CIP Benchmarking Study

California Multi-Agency CIP Benchmarking Study

Annual Report - Update 2008








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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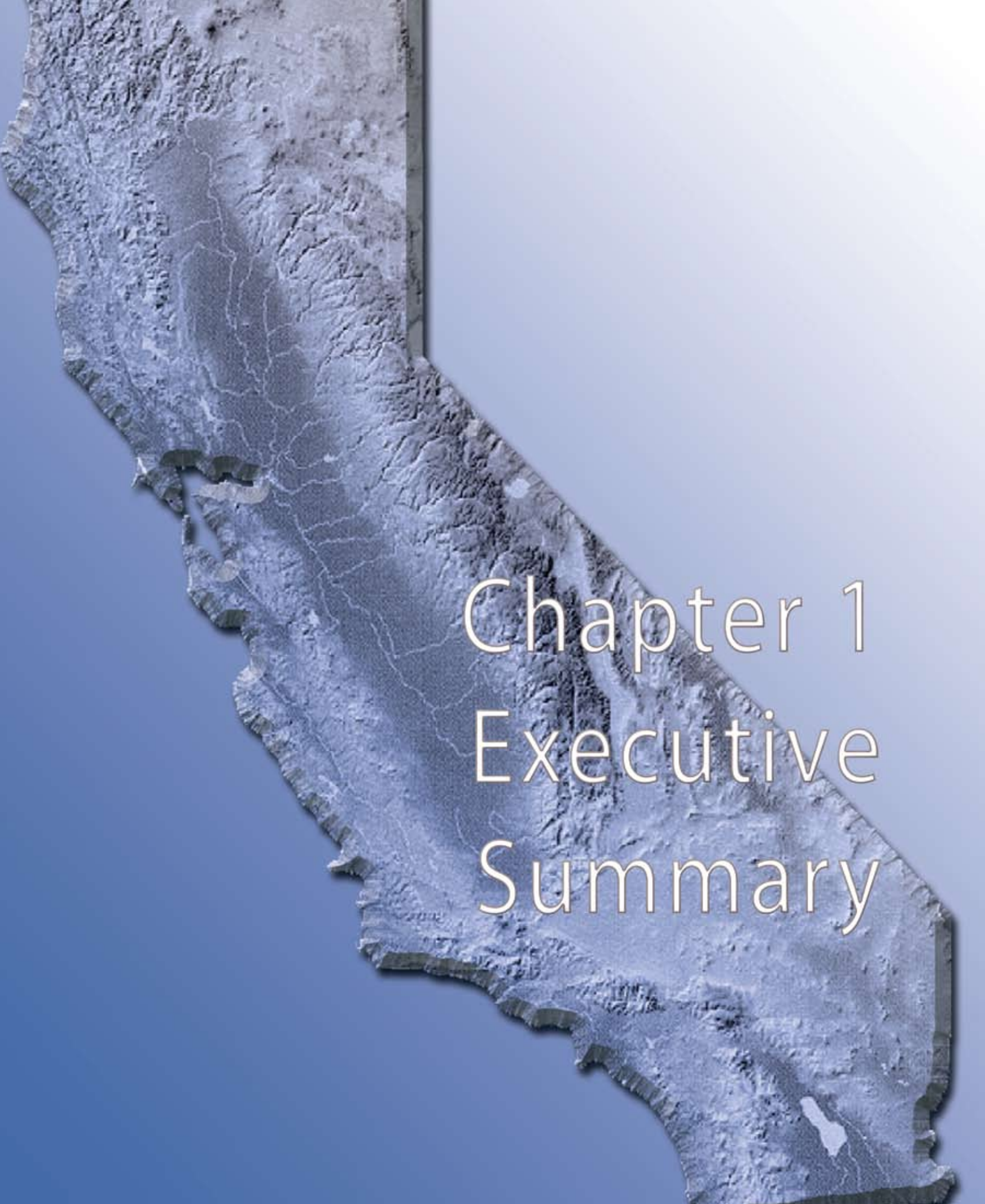

Chapter 1 Executive Summary

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A. INTRODUCTION

For the 7th consecutive year, the California Multi-Agency CIP Benchmarking Study (Study) has continued its unparalleled effort to share the collective Capital Improvement Project implementation experiences of the seven largest cities in California. This year, a substantial amount of effort was expended to improve the quality of the regression analysis methods and the statistical significance of the modeled relationships. Through a modification of the statistical methods employed, measures for goodness-of-fit for regression models have typically improved tenfold, increasing the value of the *Study* for the participants.

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 efficiency. The ability for Agencies to share information amongst themselves has greatly contributed toward this objective. Through quarterly meetings and the online discussion forum, questions can be posed and challenges discussed. It is a rare event that a challenge faced by one agency has not been studied by another. Through the collaboration of all, often times an optimized solution is found that can be translated into a Best Management Practice (BMP) for the group. In this spirit, we 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 this seventh year of the *Study*, the Update 2008 participants have continued to pursue on-going endeavors, as well as taken on new ones:

- Renewed focus on improving the statistical significance of the regression models developed.
- Continue to improve the quality of the performance data and the functionality of the database.
- Track the adoption of BMPs.
- Create new BMPs targeted to address common issues.
- Continue sharing information with one another through the online discussion forum.
- Perform a Special Study on a topic 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 2008 performance curves have been developed from data on projects completed on or after January 1, 2003. In prior *Study* years, project data points were classified as outliers based on subjective judgments by the Project Team. Projects identified as outliers were not included in the performance data analysis but were retained in the performance database. In order to develop a consistent methodology for the selection of outlier data points, the Study Team implemented statistical techniques to identify and eliminate outliers. Since outliers were identified using statistical techniques in Update 2008, some of the projects classified as outliers in previous *Study* years have been included in the performance data analysis and vice-versa. For some project classifications, certain projects were also eliminated as outliers based on visual inspection to further improve results. The 776 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.

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

Performance Model

The regression analyses in prior *Study* years compared the relationship between design costs (expressed as a percentage of the total construction cost) to the total construction cost. Since the analyses involved interdependent variables, it was not consistent with the fundamental rules of regression and caused auto-correlation in the regression analyses. Consequently, the measures for goodness-of-fit for regression models were very poor. In order to try to improve the results of the regression analyses and to eliminate suspicious data points, the Project Team developed criteria for the selection of projects in the performance database. These included criteria for the minimum project total construction costs, the elimination of project data as outliers, and the implementation of a five-year rolling window of project completion dates. Since the results of the regression analyses were still poor, the Project Team decided to use the upper and the lower bounds of the 50 percent confidence interval to determine the range of the project delivery percentages. The confidence interval is used to indicate 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. Use of the 50 percent interval indicated less certainty in the model and a greater need to collect more data before drawing conclusions from the analyses.

In Update 2008, the Study Team identified and corrected auto-correlation in the regression method previously used to generate performance models. In order to eliminate auto-correlation, regression analyses that compared the relation between absolute costs (i.e., design costs, construction management costs,

and project delivery costs) versus total construction costs were performed. As part of the analysis, a linear trendline was chosen to model the relationship between the components that constitute project delivery costs. The linear trendline passes through the origin and its slope represents the familiar project delivery cost expressed as a percentage of the total construction costs. With the elimination of auto-correlation, the correlation coefficients resulting from the regression analysis improved significantly, generally by 10-fold, demonstrating a close relationship between design costs, construction management costs, project delivery costs, and total construction costs.

With improved regression results, a more statistically-sound method for outlier analysis was developed, as discussed above. In addition, the range of the project delivery percentages were estimated based on the upper and the lower bounds of a 95 percent confidence interval which indicates a high degree of certainty in the results of the revised regression model. Given all these improvements to the analysis of the data, the reader is advised that direct comparison of data between Update 2008 and previous years may be more difficult due to these improvements.

It should be noted that the significant improvement in the results of the analyses offers the Project Team an opportunity to revisit some of the criteria for the selection of projects in the performance database during Update 2009.

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

Project Completion Year	Design	Construction Management	Project Delivery (Total)	Median Total Construction Cost ($M)
2003	22%	18%	40%	$0.46
2004	27%	18%	45%	$0.57
2005	22%	17%	39%	$0.66
2006	20%	17%	37%	$0.83
2007	24%	17%	41%	$0.56
Average	**23%**	**17%**	**40%**	**$0.60**

Notes:
1 Project Delivery percentages represent arithmetic averages of the individual projects and do not represent the results of the regression analyses.
2 Project Delivery percentages vary from year to year based on the selection and the composition of the projects in the database.

Performance Data Analyses

In Update 2007, differences in project delivery costs among project sizes and types and the distribution of projects in the database among those sizes and types were investigated as drivers that impact trends in project delivery costs. The Update 2008 performance data, shown in **Table 1-1**, indicates significant variation in the project delivery costs (as a percentage of total construction costs) for projects completed between 2003 and 2007. It is observed that the trend of project delivery costs increased between 2003 and 2004 and declined sharply in 2006 before increasing in 2007. Also, project size (measured as median total construction cost), increased significantly between 2003 and 2006, and declined sharply in 2007. A significant reduction is observed in the median total construction costs in 2007 as compared to the median total construction costs in 2006.

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*.

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.

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	22%	16%	37%	$3.05	130
Parks	22%	19%	42%	$0.33	118
Pipes	19%	17%	36%	$0.68	256
Streets	28%	18%	45%	$0.50	272
Average	**23%**	**17%**	**40%**	**$0.60**	**776**

Notes:
1 Project Delivery percentages represent arithmetic averages of the individual projects and do not represent the results from the regression analyses.
2 Project Delivery percentages vary from year to year based on the selection and the composition of the projects in the database.

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 about half of design and most of all 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.

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). The project delivery components are modeled using a linear trendline which 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 fifteen project classifications. The performance models resulting from the analyses are summarized in **Table 1-4** and the performance curves are in **Appendix B**. The selected regression model shows a mathematically direct relationship between project delivery costs and total construction costs. That is, as total construction cost increases, the total project delivery cost increases. The selected regression model is a linear trendline passing through the origin. See the discussion in **Chapter 3** and the regression curves in **Appendix B** for more detail.

The increases in R^2 values highlight the improvement in fit of the linear trendline to describe the relationship between the project delivery costs and the total construction costs in comparison to models used previously. This is best illustrated by comparing the Update 2007 and the Update 2008 R^2 values for the Streets – Reconstructions classification for the design costs versus total construction costs regressions. In the Update 2007 Study, due to auto-correlation explained earlier in this section, this classification had a R^2 value of 0.0165. When auto-correlation is eliminated, the R^2 value increases by nearly 50 times to 0.77. A similar improvement in the R^2 values is observed throughout all project types and classifications. The improved results due to the elimination of auto-correlation have added tremendous value to the *Study*. A summary of R^2 values for the different project types and classifications is presented in **Table 1-4**.

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	$25.5	57%	$19.1	43%	27%	$25.9	98%	$0.5	2%	15%	$51.4	72%	$19.6	28%	42%	$1.9	$0.6
Agency B	$11.3	47%	$13.0	53%	19%	$10.5	59%	$7.4	41%	12%	$21.8	52%	$20.3	48%	31%	$1.4	$0.4
Agency C	$17.7	90%	$1.9	10%	18%	$16.3	96%	$0.6	4%	18%	$34.0	93%	$2.5	7%	36%	$1.3	$0.8
Agency D	$51.5	50%	$52.3	50%	22%	$89.2	84%	$16.7	16%	21%	$140.7	67%	$69.0	33%	43%	$5.8	$1.3
Agency E	$2.7	26%	$7.8	74%	21%	$5.7	69%	$2.6	31%	15%	$8.5	45%	$10.4	55%	36%	$2.4	$0.6
Agency F	$34.0	59%	$23.5	41%	24%	$38.7	88%	$5.4	12%	21%	$72.8	72%	$28.9	28%	45%	$1.5	$0.4
Agency G	$9.5	64%	$5.3	36%	24%	$7.9	100%	$0.0	0%	14%	$17.4	77%	$5.3	23%	38%	$0.7	$0.4
OVERALL	$152.3	55%	$122.7	45%	23%	$194.3	85%	$33.3	15%	17%	$346.5	69%	$156.0	31%	40%	$2.2	$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.

Table 1-4
Summary of Performance Models

Project Type or Classification	Number of Projects (N)	Design Cost				Construction Management Cost				Project Delivery Cost			
		(% of TCC)	95% CI (% of TCC)	R^2	p-value	(% of TCC)	95% CI (% of TCC)	R^2	p-value	(% of TCC)	95% CI (% of TCC)	R^2	p-value
Municipal Projects	130	15%	14%-16%	0.69	2.92E-47	14%	13%-15%	0.77	1.60E-52	29%	24%-30%	0.82	4.26E-49
Libraries	38	16%	15%-18%	0.69	1.57E-22	12%	11%-14%	0.52	1.44E-17	28%	26%-30%	0.80	6.29E-27
Police/Fire Stations	30	17%	14%-20%	0.80	3.73E-13	16%	14%-19%	0.77	1.10E-12	33%	29%-39%	0.83	1.29E-14
Comm./Rec. Center/ Child Care/Gyms	55	20%	17%-22%	0.73	4.54E-23	11%	9%-12%	0.59	1.79E-20	31%	28%-33%	0.80	2.08E-28
Other Municipal	7	8%	4%-12%	0.62	0.003275	14%	10%-17%	0.89	6.42E-05	22%	19%-24%	0.97	7.62E-07
Streets Projects	272	16%	15%-18%	0.64	1.14E-70	17%	16%-18%	0.90	5.85E-143	33%	32%-35%	0.89	8.13E-139
Widening/New/ Grade Separations	44	13%	11%-15%	0.74	1.28E-17	18%	16%-19%	0.91	4.09E-25	31%	29%-33%	0.94	2.37E-30
Bridges	14	34%	24%-44%	0.75	6.1E-06	13%	11%-16%	0.91	2.86E-09	47%	38%-56%	0.87	6.15E-08
Reconstructions	65	28%	24%-31%	0.77	2.91E-25	18%	16%-20%	0.79	4.38E-27	46%	41%-50%	0.81	3.36E-28
Bike/Pedestrian/ Streetscapes	74	14%	12%-16%	0.30	3.96E-18	11%	10%-12%	0.60	6.91E-26	25%	22%-28%	0.53	1.15E-25
Signals	75	20%	17%-22%	0.61	2.78E-26	18%	15%-20%	0.57	6.49E-25	38%	35%-40%	0.86	5.081E-46
Pipes Projects	256	9%	9%-10%	0.88	1.14E-122	10%	9%-10%	0.99	3.21E-275	19%	18%-19%	0.96	4.87E-186
Pressure Systems	227	9%	9%-10%	0.88	1.29E-108	10%	9%-10%	0.99	2.89E-248	19%	18%-19%	0.96	5.91E-164
Pump Stations	18	13%	10%-17%	0.53	1.64E-07	13%	11%-15%	0.72	3.18E-10	26%	23%-30%	0.78	2.953E-11
Gravity Mains	11	14%	11%-18%	0.82	3.87E-06	10%	7%-12%	0.83	2.97E-06	24%	21%-27%	0.95	5.86E-09
Parks	118	20%	15%-21%	0.88	5.27E-35	15%	13%-15%	0.83	9.02E-74	35%	32%-36%	0.91	4.45E-64
Playgrounds	101	21%	19%-22%	0.89	1.52E-59	15%	14%-16%	0.85	2.65E-54	36%	34%-37%	0.92	3.65E-68
Sportfields	9	17%	15%-19%	0.94	1.12E-07	14%	10%-18%	0.61	5.99E-05	31%	26%-36%	0.89	5.03E-07
Restrooms	8	21%	16%-26%	0.60	2.83E-05	27%	19%-34%	0.35	6.94E-05	48%	41%-55%	0.74	9.91E-07

Notes:
TCC = Total Construction Cost; Des. = Design Cost; CM = Construction Management Cost, and PD = Project Delivery Cost. CI = Confidence Interval. The project delivery percentages indicated are the ranges corresponding to the 95 percent confidence intervals on the slope of the linear regression trendline. 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 low (below 0.80).

The R^2 values varied by project type and classification. For all project types, the R^2 values for the project delivery costs versus total construction costs regressions are greater than 0.80. This is a significant improvement from the results of prior *Study* years and can be attributed to the refinements made to the performance model in Update 2008. Generally, a significant improvement in R^2 can also be observed for project classifications.

Special Study

The agencies have employed several innovative project delivery methods in an effort to reduce costs and improve efficiency in project delivery. Some of these methods have been successful and some valuable lessons have been learned from others. Examples of these methods include non-traditional bid methods such as: accelerated sewer repair and renovation, using aerial photographs as engineering plans for street resurfacing projects, bundling multiple contracts into a single set of bids, and using informal contract processes for contracts up to $250K.

Since the projects included in the performance database are delivered by the traditional design-bid-build approach, these innovative processes employed by the agencies to improve efficiency in project delivery are not specifically captured in the *Study*. In order to share the lessons learned by the agencies from the implementation of innovative project delivery methods, the Project Team selected Innovative Project Delivery Methods as an area of Special Study in Update 2008. A summary of each agency's experience with innovative project delivery methods and the resulting successes of employing such methods is summarized in the *Study*.

C. BEST MANAGEMENT PRACTICES

At the start of the *Study*, the agencies examined over 100 practices used in project delivery. Included in the *Study* are those practices that the study participants did not already commonly use, but believed should be implemented as BMPs. New BMPs are also added annually, and in some cases existing BMPs are reworked by the agencies to address specific challenges they encounter. BMPs are also added or modified to reflect new learnings by the participants. Agency implementation of these selected practices has been and will continue to be tracked during the *Study*. Three new BMPs were added to the list this year, along with the modification of one existing BMP. These BMPs are believed to directly influence the cost of either design or construction management and ultimately, project delivery efficiency.

In Update 2008, the Project Team added three new BMPs to the BMP implementation tracking list. The BMPs were developed addressing issues in the areas of responsible charge, standard specifications, and payment process. These BMPs were:

- 2.p.2008 - Establish criteria for responsible charge design approval such that it occurs at the lowest appropriate organizational level in order to expedite design completion.

- 3.III.m.2008 - Maintain and regularly update electronic standard contract specifications and related documents, as well as technical/special provisions.

- 5.III.i.2008 - Implement an electronic progress payment system to improve efficiency.

It is anticipated that full implementation of the BMPs in the implementation list will improve project delivery performance. Changes were made to clarify one existing BMP which dealt with independent cost estimates. The revised wording is:

- 2.o. 2007 – Establish criteria for obtaining independent cost estimates which take in consideration both project characteristics and volatility of the market.

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

To support the linking of BMPs to performance improvements, BMP implementation has been tracked and project completion dates have been collected on Performance Questionnaires. It is anticipated that the performance data will eventually demonstrate that as BMPs are implemented, project delivery costs are reduced. This year, a new performance benchmarking model was implemented which should provide empirical evidence showing the impact of BMPs on project costs in the future.

D. ONLINE DISCUSSION FORUM

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

- Greening of Construction Equipment
- Errors and Omissions Classifications
- Bid Limits
- AB-983
- Electronic Progress Payment Process
- Participation Goals
- Performance Goals for Change Orders
- Cost Estimating Policy and Procedures
- Level of Responsible Charge Design Approval
- Public-Private Partnerships
- Progress Payments Retention Withholdings

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

E. CONCLUSIONS

I. Performance Benchmarking

Due to the selection of a linear regression model, the results of the performance benchmarking evaluation show that in all cases, design, construction management, and project delivery costs increase as the total construction cost increases. It should also be noted that while majority of projects are clustered near the origin of the graph, the slope of the trendline is predominantly governed by the data points scattered at relatively high total construction cost values. Since the slope of the trendline provides the design, construction management, or the project delivery costs as a percentage of the total construction cost, the reader must avoid budgeting individual projects based on these analyses.

With the correction of auto-correlation in the regression method previously used to generate performance models, the R^2 and p-values have improved significantly than in previous Study phases. In addition, the project delivery percentages have changed considerably from Update 2007. The change in the project delivery percentages is mainly attributed to the change in the regression methodology and the selection of project outlier data. The outlier analysis, performed by statistical techniques for a majority of the projects, has significantly altered the project mix and size in the performance database. The reader is cautioned that the improved results of the regression analyses only be used as a reference and not for prediction of performance. Although the results of the performance analyses are based on historical data provided by the participating agencies, there are several factors that affect project delivery and are not captured in the performance model. These include personnel turnover in the agencies, competitive bids, and escalation in construction costs.

Project arithmetic mean delivery costs (as a percentage of total construction cost) by project type in the Update 2008 analysis were:

Municipal Facilities	37%
Parks	41%
Pipes	35%
Streets	45%

It is expected that as the improvements in data collection methods and full BMP implementation improve, project delivery costs will begin to decline. In addition, it should be noted that the significant improvement in the results of the analyses offers the Project Team an opportunity to revisit some of the criteria for the selection of projects in the performance database during Update 2009.

The Special Study highlighted the lessons learned by the agencies from the implementation of innovative project delivery methods. Some of these methods have resulted in cost-savings and improved efficiency in project delivery while others have provided valuable lessons to the agencies.

II. Best Management Practices

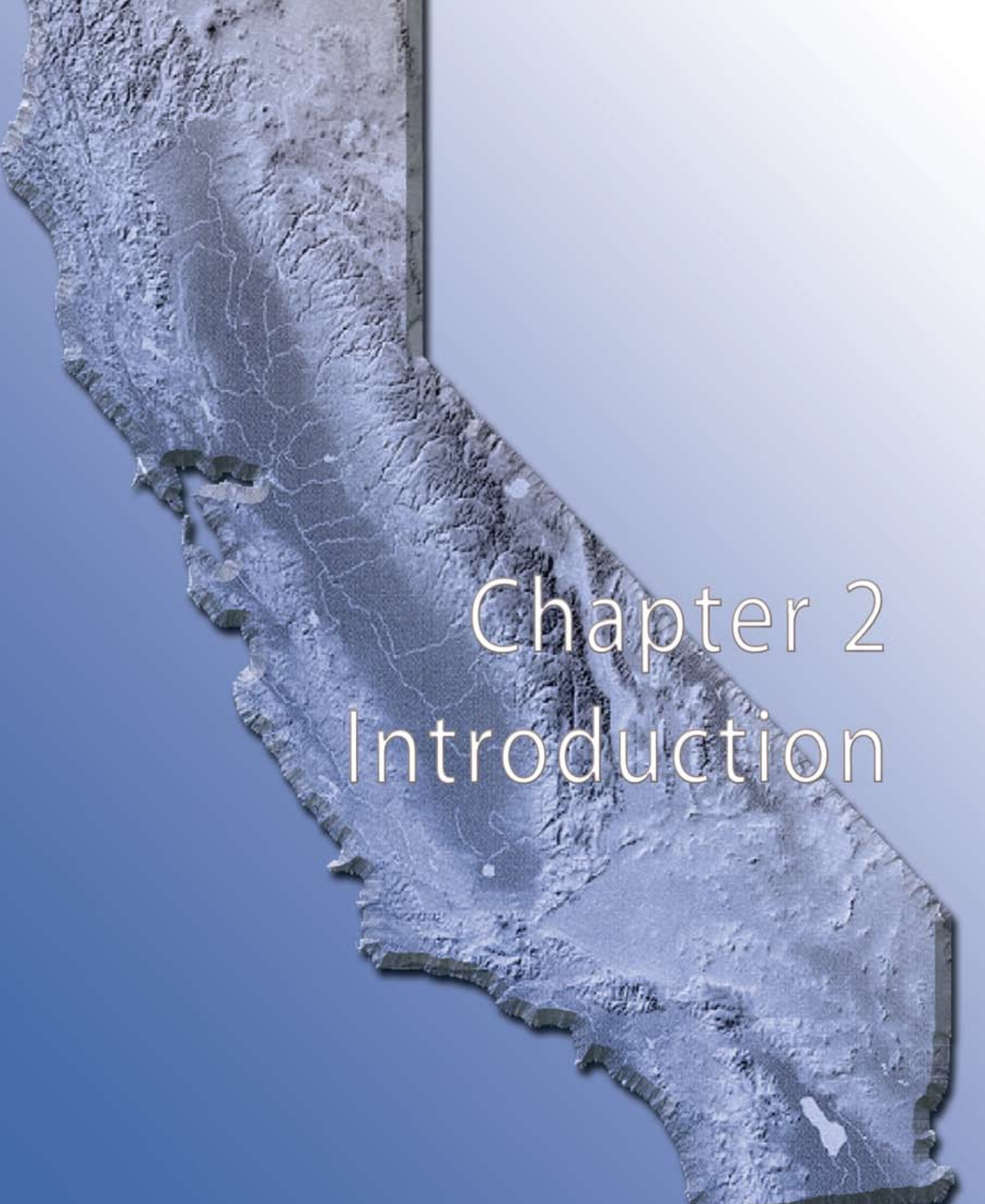
The agencies have continued to fully implement selected BMPs. As of Update 2008, the agencies have fully implemented about 70 percent of all BMPs. Many more have been partially implemented with the goal of complete implementation over the next two years.

In Update 2008, the Project Team added three new BMPs to the BMP implementation tracking list along with the modification of one existing BMP to further refine the initial intent. The BMPs were developed addressing issues in the areas of responsible charge, standard specifications, and payment process. 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 are reduced.

III. Online Discussion Forum

The Online Discussion Forum continues to be 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

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For the 7th consecutive year, the California Multi-Agency CIP Benchmarking *Study* (Study) has continued its unparalleled effort to share the collective Capital Improvement Project implementation experiences of the seven largest cities in California. This year, a substantial amount of effort was expended to improve the quality of the regression analysis methods and the statistical significance of the modeled relationships. Through a modification of the statistical methods employed, measures for goodness-of-fit for regression models have typically improved tenfold, increasing the value of the *Study* for the participants.

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 efficiency. The ability for Agencies to share information amongst themselves has greatly contributed toward this objective. Through quarterly meetings and the online discussion forum, questions can be posed and challenges discussed. It is a rare event that a challenge faced by one agency has not been studied by another. Through the collaboration of all, often times an optimized solution is found that can be translated into a Best Management Practice (BMP) for the group. In this spirit, we 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 this seventh year of the *Study*, the Update 2008 participants have continued to pursue on-going endeavors, as well as taken on new ones:

- Renewed focus on improving the statistical significance of the regression models developed.
- Continue to improve the quality of the performance data and the functionality of the database.
- Track the adoption of BMPs.
- Create new BMPs targeted to address common issues.
- Continue sharing information with one another through the online discussion forum.
- Perform a Special Study on a topic 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 seven 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, Department of Engineering and Construction
- City of Sacramento, Department of General Services, Department of Transportation, and Department of Utilities
- City of San Diego, Engineering and Capital Projects Department

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[1]
Los Angeles	4,045,873	469	http://eng.lacity.org	Mayor-Council
Oakland	399,484	66	www.oaklandnet.com	Mayor-Council-Administrator
Sacramento	457,743	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	989,496	178	http://www.sanjoseca.gov	Mayor-Council-Manager

Notes:
1 Mayor has veto power.

- 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.

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:

- 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 [Leadership in Energy and Environmental Design] and "green building" initiatives and alternative contracting methods (e.g., 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 quarterly meetings have allowed the City to discuss and explore issues common to the largest cities in California and develop ways to continually improve our processes and delivery methods by developing and implementing BMPs. Process improvements by cities are presented at the quarterly meetings, which provide information and data that can assist the other cities in implementing similar changes and improvements. For example, the City and County of San Francisco gave a presentation on electronic progress payments which has drastically reduced the amount of time it has taken them to pay their construction contractors. This has in turn increased competition in their construction bids because contractors are more willing to bid on projects when they are guaranteed a timely progress payment. The City of Los Angeles' Board of Public Works Commissioners expressed interest in implementing this improvement for the City's Bureau of Engineering's projects in the near future. In addition, the Online Discussion Forum continues to be a valuable tool throughout the course of the Study. Topics of interest are also discussed during the quarterly meetings. During a recent audit of a City of Los Angeles project, errors and omissions tracking became an issue in the audit findings. Through the Online Discussion Forum, we were able to confirm common practices of tracking errors and omissions among the largest cities in California, and ascertain what was considered a reasonable percentage of errors and omissions changes on a project before exploring whether the contractual Standard of Care has been met by the consultant".

- 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 have 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 "finds the Study extremely useful in validating our Engineering Department's performance and in setting benchmarks and goals, especially during our recent Business Process Reengineering. Participation in the quarterly meetings allows us to share information on new processes that we or the other agencies are implementing, and we always get new or better ideas to improve our project delivery. The discussion forum is a great way to keep the momentum between meetings and to share detail information on processes. For example, we received invaluable information on contracting methods to deal with emergency work which will help us be better prepared to respond to natural disasters and emergency work in general."

- According to the City of Oakland "the Study has been an invaluable resource to help the City of Oakland deliver its CIP. It has provided hard data from California's seven largest cities on the costs of planning, designing and constructing projects ranging from small restroom remodels to multimillion dollar street, sewer and building projects. It also has allowed comparison of BMPs used by each City to deliver projects; and provided a mechanism to obtain instant responses from each City to questions about how to improve their processes. The Study has greatly improved Oakland's ability to deliver projects better, cheaper and faster."

C. STUDY FOCUS

Improving the accuracy and the functionality of the performance models has been a continuous goal of the *Study*. In particular, special attention has been given to improving the quality of the regression models. Previously, this was done by studying and improving how the data was collected and utilizing other methods to reduce scatter in the data to be analyzed, such as through outlier analysis. Although these activities were useful, they never completely satisfied the Project Team's objective of producing suitably significant statistical relationships.

This year, the Project Team focused on significant revisions to the regression method. As a result, the regression models were refined and the resultant R^2 values (a measure of goodness-of-fit of the trendline) typically improved tenfold. Details regarding the changes to the regression model are presented in **Chapter 3** Performance Benchmarking.

D. STUDY GOALS

The *Study* method 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 2008, the agencies made progress on several goals:

1. **Renewed focus on improving the statistical significance of the regression models developed.** Improving the performance model has been a continuous goal of the Study. The Study Team corrected auto-correlation in the method used to generate performance curves. The modifications to the regression method resulted in a significant improvement in the R^2 values, adding further value to the performance models and performance benchmarking.

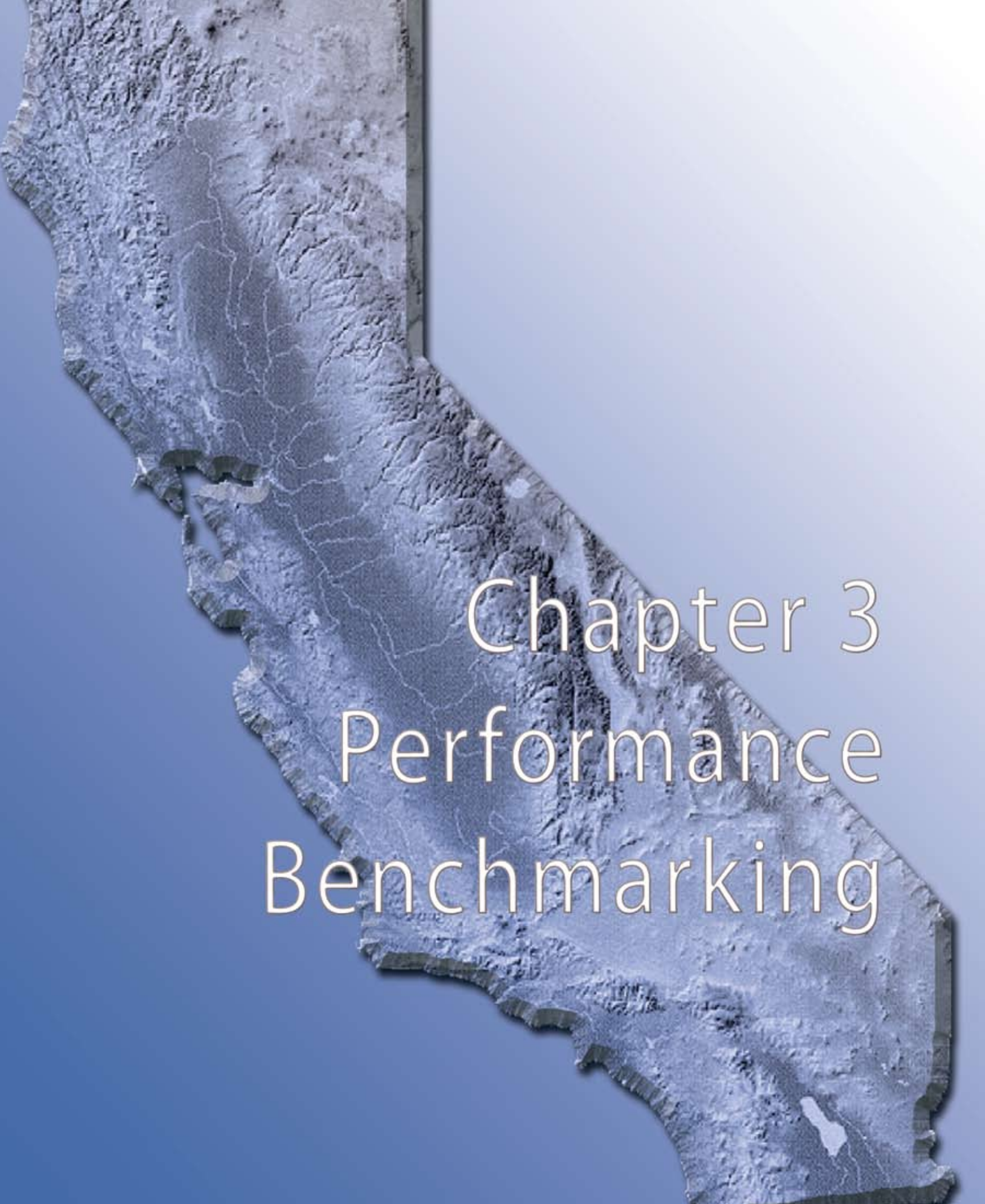
2. **Improve the quality of the performance data and the functionality of the database.** The agencies continued their efforts to capture complete project delivery costs and increase the number of projects in the database. Performance curves were developed for projects falling into 15 classifications among 4 project types. Regression analyses were performed for design costs, construction management costs, and overall project delivery costs in comparison to total construction cost (TCC). Agencies verified or corrected randomly-selected project data and made presentations on their data collection process. Projects were identified as outliers based on statistical analyses.

3. **Track the adoption of BMPs.** The Study Team continued to track the implementation of BMPs in order to link these practices to project delivery performance improvement over time in order to encourage their implementation.

4. **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 BMP implementation list.

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

6. **Perform special studies on topics of interest.** This year's Special Study highlights the lessons learned by the participating agencies in project delivery from the implementation of innovative project delivery methods.



Chapter 3
Performance Benchmarking

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). The objective of this exercise is to develop relationships between these variables. As explained in later in this chapter (see **Section D.II**), the regression model that was used in previous years has been refined and quality of the relationships developed has been significantly improved in Update 2008.

All of the actual project costs are collected from 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 2008 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. At the request of the participating agencies, increasing the minimum TCC to $200,000 was checked for its potential to improve the results of the analyses. No improvement was observed.

- **Completion Date** – Projects included in the *Study* analyses were completed on or after January 1, 2003. Projects with earlier completion dates were kept in the database, but excluded from the analyses.

- **Outlier Elimination** – Statistical elimination was used to identify outliers in the performance model. The total project delivery percentage of each project in the database was evaluated against all other projects in the same classification. An outlier was identified as a project whose total project delivery percentage was outside the range expressed by the following equation:

  $y=m + 3\sigma$, where;

  m represents the mean of the project delivery percentages and σ represents the standard deviation of the project delivery percentages for all projects in the same classification.

It should be noted that this approach allows for the inclusion of more data that in previous years where other methods were used. This change was in part allowed by improved regression techniques that will be described in more detail in subsequent subsections.

Projects confirmed as outliers by this statistical technique were kept in the database, but excluded from the analyses. However, for some project classifications where regressions were still poor, certain projects still required elimination as outliers based on visual inspection.

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 • Other Municipal Facilities
Streets	• Widening, New, & Grade Separation • Bridges • Reconstruction • Bike Ways, Pedestrian Ways, & Streetscapes • Signals
Pipe Systems	• Gravity Systems • Pressure Systems • Pump Stations
Parks	• Playgrounds • Sportfields • Restrooms

- **Project Delivery Method** – All projects in this Study were delivered through the traditional design-bid-build method. Projects delivered using other project delivery 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 the following classifications:

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

- **Project Classifications** – Fifteen project classifications grouped into four project types are used in this Study. In this year's Study, a new classification called "Other Municipal Facilities" was added for projects under the Municipal projects category. This classification will include municipal projects that do not fall under the existing categories (e.g. libraries, police/fire stations, and commercial facilities). The agencies will continue to collect data for this classification for future analyses. 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 each phase of project delivery are presented in **Table 3-2**.

Each agency delivered a presentation describing how it completes the project delivery data of the Perfomance Questionnaire. The presentations were shared with the Project Team during a quarterly meeting. 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.

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:
Planning	• 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 • Qualify bidders • Manage the pre-bid conference • Evaluate bids • 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 and 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 descriptions of the following types of change orders: • Changed/unforeseen conditions - This type of change is necessitated by discovery of actual job site conditions that differ from those shown on the contract plans or described in the specifications. These are conditions a designer could not have reasonably been expected to know about during the design of the project. • Changes to Bid Documents - This type of change is necessitated by a mistake or oversight in the original contract documents and is required to correct the plans and specifications. • Client-Initiated Changes - This type of change results from additions, deletions or revisions to the physical work.
5)Total Construction Cost (TCC):	This is the direct construction cost, including all change orders during the construction phase (from the issuance of Notice to Proceed to Notice of Completion). 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

C. PERFORMANCE DATABASE

Table 3-3 summarizes the number of projects included in the database and in the analyses. The database now contains 1,309 projects in total. Following the application of the *Study* criteria previously described, 776 projects fit the *Study* criteria and were included in the analyses. Projects identified as outliers are not included in the performance data analysis but are retained in the performance database. In prior *Study* years, project data points were classified as outliers based on a combination of statistical parameters and subjective judgments by the Project Team. Projects identified as outliers during one Study phase were kept as outliers in subsequent *Study* phases.

Table 3-3
Growth of Database

Study Phase[1]	Submitted	Deleted		Increase	Excluded		Net
	(a) Total	(b) TCC <$100K	(c) Non-Repre-sentative[2]	(d)=(a)-(b)-(c)	(e) Project Completion Date <2002	(f) Outliers[3]	Projects in Analyses (h)= (d)-(e)-(f)-(g)
I	237	25	44	168	168	0	0
II	285	0	35	250	233	5	12
III	262	0	29	233	72	6	155
IV	170	17	21	132	13	5	114
V	182	0	3	179	11	6	162
VI	189	0	0	189	0	6	183
VII	158	0	0	158	2	6	150
Total	**1,483**	**42**	**132**	**1,309**	**499**	**34**	**776**

Notes:
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, VI = 2007, and VII = 2008.
2Projects that do not fit Study criteria for project classifications and minimum TCC of $100K were removed from the database.
3Outliers are identified based on statistical analysis and visual elimination.

In order to develop a consistent methodology for the selection of outlier data points, the Study Team implemented statistical elimination on all projects in the database by classification. Some of the projects classified as outliers in previous *Study* years have been included in the performance data analysis and vice-versa. As indicated above, selected projects were eliminated as outliers based on visual inspection.

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 calculation.

As previously indicated, there are 4 project types (Municipal Facilities, Streets, Pipe Systems, and Parks) and 15 project classifications included in this *Study*. **Table 3-4** summarizes the distribution of projects included in the Update 2008 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.

Table 3-4
Projects Distribution Matrix

Agency	Long Beach	Los Angeles	Oakland	Sacramento	San Diego	San Francisco	San Jose	Total
Municipal Facilities	5	45	9	12	9	10	40	**130**
Libraries	0	23	0	0	4	1	10	**38**
Police/Fire Stations	2	8	1	6	4	2	7	**30**
Comm./Rec. Center/ Child Care/Gyms	1	12	8	6	1	6	21	**55**
Other Municipal Facilities	2	2	0	0	0	1	2	**7**
Streets	11	12	40	63	61	26	59	**272**
Widening/New/ Grade Separations	1	5	0	11	12	2	13	**44**
Bridges (New/Retrofit)	0	2	0	2	6	0	4	**14**
Reconstructions	7	4	20	8	7	10	9	**65**
Bike/Pedestrian/	2	0	11	15	13	8	20	**69**
Streetscapes	2	1	13	28	12	5	13	**74**
Signals	1	0	7	14	24	9	20	**75**
Pipe Systems	2	77	33	31	47	25	41	**256**
Gravity Systems (Storm Drains/Sewers)	2	77	33	26	33	19	37	**227**
Pressure Systems	0	0	0	2	8	6	2	**18**
Pump Stations	0	0	0	3	6	0	2	**11**
Parks	3	4	18	1	2	12	78	**118**
Playgrounds	3	2	17	0	0	12	67	**101**
Sportfields	0	2	0	1	1	0	5	**9**
Restrooms	0	0	1	0	1	0	6	**8**
Total	**21**	**138**	**100**	**107**	**119**	**73**	**218**	**776**

Notes:
Total refers to the projects included in the Update 2008 analyses only.

D. 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 2008 performance data, shown in **Table 3-5**, indicates significant variation in the project delivery costs (as a percentage of TCC) for projects completed between 2003 and 2007. It is observed that project delivery costs (expressed as a percentage of TCC) increased between 2003 and 2004 and continued to decline sharply in 2005 and 2006 before increasing in 2007.

As indicated in **Table 3-5**, project size (measured as average TCC), increased significantly between 2003 and 2004, declined sharply in 2005, increased significantly between 2005 and 2006, and decreased minimally between 2006 and 2007. A significant reduction of about one-third is observed in the median TCC in 2007 as compared to the median TCC in 2006.

Table 3-6 shows project delivery costs by each of the four project types in the Study.

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.

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[1]	Average TCC ($M)	Median TCC ($M)	Design Cost (% of TCC)	Construction Management Cost (% of TCC)	Project Delivery Cost (% of TCC)
2003	32	60	56	54	202	$1.41	$0.46	22%	18%	40%
2004	24	54	34	25	137	$3.10	$0.57	27%	18%	45%
2005	26	67	78	17	188	$1.76	$0.66	22%	17%	39%
2006	35	48	55	8	146	$2.70	$0.83	20%	17%	37%
2007	12	42	33	14	101	$2.65	$0.56	24%	17%	41%
Total	**129**	**271**	**256**	**118**	**774**	**$2.70**	**$0.60**	**23%**	**17%**	**40%**

Notes:
1Two projects in the Update 2008 analyses with a project completion date in 2008 are not included in this table.
2 Project Delivery percentages represent arithmetic averages of the individual projects and do not represent the results from the regression analyses.
3 Project Delivery percentages vary from year to year based on the selection and the composition of the projects in the database.

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 about half of design and most all of 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.

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*.

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	22%	16%	37%	$3.05	130
Parks	22%	19%	42%	$0.33	118
Pipes	19%	17%	36%	$0.68	256
Streets	28%	18%	45%	$0.50	272
Average	**23%**	**17%**	**40%**	**$0.60**	**776**

Notes:
1 Project Delivery percentages represent arithmetic averages of the individual projects and do not represent the results from the regression analyses.
2 Project Delivery percentages vary from year to year based on the selection and the composition of the projects in the database.

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	$25.5	57%	$19.1	43%	27%	$25.9	98%	$0.5	2%	15%	$51.4	72%	$19.6	28%	42%	$1.9	$0.6
Agency B	$11.3	47%	$13.0	53%	19%	$10.5	59%	$7.4	41%	12%	$21.8	52%	$20.3	48%	31%	$1.4	$0.4
Agency C	$17.7	90%	$1.9	10%	18%	$16.3	96%	$0.6	4%	18%	$34.0	93%	$2.5	7%	36%	$1.3	$0.8
Agency D	$51.5	50%	$52.3	50%	22%	$89.2	84%	$16.7	16%	21%	$140.7	67%	$69.0	33%	43%	$5.8	$1.3
Agency E	$2.7	26%	$7.8	74%	21%	$5.7	69%	$2.6	31%	15%	$8.5	45%	$10.4	55%	36%	$2.4	$0.6
Agency F	$34.0	59%	$23.5	41%	24%	$38.7	88%	$5.4	12%	21%	$72.8	72%	$28.9	28%	45%	$1.5	$0.4
Agency G	$9.5	64%	$5.3	36%	24%	$7.9	100%	$0.0	0%	14%	$17.4	77%	$5.3	23%	38%	$0.7	$0.4
OVERALL	$152.3	55%	$122.7	45%	23%	$194.3	85%	$33.3	15%	17%	$346.5	69%	$156.0	31%	40%	$2.2	$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.

E. PERFORMANCE MODEL

Regression Definitions

Performance curves produced for this Study are regressions of data, demonstrating how close of a relationship exists between the dependent variable (on the y-axis) and the independent variable (on the x-axis). For instance, a regression curve of design cost 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 evaluating the budget for a suite of projects. Caution and use of professional judgment is required when using the regression trendline to budget an individual project.

Confidence Interval

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

The linear trendline 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.

Statistical Significance (p-value)

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 forecast 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 $p \leq 0.10$ is considered statistically significant. 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.

Update 2008 Model revisions

The regression analyses in prior *Study* years compared the relationship between design costs (expressed as a percentage of the total construction cost) to the total construction cost. Since the analyses involved interdependent variables, it was not consistent with the fundamental rules of regression and caused auto-correlation in the regression analyses. Consequently, the

measures for goodness-of-fit for regression models were very poor. In order to improve the results of the regression analyses and to eliminate suspicious data points, the Project Team developed criteria for the selection of projects in the performance database. These included criteria for the minimum project total construction costs, the elimination of project data as outliers, and the implementation of a five-year rolling window of project completion dates. Since the results of the regression analyses were poor, the Project Team decided to use the upper and the lower bounds of the 50 percent confidence interval to determine the range of the project delivery percentages. The confidence interval is used to indicate 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. Use of the 50 percent interval indicated less certainty in the model and a greater need to collect more data before drawing conclusions from the analyses.

In Update 2008, the Study Team identified and corrected auto-correlation in the regression method previously used to generate performance models. In order to eliminate auto-correlation, regression analyses that compared the relation between absolute costs (i.e., design costs, construction management costs, and project delivery costs) versus total construction costs were performed. In Update 2008, the relationships between the various components that constitute project delivery costs are modeled based on a linear regression relationship. The linear trendline passes through the origin and its slope represents the familiar project delivery cost expressed as a percentage of the total construction costs. With the elimination of auto-correlation, the correlation coefficients resulting from the regression analysis improved significantly, generally by 10-fold, demonstrating a close relationship between design costs, construction management costs, project delivery costs, and total construction costs.

With improved regression results, a more statistically-sound method for outlier analysis was developed, as discussed above. In addition, the range of the project delivery percentages were estimated based on the upper and the lower bounds of a 90 percent confidence interval which indicates a high degree of certainty in the results of the revised regression model. Given all these improvements to the analysis of the data, the reader is advised that direct comparison of data between Update 2008 and previous years may be more difficult due to these improvements.

It should be noted that the significant improvement in the results of the analyses offers the Project Team an opportunity to revisit some of the criteria for the selection of projects in the performance database during Update 2009. Details regarding the regression analyses and the associated results are presented in the following section.

Performance Model Results

The results of the regression analyses are presented in **Table 3-8** and **Appendix B**. The design, construction management, and project delivery costs expressed as a percentage of the TCC and the R^2 and the p-values for the different project types are also shown in **Table 3-8**.

Due to the selection of a linear regression methodology, the results show that in all cases, the design, construction management, and project delivery cost models increase linearly with an increase in the TCC. It should also be noted that

while the majority of projects are clustered near the origin of the graph, the slope of the trendline is predominantly governed by the data points scattered at relatively high TCC values. Since the slope of the trendline provides the design, construction management, or the project delivery costs as a percentage of the TCC for a group of projects, the reader must avoid budgeting individual projects based on these analyses.

It is important to note that while the slopes of the linear regression models are an expression of the project delivery cost as a percentage of the TCC, the slopes are not equal to the average and median project delivery percentages shown in **Table 3-5** and **Table 3-6**. The reason for this is that the trendline is fit by the least squares method. In addition, it should be noted that although the R^2 and the p-values have improved significantly than in previous *Study* phases, the reader is cautioned that this table only 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.

The increases in R^2 values highlight the improvement in fit of the linear trendline to describe the relationship between the project delivery costs and the TCC in comparison to models used previously. This is best illustrated by comparing the Update 2007 and the Update 2008 R^2 values for the Streets – Reconstructions classification for the design costs versus TCC regressions. In the Update 2007 Study, due to auto-correlation explained earlier in this section, this classification had a R^2 value of 0.0165. When the phenomenon is eliminated, the R^2 value increases by nearly 50 times to 0.77.

A similar improvement in the R^2 values is observed throughout all project types and classifications. The improved results due to the elimination of auto-correlation has added tremendous value to the Study results. A summary of R^2 values for the different project types and classifications is presented in **Table 3-8**.

The R^2 values varied by project type and classification. For all project types, the R^2 values for the project delivery costs versus total construction costs regressions are greater than 0.80. This is a significant improvement from the results of prior *Study* years and can be attributed to the refinements made to the performance model in Update 2008.

The results of statistical significance tests also improved with the elimination of auto-correlation. Comparing the Update 2007 and the Update 2008 p-values for the Pipes – Pump Stations classification highlights the improvement achieved. In the Update 2007 Study, this classification had a p-value of 0.94 for the design costs versus TCC regressions. With the refined regression approach, the p-value decreases to 3.87E-06, a significant decrease. A summary of the calculated p-values is included in **Table 3-8**. Increasing the number of data points in models with p-values above 0.10 should improve (reduce) the p-values. For those models with p-values above 0.10, the model should not be used alone to forecast delivery costs for individual projects.

Increasing the size of the project database is a major challenge posed to the *Study* participants. This is primarily because of the 5-year rolling window criterion for project completion dates; even as new projects are added, old projects are excluded from analyses by the window of time. In addition,

Table 3-8
Summary of Performance Models

Project Type or Classification	Number of Projects (N)	Design Cost				Construction Management Cost				Project Delivery Cost			
		(% of TCC)	95% CI (% of TCC)	R^2	p-value	(% of TCC)	95% CI (% of TCC)	R^2	p-value	(% of TCC)	95% CI (% of TCC)	R^2	p-value
Municipal Projects	130	15%	14%-16%	0.69	2.92E-47	14%	13%-15%	0.77	1.60E-52	29%	24%-30%	0.82	4.26E-49
Libraries	38	16%	15%-18%	0.69	1.57E-22	12%	11%-14%	0.52	1.44E-17	28%	26%-30%	0.80	6.29E-27
Police/Fire Stations	30	17%	14%-20%	0.80	3.73E-13	16%	14%-19%	0.77	1.10E-12	33%	29%-39%	0.83	1.29E-14
Comm./Rec. Center/ Child Care/Gyms	55	20%	17%-22%	0.73	4.54E-23	11%	9%-12%	0.59	1.79E-20	31%	28%-33%	0.80	2.08E-28
Other Municipal	7	8%	4%-12%	0.62	0.003275	14%	10%-17%	0.89	6.42E-05	22%	19%-24%	0.97	7.62E-07
Streets Projects	272	16%	15%-18%	0.64	1.14E-70	17%	16%-18%	0.90	5.85E-143	33%	32%-35%	0.89	8.13E-139
Widening/New/ Grade Separations	44	13%	11%-15%	0.74	1.28E-17	18%	16%-19%	0.91	4.09E-25	31%	29%-33%	0.94	2.37E-30
Bridges	14	34%	24%-44%	0.75	6.1E-06	13%	11%-16%	0.91	2.86E-09	47%	38%-56%	0.87	6.15E-08
Reconstructions	65	28%	24%-31%	0.77	2.91E-25	18%	16%-20%	0.79	4.38E-27	46%	41%-50%	0.81	3.36E-28
Bike/Pedestrian/ Streetscapes	74	14%	12%-16%	0.30	3.96E-18	11%	10%-12%	0.60	6.91E-26	25%	22%-28%	0.53	1.15E-25
Signals	75	20%	17%-22%	0.61	2.78E-26	18%	15%-20%	0.57	6.49E-25	38%	35%-40%	0.86	5.081E-46
Pipes Projects	256	9%	9%-10%	0.88	1.14E-122	10%	9%-10%	0.99	3.21E-275	19%	18%-19%	0.96	4.87E-186
Pressure Systems	227	9%	9%-10%	0.88	1.29E-108	10%	9%-10%	0.99	2.89E-248	19%	18%-19%	0.96	5.91E-164
Pump Stations	18	13%	10%-17%	0.53	1.64E-07	13%	11%-15%	0.72	3.18E-10	26%	23%-30%	0.78	2.953E-11
Gravity Mains	11	14%	11%-18%	0.82	3.87E-06	10%	7%-12%	0.83	2.97E-06	24%	21%-27%	0.95	5.86E-09
Parks	118	20%	15%-21%	0.88	5.27E-35	15%	13%-15%	0.83	9.02E-74	35%	32%-36%	0.91	4.45E-64
Playgrounds	101	21%	19%-22%	0.89	1.52E-59	15%	14%-16%	0.85	2.65E-54	36%	34%-37%	0.92	3.65E-68
Sportfields	9	17%	15%-19%	0.94	1.12E-07	14%	10%-18%	0.61	5.99E-05	31%	26%-36%	0.89	5.03E-07
Restrooms	8	21%	16%-26%	0.60	2.83E-05	27%	19%-34%	0.35	6.94E-05	48%	41%-55%	0.74	9.91E-07

Notes:

Notes: TCC = Total Construction Cost; Des. = Design Cost; CM = Construction Management Cost, and PD = Project Delivery Cost. CI = Confidence Interval. The project delivery percentages indicated are the ranges corresponding to the 95 percent confidence intervals on the slope of the linear regression trendline. 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 low (below 0.80).

the agencies also struggle to identify as many completed 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: INNOVATIVE PROJECT DELIVERY METHODS

The agencies have employed several innovative project delivery methods in an effort to reduce costs and improve efficiency in project delivery. Some of these methods have been successful and some valuable lessons have been learned from others. Examples of these methods include non-traditional bid methods such as: accelerated sewer repair and renovation, using aerial photographs as engineering plans for street resurfacing projects, bundling multiple contracts into a single set of bids, and using informal contract processes for contracts up to $250K.

Since the projects included in the performance database are delivered by the traditional design-bid-build approach, these innovative processes employed by the agencies to improve efficiency in project delivery are not specifically captured in the Study. In order to share the lessons learned by the agencies from the implementation of innovative project delivery methods, the Project Team selected Innovative Project Delivery Methods as an area of Special Study in Update 2008. A summary of each agency's experience with innovative project delivery methods and the resulting successes of employing such methods is summarized in the *Study*. **Table 3-9** lists the innovative project delivery methods implemented by the Project Team.

City of Long Beach Innovative Delivery Methods

1) *Provide a brief description of the Innovative Project Delivery Method*

The City has implemented a GIS capability which allows for the costs of a citywide street light maintenance contract to be fairly and accurately allocated among City departments which receive benefits under the agreement.

The GIS capability enables the City to accurately store and track street locations where moratoriums are in effect, thus eliminating additional street work that might otherwise have taken place sooner than would otherwise be required.

The GIS capability allows the City to access a database/inventory of various street and sidewalk locations that allow for advance communications with residents in the event of disruptive street work, and also provide information to the City Clerk's office to let poll workers avoid parking tickets resulting from street sweeping activities and other City work by the Public Works, Gas and Water Departments.

This same inventory of street and sidewalk locations provides valuable information to various City departments that allow for more efficient planning and allocation of funding resources for work to be done. Additionally, an effort is underway to integrate the auto CAD and GIS capabilities to further enhance the design process for street and sidewalk repair.

2) ***List project(s) in which this method was implemented.***

The GIS capability is utilized in various street and sidewalk repair projects to avoid conflicts with work done by other City departments such as the Oil/ Gas and Water Departments.

3) ***Describe results achieved (estimate cost/schedule impacts).***

Dollar costs/schedule impacts are not yet available.

City of Los Angeles Innovative Delivery Methods

A. Accelerated Sewer Repair Program (ASRP) and the Secondary Sewer Renewal Program (SSRP)

1) ***Provide a brief description of the Innovative Project Delivery Method***

This program replaces the traditional contract drawings, which typically consist of full plans and profiles, with a narrative of the sewer work to be completed by the contractor. The Bureau of Sanitation (BOS) provides the Bureau of Engineering (BOE) with a Sewer Basin Report that identifies all sewer reaches that need repair. The BOE designer then evaluates the Sewer Basin Report and prepares the Pre-Design report for BOS approval. Once approved, the designer will then prepare the Key Map and Vicinity Map as well as the schedule of repair table. Through the use of an MS Access database, the schedule of repair table includes the sewer reach stationing, invert elevation, ground elevation, center line offset, utility conflict (both parallel and crossing) and other information relating to the sewer reach.

Table 3-9
Summary of Innovative Project Delivery Methods

Agency	Innovative Project Delivery Method
Long Beach	GIS capability for street and sidewalk repair projects
Los Angeles	Accelerated Sewer Repair Program (ASRP) and the Secondary Sewer Renewal Program (SSRP)
	Super Expedited Wastewater Emergency Rehabilitation for Sewers (SEWERS)
	Construction Services Contract (CiSCo)
Oakland	Construction Manager/General Contractor (CM/GC)
San Diego	Design-Build
San Jose	Job Order Contracting (JOC)
Sacramento	Use of aerial photographs in plan preparation
	Use of part-time CM Inspectors

2) ***List project(s) in which this method was implemented.***

The total number of ASRP and SSRP projects: 163 projects that have completed construction, 23 are in construction and 34 are in Design.

3) ***Describe results achieved (estimate cost/schedule impacts).***

This Alternative Project Delivery Method saves both time and money in project delivery costs. The design phase of the project delivery has been dramatically reduced because specifications containing full plan and profile drawings have been eliminated. The schematics and tables also require less cost to produce while still providing enough information to the contractors to properly construct the project.

B. Super Expedited Wastewater Emergency Rehabilitation for Sewers (SEWERS)

1) ***Provide a brief description of the Innovative Project Delivery Method***

This is a unit price contract which is intended for the repair of existing sewer lines by removal and replacement methods. The contract is used for urgent repair of sewers as identified by the Bureau of Sanitation. Contractors bid unit cost break downs for each component of the expected work. The unit prices are entered into a spreadsheet program that calculates the total cost to conduct work tasks representative of those expected during the duration of the contract. The contract is awarded to the contractor with the lowest net cost, through the City's normal contract award process, but work is issued to the contractor through a series of Work Orders issued by the City Engineer. Project cost is based on pre-established unit prices from the original bid.

2) ***List project(s) in which this method was implemented.***

In the last three fiscal years we have issued 482 work orders for a total of about $12 million. None of these projects have been submitted for inclusion in the Benchmarking Report database because they do not go through the normal bid and award phase.

3) ***Describe results achieved (estimate cost/schedule impacts).***

This Alternative Project Delivery Method saves both time and money for urgent small to medium sewer repair projects. There is less time and effort spent designing scaled back project plans as opposed to full scale plans that would be necessary for a traditional sewer repair project, and the bid and award phase is eliminated since the contract has been awarded and the Work Orders are issued to the contractor directly by the City Engineer.

Since these projects are not entered into our Uniform Project Reporting System, it is hard to make a direct comparison between the time and cost savings during the design phase due to scaled back drawings. However, by eliminating the bid and award phase of the delivery process, we are able to save an average of 201 days (median of 182 days) and an average of $57,385 (median value of $31,343) in staff charges.

C. Construction Services Contract (CiSCo)

1) *Provide a brief description of the Innovative Project Delivery Method*

The CiSCo contract is a specialty contract intended for smaller wastewater treatment plant projects that are needed quickly, but do not rise to the level of an emergency. However the scope identified also covers wastewater and environmental projects. The work under this contract includes small scale field construction, performance of minor modifications, procurement of materials and equipment, retrofit of design changes to existing equipment, startup and commissioning support, testing of equipment, and related tasks that may be required by the engineer. Bidders are required to submit their percent markups in five categories. The payment and performance bond amounts and individual percent markups are then used to derive the Direct Value Residual (DVR) for each bid in accordance to formulas presented in the bid documents. The contract is awarded to the bidder with the highest DVR. Work is then issued to the CiSCo contractor through a series of Task Work Orders (TWOs). TWOs under $100,000 are approved by the City Engineer, and TWOs greater than or equal to $100,000 require Board approval. The current CiSCo contract has a cost ceiling of $10 million and contract duration of three years.

2) *List project(s) in which this method was implemented.*

We issue approximately 25 TWOs under this contract per year. Since these are Wastewater Treatment Plant projects and do not go through the normal bid and award phase, none have been submitted for inclusion into the Benchmark Report data base.

3) *Describe results achieved (estimate cost/schedule impacts).*

This Alternative Project Delivery Method saves both time and money for small to medium wastewater treatment plant projects. The design phase of the project delivery is shortened because the plans do not have to be as comprehensive as they would for a traditional construction project. Additional time is saved by eliminating the bid and award phase. In general the direct benefits of Cisco Contract are as follows:

Time Savings – Project designs can be done without full sets of specifications and General Conditions/General Requirements for each project. However, since these projects are not entered into our Uniform Project Reporting System, it is hard to make a direct comparison between the time and cost savings during the design phase due to scaled back drawings and specifications.

The standard bid and award phase is eliminated. The CiSCo contractor can begin work immediately after successful negotiations. It should be noted, however, that although the bid and award phase has been eliminated, there is still some staff time needed to negotiate the scope and prices, and to prepare and submit for approval a Board Report for projects over $100.000. The average time spent in negotiations for a CiSCo contract is 95 days (median of 59 days) at a cost of $8,842 (median of $2,228) compared to the average for a normal bid and award time of 201 days (median of 182 days) at an average cost of $57,385 (median value of $31,343), for an average time savings of 106 days (median of 123 days) and an average cost savings of $48,543 (median of $29,115).

There is a fixed markup (overhead & profit) of 11% on all Cisco projects. This limits wide swings in bids when contractors are busy. Also, by dealing with one contractor that knows the treatment plant layout, operations and personnel, and who is familiar with available laydown areas, a lot of contractor risk factors are eliminated in the cost.

The following are some examples of projects where the CiSCo Contract has resulted in substantial savings to the City:

- Terminal Island Renewable Energy (TIRE) – The project was sent out to bid on May 23, 2007. Two bids were received, one for $622,223 and the other for $563,900. The plans and specifications were given to CiSCo for a quote. The CiSCo contractor proposed $380,000 to accomplish the work and the project was awarded to Cisco for a substantial savings.

- HTP SAFE Center – The project was originally sent out to bid, and one bid came in at $1.1M. The CiSCo contractor proposed $596,000 to accomplish the work and the project was awarded to CiSCo for a substantial savings.

- HTP Primary Battery "D" Structural Rehabilitation – An Emergency On-Call Contractor provided the City with a quote of $874,000 to do the work. We then gave the plans to the CiSCo contractor and they proposed $351,000 to accomplish the work. Since the project was an emergency, we directed the Emergency On-Call Contractor to hire the CiSCo contractor, and including all markups the project was completed for less than $400,000 representing a substantial savings.

- System Wide Lower NOS Inspection – A change order proposal came in at $575,000. The CiSCo contractor proposed $284,000 to accomplish the work and the project was awarded to CiSCo for a substantial savings.

- 6th Street Siphon Closure Project - The project was originally sent out to bid, and two bids came in, one at $298,000 and the other at $463,000. The CiSCo contractor proposed $198,000 to accomplish the work and the project was awarded to CiSCo for a substantial savings.

- MBE/WBE usages on the current CiSCo contract are 14% and 2% respectively, and the CiSCo contractor has been able to meet these participation levels.

City of Oakland Innovative Delivery Methods

1) ***Provide a brief description of the Innovative Project Delivery Method***

In certain instances the City employs a Construction Manager/General Contractor (CM/GC) delivery method. This involves the use of a general contractor who is selected based on their qualifications and ability to work collaboratively with the owner and the independent project designer.The CM/GC provides pre-construction services which include cost estimating, scheduling, value engineering, and constructability reviews.The CM/GC pre-qualifies subcontractors, solicits competitive bids from subcontractors, and enters into contracts with the subcontractors for the construction work.The CM/GC also acts as a general contractor by coordinating and managing the delivery of the project at an agreed upon price and within an agreed schedule.

2) ***List project(s) in which this method was implemented.***

The City of Oakland employed the CM/GC delivery method on its Fire Station No. 8 Replacement project. The project involve the demolition of the existing fire station building and replacement with a new two-story 8,000 square foot fire station.The project required an accelerated schedule due to public safety reasons of opening the Fire Station back as soon as possible.

3) ***Describe results achieved (estimate cost/schedule impacts).***

The CM/GC soliciting three separate bid packages of construction work; demolition, core and shell, and interior improvements and finishes. This helped expedite the project by allowing some construction work to proceed while design work was being completed.

Design started in October 2001 and the GM/GC was hired in December 2001 to start preconstruction services. Construction work started in April 2002; and the construction was completed in February 2003. Total construction contract cost was $3.2 million which included $57,760 in preconstruction services, $477,240 in general condition costs, and $100,000 in fixed fees.

City of San Diego Innovative Delivery Methods

1) ***Provide a brief description of the Innovative Project Delivery Method:***

Design-Build (D-B) is an alternative method of project delivery to Design-Bid-Build (DBB) in which one entity (Design-Builder) provides both engineering design and construction services. Consequently, the City oversight role particularly during design consists of monitoring and auditing progress, interpreting contract requirements, and verifying design compliance with contract requirements. Design-Builder is the Engineer of Record and responsible for delivery of a complete product i.e., design and construction.

2) ***List project(s) in which this method was implemented:***

The Sewer Group 744 project replaced approximately 2.6 miles (construction cost was approximately $3.6 million) of deteriorating and substandard sewer pipelines in the Barrio Logan neighborhood via the D-B project delivery method which separates this project from other City's utility projects. Almost all other projects particularly pipeline contracts are delivered via the common method of DBB making this project truly unique in its delivery.

3) ***Describe results achieved (estimate cost/schedule impacts):***

The project was completed six (6) months ahead of the contract duration of twenty (20) months; with no disputed issues and without any service interruptions. The informal partnering initiated immediately upon award proved effective in addressing project issues during design and construction. Several processes and tools (i.e.submittal review flow chart and progress schedule) were developed to simplify the communication in all directions which accelerated the review, response, and delivery for all parties. The following is a comparison with a project that was delivered by the City of San Diego using the traditional method, DBB, versus Sewer Job 744 D-B method. The projects are similar in type, length, and time of construction.

Sewer Group 746 and 749 (Traditional DBB Method):

Project Type – sewer pipe line
Approximate Length – 2.6 miles
Project Initiation Date –
August 28, 2001
Notice of Completion Date –
August 11, 2006
Project Total Cost
(Soft + Construction) - $4.56 million

Sewer Group 744 (D-B Method):

Project Type – sewer pipe line
Approximate Length – 2.6 miles
Project Initiation Date –
August 28, 2001
Notice of Completion Date –
October 13, 2005
Project Total Cost
(Soft + Construction) - $4.22 million

The D-B project was completed ten (10) months earlier than the traditional DBB delivery project. Additionally, there was a saving of $340,000 with the D-B project.

City of San Jose Innovative Delivery Methods

1) ***Provide a brief description of the Innovative Project Delivery Method:***

Job Order Contracting (JOC) is a project delivery method that focuses on the procurement phase of project delivery. It uses prices for construction items that are established in a pricing book. Potential contractors bid on the JOC construction contract by submitting an adjustment factor to the prices in the book. The Contractor with the lowest adjustment factor is awarded the JOC construction contract. The construction contract is for a specific duration, in this case three years, and for a not-to-exceed dollar amount, in this case six million dollars, rather than for a particular construction project. Individual construction projects are selected during the year for this project delivery method and are authorized by issuing a Job Order for each project. Bonds and insurance are obtained for the entire JOC contract amount and duration rather than for each construction project.

2) ***List project(s) in which this method was implemented:***

- Terminal C Mezzanine Sprinklers (install fire sprinklers)
- Fire Station 5, 10, 14 Upgrade (site work)
- Former FMC Site - Building Demolition (demolition & removal of metal buildings)
- Convention Center Garage Repairs (concrete demolition & replacement)
- Terrace Drive Remediation Phase 1A (mainly site work)
- Fire Station Training Center Asphalt Replacement (demolish and replace asphalt)
- Calabazas BMX Park (mainly earthwork)

3) ***Describe results achieved (estimate cost/schedule impacts):***

The Fire Training Center Asphalt Replacement project was the most successful JOC project resulting in reduced project delivery time. From the commencement of the project to the beginning of construction was less than four weeks. However, reduction in project delivery time was not consistent for all JOC projects. For us, projects that were complex or had less definitive measurable material quantities did not result in reduction of project delivery time.

JOC projects did not result in consistent construction cost savings. In addition to obtaining the JOC price for the Convention Center Garage Repair project we also bid the project with the bid amount being slightly less than the JOC project price. Similar results occurred for the Terminal C Mezzanine Sprinklers project that was bid as a portion of a larger fire sprinkler project. However, for Fire Station 5, 10, 14 Upgrade project and the Former FMC Site - Building Demolition project, the JOC project price was slightly less than our construction cost estimate. No discernable reason was discovered for the inconsistency of construction cost savings.

City of Sacramento (DOT) Innovative Delivery Methods

The City of Sacramento, Department of Transportation utilizes a variety of innovative methods in the design and construction management processes as described below.

Design

The City of Sacramento, Department of Transportation, will sometimes use aerial photographs to prepare striping plans and landscape plans instead of drafting base maps from a topographic surveys.

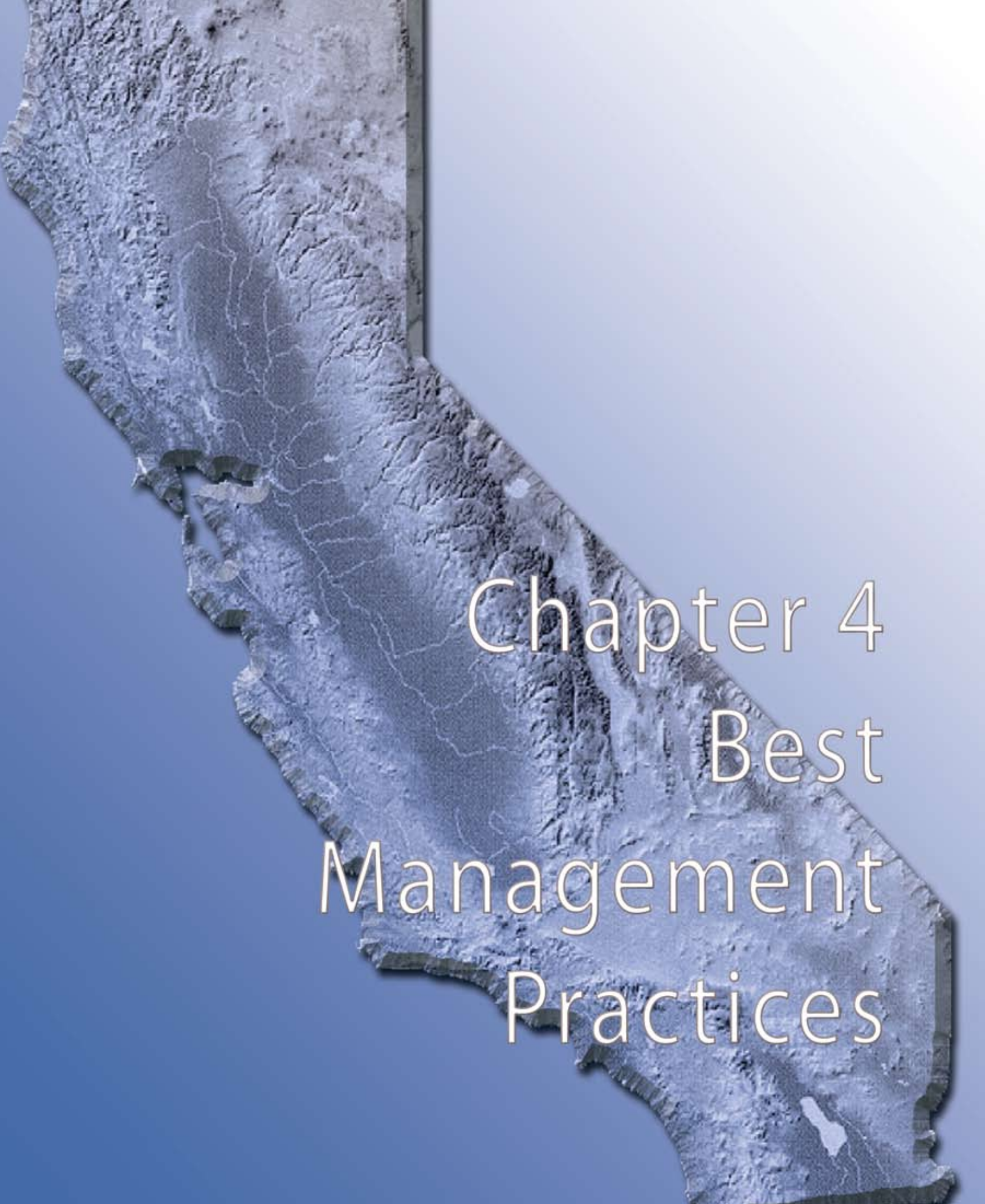
These projects generally result in lower design costs and shorter deliver times. In addition to median landscaping project, which are a benchmarking category, this method is also used for overlays, addition of on-street bike lanes, and two-way street conversions.

Construction Management

The City of Sacrament, Department of Transportation, reported out efficiencies related to construction management at the May 2008 benchmarking meeting.

The following is a summary of the implemented best management practices supporting the benchmarking data related to lower construction management costs:

- Part time inspection – 3 CIP's/Inspector, assigned geographically.
- Inspectors assigned additional work to maintain productivity.
- Use of consultants to cover peak periods. On-call basis. No charges to projects when no activity.
- Inspectors generally are not engineers.
- CM firms generally hired for large projects are paired up with an inspector who is knowledgeable with agency requirements.
- Design PMs are in responsible charge through construction and provide construction engineering, admin, & budget management.
- In addition, the following best management practices where also discussed during the presentation contributing to lower construction management costs:
- Material testing is provided by on-call geotechnical consultants, while survey work is provided by City crews that are very familiar with City horizontal and vertical control. On-call consultants would generally only be used to address peak work load periods.



Chapter 4
Best Management Practices

CHAPTER 4 Best Management Practices

At the start of the *Study*, the agencies examined over 100 practices used in project delivery. Included in the *Study* are those practices that the study participants did not already commonly use, but believed should be implemented as BMPs. New BMPs are also added annually, and in some cases existing BMPs are reworked by the agencies to address specific challenges they encounter. BMPs are also added or modified to reflect new learnings by the participants. Agency implementation of these selected practices has been and will continue to be tracked during the *Study*. Three new BMPs were added to the list this year, along with the modification of one existing BMP. 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 2008, the Project Team added three new BMPs to the BMP implementation tracking list. The BMPs were developed to address issues in the areas of responsible charge, standard specifications, and payment process. These BMPs were:

- 2.p.2008 - Establish criteria for responsible charge design approval such that it occurs at the lowest appropriate organizational level in order to expedite design completion.
- 3.III.m.2008 - Maintain and regularly update electronic standard contract specifications and related documents, as well as technical/special provisions.
- 5.III.i.2008 - Implement an electronic progress payment system to improve efficiency.

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.

Changes were made to clarify the wording of one existing BMP which dealt with independent cost estimates. The revised wording is:

- 2.o 2007 – Establish criteria for obtaining independent cost estimates which take in consideration both project characteristics and volatility of the market.

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 system will ensure that resources are directed to meet the community's most critical needs.
	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.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.
	1.i	Show projects on a Geographical Information System (GIS).	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
Design	2.b	Provide a detailed clear, precise scope, schedule, and budget to designers prior to design start.	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.
	2.f	Define requirements for reliability, maintenance, and operation prior to design initiation.	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.i	Adapt successful designs to project sites, whenever possible (e.g. fire stations, gymnasiums, etc).	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.k 2003	Train in-house staff to use Green Building Standards.	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.l 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.m 2004	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.n 2006	Show projects on a Geographical Information System (GIS).	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.
	2.o 2007	Establish criteria for obtaining independent cost estimates which take in consideration both project characteristics and volatility of the market.	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.

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

Category	Ref:*	BMP	Description
Design	2.p 2008	Establish criteria for responsible charge design approval such that it occurs at the lowest appropriate organizational level in order to expedite design completion.	Many times responsible charge design approval is set at a very high level. This can sometimes result in only one person with limited time who can approve all sheets in a design package. This leads to a bottleneck situation.
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.
	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
Quality Assurance / Quality Control	3.III.m 2008	Maintain and regularly update electronic standard contract specifications and related documents, as well as technical/special provisions.	Standard contract specifications and technical special provisions need to be regularly maintained and updated in order to reduce the amount of time required to create contract bid documents. If a City implements new requirements, the standards should be modified for every project one time instead of each manager having to modify these documents of every project.
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.
	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.

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

Category	Ref:*	BMP	Description
Construction Management	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.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.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.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.
	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.

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

Category	Ref:*	BMP	Description
Project Management	5.III.i 2008	Implement an electronic progress payment system to improve efficiency	Reduction in the length of time and inefficiencies in processing of progress payments through the use of electronic means.
	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.
	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

In Update 2008, 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. Agencies have started to review and update those BMPs that have been fully implemented for several years. Agencies continue to pursue full implementation of BMPs although this past year many were only partially implemented. As of Update 2008, the agencies have fully implemented about 70 percent of all BMPs. Many of the remaining BMPs require the involvement of multiple departments and are complicated to implement.

To support the linking of BMPs to performance improvements, BMP implementation has been tracked and project completion dates have been collected on Performance Questionnaires. It is anticipated that the performance data will eventually demonstrate that as BMPs are implemented, project delivery costs are reduced. This year, a new performance benchmarking model was implemented which should provide empirical evidence showing the impact of BMPs on project costs in the future.

BMPs targeted for future implementation and progress on actual BMP implementation since the Update 2007 are summarized below.

I. City of Los Angeles

Implemented from June 2007 to May 2008:	Targeted June 2008 Onward:
• 2.p.2008 Establish criteria for responsible charge design approval such that it occurs at the lowest appropriate organizational level in order to expedite design completion. • 3.III.k 2007 Establish a Utility Coordinating Committee with members from public and private entities. • 3.III.m.2008 Maintain and regularly update electronic standard contract specifications and related documents as well as technical/special provisions.	• 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 (partially implemented).

II. City of Long Beach

Implemented from June 2007 to May 2008:	Targeted June 2008 Onward:
• 2.k.2003 Train in-house staff to use Green Building Standards. • 5.I.k2004 Institutionalize Project Manager performance and accountability. • 5.IV.a 2006 Bundle small projects whenever possible.	• 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. • 3.III.m.2008 Maintain and regularly update electronic standard contract specifications and related documents as well as technical/special provisions. • 6.g. Implement and use a consultant rating system that identifies quality of consultant performance (In Progress).

III. City of Oakland

Implemented from June 2007 to May 2008:	Targeted June 2008 Onward:
• 2.m. 2004 Require scope changes during design to be accompanied by budget and schedule approvals. • 3.III.m.2008 Maintain and regularly update electronic standard contract specifications and related documents as well as technical/special provisions. • 5.I.k 2004 Institutionalize Project Manager performance and accountability.	• 1.d. Utilize a Board/Council project prioritization system. (partially implemented) • 1.i. Show projects on a Geographical Information System. (partially implemented)

IV. City of Sacramento

Implemented from June 2007 to May 2008:	Targeted June 2008 Onward:
Department of General Services • 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.) **Department of Transportation** • 2.p.2008 Establish criteria for responsible charge design approval such that it occurs at the lowest appropriate organizational level in order to expedite design completion. • 3.III.l 2007 Designate a responsible person or group and establish a process of notifications and milestones for utility relocations. • 3.III.m.2008 Maintain and regularly update electronic standard contract specifications and related documents as well as technical/special provisions. • 5.1.f Assign a client representative to every project. **Department of Utilities** • N/A	**Department of General Services** • 1.d. Utilize a Board/Council project prioritization system. (partially implemented) • 2.f. Define requirements for reliability, maintenance, and operation prior to design initiation. (partially implemented) • 4.V.c 2003 Make bid documents available online. (partially implemented) • 5.III.f 2006 Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables. (partially implemented) • 5.III.g 2006 Monitor "earned value" versus budgeted and actual expenditures during project delivery. (partially implemented) **Department of Transportation** • 4.V.c 2003 Make bid documents available online. • 5.I.k 2004 Institutionalize Project Manager performance and accountability. (partially implemented) • 5.III.e.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.) (partially implemented). • 5.III.f 2006 Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables. (partially implemented) • 5.III.g 2006 Monitor "earned value" versus budgeted and actual expenditures during project delivery. (partially implemented) • 5.III.h 2007 Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments. (partially implemented) **Department of Utilities** • 1.d Utilize a Board/Council project prioritization system. (partially implemented) • 4.V.c 2003 Make bid documents available online. (partially implemented) • 5.III.e 2006 Implement a financial system that tracks expenditures by category to monitor project hard and soft costs during project delivery. (partially implemented) • 5.III.h Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments. (partially implemented)

V. City of San Diego

Implemented from June 2007 to May 2008:	Targeted June 2008 Onward:
• 3.III.m.2008 Maintain and regularly update electronic standard contract specifications and related documents as well as technical/special provisions.	• 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. • 1.e Resource load all CIP projects for design and construction. (partially implemented) • 1.f Include a Master Schedule in the CIP that identifies start and finish dates for projects. • 2.b Provide a detailed clear, precise scope, schedule, and budget to designers prior to design start. • 3.I.a Develop and use a standardized Project Delivery Manual. (partially implemented) • 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. (partially implemented) • 5.I.k 2004 Institutionalize Project Manager performance and accountability. (partially implemented) • 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. (partially implemented)

VI. City and County of San Francisco

Implemented from June 2007 to May 2008:	Targeted June 2008 Onward:
• 2.p.2008 Establish criteria for responsible charge design approval such that it occurs at the lowest appropriate organizational level in order to expedite design completion. • 3.III.m.2008 Maintain and regularly update electronic standard contract specifications and related documents as well as technical/special provisions. • 5.III.i.2008 Implement an electronic progress payment system to improve efficiency.	• 1.f Include a Master Schedule in the CIP that identifies start and finish dates for projects. • 2.I. 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 2007 to May 2008:	Targeted June 2008 Onward:
• 3.III.k 2007 Establish a Utility Coordinating Committee with members from public and private entities.	• 2.o.2007 Establish criteria for obtaining independent cost estimates which take in consideration both project characteristics and volatility of the market (partially implemented). • 2.p.2008 Establish criteria for responsible charge design approval such that it occurs at the lowest appropriate organizational level in order to expedite design completion (partially implemented). • 3.1.a Develop and use a standardized Project Delivery Manual • 3.III.a Use a formal Quality Management System. • 3.III.l 2007 Designate a responsible person or group and establish a process of notifications and milestones for utility relocations (partially implemented). • 3.III.m 2008 Maintain and regularly update electronic standard contract specifications and related documents as well as technical/special provisions. • 5.I.k 2004 Institutionalize Project Manager performance and accountability. (partially implemented) • 5.II.a Provide formal training for Project Managers on a regular basis. (partially implemented) • 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. (partially implemented) • 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. (partially implemented)

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 BMPs

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.	✓	✓	✓	✓	✓	✓	2009	✓	✓	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.	✓	✓	✓	✓	✓	✓	2009	✓	✓	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
	1.d.	Utilize a Board/Council project prioritization system.	✓	NI	PI, TBD	PI, 2008	✓	PI, 2009	✓	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
	1.f.	Include a Master Schedule in the CIP that identifies start and finish dates for projects.	✓	TBD	✓	✓	✓	✓	2009	2009	✓	LB: Software in development. SC DU: Completion date only estimated, not determined by scheduling analysis.

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 BMPs (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
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
Design	2.b.	Provide a detailed clear, precise scope, schedule, and budget to designers prior to design start.	✓	✓	✓	✓	✓	✓	2009	✓	✓	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
	2.k. 2003	Train in-house staff to use Green Building Standards.	✓	✓	✓	✓	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.	✓	✓	✓	✓	✓	✓	✓	2009	✓	SC DU: Control and minimize, but difficult to eliminate, since clients and engineers come up with new/better solutions.

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Table 4-2
Implementation of BMPs (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Design	2.m. 2004	Require scope changes during design to be accompanied by budget and schedule approvals.	✓	✓	✓	✓	✓	NI	✓	2009	✓	
	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.)	NI	✓	NI	✓	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	Establish criteria for obtaining independent cost estimates which take in consideration both project characteristics and volatility of the market.	TBD	PI, TBD	TBD	TBD	2009	TBD	TBD	TBD	PI, 2008	
	2.p 2008	Establish criteria for responsible charge design approval such that it occurs at the lowest appropriate organizational level in order to expedite design completion.	✓	PI, 2009	✓	✓	✓	✓	PI, 2009	✓	2009	

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Table 4-2
Implementation of BMPs (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	✓	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	✓	✓	✓	✓	✓	NI	LA: For projects > $10M LB: As needed SC: As needed SD: As needed SF: As needed SJ: For projects > $5 million
	3.III.a.	Use a formal Quality Management System.	✓	PI, 2009	NI	✓	✓	NI	✓	✓	2009	SD: Some Divisions only
	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	✓	NI	✓	✓	✓	✓	✓	
	3.III.l 2007	Designate a responsible person for and establish a process of notifications and milestones for utility relocations.	✓	NI	TBD	NI	✓	✓	2008	✓	PI, 2009	

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
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Table 4-2
Implementation of BMPs (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Quality Assurance/ Quality Control	3.III.m 2008	Maintain and regularly update electronic standard contract specifications and related documents as well as technical/special provision.	✓	2009	✓	TBD	✓	TBD	✓	✓	2009	
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
	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	✓	✓	✓	✓	

Key:
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PI: Partially implemented
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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 BMPs (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.	TBD	✓	TBD	PI, 2008	2009	TPI. 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.	✓	✓	✓	✓	PI, 2009	NI	PI, 2009	TBD	PI, 2009	SC DU: There is interest but no definite plan. SD: Only non-standardized goals
	5.II.a	Provide formal training for Project Managers on a regular basis.	✓	TBD	✓	✓	✓	NI	✓	✓	PI, 2009	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	2009	

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Table 4-2
Implementation of BMPs (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Project Management	5.III.a.	Adopt and use a Project Control System on all projects.	✓	✓	✓	✓	✓	NI	✓	✓	✓	SD: Project controls incorporated into Primavera schedule
	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.	2009	✓	✓	PI, 2009	PI, 2009	NI	✓	TBD	PI, 2009	SC DT: Working to/ Update: Provide Microsoft Project to all Project Managers and produce schedules with tasks/sub-task schedules
	5.III.g 2006	Monitor "earned value" versus budgeted and actual expenditures during project delivery.	2010	NI	✓	PI, 2008	PI, 2009	NI	PI, 2009	TBD	NI	
	5.III.h 2007	Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments.	PI	TBD	TBD	NI	PI, 2008	PI, 2008	TBD	NI	✓	
	5.III.i 2008	Implement an electronic progress payment system to improve effieciency.	TBD	NI	TBD	TBD	NI	TBD	TBD	✓	TBD	

Key:
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Table 4-2
Implementation of BMPs (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC			SD	SF	SJ	Notes
						DGS	DT	DU				
Project Management	5.IV.a 2006	Bundle small projects whenever possible.	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	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, TBD	
Consultant Selection and Use	6.c.	Include a standard consultant contract in the RFQ/RFP with an indemnification clause.	✓	✓	✓	✓	✓	NI	✓	✓	✓	SD: Some Divisions only
	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	✓	✓	2009	SC DU: Threshold is $100,000.
	6.g.	Implement and use a consultant rating system that identifies quality of consultant performance.	✓	PI	✓	✓	NI	✓	✓	✓	PI	SC DU: Track performance for those selected for "support services." SJ: Need to incorporate more post-project review.
	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.	✓	✓	✓	✓	✓	✓	✓	✓	✓	

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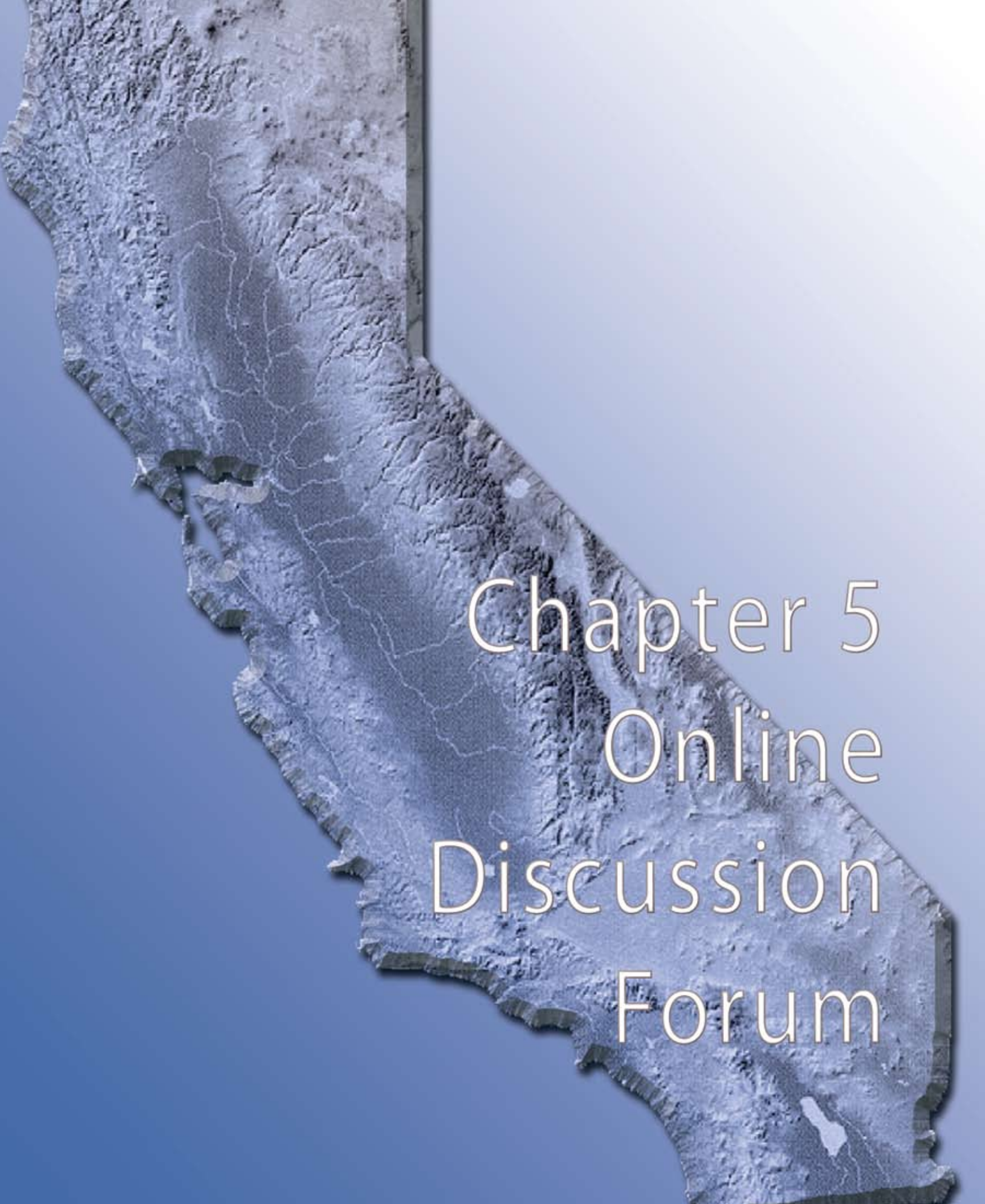


Chapter 5
Online Discussion Forum

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 Online forum and receive input from the fellow team members. During the year, a total of 30 topics were discussed. From this set of discussions, the following 11 topics are presented as an example of the types of informational exchanges that took place within the Update 2008 Online Discussion Forum.

- Greening of Construction Equipment
- Errors and Omissions Classifications
- Bid Limits
- AB-983
- Electronic Progress Payment Process
- Participation Goals
- Performance Goals for Change Orders
- Cost Estimating Policy and Procedures
- Level of Responsible Charge Design Approval
- Public-Private Partnerships
- Progress Payments Retention Withholdings

A. GREENING OF CONSTRUCTION EQUIPMENT

The City of Los Angeles initiated this question in response to a request generated from one of their Council offices. That Council office wanted to consider a pilot project to provide incentives to contractors who utilize lower emissions construction equipment on their projects. The City of Los Angeles wanted to know if other cities had such a program.

The City of Oakland responded that they do not have such a program. However, they acknowledged that state regulations are moving in that direction. They expressed concern regarding the new regulation's impact on small local businesses within their city.

The City of San Jose noted that they had not developed any program along these lines. However, San Jose's Mayor has released San Jose's Green Vision Goals, one of which is that "100 percent of our public fleet vehicles run on alternative fuels."

The City of Sacramento stated they have not developed an incentive program, but

"…we have worked with our local Sacramento Metropolitan Air Quality Management District (SMAQMD) staff to implement a 24 month pilot program (started in early 2006) to educate and promote their Low Emission Vehicle (LEV) Incentive Program to replace pollution engines."

The City and County of San Francisco currently do not have any pilot programs or requirements for lower emissions construction equipment. However, in the fall of 2007 a Board of Supervisors sub-committee had discussions that explored this issue, but no policy has been initiated.

The City of Long Beach has no such program at this time. They too expressed concern regarding the impact upon small contractors.

B. ERRORS AND OMISSIONS

The City of Los Angeles initiated a survey of the approaches taken toward Errors and Omissions by professional service providers. All agencies responded to the survey. **Table 5-1** summarizes the agencies' responses.

C. INFORMAL BID LIMITS

The City of Oakland initiated a survey amongst the agencies related to informal bid limits and maximum contract authority. Most agencies responded with their limits and authority levels. Detailed responses from participating agencies are summarized in **Table 5-2**.

D. ASSEMBLY BILL-983

If passed, AB-983, would require a local public entity, charter city, or charter county, before entering into any contract for a project, to provide full, complete, and accurate plans and specifications and estimates of cost, giving such direction as will enable any competent mechanic or other builder to carry them out. This bill would exempt from these provisions any clearly identified design-build projects or design-build portion of a project.

The City of Oakland initiated discussion by asking the other agencies if they were aware of this potential bill, if they had any concerns about how it would impact their capital projects (especially on smaller projects), and whether or not they were going to take a position on this bill.

The City of Sacramento, Department of Utilities, replied that they had already sent a letter to the State opposing AB-983. The Department of Transportation stated that they are now in the process of writing a letter of opposition to Assembly Member Ma. The Department of General Services was not aware of the bill and has not decided whether to take a position on it. They remarked that this bill expands the authority of local governments to use design-build contract methods.

The City of San Jose was aware of both AB-983 and AB-642 and shared concerns with respect to AB-983's potential effect on informal plan/spec project delivery. Due to their Charter City status, AB-642 will not alter their current design build procedures already in place.

The City and County of San Francisco and Long Beach both replied that a letter opposing this bill was sent.

After reviewing the bill, The City of Los Angeles Bureau of Engineering agreed that it is poorly written and lacks a clear definition of "full, complete and accurate plans and specifications and estimates of cost." The have sent a letter to the Mayor's Office and the Chief Legislative Analyst recommending that the City oppose this legislation.

Table 5-1
City of Los Angeles Survey

Questions	1. Do you currently classify Errors and Omissions separately on your change order forms, or are they lumped together?	2. Do you consider past Errors and Omissions performance in the formal scoring of RFQs/RFPs?	3. Do you have a limit set in your contractual standard of care for errors and omissions? If so, what percentage?
City of Long Beach	We do not separate Errors and Omissions into two different categories	No response	No response
City of Oakland	We do not classify the change order type in the change order itself. However, we do issue an internal memo with the classification.	No	No
City of Sacramento – Department of General Services	No	No	No. However, above 3-5% range it becomes an area of concern.
City of Sacramento – Department of Transportation	Yes, there is a separate design error category.	No	No
City of Sacramento – Department of Utilities	No	No	No
City of San Diego	No	Yes, but only from the information given to us from reference checks.	No
City of San Francisco	Yes, currently reporting separately on errors and omissions.	Do not have an answer. Would like to see it in scoring, but it is not right now. References can provide this information.	No response.
City of San Jose	No	No	No

Table 5-2
City of Oakland Survey

Questions	1. Do you have an informal bid limit? If so, how much?	2. What is the maximum contract amount that can be awarded by the Director of Public Works without going to the Council or Board of Supervisors?
City of Long Beach		Project under $100,000 can be awarded by the City Manager. Projects above this amount needs City Council approval.
City of Los Angeles	Not required to competitively bid construction projects under $25,000. City Charter allows for the suspension of competitive bidding during a declared state of emergency.	City Engineer is required to go to the Board of Public Works to award all construction contracts, regardless of amount, except where a list of contractors already has Board approval. Verbal approval from one Board member is usually obtained to use such a list. Current lists include on-call emergency sewer repair, on-call emergency slope repair, and demolition.
City of Sacramento - DOT	$100,000 per City Code.	The maximum City Manager contract authority, which is delegated to Department heads, is $100,000.
City of San Francisco	The informal contact limit is $114,000.	Board of Supervisors provides funding approval/ allocation. Director of DPW does not have to go to the Board to obtain approval of any contract amount once Board provides funding approval/allocation.
City of San Jose	Formal bidding is required for projects in excess of $100,000. Minor Contract Procedures exist for projects less than $100,000.	Public Works Director has been delegated authority by City Council to award projects up to $1,000,000. If bid anomalies or protests arise on such projects, they must go to Council for award.

E. ELECTRONIC PROGRESS PAYMENT PROCESS

The City and County of San Francisco initiated a discussion on the use of electronic progress payment and/or change order processing systems. The cities of San Jose, Los Angeles, Oakland, and Sacramento all responded that they did not have such systems. However, various agencies indicated that preliminary processing steps may be done electronically, but the final documents all receive a wet signature. The length of processing time was also explored. Responses varied from 2 weeks to several months. As a result of a great deal of interest being expressed during the first quarter team meeting by all the agencies, the City and County of San Francisco made a formal presentation on the electronic processes they have developed to date at the second quarter meeting. During the third quarter team meeting this item was added as a new 2008 BMP (5.III.i 2008).

F. LOCAL AND DISADVANTAGED BUSINESS ENTERPRISE GOALS

The City and County of San Francisco initiated a discussion on this topic since it was reviewing its policy on Local (LBE) and or Disadvantaged (DBE) Enterprises as it related to participation goals on construction contracts. They asked a total of 9 questions. Responses were received from five out of six agencies. The detailed responses can be found in **Table 5-3** below. The City of San Jose was the only responding agency that did not have any programs, except for those that were federally funded.

G. PERFORMANCE GOALS FOR CHANGE ORDERS

The City and County of San Francisco wanted to compare their internal maximum change order goals of 10% for construction projects under $2 million and 7% over $2 million to other cities. They initiated an online discussion inquiring what other cities' change order cap goals might exist.

The City of Long Beach stated that all projects include a 15% change order cap but that can be increased to 25% if requested at time of award. Effort is made to try and hold contracts to less than 10% in change orders.

The City of Los Angeles does not have any official cap on total change orders. Unofficially they try and keep the cumulative change order amounts below 10%. A Project Manager must brief the City Engineer and get authority from the Board of Public Works anytime a single change order exceeds $100,000, when the cumulative changes exceed 25% of the contract value, or when the change exceeds the remaining contingency limit for the project.

The City of Sacramento Department of Transportation liked the concept of varying goals based on contract amounts. While they currently have no internal change order cap goals, the City of Sacramento Department of Transportation stated that they are in the process of developing such goals.

The City of San Diego responded that 5% contingency is set aside for change orders on their construction projects. Any change order amounts that exceed this must receive Council approval.

Table 5-3
City of San Francisco Survey

Questions	1. Does Any Agency have participation goals for construction contracts?	2. Are there overall contract goals or do they only apply to sub-contractors?	3. How are the goals measured for each bid?	4. Are bid amounts discounted for meeting goals? How are the discounts calculated?	5. In there a threshold contract dollar limit triggering goals?	6. If a prime contractor is already a L/DBE, can they use their company to count toward the goals?	7. Can a contractor still win a bid without meeting goals? If so, how?	8. Do you require local hiring?	9. Does a contractor need to demonstrate good faith efforts in meeting goals?
City of Long Beach	Agreed to apply HUD Section 3 hiring guidelines.	Prime required making good faith effort to ensure 30% of all new hires live in Section 3 residences and that 10% of subcontracts be Section 3 companies.	A percentage of the total construction contract amount awarded.	No	$100,000 for Section 3 projects.	For Section 3 and federally funded projects, both Section 3 and DBE primes count towards the goal.	As long as the good faith effort was made properly.	Yes	Yes
City of Los Angeles	Yes, Anticipated Participation Levels (APL) for MBE & WBE.	Only apply to subcontractors	Calculated as a percentage of the contractor's bid amount less allowances.	No	$100,000	Prime does not count toward goals.	Yes, if they meet the requirements of the good faith effort.	No, except projects with Project Labor Agreements.	Yes, if they meet the requirements of the good faith effort. No GFE needed on Cal Trans projects.
City of Oakland	No goals. Have 20 % minimum L/SLBE requirement.	Overall	20% of total dollar amount.	Yes, 2% bid discount for meeting 20% min., 3% for 30%, 4% for 40% and 5% for 50%.	$50,000	Yes	Yes, if bid submittals do not satisfy all requirements. Council action may be necessary.	Yes. 50% local Oakland resident participation and 15% Oakland apprentice participation.	No good faith effort option.
City of Sacramento-DU	Yes	Overall	Dollar amount indicated on "subcontractor and ESBE Participation Verification" form.	No. 20% minimum participation or bid is declared non-responsive.	$25,000, unless waiver or modification from standard is applied for by PM and granted by ESBE office.	Yes	No	No	No
City of San Jose	No	No	N/A	No	DBE requirements only apply to federally funded projects.	Yes in accordance with US DOT requirements on federally funded projects.	Yes, DBE program is race neutral.	No	Only on federally funded projects.
City of San Jose	No	No	No						

The City of Oakland stated that their change order contingency is 10% of the contract price. Although, they have no formal percentage based total change order goal, they have a performance goal for design related changed orders of 3%.

The City of San Jose responded that they do not have any change order performance goals while the City of Long Beach responded that they try to hold change orders to less than 10% on all contracts.

H. CAPITAL PROJECT COST ESTIMATING POLICY/PROCEDURES

The City of San Jose is undertaking an effort to revise its Council-approved Capital Project Cost Estimating Policy and its associated procedure in their Project Management Manual. They asked each agency whether or not they had any written policy or documented procedure for crafting capital project cost estimates and, if so, to provide a sample of what was used. Representatives from all cities, except for the City of Los Angeles, responded that they had no such written policy of procedures. Two cities, Oakland and Long Beach, provided templates that each use in preparing estimates.

The City of Los Angeles has established an internal procedure for project cost estimating that has been outlined in the Bureau's Project Delivery Manual. Found in Chapter 3.7, version 2, project estimating responsibilities and procedures are outlined. The Project Engineer is responsible for preparing and updating construction estimates for their assigned projects. Two forms are used: the first is the Construction Cost Estimate Sheet and the second is the BOE Project Cost Estimate Form which is used for the initial project cost estimate. For different stages in a project's lifecycle, corresponding estimate "class types" are employed. They are as follows:

Type	Project Stage
Class "O"	Planning, used as a CIP placeholder
Class "C"	Pre-design, between 5-20% complete
Class "B"	Update of Class "C", 20-50% complete
Class "A"	Final, 90% complete. Becomes City Engineer's Estimate.

I. LEVEL OF RESPONSIBLE CHARGE

The City of San Jose polled the participating cities for the typical completion level at which plans and specifications are signed and sealed. The question generated response from most agencies. During the third quarter team meeting, this online discussion item precipitated the development of a new 2008 BMP (2.p 2008). The various responses from participating agencies are summarized in **Table 5-4**.

J. PUBLIC-PRIVATE PARTNERSHIPS

The City of San Jose was searching for information pertaining to public-private partnerships that cities may have initiated. Public-private partnerships are gaining momentum and are providing another way to obtain funding for projects that may otherwise have to wait many years. Due to the complexity of the subject and the level of which the cities work on these partnerships, each city provided a list of contacts for the City of San Jose to utilize.

K. RETENTION FOR PROGRESS PAYMENTS

The City and County of San Francisco was reviewing its Administrative Code as it relates to construction contracts. During that process the section on progress payment retention was flagged for revision. The City of San Francisco initiated a discussion asking each agency what their retention policy was for projects less than 50% complete, over 50% complete and at 95% completion. The percentage withheld for retention is standard among the agencies at 10%, yet the level of project completeness up to which they withhold does vary slightly.

The City of Long Beach replied that they follow the "Greenbook" and withhold 10% of all progress payments. They stated that above 50% complete, a contractor may request a reduction in retention to 5%. They generally do not further reduce the contractor's retention below 5%.

The City of Los Angeles provided an excerpt from their General Requirements included in all construction contracts (section 01292 article 1.1.E). It states that the City may retain a portion of the amount otherwise due to the contract which shall be labeled retention which will be equal to 10% of the original Contract value on each approved payment until the amount paid of the original Contract equals 50%. The city may then, at its sole discretion, discontinue further retention. However, it may reinstate the 10% retention at its sole discretion.

Table 5-4
City of San Jose Survey

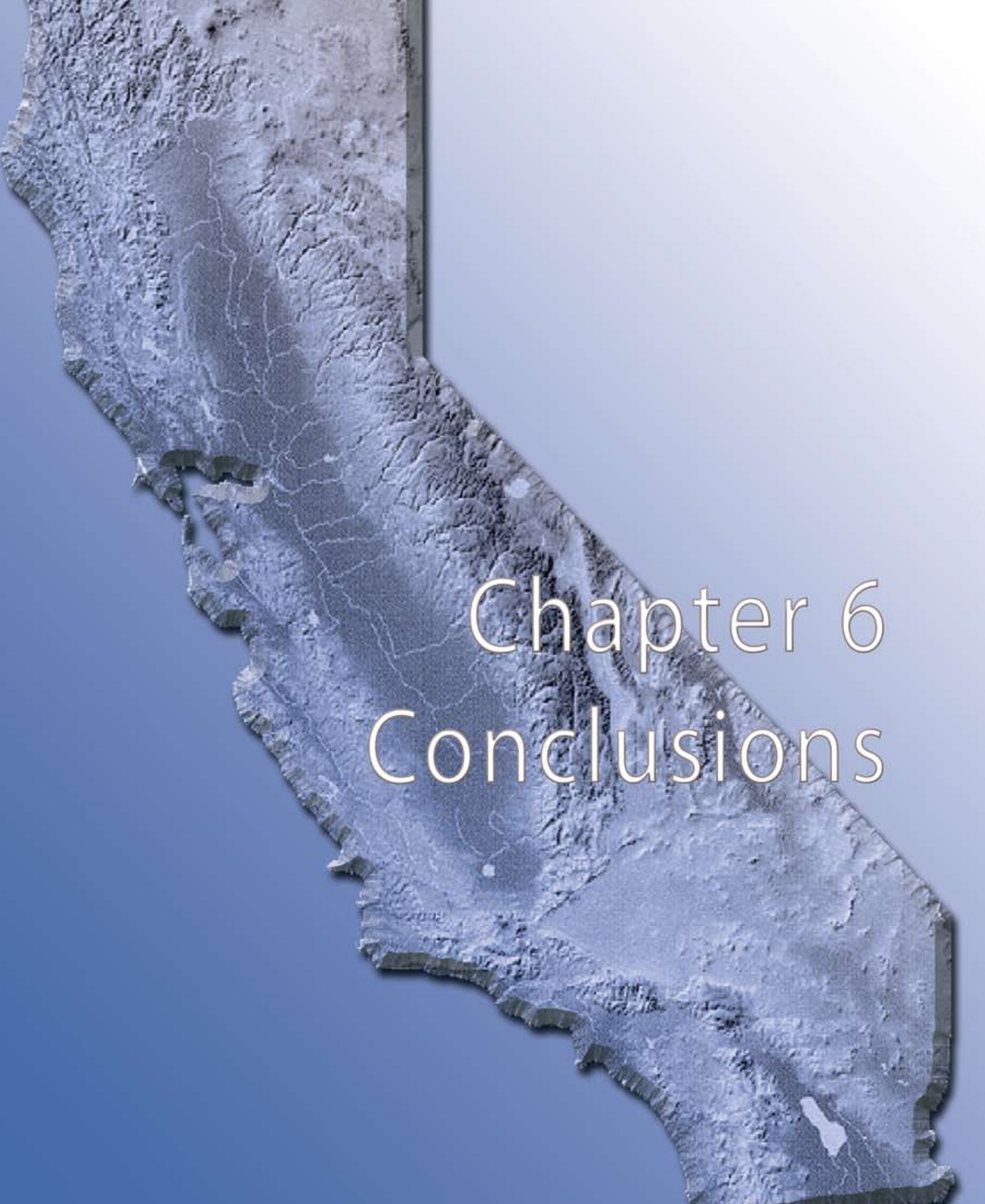
Agency	Typical level of Responsible Charge
City of Long Beach	Project and Division Engineer's sign plans. The City Engineer stamps and signs the title sheet.
City of Los Angeles	Project Engineer for all sheets and City Engineer for front sheet of CIP project plans.
City of Oakland	Supervising Civil Engineer stamps plans. Project Engineer (if licensed) and their supervisor sign and stamp contract specifications.
City of Sacramento - DGS	Supervising architect signs off on the architectural drawings and Senior Engineer signs off on the engineering drawings.
City of Sacramento - DU	City of Sacramento - DU
City of San Diego	Senior Civil Engineers that are Deputized by the City Engineer.
City of San Francisco	Respective Project Engineers (Associate Engineers and above).

The City of Oakland's policy was similar in that it too withheld 10% of all progress payments. Above 50% complete they reduce retention to 5%.

The City of Sacramento's standard Agreement stipulates that a standard 10% retention will be withheld throughout the project until completion and final acceptance. There is also a provision that allows for up to 5% to be released at the discretion of the City.

The City of San Diego submitted a copy of section 9.3.2 of the City Supplement to their standard contract, which states that retention will be a flat 5% throughout the life of the project until the project has reached final completion and been accepted by the City.

The City of San Jose also withholds 10% of the estimated value of work done. Above 50% complete it continues to withhold 10% but has the option to reduce it to 5% of estimated work complete. At 95% complete "the City may reduce the amount withheld from payment to such lesser amount as the Engineer determines is adequate security for the fulfillment of the balance of the work and other requirements of the contract (but in no event will said amount be reduced to less than 125 percent of the estimated value of the work yet to be completed as determined by the Engineer)."



Chapter 6
Conclusions

CHAPTER 6 Conclusions

A. PERFORMANCE BENCHMARKING

Due to the selection of a linear regression methodology for the Update 2008 Study, the results of the performance benchmarking evaluation show that in all cases, the design, construction management, and project delivery cost models increase linearly with an increase in the TCC. It should also be noted that while the majority of projects are clustered near the origin of the graph, the slope of the trendline is predominantly governed by the data points scattered at relatively high TCC values. Since the slope of the trendline provides the design, construction management, or the project delivery costs as a percentage of the TCC, the reader must avoid budgeting individual projects based on these analyses.

With the correction of auto-correlation in the regression method previously used to generate performance models, the R^2 and p-values have improved significantly than in previous *Study* phases. In addition, the project delivery percentages have changed considerably from Update 2007. The change in the project delivery percentages is mainly attributed to the change in the regression methodology and the selection of project outlier data. The outlier analysis, performed by statistical techniques for a majority of the projects, has significantly altered the project mix and size in the performance database. The reader is cautioned that the improved results of the regression analyses only be used as a reference and not for prediction of performance. Although the results of the performance analyses are based on historical data provided by the participating agencies, there are several factors that affect project delivery and are not captured in the performance model. These include personnel turnover in the agencies, competitive bids, and escalation in construction costs.

Project arithmetic mean delivery costs (as a percentage of total construction cost) by project type in the Update 2008 analysis were:

Municipal Facilities	37%
Parks	41%
Pipes	35%
Streets	45%

It is expected that as the improvements in data collection methods and full BMP implementation improve, project delivery costs will begin to decline. In addition, it should be noted that the significant improvement in the results of the analyses offers the Project Team an opportunity to revisit some of the criteria for the selection of projects in the performance database during Update 2009.

The Special Study highlighted the lessons learned by the agencies from the implementation of innovative project delivery methods. Some of these methods have resulted in cost-savings and improved efficiency in project delivery while others have provided valuable lessons to the agencies.

B. BEST MANAGEMENT PRACTICES

The agencies have continued to fully implement selected BMPs. As of Update 2008, the agencies have fully implemented about 70 percent of all BMPs. Many more have been partially implemented with the goal of complete implementation over the next two years.

In Update 2008, the Project Team added three new BMPs to the BMP implementation tracking list along with the modification of one existing BMP to further refine the initial intent. The BMPs were developed addressing issues in the areas of responsible charge, standard specifications and payment process. 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 are reduced.

C. ONLINE DISCUSSION FORUM

The Online Discussion Forum continues to be 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 2008, the Project Team identified a number of activities to consider including next year in Update 2009. These activities include:

- Performing a single Special Study for Update 2009. Planning for the Special Study will begin during Meeting # 1 of Update 2009.

- Reviewing the project classifications used in this Study for appropriateness and relevance to the agencies.

E. ACKNOWLEDGEMENTS

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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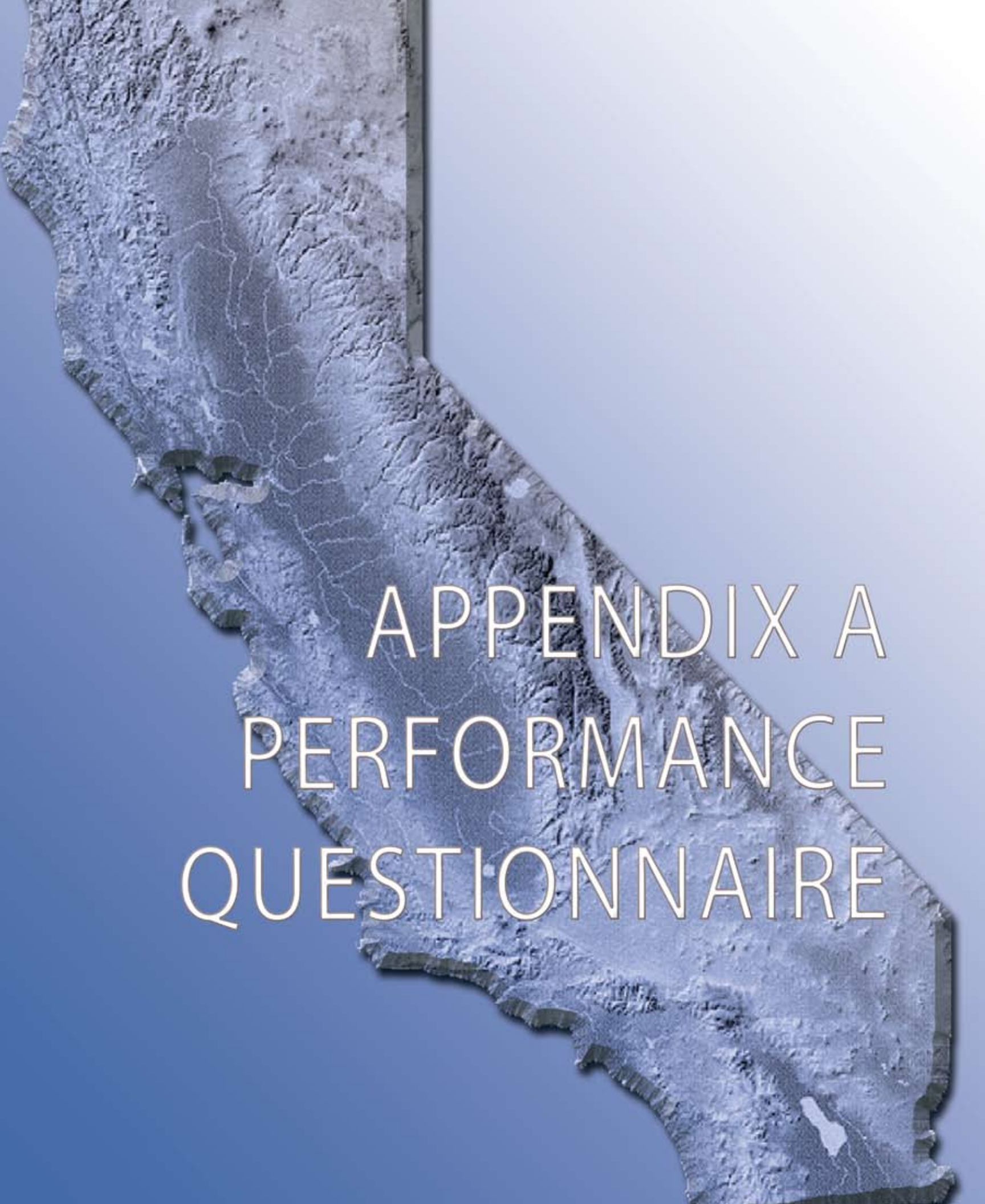
Update 2008 Project Team

APPENDICES



APPENDIX A PERFORMANCE QUESTIONNAIRE

APPENDIX A Performance Questionnaire

California Multi-Agency Benchmarking Study Update 2008 Performance Questionnaire

Agency: | Project Name:

Project type: | ☐ LEED Green Building

New/Rehab Index:

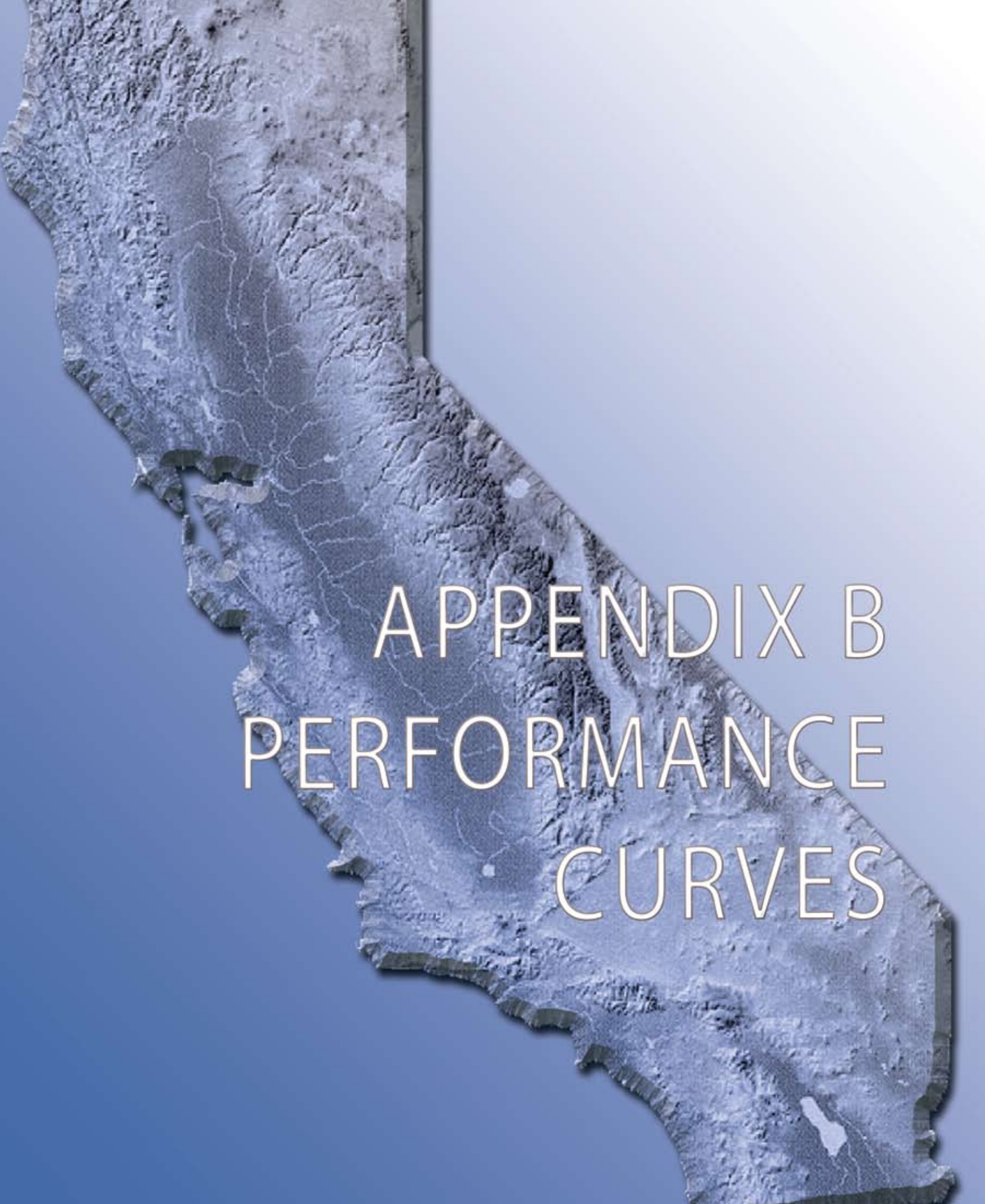
Description:

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

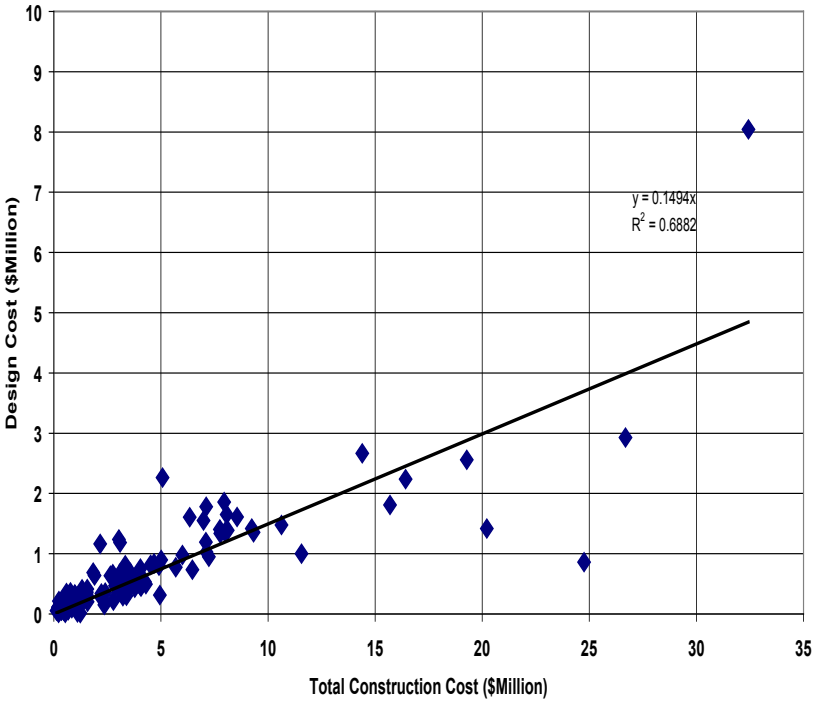
APPENDIX B

Performance Curves

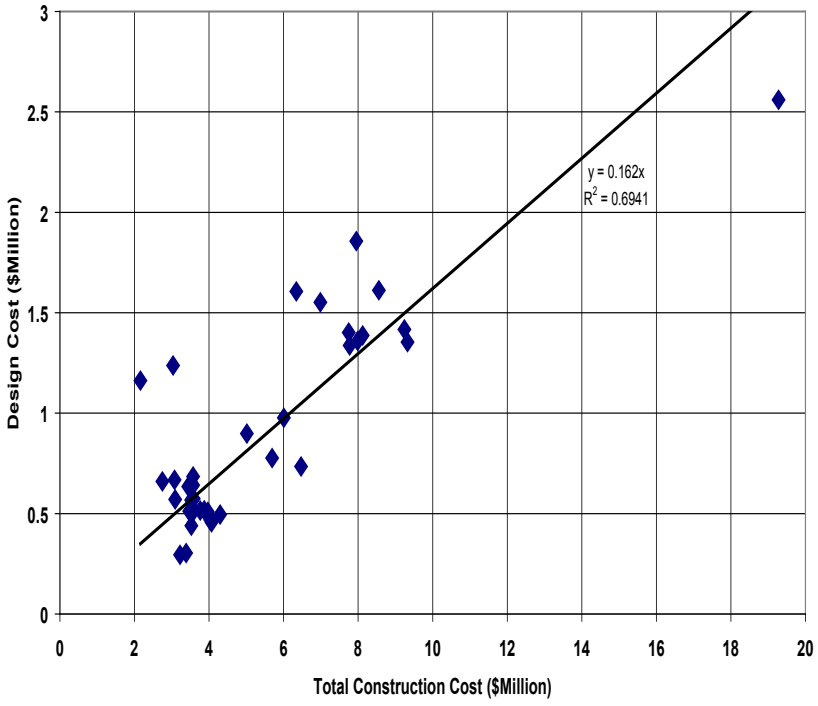
CURVES GROUP 1

Design Cost
vs
Total Construction Cost

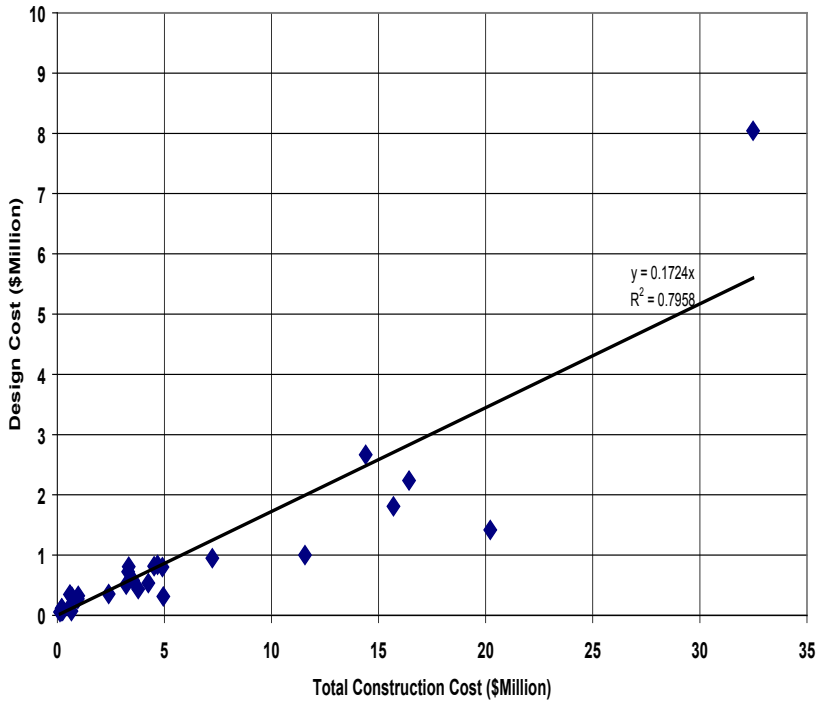
Municipal Facilities - All Classifications
Design Cost Versus Total Construction Cost (N=130)



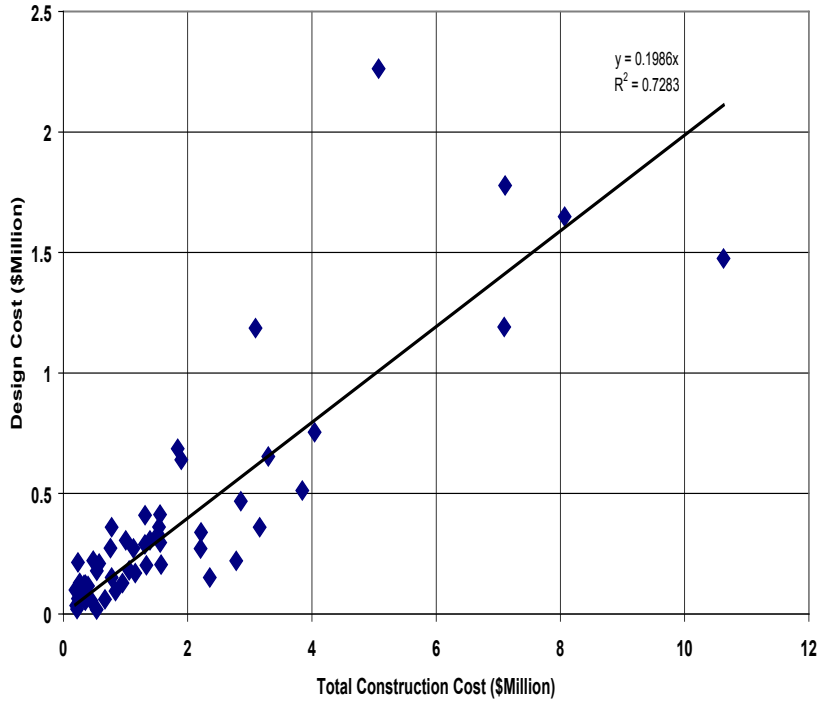
Municipal Facilities - Libraries
Design Cost Versus Total Construction Cost (N=38)



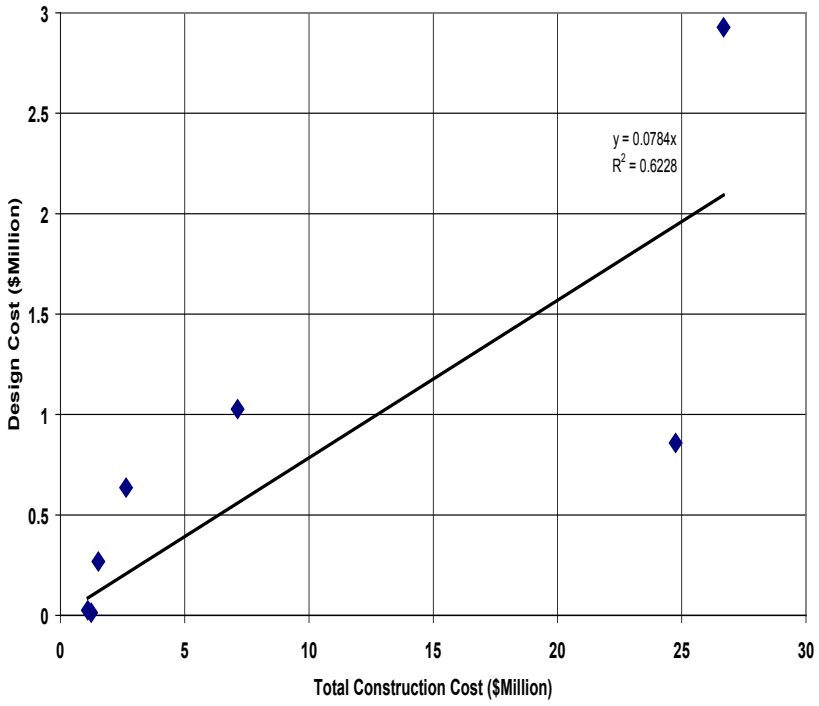
Municipal Facilities - Police/Fire Stations
Design Cost Versus Total Construction Cost (N=30)



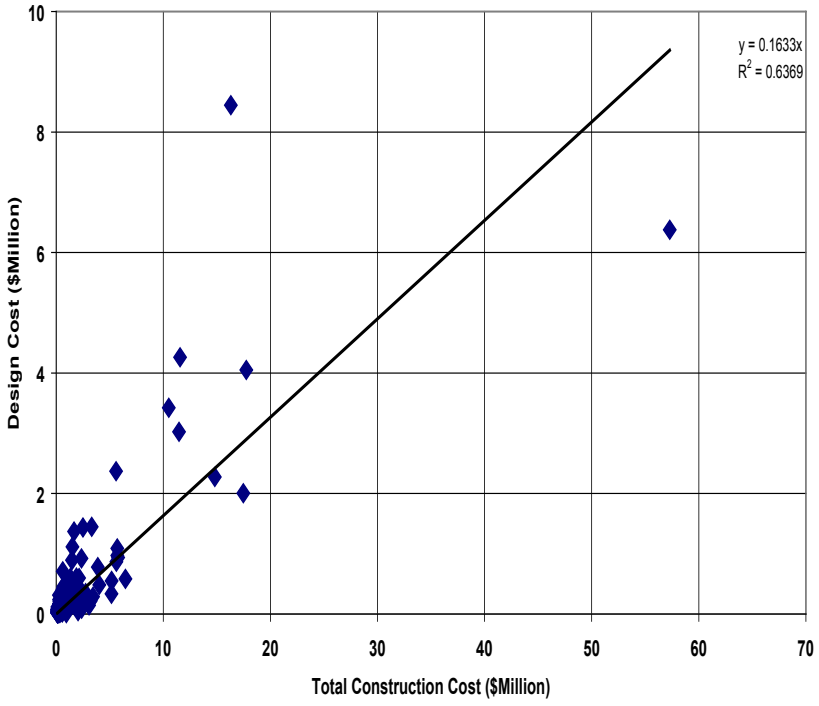
Municipal Facilities - Comm./Rec. Center/Child Care/Gyms
Design Cost Versus Total Construction Cost (N=55)



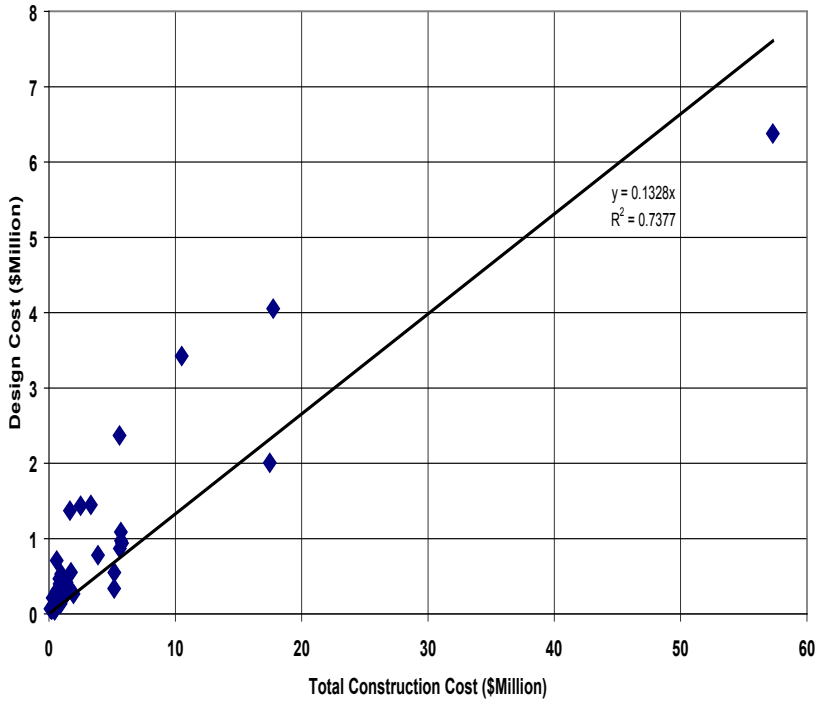
Municipal Facilities - Other Municipal Facilities
Design Cost Versus Total Construction Cost (N=7)



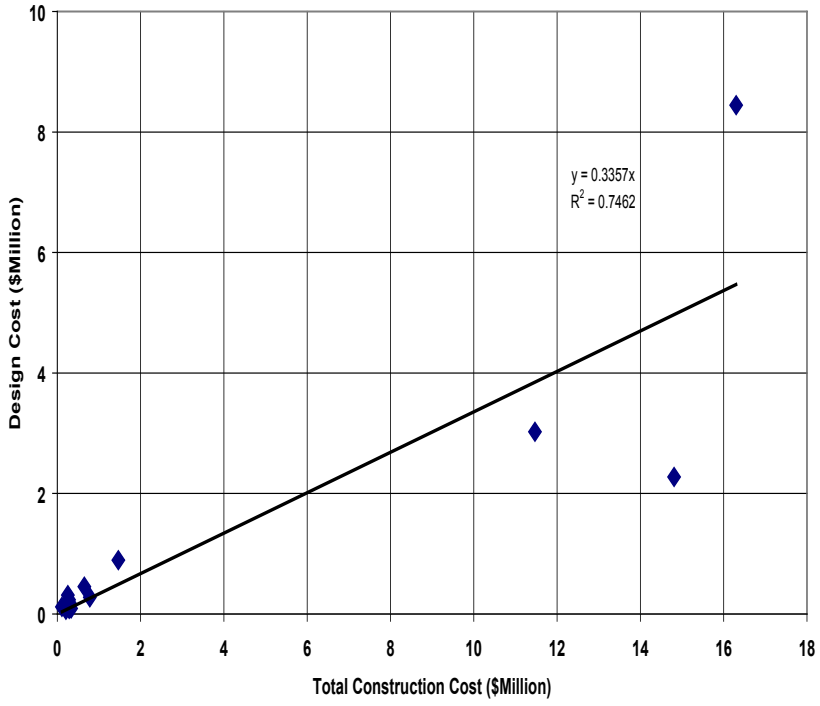
Streets - All Classifications
Design Cost Versus Total Construction Cost (N=272)



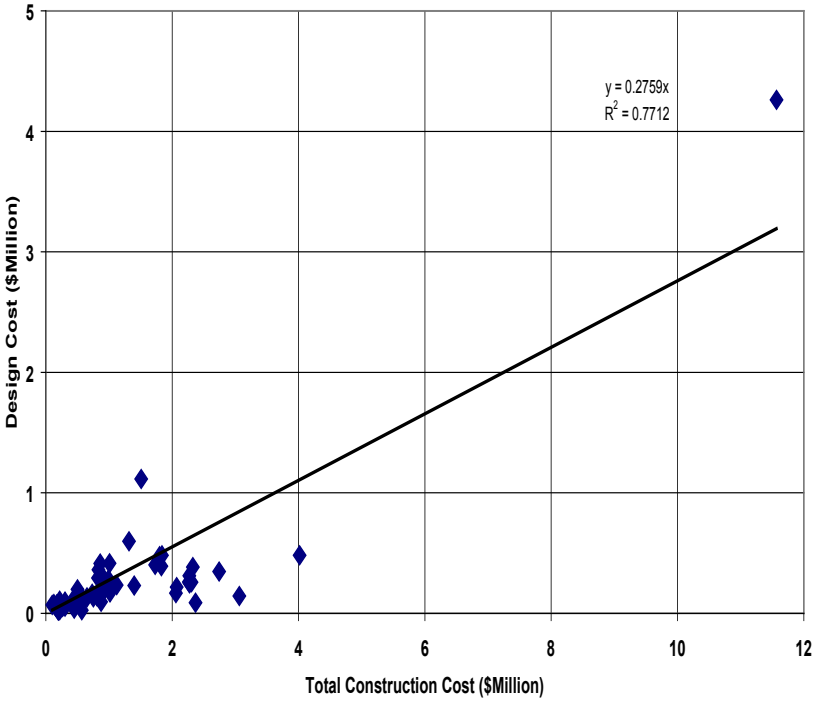
Streets - Widening/New/Grade Separations
Design Cost Versus Total Construction Cost (N=44)



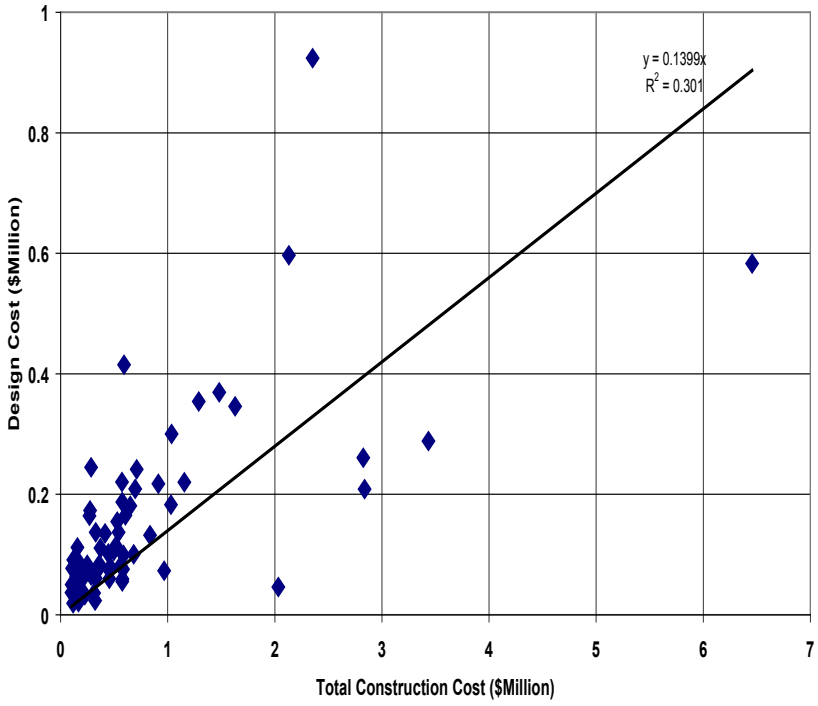
Streets - Bridges (New/Retrofit)
Design Cost Versus Total Construction Cost (N=14)



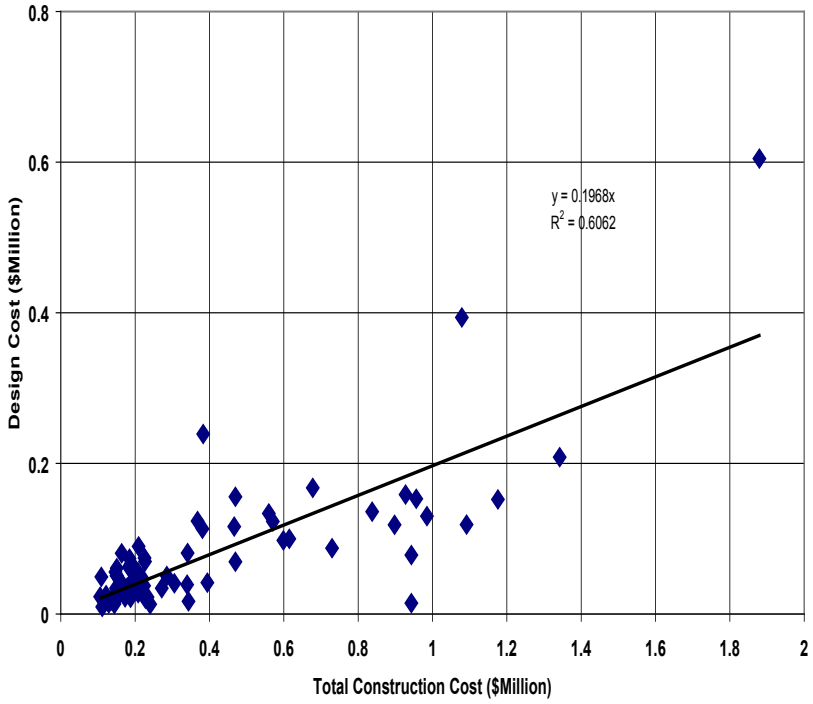
Streets - Reconstructions
Design Cost Versus Total Construction Cost (N=65)



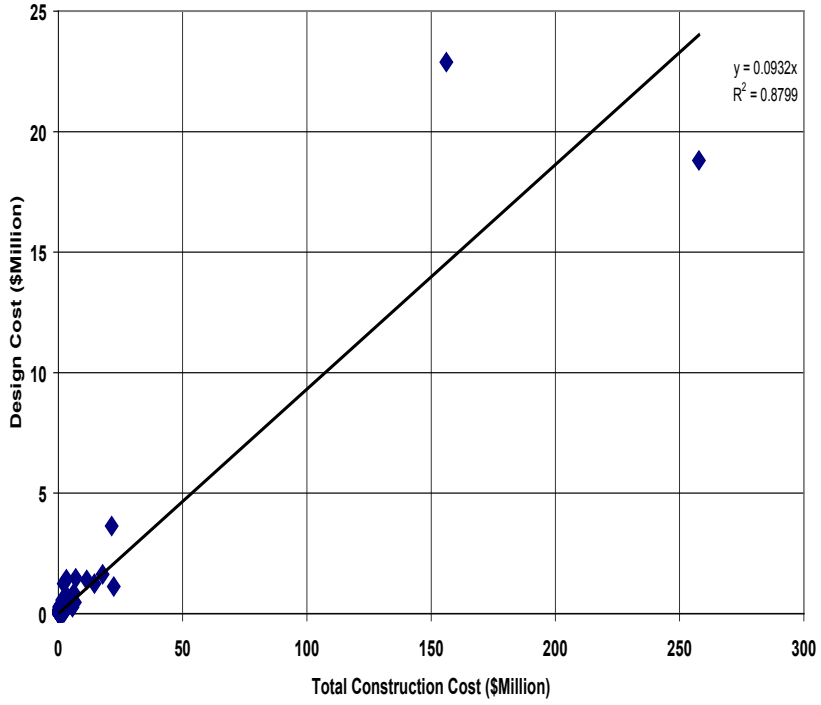
Streets - Bike/Pedestrian/Streetscapes
Design Cost Versus Total Construction Cost (N=74)



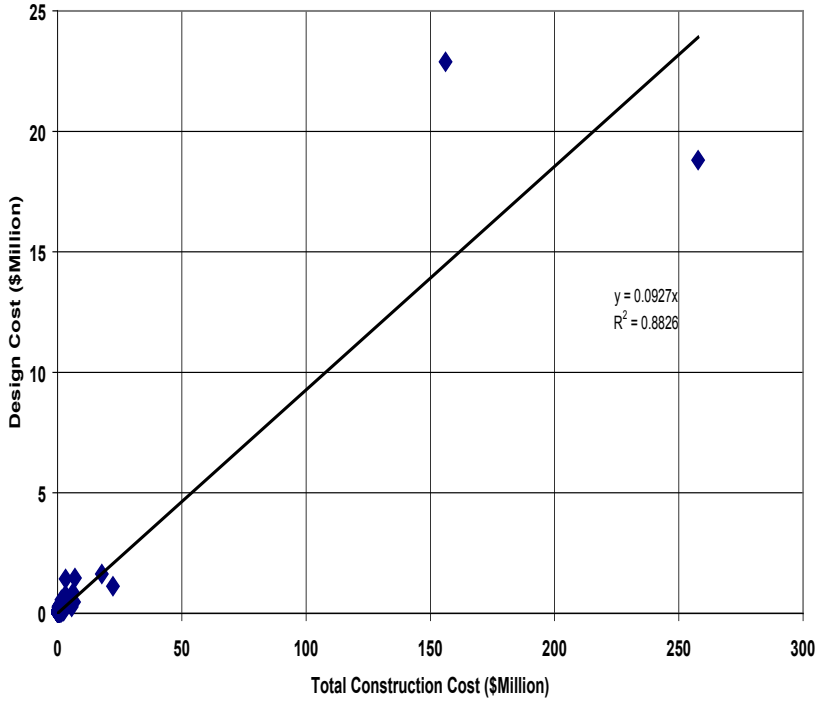
Streets - Signals
Design Cost Versus Total Construction Cost (N=75)



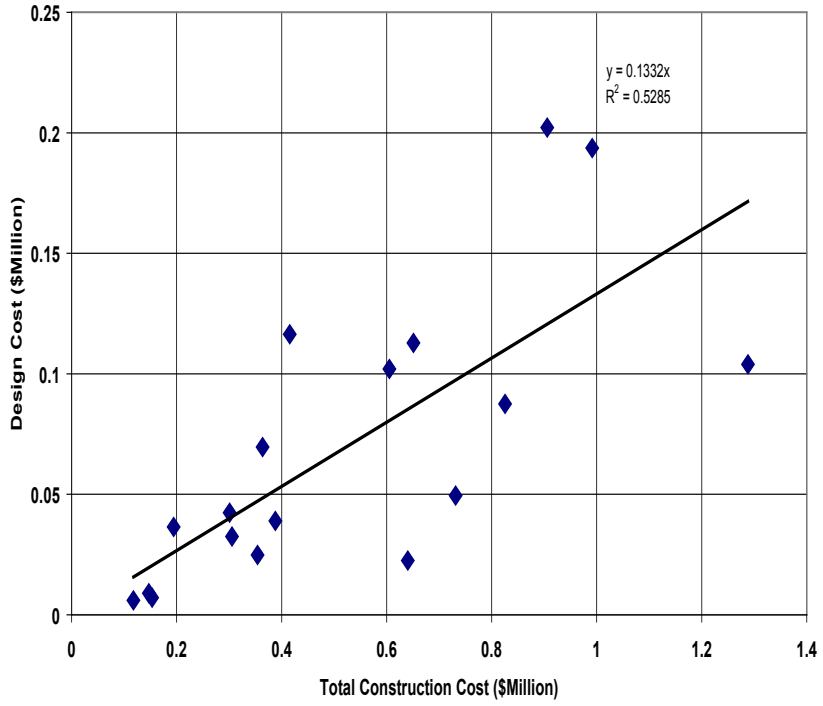
Pipe Systems - All Classifications
Design Cost Versus Total Construction Cost (N=256)



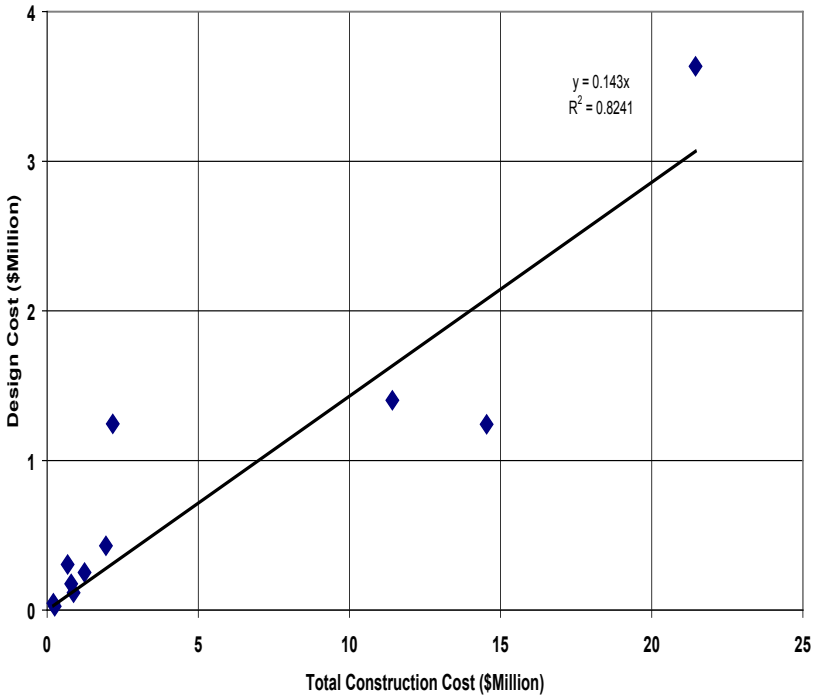
Pipe Systems - Gravity Systems (Storm Drains/Sewers)
Design Cost Versus Total Construction Cost (N=227)



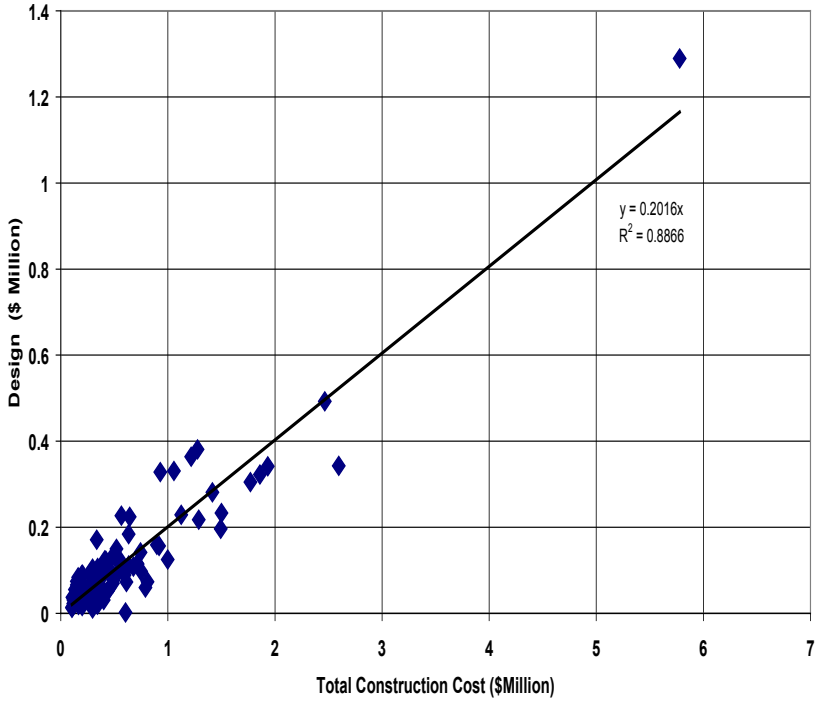
Pipe Systems - Pressure Systems
Design Cost Versus Total Construction Cost (N=18)



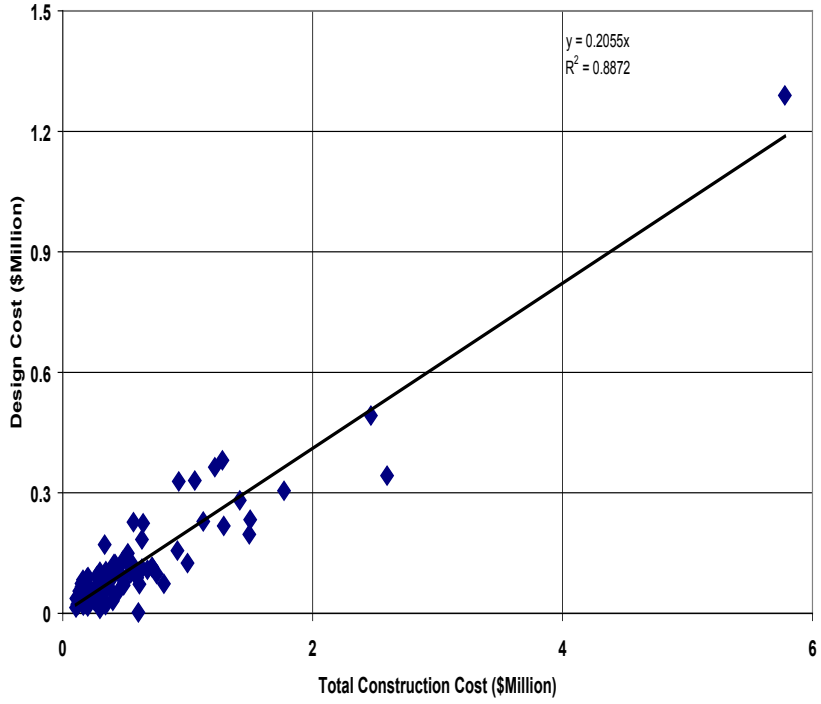
Pipe Systems - Pump Stations
Design Cost Versus Total Construction Cost (N=11)



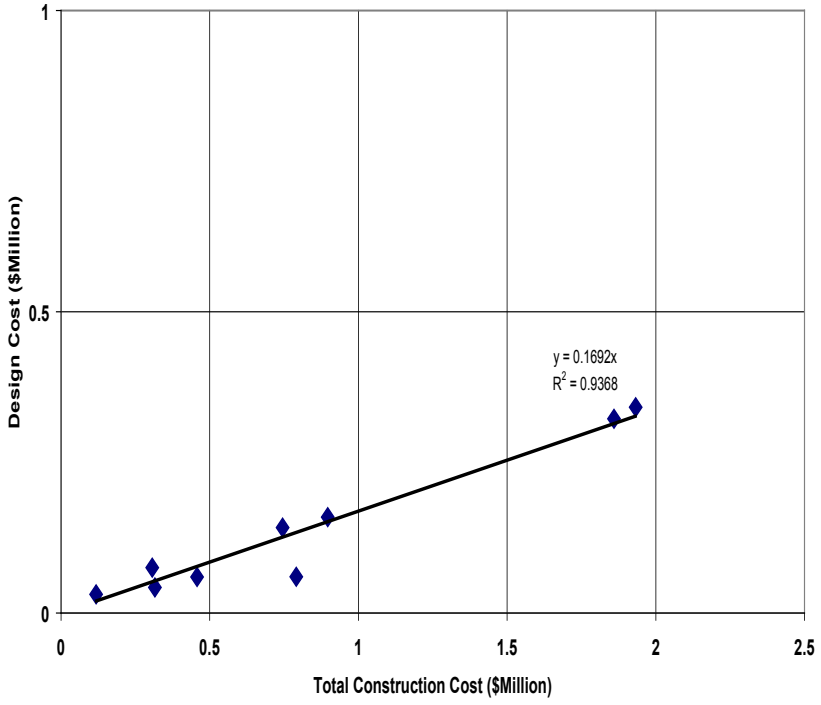
Parks - All Classifications
Design ($ Million) Versus Total Construction Cost (N=118)



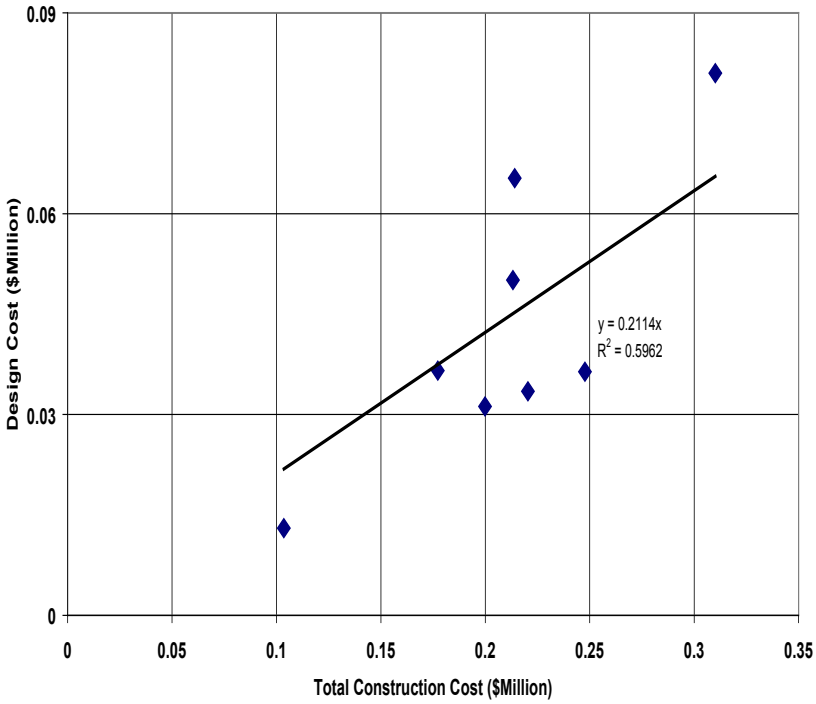
Parks - Playgrounds
Design Cost Versus Total Construction Cost (N=101)



Parks - Sportfields
Design Cost Versus Total Construction Cost (N=9)



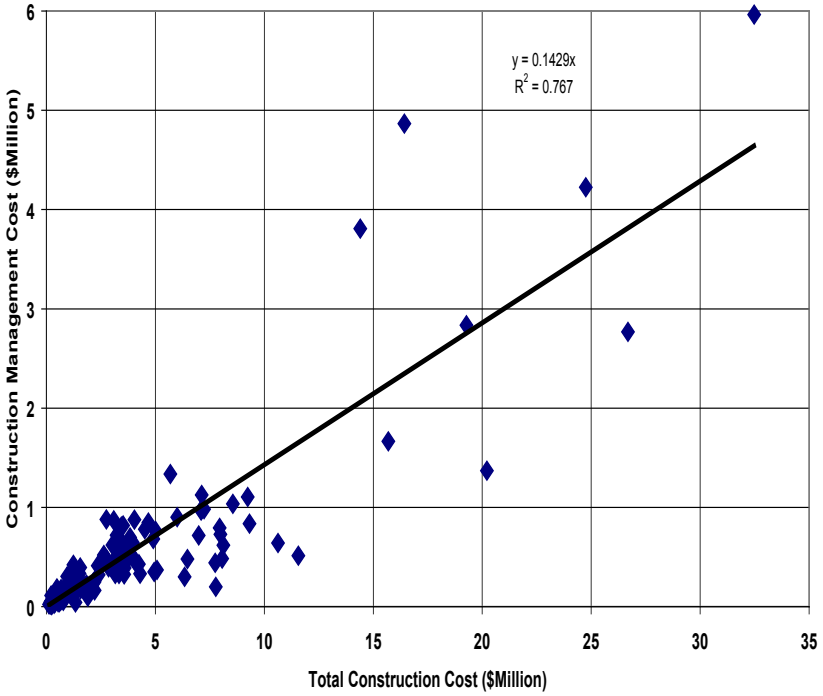
Parks - Restrooms
Design Cost Versus Total Construction Cost (N=8)



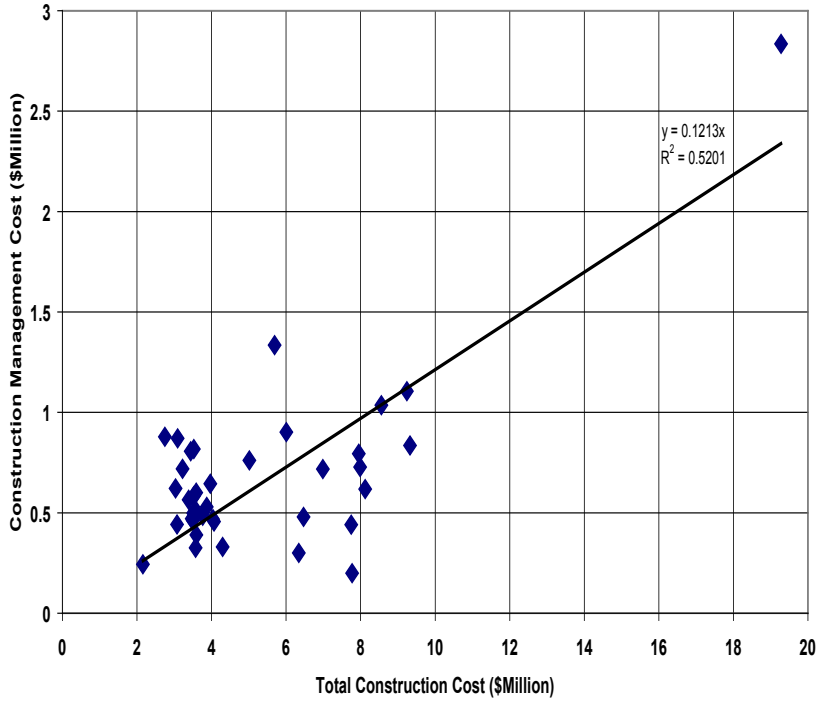
CURVES GROUP 2

Construction Management Cost
vs
Total Construction Cost

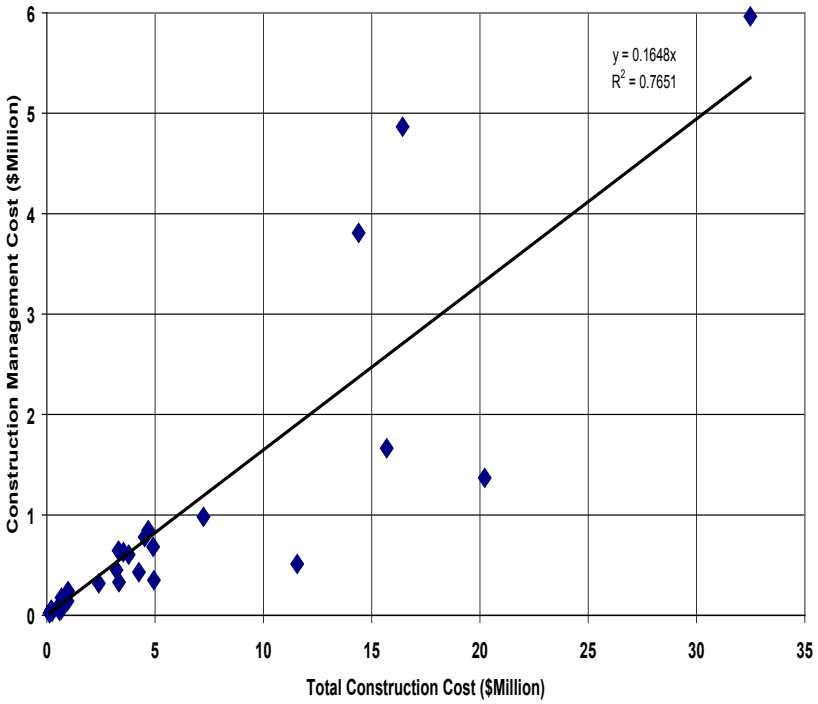
Municipal Facilities - All Classifications
Construction Management Cost Versus Total Construction Cost (N=130)



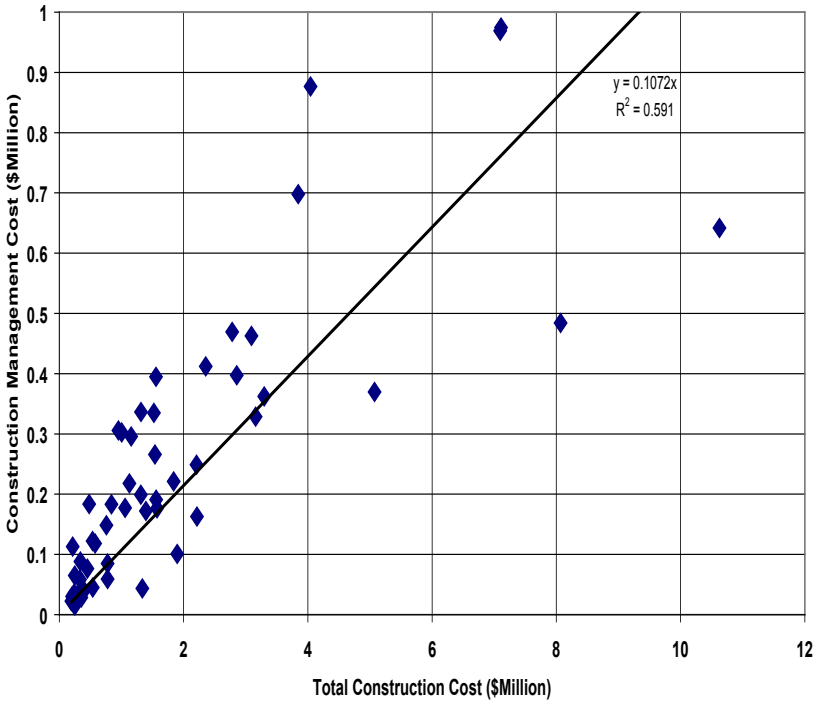
Municipal Facilities - Libraries
Construction Management Cost Versus Total Construction Cost (N=38)



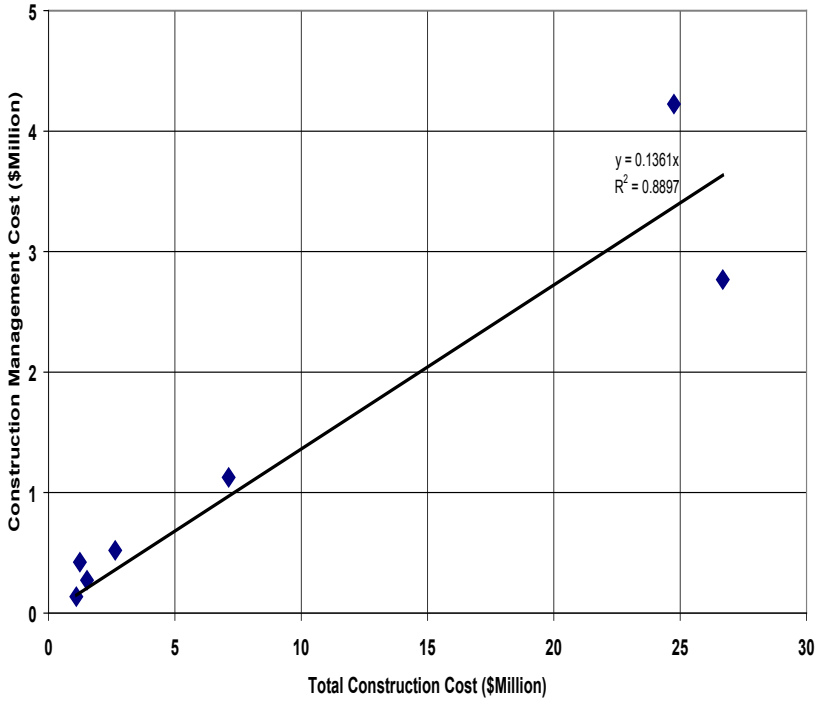
Municipal Facilities - Police/Fire Stations
Construction Management Cost Versus Total Construction Cost (N=30)



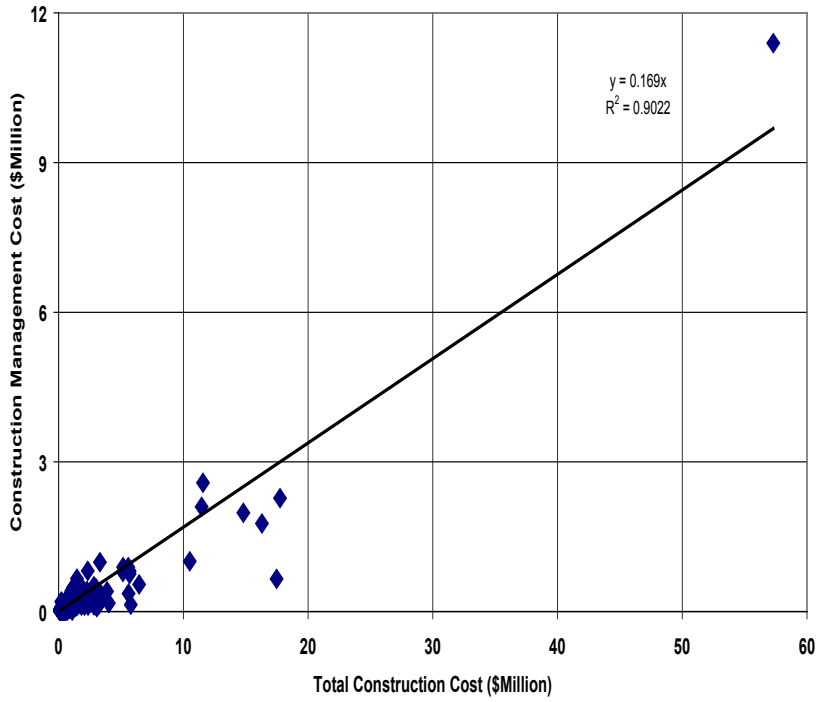
Municipal Facilities - Comm./Rec. Center/Child Care/Gyms
Construction Management Cost Versus Total Construction Cost (N=55)



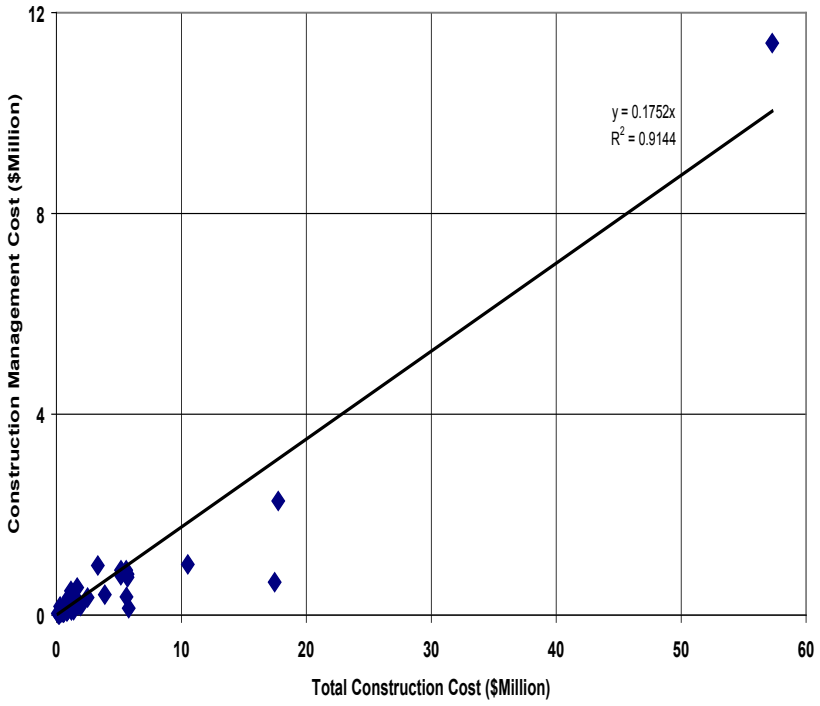
Municipal Facilities - Other Municipal Facilities
Construction Management Cost Versus Total Construction Cost (N=7)



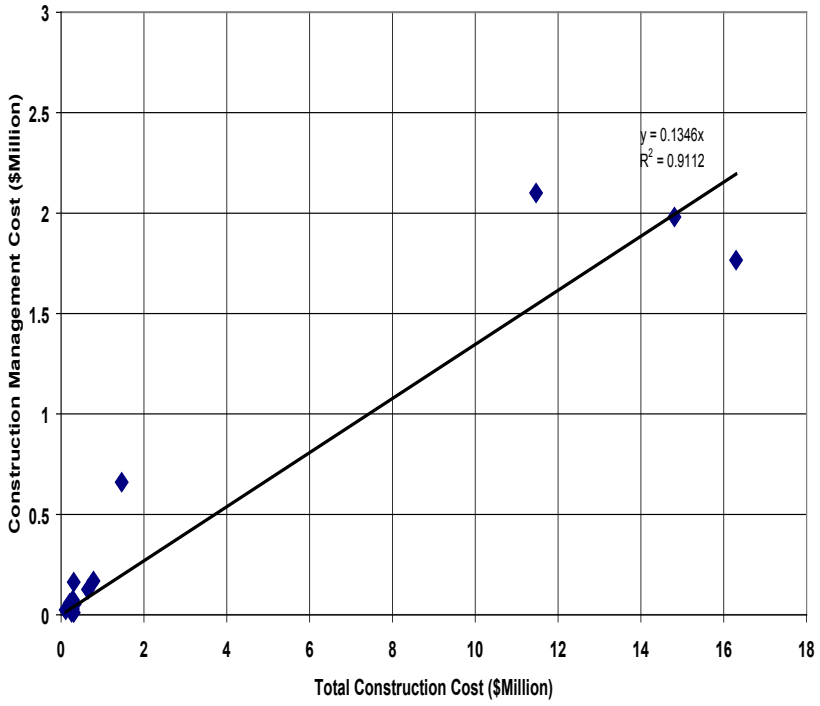
Streets - All Classifications
Construction Management Cost Versus Total Construction Cost (N=272)



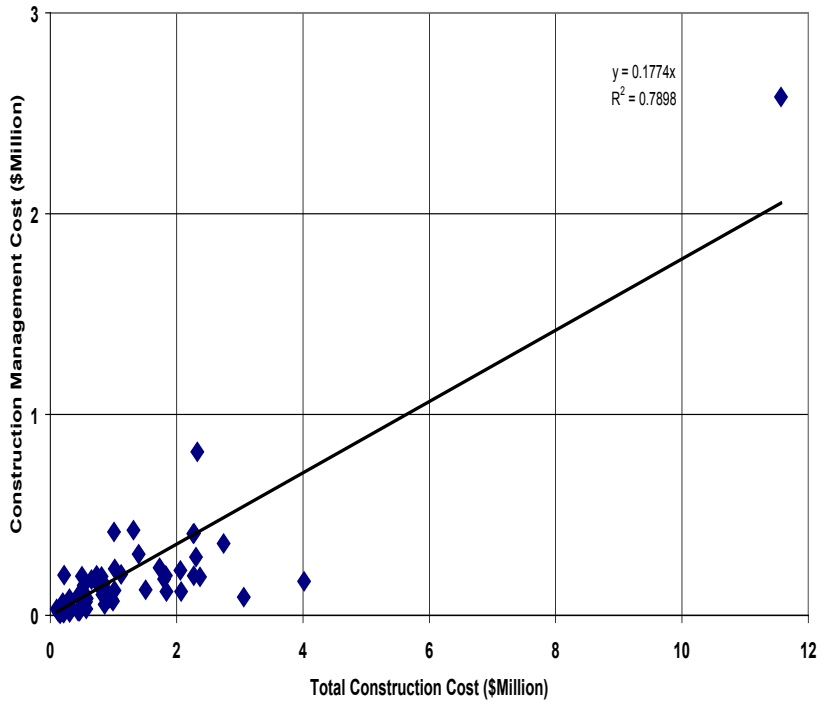
Streets - Widening/New/Grade Separations
Construction Management Cost Versus Total Construction Cost (N=44)



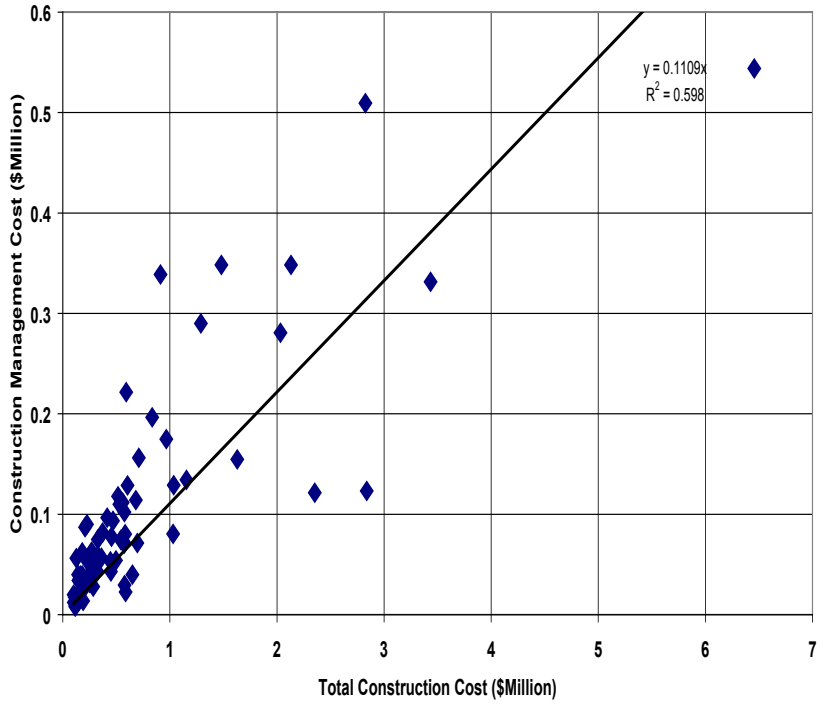
Streets - Bridges (New/Retrofit)
Construction Management Cost Versus Total Construction Cost (N=14)



Streets - Reconstructions
Construction Management Cost Versus Total Construction Cost (N=65)



Streets - Bike/Pedestrian/Streetscapes
Construction Management Cost Versus Total Construction Cost (N=74)



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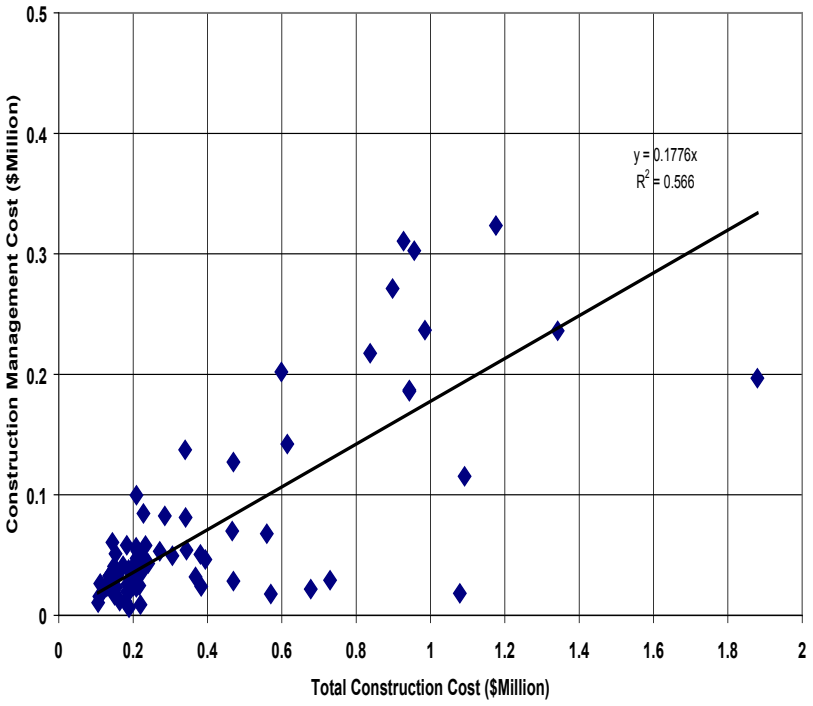
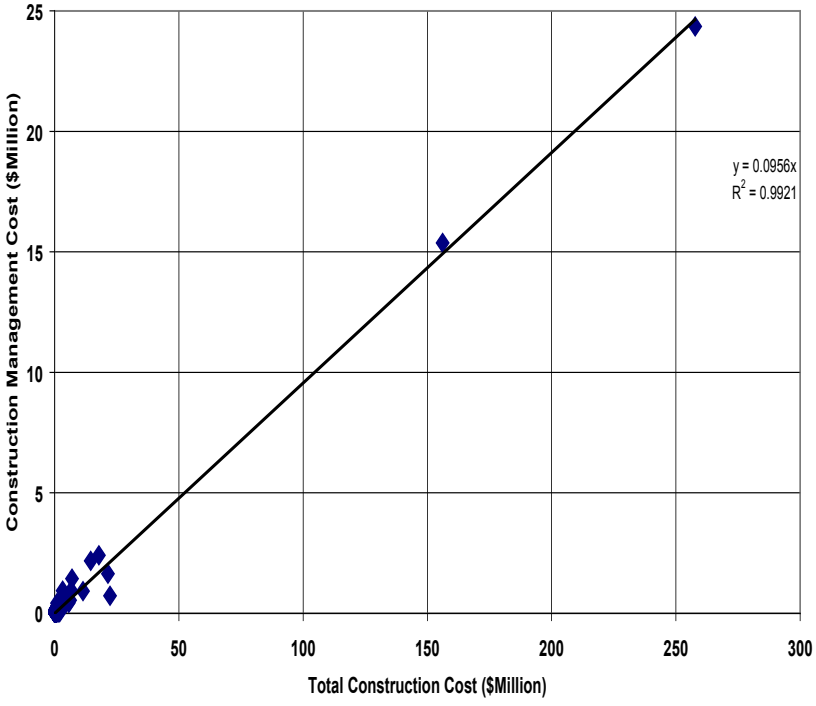
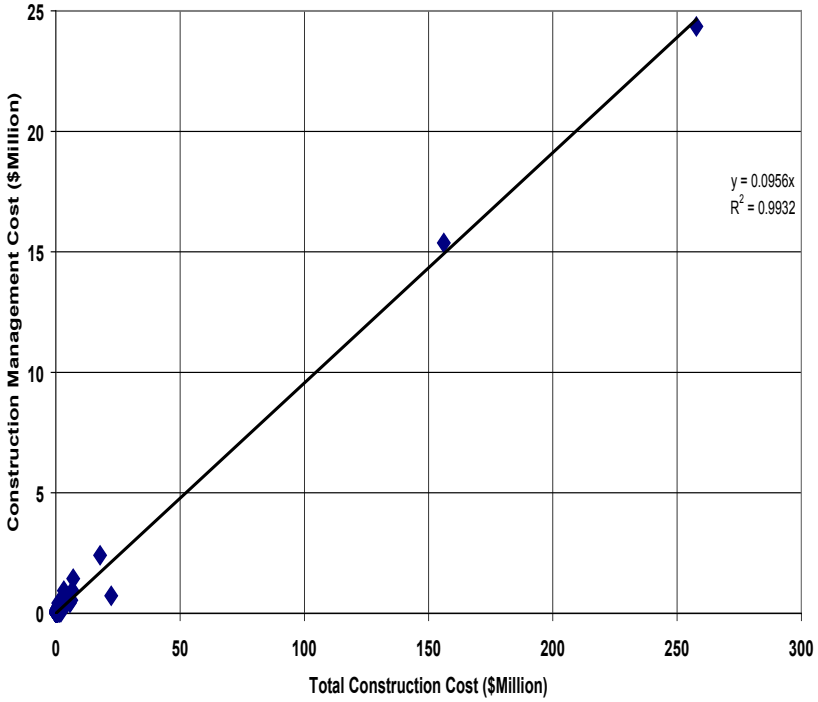
Construction Management Cost Versus Total Construction Cost (N=75)



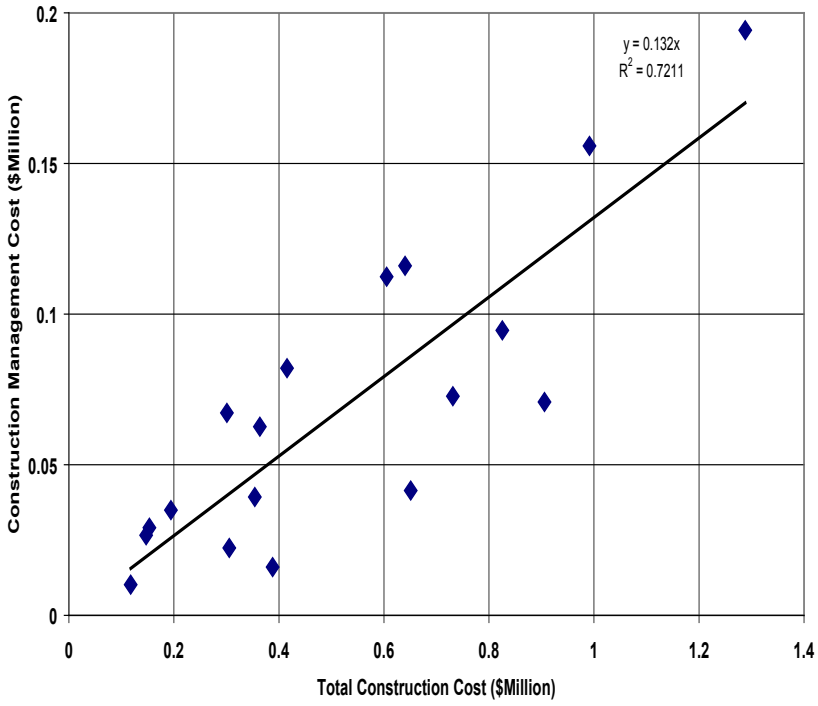
Pipe Systems - All Classifications
Construction Management Cost Versus Total Construction Cost (N=256)



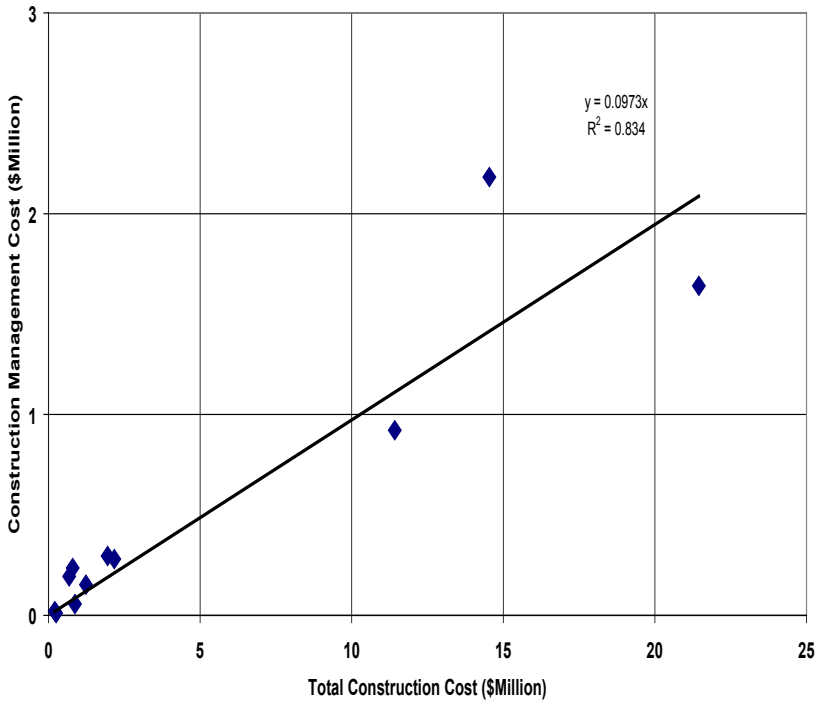
Pipe Systems - Gravity Systems (Storm Drains/Sewers)
Construction Management Cost Versus Total Construction Cost (N=227)



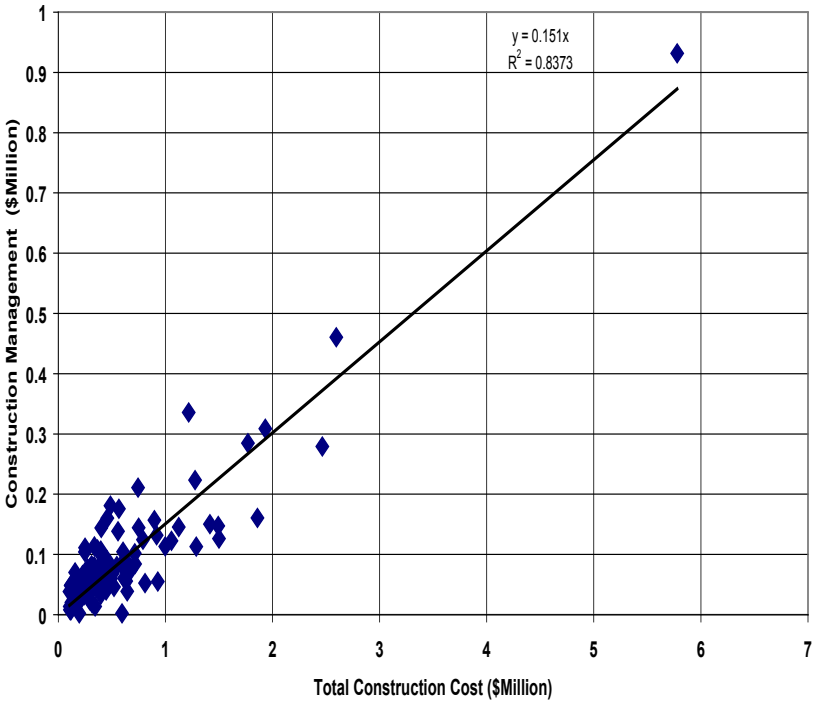
Pipe Systems - Pressure Systems
Construction Management Cost Versus Total Construction Cost (N=18)



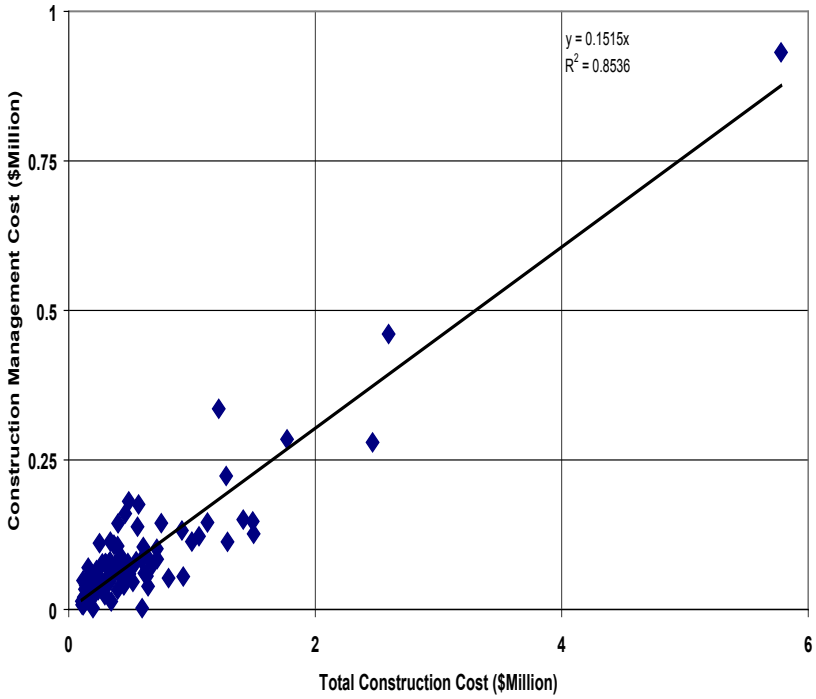
Pipe Systems - Pump Stations
Construction Management Cost Versus Total Construction Cost (N=11)



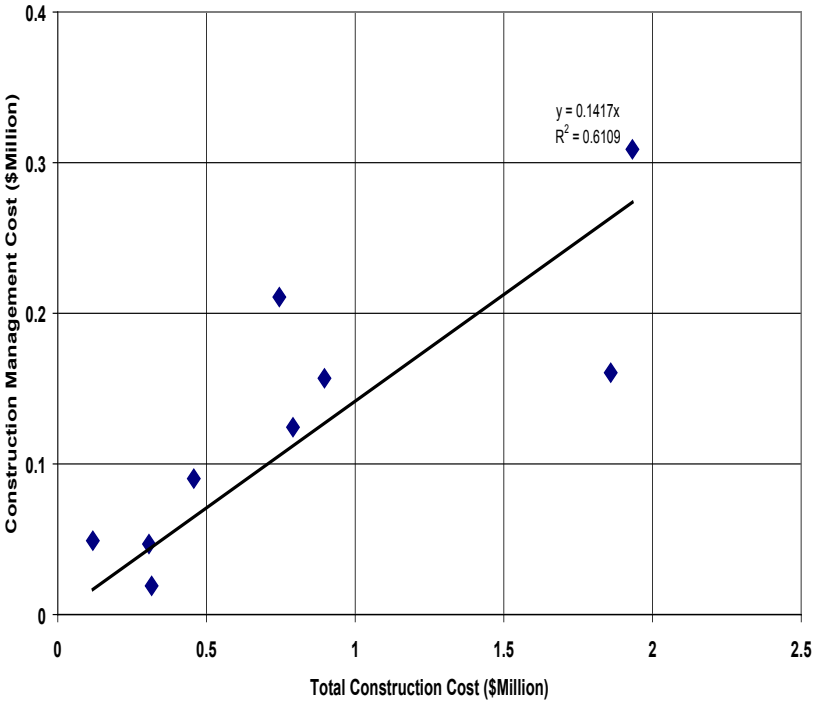
Parks - All Classifications
Construction Management Versus Total Construction Cost (N=118)



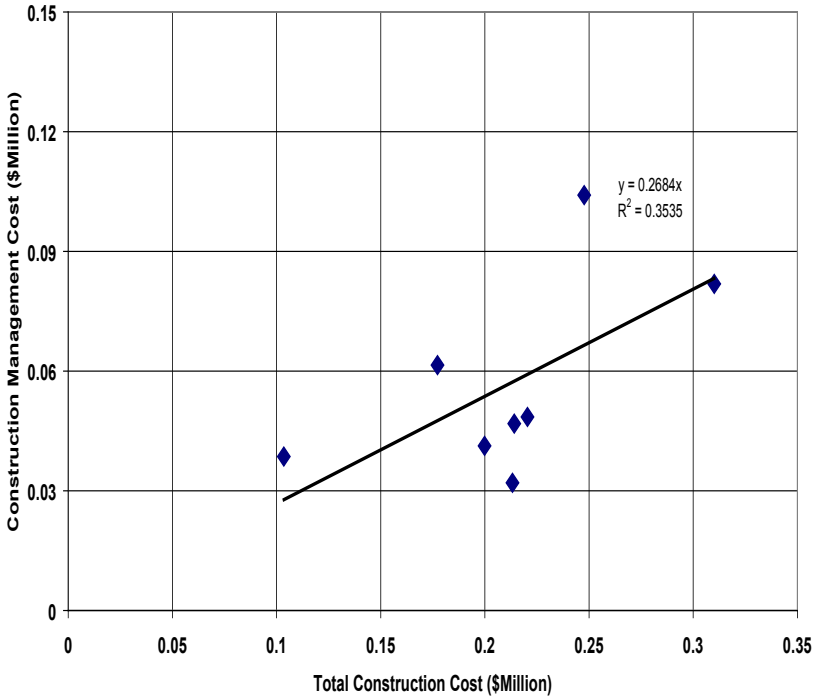
Parks - Playgrounds
Construction Management Cost Versus Total Construction Cost (N=101)



Parks - Sportfields
Construction Management Cost Versus Total Construction Cost (N=9)



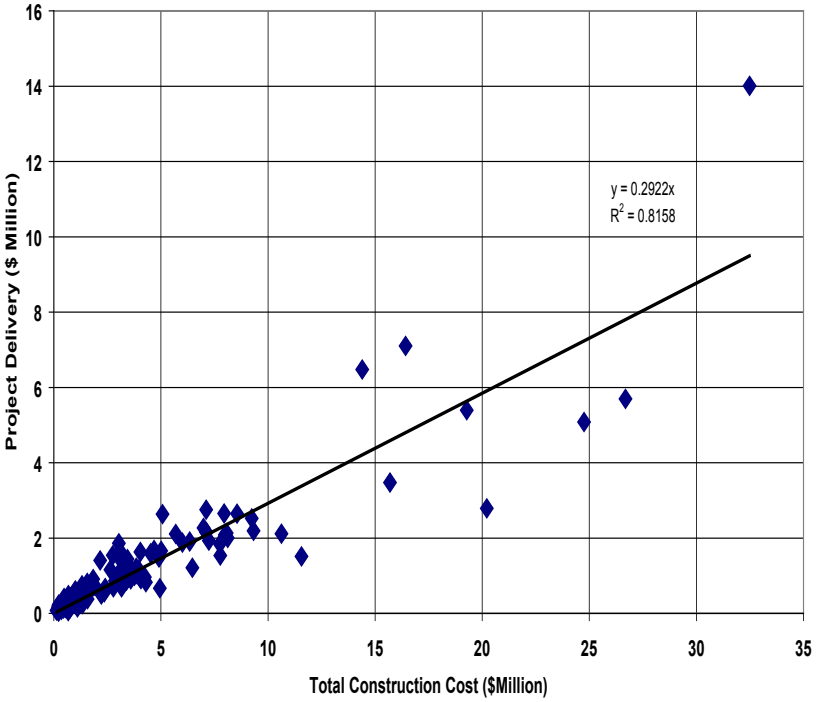
Parks - Restrooms
Construction Management Cost Versus Total Construction Cost (N=8)



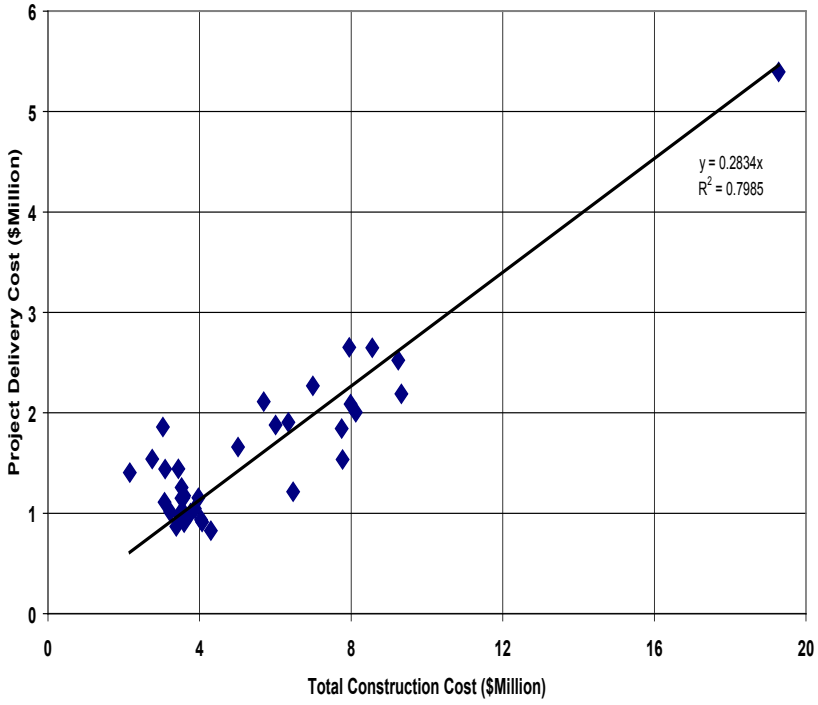
CURVES GROUP 3

Project Delivery Cost
vs
Total Construction Cost

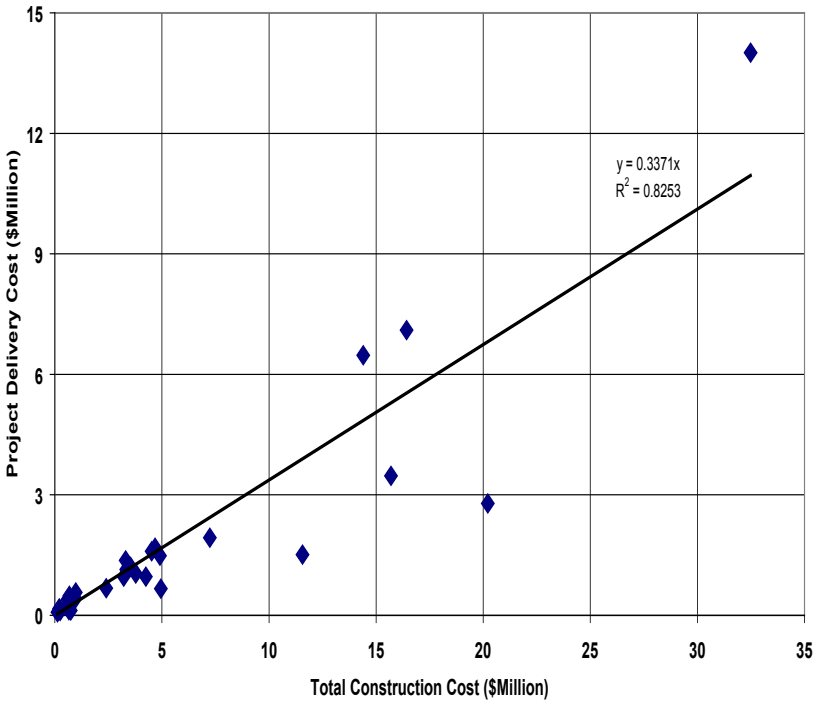
Municipal Facilities - All Classifications
Project Delivery ($ Million) Versus Total Construction Cost (N=130)



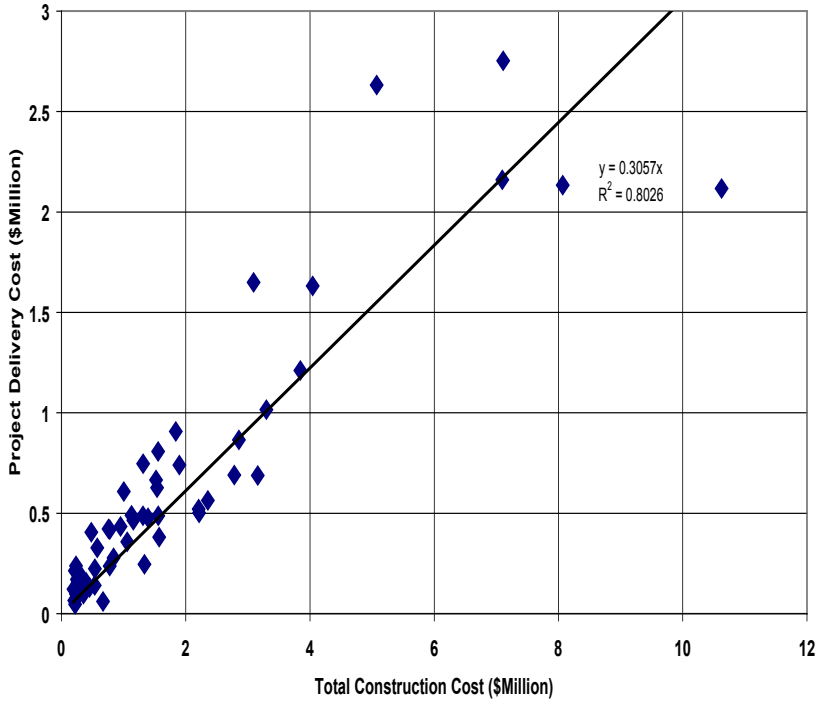
Municipal Facilities - Libraries
Project Delivery Cost Versus Total Construction Cost (N=38)



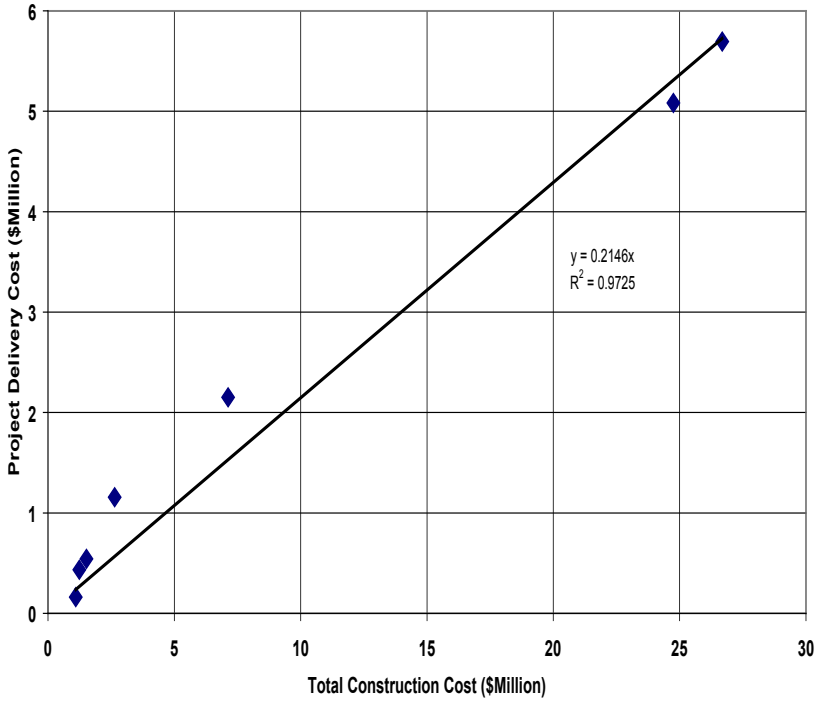
Municipal Facilities - Police/Fire Stations
Project Delivery Cost Versus Total Construction Cost (N=30)



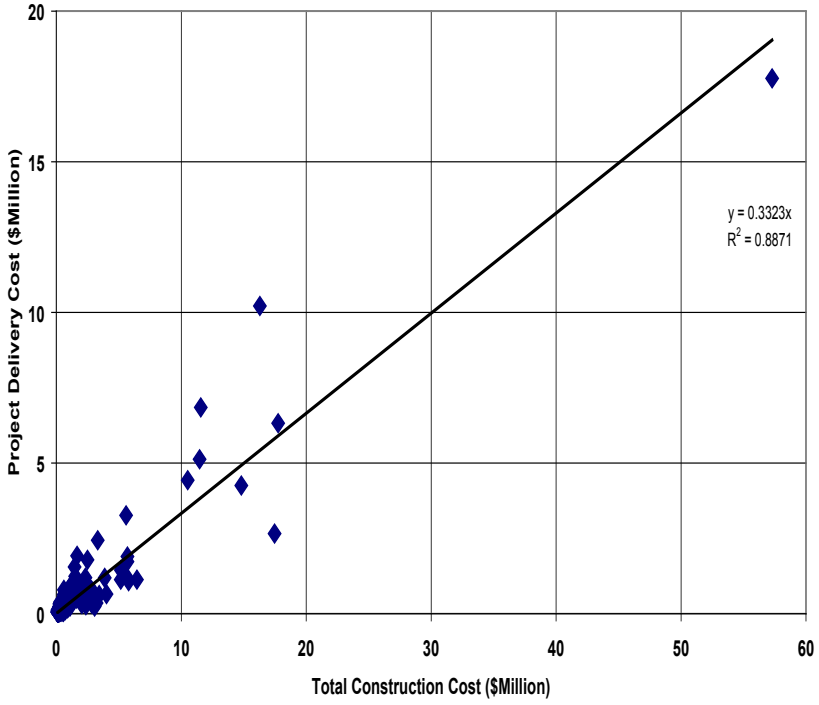
Municipal Facilities - Comm./Rec. Center/Child Care/Gyms
Project Delivery Cost Versus Total Construction Cost (N=55)



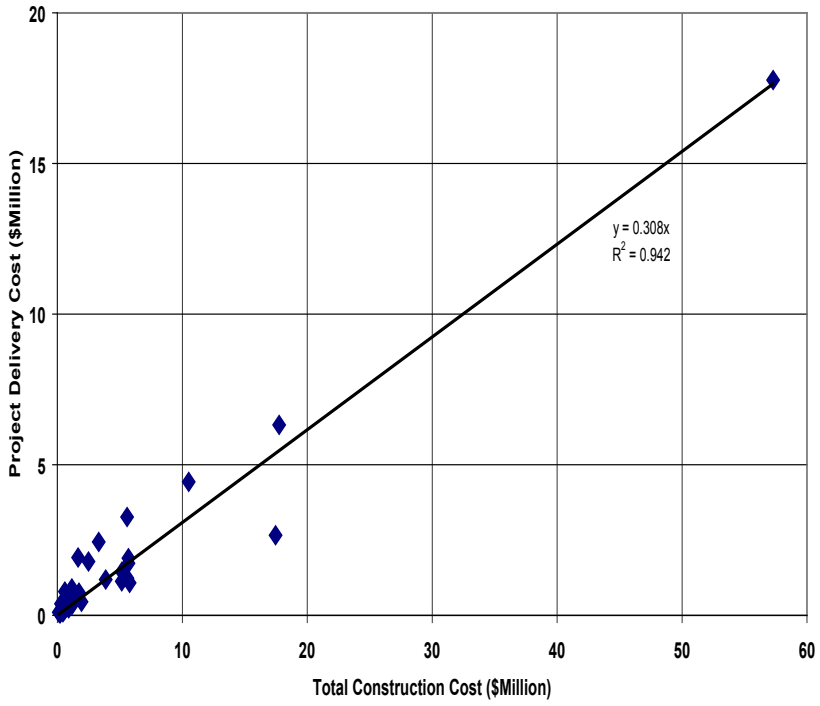
Municipal Facilities - Other Municipal Facilities
Project Delivery Cost Versus Total Construction Cost (N=7)



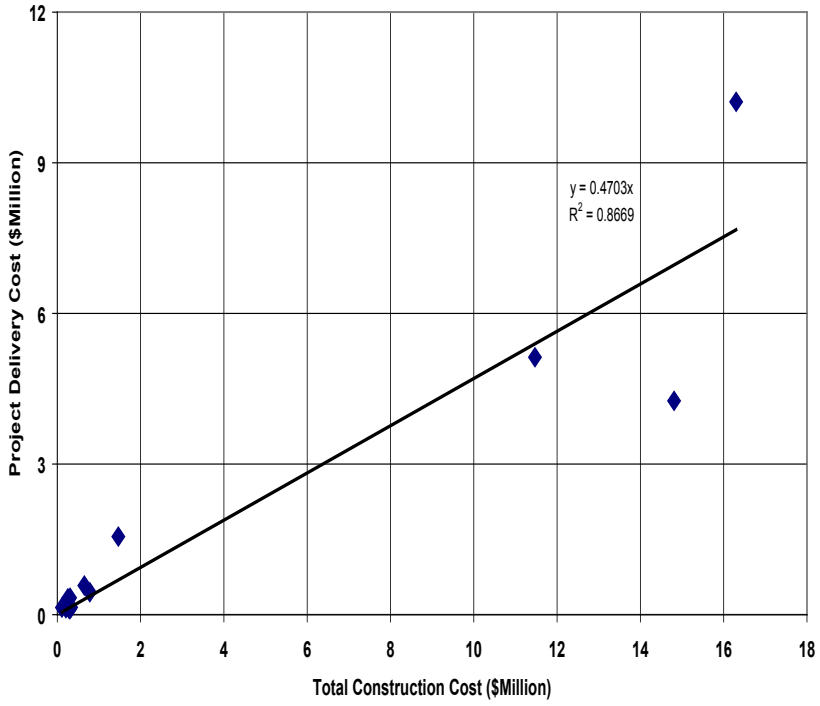
Streets - All Classifications
Project Delivery Cost Versus Total Construction Cost (N=272)



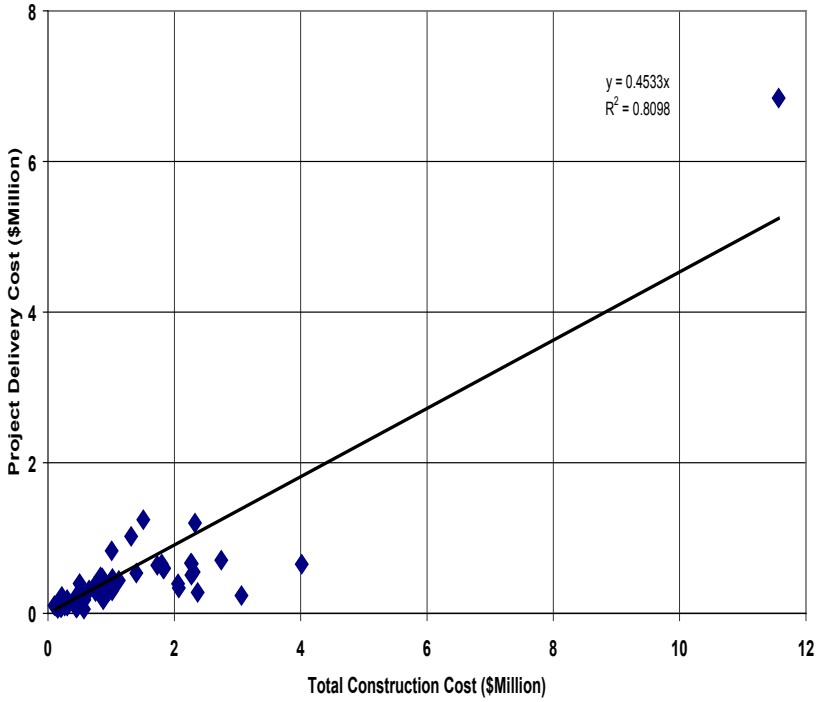
Streets - Widening/New/Grade Separations
Project Delivery Cost Versus Total Construction Cost (N=44)



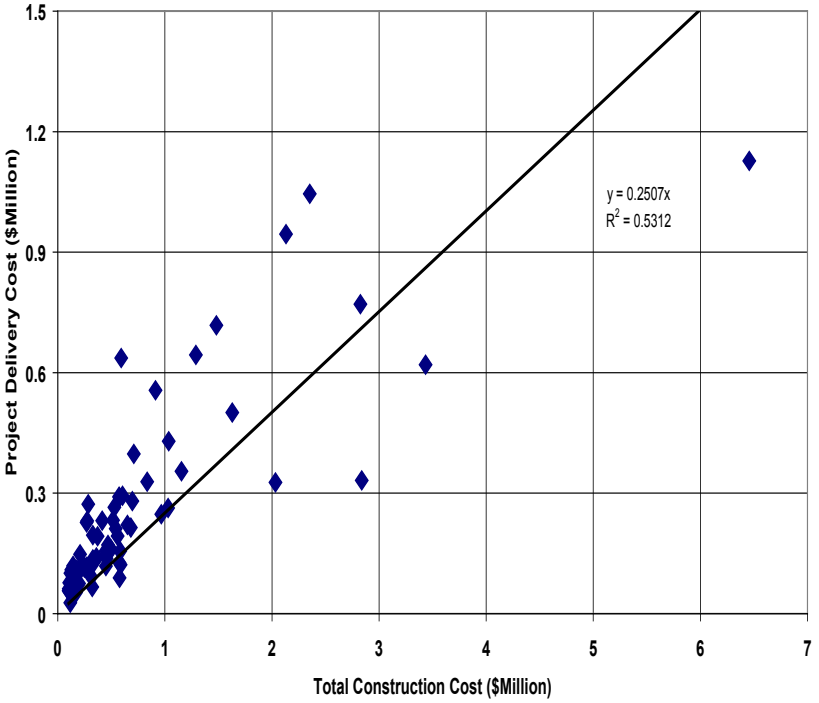
Streets - Bridges (New/Retrofit)
Project Delivery Cost Versus Total Construction Cost (N=14)



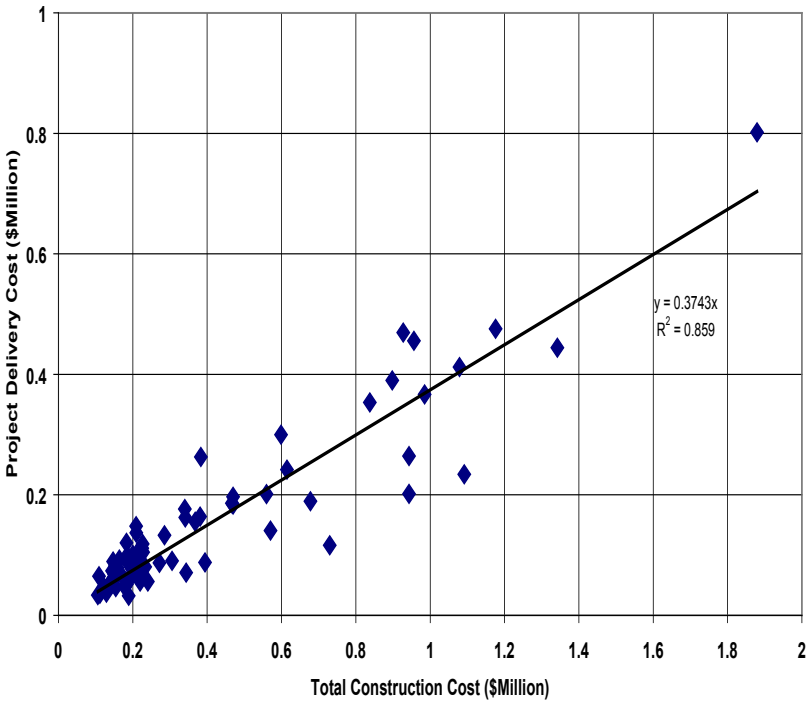
Streets - Reconstructions
Project Delivery Cost Versus Total Construction Cost (N=65)



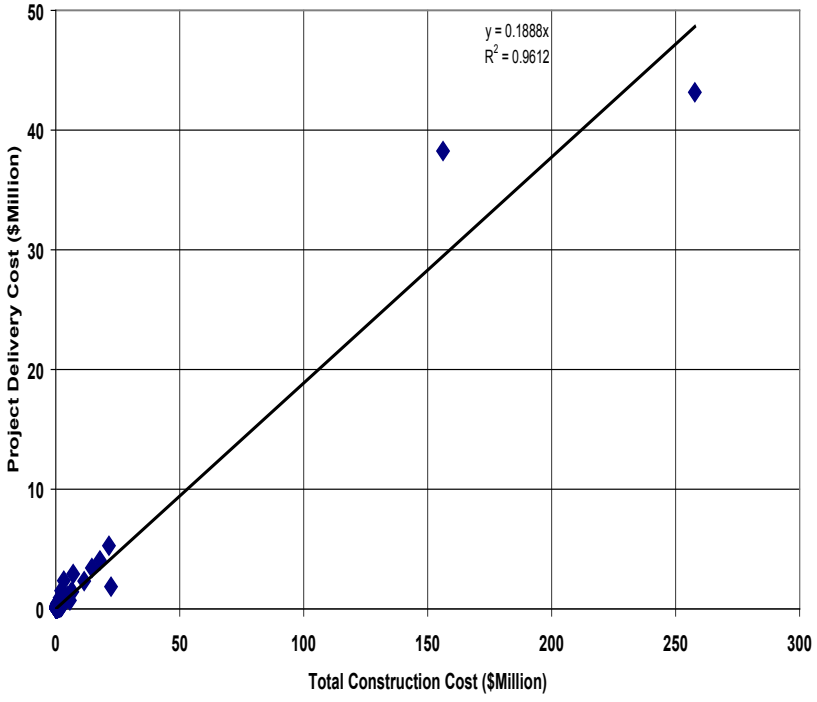
Streets - Bike/Pedestrian/Streetscapes
Project Delivery Cost Versus Total Construction Cost (N=74)



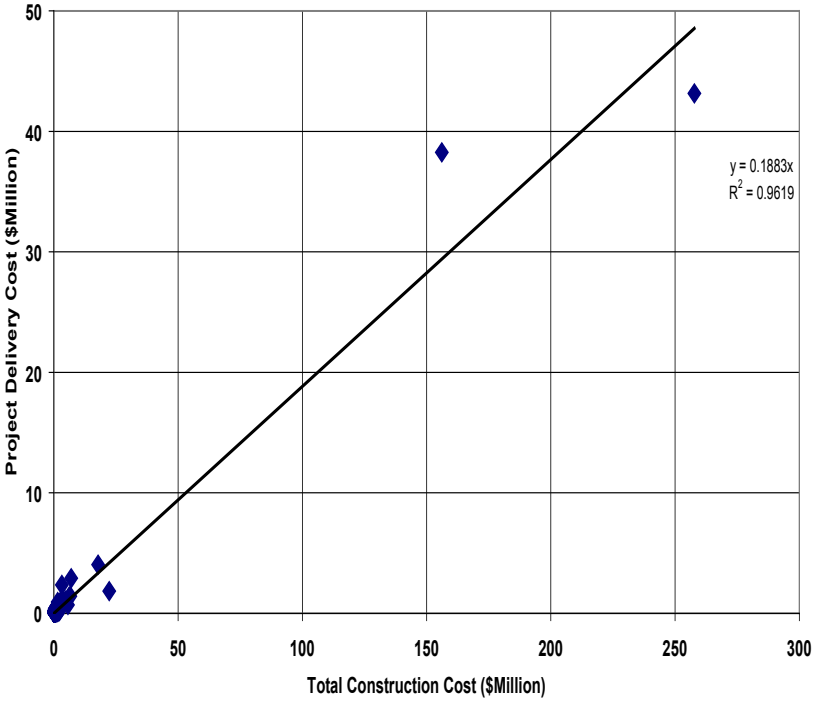
Streets - Signals
Project Delivery Cost Versus Total Construction Cost (N=75)



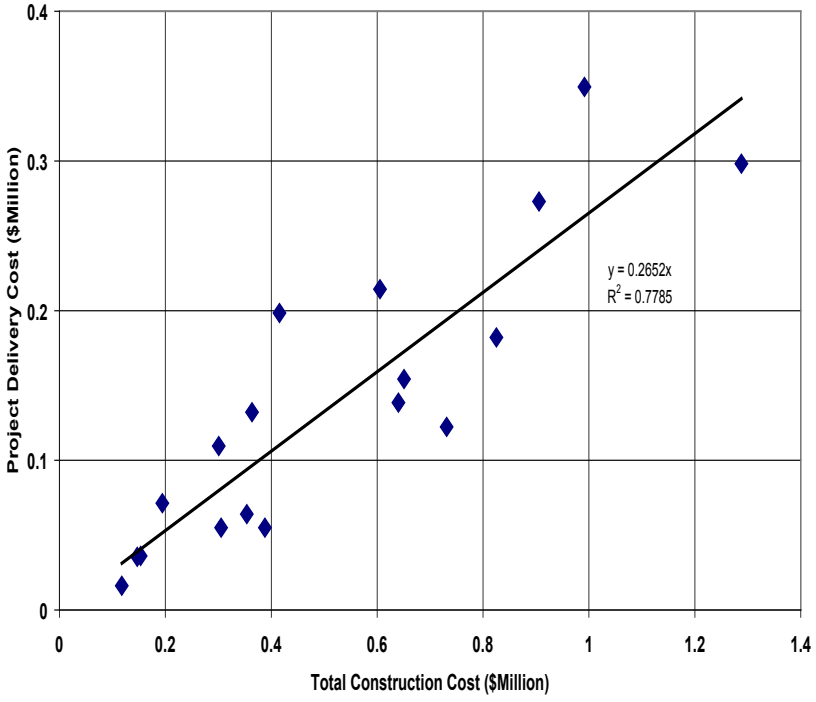
Pipe Systems - All Classifications
Project Delivery Cost Versus Total Construction Cost (N=256)



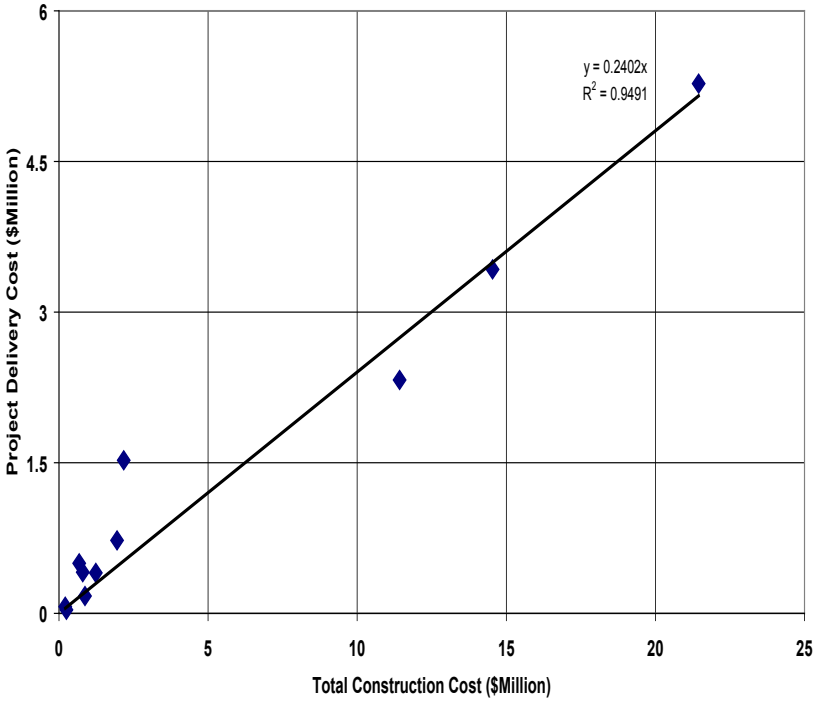
Pipe Systems - Gravity Systems (Storm Drains/Sewers)
Project Delivery Cost Versus Total Construction Cost (N=227)



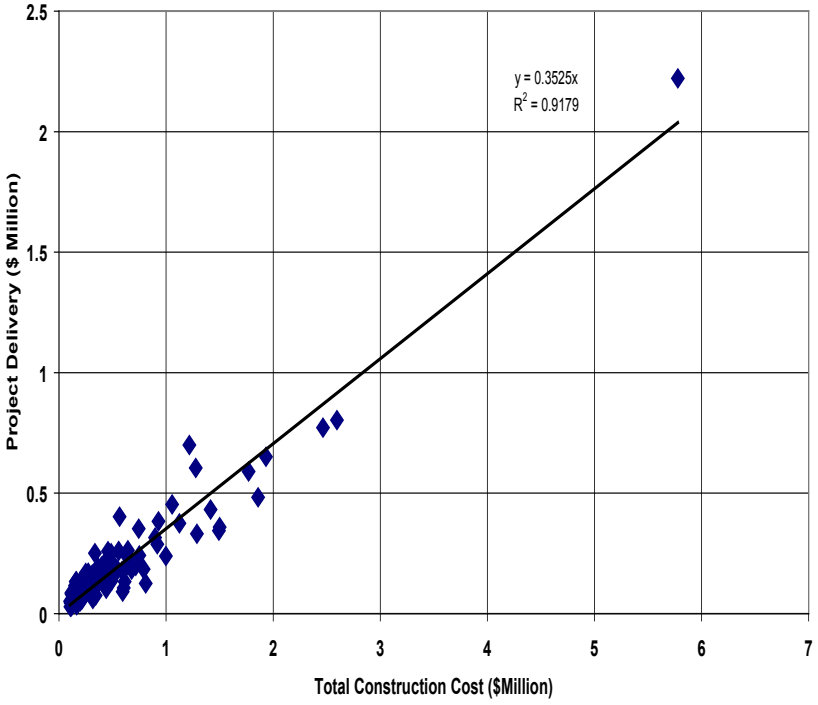
Pipe Systems - Pressure Systems
Project Delivery Cost Versus Total Construction Cost (N=18)



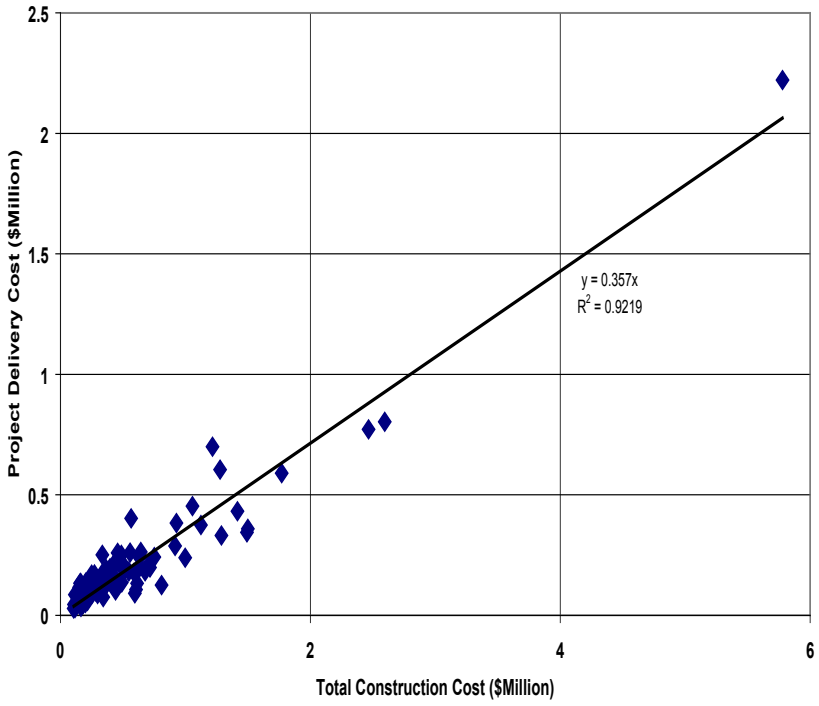
Pipe Systems - Pump Stations
Project Delivery Cost Versus Total Construction Cost (N=11)



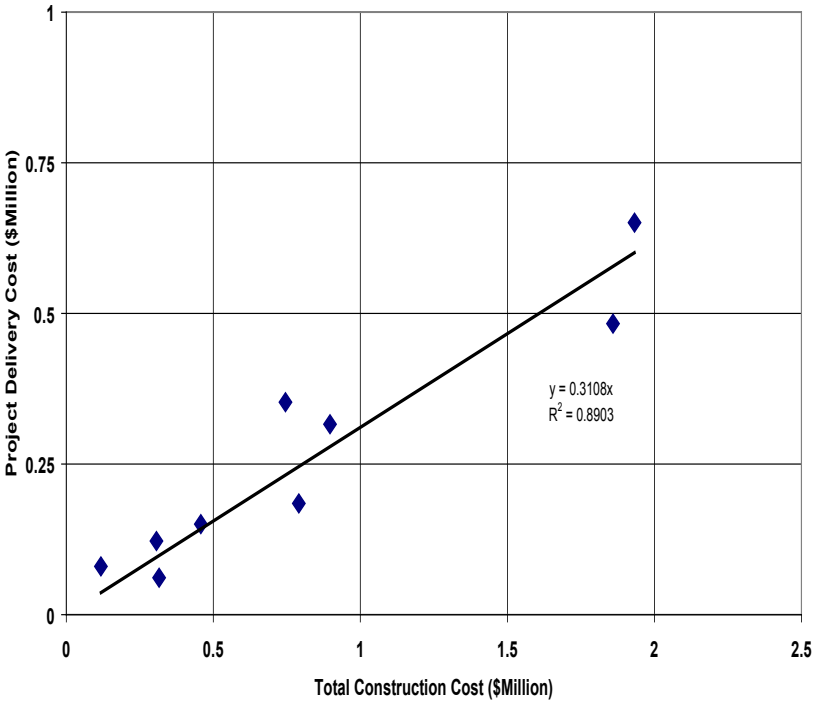
Parks - All Classifications
Project Delivery ($ Million) Versus Total Construction Cost (N=118)



Parks - Playgrounds
Project Delivery Cost Versus Total Construction Cost (N=101)



Parks - Sportfields
Project Delivery Cost Versus Total Construction Cost (N=9)



Parks - Restrooms
Project Delivery Cost Versus Total Construction Cost (N=8)

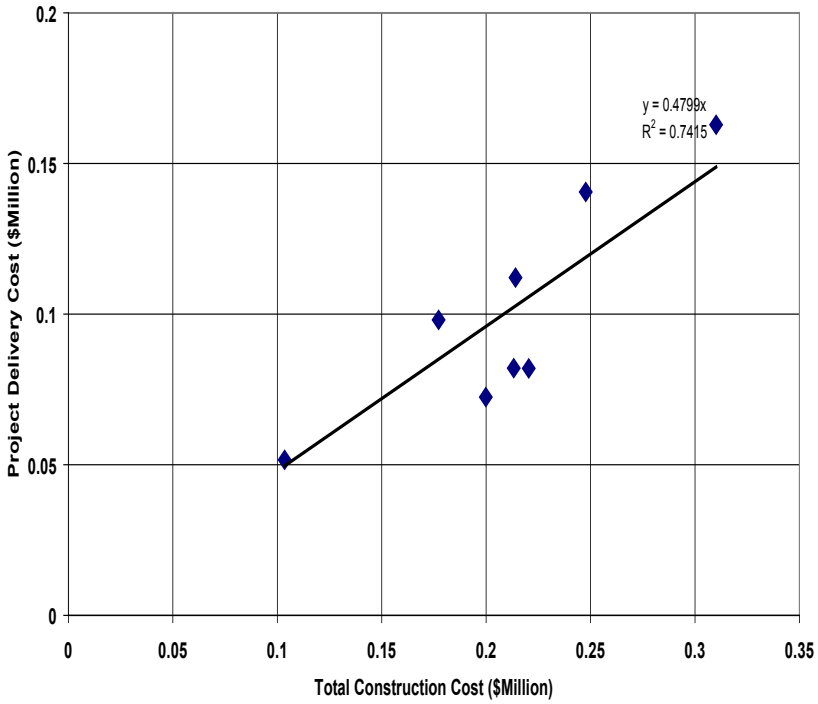
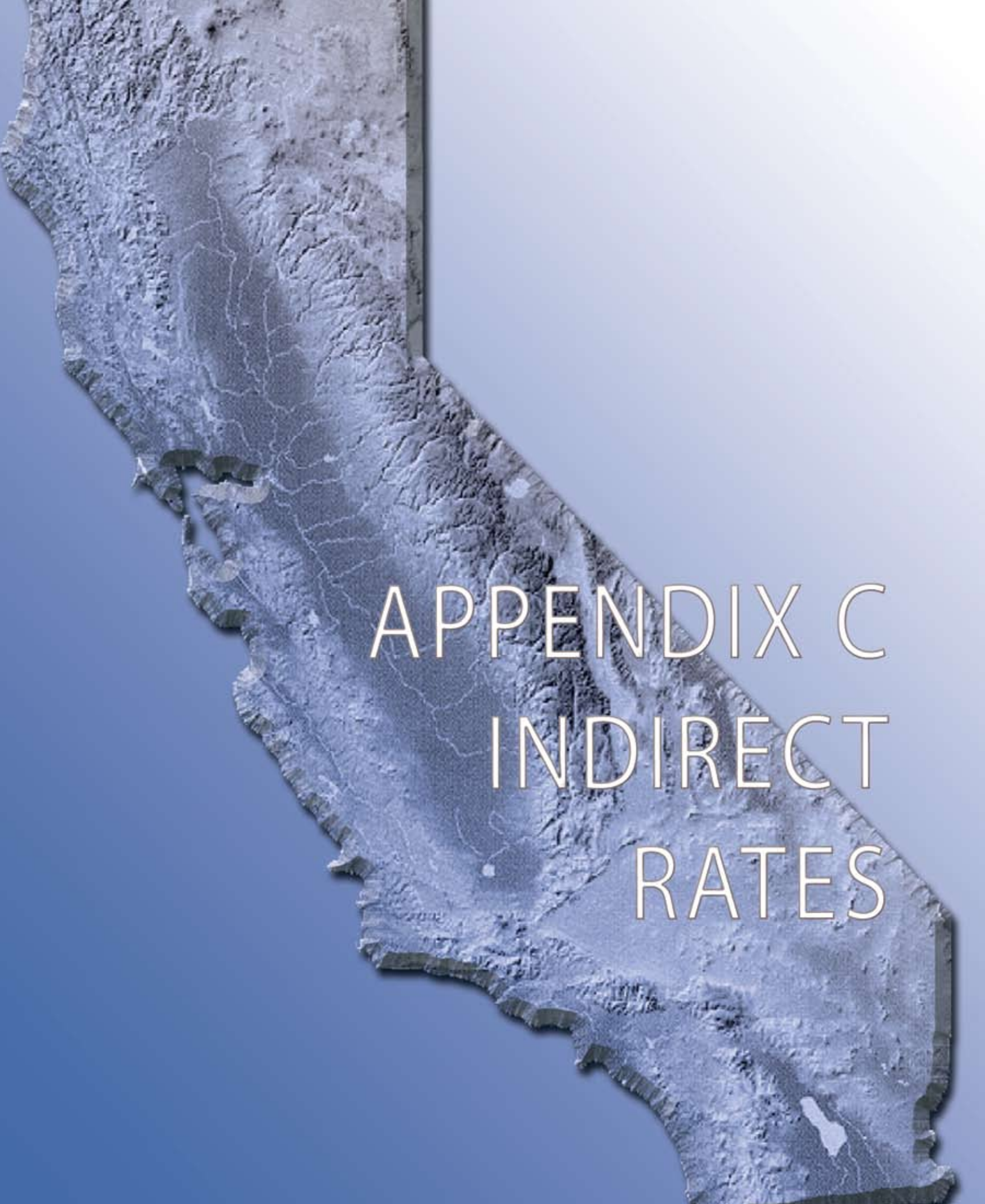


Table B-1
Summary of Regression Equations

Project Type or Classification	Design Cost ($) vs. Total Construction Cost ($) y = mx	Construction Management Cost ($) vs. Total Construction Cost ($) y = mx	Project Delivery Cost ($) vs. Total Construction Cost ($) y = mx
Municipal Projects	y = 0.15x	y = 0.14x	y = 0.29x
Libraries	y = 0.16x	y = 0.12x	y = 0.28x
Police/Fire Stations	y = 0.17x	y = 0.16x	y = 0.33x
Comm./Rec.Center/ Child Care/Gyms	y = 0.2x	y = 0.11x	y = 0.31x
Other Municipal	y = 0.08x	y = 0.14x	y = 0.22x
Streets Projects	y = 0.16x	y = 0.17x	y = 0.33x
Widening/New/Grade Separations	y = 0.13x	y = 0.18x	y = 0.31x
Bridges	y = 0.34x	y = 0.13x	y = 0.47x
Reconstructions	y = 0.28x	y = 0.18x	y = 0.46x
Bike/Pedestrian/Streetscapes	y = 0.14x	y = 0.11x	y = 0.25x
Pipes Projects	y = 0.09x	y = 0.1x	y = 0.19x
Gravity Mains	y = 0.09x	y = 0.1x	y = 0.19x
Pressure Systems	y = 0.13x	y = 0.13x	y = 0.26x
Pump Stations	y = 0.14x	y = 0.1x	y = 0.24x
Parks	y = 0.2x	y = 0.15x	y = 0.35x
Playgrounds	y = 0.21x	y = 0.15x	y = 0.36x
Sportfields	y = 0.17x	y = 0.14x	y = 0.31x
Restrooms	y = 0.21x	y = 0.27x	y = 0.48x

Notes:
m = slope of the regression trendline which is the project delivery percentage.



APPENDIX C
INDIRECT RATES

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	39.24%	19.40%	0%	5.68%	42.0%	106.32%	YES
City of Los Angeles Department of Public Works Bureau of Engineering[2]	34.93%	18.28%	11.32%	17.04%	48.06%	129.63%	YES
City of Oakland Department of Engineering & Construction	71.32%	22.04%	22.05%	8.63%	16.85%	140.89%	NO
City of Sacramento Department of General Services	32.00%	18.70%	0%	0%	73%	131.9%	NO
Department of Transportation	30.00%	18.70%	12.52%	9.82%	47.71%	118.75%	
Department of Utilities	39.6%	18.70%	61.3%			119.33%	
City of San Diego Architectural Engineering & Contract Services	49.90%	21.65%	0%	0%	83.80%	215%	NO
Transportation Engineering Division	49.79%	19.00%	0%	0%	77.10%	170%	
Water & Wastewater Facilities Division	52.46%	19.96%	0%	0%	54.70%	167%	
City and County of San Francisco Department of Public Works Bureau of Engineering Bureau of Construction Management Bureau of Architecture	23.34%	24.22%	0	36.92%	68.03%	152.51%	NO
City of San Jose Department of Public Works	34.90%	36.57%	53.86%	24.62%	Included	149.95%	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.

PARTICIPATING AGENCIES

City of Long Beach
Department of Public Works

City of Los Angeles
Department of Public Works
Bureau of Engineering

City of Oakland
Department of Engineering and Construction

City of Sacramento
Department of General Services
Department of Transportation
Department of Utilities

City of San Diego
Engineering & Capital Projects

City & County of San Francisco
Department of Public works
Bureau of Engineering
Bureau of Construction Management
Bureau of Architecture

City of San Jose
Department of Public Works

http://eng.lacity.org/techdocs/cabm/