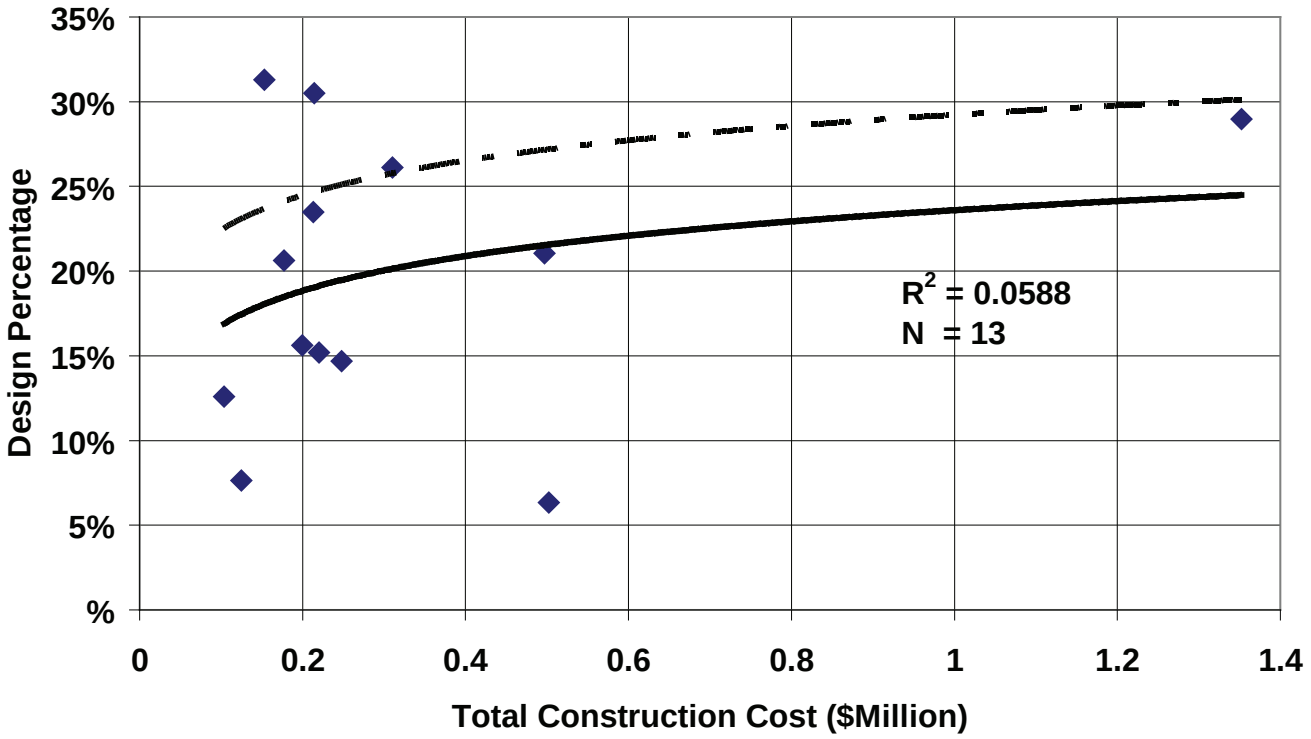
Parks - Playgrounds
Design Percentage Versus Total Construction Cost



Parks - Sportfields
Design Percentage Versus Total Construction Cost



Parks - Restrooms
Design Percentage Versus Total Construction Cost



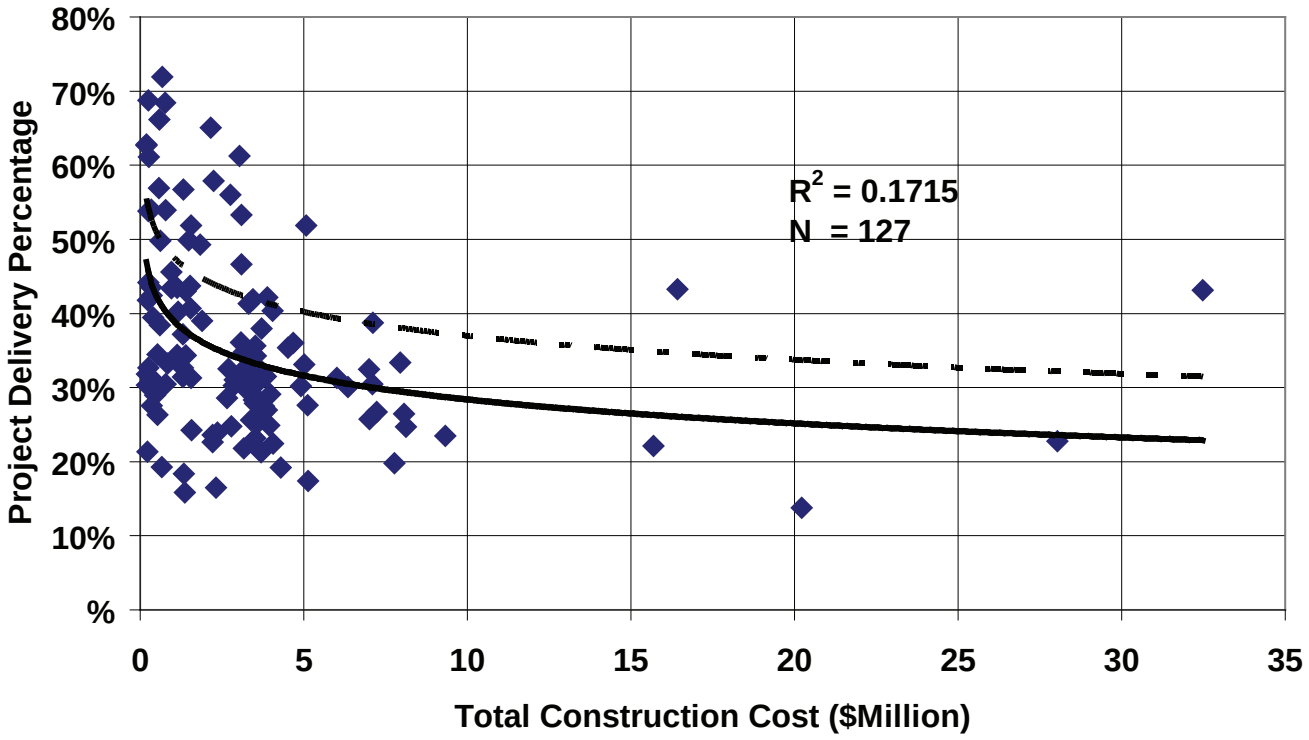
CURVES GROUP 2

Construction Management Cost / Construction Cost

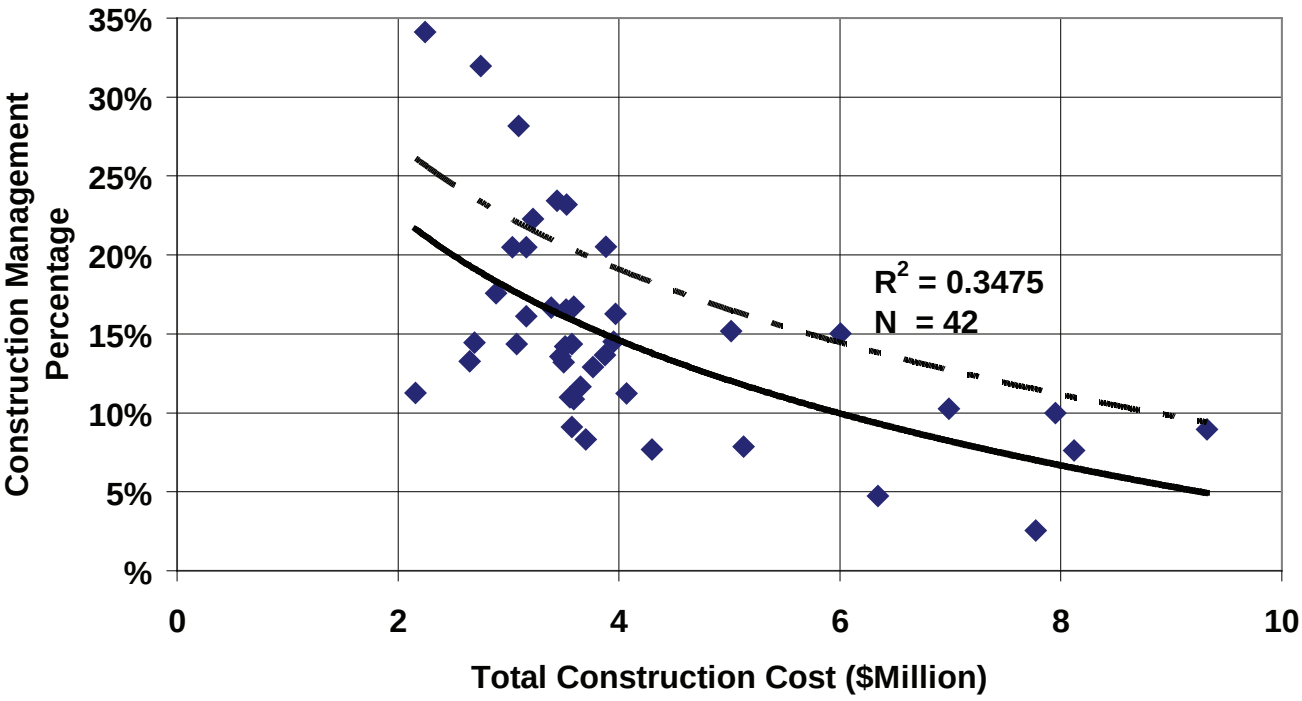
Versus

Total Construction Cost

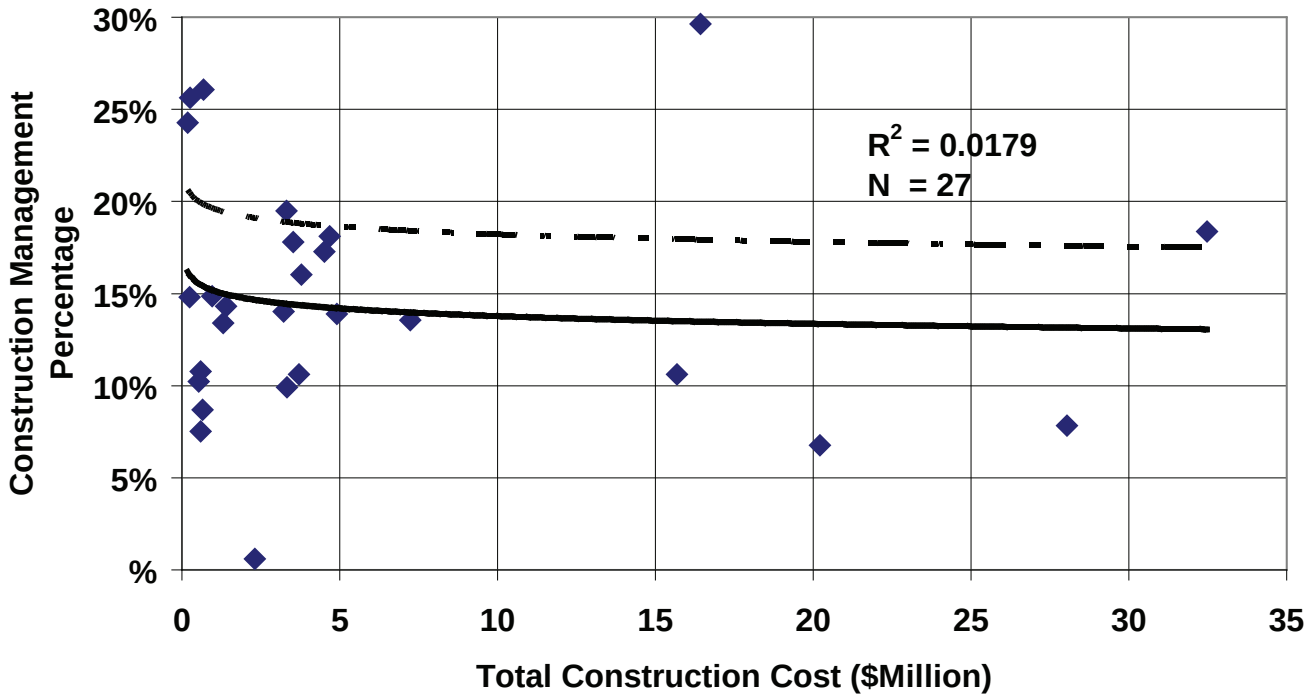
Municipal Facilities - All Classifications
Project Delivery Percentage Versus Total Construction Cost



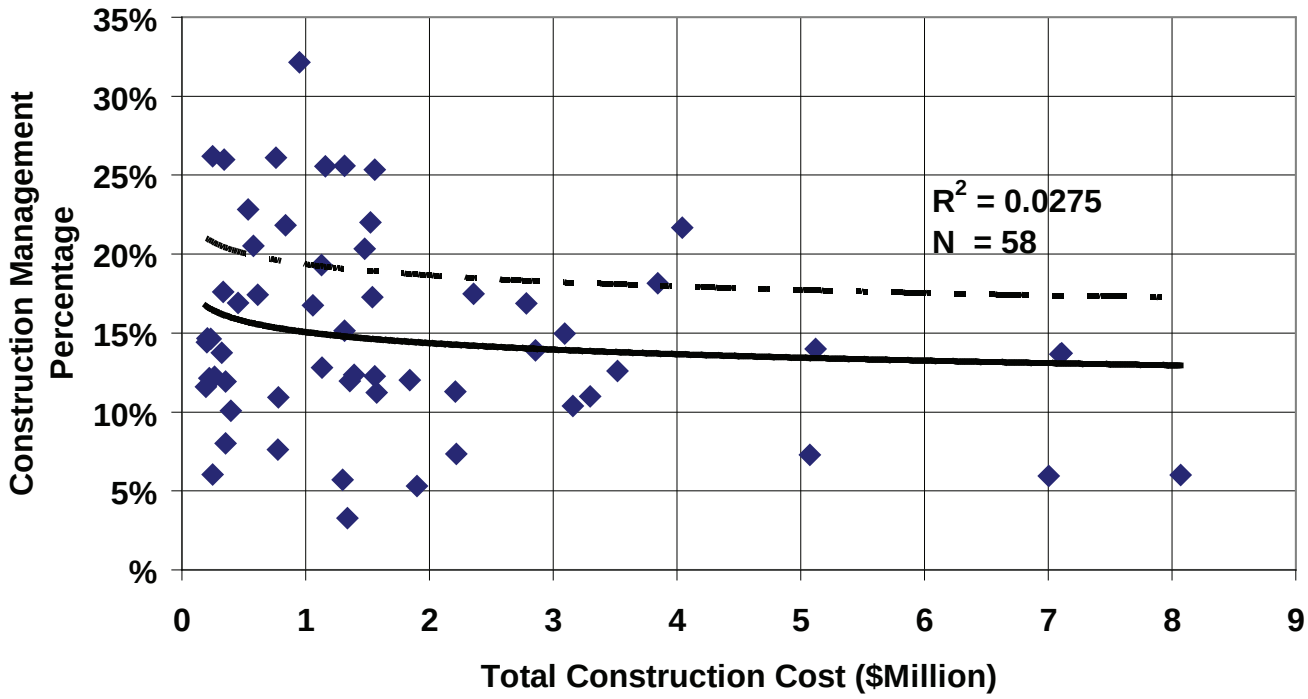
Municipal Facilities - Libraries
Construction Management Percentage Versus Total Construction Cost



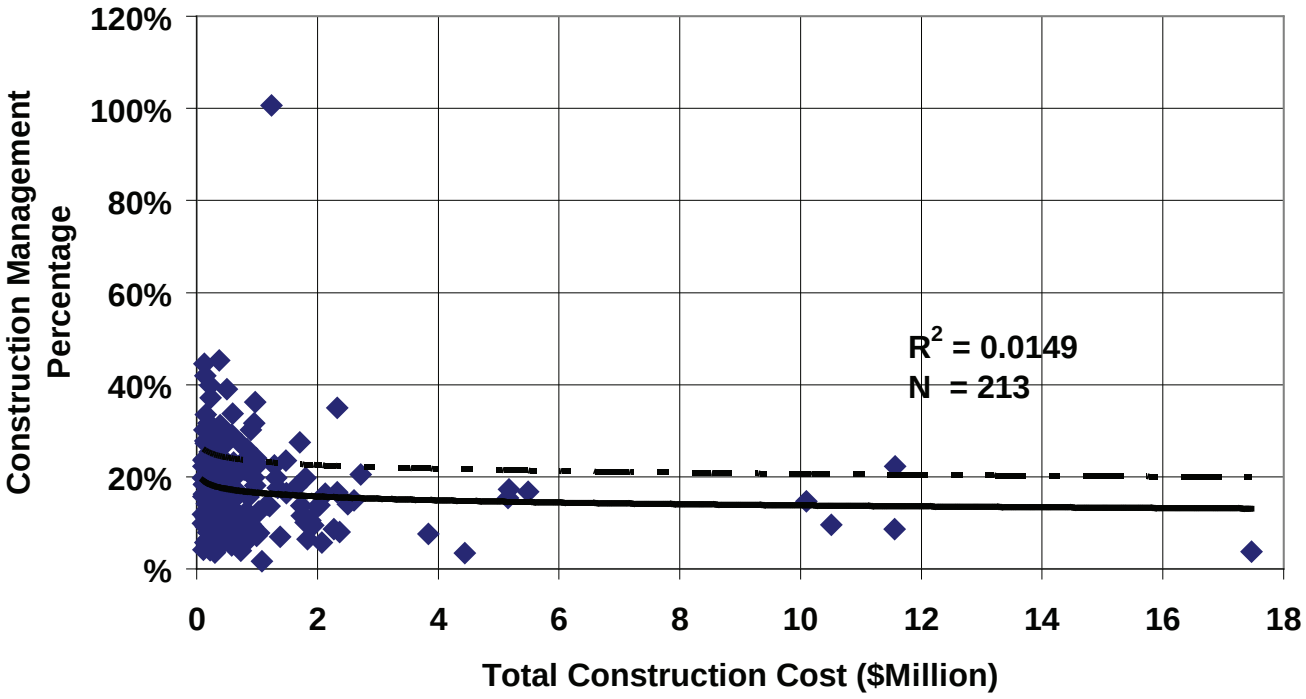
Municipal Facilities - Police/Fire Stations
Construction Management Percentage Versus Total Construction Cost



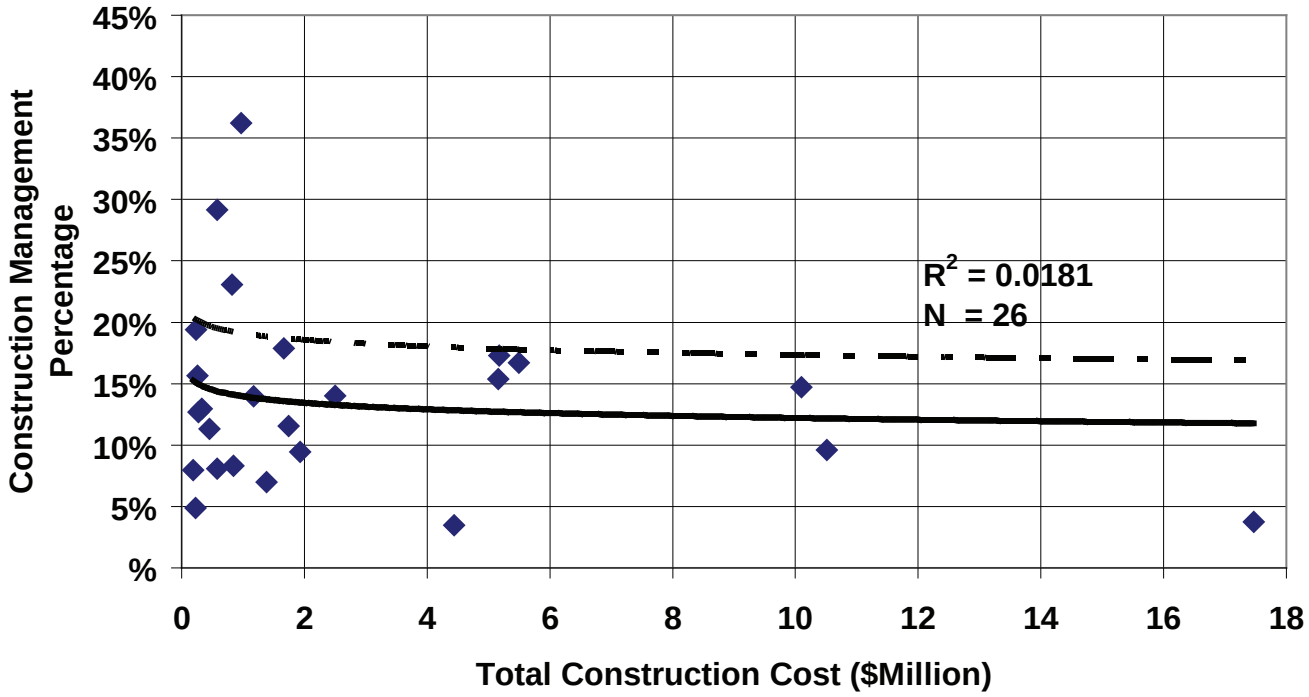
Municipal Facilities - Comm./Rec. Center/Child Care/Gyms
Construction Management Percentage Versus Total Construction Cost



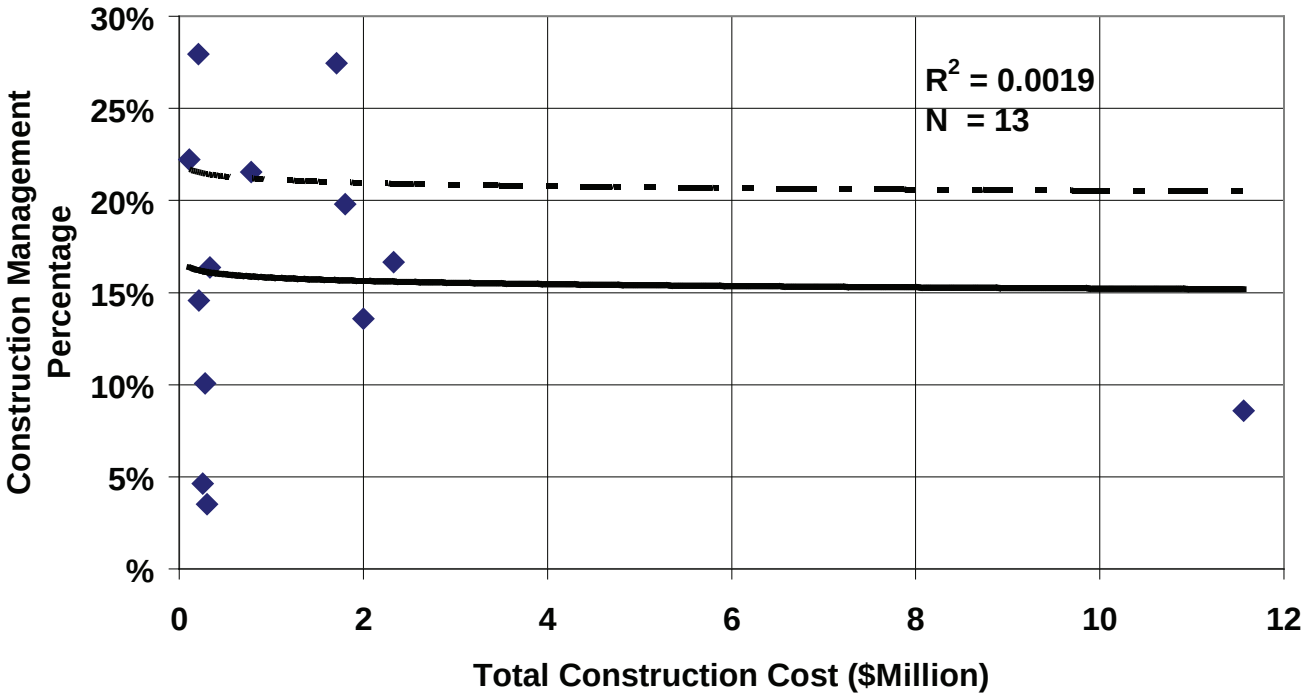
Streets - All Classifications
Construction Management Percentage Versus Total Construction Cost



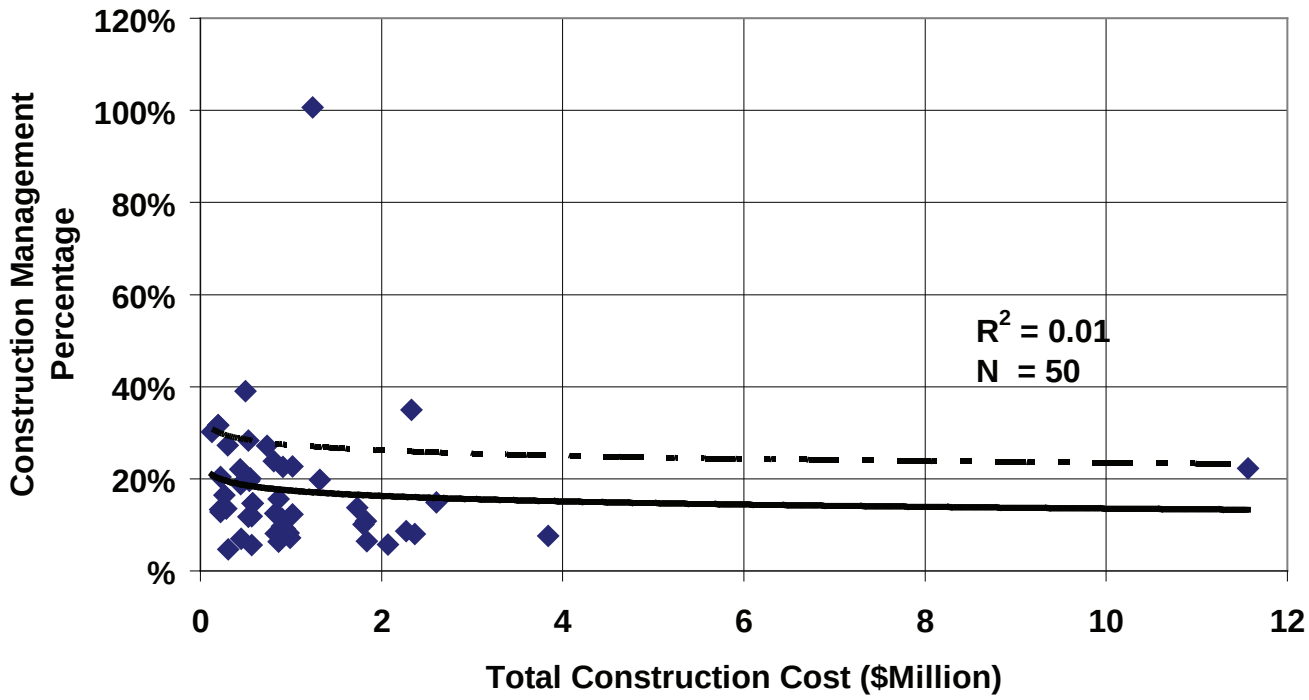
Streets - Widening/New/Grade Separations
Construction Management Percentage Versus Total Construction Cost



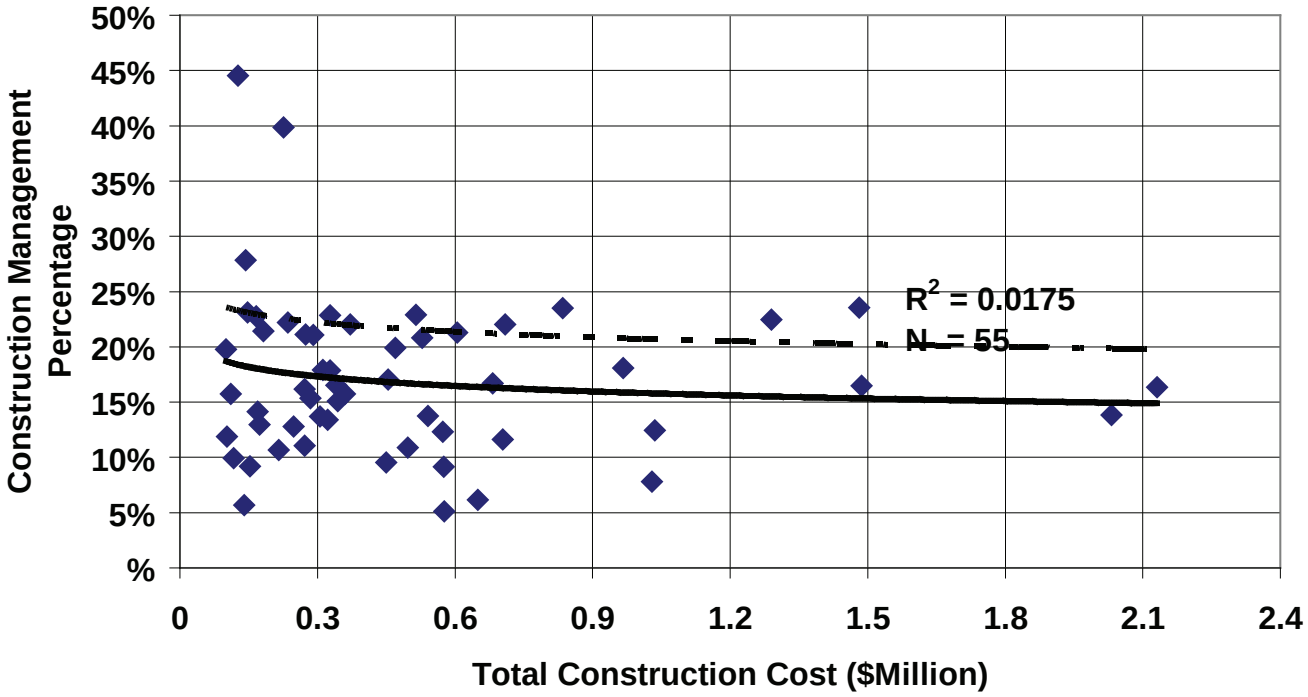
Streets - Bridges (New/Retrofit)
Construction Management Percentage Versus Total Construction Cost



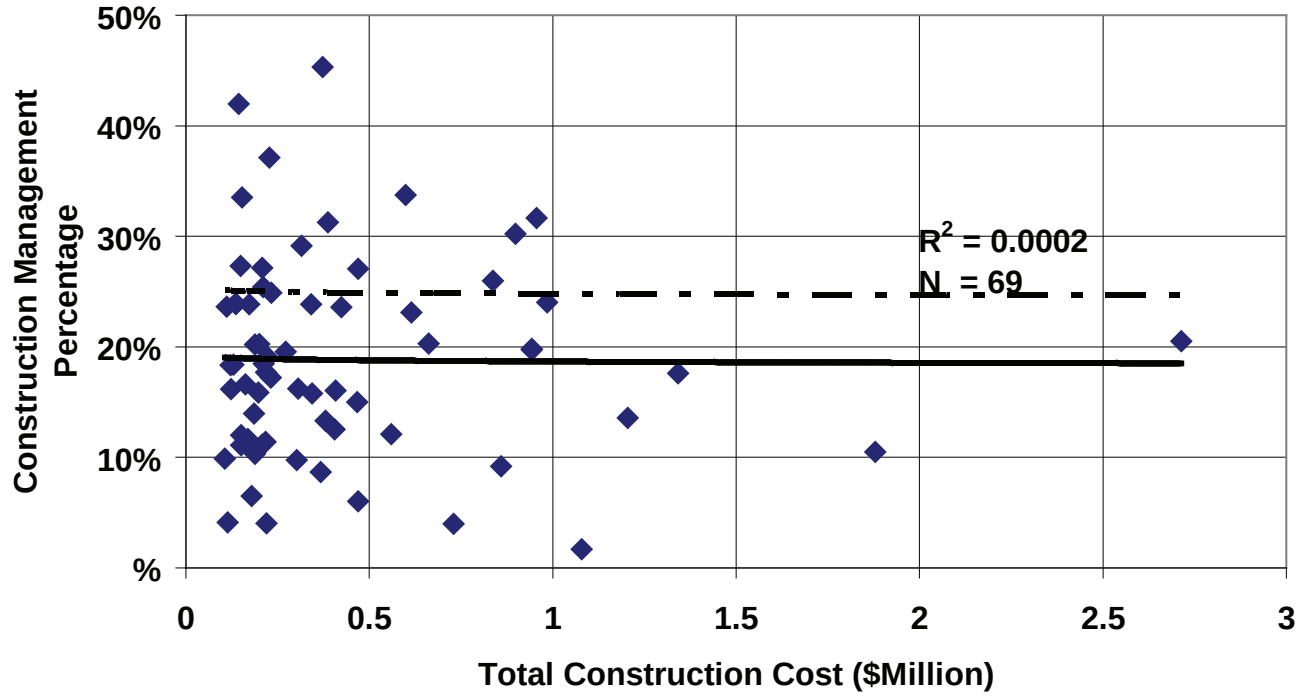
Streets - Reconstructions
Construction Management Percentage Versus Total Construction Cost



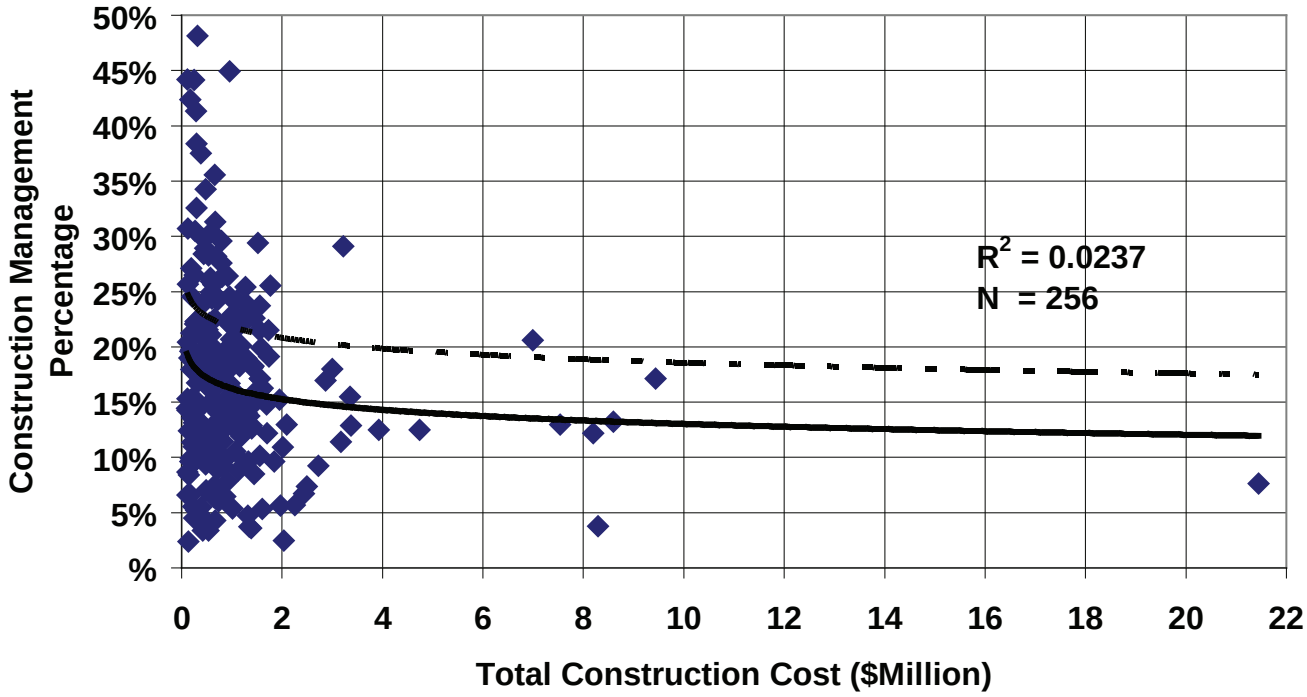
Streets - Bike/Pedestrian/Streetscapes
Construction Management Percentage Versus Total Construction Cost



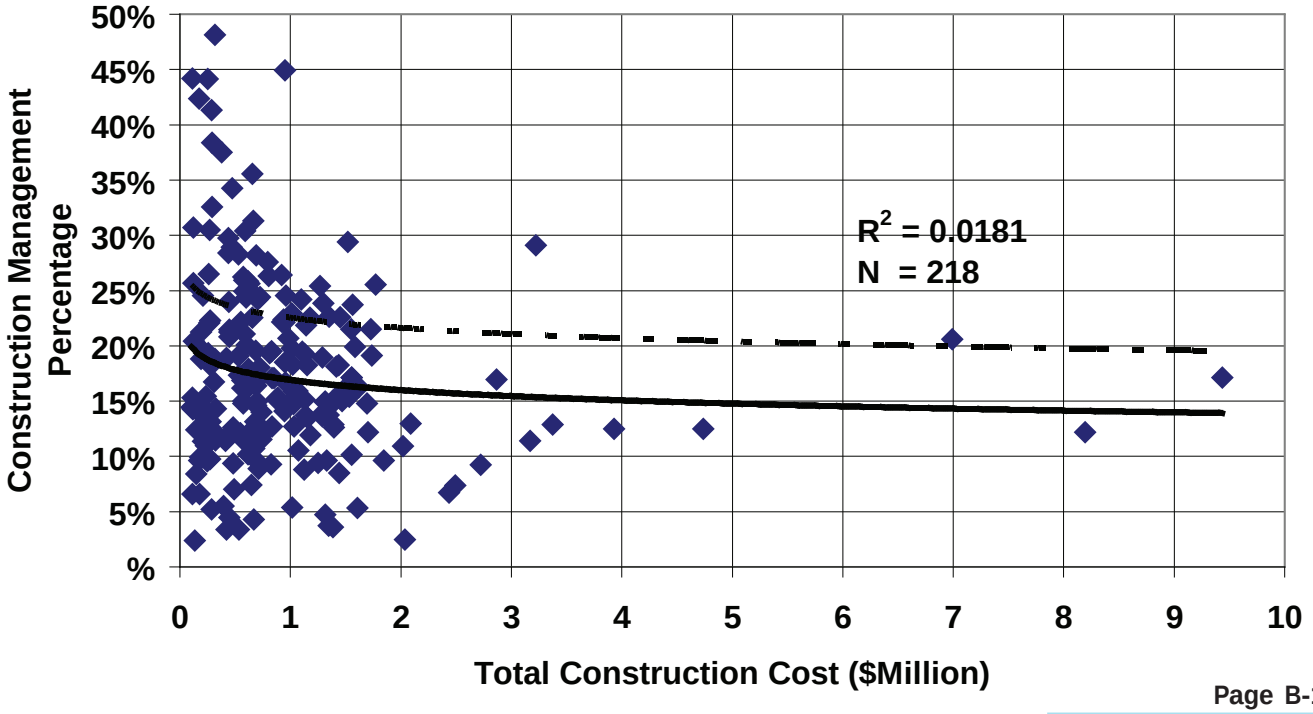
Streets - Signals
Construction Management Percentage Versus Total Construction Cost



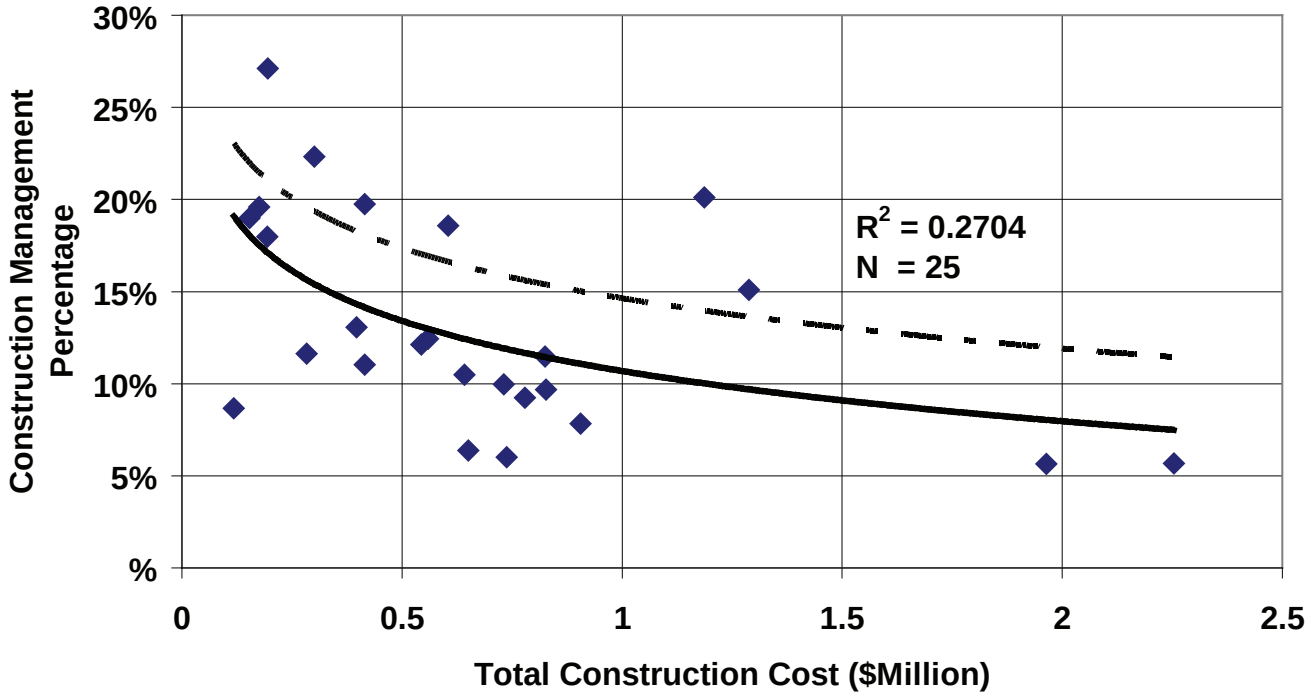
Pipe Systems - All Classifications
Construction Management Percentage Versus Total Construction Cost



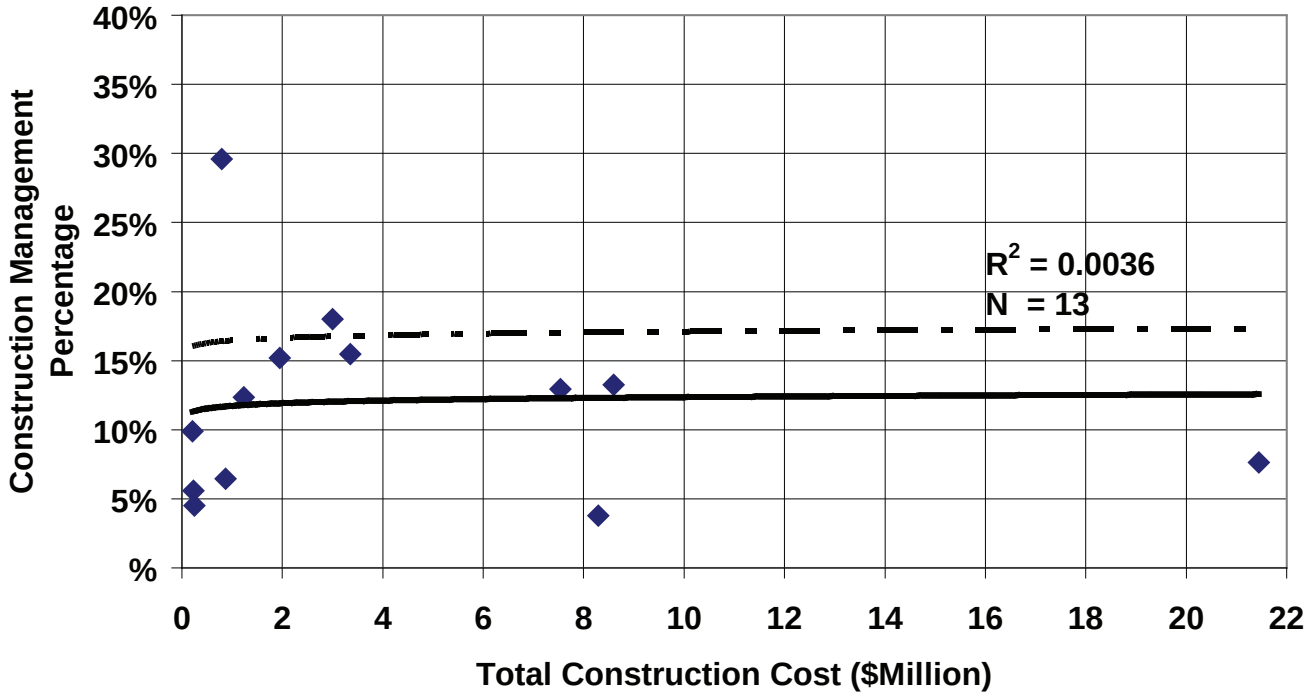
Pipe Systems - Gravity Systems (Storm Drains/Sewers)
Construction Management Percentage Versus Total Construction Cost



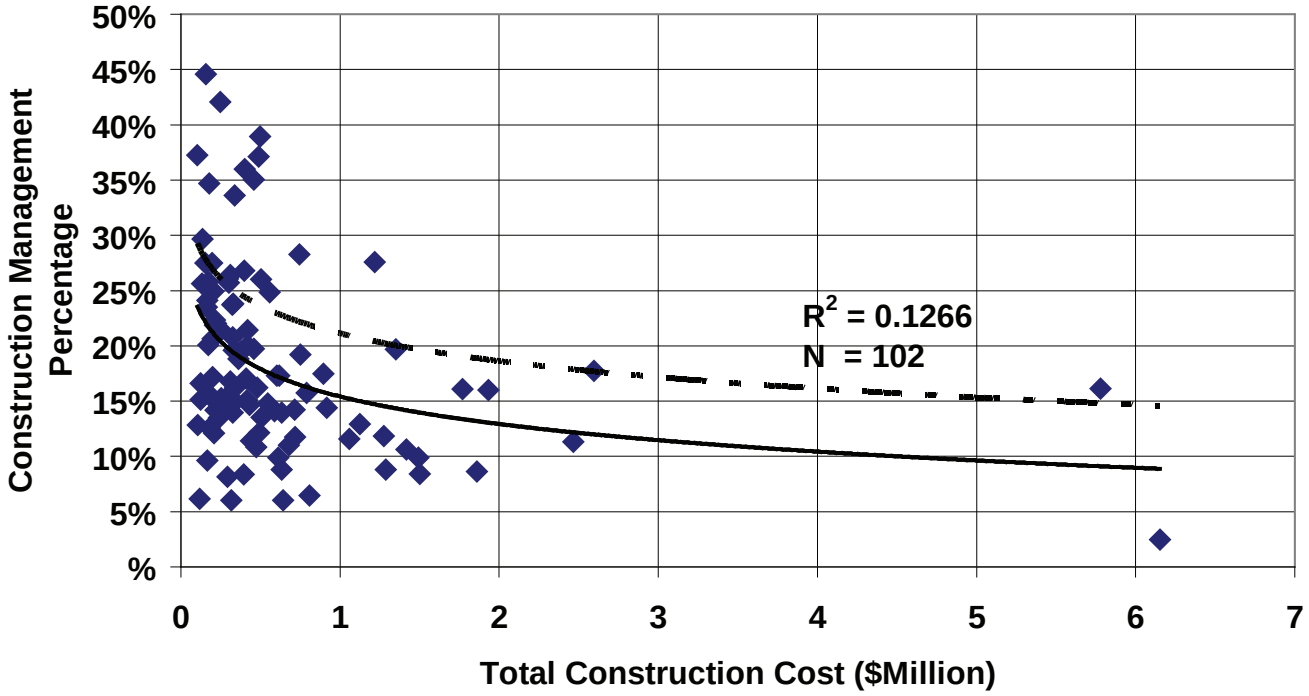
Pipe Systems - Pressure Systems
Construction Management Percentage Versus Total Construction Cost



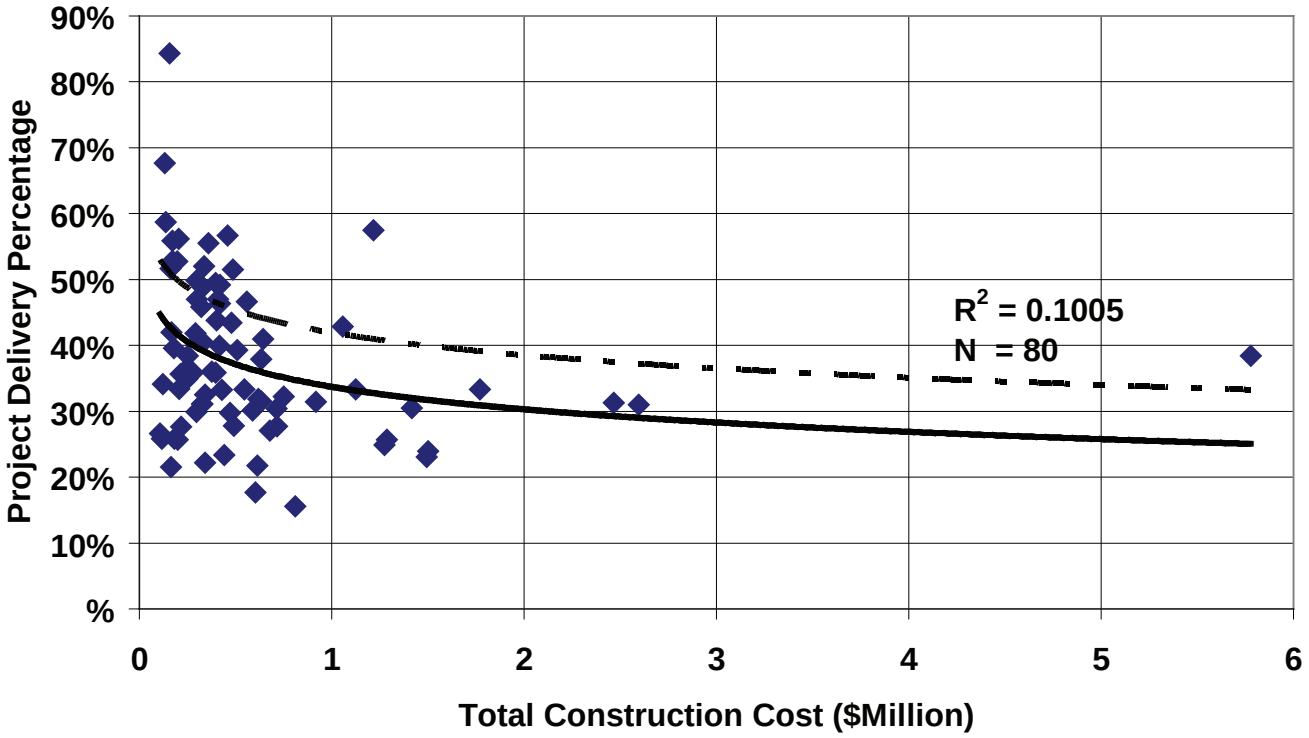
Pipe Systems - Pump Stations
Construction Management Percentage Versus Total Construction Cost



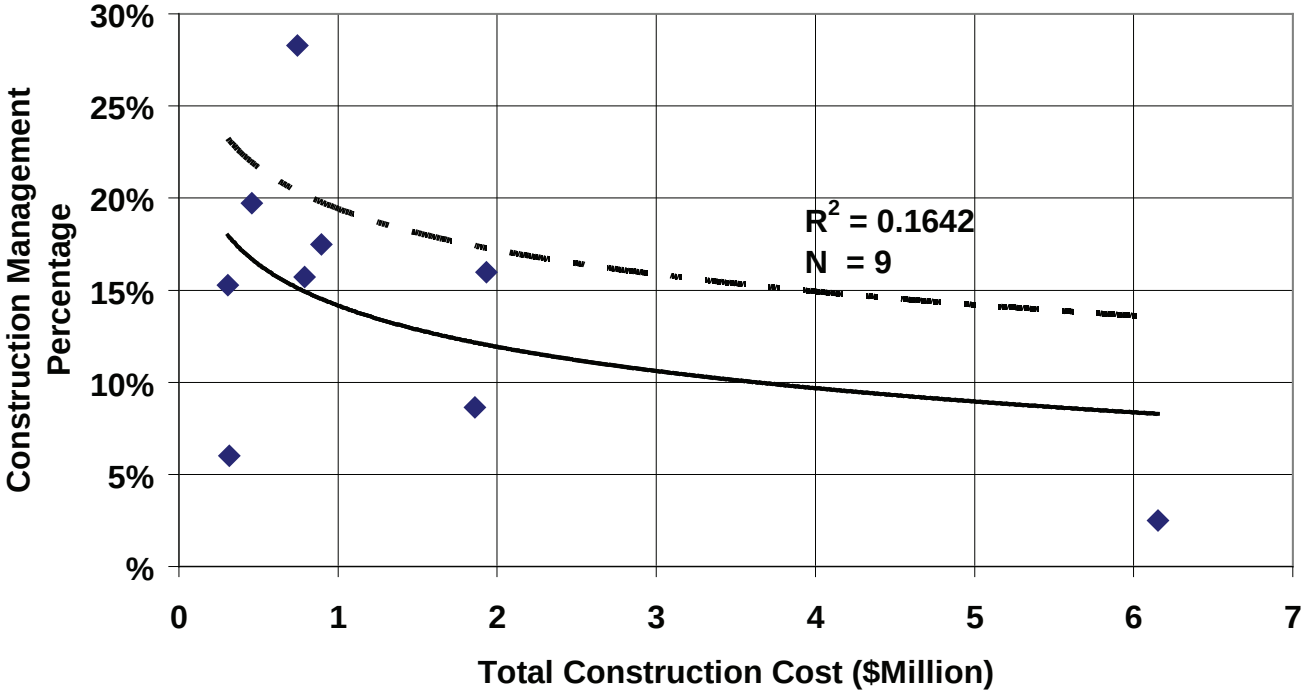
Parks - All Classifications
Construction Management Percentage Versus Total Construction Cost



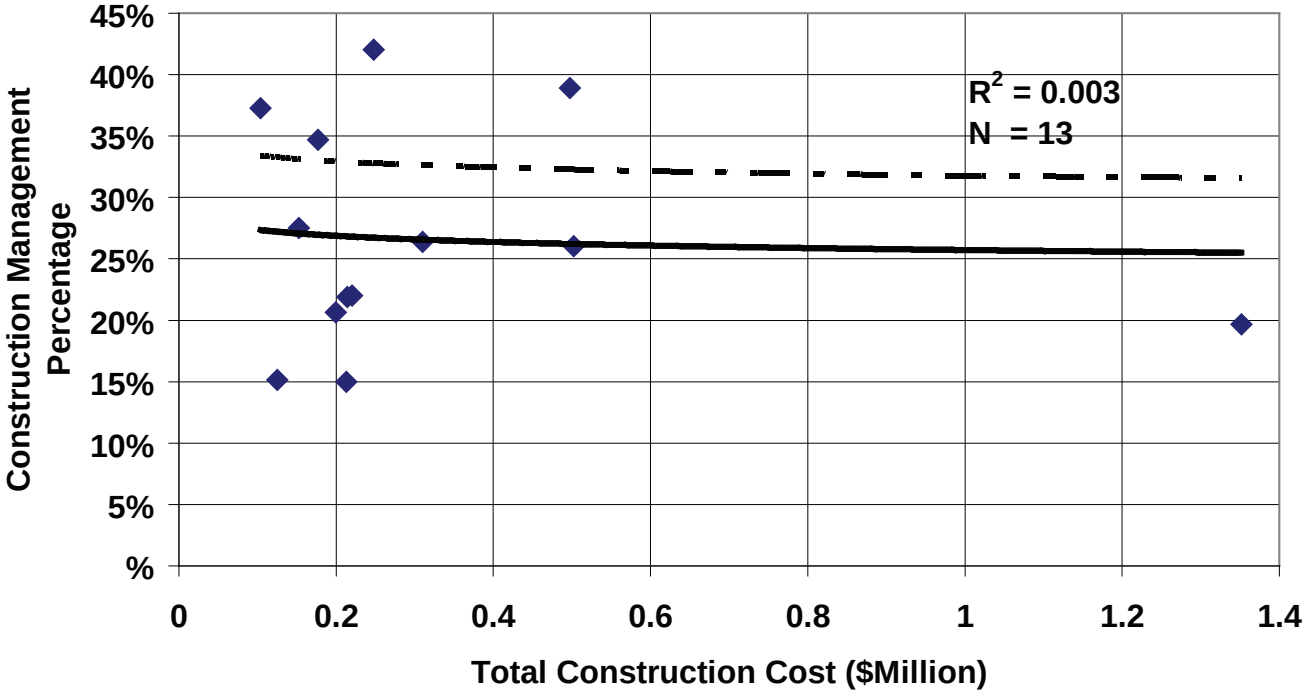
Parks - Playgrounds
Project Delivery Percentage Versus Total Construction Cost



Parks - Sportfields
Construction Management Percentage Versus Total Construction Cost



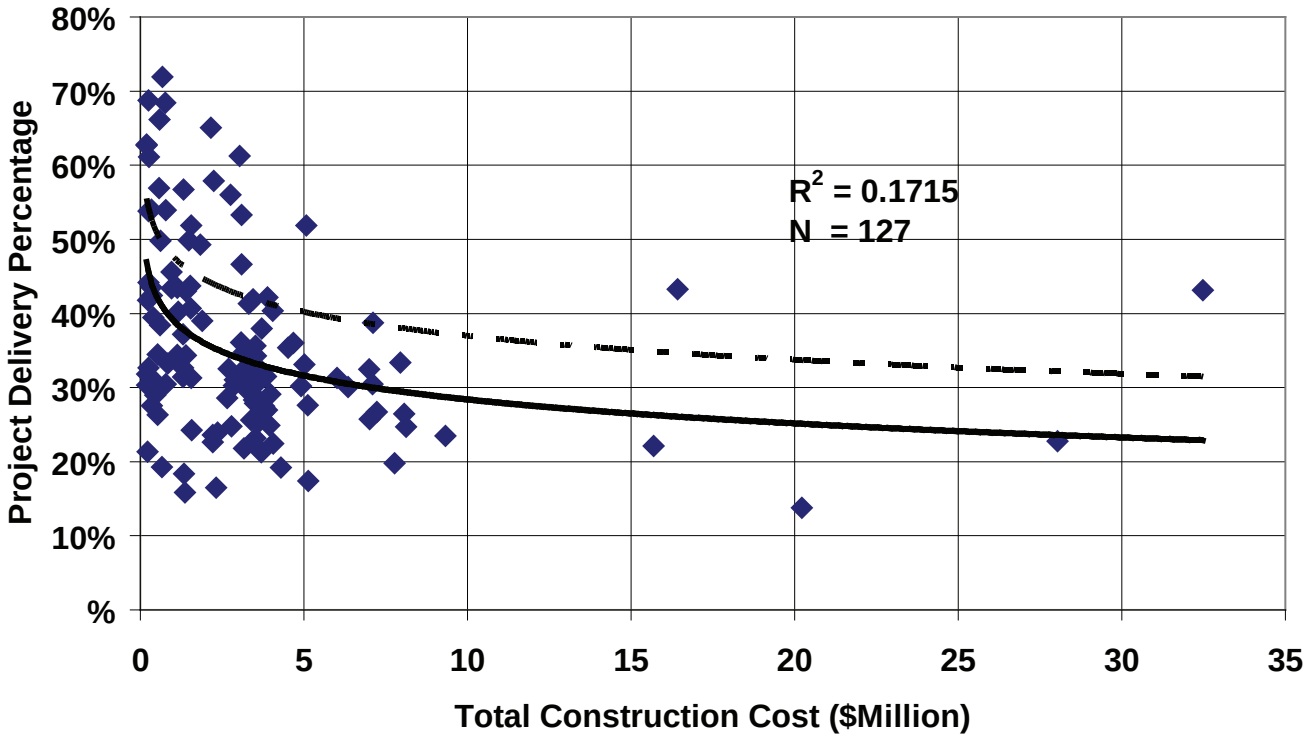
Parks - Restrooms
Construction Management Percentage Versus Total Construction Cost



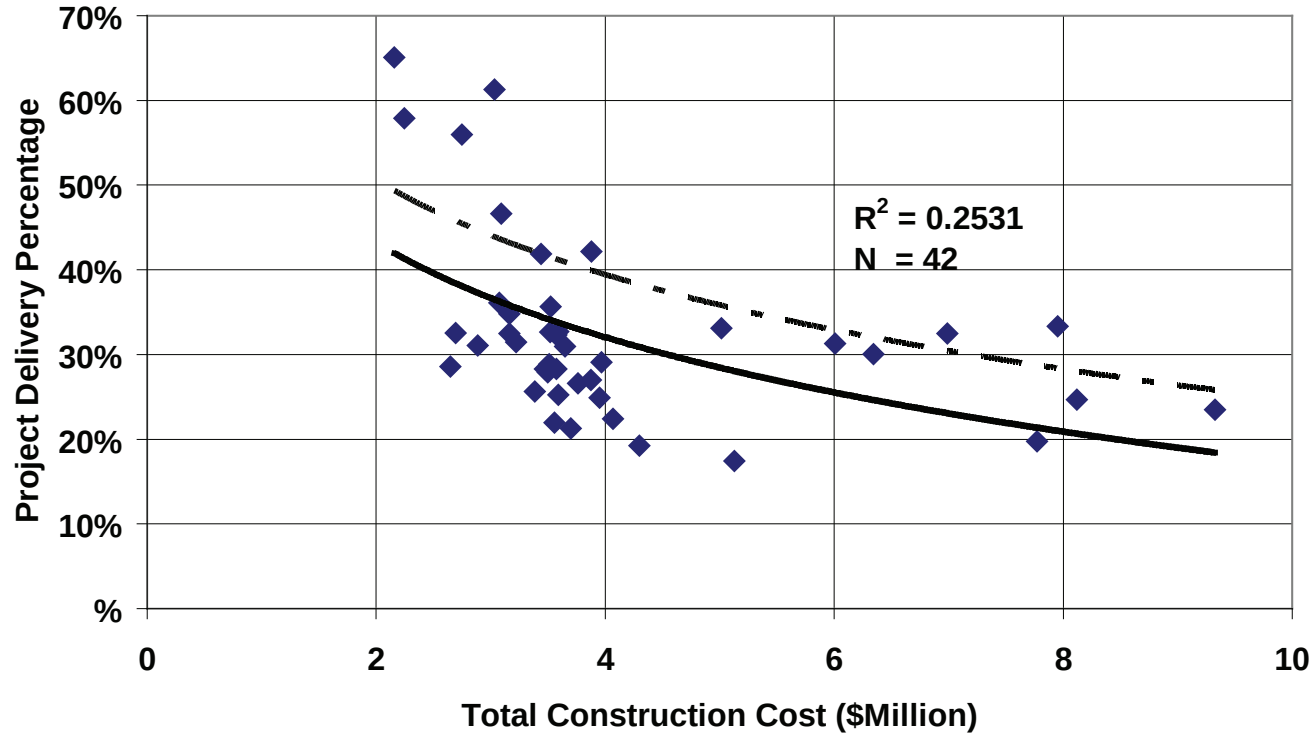
CURVES GROUP 3

Project Delivery as Percentage of Total Construction Cost vs Total Construction Cost

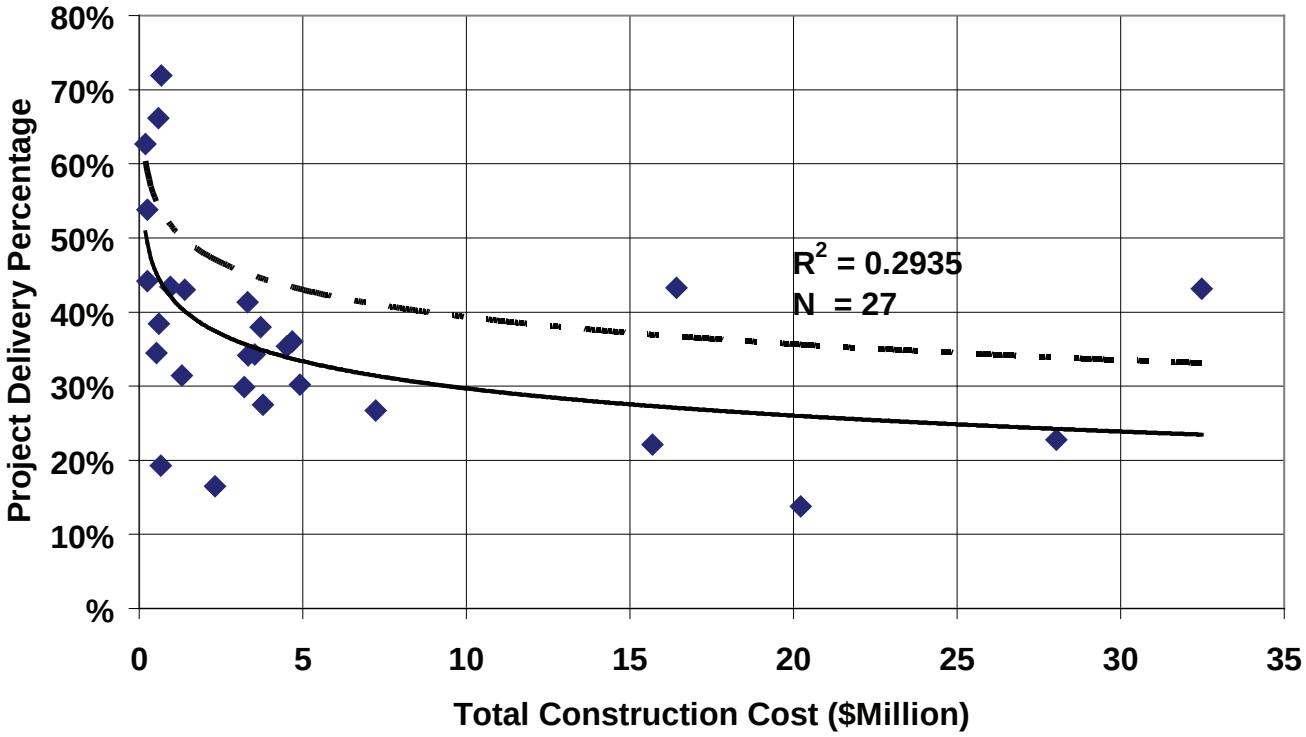
Municipal Facilities - All Classifications
Project Delivery Percentage Versus Total Construction Cost



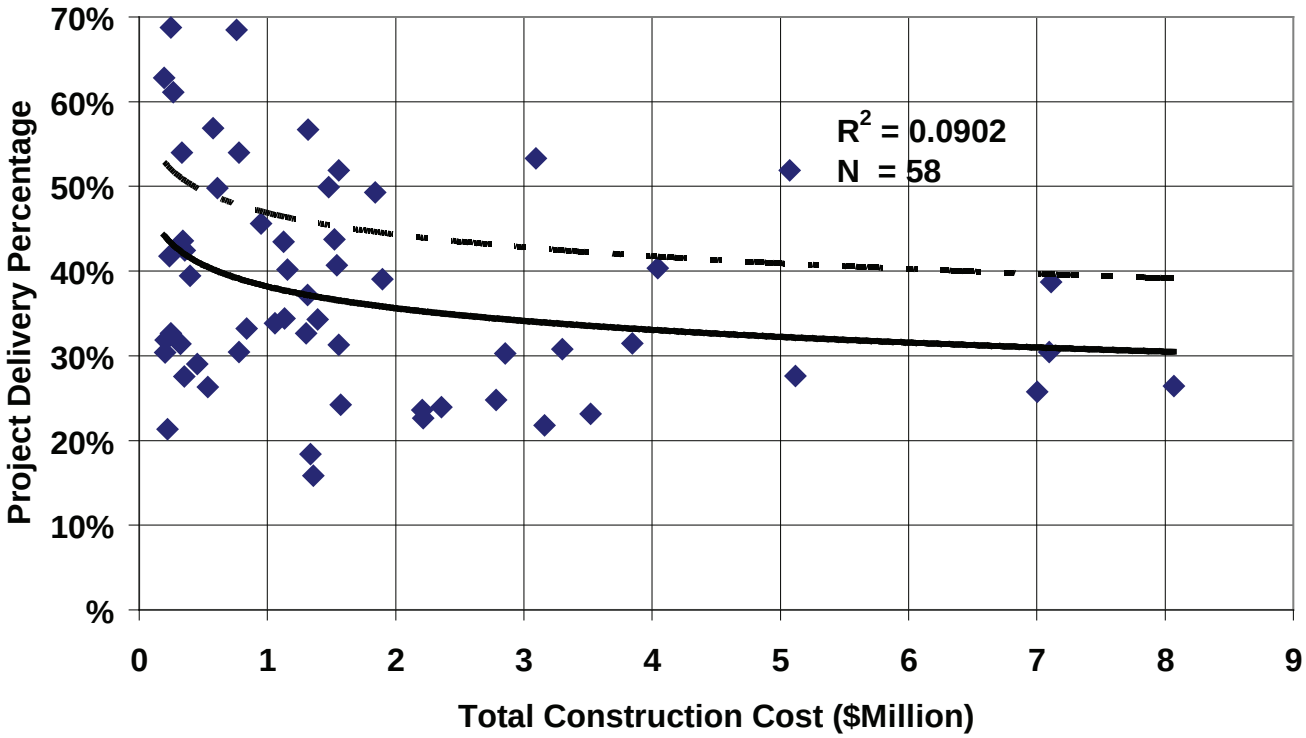
Municipal Facilities - Libraries
Project Delivery Percentage Versus Total Construction Cost



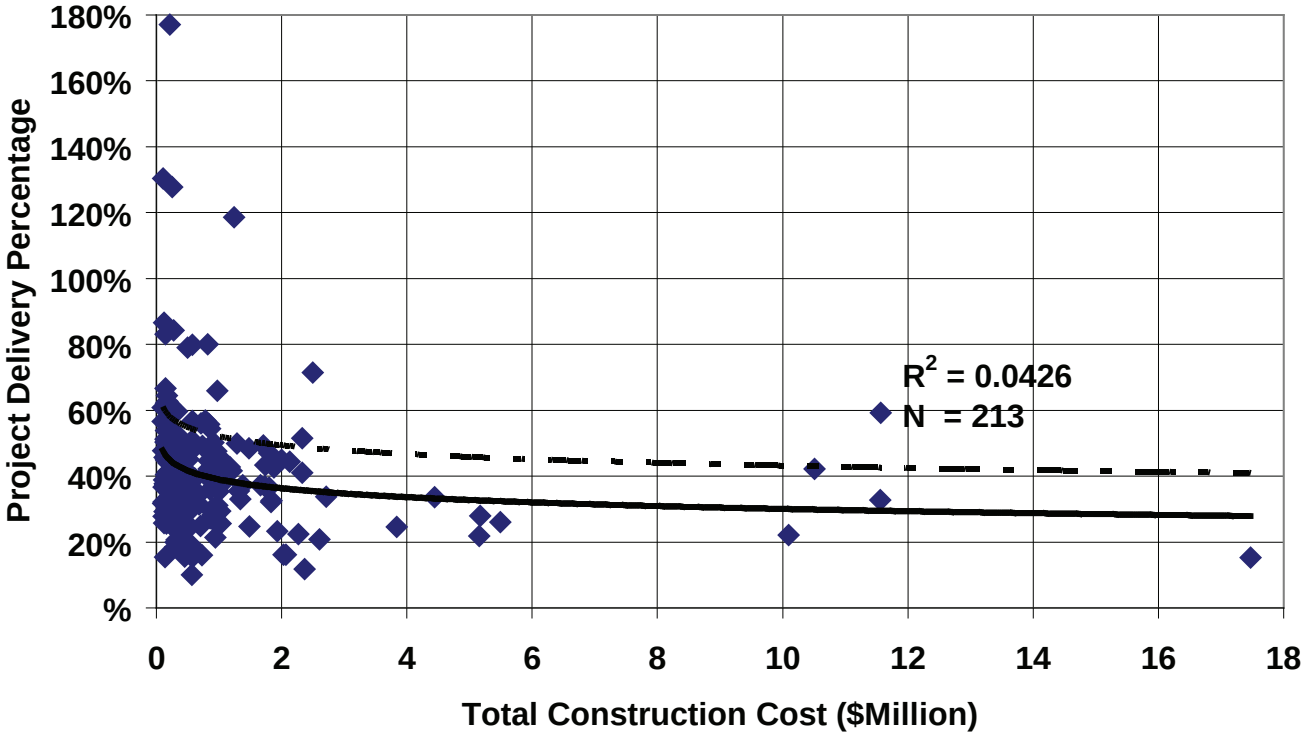
Municipal Facilities - Police/Fire Stations
Project Delivery Percentage Versus Total Construction Cost



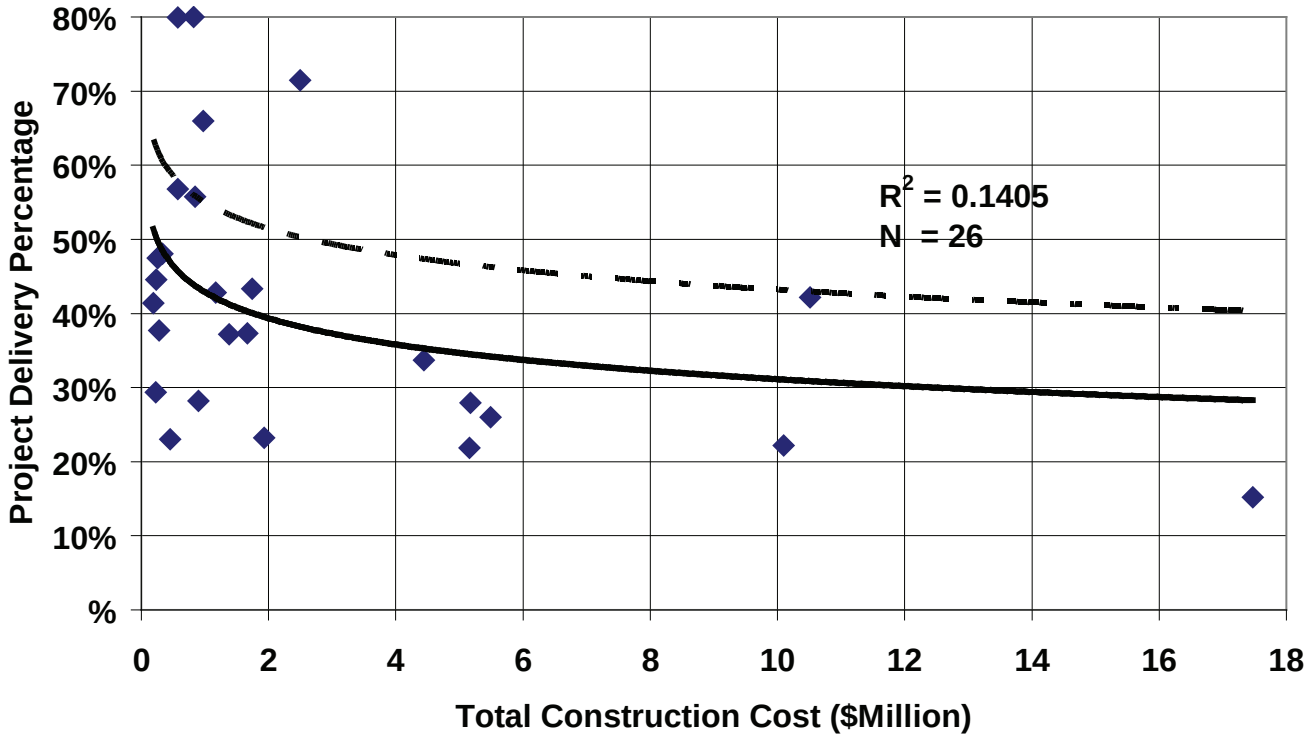
Municipal Facilities - Comm./Rec. Center/Child Care/Gyms
Project Delivery Percentage Versus Total Construction Cost



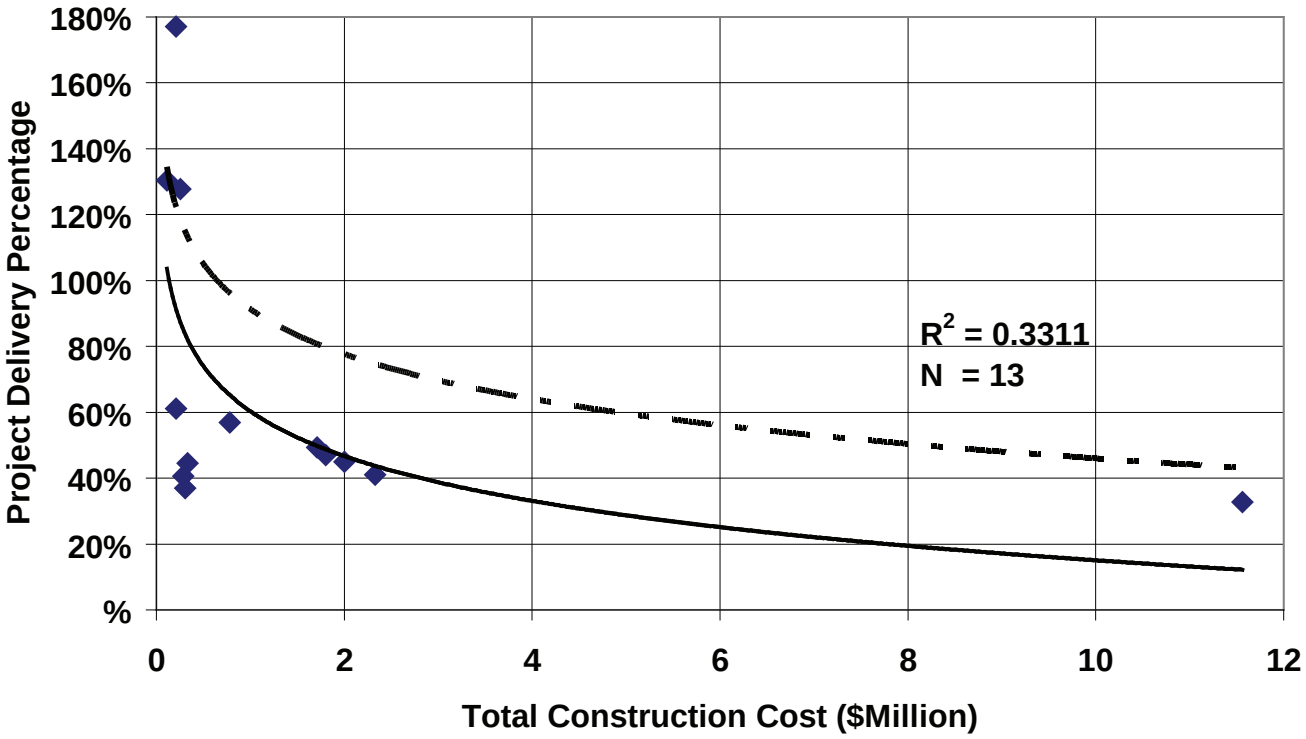
Streets - All Classifications
Project Delivery Percentage Versus Total Construction Cost



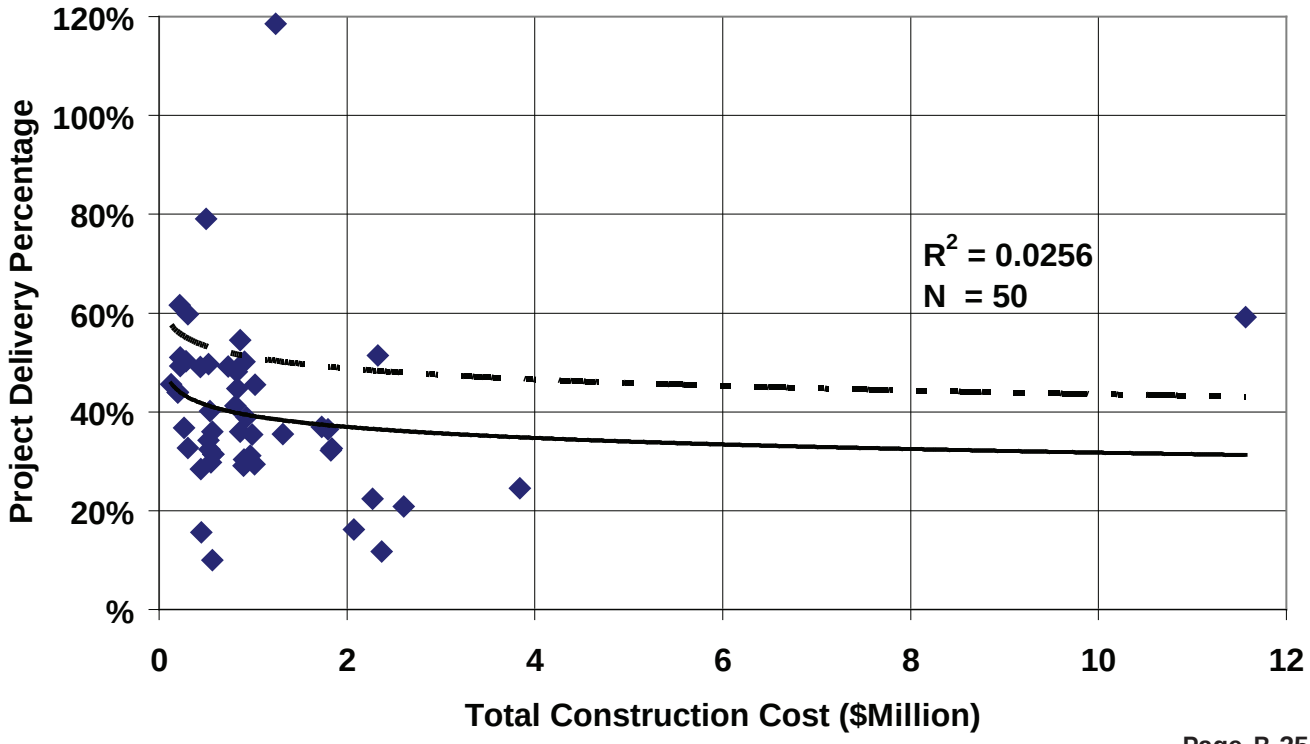
Streets - Widening/New/Grade Separations
Project Delivery Percentage Versus Total Construction Cost



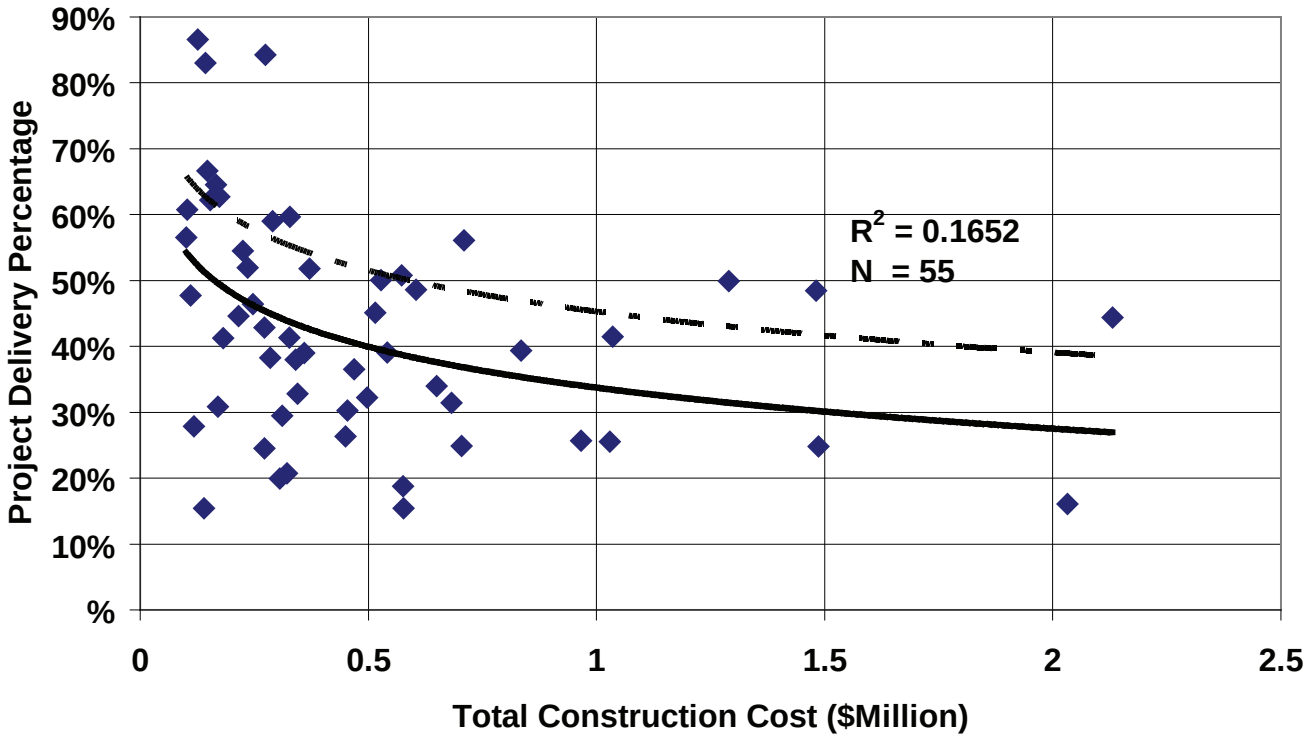
Streets - Bridges (New/Retrofit)
Project Delivery Percentage Versus Total Construction Cost



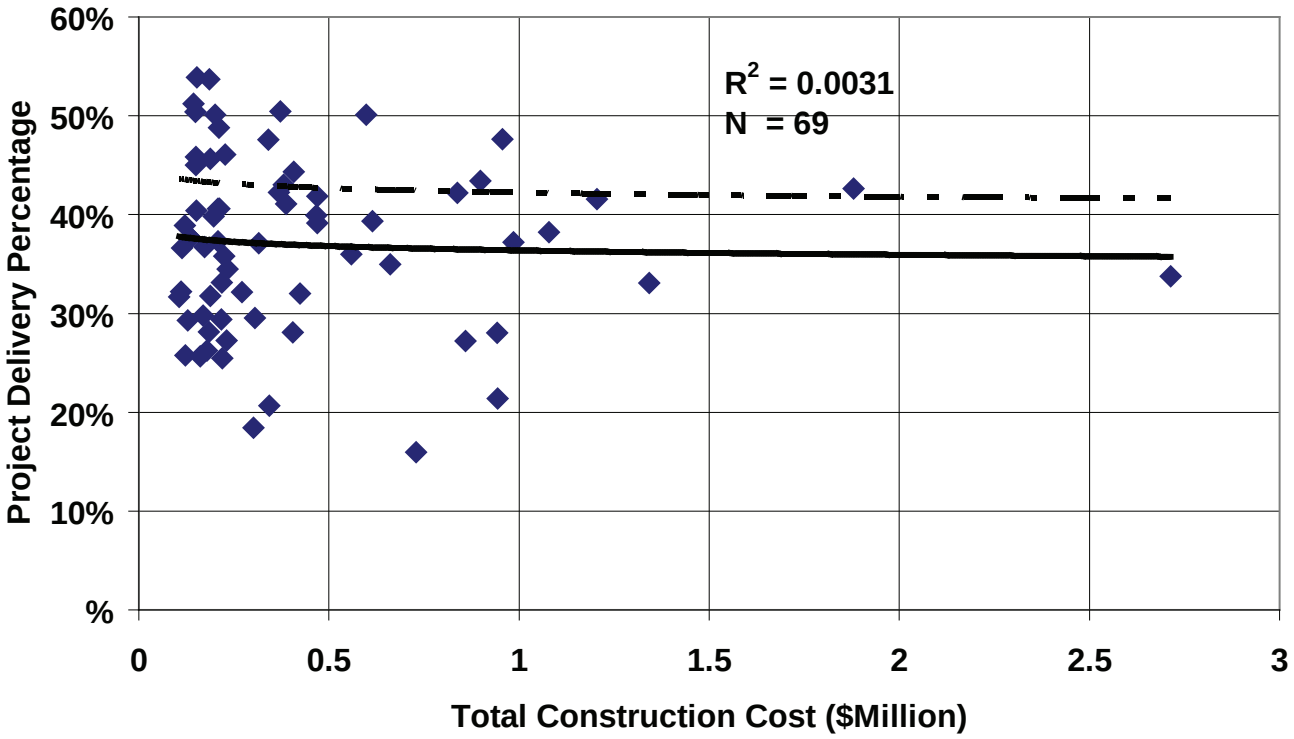
Streets - Reconstructions
Project Delivery Percentage Versus Total Construction Cost



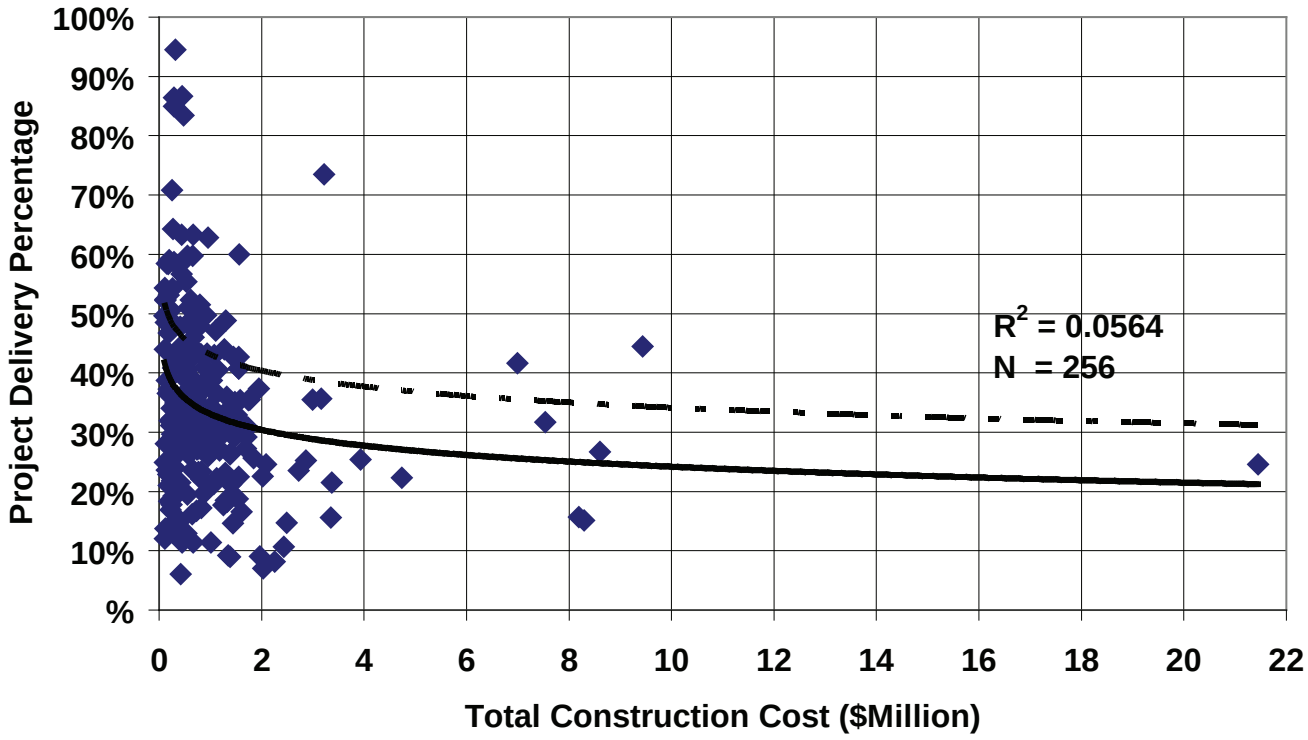
Streets - Bike/Pedestrian/Streetscapes
Project Delivery Percentage Versus Total Construction Cost



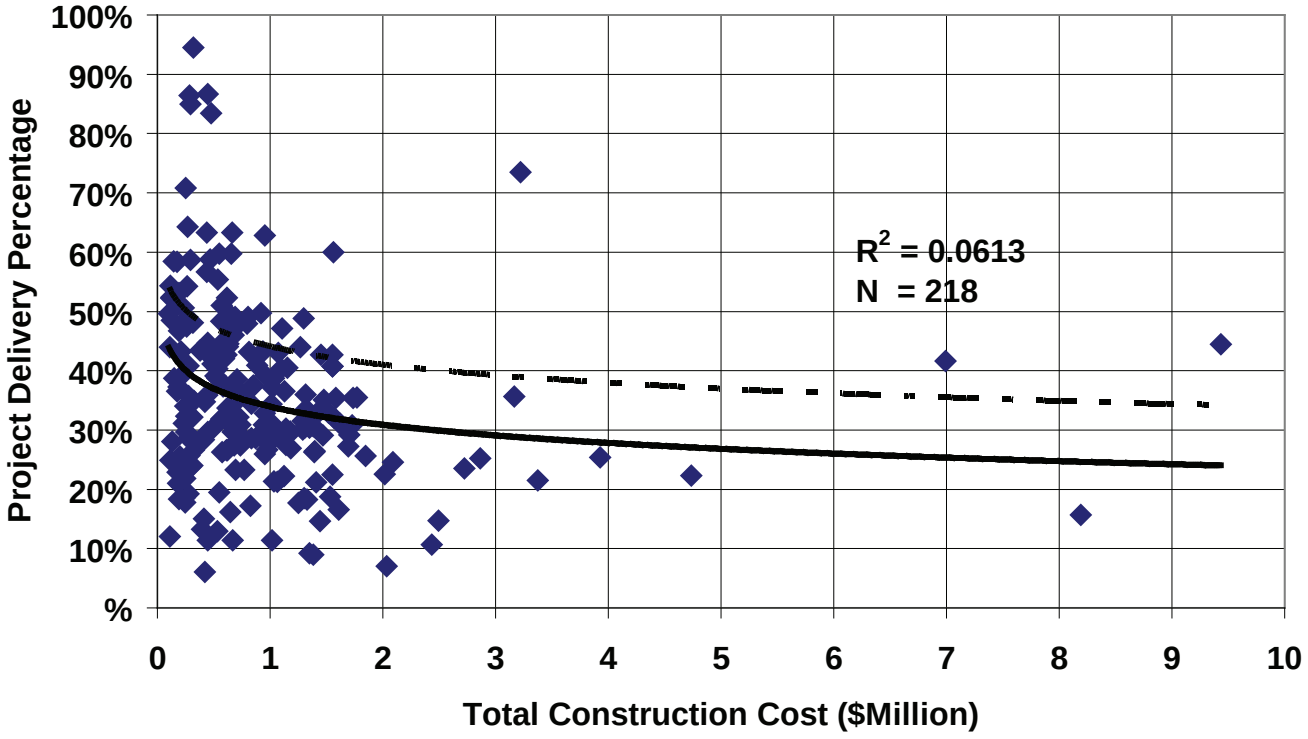
Streets - Signals
Project Delivery Percentage Versus Total Construction Cost



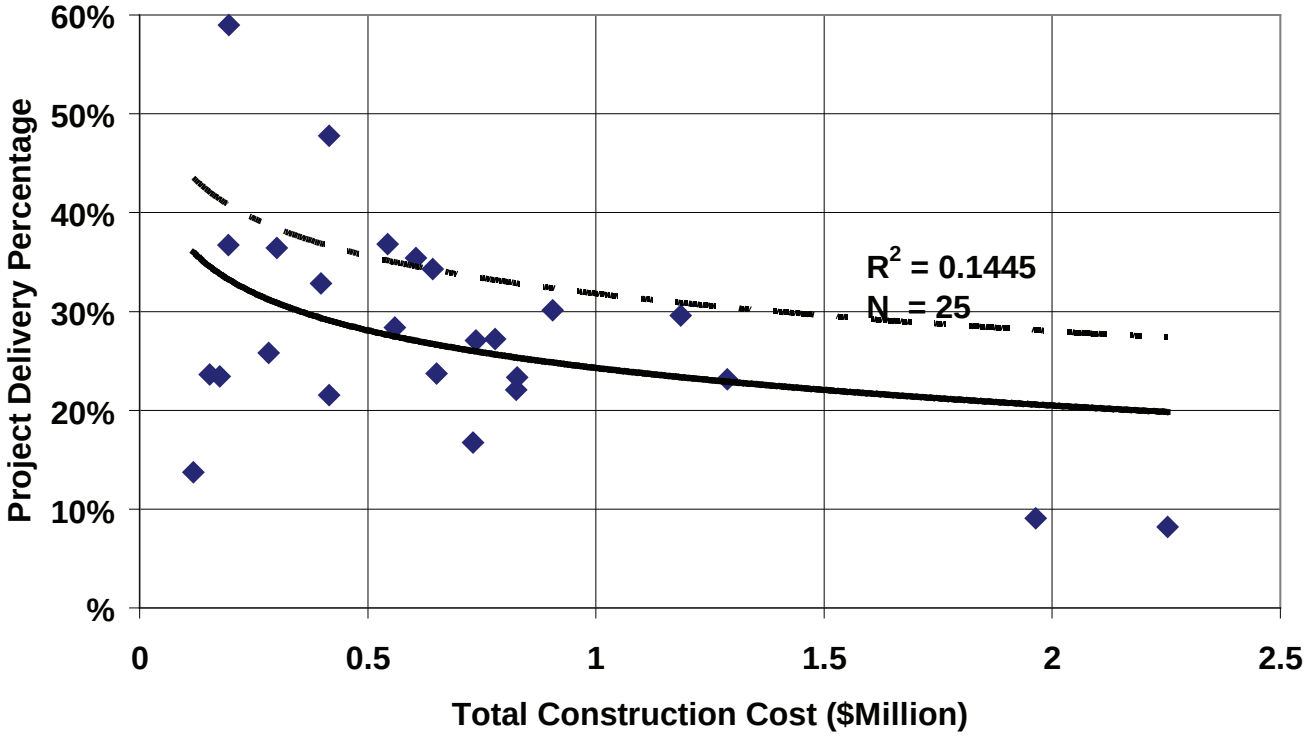
Pipe Systems - All Classifications
Project Delivery Percentage Versus Total Construction Cost



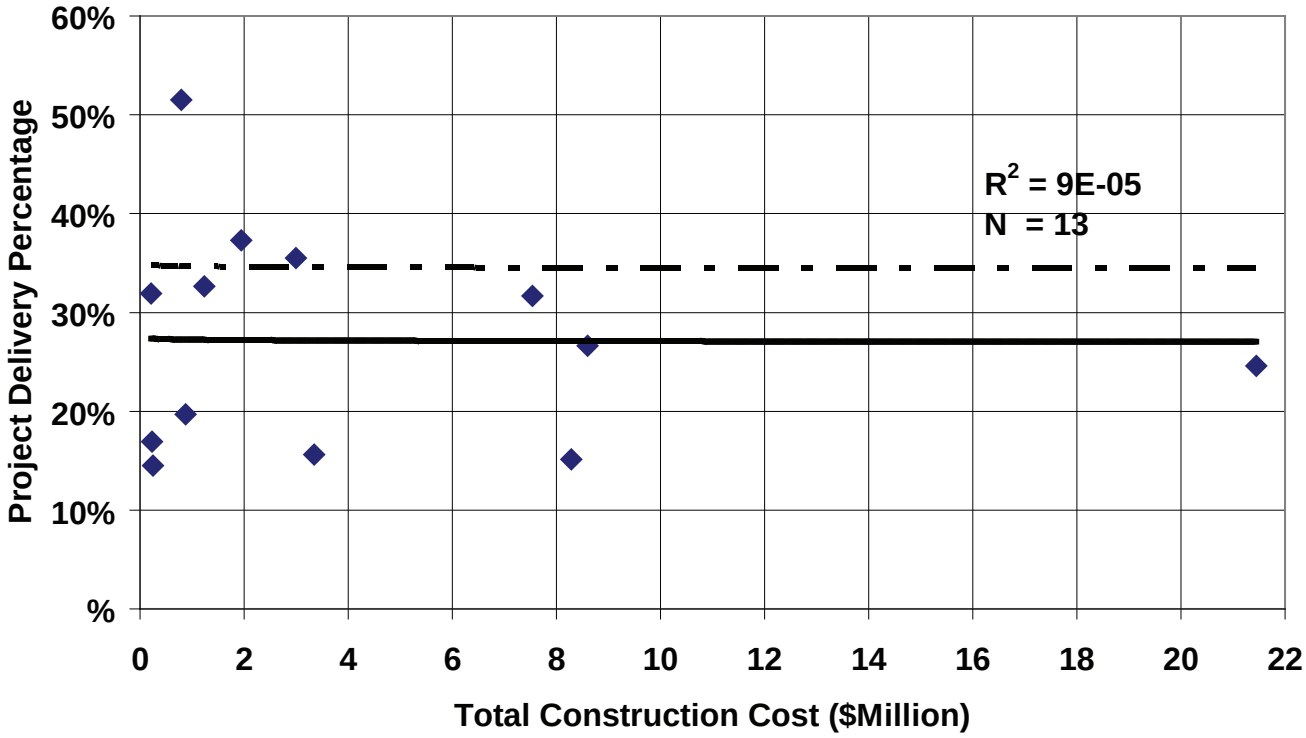
Pipe Systems - Gravity Systems (Storm Drains/Sewers)
Project Delivery Percentage Versus Total Construction Cost



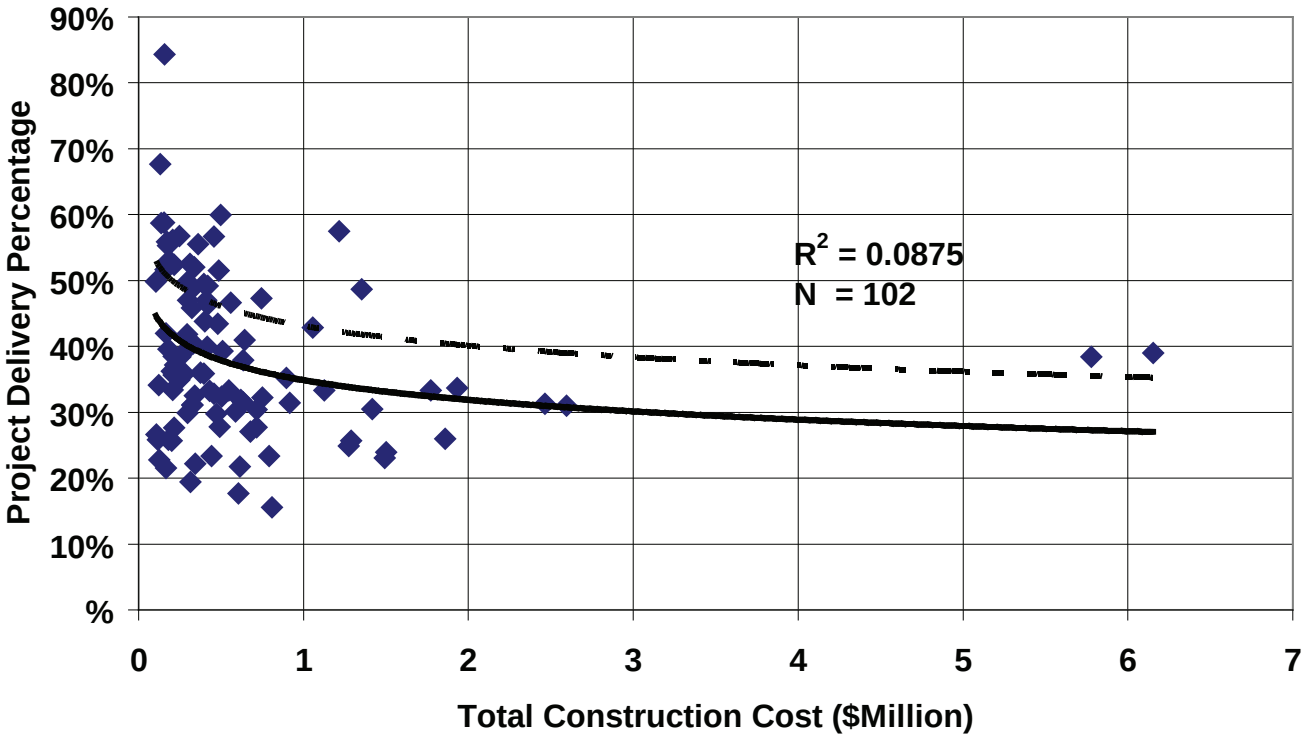
Pipe Systems - Pressure Systems
Project Delivery Percentage Versus Total Construction Cost



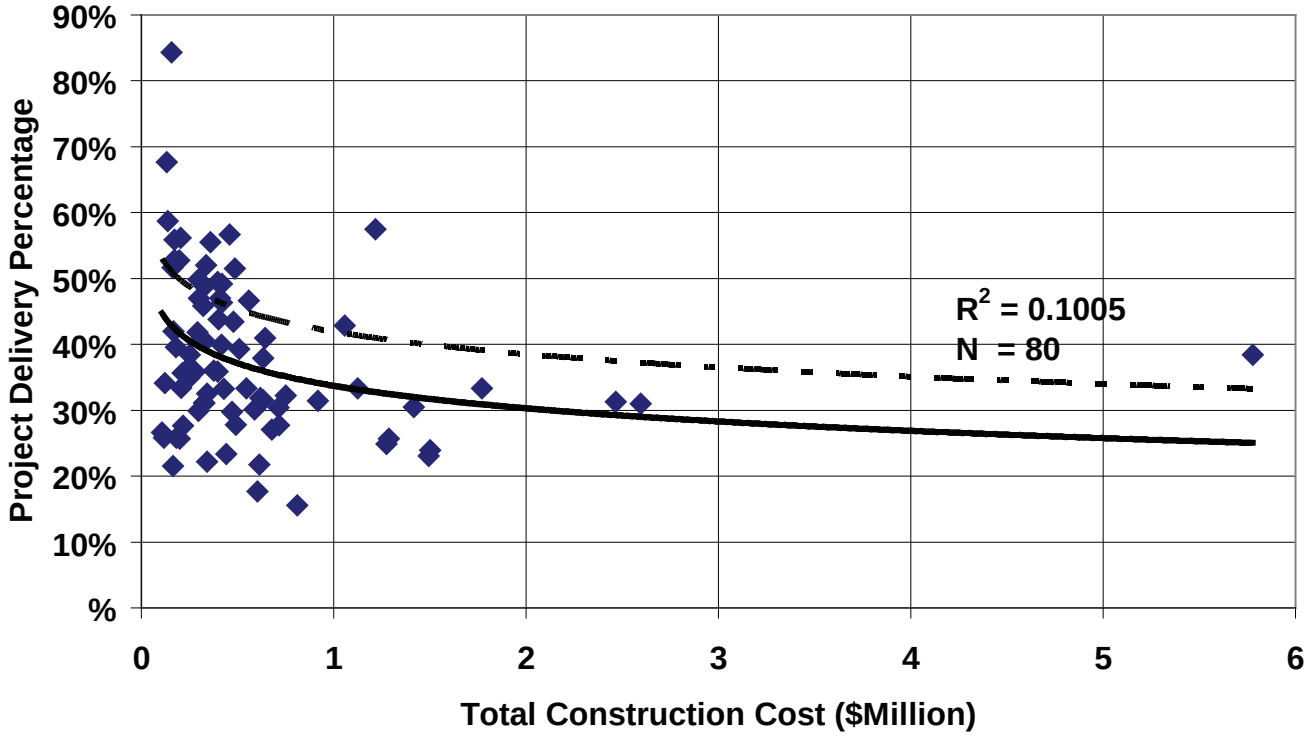
Pipe Systems - Pump Stations
Project Delivery Percentage Versus Total Construction Cost



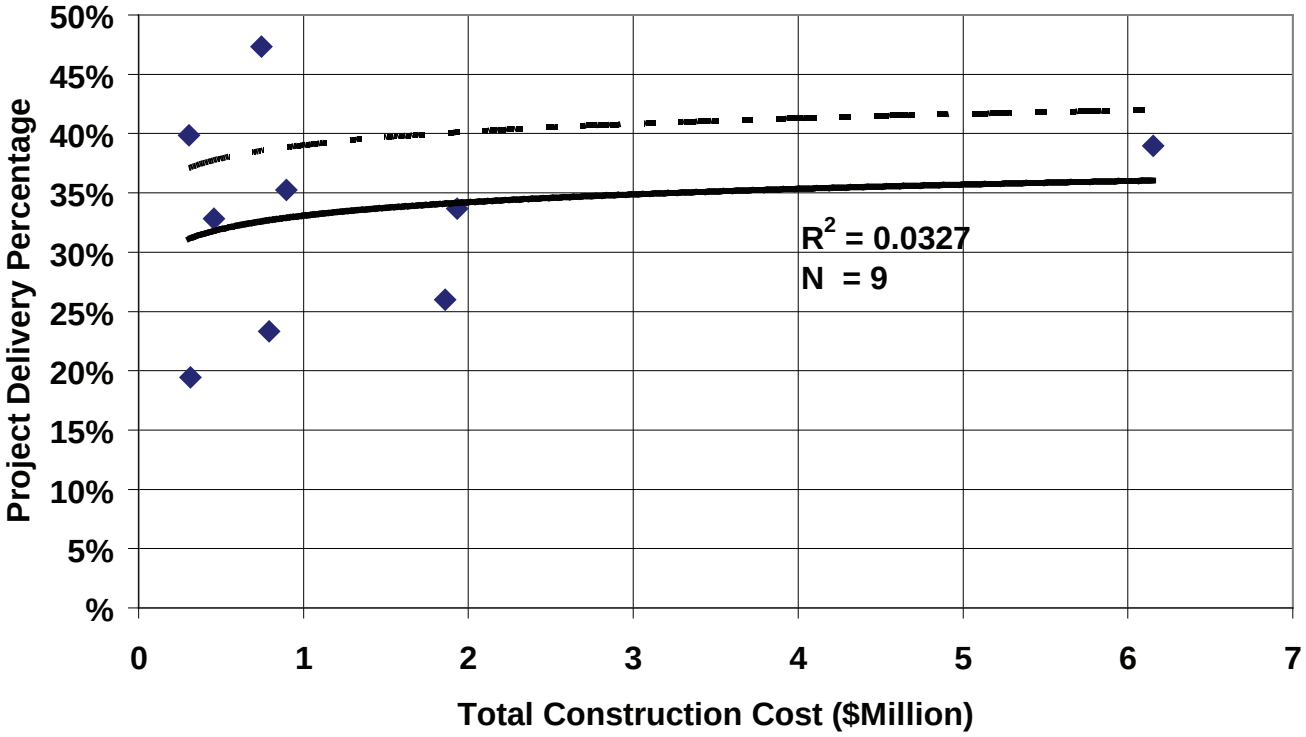
Parks - All Classifications
Project Delivery Percentage Versus Total Construction Cost



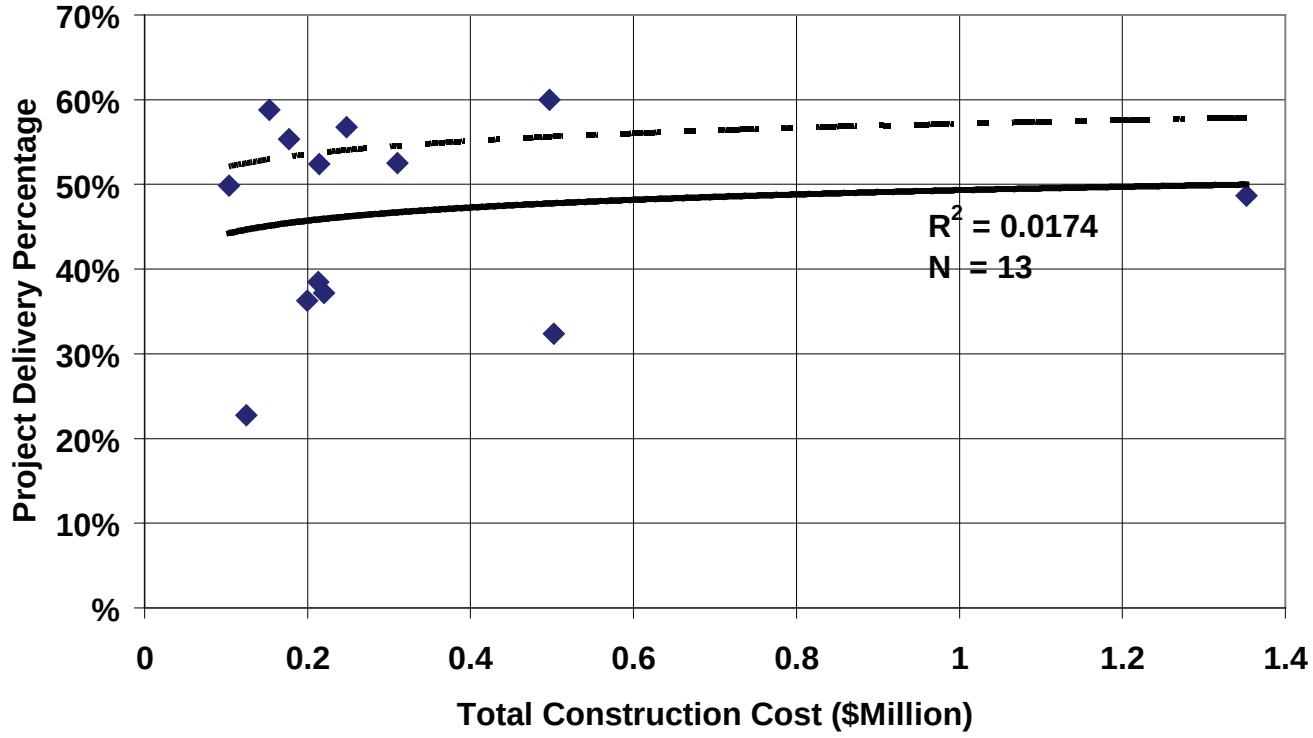
Parks - Playgrounds
Project Delivery Percentage Versus Total Construction Cost



Parks - Sportfields
Project Delivery Percentage Versus Total Construction Cost



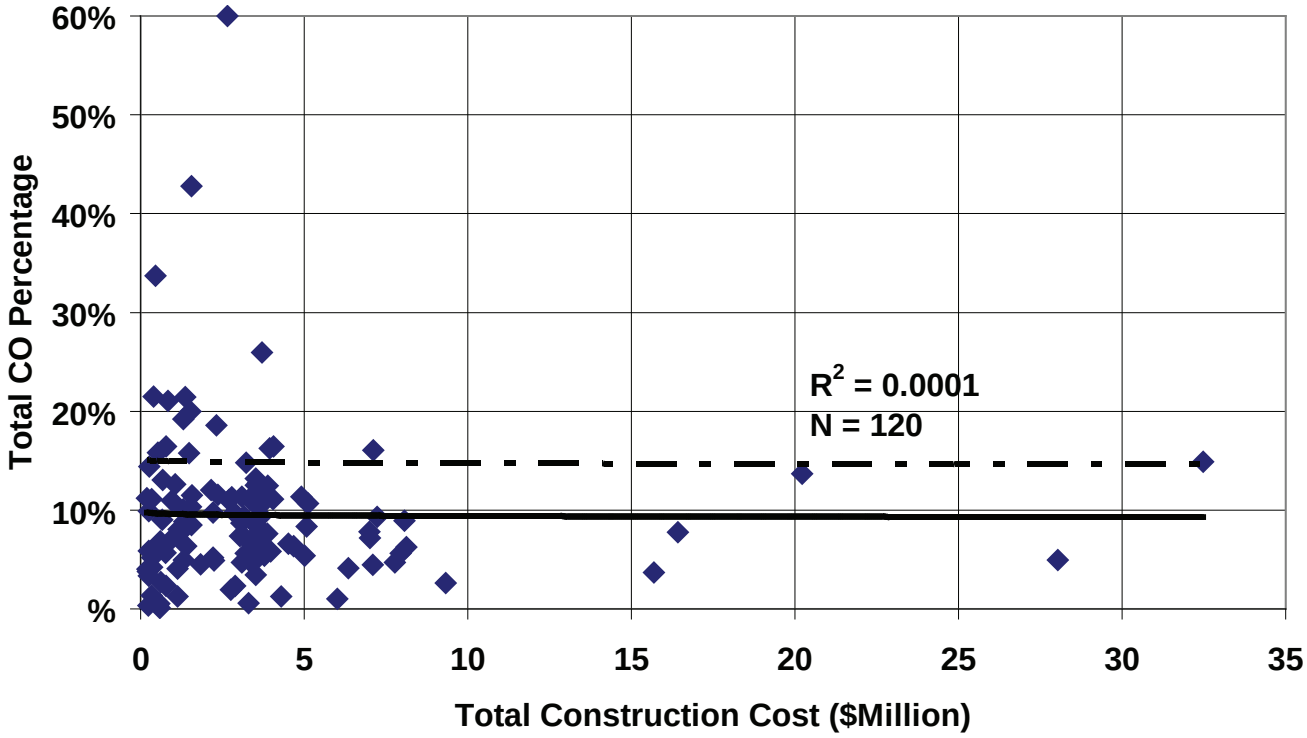
Parks - Restrooms
Project Delivery Percentage Versus Total Construction Cost



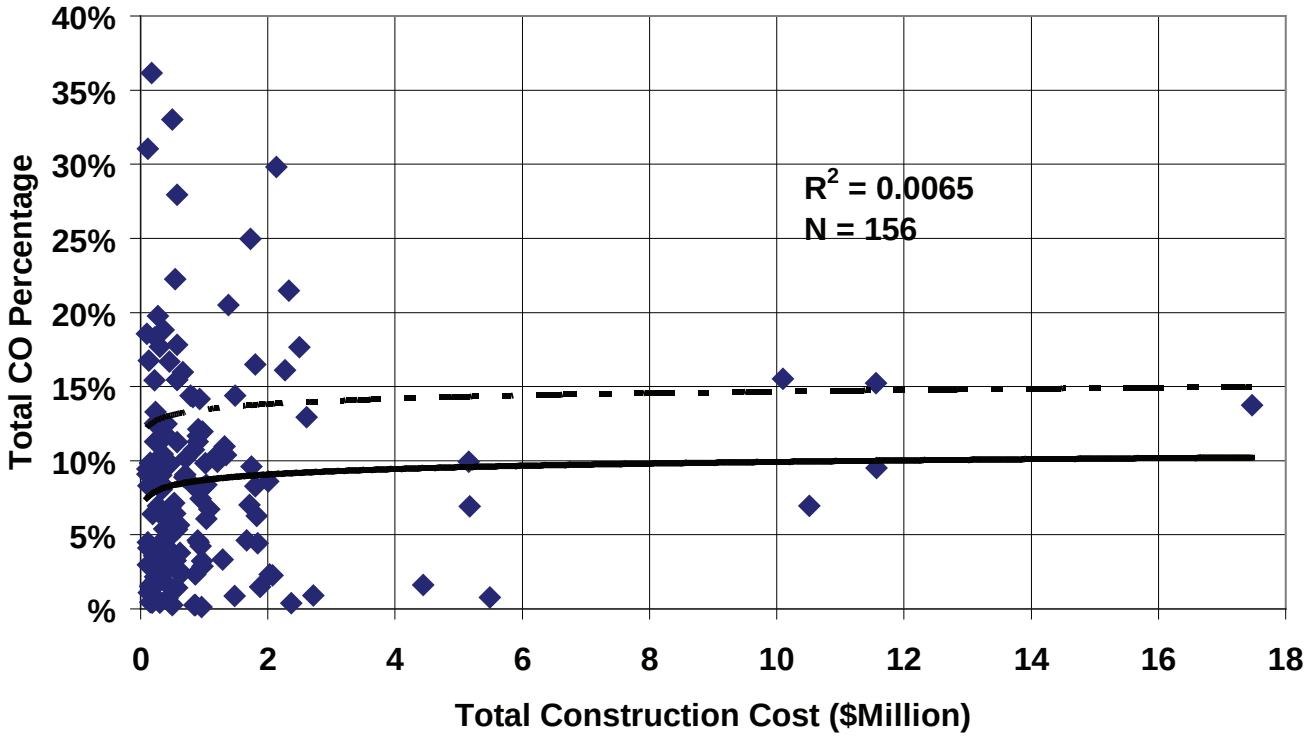
CURVES GROUP 4

Change Orders as Percentage of Total Construction Cost
vs
Total Construction Cost

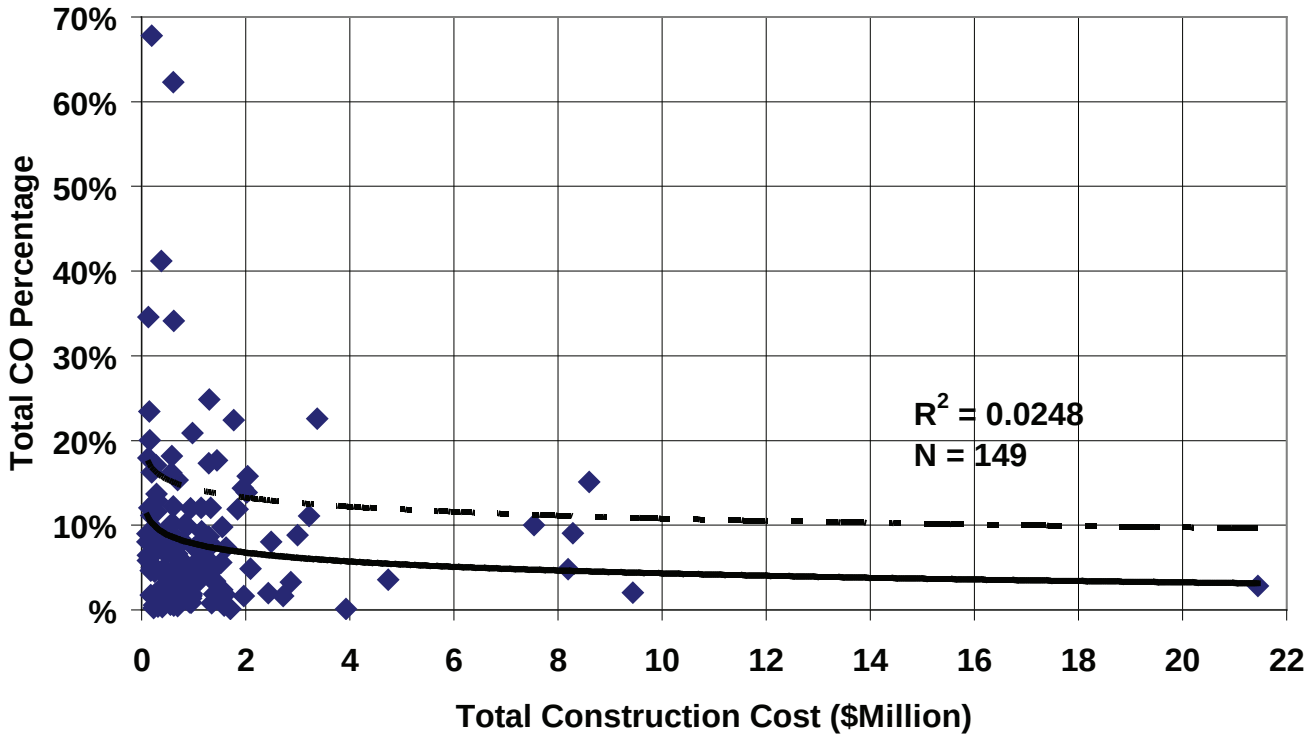
Municipal Facilities - All Classifications
Total CO Percentage Versus Total Construction Cost



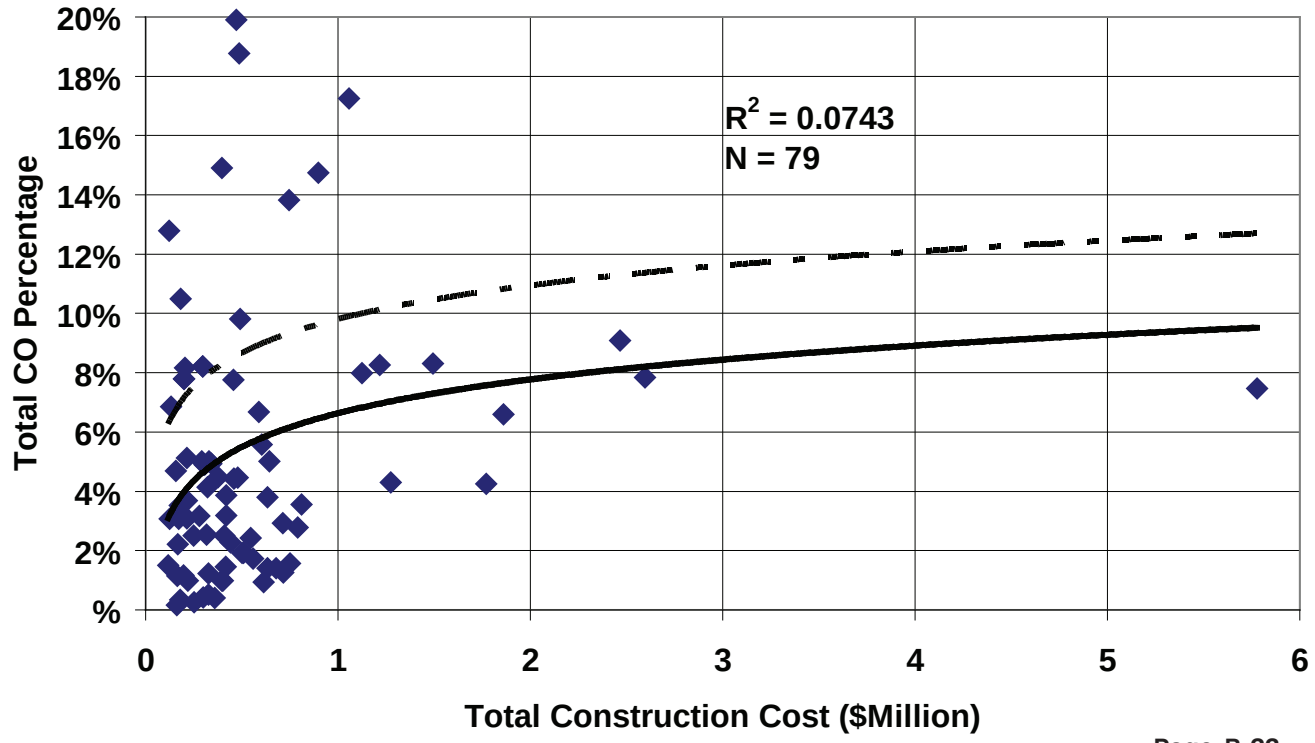
Streets - All Classifications
Total CO Percentage Versus Total Construction Cost



Pipe Systems - All Classifications
Total CO Percentage Versus Total Construction Cost



Parks - All Classifications
Total CO Percentage Versus Total Construction Cost



Tabel B-1 Coefficient of Determination (R^2 Values)

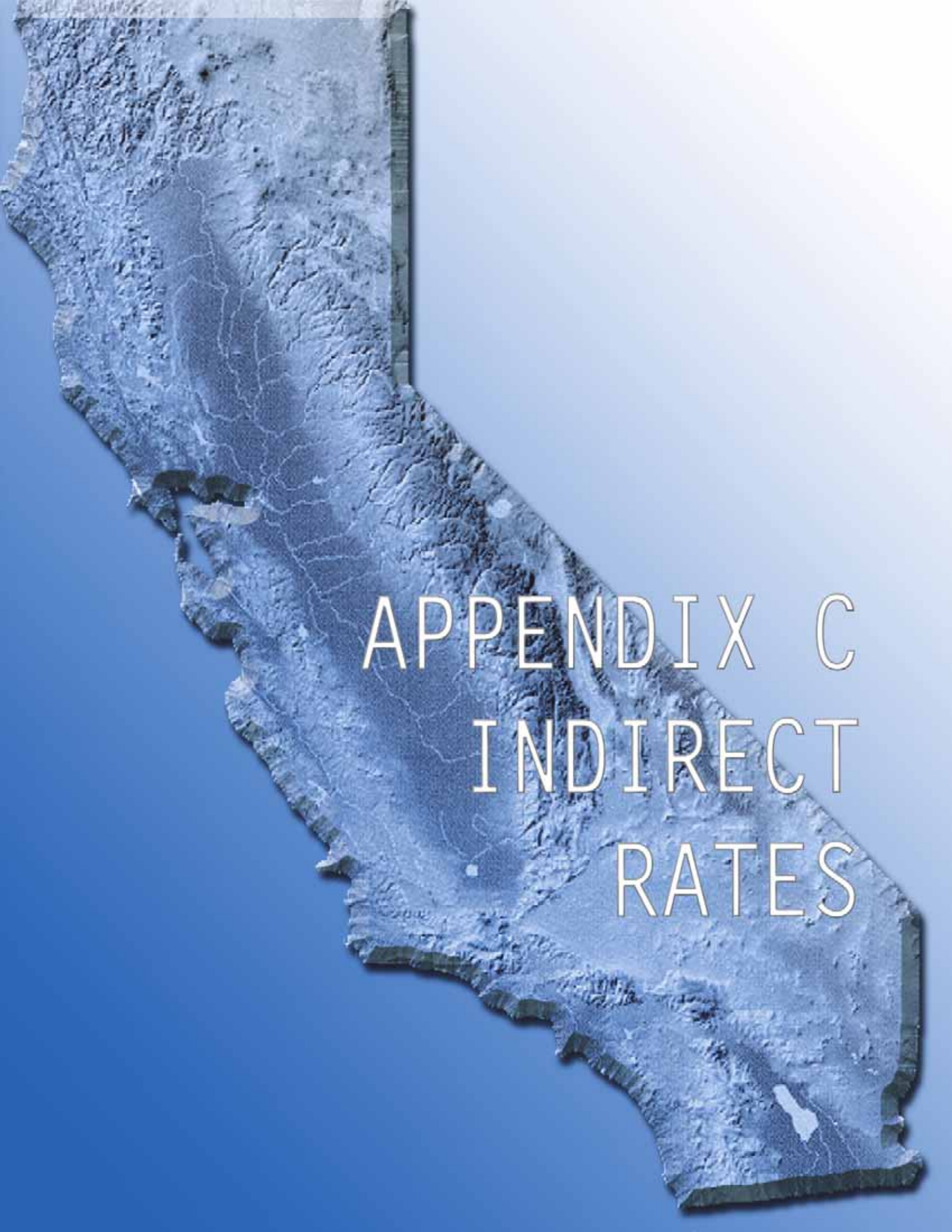
PROJECT TYPE AND CLASSIFICATION	DESIGN % VS TCC[1]	CONSTRUCTION MANAGEMENT % VS TCC	PROJECT DELIVERY % VS TCC
Municipal Facilities	0.153	0.028	0.172
Libraries	0.038	0.348	0.253
Police/Fire Station	0.359	0.018	0.294
Community Building / Recreation Center / Child Care Center / Gymnasium	0.059	0.028	0.090
Streets	0.026	0.015	0.043
Widening / New / Grade Separation	0.154	0.018	0.141
Bridge (New / Retrofit)	0.312	0.002	0.331
Reconstruction	0.017	0.01	0.026
Bike / Pedestrian / Streetscapes	0.190	0.018	0.165
Signals	0.005	0.000	0.003
Pipe Systems	0.052	0.024	0.056
Gravity System (Storm Drains / Sewers)	0.067	0.018	0.061
Pressure Systems	0.022	0.270	0.145
Pump Station	0.007	0.004	0.000
Parks	0.006	0.127	0.088
Playgrounds	0.037	0.089	0.101
Sportfields	0.334	0.164	0.033
Restrooms	0.059	0.003	0.017

Note: [1]TCC=Total Construction Cost (Including net Change Orders)
Shaded values indicate poor R^2 values below 0.10.

Tabel B-2 Statistical Significance (P-Values)

PROJECT TYPE AND CLASSIFICATION	DESIGN % VS TCC[1]	CONSTRUCTION MANAGEMENT % VS TCC	PROJECT DELIVERY % VS TCC
Municipal Facilities	0.01	0.12	0.004
Libraries	0.53	0.000	0.01
Police/Fire Station	0.06	0.83	0.11
Community Building / Recreation Center / Child Care Center / Gymnasium	0.24	0.05	0.04
Streets	0.21	0.06	0.04
Widening / New / Grade Separation	0.03	0.21	0.02
Bridge (New / Retrofit)	0.31	0.49	0.24
Reconstruction	0.73	0.88	0.94
Bike / Pedestrian / Streetscapes	0.01	0.56	0.02
Signals	0.83	0.75	0.70
Pipe Systems	0.08	0.02	0.01
Gravity System (Storm Drains / Sewers)	0.02	0.10	0.01
Pressure Systems	0.07	0.01	0.01
Pump Station	0.94	0.53	0.66
Parks	0.52	0.003	0.11
Playgrounds	0.41	0.08	0.10
Sportfields	0.01	0.10	0.57
Restrooms	0.37	0.67	0.76

Note: 1TCC=Total Construction Cost (including net Change Orders)
Shaded values indicate that the result does not pass the test of statistical significance (i.e., the resulting p-value > 0.10).



APPENDIX C
INDIRECT RATES

CIP Benchmarking Study

Table C-1 Indirect Rates Applied to Capital Projects

Agency	Fringe Benefits	Compensated Time Off	City Overhead	Department Overhead	Agency Overhead	Indirect Rate Factor[1]	Receive General Fund Support For CIP
City of Long Beach							
Department of Public Works	38.60%	19.40%	4.00%	11.90%	72.70%	147%	YES
City of Los Angeles							
Department of Public Works							
Bureau of Engineering[2]	27.89%	19.60%	10.91%	13.39%	54.21%	126%	YES
City of Oakland							
Public Works Agency	65.95%	23.44%	22.05%	9.70%	13.97%	135.11%	NO
City of Sacramento							
Department of General Services	32.00%	18.70%	0%	0%	73%	131.90%	
Department of Transportation	30.00%	18.70%	14.51%	11.39%	79.75%	132.32%	
Department of Utilities	39.60%	18.70%			61.30%	119.33%	NO
City of San Diego							
Architectural Engineering and Contract Services	44.69%	20.75%	0%	0%	72.75%	186%	
Transportation Engineering Division	45.18%	18.75%	0%	0%	66.95%	152%	
Water and Wastewater Facilities Division	47.85%	20.00%	0%	0%	52.25%	154%	NO
City and County of San Francisco							
Department of Public Works							
Bureau of Engineering							
Bureau of Construction Management							
Bureau of Architecture	23.26%	24.36%	31.89%[3]	39.88%	82.73%	170.23%	NO
City of San Jose							
Department of Public Works	34.80%	34.21%	46.61%	35.52%	Included	151.14%	NO

Notes:

[1] This value may be different from the sum of overhead values since the compounding formula may vary by agency.

[2] Based on averages of all Bureau program overhead rates provided under CAP 28.

[3] Not included in the Indirect Rate.