CIP Benchmarking Study

California Multi-Agency CIP Benchmarking Study

Annual Report - Update 2013








Department of PUBLICWORKS
CITY OF SACRAMENTO

OAKLAND
PUBLIC WORKS AGENCY

CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

CITY OF LONG BEACH

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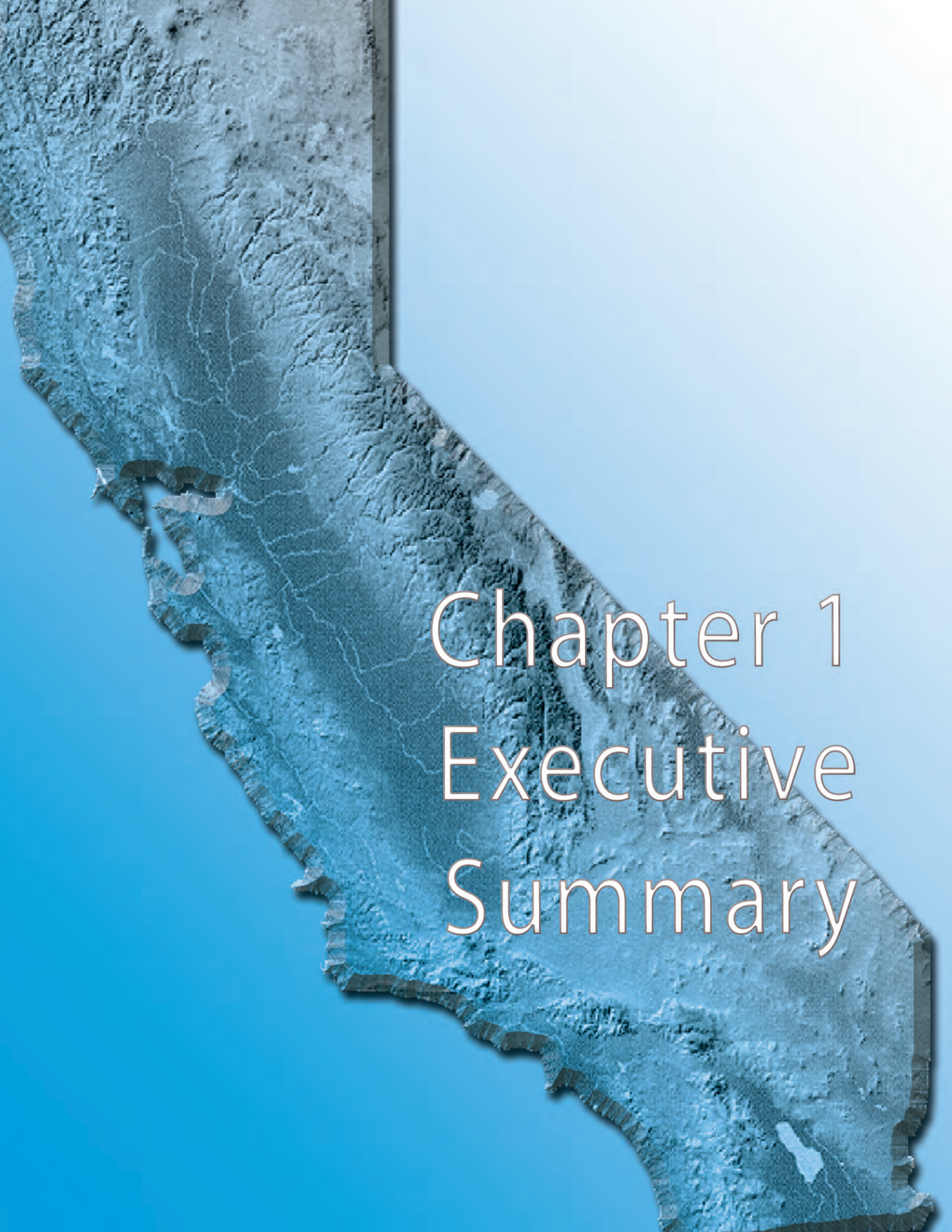
TOC

Table of Contents

CHAPTER 5 ONLINE DISCUSSION FORUM

CHAPTER 6 CONCLUSIONS

TABLES



Chapter 1 Executive Summary

CHAPTER 1 Executive Summary

A. INTRODUCTION

As economic growth in California begins to increase, governmental agencies are seeing an increase in their capital improvement programs (CIPs) and a relaxation of hiring restrictions. Despite these changes, municipal agencies in California are still being asked to do more with fewer resources: they are expected to increase their efficiency in delivering services, employ best management practices, implement continuous training programs, and develop best-in-class capabilities. Throughout the changing economic conditions, the *California Multi-Agency CIP Benchmarking Study (Study)* has continued its unparalleled effort to share the collective CIP implementation experiences of seven out of the eight largest cities in California for the twelfth consecutive year. 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 developed improved capital project delivery process approaches and an appreciation for the need to maximize efficiencies in the face of shrinking budgets.

The *Study* provides a forum for the agencies to share information among themselves via meetings with a focus on current issues, an online portal where topics for discussion can be posed and challenges addressed, and a database that serves as both a repository of the agencies' projects and a tool for data analysis. The purpose of this collaboration is to share the best ideas of the group for the benefit of all and to gather insight on how to address challenges that might appear to be new, but which others have already faced and addressed successfully.

This year, the participating agencies performed a Special Study to investigate the impacts of declining construction costs on project delivery percentages. The Update 2013 report describes the methodology adopted, findings, and conclusions of the Special Study. The agencies also developed a new Best Management Practice that would develop a framework for analyzing consultant fees to assist the agencies in cost negotiations prior to award.

B. 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 by performing regression analyses. Since Update 2009, the results of the regression analyses have yielded significantly better correlation compared to prior years of the *Study*. This is primarily due to the adoption of statistical techniques for model selection and significant improvements in the modeling methodology.

The project costs data 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**.

Performance Database

The projects data submitted by the agencies are complied in a customized Microsoft Access® database. This database not only serves as a repository for the data collected since the inception of the *Study*, but also allows for data analysis using built-in functions. The database also provides customized reports and tables for easy data interpretation. Each year, the projects database is updated with the inclusion of projects data submitted for that *Study* year. The analysis and the reporting features of the database are also updated.

Table 1-1 summarizes the number of projects included in the database and in the analyses. The 5-year database (2008-2012) used for the current analysis contains 655 projects. This total excludes project data older than five years or projects identified as outliers. Projects identified as outliers are not included in the performance data analysis but are retained in the performance database. In addition, projects delivered by alternative delivery methods are excluded from the analysis but included in the database. The 655 projects selected for analysis do not include projects delivered by alternative delivery mechanisms such as design-build, job order contracting (JOC), and CM@Risk. As explained under subsection A Study Criteria of this chapter, outlier analysis was performed using statistical techniques to ensure consistency in the selection of outlier data points. This methodology was first implemented during *Update 2008* and the agencies recognize the merits of a scientific approach for outlier elimination. Some of the projects classified as outliers in previous *Study* years have been included in the performance data analysis, and vice-versa.

This is an improved practice when compared to prior Study years where project data points were classified as outliers based on a combination of statistical parameters and subjective judgments by the Project Team. Previously, projects identified as outliers during one *Study* phase were kept as outliers in subsequent *Study* phases.

Table 1-1 shows that as the rules for project selection were refined, the number of non-representative projects and projects with TCC less than $100K have decreased. In addition, only fourteen projects have been excluded as outliers in the Update 2013 *Study* as compared to the elimination of several hundred projects prior to the refinement of the statistical model in 2009.

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. While over 2,000 projects have been collected in the database, the number of projects analyzed in any *Study* phase is significantly lower due to the criteria selected for the inclusion of projects in the analyses. Although the requirement for the minimum number of projects per classification has been met for most project categories, more data needs to be collected to ensure an even distribution of projects amongst all classifications.

Table 1-1
Growth of Database

Study Phase[1]	Submitted			Deleted[2]		Count After Deletions[5]	Excluded		Net
	Traditional Projects Submitted	(a) Alternative Delivery Projects Submitted[4]	(b) Total	(c) TCC <$100K	(d) Non-Representative	(e)=(b)-(a)-(c)-(d)	(f) Project Completion Date < 2008	(g) Outliers[3]	Projects in Analyses (h)=(e)-(f)-(g)
I	239	0	239	27	44	168	168	0	0
II	285	0	285	0	35	250	250	0	0
III	262	0	262	0	29	233	233	0	0
IV	173	0	173	18	24	131	131	0	0
V	182	0	182	0	4	178	178	0	0
VI	191	0	191	0	4	187	187	0	0
VII	158	0	158	2	0	156	156	0	0
VIII	153	0	153	4	0	149	43	1	105
IX	173	10	183	2	0	171	24	3	144
X	123	15	138	1	0	122	0	2	120
XI	159	15	174	0	4	155	1	6	148
XII	143	8	151	3	0	140	0	2	138
Total	**2,241**	**48**	**2,289**	**57**	**144**	**2,040**	**1,371**	**14**	**655**

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, VII = 2008, VIII = 2009, IX = 2010, X = 2011, XI = 2012, and XII = 2013.

[2] Projects that do not fit *Study* criteria for project classifications and minimum TCC of $100K were removed from the database.

[3] Outliers are identified based on statistical analysis.

[4] These represent projects delivered by alternative project delivery techniques. These projects are kept in the database, but not analyzed. These projects will be analyzed when a sufficient number of such projects are available to facilitate meaningful analyses.

[5] Projects delivered by alternative techniques are retained in the database but not analyzed. These projects are not included in the 655 projects selected for analysis in the Update 2013 Study.

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. As previously indicated, there are 4 project types (Municipal Facilities, Streets, Pipe Systems, and Parks) and 16 project classifications included in this *Study*.

Characteristics of Data Analyzed

Project performance data were analyzed using the custom database application at both the Project Type level and the Project Classification level.

Project Count and Project Delivery by Completion Year

Table 1-2 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 percent of the values are above and 50 percent of the values are below.

As indicated in **Table 1-2**, median project size has fluctuated considerably since 2008. The median project size declined

Table 1-2
Project Count and Project Delivery by Completion Year

Project Completion Date	Count by Project Type					Project Delivery Data				
	Municipal Facilities	Streets	Pipes	Parks	Total	Average TCC ($M)	Median TCC ($M)	Design Cost (% of TCC)	Construction Management Cost (% of TCC)	Project Delivery Cost (% of TCC)
2008	17	46	50	15	128	$2.32	$0.90	24%	17%	41%
2009	26	72	56	10	164	$2.44	$0.83	21%	18%	39%
2010	15	49	78	8	150	$2.47	$1.04	22%	19%	41%
2011	23	49	58	11	141	$2.60	$1.03	26%	21%	47%
2012	7	28	28	9	72	$1.25	$0.71	29%	21%	50%
Total/ Average	**88**	**244**	**270**	**53**	**655**	**$2.33**	**$0.92**	**24%**	**19%**	**43%**

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.
[3] Total excludes projects delivered by alternative delivery mechanisms such a design-build, JOC, and CM@Risk. Projects delivered by alternative techniques are retained in the database but not analyzed. These projects are not included in the 655 projects selected for analysis in the Update 2013 Study.

approximately 8 percent between 2008 and 2009. After declining in 2009, there was a significant increase in median project size in 2010 with an approximately 25 percent increase over 2009 levels. The median project size dropped slightly between 2010 and 2011, and then dropped 31 percent in 2012. A similar trend is observed in the average project size. The fluctuations could be due to a combination of several factors such as the selection of projects using the five-year window for analysis, elimination of projects with high TCC values during the outlier analysis, and the addition of several new projects with low TCC values.

While project delivery costs measured as a percentage of the TCC have remained relatively stable in the past, this percentage has increased 9 percentage points from 2010 to 2012. This can be attributed to the "below market rate" bids that are being widely observed in California's construction sector. In addition, factors such as personnel turnover in the agencies have also affected productivity, leading to inefficiencies due to the loss of project specific knowledge. The Special Study performed as part of Update 2013 focuses on the impacts of declining construction costs on project delivery percentages.

Project Delivery Costs by Project Type

Table 1-3 shows project delivery costs by each of the four project types in the *Study* for the full range of TCC. The project delivery percentage for a category is the arithmetic average of the project delivery percentages of the individual projects grouped under that category.

Table 1-3
Average Project Delivery Costs by Project Type (% of TCC)
(Full Range of TCC)

Type	Design	Construction Management	Project Delivery (Total)	Median Total Construction Cost ($M)	Number of Projects (N)
Municipal Facilities	19%	14%	33%	2.35	88
Parks	28%	21%	49%	0.49	53
Pipe Systems	23%	20%	43%	1.06	270
Streets	25%	20%	45%	0.74	244
Average	**24%**	**19%**	**43%**	**0.92**	**655**

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.
[3] Total excludes projects delivered by alternative delivery mechanisms such a design-build, JOC, and CM@Risk. Projects delivered by alternative techniques are retained in the database but not analyzed. These projects are not included in the 655 projects selected for analysis in the Update 2013 Study.

Projects belonging to the Municipal category have the lowest average project delivery percentage. The Pipes category has the maximum number of projects (n = 270) in the *Update 2013* database. The Streets category also has a similar number of projects in the database (n = 244). Along with the Parks category, the Streets category also exhibits a high average project delivery cost. The average project delivery percentage for the overall dataset is approximately 43 percent. These percentages have remained relatively stable for the four project types over the past few years.

Table 1-4 shows project delivery costs by each of the four project types in the *Study* for the 80th percentile subset of TCC (Note: In Update 2009, the concept of looking at a subset of projects was introduced. This subset generally characterizes the projects in the type or classification being examined. This step was taken as it was generally believed that projects project delivery for the very large projects did not characterize the overall projects in the type of classification being examined.). The trends in the project delivery costs for the projects in the 80th percentile subset of TCC follow that of the projects in the full range of TCC. As expected based upon the agencies' practical experience, project delivery costs are higher for projects that fall in the 80th percentile subset of TCC.

Table 1-4
Average Project Delivery Costs by Project Type (% of TCC)
(80th Percentile Subset of TCC)

Type	Design	Construction Management	Project Delivery (Total)	Median Total Construction Cost ($M)	Number of Projects (N)
Municipal Facilities	21%	14%	35%	1.00	70
Parks	30%	23%	53%	0.42	43
Pipe Systems	25%	21%	46%	0.76	217
Streets	27%	21%	48%	0.52	195
Average	**26%**	**20%**	**46%**	**0.65**	**525**

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.

[3]. Total excludes projects delivered by alternative delivery mechanisms such a design-build, JOC, and CM@Risk. Projects delivered by alternative techniques are retained in the database but not analyzed. These projects are not included in the 655 projects selected for analysis in the Update 2013 Study.

Consultant Usage Analysis

Project delivery performance and consultant usage by agency are presented in **Table 1-5**. The table indicates that approximately 59 percent of the design work and approximately 80 percent of the construction management efforts are completed in-house by the participating agencies. Consultants account for approximately 30 percent of the total project delivery costs while in-house efforts by the participating agencies accounts for the remaining 70 percent of the project delivery costs. For the available data, a clear relationship between the level of in-house effort and project delivery costs cannot be established.

C. REGRESSION ANALYSES

During *Update 2008*, several changes were made to improve the modeling methodology. These included developing a statistically-sound method for outlier analysis, using a linear trendline regression for modeling project costs relationships, and using the upper and lower bounds of a 95 percent confidence interval to estimate the range of the project delivery percentages. As a result of these improvements, the model relationships could be predicted with a high degree of certainty as compared to previous Study years. As previously indicated, during *Update 2009*, the modeling methodology was further refined by analyzing the data in two ranges of TCC. Results from the regression analysis methodology are discussed in **Appendix B**.

Table 1-5
Project Delivery Performance and Consultant Usage by Agency

AGENCY	DESIGN					CONSTRUCTION MANAGEMENT					PROJECT DELIVERY					TCC	
	In-House		Consultants		Total % of TCC[2]	In-House		Consultants		Total % of TCC	In-House		Consultants		Total % of TCC	Average	Median
	($M)	% of Design	($M)	% of Design		($M)	% of CM	($M)	% of CM		($M)	% of PD	($M)	% of PD			
Agency A	44.8	58%	32.5	42%	25%	45.8	66%	23.6	34%	18%	90.6	62%	56.1	38%	43%	2.8	1.1
Agency B	8.6	52%	8.1	48%	27%	8.1	73%	3.0	27%	17%	16.7	60%	11.1	40%	44%	1.1	0.5
Agency C	29.5	96%	1.2	4%	19%	27.6	99%	0.2	1%	16%	57.1	98%	1.4	2%	35%	1.9	1.4
Agency D	28.4	57%	21.7	43%	21%	62	89%	7.8	11%	28%	90.4	75%	29.4	25%	49%	4.3	1.4
Agency E	4.8	30%	11.1	70%	18%	7.5	49%	7.7	51%	14%	12.3	40%	18.8	60%	32%	1.6	0.7
Agency F	23.8	53%	21.5	47%	28%	38.8	87%	5.6	13%	27%	62.6	70%	27.1	30%	56%	2.7	0.5
Agency G	13.6	61%	8.6	39%	25%	7.6	100%	0	0%	9%	21.2	71%	8.6	29%	34%	1.3	0.5
OVERALL	**153.5**	**59%**	**104.6**	**41%**	**24%**	**197.3**	**80%**	**48**	**20%**	**19%**	**350.9**	**70%**	**152.7**	**30%**	**43%**	**2.3**	**0.9**

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.

In most cases, the results reflect the agencies' experience with the delivery of capital projects that on a percentage basis projects with lower TCCs are more expensive to deliver than projects with higher TCCs. Only 3 out of the 16 categories have lower project delivery percentages for the smaller subset of projects than the full range of projects. It is concluded that the model results are reasonable from a statistical perspective.

D. OTHER CONSIDERATIONS

Effect of Economic Conditions

Due to the lagging recovery in the economy, agencies are receiving bids that are significantly lower than the engineer's estimates. During the *Update 2010 Study*, the participating agencies summarized the trends observed in construction bids. This trend continued in 2012 and most of participating agencies observed construction bids significantly lower than the engineer's estimates. The participating agencies had conducted a preliminary analysis in the *Update 2012 Study* where they compared bids received from contractors to the engineer's estimates for projects completed between 2009 and 2011. The analysis revealed that for almost all project categories, the bids received were substantially lower than the engineer's estimates. This analysis and the data presented in **Table 1-2** validated the agencies' concerns published in previous Study years regarding the impact of depressed construction bids on project delivery percentages. These findings resulted in the Special Study in *Update 2013* which focused on the impacts of declining construction costs on project delivery percentages.

Size of the Database

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. The participating agencies are also challenged to identify as many completed projects as possible that meet the rest of the *Study* criteria. The benefits of projects delivered via alternative delivery techniques need to be quantified by including them for analysis in the project database. However, due to the significant difference in delivery mechanisms, those projects will have to be analyzed separately from the rest of the projects in the database.

E. SPECIAL STUDY

The Update 2013 Study investigated the impacts of declining construction costs on project delivery percentages as part of a Special Study. In order to evaluate the impact of construction costs on project delivery percentages, an 'indexed' construction cost is used. It is assumed that 2007 construction costs are representative of the baseline construction costs, based on the CalTrans Price Index[1]. Using this index, construction costs for projects in the performance database

[1] The CalTrans construction cost index tracks prices for: Roadway Excavation Aggregate Base, Asphalt Concrete Pavement, Portland Cement Concrete (Pavement), Portland Cement Concrete (Structure), Bar Reinforcing Steel, and Structural Steel.

that were bid in the 2008 – 2010 period are adjusted based on their variance from the baseline construction cost. The adjustment factor for any year is calculated by dividing the baseline number, 100, by the CalTrans price index for that year. The project delivery costs for the 2008 – 2010 periods are then recomputed based on the adjusted construction cost and then compared against the actual project delivery percentages for the 2008 – 2010 periods. Data for 2011 was not used as most projects bid in 2011 have not been completed, and those projects that were bid in 2011 and are complete were not representative of all projects bid in 2011. The Special Study methodology and conclusions are presented in **Appendix D**.

BMP Implementation and Project Delivery Costs

Although it is desirable for project delivery costs to decrease as agency efficiencies increase and BMPs are implemented, this can be confounded by other factors that change annually such as project size and construction cost fluctuations.

F. BEST MANAGEMENT PRACTICES

At the beginning of this *Study*, the agencies examined over 100 practices used in project delivery. Included in this *Study* were a number of practices that the participants did not commonly use at the time, but believed could have value if ultimately implemented as Best Management Practices (BMPs). Each year the agencies look at changes in the industry in order to identify new BMPs. Existing BMPs, in some cases, are reworked by the agencies to address specific challenges encountered during implementation. BMPs are also added or modified to reflect relevant experiences by the participants. As with prior reports, agency implementation of these selected practices will continue to be tracked during the *Study*.

While a BMP may be developed to address a specific issue, its implementation may affect other elements of project delivery. A BMP that reduces project schedule, for example, may also favorably impact both communication and project costs. While it is not possible to discreetly quantify all the benefits of the BMPs, the participating agencies developed an approach to identify the major benefits associated with each BMP. This was accomplished in *Update 2010 Study* by assigning a *Perceived Value* to each BMP. The participating agencies judged that each of the BMPs favorably impact one of the following categories:

- Cost
- Schedule
- Quality
- Communication
- Environment
- Customer Service

In *Update 2013*, the Project Team added one new BMP to the BMP implementation tracking list. The new BMP was developed by discussions during a quarterly meeting plus several follow-up conference calls. The new BMP is:

- 6.n 2013 – Determine appropriate consultant costs for professional services agreements.

This new BMP is believed to directly influence cost, schedule, communication, and customer service aspects of either design or construction management, and, ultimately, project delivery efficiency.

G. ONLINE DISCUSSION FORUM

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

- APWA Media Query – CA Municipal Construction Bid Contingencies Issue
- Public Contract Code Section 4100 et seq. Subletting and Subcontracting Fair Practices Act
- Bidders' Inquiries
- ADA Curb Ramps
- Building Contractor Prequalification Questionnaire
- Consulting Management Manual/Guidelines
- Architectural Services Organization Structure
- Bid to Award Timeline and Percent to SLBE/ELBE
- Multi-Year CIP

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

H. CONCLUSIONS

Performance Benchmarking

Performance Benchmarking for the Update 2013 *Study* involved analysis of 655 projects in the projects database. In prior *Study* years, project costs data were only collected and analyzed for projects delivered using the traditional design-bid-build method. In Update 2010, the agencies decided to collect costs data for projects delivered via alternative delivery methods for potential analysis at a later date when sufficient numbers of projects are collected to facilitate meaningful analyses. Collection of projects delivered via alternative methods continued in 2013. There are 48 projects delivered via alternative project delivery mechanisms in the performance database.

The results of the performance benchmarking evaluation show that in almost all cases project delivery costs expressed as a percentage of TCC are higher for projects with lower TCCs. This clearly indicates that an economy of scale exists in the delivery of capital projects. Project delivery percentages (arithmetic averages) for the *Update 2013 Study* varied between the following values for the full range and the smaller project subset of TCC respectively:

Table 1-6
Update 2013 Project Delivery Percentages

Type	Project Delivery Percentages
Municipal Projects	33% - 35%
Parks Projects	49% - 52%
Pipes Projects	42% - 46%
Streets Projects	45% - 48%

The participating agencies conducted a preliminary analysis where they compared bids received from contractors to the engineer's estimates for projects completed between 2009 and 2011. The analysis revealed that for almost all project categories, the bids received were substantially lower than the engineer's estimates. This analysis and the data presented in **Table 3-5** validated the agencies' concerns published in previous *Study* years regarding the impact of depressed construction bids on project delivery percentages.

Although the results of the performance analyses are based on historical data provided by the participating agencies, there are several factors that could affect project delivery and are not captured in the performance model. These external factors include personnel turnover in the agencies, competitive bids etc. which impact project delivery. Since such factors are not captured in the performance model, the reader is cautioned that the improved results of the regression analyses only be used as a reference and not for prediction of performance. In addition, in light of the current bid environment, it is recommended that the reader use best judgment in the context of the current economic downturn when using the *Study* results for planning and budgeting.

Best Management Practices

In *Update 2013*, the agencies continued to exchange ideas regarding strategies for implementing various BMPs using networking opportunities at the face-to-face meetings, conference calls, and the online discussion forum. In *Update 2013*, the Project Team added one new BMP:

- 6.n 2013 – Determine appropriate consultant costs for professional services agreements.

This new BMP is believed to directly influence cost, schedule, communication, and customer service aspects of either design or construction management, and, ultimately, project delivery efficiency.

Based on feedback received, agencies continue to review and update BMPs that have been fully implemented. The agencies continue to pursue full implementation of BMPs although some remain only partially implemented. In some cases, constraints limit the full implementation of BMPs. Full implementation of BMPs continues to be impacted by staff reductions, furloughs, and the management's increased involvement in resolving budgetary issues. The agencies continue to focus their efforts on monitoring adherence to BMPs that have been implemented and are judged to provide efficiencies in project delivery processes for participating departments. However, several agencies have established a goal of implementing several BMPs for the upcoming year.

To support the linking of BMPs to performance improvements, BMP implementation by the agencies are tracked. As of *Update 2013*, and including the addition of the new BMP, the agencies have fully implemented about 70 percent of all BMPs. Seven (7) percent of the total BMPs have been partially implemented by the agencies. Many of the remaining BMPs require more involvement and input from multiple departments making them more complicated to implement than other BMPs.

Online Discussion Forum

In Update 2013, the Online Discussion Forum continues to be an important feature for *Study* participants. Active, meaningful exchanges occur along with important issues being addressed resulting in changes to policy, approach, or BMP implementation. Participants continue sharing information through the Online Discussion Forum, conference calls, and during the face-to-face meetings. The interesting outcomes of these discussions are presented to the public through the *Study* reports. The continued sharing of challenges and solutions through the Online Discussion Forum remains a remarkable benefit to all participants.

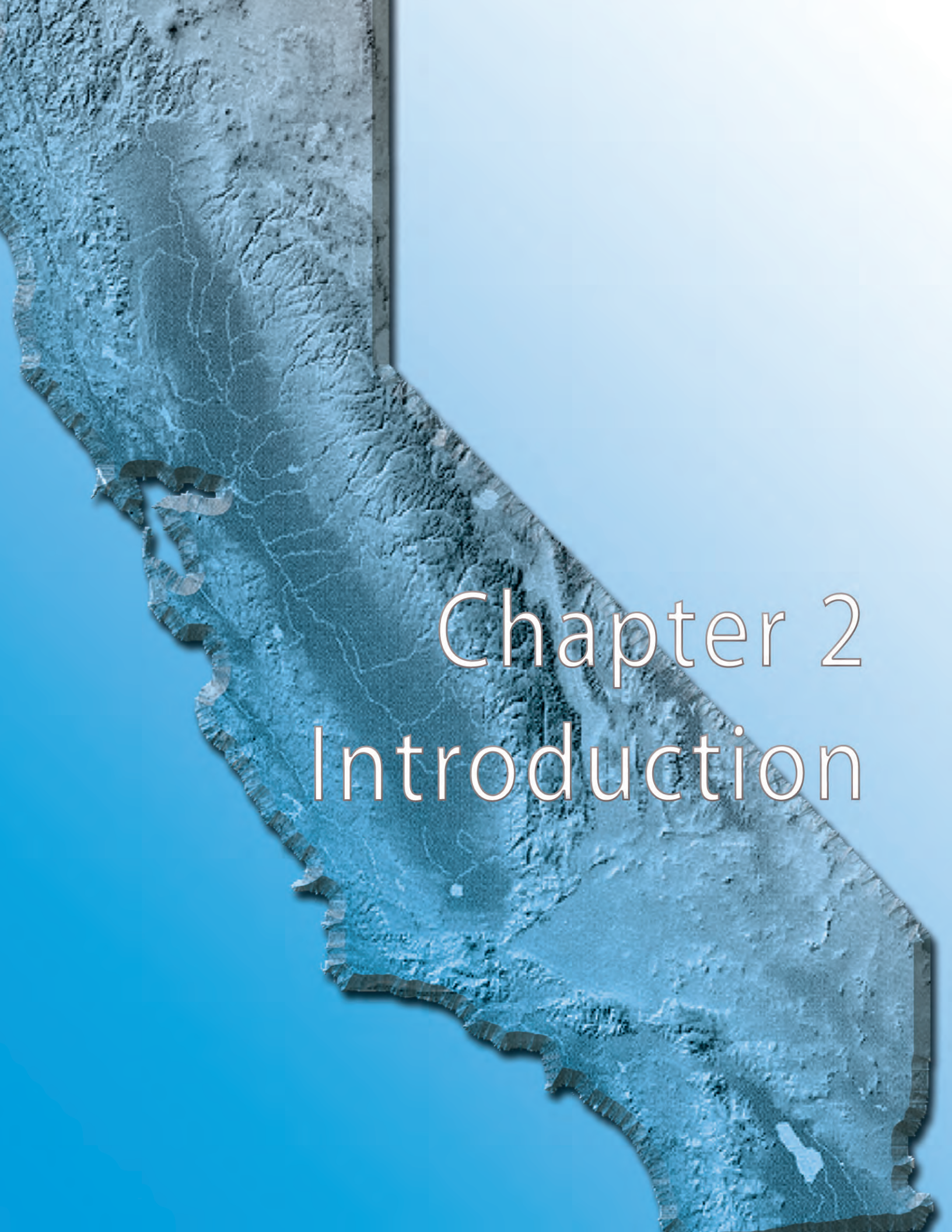
Special Study

The increase in project delivery costs is not fully accounted for by the decrease in construction costs. Based on the analyses, project delivery costs have continued to increase over the last five years regardless of the bid prices. Possible influences on the increased project delivery percentages include: reduced efficiencies due to employee turnover and/or staff reductions and other factors that cannot be quantified. In addition, the impact of consultant cost increases over the past few years on project delivery percentages needs to be quantified. A close examination of the mix of projects that make up the Special Study shows that the data contain a different mix of small projects and large projects. The composition of the projects for each year drives the project delivery percentage for that year. It is likely that the project delivery percentage is also being influence by the size and distribution of construction costs among the projects in the database. As the specific projects that make up the database change year by year in scope and complexity, the project delivery costs change as well, influencing the numbers significantly.

Planning for Update 2014

Over the course of *Update 2013*, the Project Team identified a number of activities to consider including next year in *Update 2014*. These activities include:

- Continue discussions on how to implement the new BMP (6.n) to determine appropriate consultant costs for professional services agreements;
- Continue collecting data on projects delivered via alternative delivery techniques;
- Developing new BMPs and tracking the implementation of adopted BMPs;
- Continuing discussion on current topics via the round-table discussion forum; and
- Continuing meaningful exchanges on the Online Discussion Forum via the SharePoint website.



Chapter 2
Introduction

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As economic growth in California begins to increase, governmental agencies are seeing an increase in their capital improvement programs (CIPs) and a relaxation of hiring restrictions. Despite these changes, municipal agencies in California are still being asked to do more with fewer resources: they are expected to increase their efficiency in delivering services, employ best management practices, implement continuous training programs, and develop best-in-class capabilities. Throughout the changing economic conditions, the *California Multi-Agency CIP Benchmarking Study (Study)* has continued its unparalleled effort to share the collective CIP implementation experiences of seven out of the eight largest cities in California for the twelfth consecutive year. 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 developed improved capital project delivery process approaches and an appreciation for the need to maximize efficiencies in the face of shrinking budgets.

The *Study* provides a forum for the agencies to share information among themselves via meetings with a focus on current issues, an online portal where topics for discussion can be posed and challenges addressed, and a database that serves as both a repository of the agencies' projects and a tool for data analysis. The purpose of this collaboration is to share the best ideas of the group for the benefit of all and to gather insight on how to address challenges that might appear to be new, but which others have already faced and addressed successfully.

This year, the participating agencies performed a Special *Study* to investigate the impacts of declining construction costs on project delivery percentages. The *Update 2013* report describes the methodology adopted, findings, and conclusions of the Special *Study*. The agencies also developed a new Best Management Practice that would develop a framework for analyzing consultant fees to assist the agencies in cost negotiations prior to award.

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*. The Project Team agrees that there have been significant benefits of collaborating and pooling their project delivery knowledge and experience since the inception of the *Study*.

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

Table 2-1 summarizes some of general characteristics of the participating agencies and/or of specific departments. While the participating agencies have many similarities in terms of function and capital program delivery, it is important to note that a number of factors create differences. Some of these include organization and cost structure. This is reflected in the "Indirect Rates Applied to Capital Projects" table shown in **Appendix C**. Variances amongst the agency indirect rates can create measureable delivery cost differences between the agencies for similar projects. However, the large magnitude of projects in the *Study* database has normalized these differences when data is compiled for major project categories and/or across all project types.

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.

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 continues to benefit by having ready access to the performance data and BMPs of the largest cities in California. This has assisted our decision-making process regarding policy and procedural improvements, as well as our training initiatives as a new generation of project managers enters our workforce. 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 use the *Study* in working with other City agencies using our services. Design costs initially quoted by outside consultants may not reflect the final design costs associated with occupied facilities, seismic retrofits, and rehabilitation (especially involving corrosion, dry rot, and hazardous material abatement). Presenting data from seven cities is far more persuasive than presenting our estimates and past data alone. International prices for steel, cement, and petroleum-based products have been volatile over the past 5 years. Tech money and startups have helped stimulate the economy of the San Francisco Bay Area, along with office relocations by social media companies like Twitter, Zynga, and Spotify to the mid-Market St. area in San Francisco. Construction of the 49ers stadium, Apple campus, Google campus, and various condo developments has made the bidding climate even more competitive, the bidding environment has been even more unpredictable. Having the larger sample size of information afforded by the *Study* is essential to forecasting pricing trends with any degree of certainty. The online forum has helped us provide elected officials accurate information quickly regarding other cities' practices on accepting streets and structures for maintenance, and how maintenance work is funded."

- The City of Los Angeles has stated that "As we review the data from year to year it is valuable to look at the changing results, make an assessment as to the possibilities that have contributed to the differences from previous years, and use that information as we continue to look for opportunities to improve our delivery of projects. Also, we find it most interesting to hear how other agencies are coping in these very challenging economic times. Many of the agencies are experiencing similar challenges, and the actions taken are some of the same the City of Los Angeles is implementing."

- The City of Long Beach offers this comment: "For the first time in several years, the City of Long Beach has forecasted budgeted surpluses from a variety of funding sources, and the City Council has directed that the majority of these unanticipated additional revenues be allocated to one time infrastructure projects, as opposed to ongoing programmatic expansions. This direction will have a significant impact on the City's Capital Improvement Program, in terms of both budgets, schedules and staffing needs. Nevertheless, staffing sizes to manage the City's CIP have not expanded, and are not anticipated to expand in the coming years. This will put increased pressure on the City staff to deliver more projects more efficiently, increasing the

need to identify and implement new and proven best management practices in project delivery. Participation in the statewide benchmarking process has allowed the City of Long Beach to share and acquire the knowledge necessary to tackle these project delivery challenges and to determine if the costs of project delivery are reasonable in today's environment".

- 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 continue to improve. 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 comments that "the *Study* continues to be used as an invaluable resource in providing benchmarks that are significant for municipalities. Although it is well understood that the data changes from year to year based on factors which primarily affect construction costs, the five year state-wide averages are used to continuously review our processes for more efficiency and improved delivery costs. The *Study* also helps staff to better communicate typical CIP challenges e.g., needed resources with elected officials and community stakeholders. The statistical models from the report continue to be refined and provide good benchmarks for estimating our program delivery goals. The City has been so pleased with the results that we now are pursuing similar efforts with regional focus through San Diego Regional Construction Procurement Committee (RCPC). RCPC is working on identifying current and future pressing issues which will have the most significant impact on the region's design and construction plans in the coming decade. The *Study* is a great model for implementing this regional effort. We continue to take advantage of our quarterly meetings and discussion forum, which provide the means to obtain useful information on processes and best management practices from the other participating Cities".

- The City of Oakland offers this comment. "One of the many benefits of the *Study* is the sharing of our challenges in delivering capital projects and ideas on how to address these issues. The Benchmarking group is also an invaluable resource to collect information on common practices of various city policies and standards. We are glad that the Benchmarking group has decided to continue the *Study* and meet semi-annually instead of quarterly during these very difficult economic times. We are proud to be part of this larger Public Works family in California that works together wholeheartedly to improve the delivery of our capital projects".

Table 2-1
Agencies' Overall Information

Information	Population[2]	Area (sq. mi.)	Website	Government Form
Long Beach	464,892	50	http://www.longbeach.gov	Council-Manager-Charter[1]
Los Angeles	3,827,172	469	http://eng.lacity.org	Mayor-Council
Oakland	394,932	66	http://www2.oaklandnet.com/	Mayor-Council-Administrator
Sacramento	470,437	99	http://www.cityofsacramento.org	Council-Manager
Dept. of Public Works				
Dept. of Utilities				
San Diego	1,315,173	342	http://www.sandiego.gov	Mayor-Council
San Francisco	816,311	49	http://www.sfdpw.org	Mayor-Board of Supervisors (11 members)
San Jose	969,876	178	http://www.sanjoseca.gov	Mayor-Council-Manager

Notes:
[1] Mayor has veto power.
[2] Source: E-1 Population Estimates for Cities, Counties, and the State — January 1, 2012 and 2013, California Department of Finance

C. STUDY FOCUS

This year, the participating agencies performed a Special *Study* to investigate the impacts of declining construction costs on project delivery percentages. Chapter 3 Performance Benchmarking briefly discusses findings from the Special *Study*. **Appendix D** of the *Update 2013* report describes the methodology adopted, findings, and conclusions of the Special *Study* in detail. The agencies also developed a new Best Management Practice that would develop a framework for analyzing consultant fees to assist the agencies in cost negotiations prior to award. The new BMP is presented below:

- 6.n 2013 – Determine appropriate consultant costs for professional services agreements.

Agency implementation of these selected practices has been and will continue to be tracked during the *Study*. A description of the newly added BMP along with their "Perceived Value" is presented in **Chapter 4** Best Management Practices.

D. STUDY GOALS

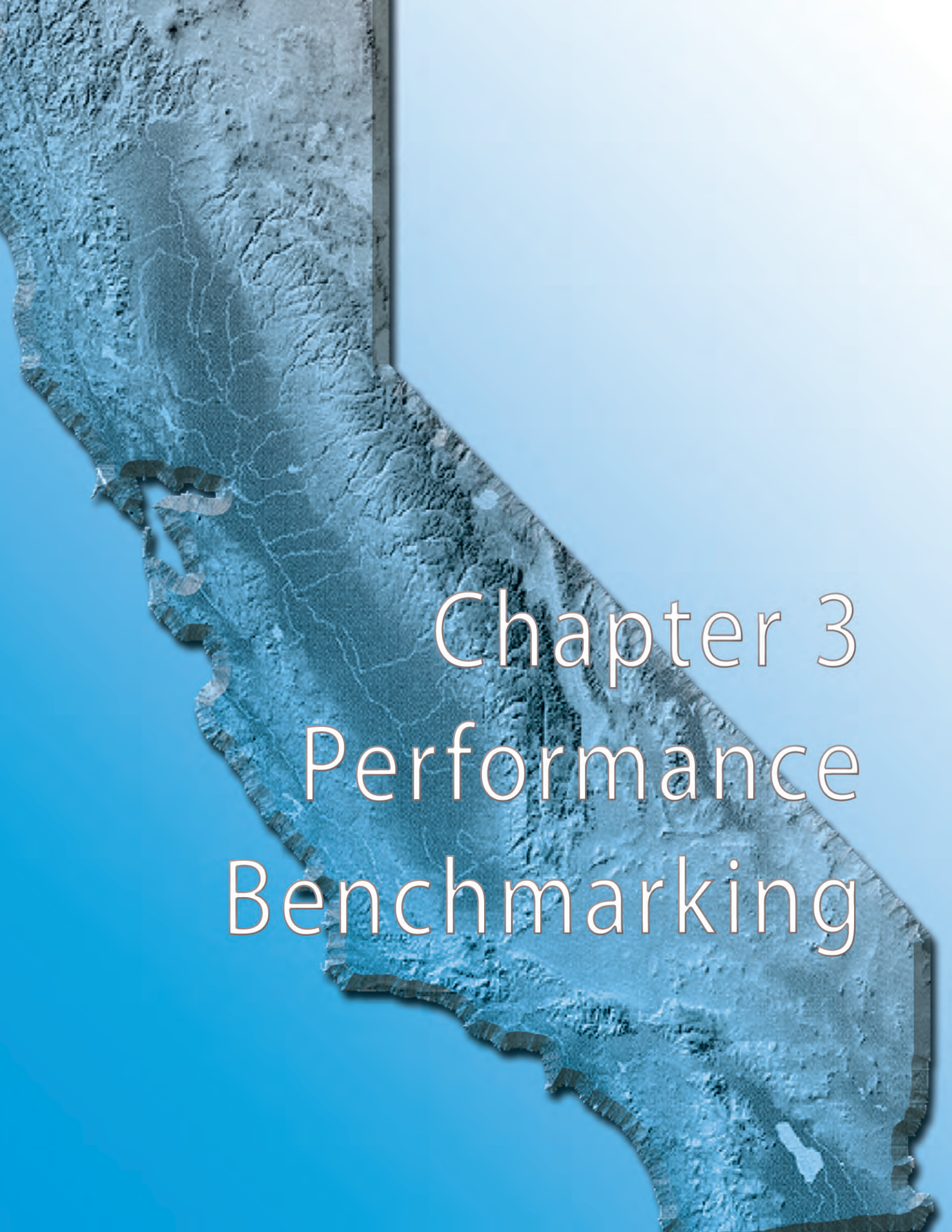
The *Study* method is described in detail in the first *Study* report (published in 2002) and modifications to it have been documented in subsequent *Study* reports. In *Update 2013* the agencies made progress on several goals:

1. Collect projects delivered by alternative delivery techniques in the performance database. Over the years, the participating agencies have executed several projects using alternative delivery methods such as design-build and job-order-contracting yielding benefits in areas such as cost, schedule, and overall project delivery. In order to capture such projects as part of the *Study*, the agencies have decided to collect costs data for projects delivered via alternative methods. This practice was initiated in *Update 2011* and continued in *Update 2013*. However, the agencies decided that these projects will not be analyzed until a sufficient number of projects are collected to facilitate meaningful analyses. In addition, criteria for analysis for projects delivered by alternative delivery techniques need to be defined.

2. Track the adoption of BMPs. The Project 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.

3. Create new BMPs targeted to address commonly held problem areas. The Project Team continued to discuss common challenges and share ideas for addressing those challenges during the quarterly meetings as well as in the online discussion forum. One new BMP was adopted by the Project Team for implementation and added to the BMP implementation list.

4. Continue efficient information sharing with one another through the online discussion forum. In *Update 2013*, the Project Team continued to utilize an online portal for discussing issues and challenges. The use of the online portal for exchanging ideas and discussing topics of common interest was first started in 2009. The portal allows for efficient archiving of discussion topics and ease of access. The Project Team uses the discussion forum to share information; survey current processes and policies; and collaborate on implementing new processes and policies.



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 by performing regression analyses. Since *Update 2009*, the results of the regression analyses have yielded significantly better correlation compared to prior years of the *Study*. This is primarily due to the adoption of statistical techniques for model selection and significant improvements in the modeling methodology.

The project costs data 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 2013* performance benchmarking analyses:

- T**otal Construction Cost** – TCC is the sum of costs associated with the awarded construction contract, net change orders, utility relocation, and construction by agency forces. TCC does not include the cost of land acquisition, environmental monitoring and mitigation, design, or construction management. All projects included in the analyses have a TCC exceeding $100,000. The participating agencies use fully-loaded (direct and indirect) costs for project delivery tasks. (See **Appendix C**).

- **Completion Date** – Projects included in the *Study* analyses were completed on or after January 1, 2008. 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, which was first adopted in *Update 2008*, allows for the inclusion of more data than in previous years. Previously, other methods including visual inspection were used for the elimination of outlier data points. This change was in part allowed by the improved modeling techniques that have been documented in prior *Study* reports.

Projects confirmed as outliers by this statistical technique were kept in the database, but excluded from the analyses.

- **Project Delivery Method** – All projects analyzed in this *Study* were delivered through the traditional design-bid-build method. In prior *Study* years, project costs data were only collected and analyzed for projects delivered using the traditional design-bid-build method. Over the years, the participating agencies have executed several projects using alternative delivery methods such as design-build and job-order-contracting yielding benefits in areas such as cost, schedule, and overall project delivery. In order to capture such projects as part of the *Study*, the agencies have decided to collect costs data for projects delivered via alternative methods. However, the agencies decided that these projects will not be analyzed until a sufficient number of projects are collected to facilitate meaningful analyses.

- **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** – Sixteen project classifications grouped into four project types are used in this *Study*. In *Update 200*8, two new project classifications, "Other Municipal Facilities" and "Other Pipes" were added to the Municipal and the Pipes projects categories respectively. These two classifications will include projects that do not fall under the existing Municipal and Pipes classifications but are representative of the Municipal and the Pipes categories. The agencies will continue to collect data for these classifications for future analyses. The project types and classifications are shown in **Table 3-1**.

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[1]
Streets	• Widening, New, and Grade Separation • Bridges • Reconstruction • Bike Ways, Pedestrian Ways, and Streetscapes • Signals
Pipe Systems	• Gravity Systems • Pressure Systems • Pump Stations • Other Pipes
Parks	• Playgrounds • Sportfields • Restrooms

[1] Projects include design and/or construction activities for parking structures, yards, soil anchors, docks, animal shelters, reservoirs, water treatment plants, piers, and animal services centers.

B. DATA COLLECTION AND CONFIRMATION

To obtain meaningful results from the performance model, it is essential that the data collected from the agencies are accurate and conform to the *Study* criteria. The agencies recognize the importance of quality input data and 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**.

For the *Update 2013 Study*, the agencies completed the questionnaires with comparable, complete, and accurate values. The agencies also review and compare their data collection and confirmation techniques on a regular basis. For example, in a quarterly meeting during *Update 2008*, each agency delivered a presentation describing how it compiles the project delivery data for the Performance Questionnaire. In addition, discussion among the Project Team helps clarify and resolve inconsistencies in the data collection methodologies. It also ensures that input data is vetted before projects are submitted for analysis.

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
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

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

Category and Phase	Description
2) Construction Management Costs:	All costs associated with construction management, including closeout costs, are included in this category. Construction management costs consist of direct labor, other agency costs, and consultant usage. Construction management may include the following:
Construction	• Hold pre-construction conference • Review and approve schedule and schedule updates • Perform on-site management • Review shop drawings, samples, and submittals • Perform testing and inspection • Process payment requests • Review and negotiate Change Orders • Prepare monthly reports to owner and agencies • Respond to Requests for Information • Develop and implement a project communications plan • Perform document control • Manage claims • Perform final inspections and develop 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.
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.

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

Category and Phase	Description
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

The projects data submitted by the agencies are compiled in a customized Microsoft Access® database. This database not only serves as a repository for the data collected since the inception of the *Study*, but also allows for data analysis using built-in functions. The database also provides customized reports and tables for easy data interpretation. Each year, the projects database is updated with the inclusion of projects data submitted for that *Study* year. The analysis and the reporting features of the database are also updated.

Table 3-3 summarizes the number of projects included in the database and in the analyses. The 5-year database used for the current analysis contains 655 projects. This total excludes project data older than five years or projects identified as outliers. Projects identified as outliers are not included in the performance data analysis but are retained in the performance database. In addition, projects delivered by alternative delivery are excluded from the analysis but included in the database. The 655 projects selected for analysis do not include projects delivered by alternative delivery. As explained under subsection A *Study* Criteria of this chapter, outlier analysis was performed using statistical techniques to ensure consistency in the selection of outlier data points. This methodology was first implemented during *Update 2008* and the agencies recognize the merits of a scientific approach for outlier elimination. Some of the projects classified as outliers in previous *Study* years have been included in the performance data analysis, and vice-versa.

This is an improved practice when compared to prior *Study* years where project data points were classified as outliers based on a combination of statistical parameters and subjective judgments by the Project Team. Previously, projects identified as outliers during one *Study* phase were kept as outliers in subsequent *Study* phases.

Table 3-3 shows that as the rules for project selection were refined, the number of non-representative and projects with TCC less than $100K have decreased. In addition, only fourteen projects have been excluded as outliers in the *Update 2013 Study* as compared to the elimination of several hundred projects prior to the refinement of the statistical model in 2009.

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. While over 2,000 projects have been collected in the database, the number of projects analyzed in any *Study* phase is significantly lower due to the criteria selected for the inclusion of projects in the database. Although the requirement for the minimum number of projects per classification has been met for most project categories, more data needs to be collected to ensure an even distribution of projects amongst all classifications.

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. As previously indicated, there are 4 project types (Municipal Facilities, Streets, Pipe Systems, and Parks) and 16 project classifications included in this *Study*. **Table 3-4** summarizes the distribution of projects included in the *Update 2013* analyses.

Table 3-3
Growth of Database

Study Phase[1]	Submitted			Deleted[2]		Count After Deletions[5]	Excluded		Net
	Traditional Projects Submitted	(a) Alternative Delivery Projects Submitted[4]	(b) Total	(c) TCC <$100K	(d) Non-Repre-sentative	(e)=(b)-(a)-(c)-(d)	(f) Project Completion Date < 2006	(g) Outliers[3]	Projects in Analyses (h)= (e)-(f)-(g)
I	239	0	239	27	44	168	168	0	0
II	285	0	285	0	35	250	250	0	0
III	262	0	262	0	29	233	233	0	0
IV	173	0	173	18	24	131	131	0	0
V	182	0	182	0	4	178	178	0	0
VI	191	0	191	0	4	187	187	0	0
VII	158	0	158	2	0	156	156	0	0
VIII	153	0	153	4	0	149	43	1	105
IX	173	10	183	2	0	171	24	3	144
X	123	15	138	1	0	122	0	2	120
XI	159	15	174	0	4	155	1	6	148
XII	143	8	151	3	0	140	0	2	138
Total	**2,241**	**48**	**2,289**	**57**	**144**	**2,040**	**1,371**	**14**	**655**

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, VII = 2008, VIII = 2009, IX = 2010, X = 2011, XI = 2012, and XII = 2013.

[2] Projects that do not fit *Study* criteria for project classifications and minimum TCC of $100K were removed from the database.

[3] Outliers are identified based on statistical analysis.

[4] These represent projects delivered by alternative project delivery techniques. These projects are kept in the database, but not analyzed. These projects will be analyzed when a sufficient number of such projects are available to facilitate meaningful analyses.

[5] Projects delivered by alternative techniques are retained in the database but not analyzed. These projects are not included in the 655 projects selected for analysis in the Update 2013 Study.

Table 3-4
Projects Distribution Matrix

Agency	San Diego	Sacramento	San Francisco	Los Angeles	Long Beach	San Jose	Oakland	Total[3]
Municipal Facilities	**15**	**8**	**11**	**9**	**9**	**17**	**19**	**88**
Comm./Rec. Center/ Child Care/Gyms		1	4	1	2	4	13	25
Libraries	2		3		1	7	2	15
Other Municipal Facilities[2]	13	7	4	4	5		2	35
Police/Fire Stations				4	1	6	2	13
Parks	**9**	**1**	**5**	**8**	**1**	**15**	**14**	**53**
Playgrounds	4	1	4	5	1	11	8	34
Restrooms	1					2	2	5
Sportfields	4		1	3		2	4	14
Pipe Systems	**89**	**23**	**28**	**59**	**5**	**38**	**28**	**270**
Gravity Systems (Storm Drains/Sewers)	37	15	26	56	1	37	28	200
Other Pipes	6	3		3	1			13
Pressure Systems	41	5	2					48
Pump Stations	5				3	1		9
Streets	**24**	**42**	**53**	**15**	**46**	**39**	**25**	**244**
Bike/Pedestrian/ Streetscapes	13	21	7	2	2	11	16	72
Bridges (New/Retrofit)	2	3		6	3	2	1	17
Reconstructions	3	3	43	3	37	6	2	97
Signals	1	10	3		3	18	6	41
Widening/New/ Grade Separations	5	5		4	1	2		17
Total[1]	**137**	**74**	**97**	**91**	**61**	**109**	**86**	**655**

Notes:

[1] Total refers to the projects included in the Update 2013 analyses only.

[2] Projects include design and/or construction activities for parking structures, yards, soil anchors, docks, animal shelters, reservoirs, water treatment plants, piers, and animal services centers.

[3] Total excludes projects delivered by alternative delivery mechanisms such a design-build, JOC, and CM@Risk. Projects delivered by alternative techniques are retained in the database but not analyzed. These projects are not included in the 655 projects selected for analysis in the Update 2013 Study.

D. CHARACTERISTICS OF DATA ANALYZED

Project performance data were analyzed using the custom database application at both the Project Type level and the Project Classification level (see **Table 3-1**).

Project Count and Project Delivery by Completion Year

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 percent of the values are above and 50 percent of the values are below.

As indicated in **Table 3-5**, median project size has fluctuated considerably since 2008. The median project size declined approximately 8 percent between 2008 and 2009. After declining in 2009, there was a significant increase in median project size in 2010 with an approximately 25 percent increase over 2009 levels. The median project size dropped slightly between 2010 and 2011, and then dropped 31 percent in 2012. A similar trend is observed in the average project size. The fluctuations could be due to a combination of several factors such as the selection of projects using the five-year window, elimination of projects with high TCC values during the outlier analysis, and the addition of several new projects with low TCC values.

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

Project Completion Date	Count by Project Type					Project Delivery Data				
	Municipal Facilities	Streets	Pipes	Parks	Total	Average TCC ($M)	Median TCC ($M)	Design Cost (% of TCC)	Construction Management Cost (% of TCC)	Project Delivery Cost (% of TCC)
2008	17	46	50	15	128	$2.32	$0.90	24%	17%	41%
2009	26	72	56	10	164	$2.44	$0.83	21%	18%	39%
2010	15	49	78	8	150	$2.47	$1.04	22%	19%	41%
2011	23	49	58	11	141	$2.60	$1.03	26%	21%	47%
2012	7	28	28	9	72	$1.25	$0.71	29%	21%	50%
Total/ Average	**88**	**244**	**270**	**53**	**655**	**$2.33**	**$0.92**	**24%**	**19%**	**43%**

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.

[3] Total excludes projects delivered by alternative delivery mechanisms such a design-build, JOC, and CM@Risk. Projects delivered by alternative techniques are retained in the database but not analyzed. These projects are not included in the 655 projects selected for analysis in the Update 2013 Study.

While project delivery costs measured as a percentage of the TCC have remained relatively stable in the past, this percentage has increased 9 percentage points from 2010 to 2012. This can be attributed to the "below market rate" bids that are being widely observed in California's construction sector. In addition, factors such as personnel turnover in the agencies have also affected productivity, leading to inefficiencies due to the loss of project specific knowledge.

Project Delivery Costs by Project Type

Table 3-6 shows project delivery costs by each of the four project types in the *Study* for the full range of TCC. The project delivery percentage for a category is the arithmetic average of the project delivery percentages of the individual projects grouped under that category.

Projects belonging to the Municipal category have the lowest average project delivery percentage. The Pipes category has the maximum number of projects (n = 270) in the *Update 2013* database. The Streets category also has a similar number of projects in the database

Table 3-6
Project Delivery Costs by Project Type (% of TCC) (Full Range of TCC)

Type	Design	Construction Management	Project Delivery (Total)	Median Total Construction Cost ($M)	Number of Projects (N)
Municipal Facilities	19%	14%	33%	2.35	88
Parks	28%	21%	49%	0.49	53
Pipe Systems	23%	20%	42%	1.06	270
Streets	25%	20%	45%	0.74	244
Average	**24%**	**19%**	**43%**	**0.92**	**655**

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.
[3] Total excludes projects delivered by alternative delivery mechanisms such a design-build, JOC, and CM@Risk. Projects delivered by alternative techniques are retained in the database but not analyzed. These projects are not included in the 655 projects selected for analysis in the Update 2013 Study.

(n = 244). Along with the Parks category, the Streets category also exhibits a high average project delivery cost. The average project delivery percentage for the overall dataset is approximately 43 percent. These percentages have remained relatively stable for the four project types over the past few years.

Over the course of the *Study*, the agencies have 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.

Table 3-7 shows project delivery costs by each of the four project types in the *Study* for the 80th percentile subset of TCC (Note: In *Update 2009*, the concept of looking at a subset of projects was introduced. This subset generally characterizes the projects in the type or classification being examined. This step was taken as it was generally believed that project delivery for the very large projects did not characterize the overall projects in the type of classification being examined.). The trends in the project delivery costs for the projects in the 80th percentile subset of TCC follow that of the projects in the full range of TCC. As expected based upon the agencies' practical experience, project delivery costs are higher for projects that fall in the 80th percentile subset of TCC.

Table 3-7
Project Delivery Costs by Project Type (% of TCC)
(Smaller Project Subset of TCC)

Type	Design	Construction Management	Project Delivery (Total)	Median Total Construction Cost ($M)	Number of Projects (N)
Municipal Facilities	21%	14%	35%	1.00	70
Parks	30%	23%	53%	0.42	43
Pipe Systems	25%	21%	46%	0.76	217
Streets	27%	21%	48%	0.52	195
Average	**26%**	**20%**	**46%**	**0.65**	**525**

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.

[3] Total excludes projects delivered by alternative delivery mechanisms such a design-build, JOC, and CM@Risk. Projects delivered by alternative techniques are retained in the database but not analyzed. These projects are not included in the 655 projects selected for analysis in the Update 2013 Study.

Consultant Usage Analysis

Project delivery performance and consultant usage by agency are presented in **Table 3-8**. The table indicates that approximately 59 percent of the design work and approximately 80 percent of the construction management efforts are completed in-house by the participating agencies. Consultants account for approximately 30 percent of the total project delivery costs while in-house efforts by the participating agencies accounts for the remaining 70 percent of the project delivery costs. For the available data, a clear relationship between the level of in-house effort and project delivery costs cannot be established.

Table 3-8
Project Delivery Performance and Consultant Usage by Agency

AGENCY	DESIGN					CONSTRUCTION MANAGEMENT					PROJECT DELIVERY					TCC	
	In-House		Consultants		Total % of TCC[2]	In-House		Consultants		Total % of TCC	In-House		Consultants		Total % of TCC	Average	Median
	($M)	% of Design	($M)	% of Design		($M)	% of CM	($M)	% of CM		($M)	% of PD	($M)	% of PD			
Agency A	44.8	58%	32.5	42%	25%	45.8	66%	23.6	34%	18%	90.6	62%	56.1	38%	43%	2.8	1.1
Agency B	8.6	52%	8.1	48%	27%	8.1	73%	3	27%	17%	16.7	60%	11.1	40%	44%	1.1	0.5
Agency C	29.5	96%	1.2	4%	19%	27.6	99%	0.2	1%	16%	57.1	98%	1.4	2%	35%	1.9	1.4
Agency D	28.4	57%	21.7	43%	21%	62	89%	7.8	11%	28%	90.4	75%	29.4	25%	49%	4.3	1.4
Agency E	4.8	30%	11.1	70%	18%	7.5	49%	7.7	51%	14%	12.3	40%	18.8	60%	32%	1.6	0.7
Agency F	23.8	53%	21.5	47%	28%	38.8	87%	5.6	13%	27%	62.6	70%	27.1	30%	56%	2.7	0.5
Agency G	13.6	61%	8.6	39%	25%	7.6	100%	0	0%	9%	21.2	71%	8.6	29%	34%	1.3	0.5
OVERALL	**153.5**	**59%**	**104.6**	**41%**	**24%**	**197.3**	**80%**	**48**	**20%**	**19%**	**350.9**	**70%**	**152.7**	**30%**	**43%**	**2.3**	**0.9**

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. REGRESSION ANALYSES RESULTS

During *Update 2008*, several changes were made to improve the modeling methodology. These included developing a statistically-sound method for outlier analysis, using a linear trendline regression for modeling project costs relationships, and using the upper and lower bounds of a 95 percent confidence interval to estimate the range of the project delivery percentages. As a result of these improvements, the model relationships could be predicted with a high degree of certainty as compared to previous *Study* years. As previously indicated, during *Update 2009*, the modeling methodology was further refined by analyzing the data in two ranges of TCC. Results from the regression analysis methodology are discussed in **Appendix B**.

In most cases, the results reflect the agencies' experience with the delivery of capital projects that on a percentage basis projects with lower TCCs are more expensive to deliver than projects with higher TCCs. Only 3 out of the 16 categories have lower project delivery percentages for the 80th percentile subset of projects than the full range of projects. It is concluded that the model results are reasonable from a statistical perspective.

F. OTHER CONSIDERATIONS

Effect of Economic Conditions

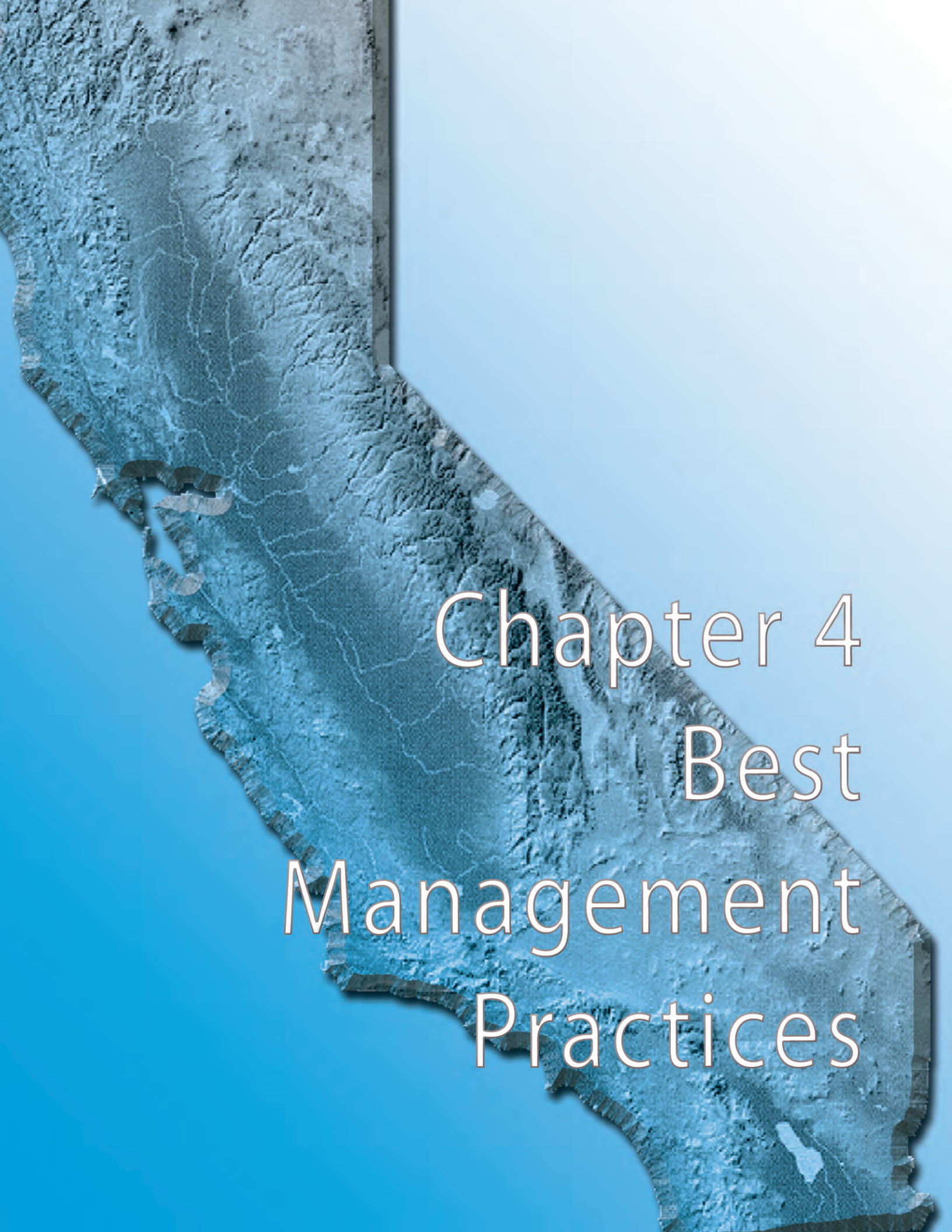
Due to the lagging recovery in the economy, agencies are receiving bids that are significantly lower than the engineer's estimates. The impact of such low bids on project delivery percentages were discussed in the *Update 2010 Study* where the participating agencies summarized the trends observed in construction bids. In *Update 2011* and *Update 2012*, the participating agencies conducted a preliminary analysis comparing construction bids to engineer's estimates to identify the variances and discussed potential causes for the variances. The analysis revealed that for almost all project categories, the bids received were substantially lower than the engineer's estimates. These findings resulted in the development of a Special Study in *Update 2013* which focused on developing a methodology to understand and quantify the impacts of declining construction costs on project delivery percentages. The Special Study methodology and conclusions are presented in **Appendix D**.

Size of the Database

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. The participating agencies are also challenged to identify as many completed projects as possible that meet the rest of the *Study* criteria. The benefits of projects delivered via alternative delivery techniques need to be quantified by including them for analysis in the project database. However, due to the significant difference in delivery mechanisms, those projects will have to be analyzed separately from the rest of the projects in the database.

BMP Implementation and Project Delivery Costs

Although it is desirable for project delivery costs to decrease as agency efficiencies increase and BMPs are implemented, this can be confounded by other factors that change annually such as project size and construction cost fluctuations.



Chapter 4
Best Management Practices

CHAPTER 4 Best Management Practices

At the genesis of this *Study*, the agencies examined over 100 practices used in project delivery. Included in this *Study* were a number of practices that the participants did not commonly use at the time, but believed could have value if ultimately implemented as Best Management Practices (BMPs). Each year the agencies look at changes in the industry in order to identify new BMPs. Existing BMPs, in some cases, are reworked by the agencies to address specific challenges encountered during implementation. BMPs are also added or modified to reflect relevant experiences by the participants. As in the past, agency implementation of these selected practices will continue to be tracked during the *Study*.

While a BMP may be developed to address a specific issue, its implementation may affect other elements of project delivery. A BMP that reduces project schedule, for example, may also favorably impact both communication and project costs. While it is not possible to discreetly quantify all the benefits of the BMPs, the participating agencies developed an approach to identify the major benefits associated with each BMP. This was accomplished in *Update 2010 Study* by assigning a Perceived Value to each BMP. This continues for all new BMPs. The participating agencies judge that each of the BMPs favorably impact one of the following categories:

- Cost
- Schedule
- Quality
- Communication
- Environment
- Customer Service

To identify the predominant Perceived Values associated with each new BMP, the participating agencies vote on which Perceived Values are most applicable and the responses are then tabulated. A Perceived Value receiving three or more votes relative to a BMP is considered to be of significance and received a check mark as shown in **Table 4-1**. If a check mark is not shown, it indicates that the Perceived Value received two or less votes relative to a BMP; it does not mean that a BMP has no benefit to that Perceived Value category. The majority of the BMPs are assigned a Perceived Value of either “cost” or “schedule”, followed by “quality”. This indicates that majority of the agencies found these “Perceived Values” as most applicable to the adopted BMPs.

A. NEW BEST MANAGEMENT PRACTICES

In *Update 2013*, the Project Team added one new BMP to the BMP implementation tracking list. The new BMP was developed by discussions during a quarterly meetings plus several follow-up conference calls. The new BMP is:

- 6.n 2013 – Determine appropriate consultant costs for professional services agreements.

This new BMP is believed to directly influence cost, schedule, communication, and customer service aspects of either design or construction management, and, ultimately, project delivery efficiency.

B. DESCRIPTION OF BEST MANAGEMENT PRACTICES

Included in this report are descriptions of each BMP. They were first included in the *Study 2002* report. These descriptions, presented in **Table 4-1**, have been updated to reflect the changes in the interpretation of those BMPs, the inclusion of Perceived Values for each BMP as well as additions (year developed shown with number) to the BMP list since 2002.

Table 4-1
Description of Best Management Practices

Category	Ref:*	BMP	Description	Perceived Value					
				Cost	Schedule	Quality	Communication	Environment	Customer Satisfaction
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.	✓	✓				

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

Category	Ref:*	BMP	Description	Perceived Value					
				Cost	Schedule	Quality	Communication	Environment	Customer Satisfaction
Planning	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.		✓		✓		
Design	2.b.	Provide a detailed clear, precise scope, schedule, and budget to designers prior to design start.	Design professionals will work more efficiently if given a clear scope when contracted to provide the design services. Clear scope and budget should be defined in advance and made a part of the design professional's contract if/when a consultant is used.	✓	✓	✓	✓		
	2.f.	Define requirements for reliability, maintenance, and operation prior to design initiation.	Reliability, maintenance, operational requirements, and standard materials and equipment should be clearly defined in advance, approved by the user/ client, and included in the design professional's contract when a consultant is used.	✓		✓			✓
	2.i.	Adapt successful designs to project sites, whenever possible (e.g. fire stations, gymnasiums, etc).	Successful designs of fire stations, police facilities, maintenance facilities, pump stations, and many other projects should be re-used when possible. Site adaptations of successful designs may reduce design costs by half.	✓	✓				

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

Category	Ref:*	BMP	Description	Perceived Value					
				Cost	Schedule	Quality	Communication	Environment	Customer Satisfaction
Design	2.k. 2003	Train in-house staff to use Green Building Standards.	Communities have a stake in the environment as well as in the cost of operating and maintaining public facilities. Utilizing "Green Building Standards" allows facilities to be built and operated with renewable resources and other environmentally sound practices.					✓	
	2.l. 2004	Limit Scope Changes to early stages of design.	It is well known within the industry that the later a change occurs in the construction process, the more costly the change is.	✓	✓				
	2.m. 2004	Require scope changes during design to be accompanied by budget and schedule approvals.	All scope changes after the initial definition within the design agreement will affect project delivery cost and therefore should be documented. Documentation should include an understanding and acceptance/approval by all stakeholders of the cost and time implications of any changes.	✓	✓				
	2.n. 2006	Implement a rotating Request for Quote process for contracting small projects to streamline the bidding and award process during construction. (Include criteria for exemptions from formal Council approval.)	Smaller projects cost more (as a percentage of construction cost) to deliver. One way of reducing the cost of project delivery on small projects is to shorten the bid and award process by setting a threshold amount under which the delivery team may solicit and receive quotes from qualified contractors and award contracts without getting Board/Council prior approval.	✓	✓				
	2.o 2007	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	Perceived Value					
				Cost	Schedule	Quality	Communication	Environment	Customer Satisfaction
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.	✓	✓				
	2.q 2010	Receive bids electronically.	Electronic bidding programs have increased over the last several years. Receiving bids electronically provides a centralized location to store all bid related documents for public access along with ability to increase bidder participation.				✓		✓
	2.r.2011	Use of electronic signatures to do direct conversion from CAD to PDF.	Currently wet signatures on all pages is standard practice. This causes scanned files to be very large electronic files. Use of electronic signatures in all but the cover page will reduce file size and allow for easier distribution.	✓	✓	✓			
	2.s.2011	Have awarding authority to approve plans, advertisement and award of contract in one board action.	Combine approval of plans, advertisement and award of contract by the awarding authority into a single action.		✓				
	2.t.2011	Expedite project duration from design completion to notice to proceed. Examples include items such as: - Pre-qualification of contractors - Good Faith Effort submitted on-line - Submittal incentives (i.e., award and material submittals allowed 30 day period. Every day early is added to construction contract duration) - Contract liaison within department. - Electronic proposal documents provided 48 hours after bid opening. Hard copy provided at bid time - Contractor's self certification	Implementation of new practices such as using an electronic process or pre-qualification in an effort to reduce the overall timeframe from design completion to notice to proceed.	✓	✓				✓

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

Category	Ref:*	BMP	Description	Perceived Value					
				Cost	Schedule	Quality	Communication	Environment	Customer Satisfaction
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.			✓			

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

Category	Ref:*	BMP	Description	Perceived Value					
				Cost	Schedule	Quality	Communication	Environment	Customer Satisfaction
Quality Assurance / Quality Control	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.	✓	✓		✓		
	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.	✓	✓				

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

Category	Ref:*	BMP	Description	Perceived Value					
				Cost	Schedule	Quality	Communication	Environment	Customer Satisfaction
Construction Management	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.	✓		✓	✓		
	4.IV.b 2010	Implement Electronic Contract Payment Process.	Many approvals are required to process contract payments. Using electronic procedures provides an avenue to expedite the necessary approvals.	✓					✓

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

Category	Ref:*	BMP	Description	Perceived Value					
				Cost	Schedule	Quality	Communication	Environment	Customer Satisfaction
Construction Management	4.IV.c 2010	Agency should file As-built drawings within 6 months of project completion.	One of the last tasks for a project is the updating and filing of As-built drawings. Many times, this task is put off for other pressing matters. This BMP establishes a 6 month deadline.			✓			✓
	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.	✓					

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

Category	Ref:*	BMP	Description	Perceived Value					
				Cost	Schedule	Quality	Communication	Environment	Customer Satisfaction
Project Management	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.			✓			
	5.II.d 2006	Implement verification procedures to ensure that PM training includes Agency policies, procedures, forms, and standards of practice (scheduling, budgeting, claims avoidance, risk analysis, etc).	The success of a project is influenced significantly by the education and skills of the project manager. Agencies should verify that PM's know and use the tools available within an Agency and that they are current with industry practices.		✓	✓			
	5.III.a.	Adopt and use a Project Control System on all projects.	A web-based project control system will improve collaboration and documentation during the design and construction process. Questions, answers, proposals, and decisions can be expedited using a collaborative system.	✓	✓		✓		
	5.III.e 2006	Implement a financial system that tracks expenditures by category to monitor project hard and soft costs during project delivery.	It is recommended that a system that identifies actual expenditures against planned budgets be made available to project managers to be used as a performance measurement tool.	✓					
	5.III.f 2006	Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables.	Getting accurate data on the cost of project delivery depends upon being able to capture and classify expenses to the phases of construction on each project. Ideally, costs would be identified by each of five project delivery phases and coded to particular milestones or deliverables.	✓	✓				

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

Category	Ref:*	BMP	Description	Perceived Value					
				Cost	Schedule	Quality	Communication	Environment	Customer Satisfaction
Project Management	5.III.g 2006	Monitor "earned value" versus budgeted and actual expenditures during project delivery.	Soft costs "burn rate" should be proportionate to percent complete during the design and construction phases. Using a program which measures and relates soft cost expenses to earned values permits better tracking and control during project delivery.	✓					
	5.III.h 2007	Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments.	Prolonged ROW acquisition can be avoided if all stakeholders agree on milestones to complete the acquisitions.		✓				
	5.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.III.j 2012	Implement a schedule tracking system that monitors the actual percent complete against the percent of time elapsed for each identified phase of the approved project.	Establishing a system where a project's schedule is broken into its phases. Actual percent complete is then measured against time elapsed in each phase throughout the development of the project. This system becomes a tool for management by project managers and supervisors."	✓	✓		✓		✓
	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.	✓	✓			✓	

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

Category	Ref:*	BMP	Description	Perceived Value					
				Cost	Schedule	Quality	Communication	Environment	Customer Satisfaction
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.	✓	✓				
	6.n.2013	Determine appropriate consultant costs for professional services agreements.	Establish a documented agency methodology for analyzing acceptable consultant costs and billing rates for use in contract negotiations.	✓	✓		✓		✓
Sustainable Development	7.a.2009	Identify the environmental benefits of the project at the time of award.	Provide written, environmental benefits to the awarding authority on projects that use sustainable practices or aim to achieve LEED certification.					✓	

C. PROGRESS ON BEST MANAGEMENT PRACTICE IMPLEMENTATION

The agencies continued to exchange ideas regarding strategies for implementing various BMPs, during *Update 2013*, by using networking opportunities during the face-to-face meetings, team discussions during conference calls, and the online discussion forum. Agencies shared experiences and provide feedback to update BMPs that have been fully implemented for several years. Agencies pursued fully implementing BMPs even though many remain only partially implemented. Constraints limit the full implementation of BMPs for some agencies. In those instances, a partially implemented BMP is considered complete by that agency and is noted in **Table 4-2**. Full implementation of BMPs continues to be impacted by staff reductions, furloughs, and the management's increased involvement in resolving budgetary issues. Agencies continue to focus their efforts on adherence to BMPs that have been implemented and judged to provide efficiencies in project delivery processes for participating departments. However, several agencies have established a goal of implementing several BMPs for the upcoming year. As of *Update 2013*, and including the addition of the new BMP, the agencies have fully implemented about 70 percent of all BMPs. Seven (7) percent of the total BMPs have been partially implemented by the agencies. Many of the remaining BMPs require more involvement and input from multiple departments making them more complicated to implement than other BMPs.

To support the linking of BMPs to performance improvements, BMP implementation by the agencies is tracked.

BMPs targeted for future implementation and progress on implementation of adopted BMPs since the *Update 2013* are summarized below.

I. City of Los Angeles

Implemented from June 2012 to September 2013:	Targeted October 2013 Onward:
• 2.r. 2011 Use of electronic signatures to do direct conversion from CAD to PDF (Partially Implemented) • 5.III.j 2013 Implement a schedule tracking system that monitors the actual percent complete against the percent of time elapsed for each identified phase of the approved project and schedule.	• 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.

II. City of Long Beach

Implemented from June 2012 to September 2013:	Targeted October 2013 Onward:

III. City of Oakland

Implemented from June 2012 to September 2013:	Targeted October 2013 Onward:
• 3.III.I.2007 Designate a responsible person for and establish a process of notifications and milestones for utility relocations (Partially Implemented) • 4.IV.c 2010 Agency should file As-built drawings within 6 months of project completion (Fully Implemented). • 6.n 2013 Determine appropriate consultant costs for professional services (partially implemented).	

IV. City of Sacramento

Implemented from June 2012 to September 2013:	Targeted October 2013 Onward:
Department of Transportation Department of Utilities • 2.r. 2011 Use of electronic signatures to do direct conversion from CAD to PDF (Implemented in 2012) • 2.s. 2011 Have awarding authority to approve plans, advertisement and award of contract in one board/council action. • 3.II.b Perform a formal Value Engineering Study for projects larger than $1 million • 4.IV.c 2010 Agency should file As-built drawings within 6 months of project completion. • 5.III.j 2013 Implement a schedule tracking system that monitors the actual percent complete against the percent of time elapsed for each identified phase of the approved project and schedule (partially Implemented) • 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. (Implemented in 2009).	Department of Transportation Department of Utilities • 4.V.c 2003 Make bid documents available online.

V. City of San Diego

Implemented from June 2012 to September 2013:	Targeted October 2013 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. • 2.q 2010 Receive bids electronically.	

VI. City and County of San Francisco

Implemented from June 2012 to September 2013:	Targeted October 2013 Onward:
• 6.n 2013 Determine appropriate consultant costs for professional services (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) (Partially Implemented).

VII. City of San Jose

Implemented from June 2012 to September 2013:	Targeted October 2013 Onward:
• 6.n 2013 Determine appropriate consultant costs for professional services (partially implemented).	• 3.I.a Develop and use a standardized Project Delivery Manual (partially implemented) • 3.III.a. Use a formal Quality Management System. (partially implemented) • 3.III.m.2008 Maintain and regularly update electronic standard contract specifications and related documents as well as technical/special provisions. • 5.II.a Provide formal training for Project Managers on a regular basis. • 5.II.d 2006 Implement verification procedures to ensure that PM training includes agency policies, procedures, forms, and standards of practice (scheduling, budgeting, claims avoidance, risk analysis, etc.).

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
						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.	✓	✓	✓	✓	✓	✓	✓	✓	SC DU: Community involved after project is better-defined, typically at 30% design.
	1.b.	Complete Feasibility Studies on projects prior to defining budget and scope.	✓	✓	✓	✓	✓	✓	✓	✓	LB, SD: When applicable SC DU: Only on complex projects that require a Feasibility Study
	1.d.	Utilize a Board/Council project prioritization system.	✓	NI	✓	✓	TBD	✓	✓	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 SF: Capital plan developed City-wide and priorities set by City-wide committee of major department heads.
	1.e.	Resource load all CIP projects for design and construction.	✓	NI	✓	✓	✓	✓	✓	✓	SC DU: Estimate drafting only. SD: Doesn't include human resource loading.
	1.f.	Include a Master Schedule in the CIP that identifies start and finish dates for projects.	✓	NI	✓	✓	✓	✓	✓	✓	SC DU: Completion date only estimated, not determined by scheduling analysis.

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

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Planning	1.g 2007	Make an early determination on which environmental document is required and incorporate into the schedule.	✓	✓	✓	✓	✓	✓	✓	✓	
	1.i.	Show projects on a Geographical Information System.	✓	✓	✓	✓	✓	✓	✓	✓	LB: Infrastructure only
Design	2.b.	Provide a detailed clear, precise scope, schedule, and budget to designers prior to design start.	✓	✓	✓	✓	✓	✓	✓	✓	SC DU: General scope only for simple projects.
	2.f.	Define requirements for reliability, maintenance, and operation prior to design initiation.	✓	✓	✓	✓	NI	✓	✓	✓	SD: Some Asset types only.
	2.i.	Adapt successful designs to project sites, whenever possible (e.g. fire stations, gymnasiums, etc).	✓	✓	✓	✓	✓	NI	✓	✓	SD: Due to the public input.
	2.k. 2003	Train in-house staff to use Green Building Standards.	✓	✓	✓	NI	NI	✓	✓	✓	This BMP is intended to improve client satisfaction (quality) and may not reduce project delivery cost directly. SF: When applicable

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

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Design	2.l. 2004	Limit Scope Changes to early stages of design.	✓	✓	✓	✓	NI	✓	✓	✓	SC DU, SD: Control and minimize, but difficult to eliminate, since clients and engineers come up with new/better solutions in addition to the community and politicians influence.
	2.m. 2004	Require scope changes during design to be accompanied by budget and schedule approvals.	✓	✓	✓	✓	NI	✓	✓	✓	
	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	✓	✓	PI	SC DT: Maintains on-call consultant list for various engineering, traffic, landscape, architecture, and geotechnical services. SF: As-needed job order contracting (JOC). SJ: Regularly procures a number of on-call contractors for various small projects.
	2.o 2007	Establish criteria for obtaining independent cost estimates which take in consideration both project characteristics and volatility of the market.	NI	PI, TBD	TBD	TBD	NI	TBD	✓	PI	SF: Establishing estimating database SJ: No criteria established – done on a case-by-case basis.
	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.	✓	TBD	TBD	✓	✓	✓	✓	✓	

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

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Design	2.q 2010	Receive bids electronically.	NI	PI	PI	NI	TBD	✓	NI	TBD	LB: Currently receive bids for projects less than $100k
	2.r. 2011	Use of electronic signatures to do direct conversion from CAD to PDF.	PI	TBD	NI	TBD	✓	✓	TBD	TBD	
	2.s. 2011	Have awarding authority to approve plans, advertisement and award of contract in one board/council action.	NI	✓	✓	✓	✓	✓	TBD	✓	SCDT: City Council approval is not required to advertise. SJ: The Director of Public Works approves all plans and advertisements; also generally awards contracts $1M or less. SD: Part of the CIP streamlining, city council approval is obtained once a year on a list of projects to be awarded as a part of the annual budget hearing.

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Table 4-2
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Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Design	2.t. 2011	Lessen time period between design completion and issuance of notice to proceed. Examples include items such as: - Pre-qualification of contractors - Good Faith Effort submitted on-line - Submittal incentives (i.e., award and material submittals allowed 30 day period. Every day early is added to construction contract duration) - Have ability to issue contracts within your department . - Electronic proposal documents provided 48 hours after bid opening. Hard copy provided at bid time - Contractor's self certification	✓	TBD	PI	PI	TBD	✓	TBD	✓	SCDT: Can the last item be clarified? What is meant by "contractor's self-certification"? SD: has an established contractors pre-qualification program
Quality Assurance/ Quality Control	3.I.a.	Develop and use a standardized Project Delivery Manual.	✓	PI, 2011	✓	✓	✓	✓	✓	PI, 2014	SC DU: Badly needs updating. LB: Staffing cuts have delayed completion SD: currently updating it as a result of some organization changes

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Implementation of BMPs (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Quality Assurance/ Quality Control	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
	3.III.a.	Use a formal Quality Management System.	✓	✓	✓	✓	NI	✓	✓	PI 2014	SD: Some asset types only LB: Staffing cuts have delayed completion
	3.III.b	Perform and use post-project reviews to identify lessons learned.	✓	PI	✓	✓	✓	✓	✓	✓	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. LB: Is being done only on projects that exceed 10% contingency or go into liquidated damages
	3.III.k 2007	Establish a Utility Coordinating Committee with members from public and private entities.	✓	PI	✓	✓	✓	✓	✓	✓	LB: Committee meets on an ad-hoc basis depending on utility availability
	3.III.l 2007	Designate a responsible person for and establish a process of notifications and milestones for utility relocations.	✓	NI	PI	✓	✓	✓	✓	✓	LB: PM remains responsible for all utility work on their projects SJ: Various Divisions/Sections have a utility coordinator and processes as needed
	3.III.m	Maintain and regularly update electronic standard contract specifications and related documents as well as technical/special provision.	✓	✓	✓	✓	✓	✓	✓	PI, 2014	SD: all standard documents are posted on the Dept. SharePoint for staff use.

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Implementation of BMPs (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
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	✓	✓	✓	✓	SD: Individual CO < $500,000 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	✓	✓	✓	✓	✓	✓	SJ: For projects > $10 M LB: City Attorney will not allow this language in project specifications
	4.III.a.	Use a team building process for projects greater than $5 million.	✓	✓	✓	✓	✓	✓	✓	✓	LB: As-needed SD: As-needed SF: As-needed SJ: For projects > $10 M SCDU: As needed
	4.IV.a.	Involve the Construction Management Team prior to completion of design.	✓	✓	✓	✓	✓	✓	✓	✓	SD: always request a constructability review service from the CM team on all projects.
	4.IV.b 2010	Implement Electronic Contract Payment Process.	NI	PI	TBD	NI	TBD	TBD	✓	TBD	LB: Currently done for some street related projects. SF: We are doing payments electronically via our first generation system which was demonstrated back in San Diego around 2008. We pay within the Mayor's directive of 10 to 15 days. And direct deposit is already available to the contractors through BofA.

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

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Construction Management	4.IV.c 2010	Agency should file As-built drawings within 6 months of project completion.	✓	PI	✓	✓	✓	PI	✓	PI	LB: being done on a go forward basis. Past projects still backlogged. SJ: Generally yes, however, it depends on post-construction circumstances. SD: has been implemented on sewer and water pipeline projects. LA: procedures are established in the Bureau of Engineering Project Delivery Manual.
	4.V.a. 2003	Delegate authority below Council to make contract awards under $1 million.	✓	✓	NI	NI	NI	✓	✓	✓	SD: Up to $30 million
	4.V.b 2003	Establish a pre-qualification process for contractors on large, complex projects.	✓	NI	✓	NI	✓	✓	✓	✓	LB: City uses minimum qualification in project specs in lieu of prequalification process
	4.V.c 2003	Make bid documents available online.	✓	✓	✓	✓	2013	✓	✓	✓	LA: Requested this through our ITA Dept for integration with our bid outreach application, but implementation will depend on their resource availability. SF: Documents on CD in interim SD: Bid documents are always posted on the E-bid board site.
Project Management	5.I.f.	Assign a client representative to every project.	✓	✓	✓	✓	✓	✓	✓	✓	
	5.I.j 2003	Create in-house project management team for small projects.	NI	✓	✓	NI	NI	NI	✓	✓	SC DU: Not enough PMs to justify this. Don't want to restrict staff to small, less-rewarding projects.

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

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Project Management	5.I.k 2004	Institutionalize Project Manager performance and accountability.	✓	✓	✓	✓	PI	✓	✓	✓	SC DU: There is interest but no definite plan. Implementation, although partially complete, is taken as far as it can go with our Agency.
	5.II.a	Provide formal training for Project Managers on a regular basis.	✓	TBD	✓	✓	NI	✓	✓	2014	LB, SD: Program implementation put on hold due to budget cuts
	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	✓	PI 2014	2014	
	5.III.a.	Adopt and use a Project Control System on all projects.	✓	✓	✓	✓	NI	✓	✓	✓	
	5.III.e 2006	Implement a financial system that tracks expenditures by category to monitor project hard and soft costs during project delivery.	✓	✓	✓	✓	✓	✓	✓	✓	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.	2013	✓	✓	✓	NI	✓	✓	TBD	
	5.III.g 2006	Monitor "earned value" versus budgeted and actual expenditures during project delivery.	2013	NI	✓	✓	NI	PI	✓	NI	

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Implementation of BMPs (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Project Management	5.III.h 2007	Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments.	PI	PI	NI	✓	NI	PI	NI	✓	SF: No additional ROW required outside military base closure. SD: It is difficult to get the commitments side.
	5.III.i 2008	Implement an electronic progress payment/schedule of values system to improve efficiency.	NI	NI	TBD	✓	NI	TBD	✓	TBD	LB: Current accounting system cannot accommodate a fully electronic approval process
	5.III.j 2012	Implement a schedule tracking system that monitors the actual percent complete against the percent of time elapsed for each identified phase of the approved project schedule.	✓	NI	✓	TBD	PI	TBD	PI	TBD	San Francisco DPW has developed a nascent database called the Enterprise Project Management system or EPM. The EPM is utilized for project updates, financial and schedule tracking, and as a reporting tool. Projects are scheduled utilizing MS Project software and imported into the EPM. Project Leads are responsible for creating the schedules per client department MOUs, and tracking actual schedules to baseline schedules. Because the EPM is relatively new, monitoring protocols have not been standardized. However, establishing the monitoring protocols and assuring Project Lead schedule conformance is the task for next year.
	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	✓	✓	✓	SJ: Various Divisions/Sections have an environmental coordinator as needed

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Implementation of BMPs (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Consultant Selection and Use	6.c.	Include a standard consultant contract in the RFQ/RFP with an indemnification clause.	✓	✓	✓	✓	✓	✓	✓	✓	SD: Some asset types 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	✓	✓	PI	SC DU: Threshold is $100,000. LB: City Manager retains authority up to $100k. SJ: City Manager has authority described.
	6.g.	Implement and use a consultant rating system that identifies quality of consultant performance.	✓	PI	✓	NI	NI	✓	✓	✓	SC DU: Track performance for those selected for "support services." LB: Used for on-call consulting services contracts
	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.	✓	✓	✓	✓	✓	✓	✓	✓	
	6.n 2013	Determine appropriate consultant costs for professional services agreements.	PI 2014	TBD	PI	PI	PI	PI	PI 2014	PI 2014	SC & SD indicate a strategy has been developed.

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Implementation of BMPs (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Sustainable Development	7.a. 2009	Identify the environmental benefits of the project at the time of award	TBD	✓	✓	✓	TBD	TBD	PI, TBD	✓	

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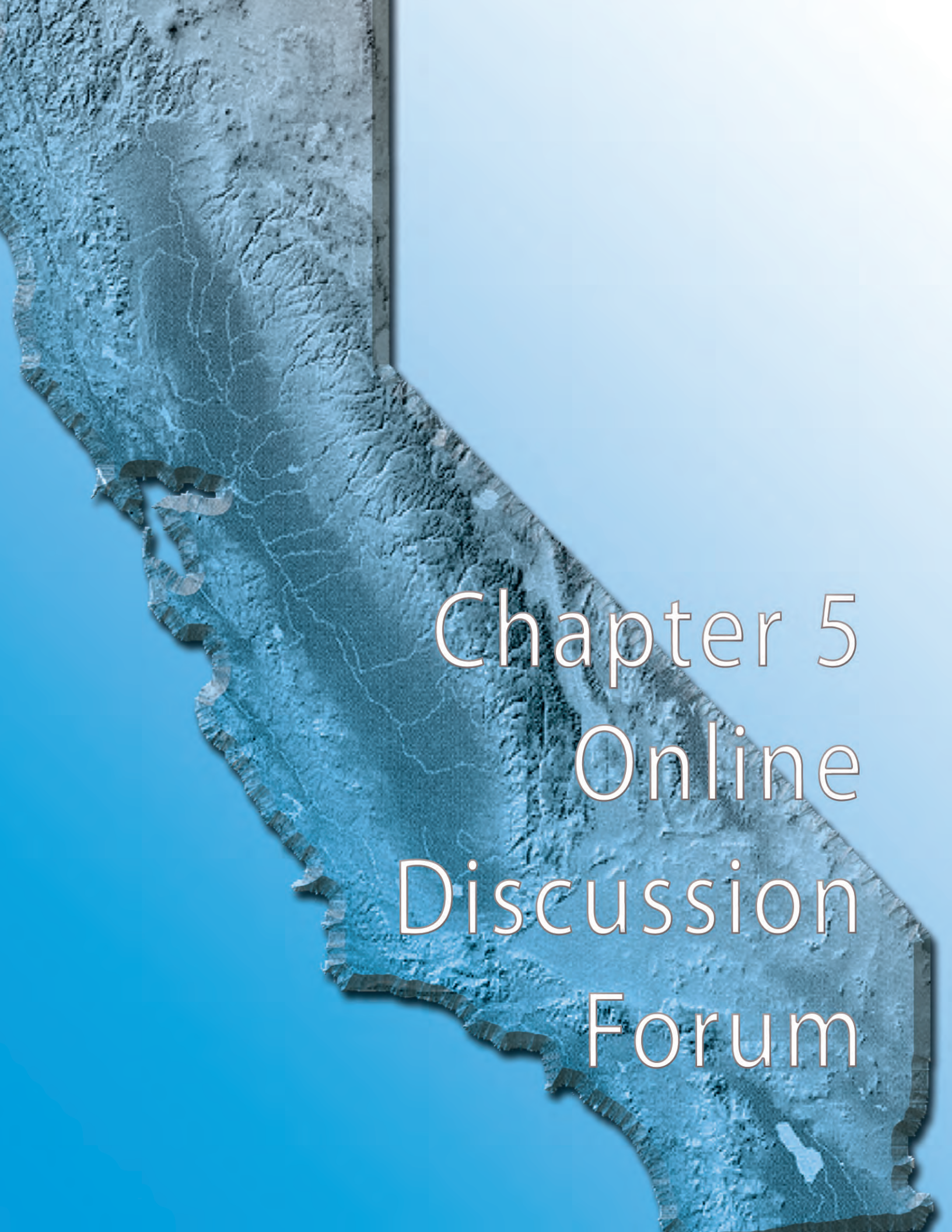


Chapter 5
Online Discussion Forum

CHAPTER 5 Online Discussion Forum

As in previous years, the ability to share issues or concerns continues to be one of the Study benefits most appreciated by the participating agencies. Information exchange occurs in a web based forum which provides an avenue to receive input from fellow team members. A total of ten topics were discussed during *Update 2013*. From this set of discussions, the following nine topics are presented as an example of the types of informational exchanges that occurred within the *Update 2013* Online Discussion Forum.

- APWA Media Query – CA Municipal Construction Bid Contingencies Issue
- Public Contract Code Section 4100 et seq. Subletting and Subcontracting Fair Practices Act
- Bidders' Inquiries
- ADA Curb Ramps
- Building Contractor Prequalification Questionnaire
- Consulting Management Manual/Guidelines
- Architectural Services Organization Structure
- Bid to Award Timeline and Percent to SLBE/ELBE
- Multi-Year CIP

A. APWA MEDIA QUERY – CALIFORNIA MUNICIPAL CONSTRUCTION BID CONTINGENCIES ISSUE

The City of San Diego received a question from APWA asking if there are industry standards in regards to municipal construction bid contingencies for California such as 10% to 15% on bid overages. San Diego replied they use 5% for Field Order (bid item) plus contingency (5% of contracts that are above $1.0 million and 10% for small contracts less than $1.0 million. Responses were also received from five other agencies.

The City of Los Angeles stated that they were unaware of an industry standard. However, generally, they typically have a 10% set-aside as a construction contingency in their overall project budget. In some cases where a project has a higher level of unknowns, such as unquantifiable amount of hazardous material removal, a construction contingency may be as high as 15-20%.

The City of Oakland typically use a 10% construction contingency in their overall project budget. However, if a project has more uncertainties and there is available budget, then they usually include an allowance in the bid item.

The City of Sacramento, Department of Public Works usually uses a 10% contingency. The City of San Francisco added that there is no legislation regarding project contingencies. They too typically

include a 10% contingency for new projects and 15% for renovations work. This will vary depending on project type and available budgets.

The City of San Jose, like others, responded that they were unaware of an industry standard. In 2002, the City of San Jose, adopted a Capital Project Contingency Policy. To briefly summarize their policy, it establishes general contingencies based on the type of project: 5% for street, sidewalk, or park projects; 10% for utility or building projects; 15% for building renovation projects. The contingency typically grows with projects that have greater unknowns, and a customized contingency can be established for any particular project via Council approval.

B. PUBLIC CONTRACT CODE SECTION 4100, ET SEQ. SUBLETTING AND SUBCONTRACTING FAIR PRACTICES ACT

The City of San Francisco has been receiving many bid protests or challenges to the sub listings resulting in the loss of some potential low bids based on our recent rulings that find the prime bidder non-responsible or his/her bid non-responsive due to the failure to list subs or failure to list responsible and qualified subs to perform specialty work.

In the past the rejection of a prime bidder was limited to failure to list specialty subs and they themselves did not possess those specialty license to self-perform the work. However, more recently a challenge was made to the failure of a prime bidder to list a qualified sub that possessed a Hazardous Substance removal Certification or Asbestos Certification to perform abatement work and the prime bidder did not possess those certification.

The City used to treat the failure to list subs an enforcement issue subject to penalties of up to 1-% of the subcontract amount for violating the Act but in doing so, we had to find most of the prime bidders qualified to perform the work of unlisted subs. The Bureau of CM asked the following questions:

1. How does your agency determine if the prime bidder is responsible and submits a responsive bid with these potential subcontracting infractions?

2. How does your agency deal with prime bidders failing to list subcontractors performing work amounting to in excess of ½ of 1% of the prime bidder's total bid price or, $10,000 whichever is greater if the work is for streets or highways including bridges, when the prime bidder may not be licensed or qualified to perform that work himself or herself?

3. If the prime bidder lists a sub that in not properly licensed or qualified (based on requirements in the Specification) and the prime bidder is also not qualified or licensed to perform that work, does your agency find the bidder either non-responsible (not qualified) or his/her bid non-responsive (not meeting the requirements of the bid) and reject that bid?

Responses were received from six agencies. The detailed responses can be found in **Table 5-1 below.**

Table 5-1 City of San Francisco
Public Contract Code Section 4100

Questions	1. How does your agency determine if the prime bidder is responsible and submits a responsive bid with these potential subcontracting infractions?	2. Buildings: Number of Public Safety Buildings and cost for replacement, Number of Civic Buildings and cost of replacement?	3. Storm Drains: CMP mileage and cost of replacement, other drainage mileage and estimated cost of replacement?
City of Los Angeles BOE	The Prime bidder is not required to subcontract any specific work (including specialty work like asbestos abatement for example), and may self-perform the work with their forces. The Prime bidder, or their workers, must possess the proper license or certificate prior to the start of any work on the project. The City of Los Angeles Inspector of Public Works verifies that the contractor holds the proper license classification for the work described, and approves them prior to the start of any work. The Prime bidder has the ability to hire someone on their payroll who has the license, and they would be within the requirements of the CPCC.	The City expects the prime bidder to self-perform if they failed to list a subcontractor in their bid. Section 4106 of the PCC states that "if a prime contractor fails to specify a subcontractor in excess of ½ of 1% of the prime contractor's total bid, the prime contractor agrees that he or she is fully qualified to perform that portion himself or herself, and that the prime contractor shall perform that portion himself or herself." Again, the Inspector of Public Works verifies that the contractor holds the proper licenses for certifications in writing prior to the start of any work on the project.	With regards to license status, the Board of Public Works does not disqualify bids if they do not possess an active license for specific work at the time of the bid. Only the Prime bidders must hold a current and active general contractor's license at the time of the bid. The Business of Professions Code is adamant about the licenses status of the Prime bidders on public agency projects. It does not require a contractor, listed as a subcontractor, to possess an appropriate license classification for specific or specialty work at the time of the bid opening. The Inspector of Public Works approves all subcontractors working on the project in writing prior to the start of their work. At such time, the subcontractor must hold the proper license and /or classification for the specific work described.
City of Oakland	Oakland's Contract Compliance Department reviews and makes determination of prime's "responsiveness" based on the City's L/SLBE or federal DBE programs when used. This is done by review of the listed subcontractors and associated dollar amounts in the bid. Oakland rarely deems a contractor "non-responsible". If they do, they would consult with their City Attorney and will go through a "due process" before making such determination.	Oakland currently does not have a process for determining if a prime failed to list the required subcontractor or supplier. It is mostly complaint-driven. When a bid protest is received, the Project Manager will work with the City Attorney to determine if the bid is responsive or not.	In this case, Oakland will find the bidder non-responsive.

Table 5-1 City of San Francisco
Public Contract Code Section 4100 (cont'd)

Questions	1. How does your agency determine if the prime bidder is responsible and submits a responsive bid with these potential subcontracting infractions?	2. Buildings: Number of Public Safety Buildings and cost for replacement, Number of Civic Buildings and cost of replacement?	3. Storm Drains: CMP mileage and cost of replacement, other drainage mileage and estimated cost of replacement?
City of Sacramento	This City of Sacramento's construction plans and specifications require the Contractor to possess at bid opening a valid Class "A" license or a combination of classes required by the categories and classes of work included in the project. Additionally, they have a 14 question, "Minimum Qualifications Questionnaire," that is included in all Contract Bid Specifications. Answering "yes" to any question immediately deems the bidder a "non-responsible bidder" effectively eliminating him/her from submitting a bid or if they submit a bid having their bid rejected.	25% SLBE and 25% LBE.	Yes, 25%.
City of San Francisco	SF views Hazmat/ASB work the same as a licensed construction trade, meaning the subcontractor listing requirements of PCC 4104 apply to listings for HAZ/ASB subs. So under that logic, if a prime failed to list a certified sub and also could not perform the work themselves, the City of San Francisco would reject the bid on the basis of contractor responsibility.	If a prime fails to list a subcontractor for a portion of work, the City of San Francisco presume that the prime intends to self-perform the work. If the prime bidder is not licensed or qualified to perform, then their bid is rejected on the basis of contractor responsibility, i.e. they are not qualified/ licensed to perform the work under consideration.	If a prime bidder lists a sub that is not properly licensed or qualified, the listing is deemed invalid and it is presumed the prime intends to self-perform the work. If the prime bidder is not licensed or qualified to perform, then their bid is rejected on the basis of contractor responsibility, i.e. they are not qualified/licensed to perform the work under consideration.

Table 5-1 City of San Francisco
Public Contract Code Section 4100 (cont'd)

Questions	1. How does your agency determine if the prime bidder is responsible and submits a responsive bid with these potential subcontracting infractions?	2. Buildings: Number of Public Safety Buildings and cost for replacement, Number of Civic Buildings and cost of replacement?	3. Storm Drains: CMP mileage and cost of replacement, other drainage mileage and estimated cost of replacement?
City of San Jose	The Prime contractor must possess the necessary license and/or other qualifications prescribed in the bid documents at the time of bid opening. If a subcontractor is listed for a portion of the work and that subcontractor must have a particular license and/or other qualification in order to perform the work, this is practically evaluated at the time of the bid opening but essentially necessary at the time that work is set to commence. Therefore, responsibility at the time of the bid opening is determined by the prime contractor's qualifications, and whether they properly listed a subcontractor in excess of ½ of 1% of the work.	If a prime contractor does not list a subcontractor for a particular item of work, it is presumed that the prime contractor intends to self-perform. Our Standard Specifications contain remedies for (1) claims of inadvertent clerical error in the listing (or non-listing) of a subcontractor, (2) subcontracting where no subcontractor was listed (i.e. emergency or public necessity), (3) subcontractor listing violations (i.e. unauthorized substitution or non-listing of a subcontractor who is used in excess of ½ of 1%). The remedies for item #3 above includes cancellation of contract or monetary penalty.	Unless specifically written in the bid documents, that that a subcontractor must have a particular license or qualification at the time of the bid opening (and this is very rare), the license or qualification of a subcontractor is only necessary at the time of performance of the subcontracted work activity. If the bid documents require that a listed subcontractor be licenses or otherwise qualified at the time of bid, then the City of San Jose would likely find the bid non-responsive. It should be noted that the highly-competitive market of the past few years has resulted in a number of protests of some construction projects where subcontractor licenses and qualification issues were raised. However, in general, these protests have been found without merit on the basis that a subcontractor's license and/ or other qualifications need only be established at the time the work is to be performed.

Table 5-1 City of San Francisco
Public Contract Code Section 4100 (cont'd)

Questions	1. How does your agency determine if the prime bidder is responsible and submits a responsive bid with these potential subcontracting infractions?	2. Buildings: Number of Public Safety Buildings and cost for replacement, Number of Civic Buildings and cost of replacement?	3. Storm Drains: CMP mileage and cost of replacement, other drainage mileage and estimated cost of replacement?
City of San Diego	The City cannot determine if a bidder is not responsible for failing to list a subcontractor, unless there is a specific license requirement called out for in the contract requirements (e.g. C-27 requirement for re-vegetation agreements and the prime does not hold the license themselves). If a prime fails to list a subcontractor, the City assumes a) the amount of the subcontract is less than ½ of 1%; b) the prime contractor is capable of performing the work themselves (PCC 4106); or c) the prime may hire an individual qualified to perform the scope of work in order to complete said SOW (means & methods). If the prime contractor fails to meet any of these assumptions, or if the prime adds a subcontractor without authorization by the awarding agency, penalties under 4110 will be assessed.	The City of San Diego has had this issue come up and, when told the subcontract is actually ½ of 1% the City will request a copy of the subcontractor's bid to ensure this is the case. However, because the City cannot dictate a contractor's means and methods, the contractor can potentially hire a licensed/ qualified subcontractor (if more than ½ of 1%) under their payroll to perform the scope of work in question. While the practice is frowned upon, there is nothing that precludes the prime from doing so. Again, if the prime fails to meet the requirement, and the prime adds a subcontractor without authorization by the awarding agency, penalties under 4110 will be assessed.	A subcontractor must be licensed by the time the scope of work they are awarded is due to start not at the time of award. PCC 4107(a)(6) allows the prime contractor to substitute a subcontractor for failure to have a license. The City would not find the bidder non-responsible/non-responsible and reject their bid.

C. BIDDER'S INQUIRIES

The City of San Diego posted a question asking for what other cities best practices for handling bidder's questions received during the bidding period. For the Addendum purposes, should the Owner include them word-for-word or screen and edit (and sometime disregard) them as needed?

The City of Los Angeles Bureau of Engineering provides detailed instructions to staff on responding to contractor inquiries in section 13.5 of their Project Delivery manual. In summary it advises all Project Managers not to answer any questions during the bid period except via a written addendum so that no contractors are provided an unfair advantage. The only exception is, similar to San Francisco, is sometimes to direct them to a certain bid documents if the question is clearly already addressed somewhere within and we do not think it worthy of a written response. In those cases we only direct them to the bid documents. Regarding the working of the question in a written response, we do rephrase the question in our addendum if we feel that it will communicate the issue better but generally it's the original working. When similar questions are asked by multiple contractors, we might choose only one or craft one to cover both, list both and answer the second by referring back to the first answer. The City of San Diego generally follows these general methods too.

The City of Oakland issues responses to all question by addendum unless the answers can be found within the contract document. The City of Sacramento, Department of Public Works is similar but added it would also include questions that could lead to a change in bid prices. They take the question exactly as asked and answer it in the addendum. The City of San Francisco, Bureau of Engineering, in similar to both Oakland and Sacramento, however, they stated that if the answer is clearly on the plans, they do not share their directions with everyone.

The City of San Jose advertises it construction contracts using BidSync. BidSync has a built-in mechanism for plan holders to ask questions. In fact, their practice is to only use the BidSync mechanism for question submittal and we do not respond to questions submitted outside of BidSync. The questions are shown "as asked" for all to see. They correspondingly post their answers to each question. Sometimes a question results in the need to post an Addendum, and they refer people to that Addendum in the answer they post. They set the question submittal deadline typically 7 days before the bid opening.

D. ADA CURB RAMPS

The City of San Francisco received two questions from Community College of San Francisco. They asked if the design of the curb ramp was done by in-house engineers or consultants. Their second question was how much the average was to design a curb ramp.

The City of San Francisco Bureau of Engineering stated that they tried consultants and found them to be more expensive, about double. They stated an average of $1200 might work, however, $1500 would be better for planning purposes for typical locations. This would not include planning and project management costs.

The City of Los Angeles curb ramp design as a stand-alone project would typically be done in-house, where the Bureau of Engineering Standard Plan for curb ramps is utilized, a copy of which they included in their response. However, where curb ramps are part of a larger street improvement project, the design could be done in-house or using consultants, if the consultants is designing the entire project. Curb ramp design on larger projects, whether designed in-house or by consultants, is not specifically tracked.

For the City of Oakland, in most cases, they utilize their standard details which have worked for them. For non-standard installations, they have not racked design costs.

The City of Sacramento Department of Transportation designs the curb ramps with in-house engineers on their in-house projects and with consultants if they are designing the project for them. If the standard curb ramp that are in their City Standard Specifications, it will cost between $600-$800 to design. More complicated ramps requiring topographic surveys, conforms and grading plans can cost upwards of $10,000 to design.

The City of San Jose has several "Standard Details" which generally govern ADA curb ramps. Please refer to the bottom of this website: http://www.sanjoseca.gov/index.aspx?nid=3463. Occasionally, a custom design is needed. Such designs could be in-house or by consultant, depending on who is preparing the project plans. They do not have a data tracked in a way that would yield the average cost of design.

Much like the City of San Jose, the City of San Diego has standard details for different curb ramp scenarios. They can provide copies if desired. Where special design is required, these are designed by consultants or in-house. It just depends on who is designing the overall project. They do not track the cost of design for these type projects.

E. BUILDING CONTRACTOR PREQUALIFICIATION QUESTIONNAIRE

The City of San Jose having no standardized Building Prequalification Questionnaire, has begun the process of developing one. So, they wanted to know if the other agencies have an example of a Building Contract Prequalification Questionnaire for such building projects as fire stations/ libraries that they were able to share. In addition, has any agency applied a prequalification process to subcontractors successfully?

The City of Sacramento, Department of Transportation, replied that they did not but knew that their City Architect have completed a prequalification process in the past. The Cities of Los Angeles, Oakland, San Diego and San Francisco all have complete such a process and shared their example with the City of San Jose. The City of Los Angeles was for a police station and fire station facilities and San Francisco was for a library. No agency has conducted this process at a subcontractor level.

F. CONSULTANT MANAGEMENT MANUAL/GUIDELINES

The City of San Jose determined an internal need to develop Manual/Guidelines for Consutlant Management decided to reach out to the other agencies to see if they had existing examples that they were able to share. Particularly, they are looking for material that governs how task/service orders are developed and reviewed, how proposed costs.fee schedules are assessed for reasonableness, how deliverables and/or progress on assignemnets are tracked, and how choices are made in terms of assigning work amongst multiple consultants who may all have on-call contracts and capability to perform a particular assignment.

The City of Los Angeles has guidelines for utilizing consultants included in their Project Delivery Manual, Chapter 6 – Using Consultants. The PDM can be accessed at the Bureau of engineering website at http://boe.lacity.org/pdm.

The City of Oakland has draft guidelines on issuance of task orders and billing rates. The provided a copy on-line. The City of San Francisco has a general procedure that covers San Jose's questions. A copy of the general procedure was sent to San Jose via an e-mail.

The City of San Diego has several Administrative Regulations and Standard Operating Procedures for administering and managing consultants. The City also has Standard Guidelines for the preparation of PS&E by consultants. They offered to provide copies to San Jose.

The City of Sacramento Department of Public Works does not have a written manual. They provided some practices that they have in place or are developing. Here is what was provided:

- To be consistent through their CM On-Call list and their CM RFP process to pay consultant Resident Engineers no more than $165/hr (loaded rate) and Roadway/Electrical Inspectors no more than $135/hr (loaded rate). They have been successful in getting consultant CM firms to accept these rates.

- They rank their CM On-Call list and assign projects down the list and are trying to give each firm the same amount of work, if feasible.

- They request resumes for Res and Inspectors to ensure they are suited for their planned assignment.

- They are almost at the finish line with completing their process and procedures for standardized consultant 10-H form and consultant invoice requirements. The goal is to layout specific requirements and forms that they expect on consultant forms and invoices. Regardless of which PM a consultant works for, he/she will be expected to submit forms and invoices that look exactly the same.

- As part of the standardization, they are requiring every consultant to submit with every invoice a summary sheet showing tasks, budgets, amount spent, amount this invoice, amount remaining by task, percent spent and complete, DBE and ESBD participation goal and achieved. This will allow them to monitor every month and ensure consultants meet the goal.

- Their next goal is to establish reasonable ranges for loaded rates to pay for consultant engineering classifications and levels of experience.

G. ARCHITECTURAL SERVICES ORGANIZATION STRUCTURE

The City of San Jose's architectural services are situated within the City Facilities Architectural Services Division of their Public Works Department. This Division is managed by a Division Manager who oversees two Municipal Buildings Sections (each managed by a Senior Architect), a Site and Landscape Architecture Section (managed by a Senior Landscape Architect), and a Special Projects team (managed by a Senior mechanical Engineer). The City wanted to know how the other cities were structured ask how their agency's architectural service (building and landscape) were organized and what management structure is applied. If possible, they asked for an organization chart showing staffing arrangements and reporting relationships. Responses were received from 5 additional cities.

The City of Los Angeles Bureau of Engineering's architectural and landscape services are organized under their Municipal Facilities Program headed by the Chief Deputy City engineer. The Division Manager is a licensed architect. A PDF version of their organization chart was provided along with a link to a more detailed version (http://www.eng.lacity.org under "About Us" on the bottom left of page).

For the City of Oakland, all architectural and parks projects are managed under the Project Management Division within the Department of Engineering and Construction. They do not have a City Architect position and all design work is contracted out to consultants.

Architects are housed within the General Services Department for the City of Sacramento. They primarily manage consultants in performing the management and design of new City buildings or City building renovations. There is a Supervising Architect and Senior Architect and Associate Architects which work for him/her. They also have a building mechanical Engineer and Electrical Engineer on their team. The City of Sacramento's landscape Architects are housed in their Parks and Recreation Department. They perform inn-house design and also retain design consultants to perform their work. They have a Supervising Landscape Architect, Senior Landscape Architect and 3 Associate/Assistant Landscape Architects.

The City of San Diego has not had an office of a City Architect for many years; however, their Mayor has indicated that he intends to re-instate this position. Currently all CIP projects related to parks and buildings are managed by their Architectural Engineering and Parks Division of the Public Works Department which is broken into sections that manage different assets. They provided an organization chart depicting this arrangement. Public Buildings I & II mange mostly CIPs for fire, police, lifeguard, and library buildings. Program Management I, II, III manage mostly park related CIPs. Waste and Wastewater I & II manage mostly CIPs related to water utilities such as treatment plants, pump stations, etc. Most of these positions are filled with engineers, but they also have architects and landscape architects.

The City of San Francisco mostly recently re-organized the Department of Public Works and elevated the City Architect position to that of a Deputy Director (1 of 4: Operations, Finance, Engineering, and Architecture). Under the City Architect there is a new division (and position) call Building Design and Construction (BDC) that includes Architecture, Landscape Architecture, and Construction Management, formerly known as Bureaus. There are plans to add an engineering section as well sometime in the future. A copy of their organization charts can be found at http://www.sfdpw.org/index.aspx?page=1088.

H. BID TO AWARD TIMELINE AND PERCENT TO SLBE/ELBE

The City of San Diego currently targets 60 working days from bid opening to construction contract award. In addition, they target 15% of funds awarded to Small Local Business Enterprise/Emerging Local Business Enterprise (SLBE/ELBE). While these questions have been raised in the past, they wanted to know if there were any updates with the other cities. Response were received from 5 additional cities.

The City of Los Angeles' time frame from bid opening to issuance of a Notice to Proceed is 60 calendar days. They outline four policies related to small business enterprises summarized below.

1. Building Inclusion Program – This program was initiated as a Mayor's Executive directive, No. 14 to provide opportunities for small businesses. This Directive has guidelines for outreach to Minority Business Enterprise, women Business Enterprise, Small Business Enterprise, Emerging Business Enterprise, and Disabled Veterans Business Enterprise. A copy was included with their response.

2. Local Business Preference Ordinance – Ordinance No. 181910 outlines procedures and stipulations where preference points or percentages are granted to local businesses. Refer to the Ordinance provided with the City of Los Angeles' response.

3. Mandatory Subcontractor Minimum (MSM) – The City includes this minimum requirements in bid packages for Public Works Construction projects. The MSM varies from project to project, but is usually in the range of 20% to 25%

4. Small, Local Business Ordinance – The City's SLBO No. 174048 is for contracts $100,000 or less. A copy of this Ordinance was also supplied.

In the City of Oakland, they also target 60 days from bid opening to contract award. They have a total of 50% LBE and SLBE requirement with a minimum of 25% for each.

The City of Sacramento Standard Specifications requires that they award a contract within 60 calendar days of bid opening to the lowest responsive and responsible bidder. They can add a Special Provision to our Contract Specifications that increases our award time. The City of Sacramento has an Emerging and Small Business Enterprise Development Program. The goal is 20% which means that 20% of the contract work must be performed by an Emerging or Small Business that is certified by the City of Sacramento or Caltrans. The 20% goal applies to all projects funded with 100% Local and State funded projects. A bidder must achieve this goal or his/her bid is deemed non-responsive.

San Francisco, Bureau of Engineering replied by stating Federal or State grant funded projects must be awarded within one hundred twenty (120) days from the bid opening pursuant to Administrative Code §6.6(A) (Admin Code Sec. 6.6(A) - Time to Award Federal & State Contracts). If an agency is unable to award the contract within this duration, a letter should be sent to the bidder. A template letter, drafted with the assistance of the City Attorney's Office, is available from Contract Administration. In essence, the letter has the bidder agreeing to hold his or her (entire) bid good for a specified period of time and not just the bid price. The Mayor or the Mayor's designee must approve the time extension, or the board or commission concerned must approve any agreements to extend the time to award the bid by a resolution. Other local funded contracts must be awarded within ninety (90) days after the bid opening unless the bidder has stipulated in writing prior to the expiration duration for contract award that he or she will extend the period for which his or her bid would expire pursuant to Administrative Code §6.20(E) (Admin Code Sec. 6.20(E) - Time to Award Local Funded Contracts). Such time may only be extended prior to award of the contract and only upon written approval by the department head.

In terms of the LBE requirement, generally speaking it is 20% but this would have to be approved with the Contracting Management Division (formerly under HRC). SBE is required for federally funded projects

The City of San Jose has previously reported a bid opening to construction contract award average of one month (calendar). Sometimes this goes faster (2 weeks) due to efficiencies provided by our Muni Code that generally allows the Director of Public Works to award construction contracts up to $1M. When construction contract awards need to be made by the City Council, the time increases to 5-6 weeks; thus the one month average. The City of San Jose has no target, goal, or performance measure that they follow here. They simply strive to minimize the time from bid opening to award. As for % of funds to S/LBE, San Jose does not have any targets or goals established by our Muni Code or otherwise.

I. PRIOITIZATION OF CIP PROJECTS

The City of San Diego is in the process of implementing a uniform multi-year CIP across all departments. They asked a series of questions to the other agencies. The questions they would like to know are:

1. Do you have a Multi-Year CIP?
2. Is it a plan or an approved budget?
3. What is their process for developing/updating it (how do they involve the elected officials, public, and client departments)?
4. How do you address unfunded needs & risk in the plan?
5. What is the outline (table of contents) of the plan/report?
6. Can you provide a copy of their CIP Plans?
7. How have you benefitted from it?

Responses were received from six agencies. The detailed responses can be found in **Table 5-2** on the following page.

Table 5-2 City of San Diego
Multi-Year CIP

Questions	1. Do you have a Multi-Year CIP?	2. Is it a plan or an approved budget?	3. What is their process for developing/updating it (how do they involve the elected officials, public, and client departments)?	4. How do you address unfunded needs & risk in the plan?	5. What is the outline (table of contents) of the plan/ report?	6. Can you provide a copy of their CIP Plans?	7. How have you benefitted from it?
City of Los Angeles	The City of Los Angeles is on a yearly time table, and coincides with the annual budget approval process.	Refer to answer for question #1.	They work with their client agencies within the City, and the City Administrative Officer, who is the City's budget manager, to coordinate, develop, and manage the budgets for the Capital projects delivered.	Unfunded needs are address each year through the budget process for Capital projects and Programs. If funding is not available, the project does not move forward.	The outline, as shown in the City's budget (Blue Book, Volume II), is as follows: • Capital Improvement Expenditure Program • Summary • Municipal Facilities • Physical Plant • Clean Water System	The CIP plans, again, are part of their overall annual budget which is available on the City's website.	The benefit of the system we use is that funding is identified for the project upfront. If funding is not available, the project does not happen.
City of Oakland	Yes, 5-yr plan and 2-yr budget	Approved budget.	They work with each client department in the City and develop a CIP list for both funded and unfunded projects.	The City ranks them based on the following prioritization factors: leverages outside funding, mandated, life safety, hazard elimination, and preventive maintenance.	See attached.	Yes	Helped to allocate limited funding to most needed projects.

Table 5-2 City of San Diego
Multi-Year CIP (cont'd)

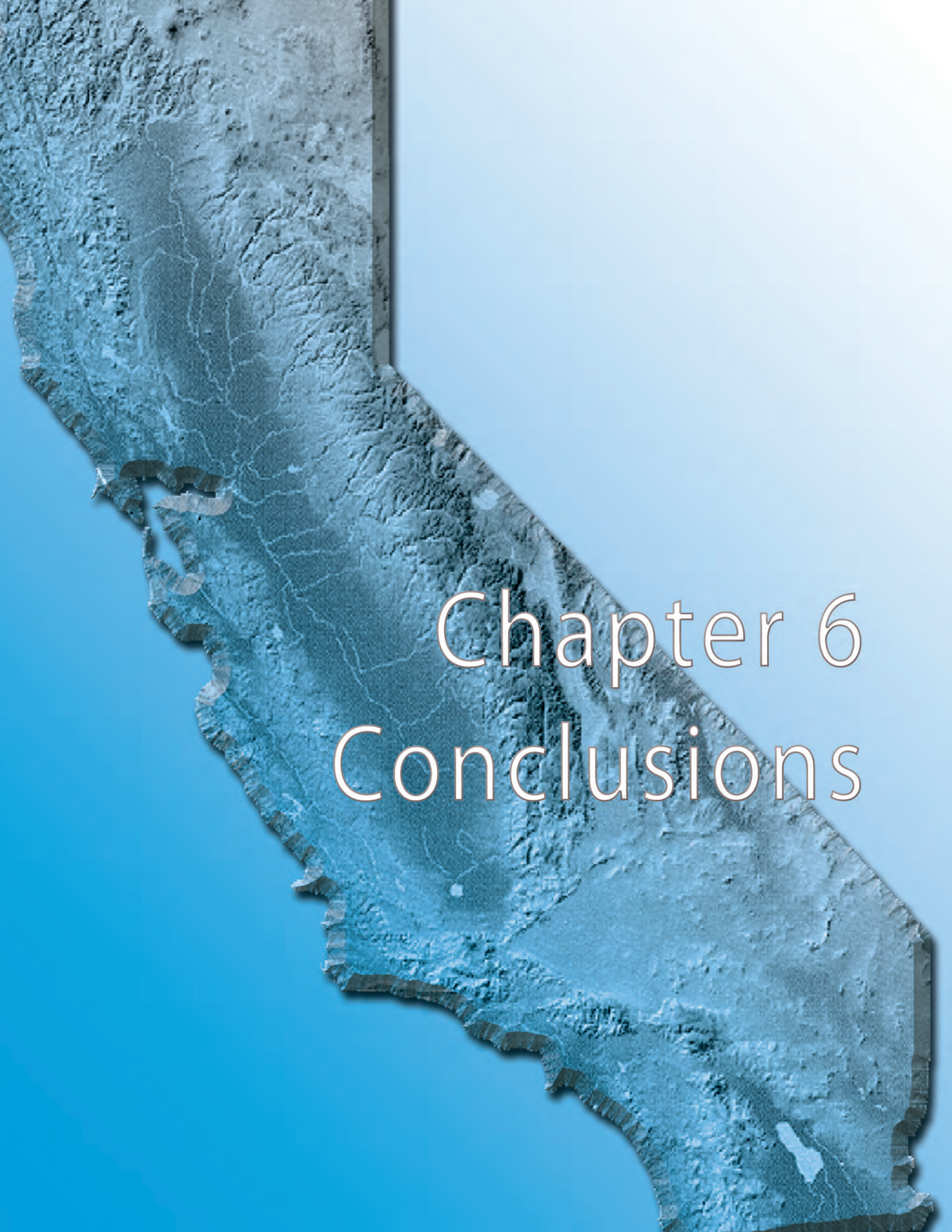
Questions	1. Do you have a Multi-Year CIP?	2. Is it a plan or an approved budget?	3. What is their process for developing/updating it (how do they involve the elected officials, public, and client departments)?	4. How do you address unfunded needs & risk in the plan?	5. What is the outline (table of contents) of the plan/ report?	6. Can you provide a copy of their CIP Plans?	7. How have you benefitted from it?
City of Sacramento	The City of Sacramento Department of Public Works has a 5 year CIP.	The first year of the 5 year CIP is approved by City Council and the remaining 4 years is a plan.	The Department's plan is developed with internal stakeholder engagement. There is no public outreach. Prior to bringing forward their 5 year CIP they do perform briefings with Council members. Furthermore, Council members are presented the plan at a hearing where questions can be asked and feedback provided with final approval of the plan at a subsequent council meeting.	Department submits a 5-year plan that is balanced by fund over the 5 years so that there is no risk of overspending their actual and estimated funds.	Sacramento lists 1.Sum-mary of all funds 2. Fund types 3.Projects receiving new funding for the upcoming fiscal year 4. Active projects showing existing and future funding 5. Projects receiving funding by fund type and project number 6. Summary of all projects with funding 7. Projects by Council District 8. Resolution approving the upcoming fiscal year budget.		They have a sustainable, reasonable and fiscally constrained plan that has approval from all of their Department Leadership and the City Council.
City of San Diego	San Diego is in the process of implementing a Multi-Year CIP (1-2 year annual budget and a 5-year rolling plan).						

Table 5-2 City of San Diego
Multi-Year CIP (cont'd)

Questions	1. Do you have a Multi-Year CIP?	2. Is it a plan or an approved budget?	3. What is their process for developing/updating it (how do they involve the elected officials, public, and client departments)?	4. How do you address unfunded needs & risk in the plan?	5. What is the outline (table of contents) of the plan/ report?	6. Can you provide a copy of their CIP Plans?	7. How have you benefitted from it?
City of San Francisco	San Francisco has a very well developed process and rolling 10-year Capital Plan.	It's a plan that informs a 2-yr capital budget, and projects a rolling 10-year capital program.	There is a city-department-wide capital planning committee to Board of Sups and Mayor; see our website http://www.onesanfrancisco.org				
City of San Jose	Yes, the City of San Jose prepares 5-Year CIP Budget.	It is an approved budget.	The annual budget process is mapped-out at the following link: http://www.sanjoseca.gov/index.aspx?NID=489. In general, between October and March, staff reviews the previous year's budget for the CIP (which is actually the current year) and assemble their proposed budget for the next year. As this is ongoing, the elected officials are reviewing the previous year's budget as well and identifying their priorities with input from the public. The public may involved in public meetings. In February, the City Manager presents the program's forecasted revenue projections to the Mayor and Council.	Each Capital program maintains a prioritized listing of unfunded needs. These needs are presented in a Deferred Maintenance Infrastructure Backlog (DMIB) report to a Council Committee (the Transportation and Environment Committee) prior to being presented to Council before the adoption of next-year's 5-year budget.	The budgets for the 2013/2014 FY are available at the following website: http://www.sanjoseca.gov/index.aspx?nid=1980. The specific link for the Capital Budget is: http://www.sanjoseca.gov/index.aspx?nid=2804.	See answer to #5	A multi-year budget is preferred because it provides the projected budgetary needs for beyond the next fiscal year. This provides a better look at long-term needs in projects/ programs.

Table 5-2 City of San Diego
Multi-Year CIP (cont'd)

Questions	1. Do you have a Multi-Year CIP?	2. Is it a plan or an approved budget?	3. What is their process for developing/updating it (how do they involve the elected officials, public, and client departments)?	4. How do you address unfunded needs & risk in the plan?	5. What is the outline (table of contents) of the plan/ report?	6. Can you provide a copy of their CIP Plans?	7. How have you benefitted from it?
City of San Jose (con't)			Mayor then compiles his/her budget message in March which provides priorities and direction for the budget. In May, the City Manager prepares his/her budget which incorporates the Mayor's direction into the proposals from the various Capital programs. The proposed budget is presented to Council in Budget Study Sessions aligned with each City Service Area (CSA). Any revisions to the budget request after this point are compiled as Manager's Budget Addenda (MBA's). Council Members may also suggest revisions in the form of "Budget Documents". In June, the Mayor will present his/her Budget Message which incorporates some (or all) of the MBA's and Budget Documents. Council then votes on and adopts this budget.	A copy of the latest report was presented in May and may be found at the following website: http://sanjoseca.gov/DocumentCenter/View/15666. The 5-year budget is continuously monitored throughout the year and adjustments can be made by Council. While, changes can be approved by Council at any time throughout the year, typically they are gathered and presented to Council together in Fall, Mid-Year, or Spring requests. An example of an off-schedule budget action request would be if the low-bid for a project is higher than anticipated and it is not desired to re-scope and re-bid the project, then a budget request can be made to shift funding from one project to another.			



Chapter 6
Conclusions

CHAPTER 6 Conclusions

A. PERFORMANCE BENCHMARKING

Performance Benchmarking for the *Update 2013 Study* involved analysis of 655 projects in the projects database. The results of the performance benchmarking evaluation show that in almost all cases project delivery costs expressed as a percentage of TCC are higher for projects with lower TCCs. This clearly indicates that an economy of scale exists in the delivery of capital projects. Project delivery percentages (arithmetic averages) for the *Update 2013 Study* varied between the following values for the full range and the 80th percentile subset of TCC respectively:

Table 6-1
Update 2013 Project Delivery Percentages

Type	Project Delivery Percentages
Municipal Projects	33% - 35%
Parks Projects	49% - 52%
Pipes Projects	42% - 46%
Streets Projects	45% - 48%

Although the results of the performance analyses are based on historical data provided by the participating agencies, there are several factors that could affect project delivery and are not captured in the performance model. These external factors include personnel turnover in the agencies etc. which impact project delivery. Since such factors are not captured in the performance model, the reader is cautioned that the improved results of the regression analyses only be used as a reference and not for prediction of performance. In addition, in light of the current bid environment, it is recommended that the reader use best judgment in the context of the current economic downturn when using the *Study* results for planning and budgeting.

B. SPECIAL STUDY

The increase in project delivery costs is not fully accounted for by the decrease in construction costs. Based on the analyses, project delivery costs have continued to increase over the last five years regardless of the bid prices. Possible influences on the increased project delivery percentages include: reduced efficiencies due to employee turnover and/or staff reductions and other factors that cannot be quantified. In addition, the impact of consultant cost increases over the past few years on project delivery percentages needs to be quantified. A close examination of the mix of projects that make up the Special Study shows that the data contain a different mix of small projects and large projects. The composition of the projects for each year drives the project delivery percentage for that year. It is likely that the project delivery percentage is also being influence by the size and distribution of construction costs among the projects in the database. As the specific projects that make up the database change year by year in scope and complexity, the project delivery costs change as well, influencing the numbers significantly.

C. BEST MANAGEMENT PRACTICES

In *Update 2013*, the agencies continued to exchange ideas regarding strategies for implementing various BMPs using networking opportunities at the face-to-face meetings, conference calls, and the online discussion forum. In *Update 2013*, the Project Team added one new BMP:

- 6.n 2013 – Determine appropriate consultant costs for professional services agreements.

This new BMP is believed to directly influence cost, schedule, communication, and customer service aspects of either design or construction management, and, ultimately, project delivery efficiency.

Based on feedback received, Agencies continue to review and update BMPs that have been fully implemented. Agencies continue to pursue full implementation of BMPs although some remain only partially implemented. In some cases, constraints limit the full implementation of BMPs. Full implementation of BMPs continues to be impacted staff reductions, furloughs, and the management's increased involvement in resolving budgetary issues. The Agencies continue to focus their efforts on monitoring adherence to BMPs that have been implemented and are judged to provide efficiencies in project delivery processes for participating departments. However, several agencies have established a goal of implementing several BMPs this upcoming year.

To support the linking of BMPs to performance improvements, BMP implementation by the agencies are tracked. As of *Update 2013*, and including the addition of the new BMP, the Agencies have fully implemented about 70 percent of all BMPs. Seven (7) percent of the total BMPs have been partially implemented by the agencies. Many of the remaining BMPs require more involvement and input from multiple departments making them more complicated to implement than other BMPs.

D. ONLINE DISCUSSION FORUM

In Update 2013, the Online Discussion Forum continues to be an important feature for *Study* participants. Active, meaningful exchanges occur along with important issues being addressed resulting in changes to policy, approach, or BMP implementation. Participants continue sharing information through the Online Discussion Forum, conference calls, and during the face-to-face meetings. The interesting outcomes of these discussions are presented to the public through the *Study* reports. The continued sharing of challenges and solutions through the Online Discussion Forum remains a remarkable benefit to all participants.

E. PLANNING FOR UPDATE 2014

Over the course of *Update 2013*, the Project Team identified a number of activities to consider including next year in *Update 2014*. These activities include:

- Continue discussions on how to implement the new BMP (6.n) to determine appropriate consultant costs for professional services agreements;Continue collecting data on projects delivered via alternative delivery techniques;

- Developing new BMPs and tracking the implementation of adopted BMPs;
- Continuing discussion on current topics via the round-table discussion forum; and
- Continuing meaningful exchanges on the Online Discussion Forum via the SharePoint website.

F. 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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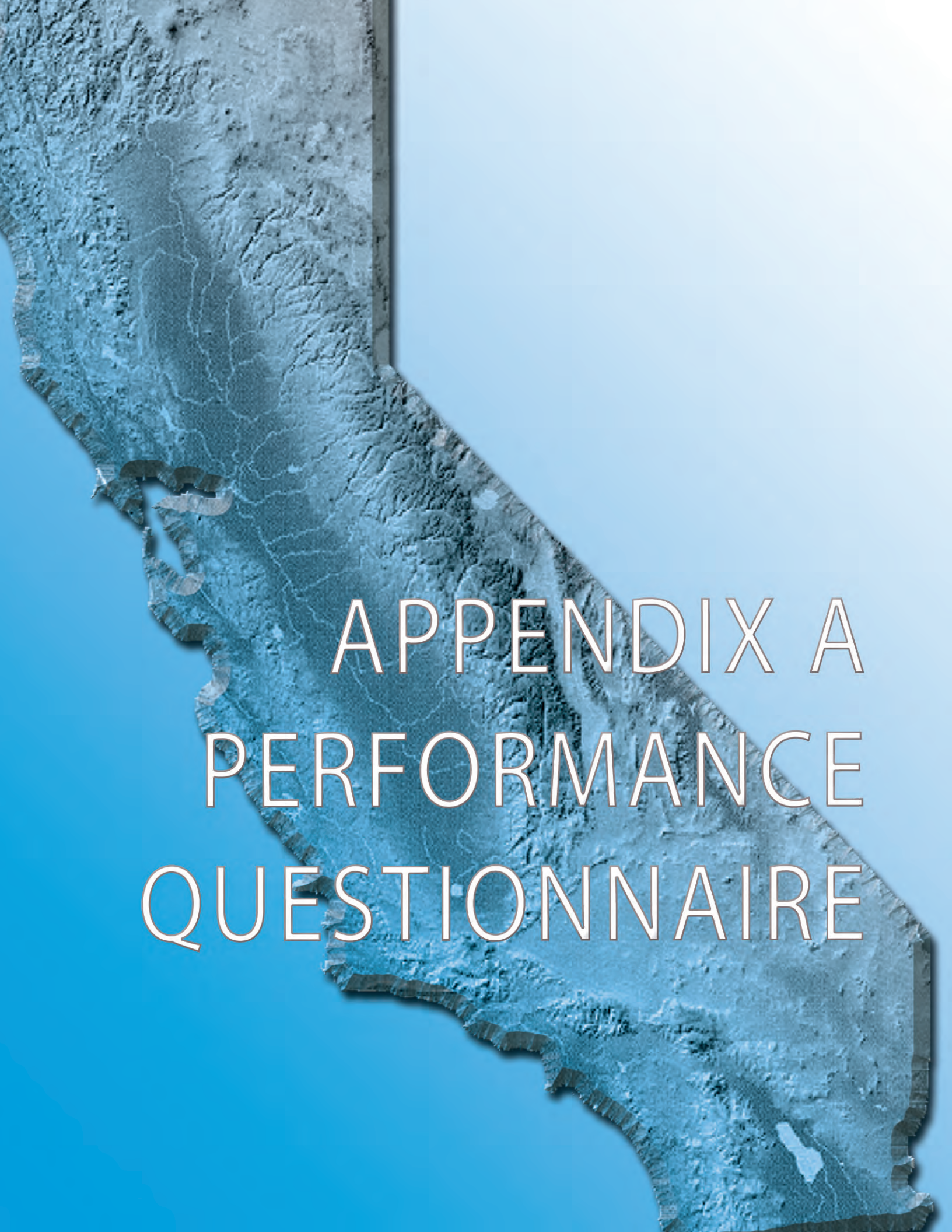
APPENDICES



APPENDIX A
PERFORMANCE QUESTIONNAIRE

APPENDIX A

Performance Questionnaire

California Multi-Agency Benchmarking Study Update 2013 Performance Questionnaire

Agency:

Project Name:

Project Type:

New/Rehab Index:

Alternative Project Delivery:

☐ LEED Green Building

☐ Project Financial Elements Closed and Complete

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 ENGINEER'S ESTIMATE							
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 15 - 19).

APPENDIX B
PERFORMANCE CURVES

APPENDIX B Performance Curves

REGRESSION ANALYSIS RESULTS

The results of the regression analysis performed using the performance model are presented in the following paragraphs.

REGRESSION DEFINITIONS

A brief overview of the relevant statistical terminology and their definitions is provided in the following paragraphs:

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 total construction cost (TCC) would be prepared to evaluate how much of the variability in design cost is due to the TCC value.

The regression trendline can be used as a starting point for evaluating the budget for a suite of projects. Caution and use of professional judgment is required if 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

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

Statistical Significance

To evaluate the statistical significance of the result obtained, the regression analyses included a calculation of p-values. Whereas the R^2 value is a descriptive statistic (i.e., describes the current set of data), the p-value is a predictive statistic. It indicates whether there are enough data points to arrive at statistically-significant results and whether the data set could be used to forecast new values. The selection of a desirable p-value is subjective, though 0.10 or 0.05 is typically 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 R2 value and p-value should be considered separately. A high R^2 value does not mean the result is statistically-significant, and vice-versa.

The results of the regression analyses are discussed in the remainder of this section. The results of the regression analyses are summarized in T**able B-1** and **Table B-2**. **Table B-1** summarizes the performance model results for the full range of TCC while **Table B-2** summarizes the results for the 80th percentile subset of TCC. These tables also summarize 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.

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 construction, the slopes are not equal to the average and median project delivery percentages shown in **Table 3-5, Table 3-6** and **Table 3-7**. This is due to the fact that the linear trendline is fit by the least squares method.

This is better explained by the following example. Consider 5 projects in the municipal category having the a1, a2, a3, a4, and a5 as their individual project delivery costs and b1, b2, b3, b4, and b5 as their individual TCC. The arithmetic average of the project delivery percentages would be represented as:

Project Delivery Percentage =

$$\left(\frac{a1}{b1} + \frac{a2}{b2} + \frac{a3}{b3} + \frac{a4}{b4} + \frac{a5}{b5} \right) \Big/ 5$$

The project delivery percentages presented in **Table 3-5**, **Table 3-6**, and **Table 3-7** are computed using the above formula which is the average of the individual project delivery percentages

In the regression analysis, the project delivery percentage is computed in fashion that is more similar to the following formula which represents the average slope of the least squares fit.

Project Delivery Percentage =

$$\left(\frac{a1 + a2 + a3 + a4 + a5}{b1 + b2 + b3 + b4 + b5} \right)$$

The project delivery percentages presented in **Table B-1** and **Table B-2** are computed using the above formula.

The plots depicting the regression relationships are shown in this section. 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 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 results better reflect the properties of a program of projects rather than that of an individual project. Therefore, the reader must avoid budgeting individual projects based solely on these analyses.

In most cases, the results reflect the agencies' experience with the delivery of capital projects that on a percentage basis projects with lower TCCs are more expensive to deliver than projects with higher TCCs. Only 3 out of the 16 categories have lower project delivery percentages for the 80th percentile subset of projects than the full range of projects. It is concluded that the model results are reasonable from a statistical perspective.

For projects belonging to the Pipes category, there is an increase of approximately nine percent in the project delivery percentages for projects evaluated in the 80th percentile subset of TCC. Similarly, project delivery percentages for projects belonging to the Parks category also exhibit a nine percent increase, while projects belonging to the Municipal category exhibit an increase of eight percent. Project delivery percentages for projects belonging to the Streets category exhibit a four percent increase. Comparing the results summarized in **Table B-1** and **Table B-2** shows that an economy of scale exists in delivering projects with a higher TCC versus those with a lower TCC.

In addition, it should be noted that although the R^2 values are slightly smaller and p-values are higher than in last years Study phase, 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 this section in conjunction with using this table.

Table B-1
Summary of Performance Models (Full Range of TCC)

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	**88**	**12%**	**11%-13%**	**0.79**	**1.41E-35**	**12%**	**11%-13%**	**0.77**	**3.73E-33**	**24%**	**22%-26%**	**0.80**	**3.92E-36**
Libraries	15	15%	13%-17%	0.78	4.76E-10	15%	13%-18%	0.78	4.19E-9	30%	27%-33%	0.91	1.63E-12
Police/Fire Stations	13	10%	8%-11%	0.92	1.65E-9	8%	7%-9%	0.85	3.2E-8	18%	15%-20%	0.91	2.02E-9
Comm./Rec.Center/ Child Care/Gyms	25	13%	12%-15%	0.88	3.74E-15	12%	11%-14%	0.92	1.11E-16	26%	24%-28%	0.94	8.75E-18
Other Municipal	35	14%	12%-17%	0.79	8.55E-14	16%	14%-18%	0.88	1.28E-17	31%	26%-35%	0.85	3.24E-16
Streets Projects	**244**	**18%**	**17%-20%**	**0.58**	**1.3E-71**	**16%**	**15%-17%**	**0.70**	**4.49E-90**	**34%**	**32%-36%**	**0.76**	**9.7E-105**
Widening/New/ Grade Separations	17	19%	12%-26%	0.39	2.19E-5	18%	14%-22%	0.72	1.18E-7	37%	31%-44%	0.78	2.39E-9
Bridges	17	19%	14%-23%	0.48	5.82E-7	15%	12%-18%	0.72	2.25E-8	33%	28%-38%	0.79	2.81E-10
Reconstructions	97	15%	13%-17%	0.45	2.41E-30	16%	15%-18%	0.61	1.55E-35	31%	28%-34%	0.61	4.97E-38
Bike/Pedestrian/ Streetscapes	72	23%	20%-27%	0.58	3.91E-22	13%	11%-15%	0.52	4.98E-21	37%	32%-41%	0.63	5.68E-25
Signals	41	19%	16%-22%	0.72	1.82E-16	15%	13%-17%	0.72	1.92E-19	34%	31%-38%	0.83	3.07E-22
Pipes Projects	**270**	**11%**	**10%-11%**	**0.61**	**2.15E-83**	**18%**	**18%-19%**	**0.87**	**7.7E-131**	**29%**	**28%-30%**	**0.87**	**1.3E-137**
Gravity Mains	200	9%	9%-10%	0.61	4.97E-61	17%	17%-18%	0.91	2.4E-116	27%	26%-28%	0.91	1.9E-115
Pressure Systems	48	18%	17%-20%	0.86	2.21E-27	15%	1.43E-22	0.81	13%-16%	33%	30%-36%	0.87	7.22E-27
Pump Stations	9	15%	4%-25%	-0.1	1.15E-2	20%	17%-24%	0.91	1.4E-6	35%	23%-47%	0.64	1.31E-4
Other Pipes	13	15%	12%-17%	0.91	9.81E-9	32%	29%-34%	98%	1.66E-11	46%	44%-49%	0.99	2.99E-14
Parks Projects	**53**	**25%**	**21%-29%**	**0.61**	**2.65E-17**	**17%**	**13%-20%**	**0.47**	**1.27E-13**	**42%**	**36%-48%**	**0.65**	**5.98E-19**
Playgrounds	34	32%	28%-36%	0.84	1.51E-17	17%	12%-21%	0.42	2.33E-8	49%	41%-57%	0.73	3.96E-14
Sportfields	14	12%	7%-17%	0.15	1.15E-4	16%	11%-22%	0.59	3.56E-5	28%	22%-35%	0.72	3.29E-7
Restrooms	5	46%	19%-73%	0.66	8.99E-3	15%	-2%-32%	--0.2	7.46E-2	61%	24%-98%	0.56	1.01E-2

Notes:

[1] 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.

[2] Other Pipes Projects are not included in this table due to a small number of projects (less than 5).

[3] Total excludes projects delivered by alternative delivery mechanisms such a design-build, JOC, and CM@Risk. Projects delivered by alternative techniques are retained in the database but not analyzed. These projects are not included in the 698 projects selected for analysis in the Update 2013 Study.

Table B-2
Summary of Performance Models (Smaller Project Subset of TCC)

Project Type or Classification	80th Percentile ($)	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	**$9,745,980**	**71**	**17%**	**16%-19%**	**0.76**	**9.27E-33**	**13%**	**12%-15%**	**0.69**	**1.23E-27**	**31%**	**28%-33%**	**0.80**	**3.15E-35**
Libraries	$10,379411	13	16%	13%-19%	0.65	1.92E-8	14%	12%-16%	0.70	3.01E-8	31%	26%-34%	0.77	1.68E-9
Police/Fire Stations	$33,774,305	11	11%	8%-14%	0.64	5.53E-6	12%	9%-14%	0.79	1.01E-6	23%	18%-27%	0.78	5.58E-7
Comm./Rec.Center/ Child Care/Gyms	$9,745,980	19	17%	14%-20%	0.79	8.9E-10	10%	8%-12%	0.79	1.42E-9	27%	24%-31%	0.89	2.33E-12
Other Municipal	$7,194,154	28	18%	14%-22%	0.66	1.57E-10	11%	8%-13%	0.53	3.75E-9	29%	23%-35%	0.65	1.5E-10
Streets Projects	**$2,071,964**	**195**	**21%**	**19%-23%**	**0.37**	**3.36E-54**	**17%**	**16%-19%**	**0.43**	**9.37E-58**	**38%**	**36%-41%**	**0.49**	**4.32E-67**
Widening/New/ Grade Separations	$3,914,838	14	25%	16%-33%	0.53	2.09E-5	20%	13%-28%	0.48	4.95E-5	45%	32%-58%	0.58	6.47E-6
Bridges	$5,397,048	14	26%	21%-31%	0.72	4.5E-8	18%	15%-22%	0.75	2.76E-8	44%	37%-51%	0.80	3.66E-9
Reconstructions	$2,125,785	76	19%	17%-21%	0.58	2.53E-31	17%	15%-18%	0.54	5.04E-30	35%	32%-38%	0.63	4.06E-35
Bike/Pedestrian/ Streetscapes	$1,596,738	58	24%	20%-28%	0.17	1.75E-17	19%	15%-22%	0.23	1.81E-14	43%	37%-49%	0.27	1.97E-19
Signals	**$849,900**	**33**	28%	24%-32%	0.48	9.01E-15	20%	15%-26%	-0.42	9.99E-9	50%	43%-57%	0.23	6.71E-16
Pipes Projects [1]	$2,192,993	217	**20%**	**18%-21%**	**0.25**	**3.63E-57**	**18%**	**17%-20%**	**0.39**	**1.48E-65**	**38%**	**38%-41%**	**0.44**	**5.72E-80**
Gravity Mains	$2,047,432	160	20%	17%-22%	0.22	4.3E-40	21%	19%-23%	0.46	7.6E-52	40%	37%-44%	0.46	1.94E-59
Pressure Systems	$2,444,112	39	17%	14%-19%	0.25	5.05E-17	13%	11%-15%	0.43	5.83E-18	30%	27%-33%	0.44	4.37E-20
Pump Stations	**$3,125,449**	**8**	23%	13%-34%	0.48	1.04E-3	23%	18%-27%	0.92	6.89E-6	45%	36%-55%	0.89	9.18E-6
Other Pipes	**$3,125,399**	**10**	15%	3%-27%	-0.4	1.83E-2	24%	18%-30%	0.81	7.39E-6	39%	22%-55%	0.39	4.99E-4
Parks Projects	$1,049,387	43	**30%**	**26%-34%**	**0.50**	**4.28E-18**	**21%**	**17%-24%**	**0.24**	**5.01E-14**	**51%**	**45%-56%**	**0.55**	**2.04E-21**
Playgrounds	$1,049,387	28	31%	26%-36%	0.56	5.62E-13	21%	16%-26%	0.18	5.47E-9	52%	44%-59%	0.56	1.98E-14
Sportfields	$2,048,637	11	11%	5%-17%	-3.9	2.77E-3	13%	8%-18%	-0.02	1.6E-4	24%	13%-34%	-1.95	5.74E-4
Restrooms [2]	$734,633	4	30%	-5%-65%	0.10	7.35E-2	19%	-13%-52%	-0.15	1.61E-1	49%	-18%-115%	-0.03	1.01E-1

Notes:

[1] Projects belonging to the Other Pipes Category are not included due to insufficient data points (N=9)

[2] The confidence intervals obtained for the Restrooms classification cannot be used for meaningful analyses due to the limited number of data points (N=5)

The elimination of auto-correlation in Update 2008 and the use of the linear trendline to describe the relationship between project delivery costs and the TCC have significantly improved the R^2 values in the past four years as compared to the *Study* years prior to 2008.

For projects evaluated under the full range of TCC, Pipes and Municipal Facilities projects exhibit higher R^2 values as compared to Streets and Parks projects for the project delivery versus TCC regressions. This may be attributed to better definition of Pipes and Municipal Facilities projects at the beginning of a project and thus allow for the design effort to be more focused. This would lead to more consistent performance and therefore higher R^2 values.

It is observed that the R^2 values are lower for projects falling in the 80th percentile subset of TCC than for projects falling under the full range of TCC. This is explained due to the fact that there is greater scatter amongst the project data points evaluated under a 80th percentile range of TCC than the full range of TCC. Project classifications with very few data points typically exhibit low R^2 values (less than 0.5).

Table B-3 Summary of Regression Equations

Project Type or Classification	Design Cost ($) vs. TCC($) Full Range of TCC	Design Cost ($) vs. TCC($) Smaller Project Subset of TCC	CM Cost ($) vs. TCC($) Full Range of TCC	CM Cost ($) vs. TCC($) Smaller Project Subset of TCC	Project Delivery Cost ($) vs. TCC($) Full Range of TCC	Project Delivery Cost ($) vs. TCC($) Smaller Project Subset of TCC
Municipal Projects	**y=0.1209x**	**y=0.1739x**	**y=0.1208x**	**y=0.1316x**	**y=0.2416x**	**y=0.3054x**
Libraries	y=0.1467x	y=0.16x	y=0.1549x	y=0.1405x	y=0.3016x	y=0.3005x
Police/Fire Stations	y=0.0976x	y=0.1092x	y=0.0792x	y=0.1174x	y=0.1767x	y=0.2266x
Comm./Rec. Center/	y=0.1342x	y=0.1714x	y=0.1241x	y=0.1006x	y=0.2583x	y=0.2719x
Other Municipal	y=0.1422x	y=0.1784x	y=0.163x	y=0.1079x	y=0.3052x	y=0.2864x
Streets Projects	**y=0.1822x**	**y=0.2084x**	**y=0.1558x**	**y=0.1746x**	**y=0.3381x**	**y=0.3835x**
Widening/New/ Grade Separations	y=0.1926x	y=0.2466x	y=0.1821x	y=0.2030x	y=0.3746x	y=0.4496x
Bridges	y=0.1853x	y=0.2592x	y=0.1479x	y=0.1831x	y=0.3332x	y=0.4422x
Reconstructions	y=0.1499x	y=0.1883x	y=0.1616x	y=0.1652x	y=0.3115x	y=0.3537x
Bike/Pedestrian/ Streetscapes	y=0.2333x	y=0.2416x	y=0.1318x	y=0.1858x	y=0.3652x	y=0.4283x
Signals	**y=0.1928x**	y=0.2798x	y=0.1484x	y=0.2045x	y=0.342x	y=0.4997x
Pipes Projects	y=0.1063x	**y=0.1972x**	**y=0.1834x**	**y=0.1848x**	**y=0.2898x**	**y=0.3821x**
Gravity Mains	y=0.0935x	y=0.1958x	y=0.1727x	y=0.2090x	y=0.2662x	y=0.4049x
Pressure Systems	y=0.1809x	y=0.1655x	y=0.1479x	y=0.1310x	y=0.3298x	y=0.2999x
Pump Stations	**y=0.1489x**	y=0.2334x	y=0.2030x	y=0.2250x	y=0.3518x	y=0.4584x
Other Pipes	**y=0.1466x**	y=0.1484x	y=0.3162x	y=0.2404x	y=0.4628x	y=0.3888x
Parks Projects	y=0.2530x	**y=0.3011x**	**y=0.1660x**	**y=0.2051x**	**y=0.4189x**	**y=0.5062x**
Playgrounds	y=0.3248x	y=0.3060x	y=0.1674x	y=0.2093x	y=0.4922x	y=0.5153x
Sportfields	y=0.1197x	y=0.1116x	y=0.164x	y=0.1257x	y=0.2837x	y=0.2372x
Restrooms	y=0.4584x	y=0.2983x	y=0.1502x	y=0.1910x	y=0.6086x	y=0.4893x

Note:
[1]m = slope of the regression trendline which is the project delivery percentage.

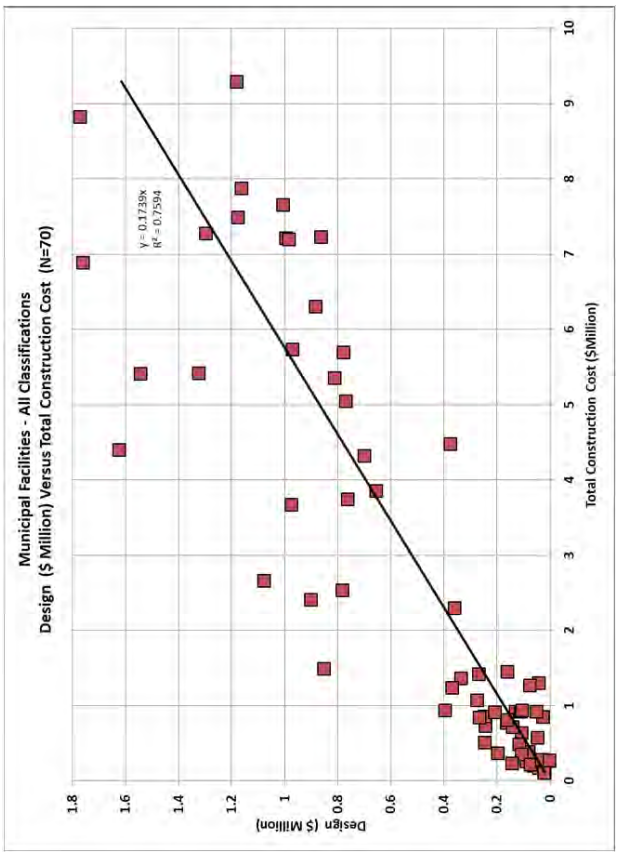
APPENDIX B

Performance Curves

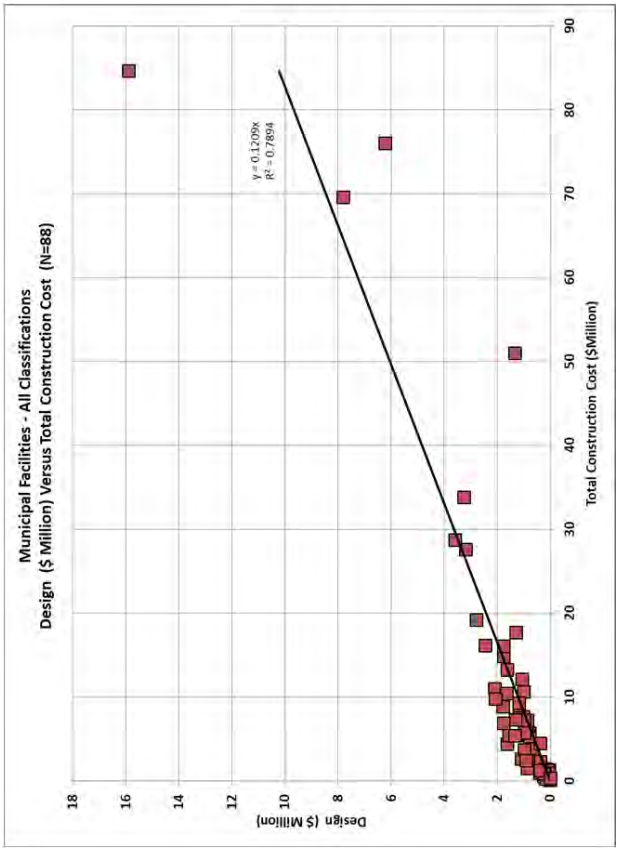
CURVES GROUP 1

Design Cost vs Total Construction Cost

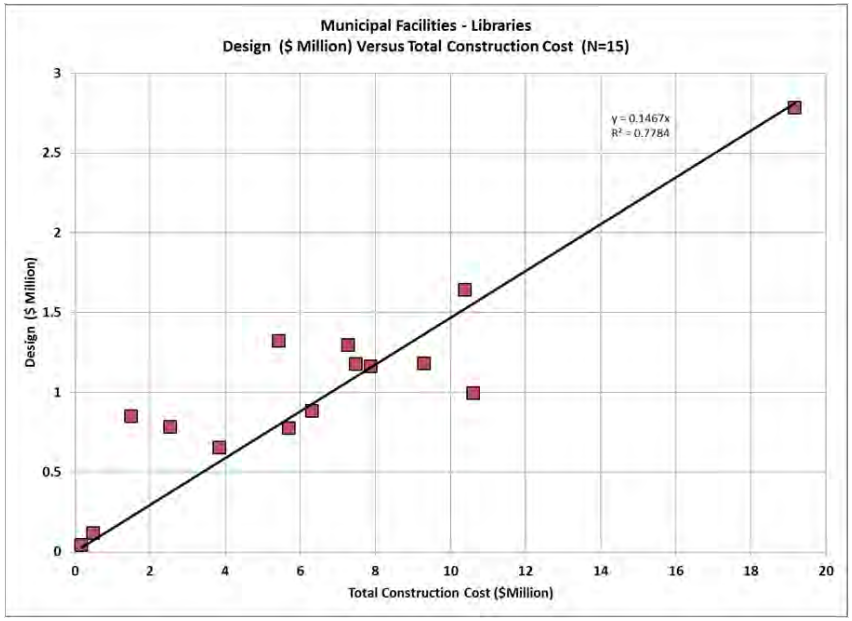
80th Percentile Projects



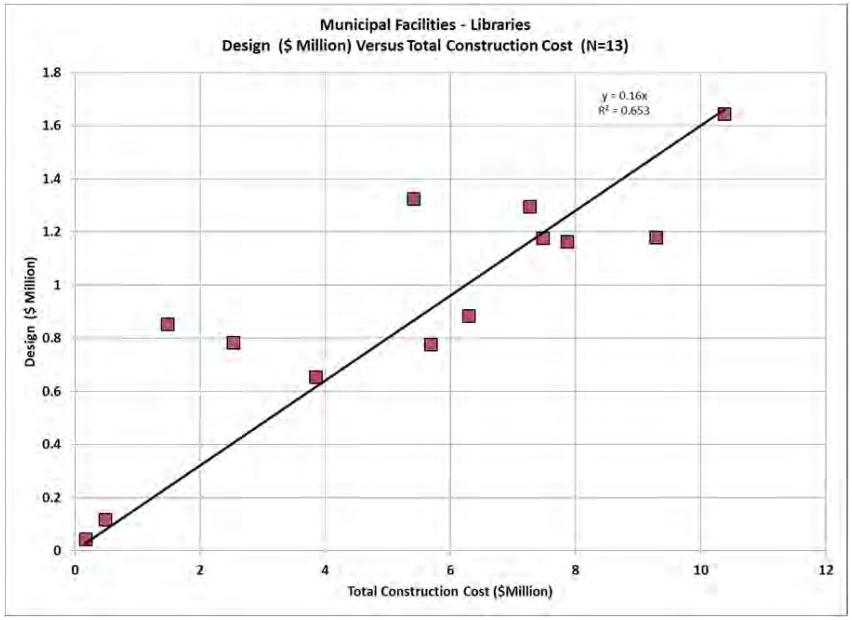
All Projects



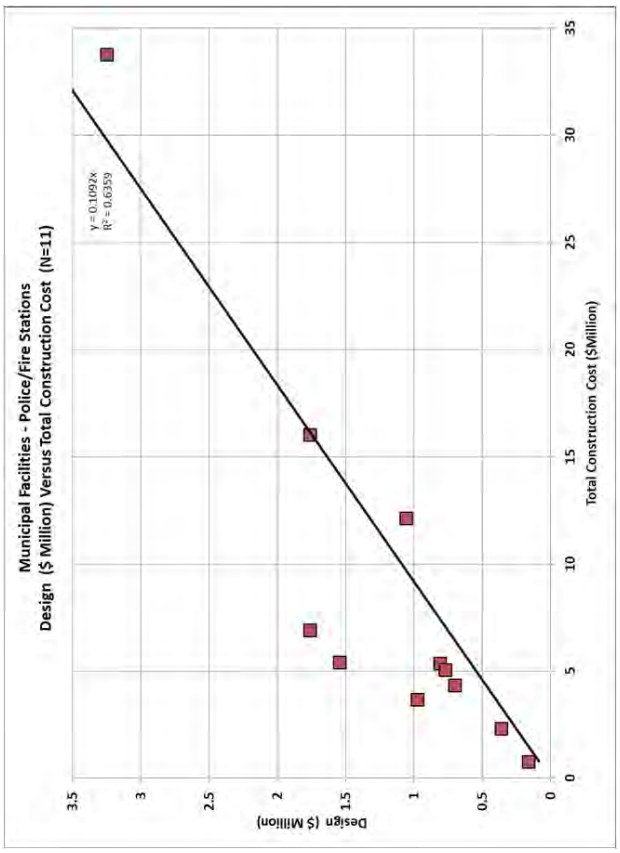
All Projects



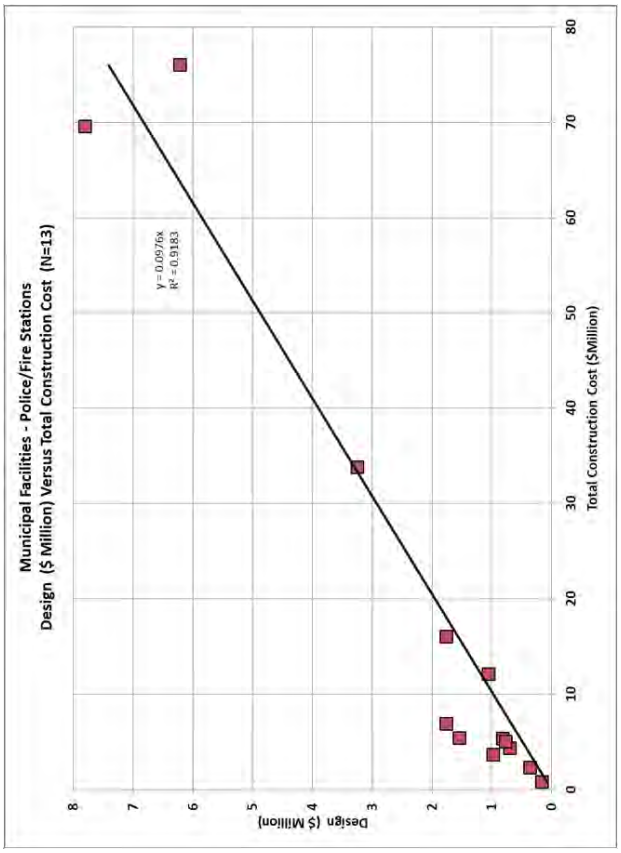
80th Percentile Projects



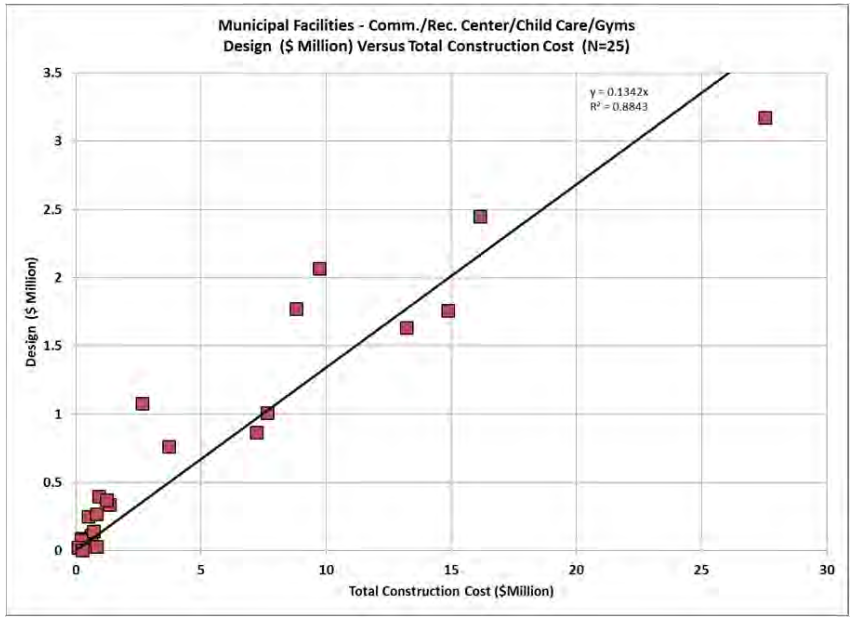
80th Percentile Projects



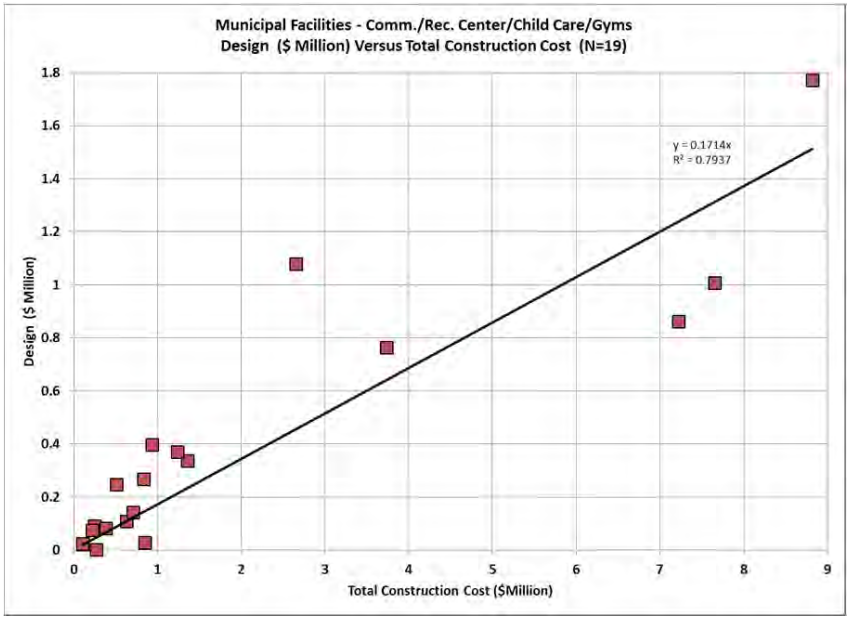
All Projects



All Projects



80th Percentile Projects



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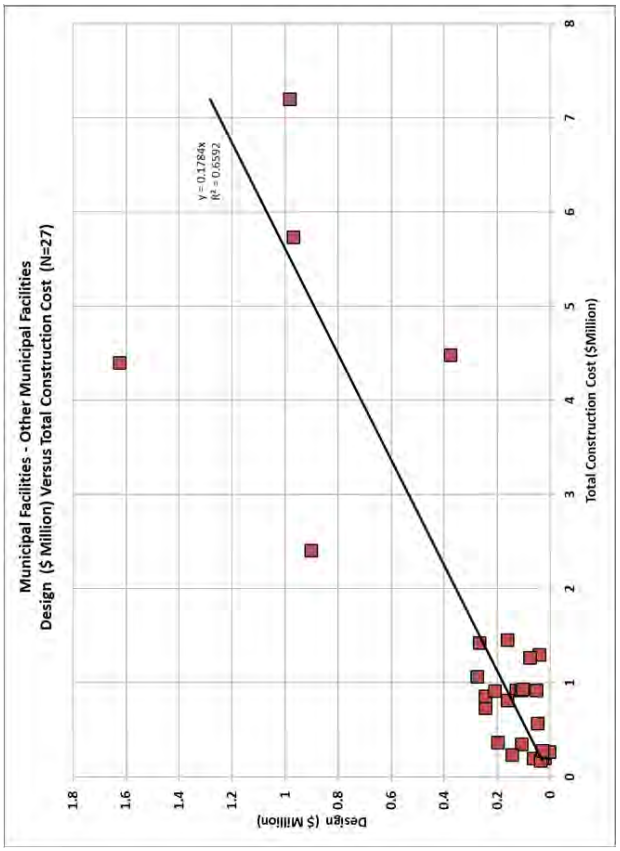
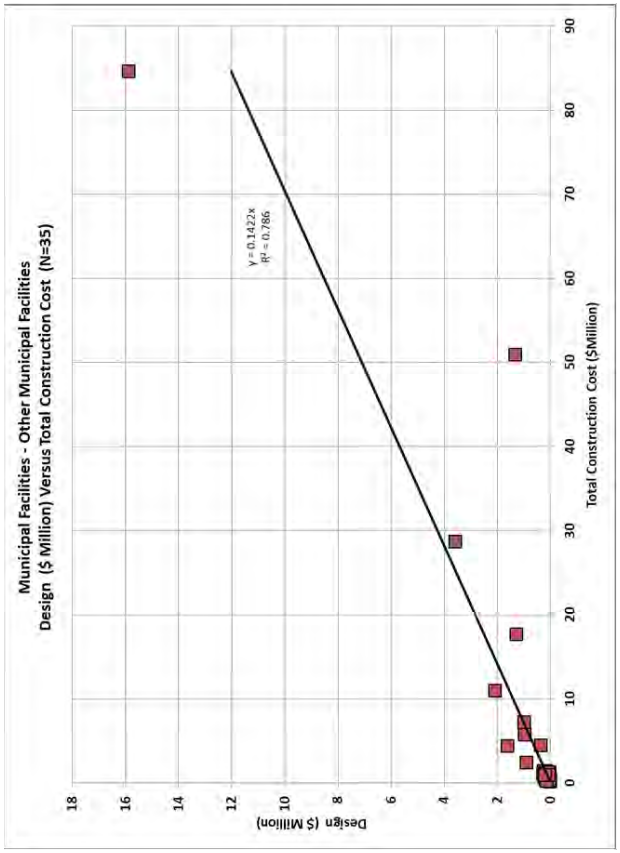
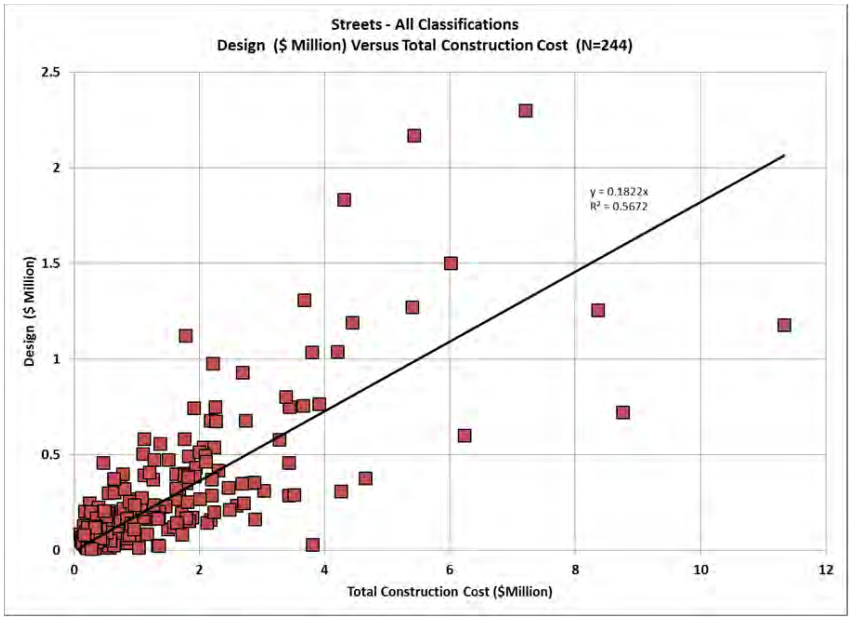


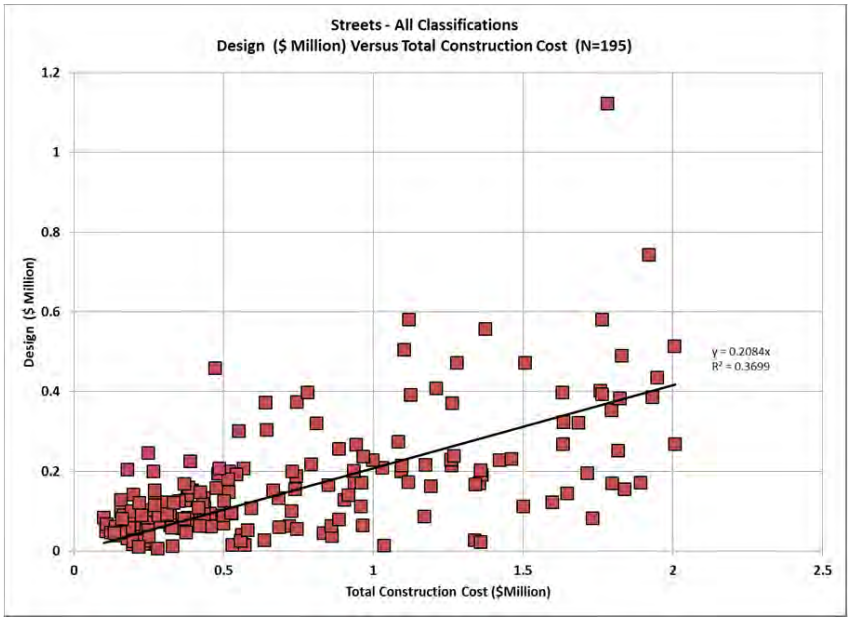
All Projects



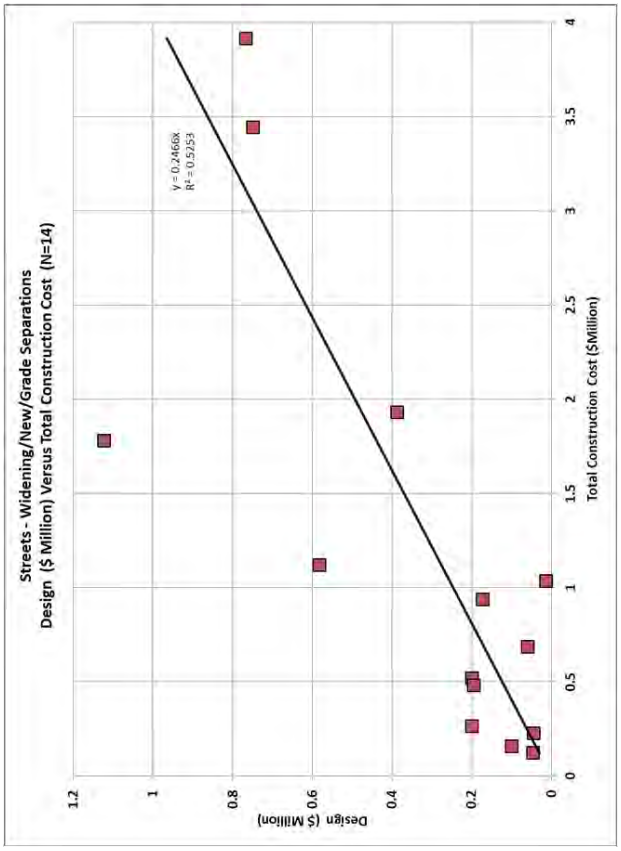
All Projects



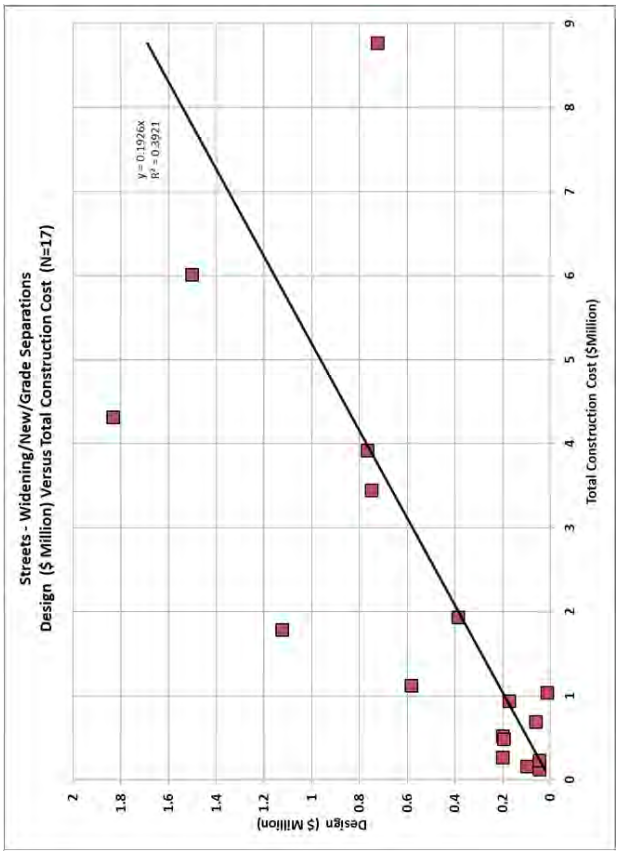
80th Percentile Projects



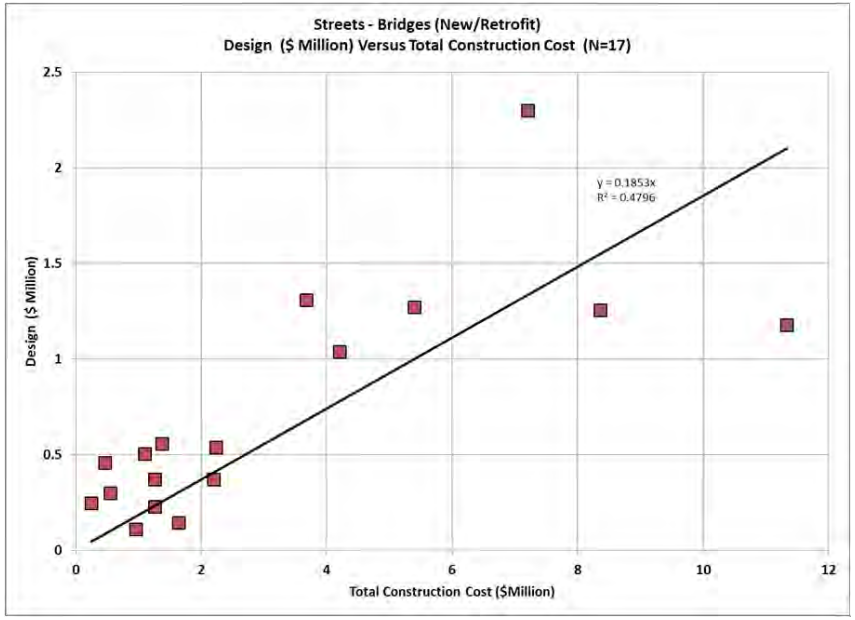
80th Percentile Projects



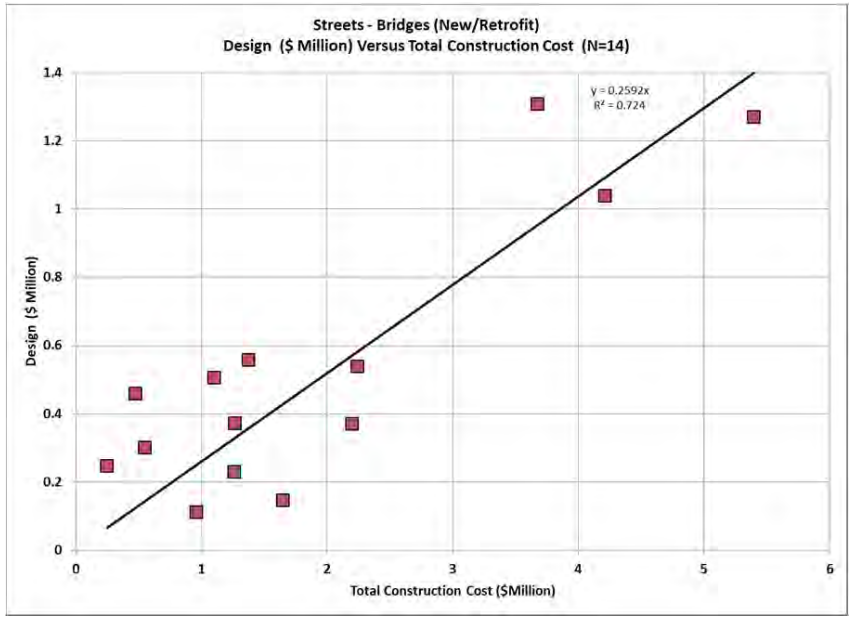
All Projects



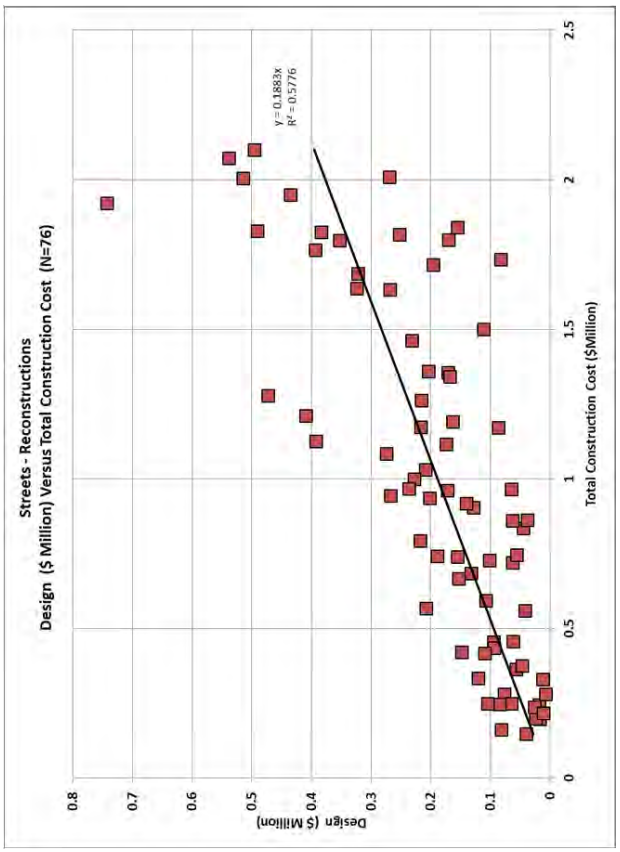
All Projects



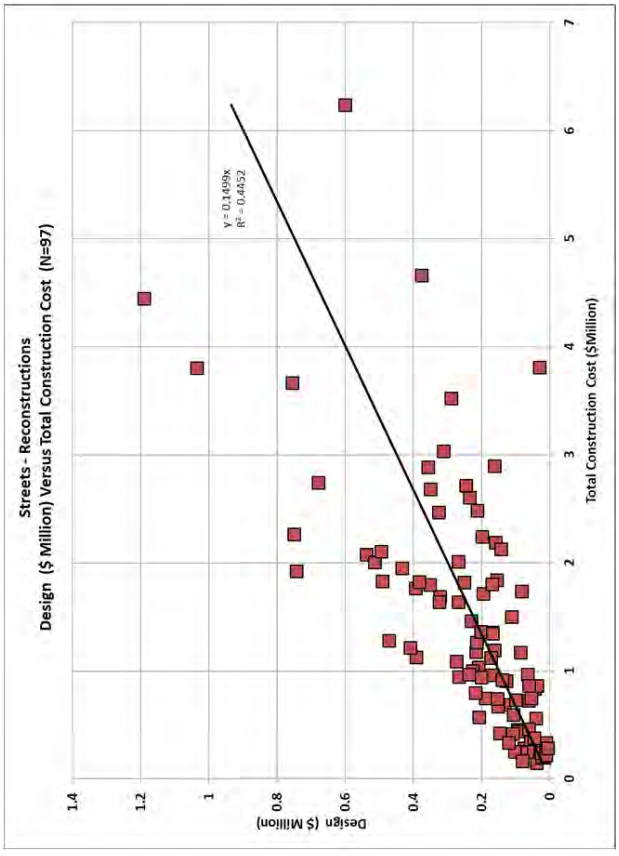
80th Percentile Projects



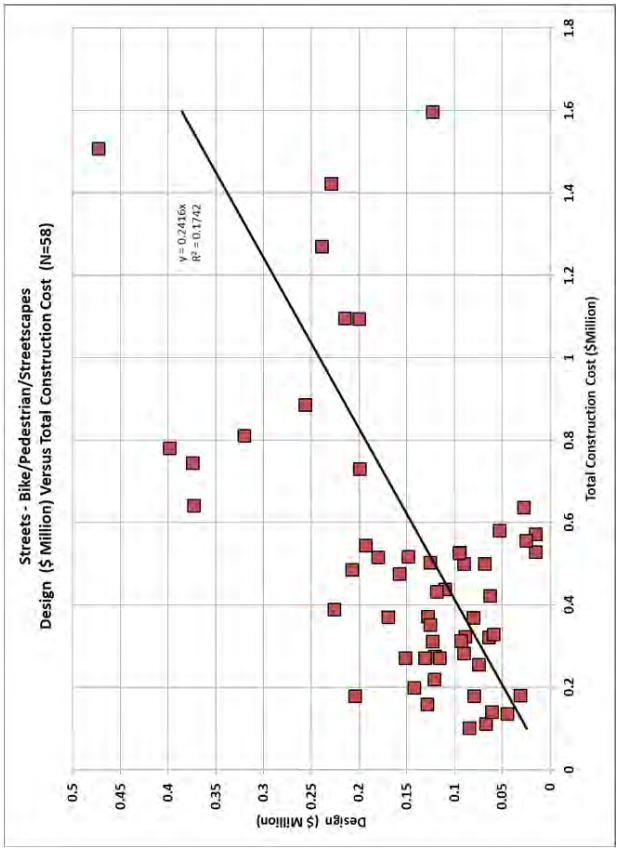
80th Percentile Projects



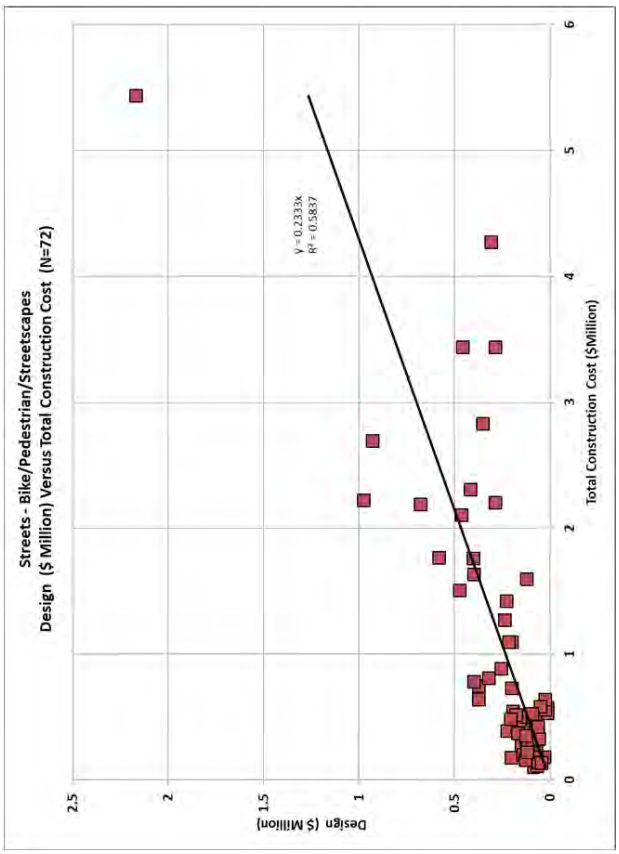
All Projects



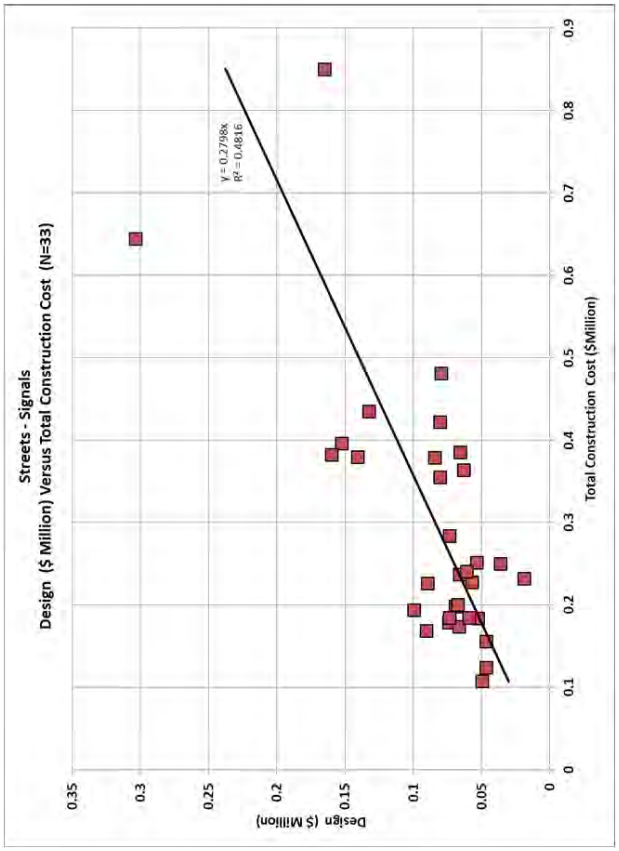
80th Percentile Projects



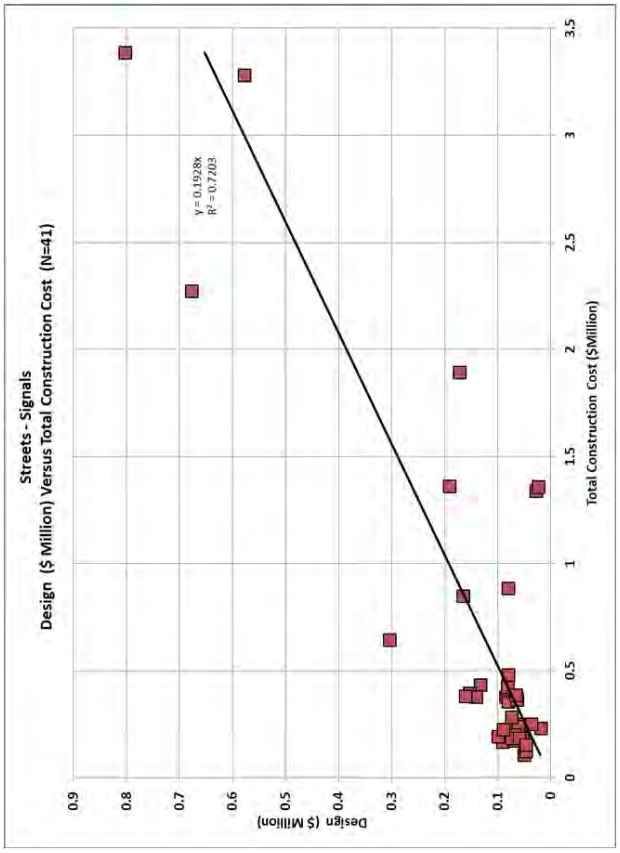
All Projects



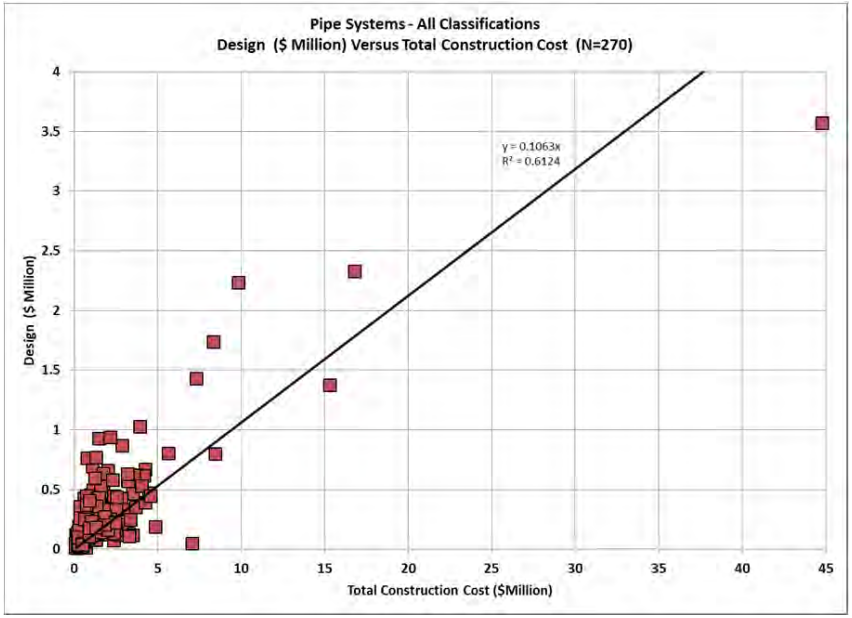
80th Percentile Projects



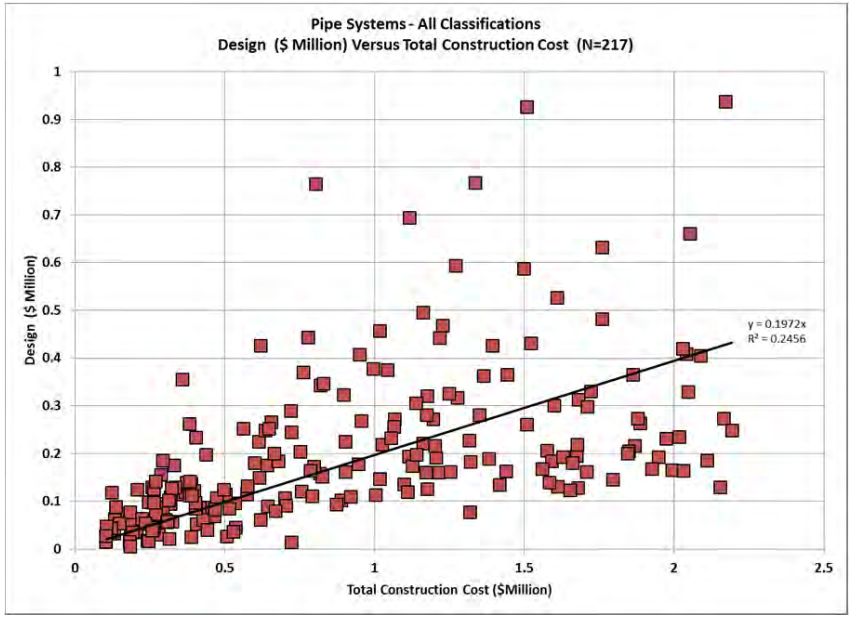
All Projects



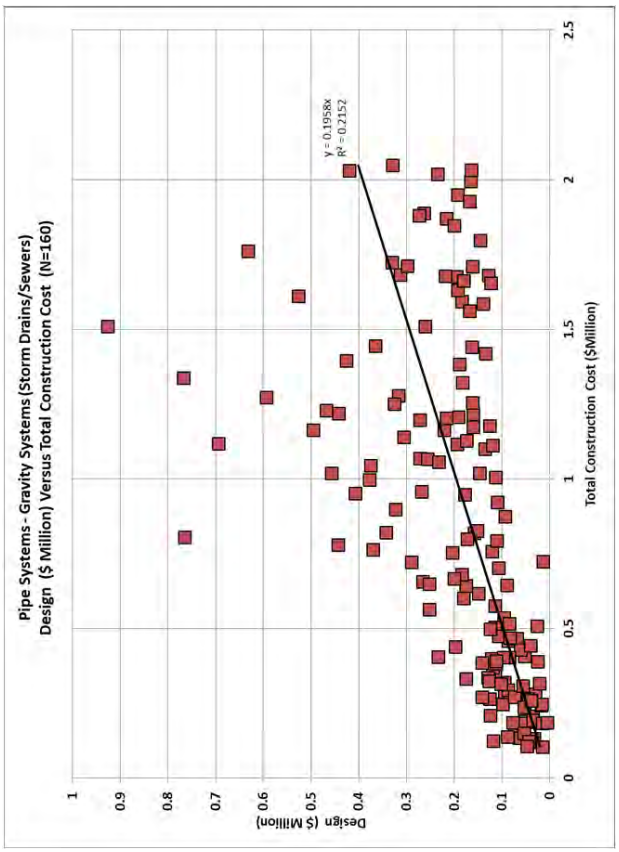
All Projects



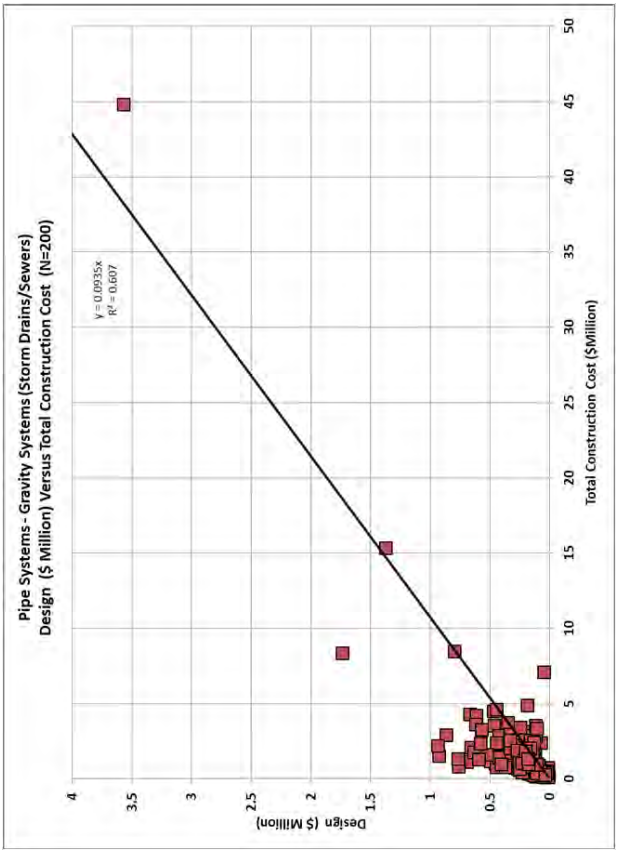
80th Percentile Projects

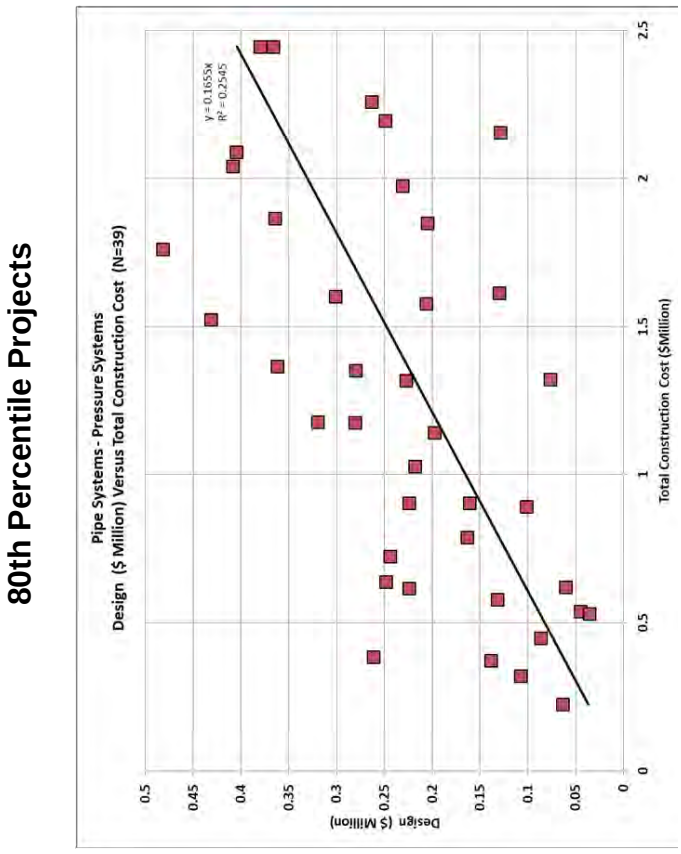


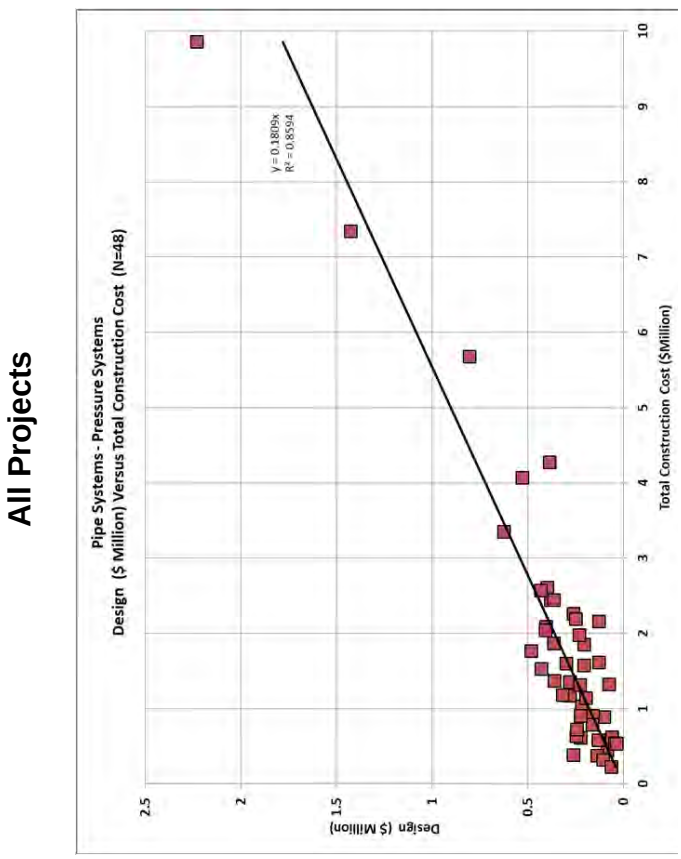
80th Percentile Projects



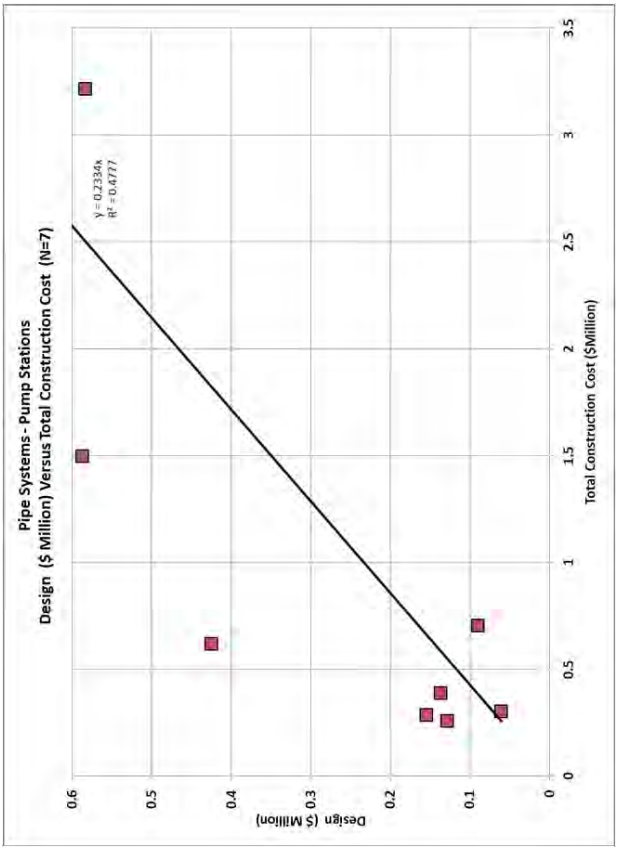
All Projects



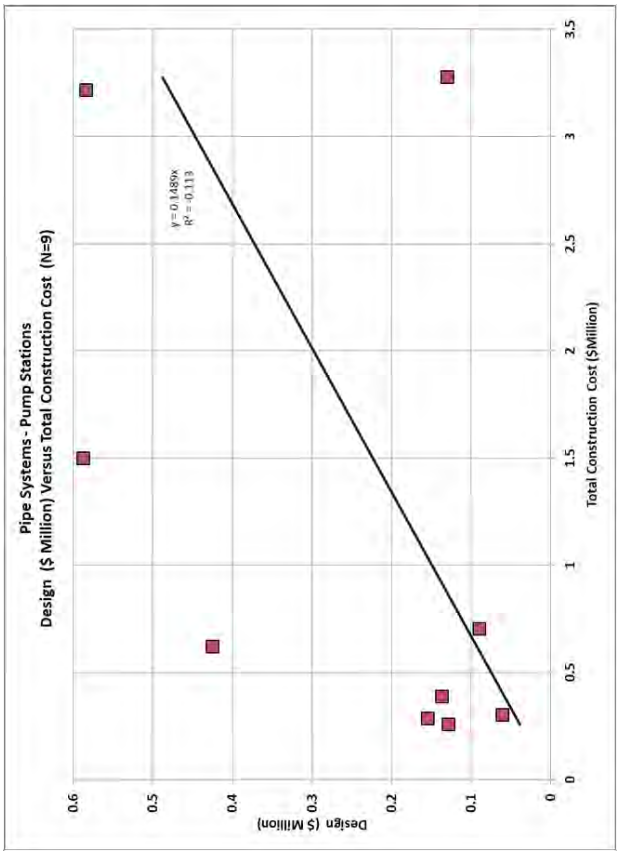

80th Percentile Projects
Pipe Systems - Pressure Systems
Design ($ Million) Versus Total Construction Cost (N=39)
y = 0.1655x
R² = 0.2545
Design ($ Million)
Total Construction Cost ($Million)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0
0.5
1
1.5
2
2.5


All Projects
Pipe Systems - Pressure Systems
Design ($ Million) Versus Total Construction Cost (N=48)
y = 0.1809x
R² = 0.8594
Design ($ Million)
Total Construction Cost ($Million)
0
0.5
1
1.5
2
2.5
0
1
2
3
4
5
6
7
8
9
10

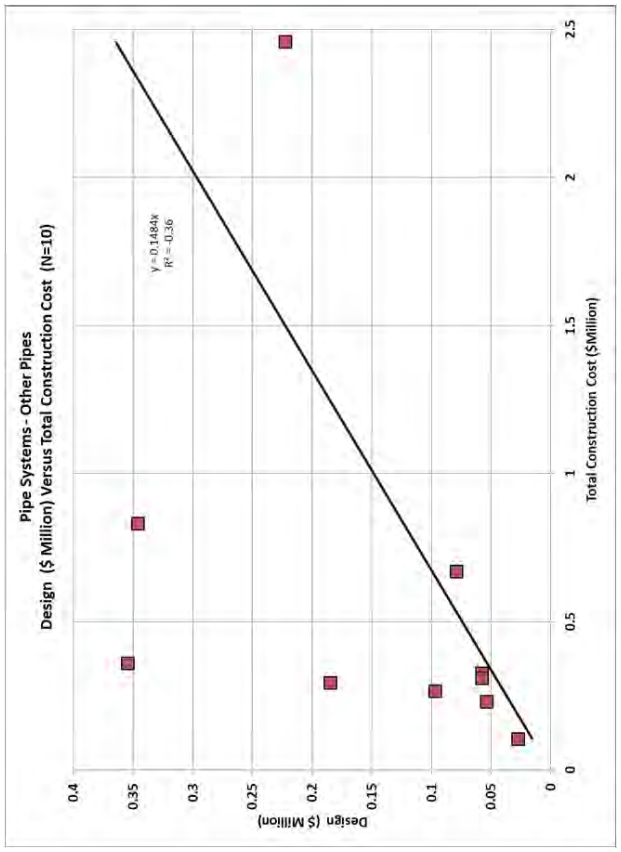
80th Percentile Projects



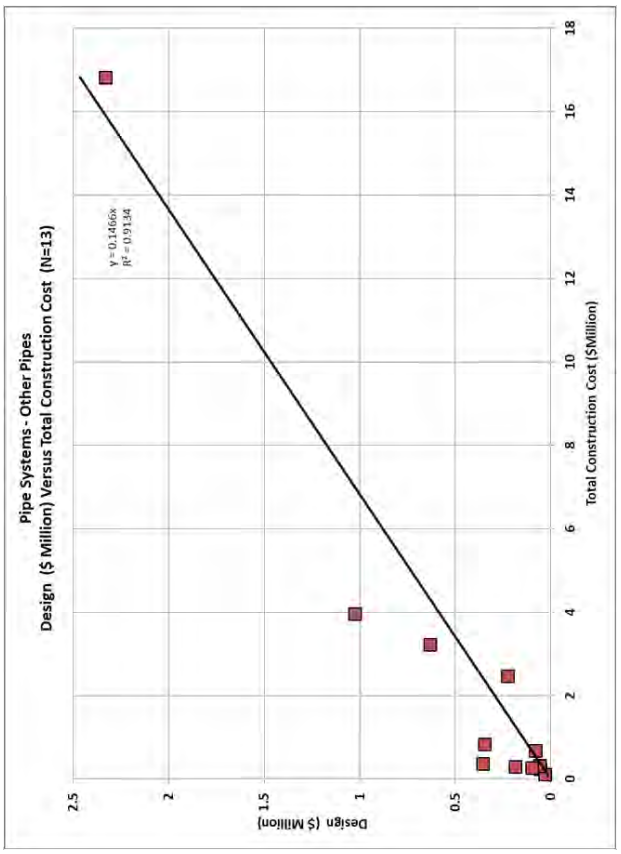
All Projects



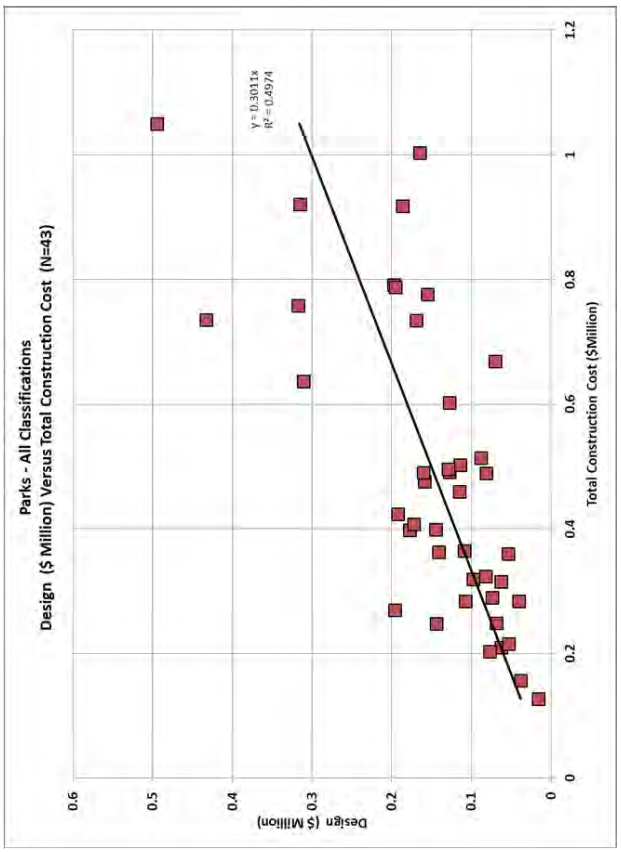
80th Percentile Projects



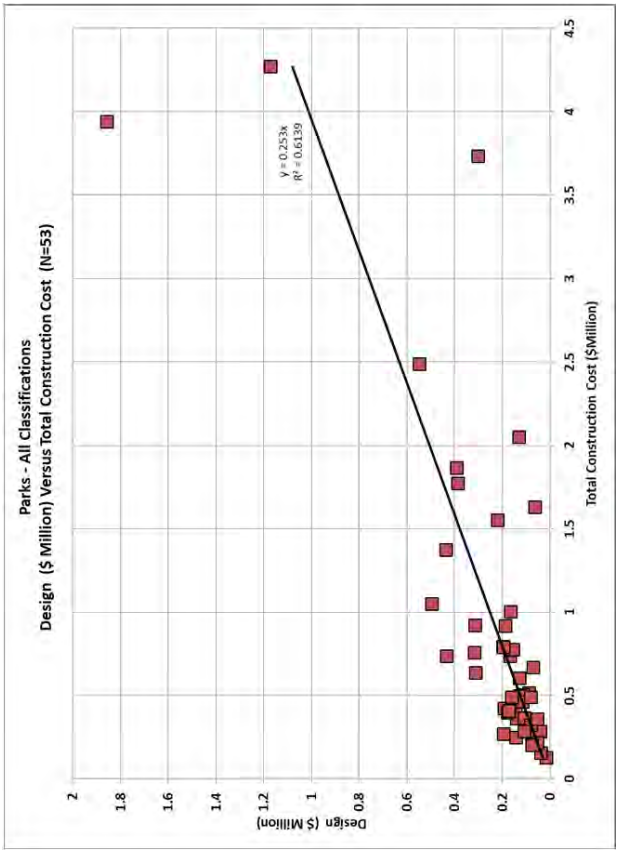
All Projects



80th Percentile Projects



All Projects



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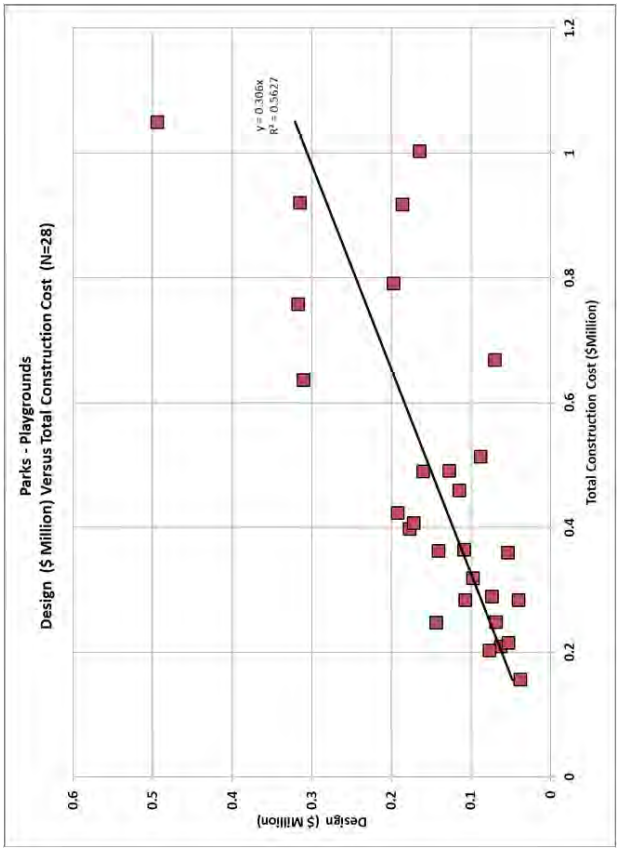
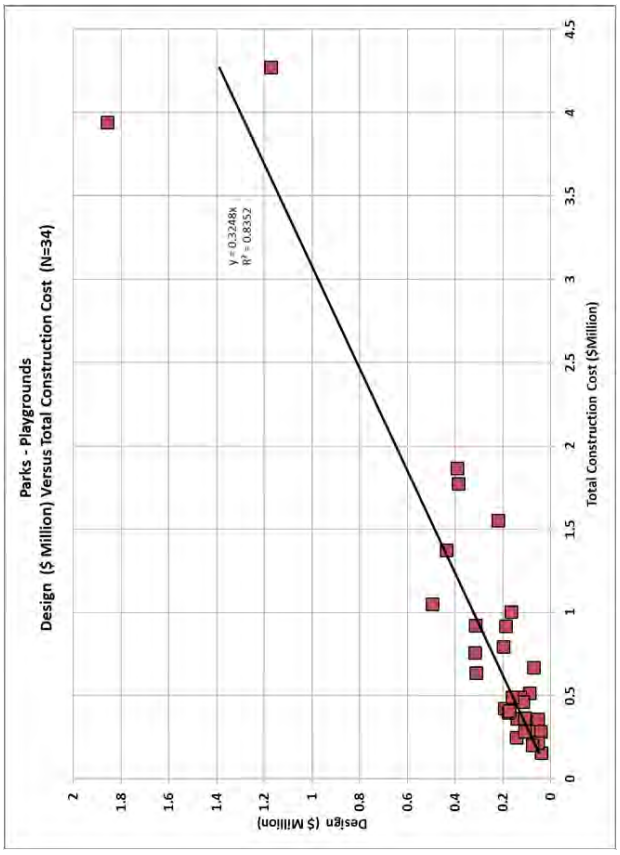


All Projects



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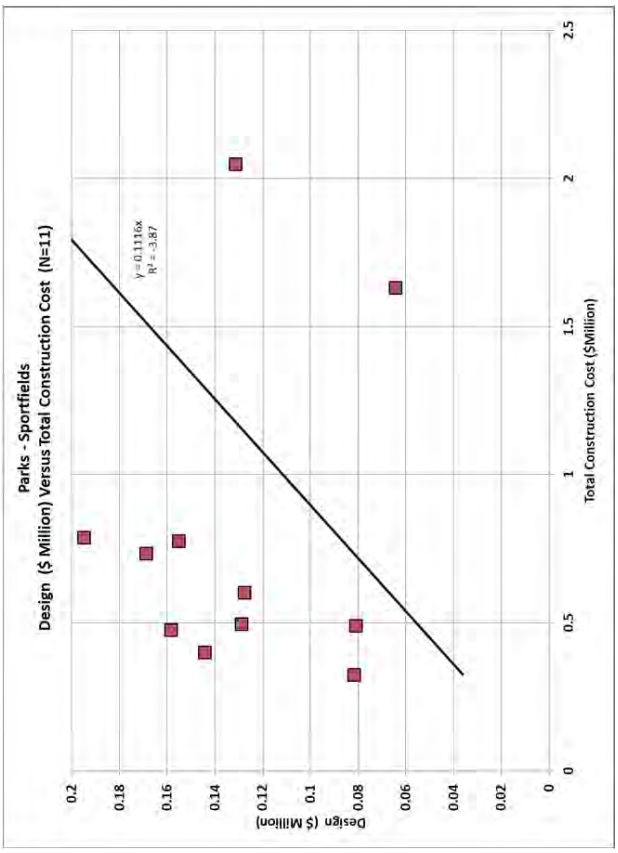

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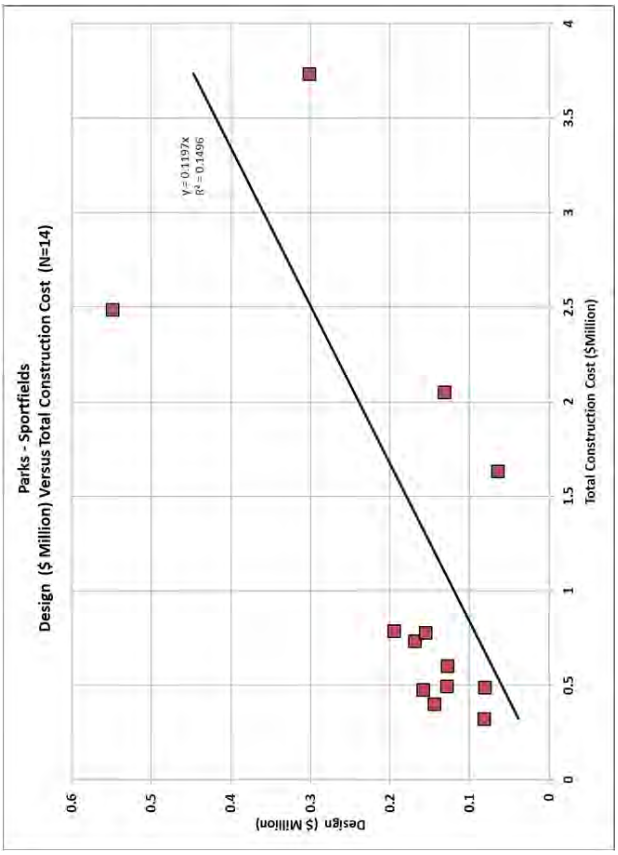

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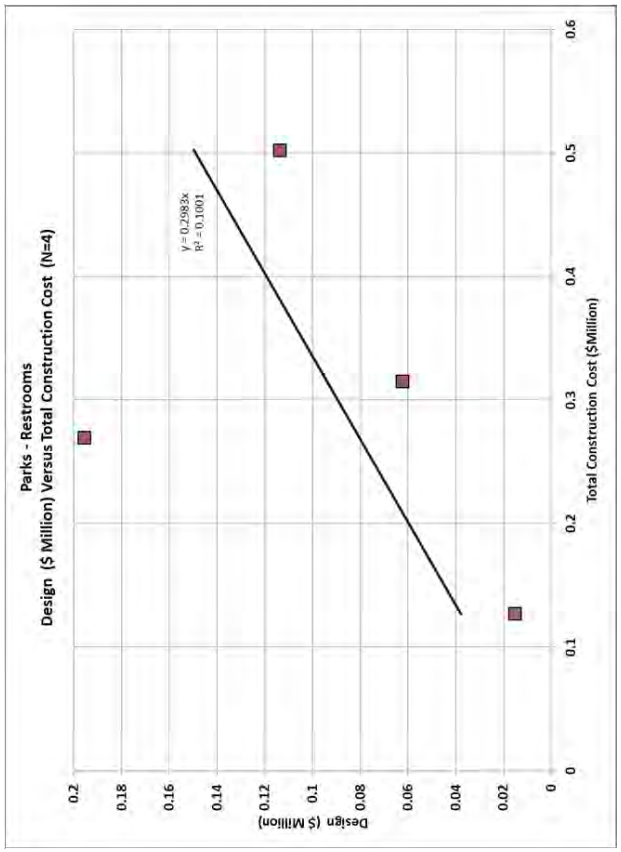
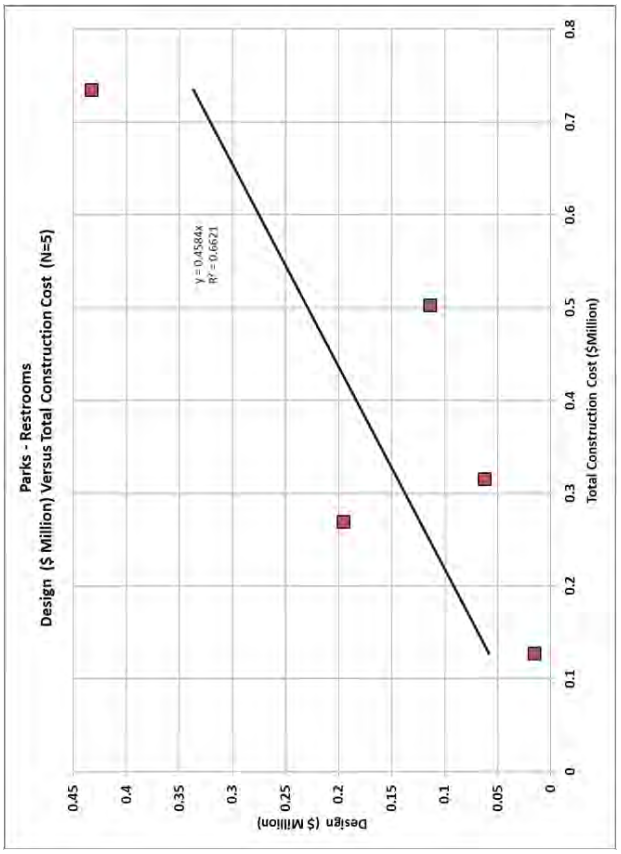


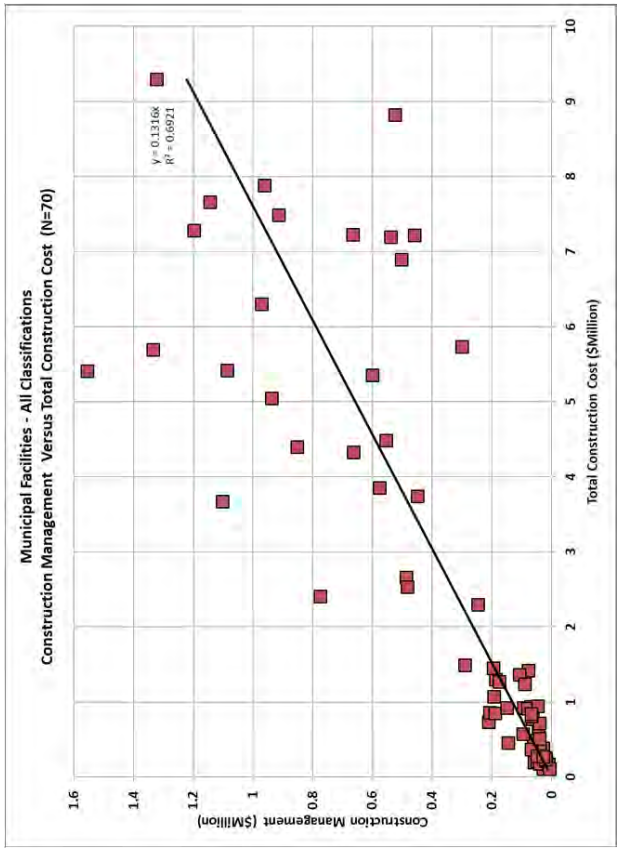
All Projects



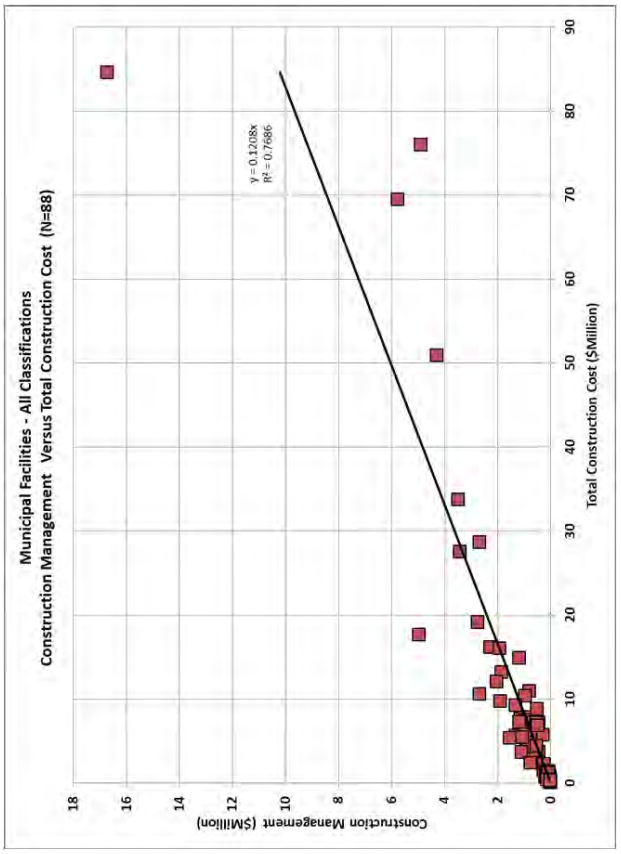
CURVES GROUP 2

Construction Management Cost
vs
Total Construction Cost

80th Percentile Projects



All Projects



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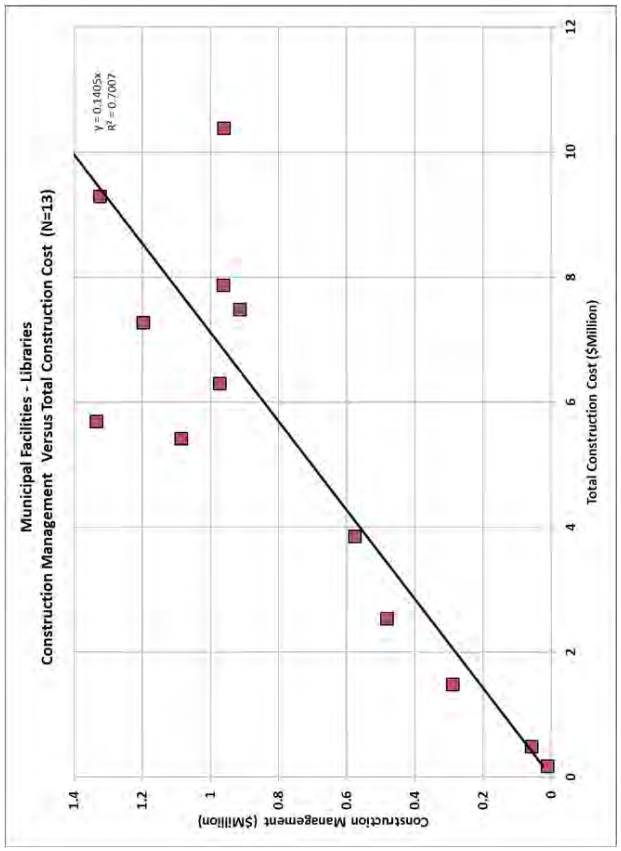
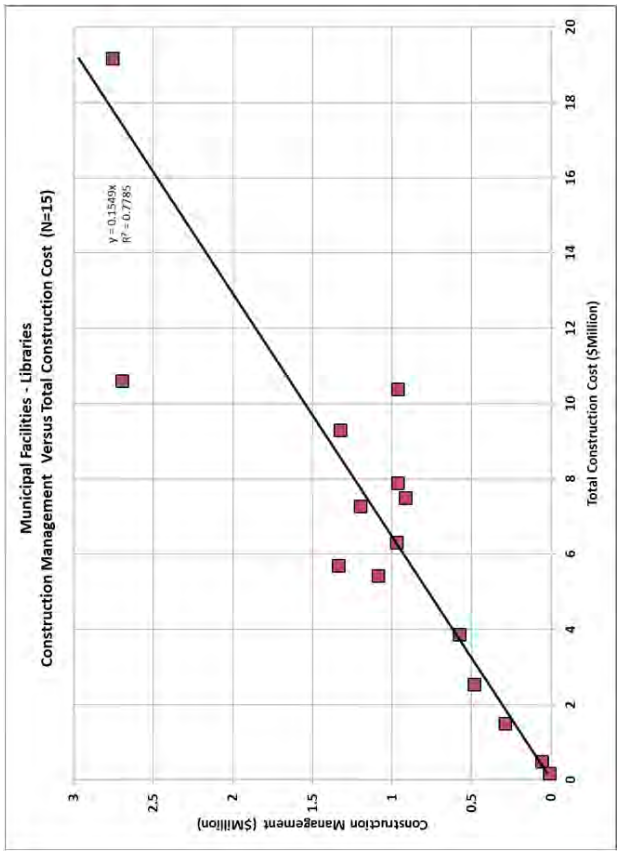
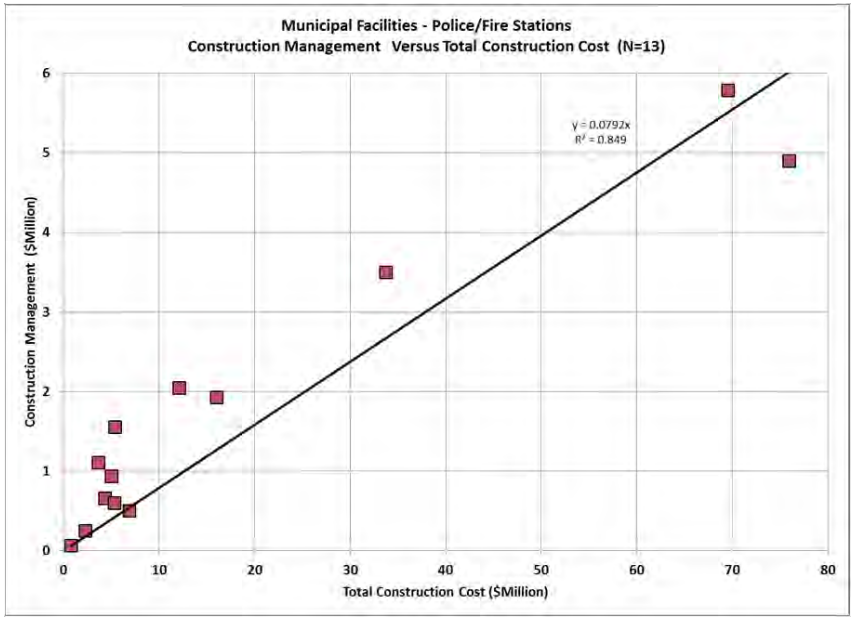


All Projects



All Projects



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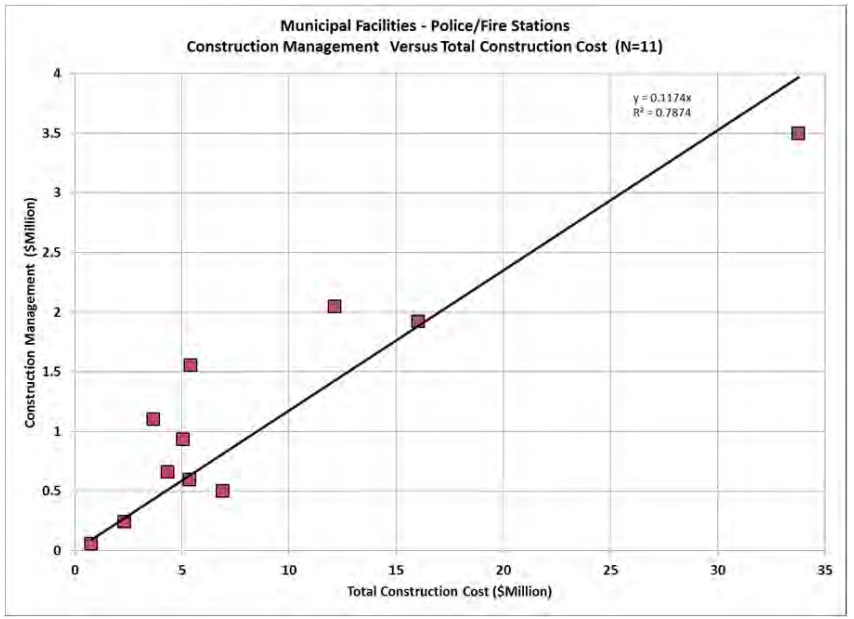
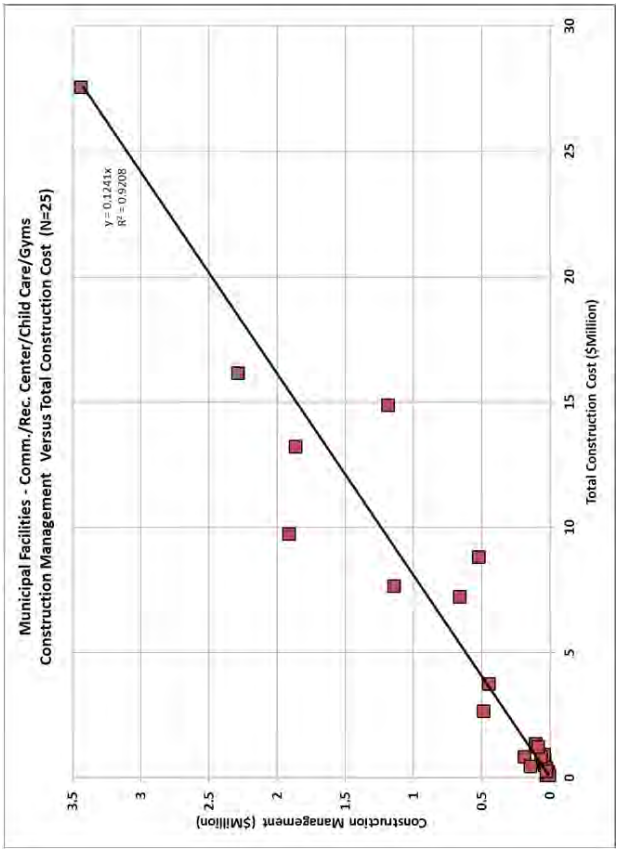


All Projects



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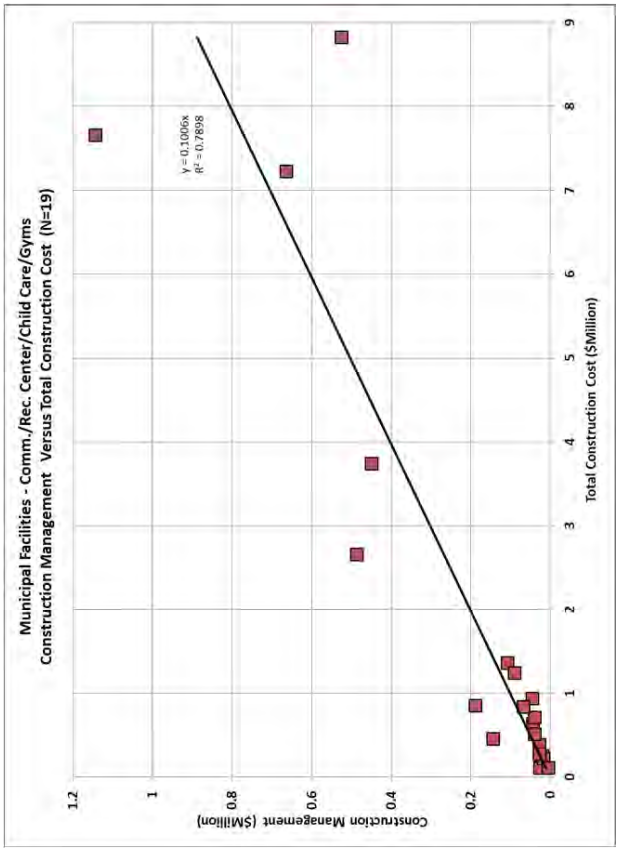
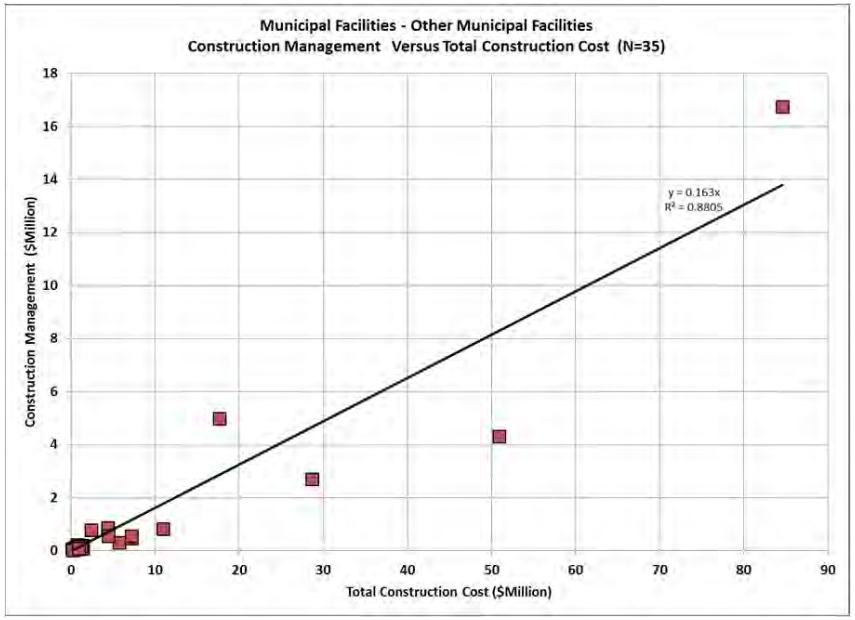


All Projects



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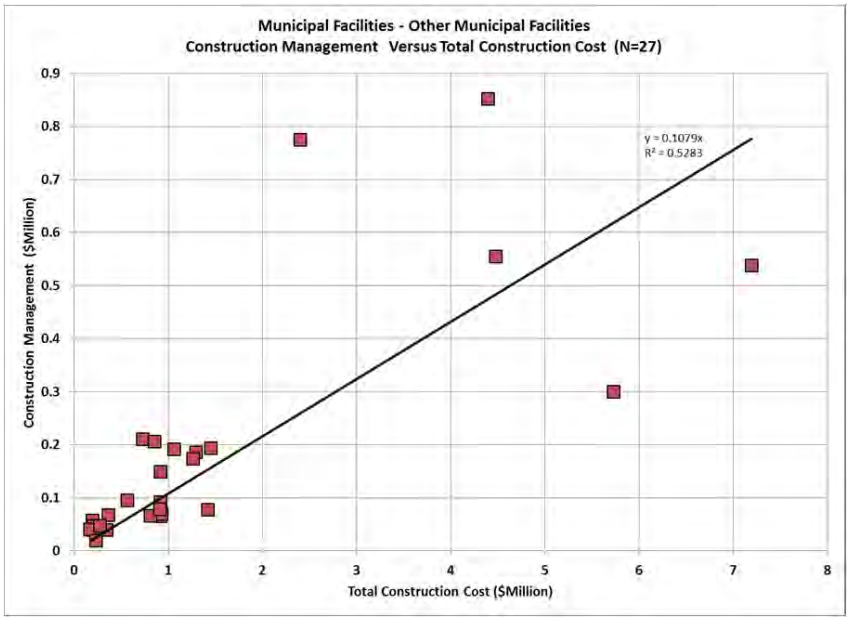

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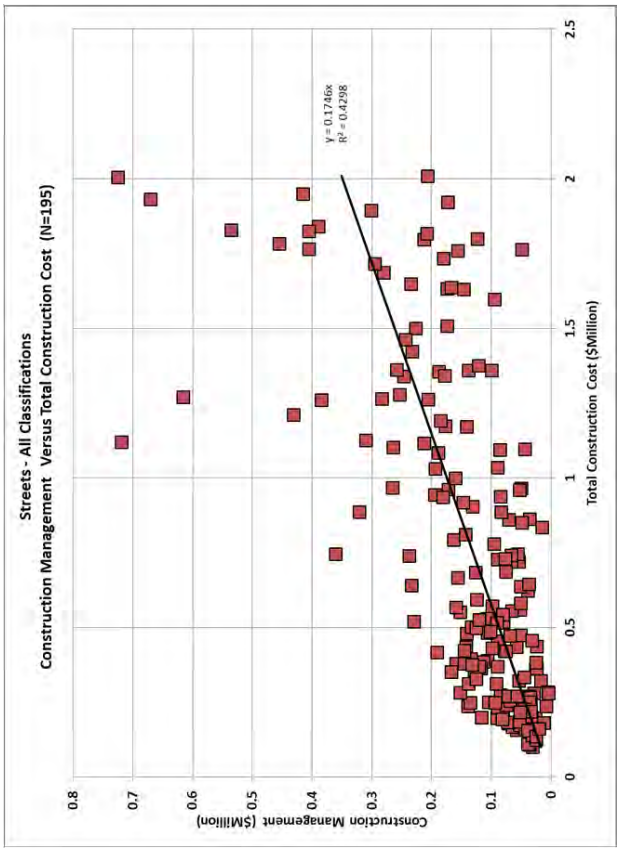
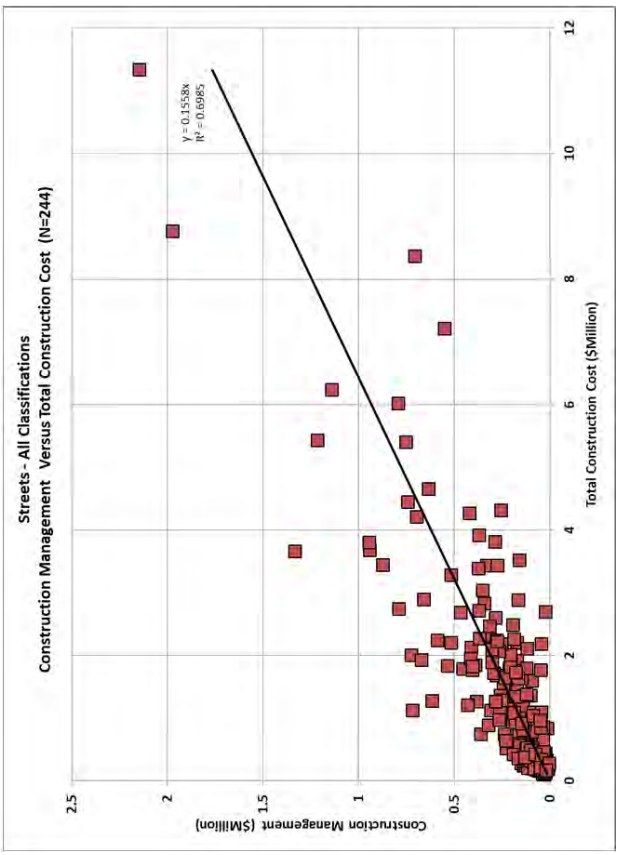


All Projects



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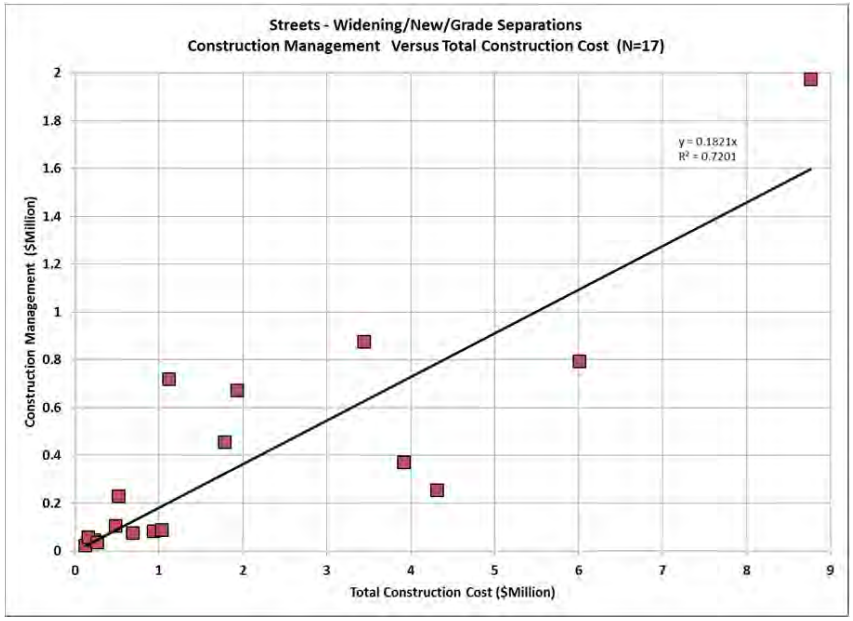

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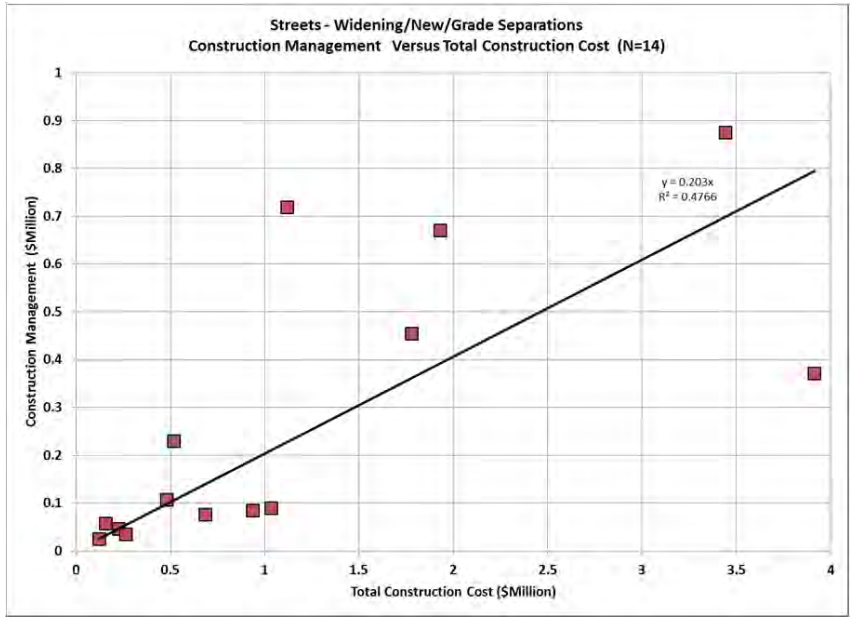

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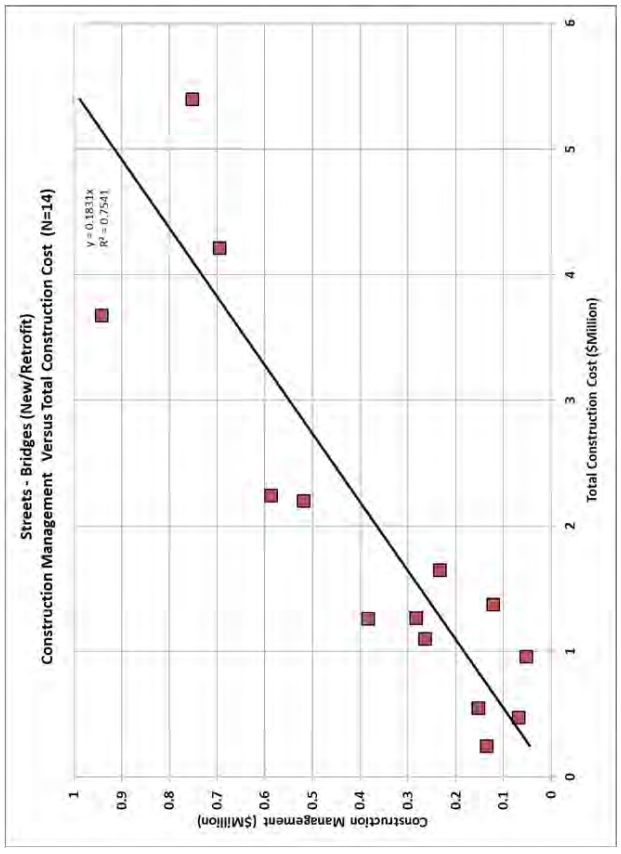
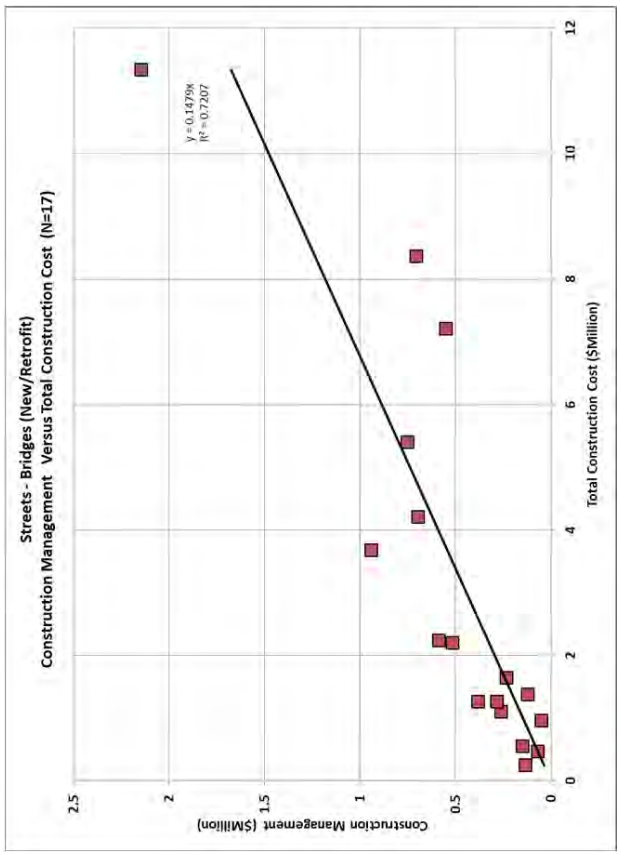
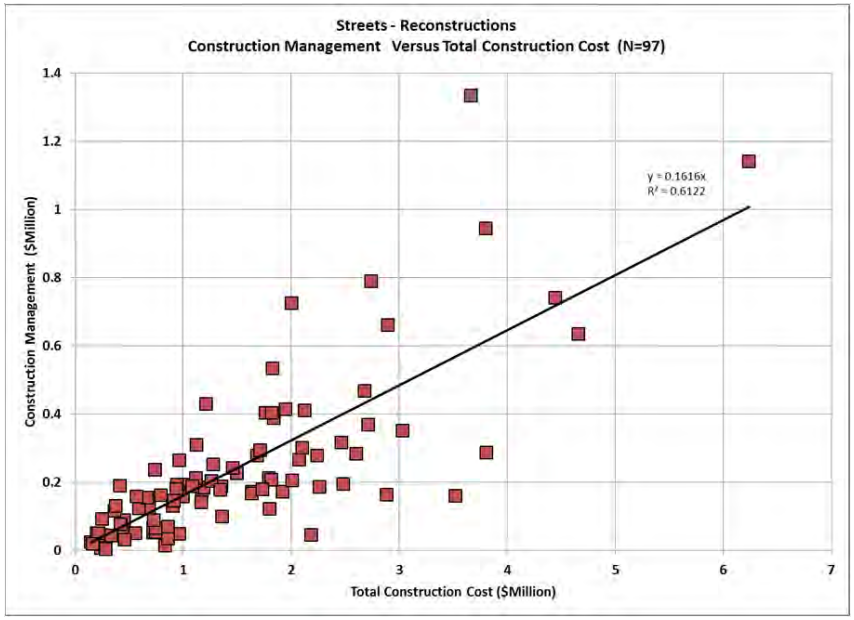


All Projects



All Projects



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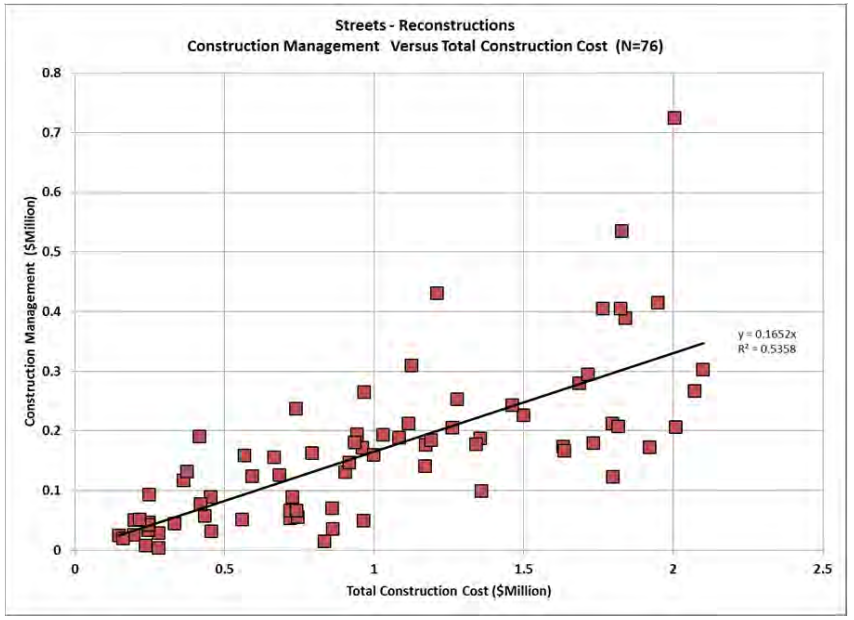

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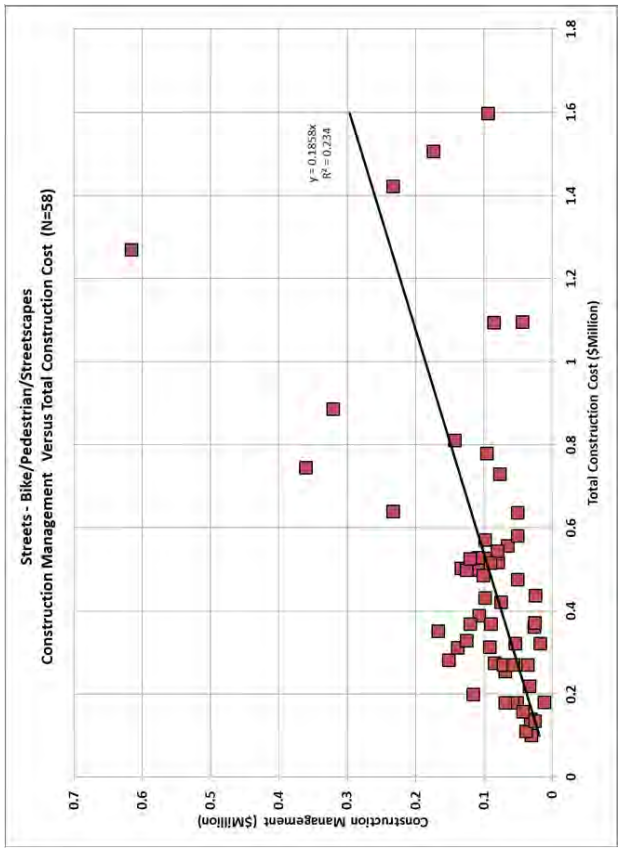
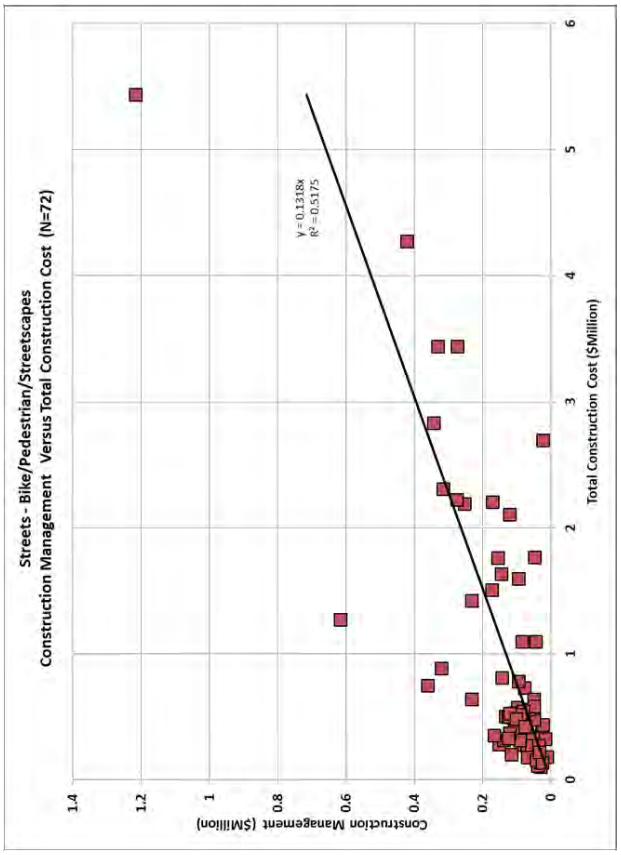


All Projects



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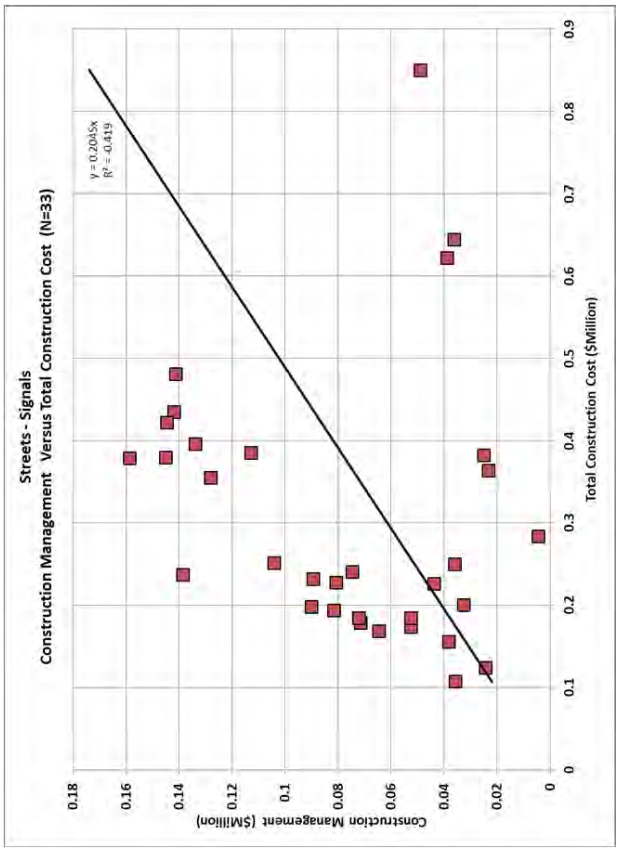

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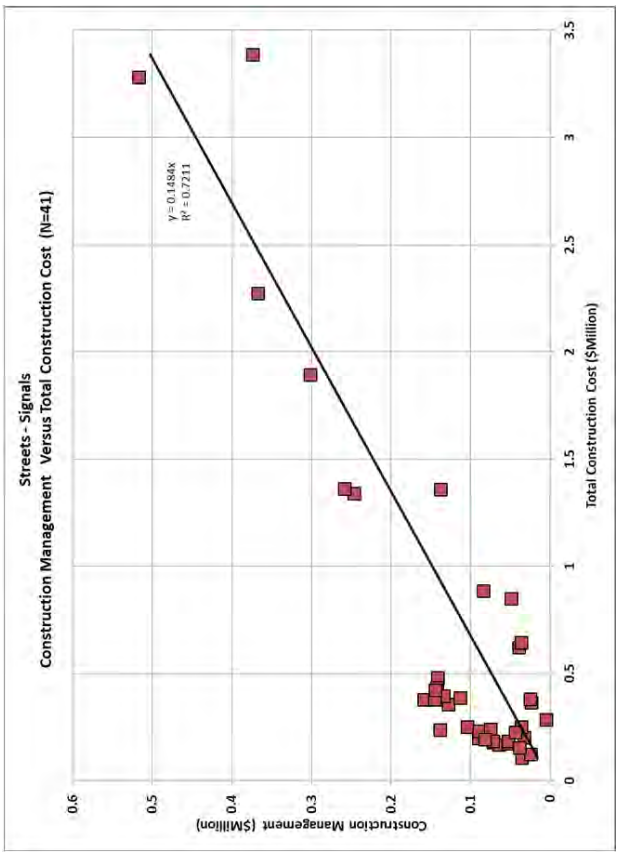

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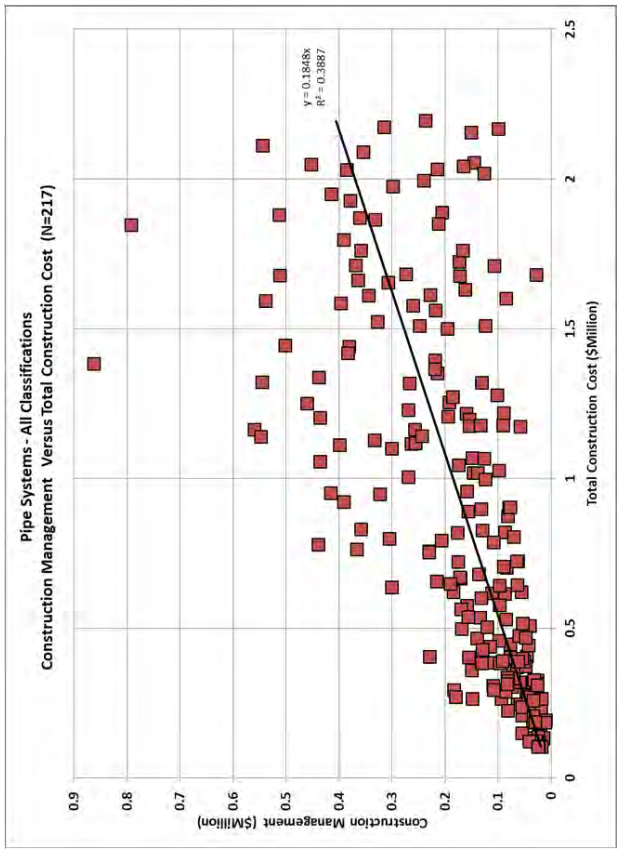
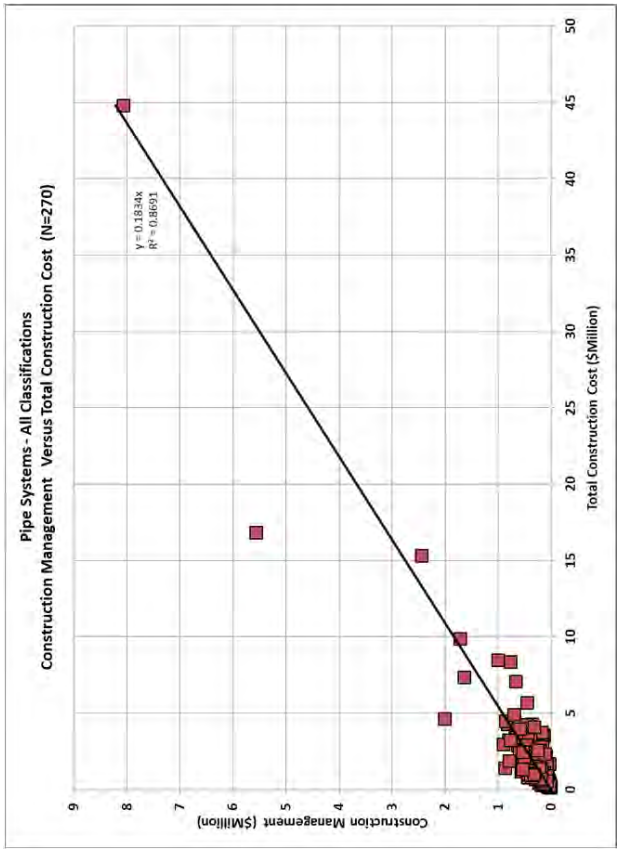
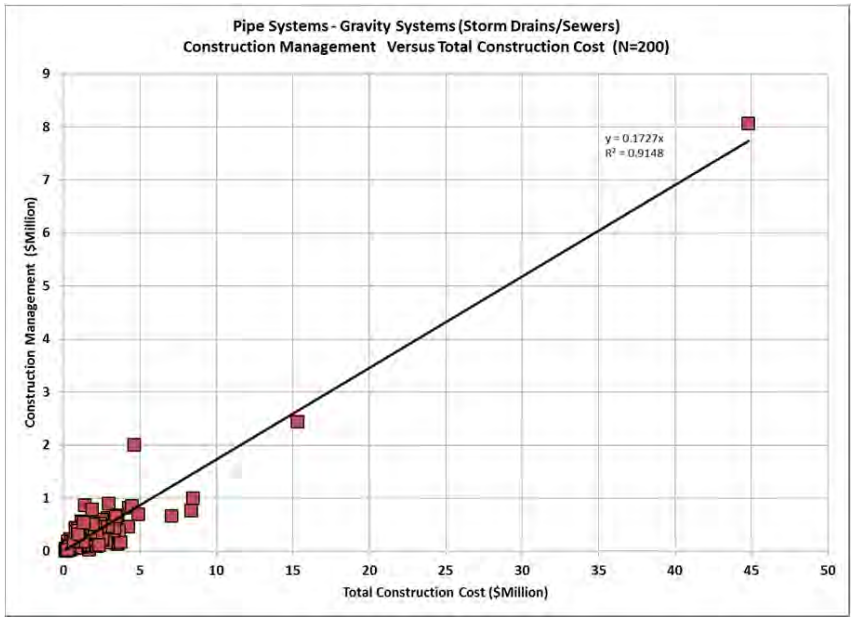


All Projects



All Projects



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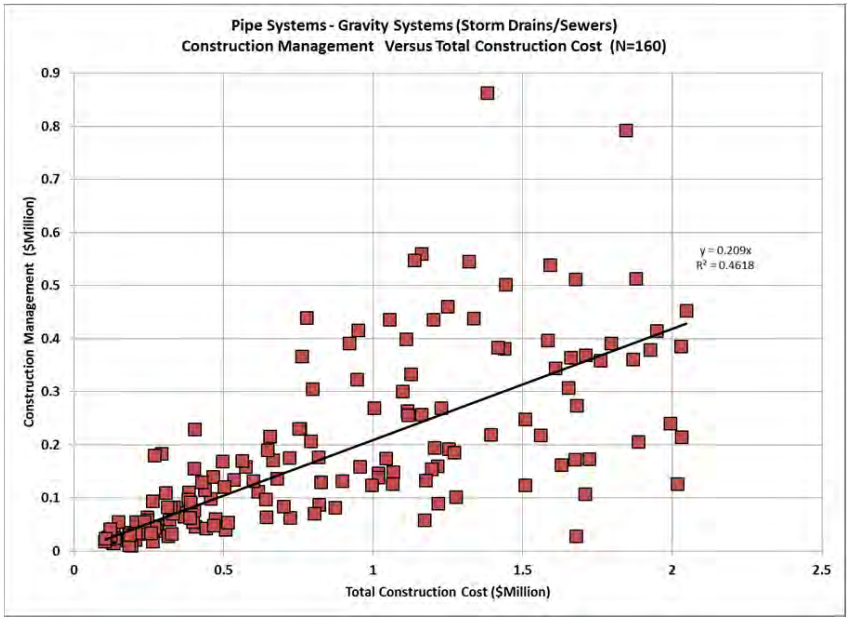

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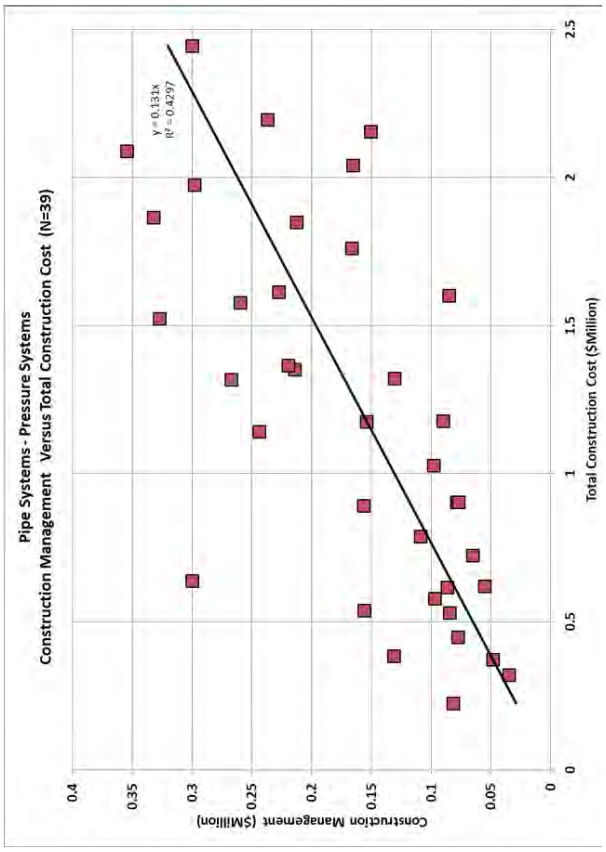

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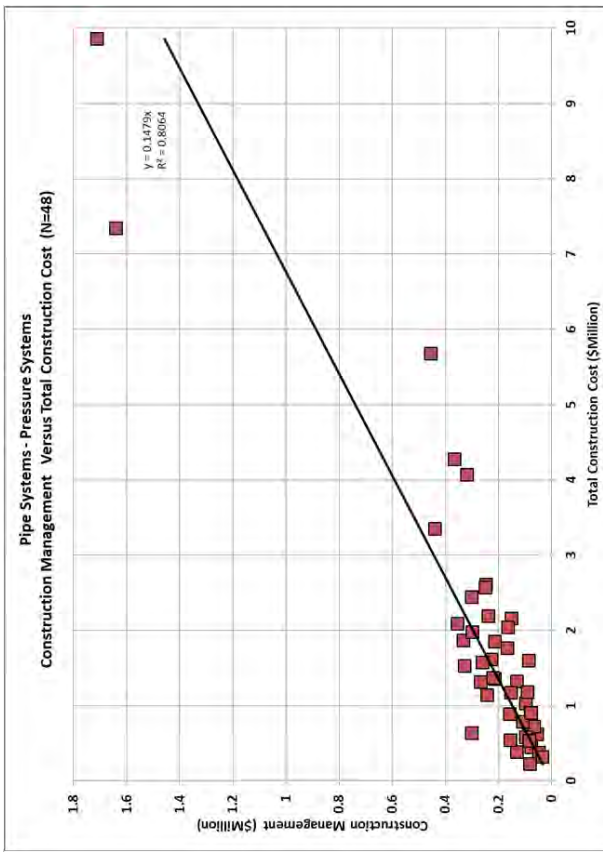
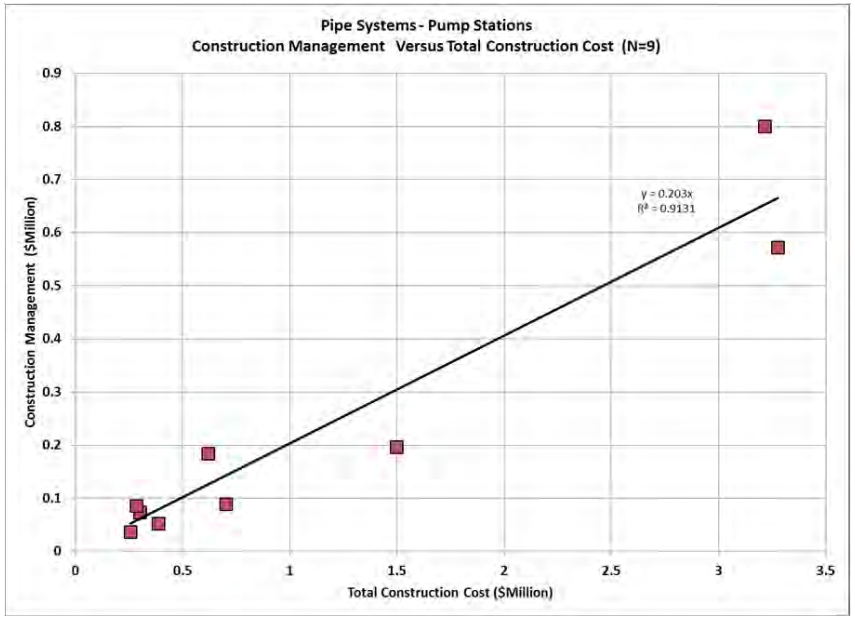


All Projects



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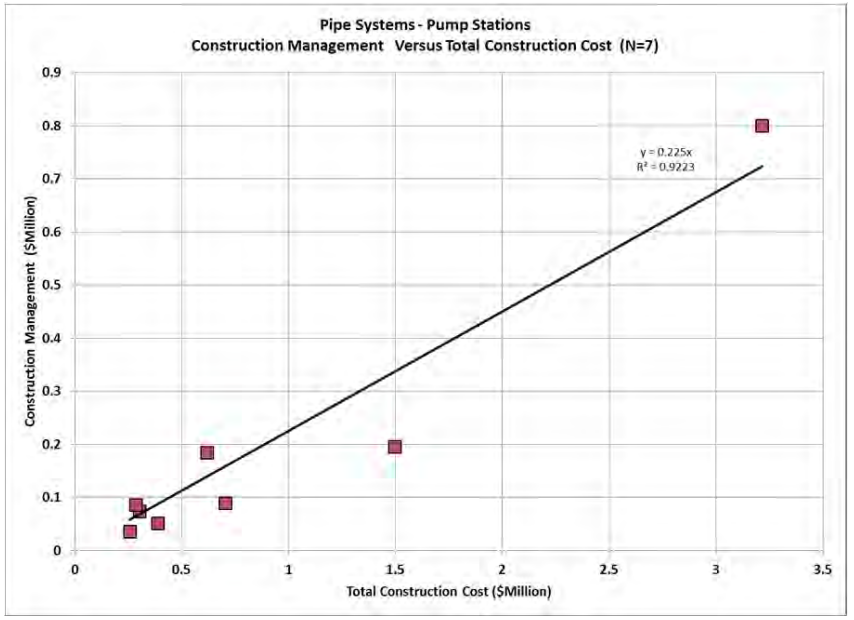

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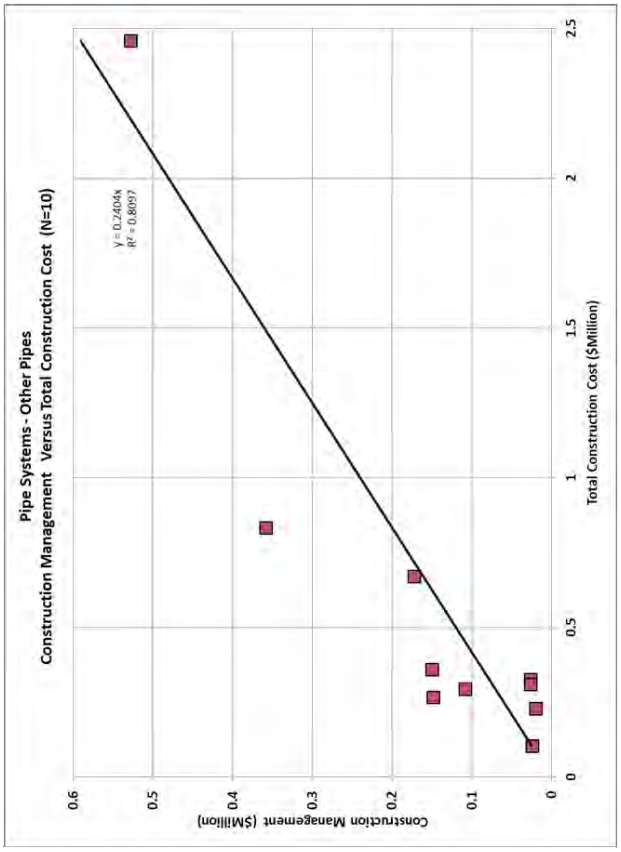
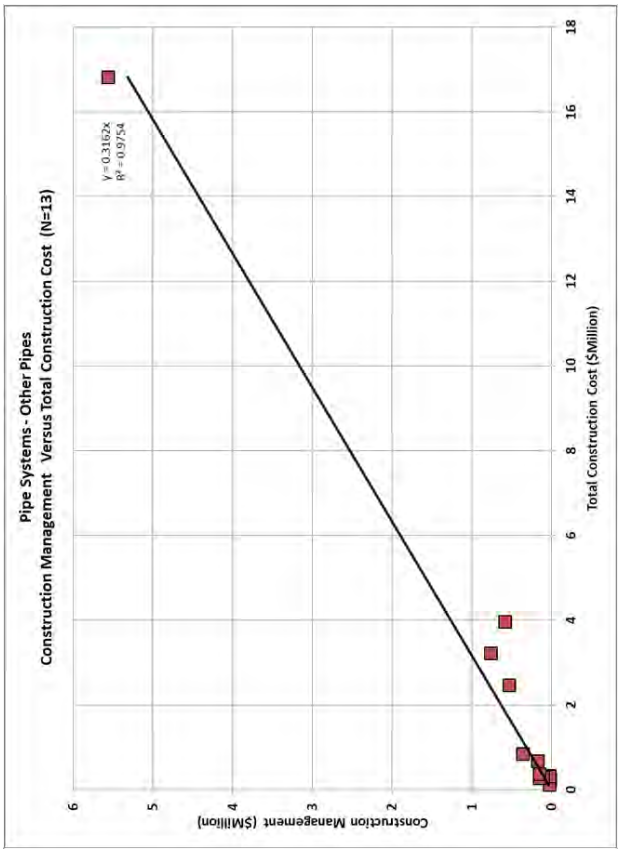


All Projects



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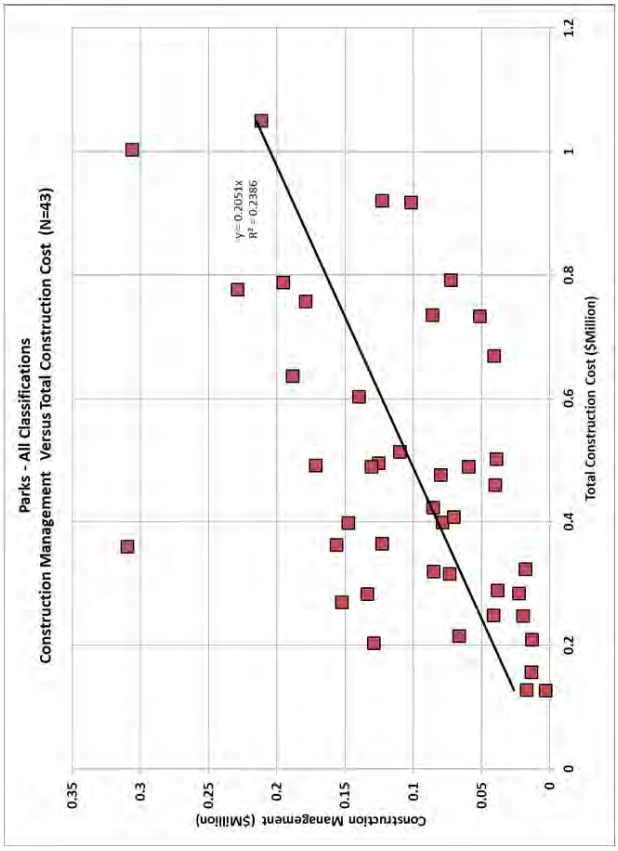
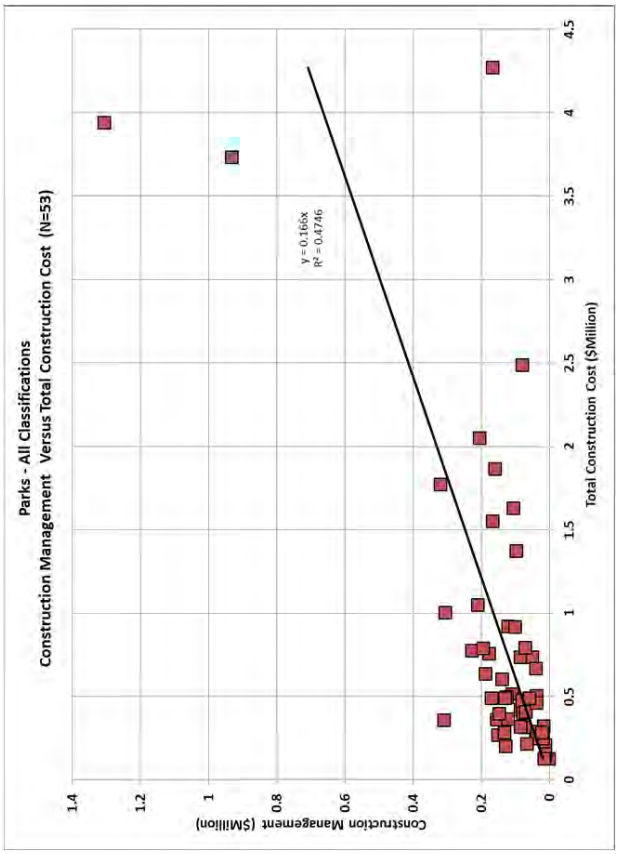


All Projects



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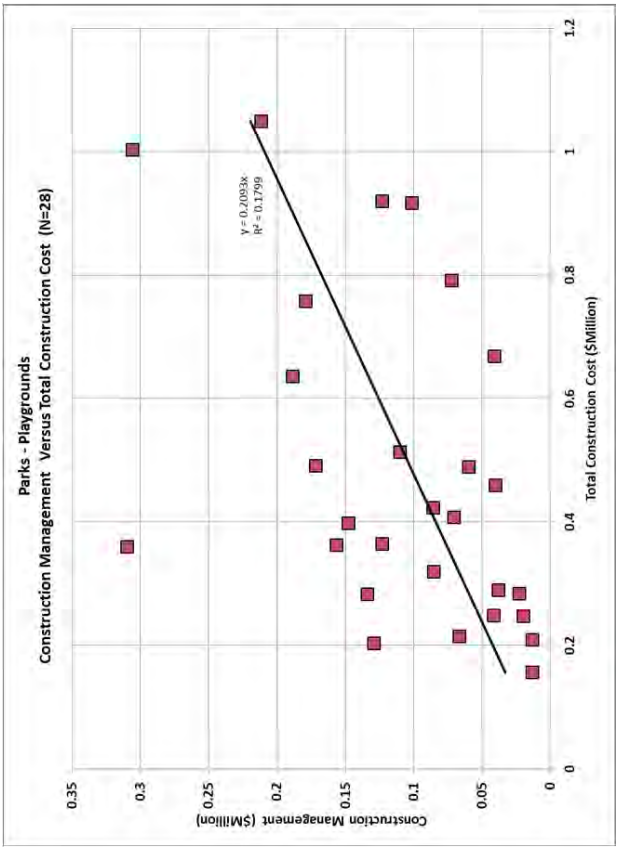
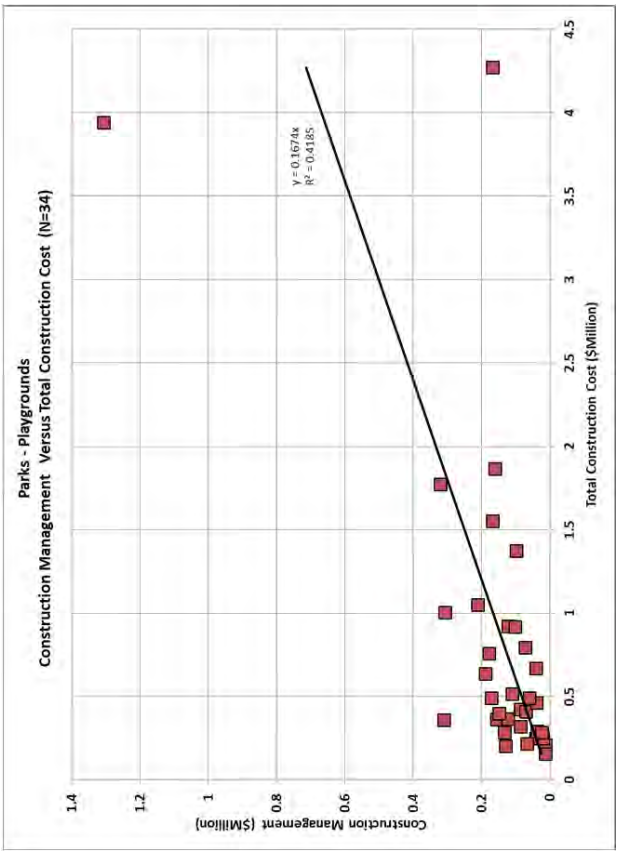


All Projects



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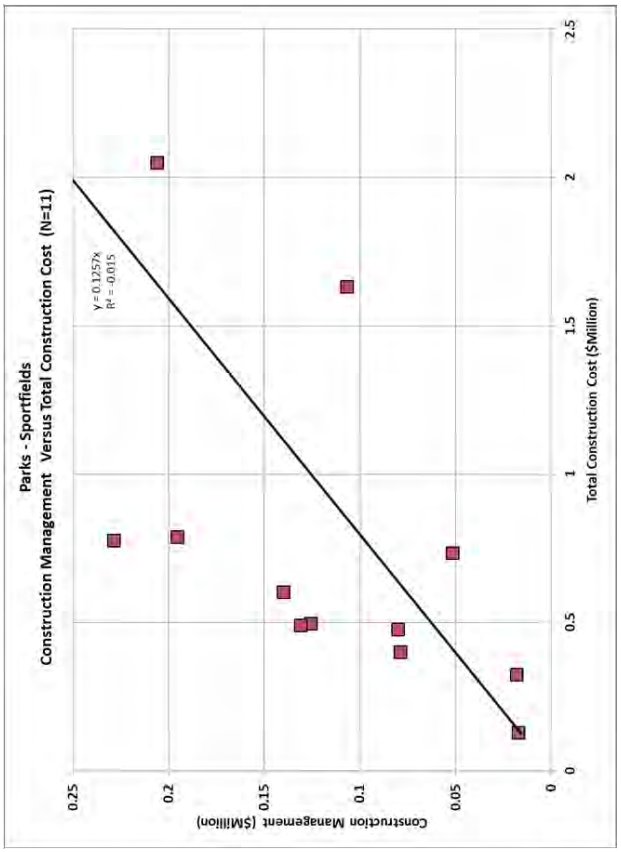
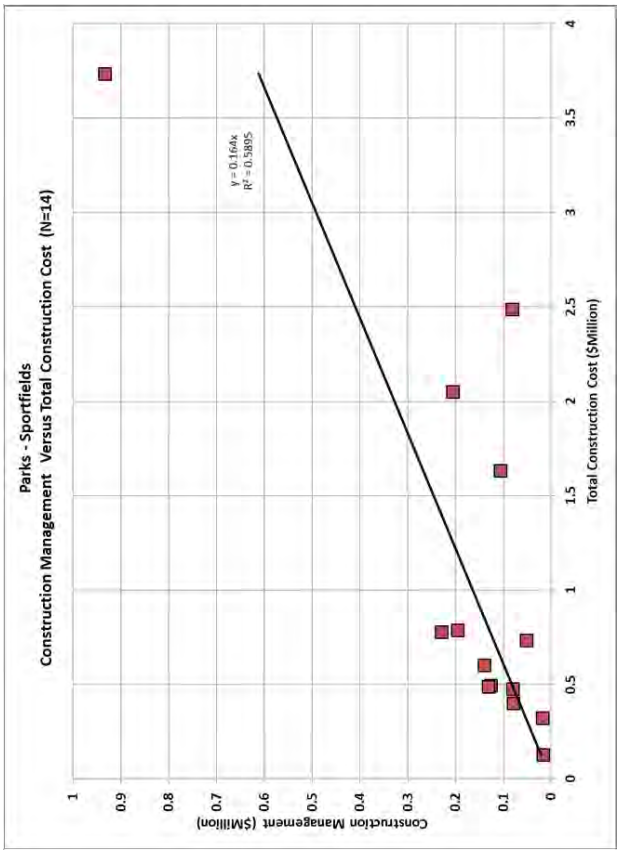


All Projects



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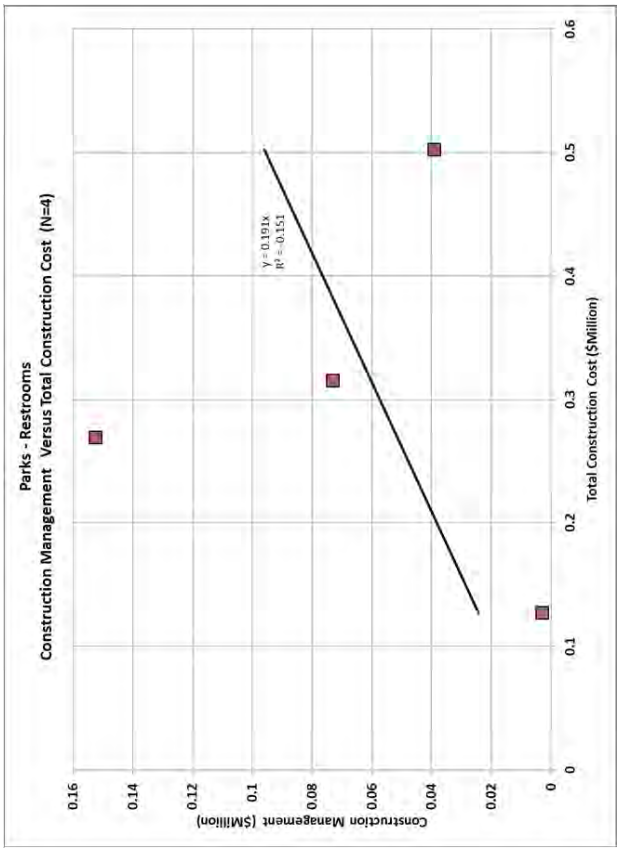
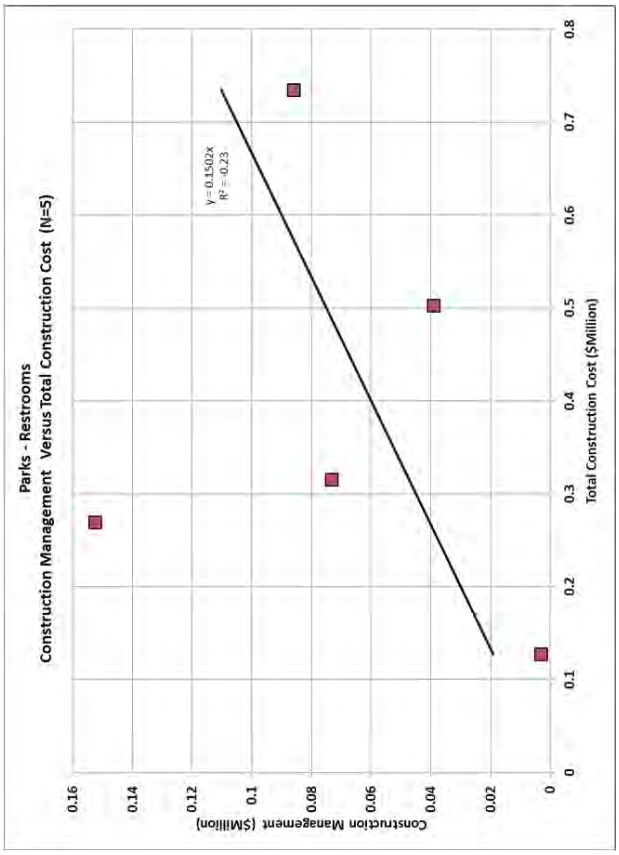


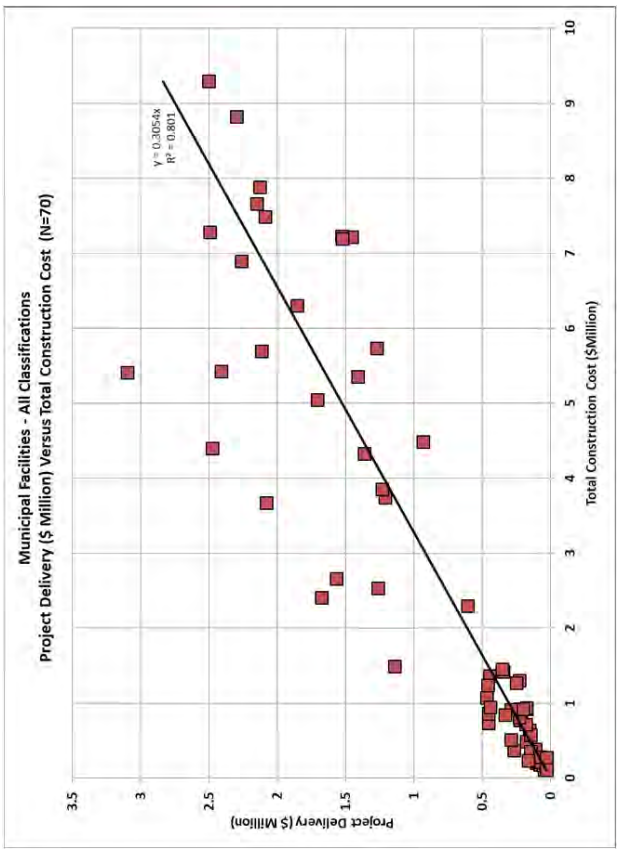
All Projects



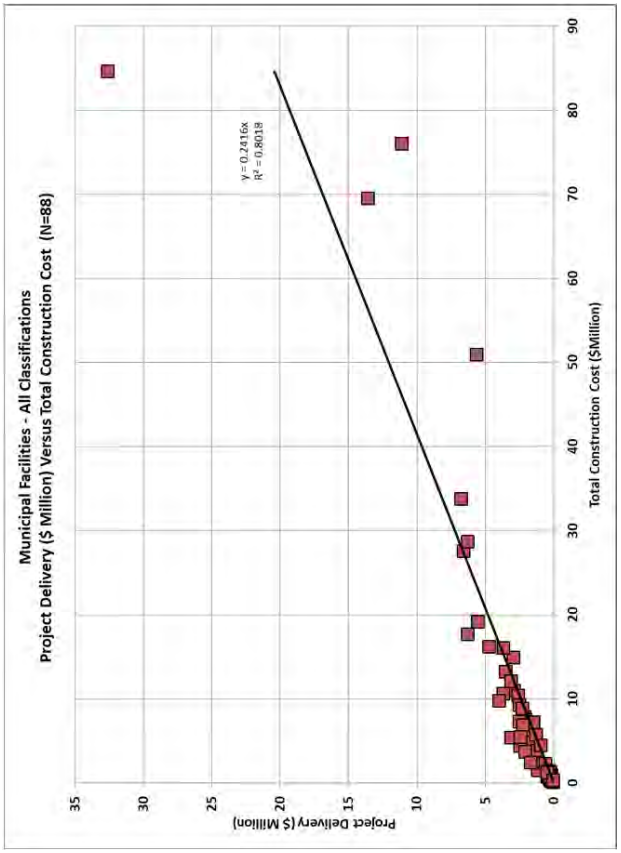
CURVES GROUP 3

Project Delivery Cost
vs
Total Construction Cost

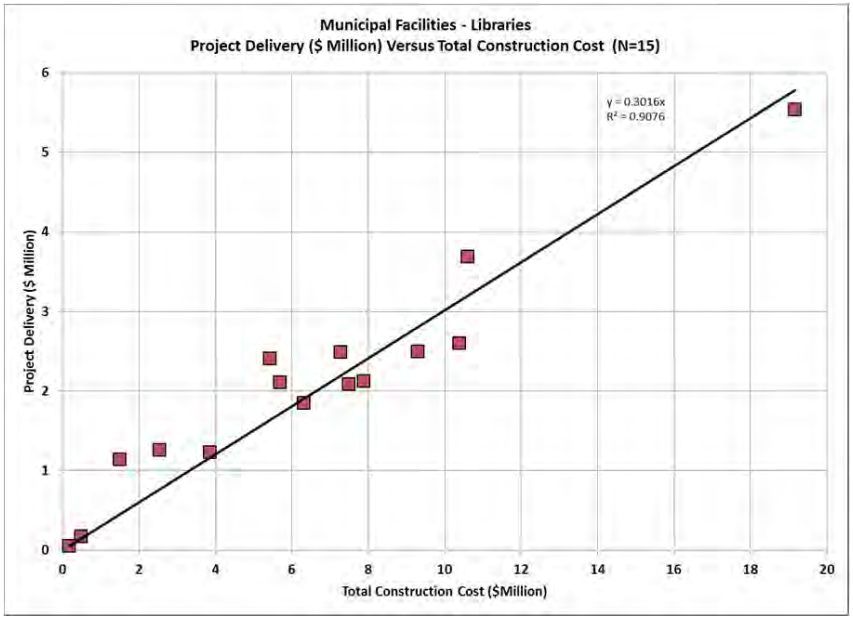
80th Percentile Projects



All Projects



All Projects



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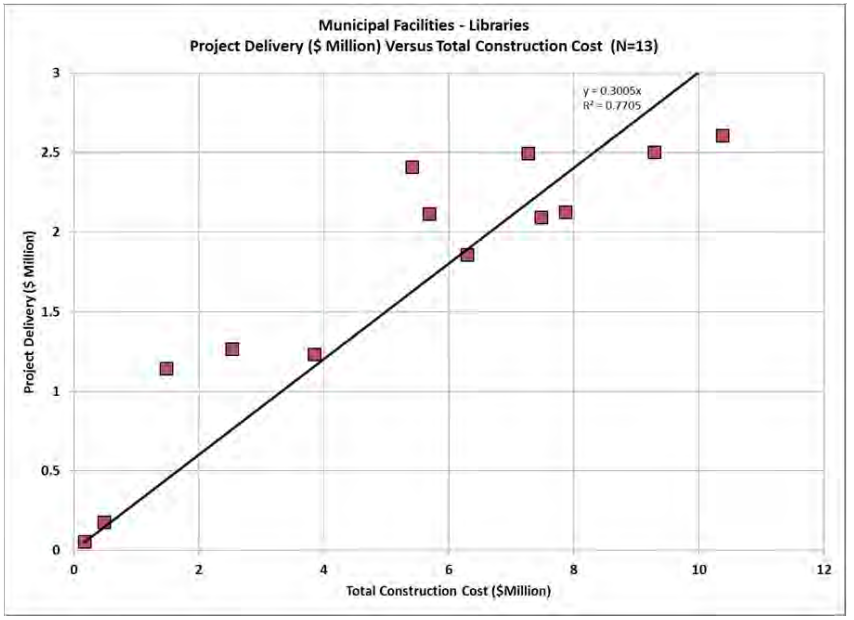

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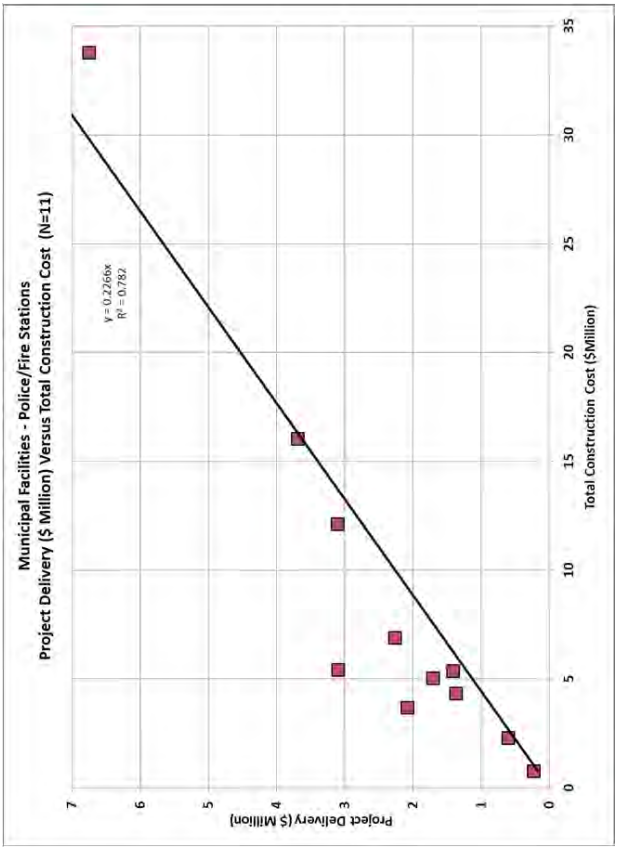
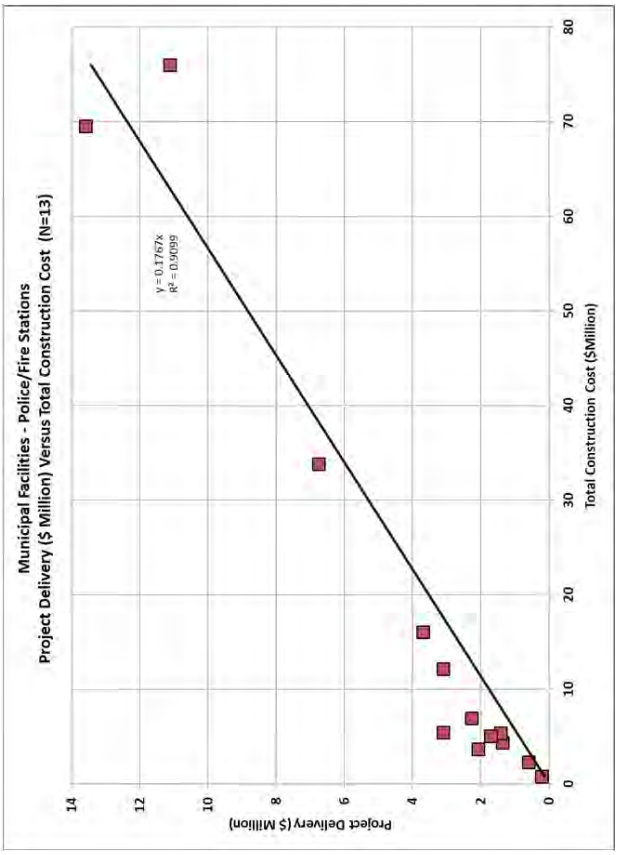
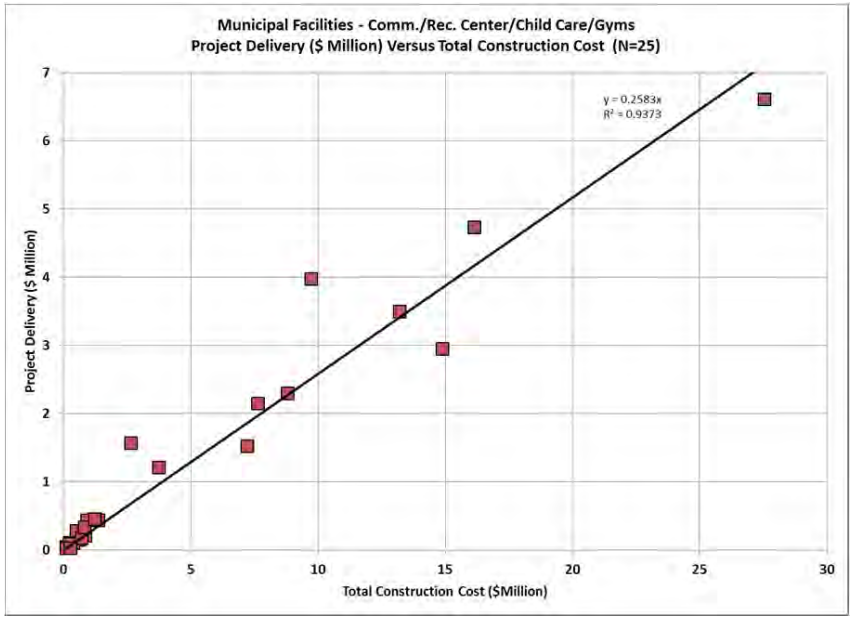


All Projects



All Projects



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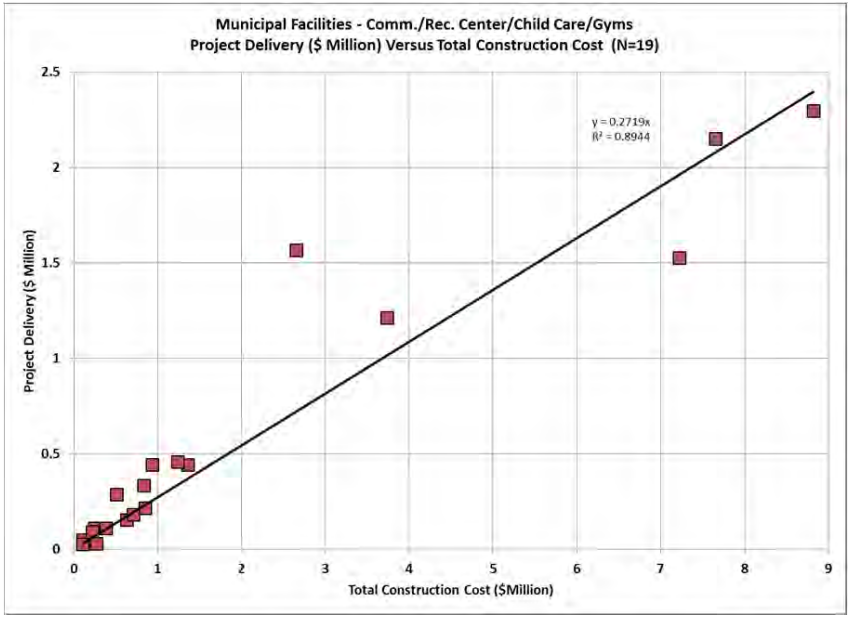

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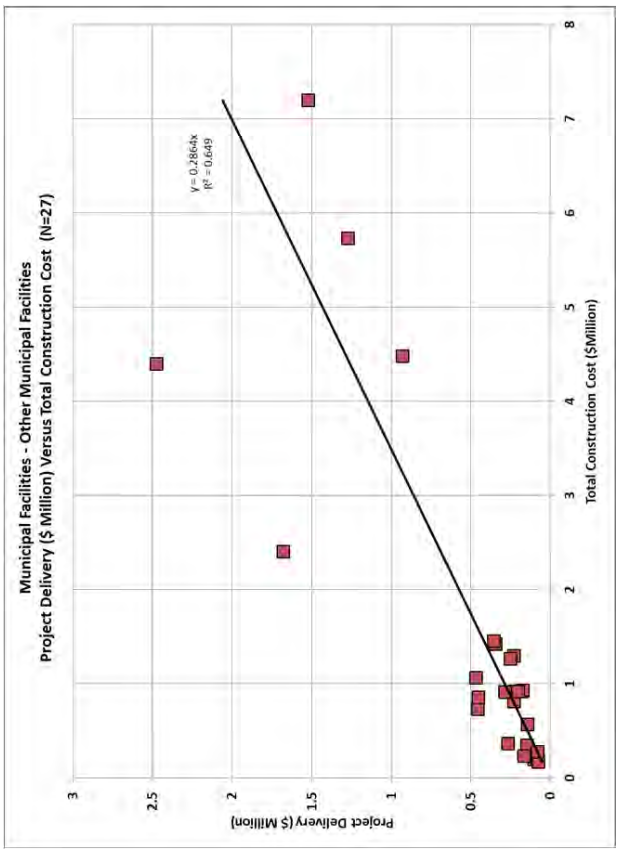
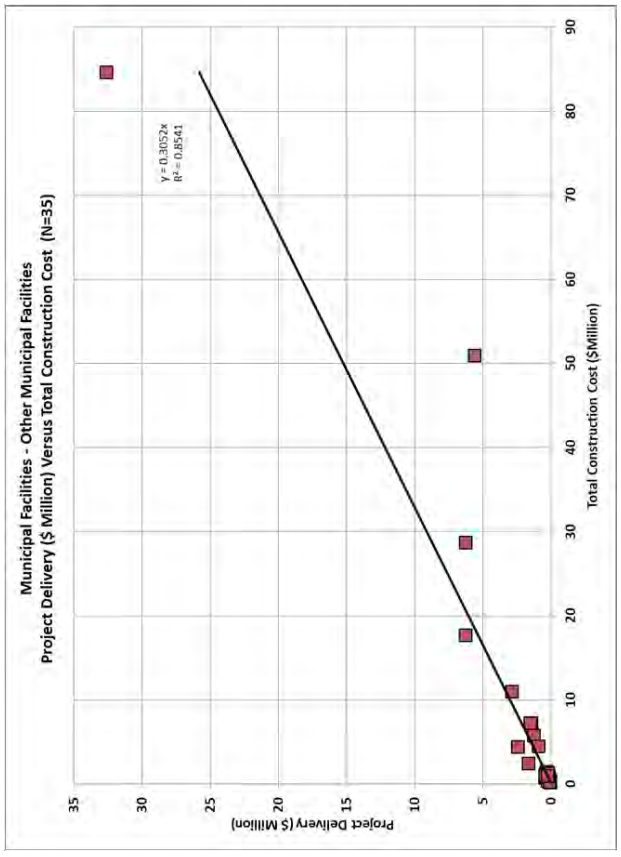
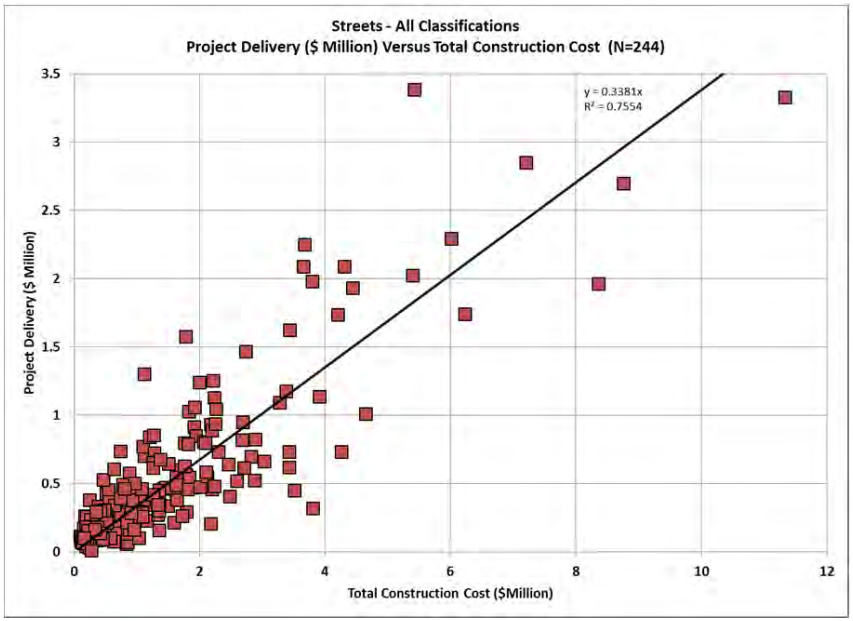


All Projects



All Projects



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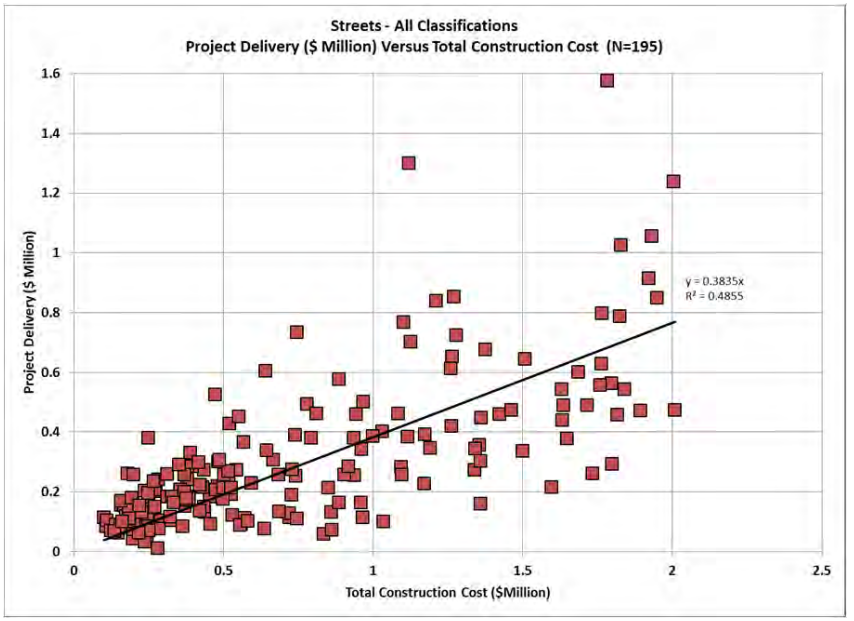

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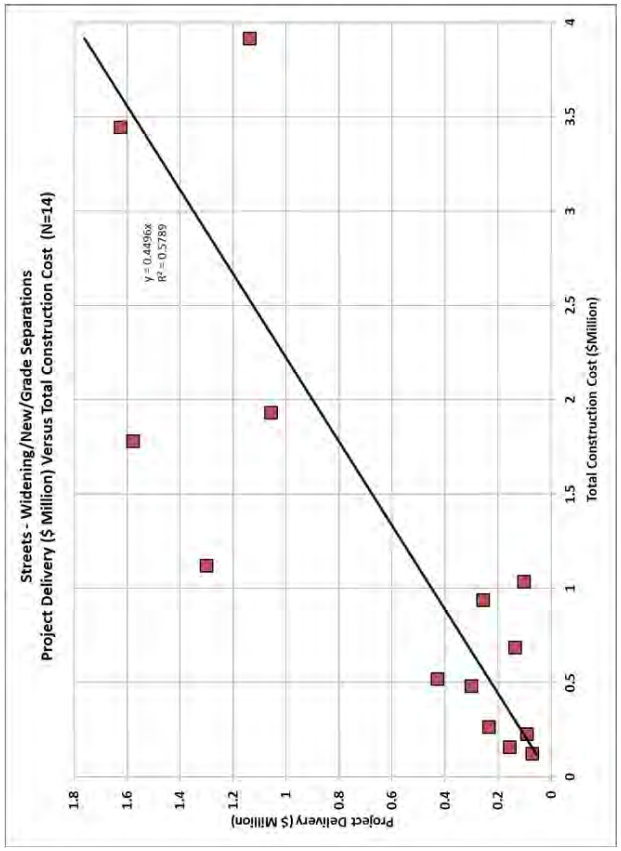

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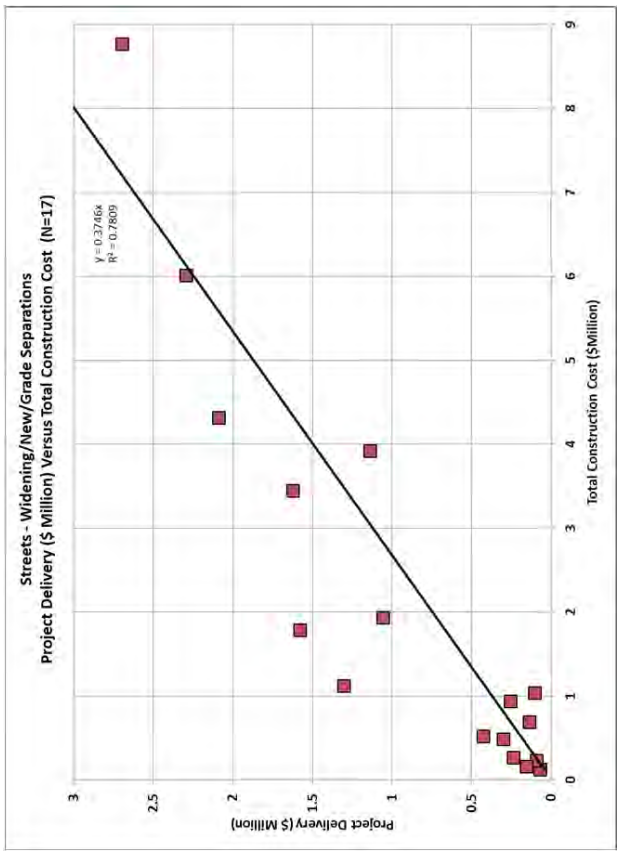

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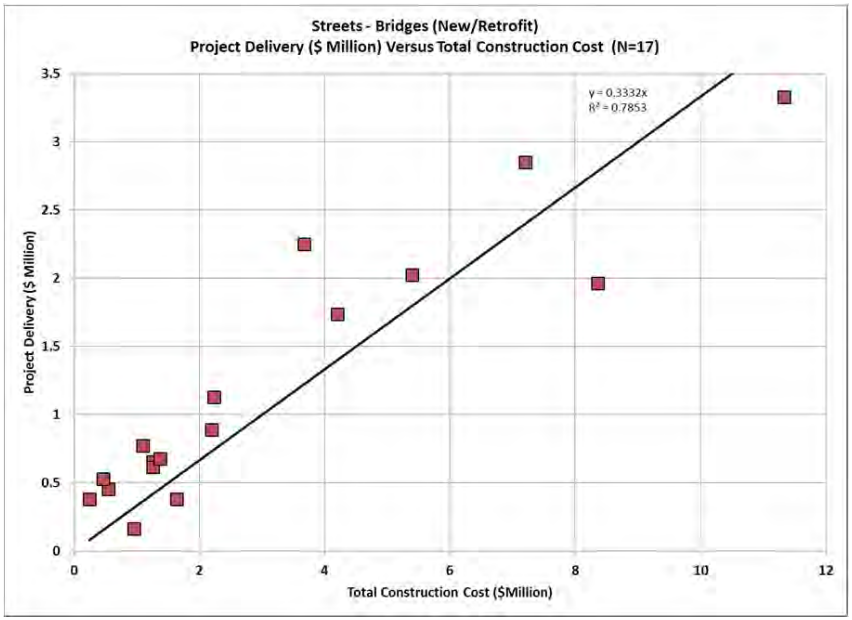

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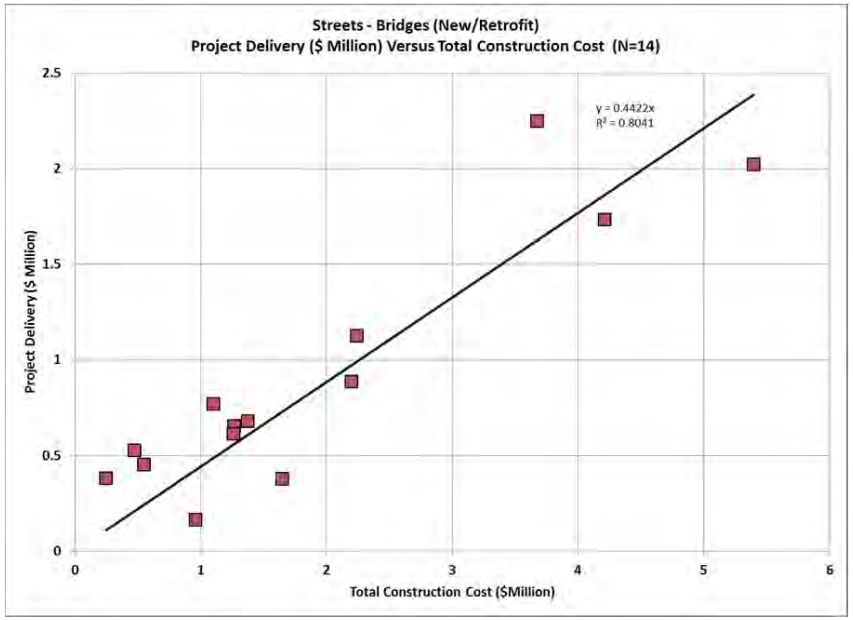

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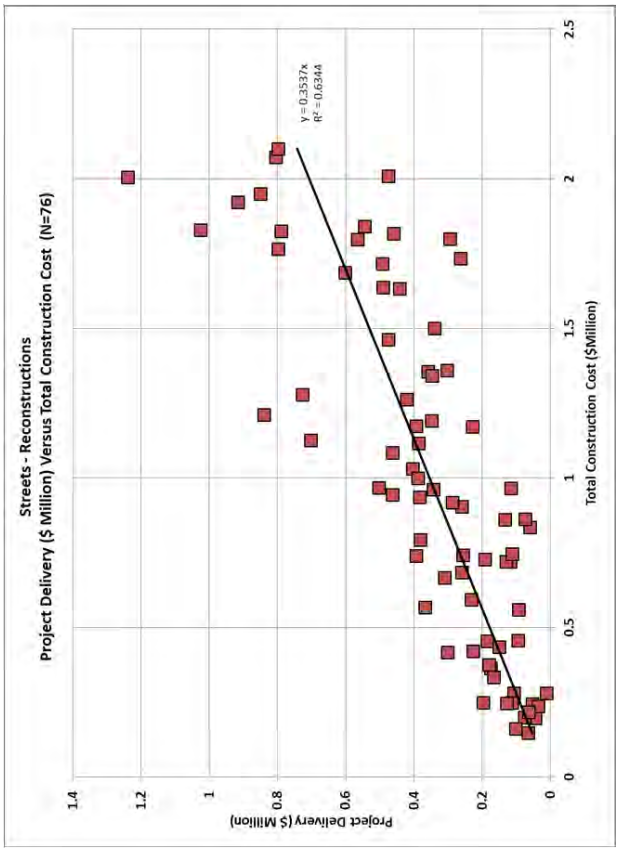

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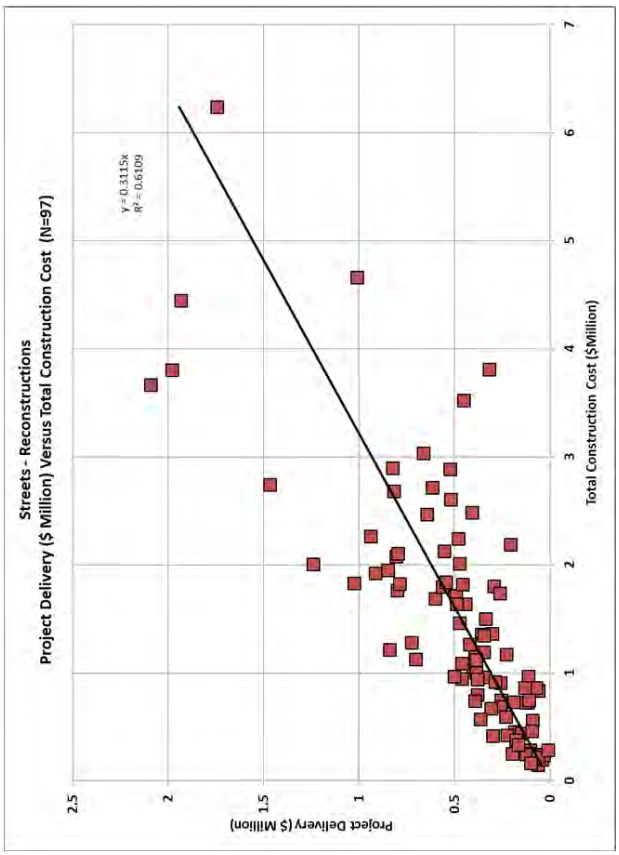

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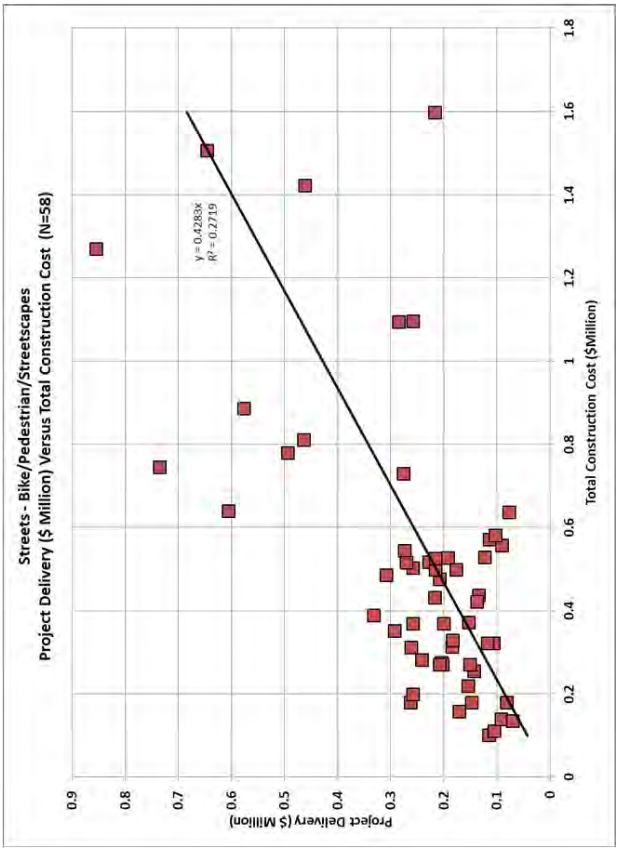

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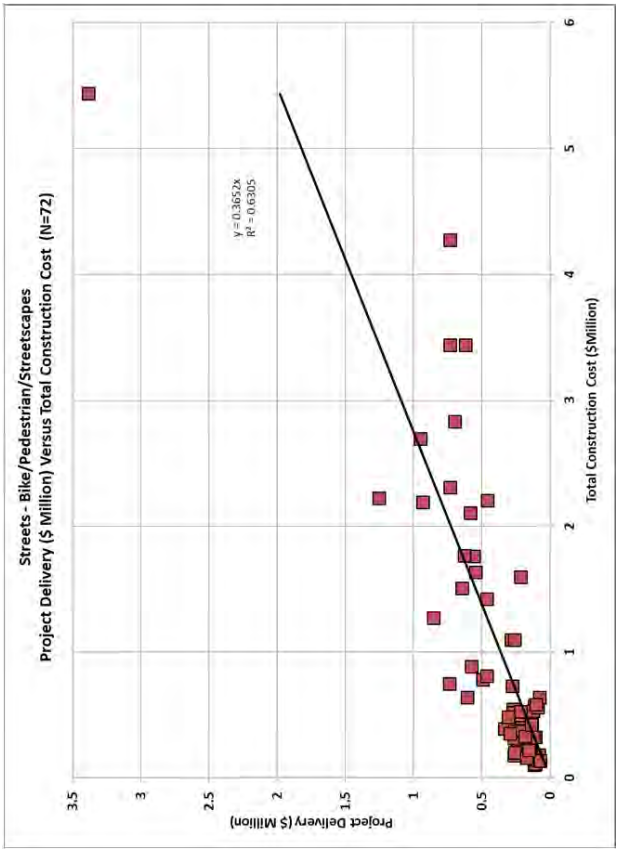

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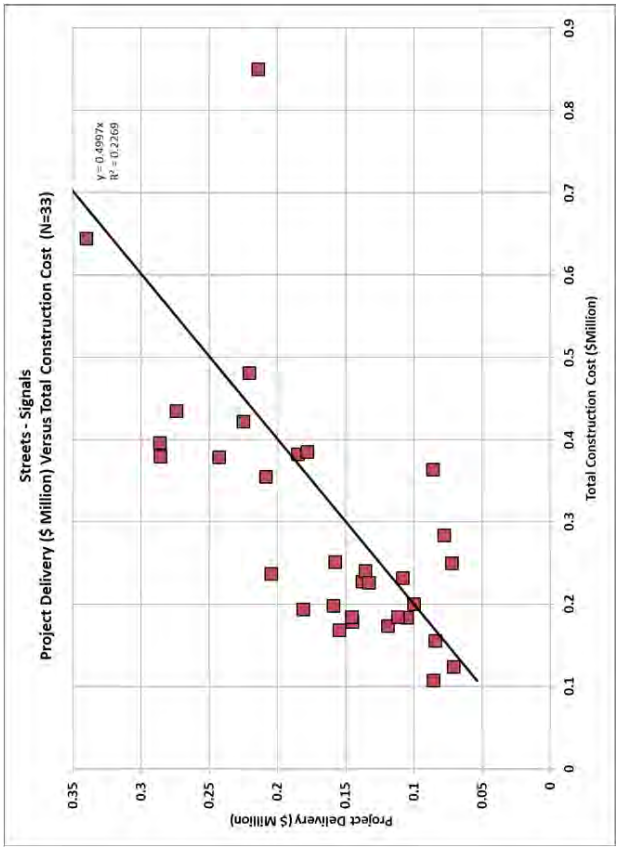

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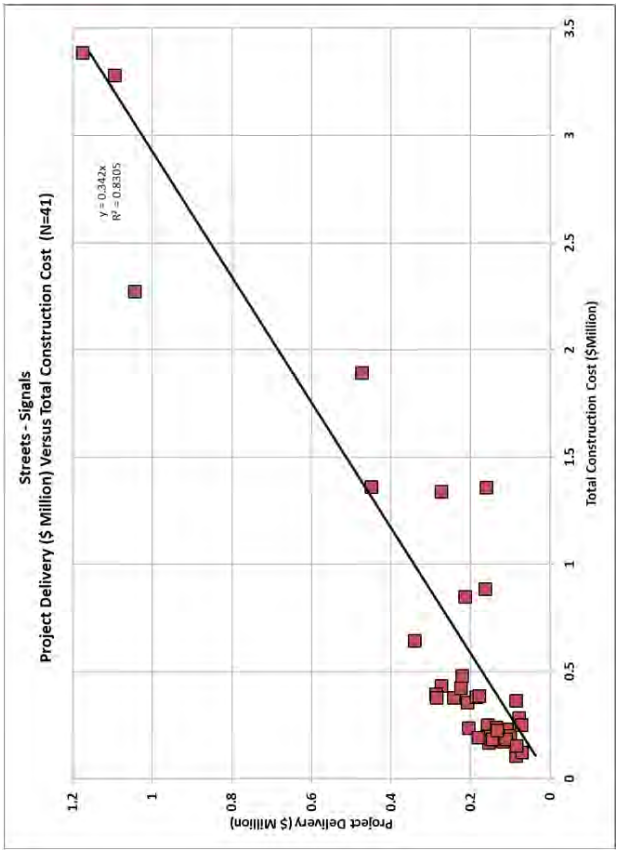

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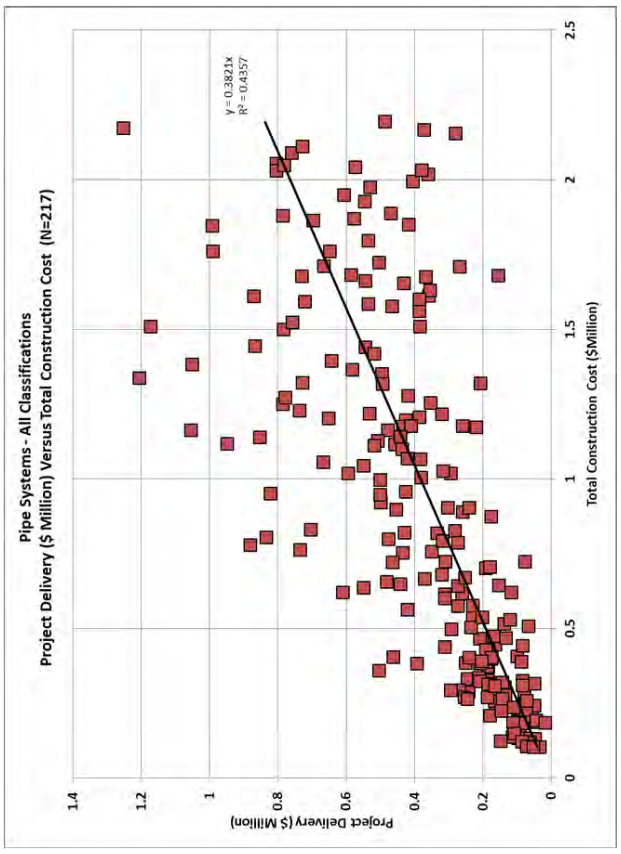

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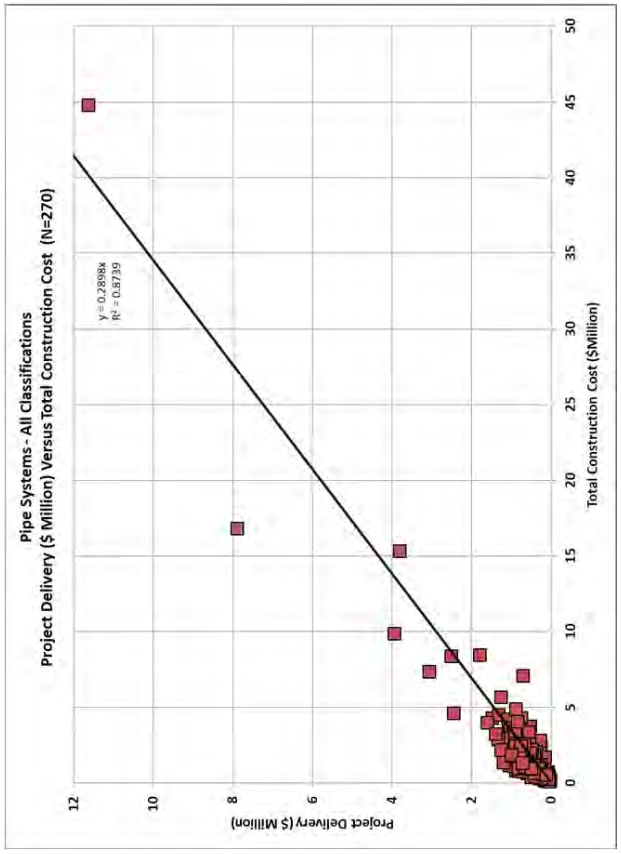

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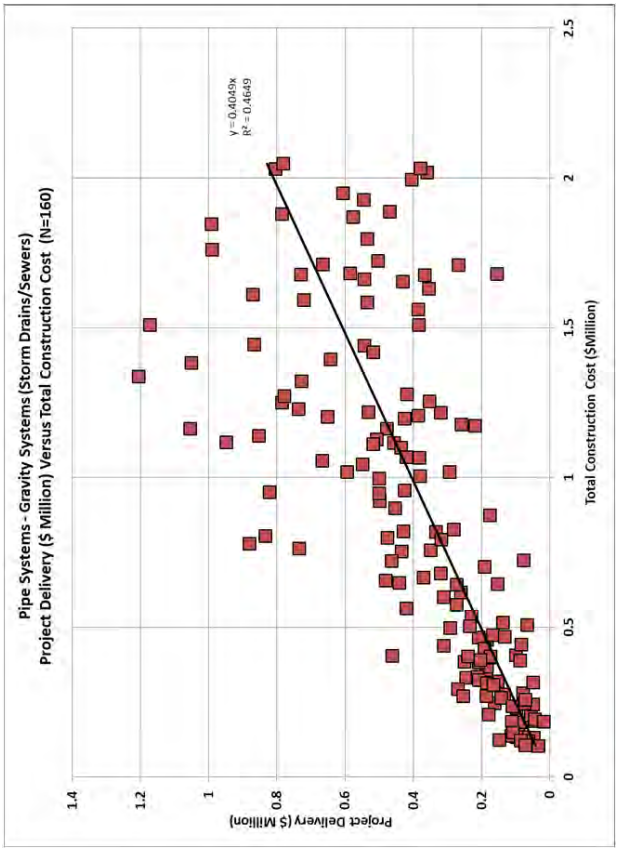

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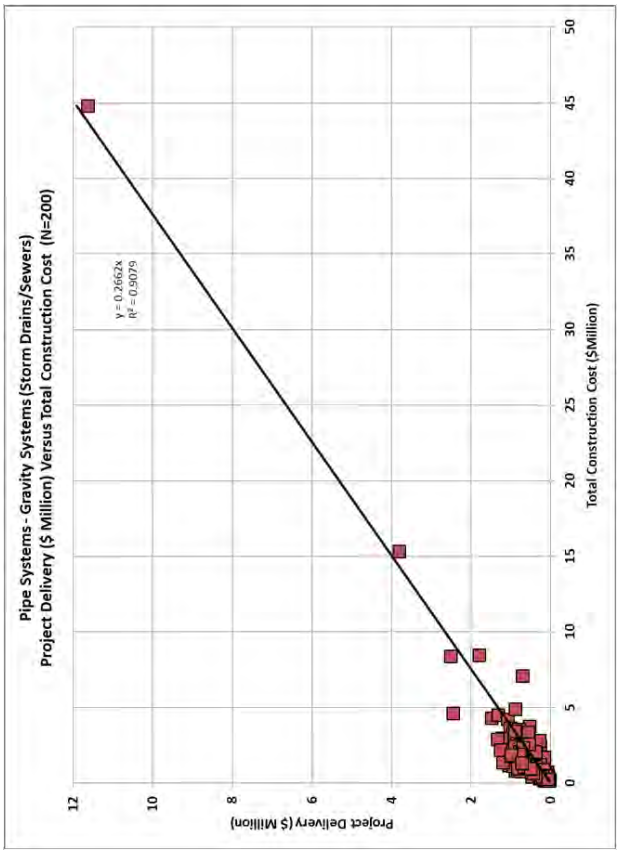

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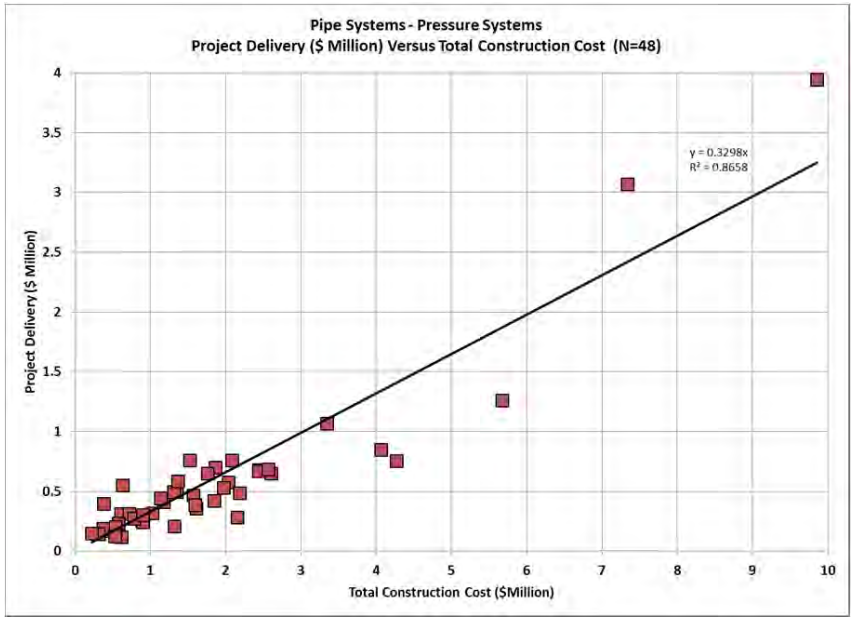

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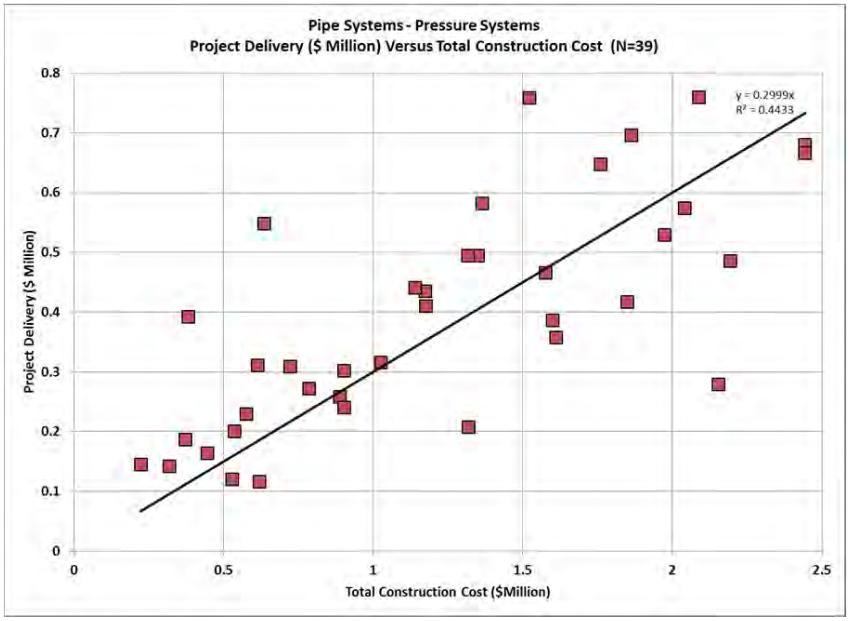

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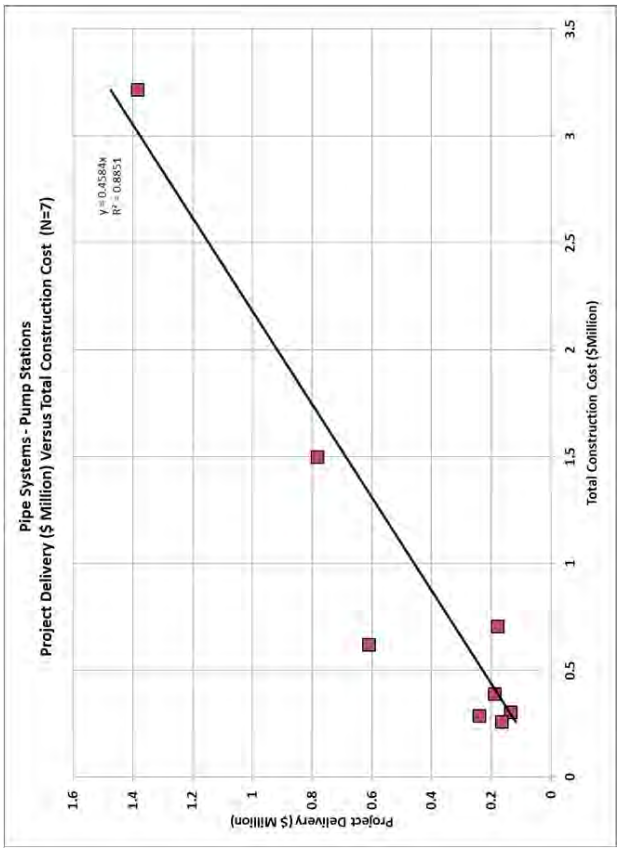

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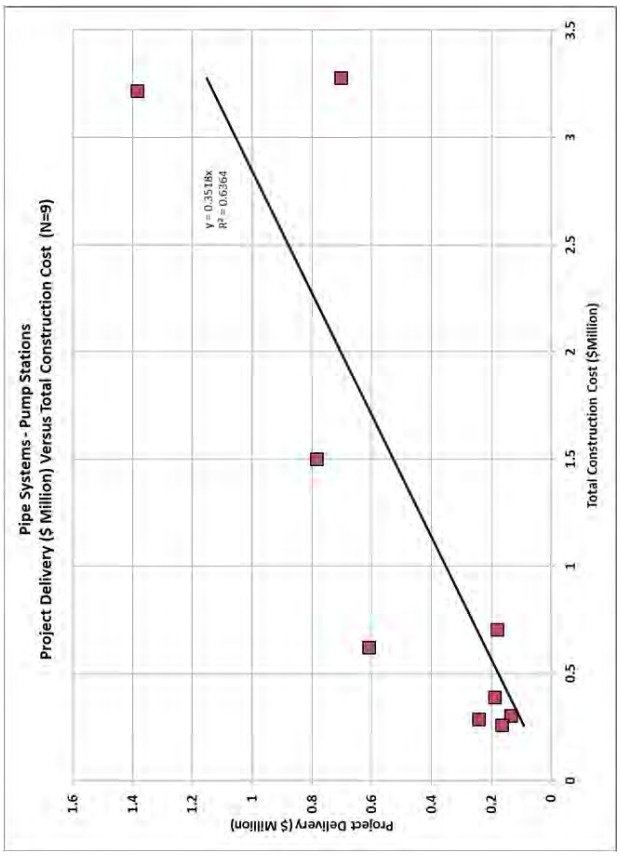

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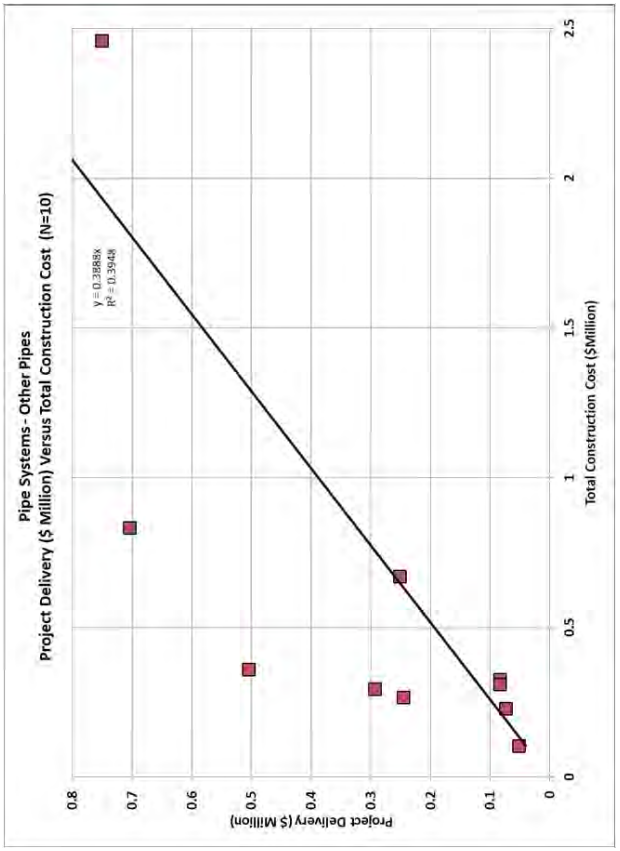

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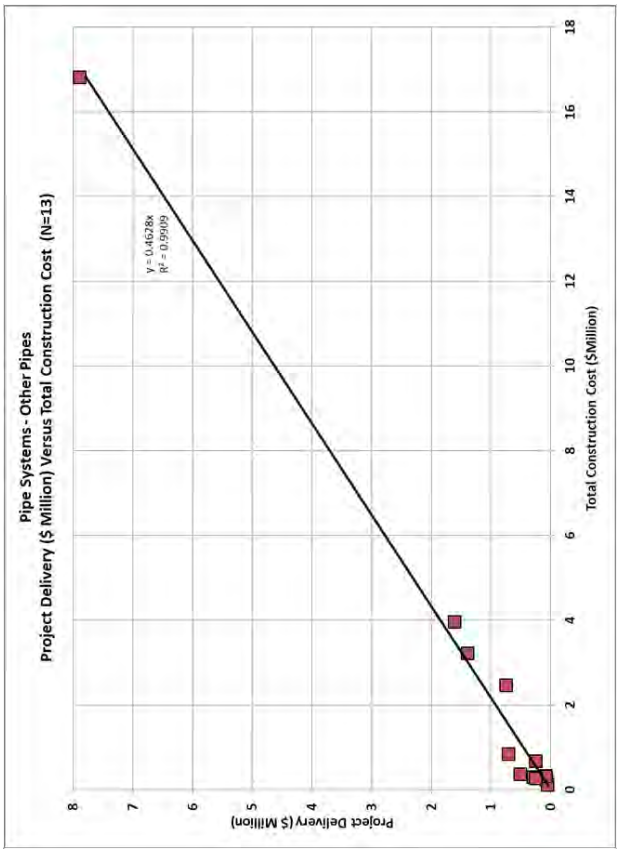

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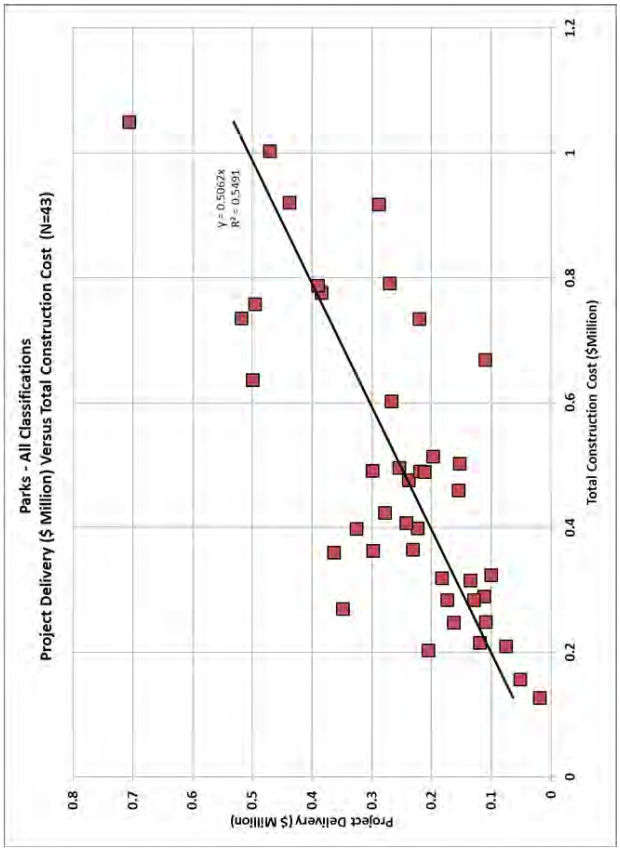

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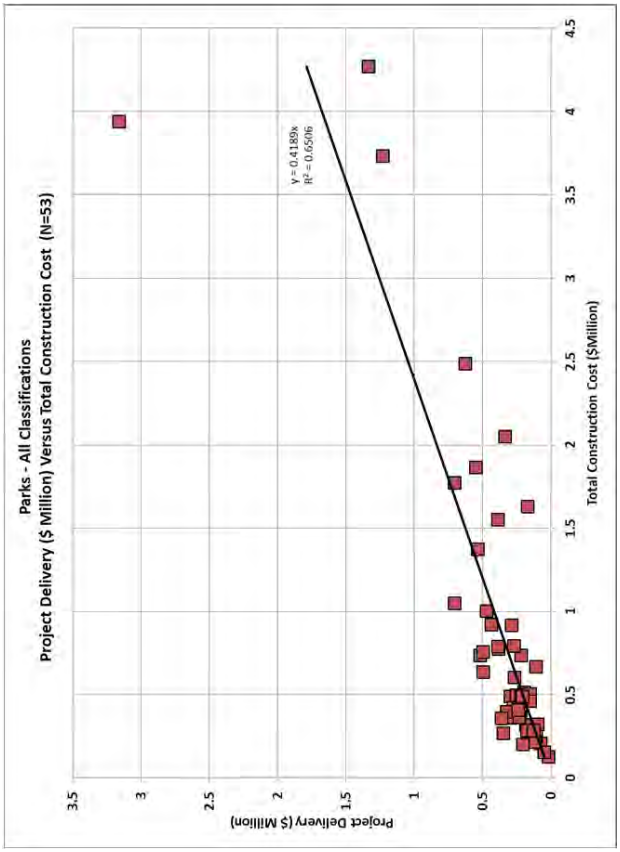

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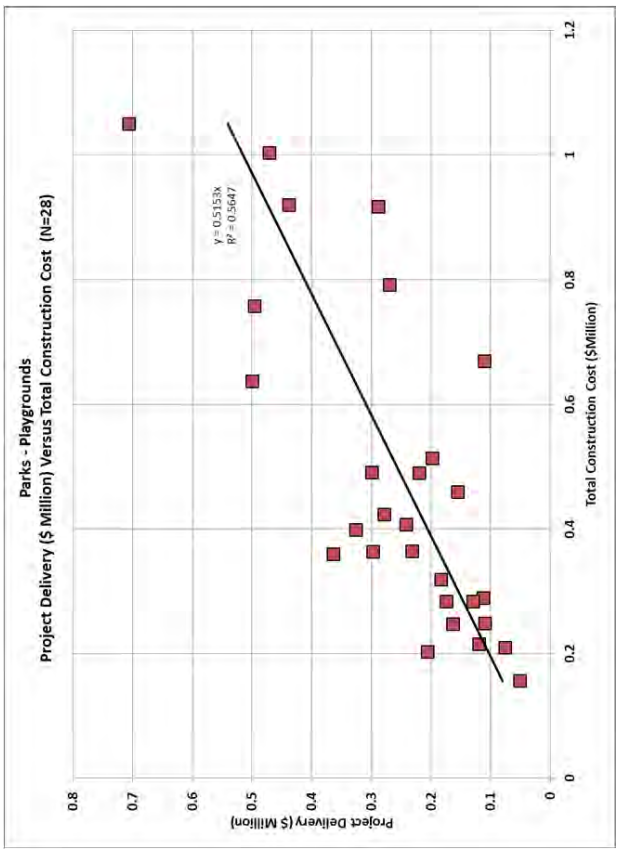

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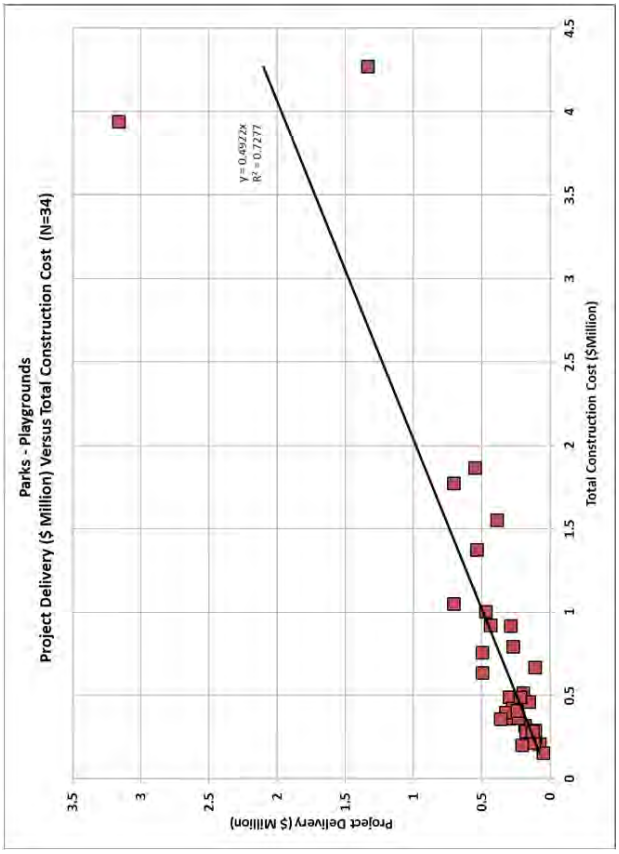

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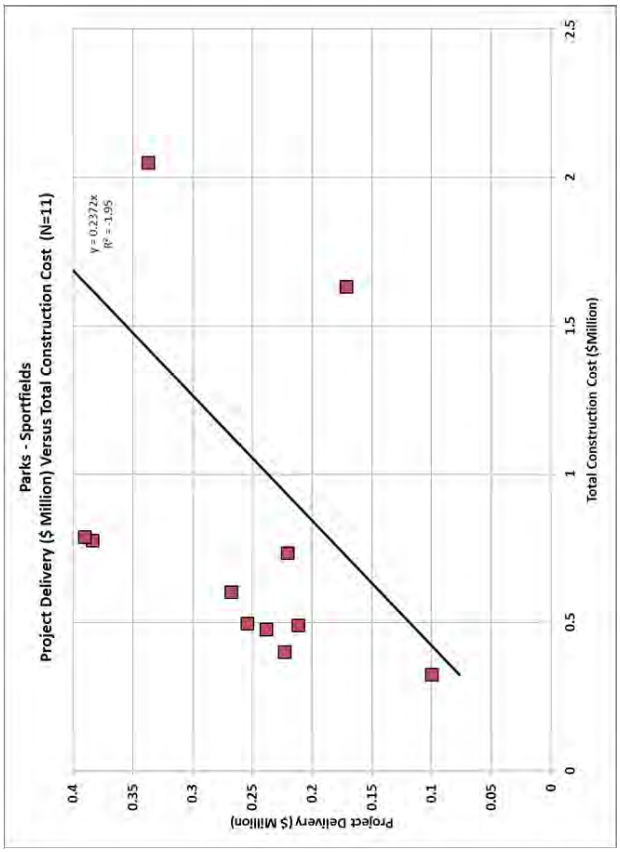

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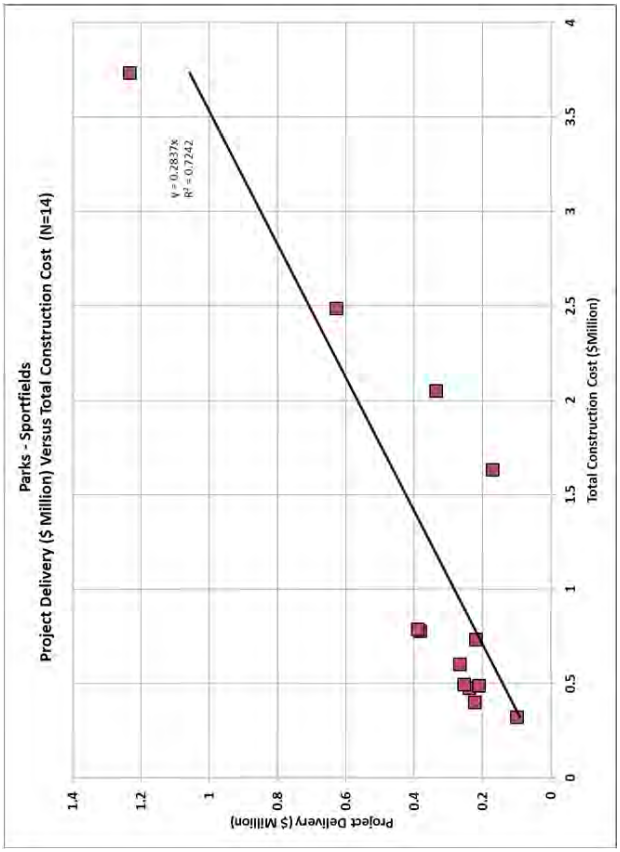

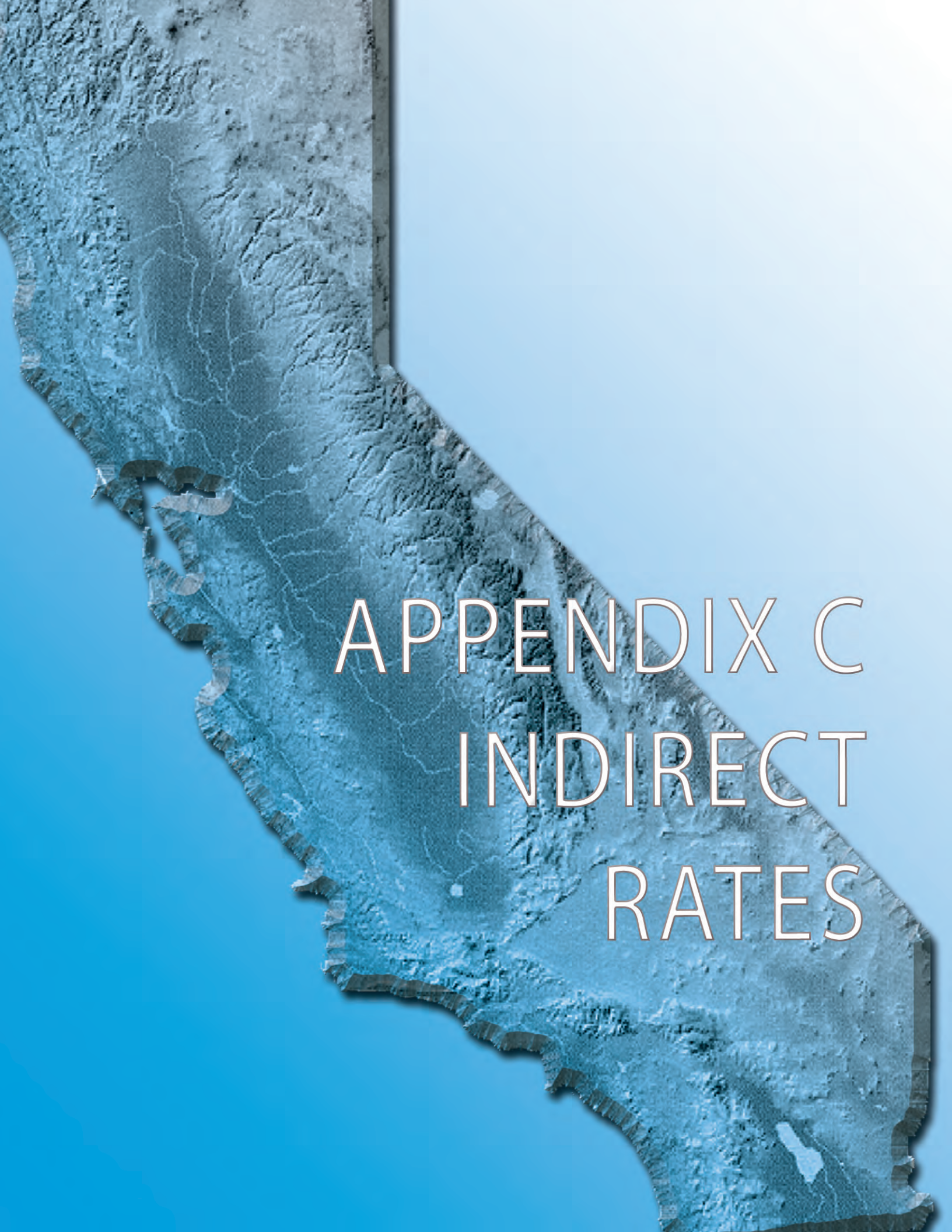

APPENDIX C
INDIRECT RATES

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[2]	41.92%	19.40%	0%	2.5%	49.21%	149.63%	YES
City of Los Angeles Department of Public Works Bureau of Engineering[3]	34.22%	20.13%	12.13%	16.56%	55.41%	138.46%	YES
City of Oakland Department of Engineering & Construction	61.53%	21.65%	24.12%	28.95%	17.31%	153.56%	NO
City of Sacramento Department of Transportation (FY13 Budgeted)							NO
	34.70%	19.00%	28.52%	14.10%	80.46%	176.78%	
Department of Utilities	37.17%	18.70%	108.59%			164.46%	
City of San Diego Engineering and Capital Projects	61.91%	16.70%	0%	0%	84.00%	164.61%	NO
City and County of San Francisco Department of Public Works Bureau of Engineering Bureau of Construction Management Bureau of Architecture	41.37%	28.84%	0%	52.15%	45.95	168.31%	NO
City of San Jose Department of Public Works (FY11-12)	67.90%	25.89%	39.86%	16.99%	Included	197.11%	NO

Notes:

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

[2] The City of Long Beach is currently in the process of recomputing its overhead rates. Rates shown in the above table are 2012 rates.

[3] Based on averages of all Bureau program overhead rates provided under CAP 33.

APPENDIX D
TECHNICAL MEMORANDUM

APPENDIX D

Technical Memorandum

To:	Nicholas Theocharides, City of Sacramento	**Date:**	December 11, 2013
From:	Ganesh Krishnamurthy, P.E. Laura Lamdin, P.E.	**Reference:**	10502076/3.3
Subject:	Technical Memorandum: Special Study		

INTRODUCTION

This Technical Memorandum (TM) is prepared as part of the *Update 2013 Benchmarking Study (Study)*. The Update 2013 Study investigated the impacts of declining construction costs on project delivery percentages as part of a Special Study. This TM describes the methodology adopted, findings, and conclusions of the Special *Study*. The methodology for the analysis was developed by the Study Team (City of Sacramento, MWH, and Vanir) and presented to the participating agencies for their review and comment prior to the analysis.

METHODOLOGY

The objective of the Special Study is to determine how the decline in construction costs since 2007 has impacted project delivery percentages. The project delivery percentage for a project is calculated using the following formula.

$$\frac{\textbf{Design (\$)+ Construction Management (\$)}}{\textbf{Total Construction Cost (\$)}}$$

In order to evaluate the impact of construction costs on project delivery percentages, an 'indexed' construction cost is used. The indexed costreflects what the total construction cost would have been, had construction costs remained constant. The CalTrans Price Index was selected as the index for the adjustment. The CalTrans Price Index is an index of common construction materials used in California municipal projects that is representative of the base materials used in projects included in the *Study*. It is

1 The CalTrans construction cost index tracks prices for: Roadway Excavation Aggregate Base, Asphalt Concrete Pavement, Portland Cement Concrete (Pavement), Portland Cement Concrete (Structure), Bar Reinforcing Steel, and Structural Steel.

assumed that 2007 construction costs are representative of the baseline construction costs, reflected in the CalTrans Price Index. Using this index, construction costs for projects in the performance database for the 2008 – 2010 period are adjusted based on their variance from the baseline construction cost. The adjustment factor for any year is calculated by dividing the baseline number, 100, by the CalTrans price index for that year. The project delivery costs for the 2008 – 2010 periods are then recomputed based on the adjusted construction cost and then compared against the actual project delivery percentages for the 2008 – 2010 periods. The period 2008 - 2010 was selected because all projects bid in 2011 and 2012 have not been completed, and those that have been completed are not representative of all projects bid in 2011 and 2012.

Projects in the database are reviewed to ensure that they conform to the project selection criteria for the Study. Projects that were not representative of projects that are collected and evaluated as part of the Study were eliminated from the analysis. For example, the review indicated the presence of a parking lot resurfacing project categorized as "Other Municipal Facilities". This project is presented below:

- Windansea Parking Lot Upgrades – Bid Year 2008

Additionally, the projects incorrectly categorized were corrected. The following project was incorrectly categorized as Municipal Facilities:

- Mission Bay Sewage Interceptor System Upgrades - Bid Year 2010

These projects were categorized as "Other Municipal Facilities".

RESULTS

Table D-1 summarizes the Price Index for the 2007 – 2010 periods. It is observed for each of the years following 2007, the Price Index is lower than the baseline index of 100. This indicates that construction costs for each year in the 2008 – 2010 periods are lower than the construction costs observed in year 2007.

Table D-1
CalTrans Price Index and Calculated Adjustment Factors

Year	CalTrans Index	Adjustment Factor
2007	100.0	1 00
2008	95.0	1.05
2009	78.4	1.27
2010	76.8	1.30

The adjustment factor for any year is calculated by dividing the baseline number, 100, by the CalTrans price index for that year. The adjustment factor is then multiplied by the Total Construction Cost (TCC) to determine the adjusted TCC. The project delivery cost is divided by the adjusted TCC to determine the adjusted project delivery percentage.

For example, consider a project with a TCC of $1 million with a project delivery cost of $500,000 completed in 2009. This project would have a project delivery percentage of 50 percent ($500,000/$1 million). Based on the adjustment factor (1.27) show in Table 1 for year 2009, the adjusted TCC for this project would be $1.27 million. The revised project delivery percentage for this project would be 39.3 percent ($500,000/$1.27 million).

Plots representing project delivery percentages over time are presented in the following pages to compare adjusted and unadjusted project delivery percentages for all projects bid in the 2007 – 2010 period. Plots are only presented for the four major categories:

- Municipal Facilities
- Streets
- Pipes
- Parks

The X-axis for the plots represents the "Bid Year". The bid year is calculated by subtracting the construction duration from the date of completion. The Y-axis represents the "Project Delivery" percentages.

Figure D-1
Project Delivery Percentages – All Project Types

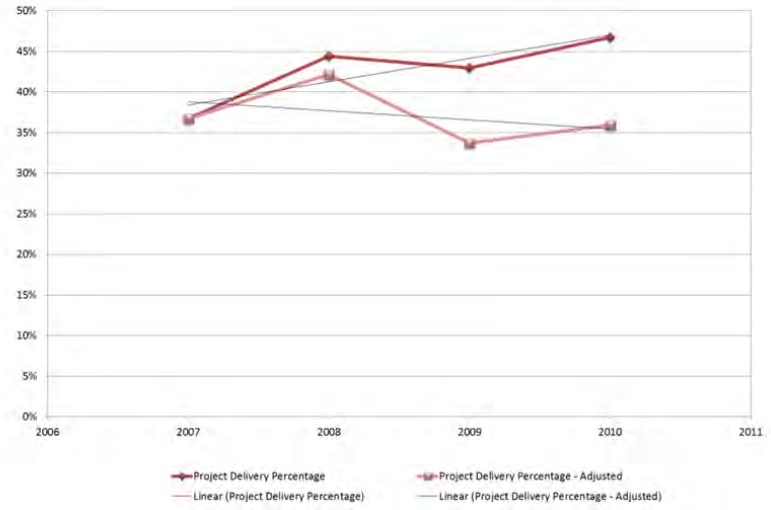

Figure D-2
Project Delivery Percentages – Municipal Projects

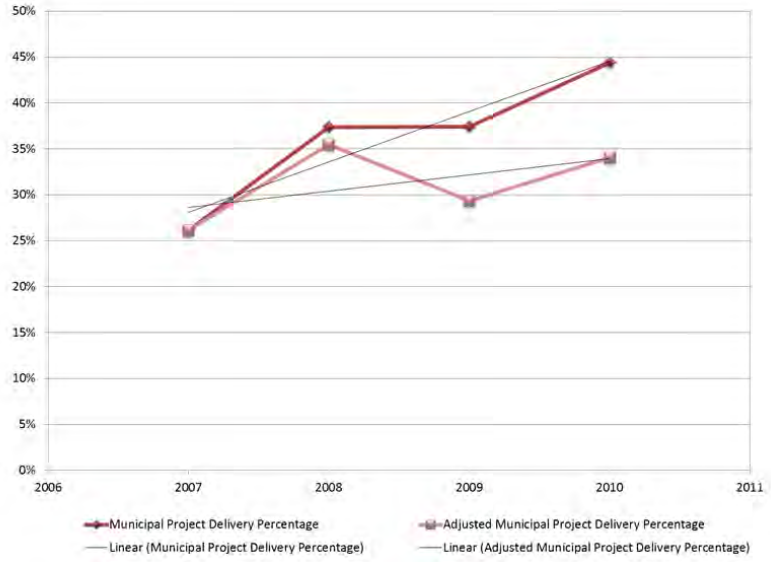

Figure D-3
Project Delivery Percentages – Streets Projects

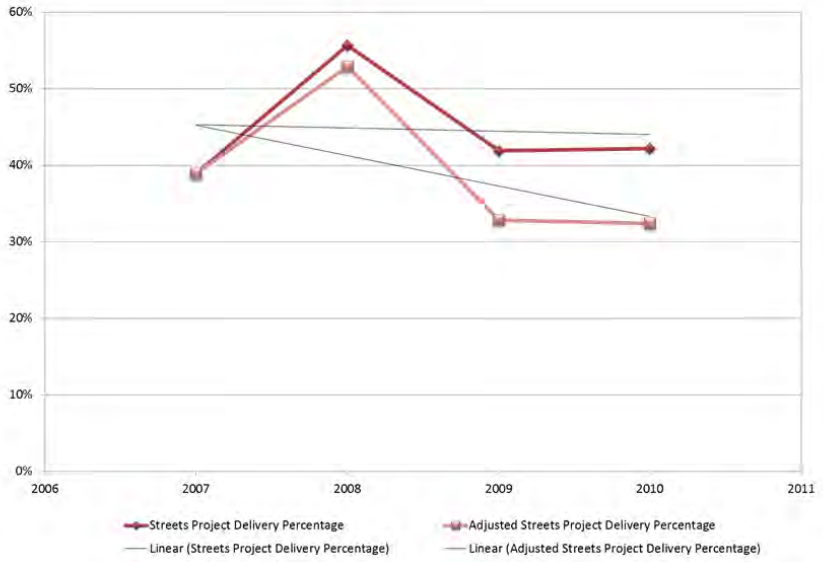

Figure D-4
Project Delivery Percentages – Pipes Projects

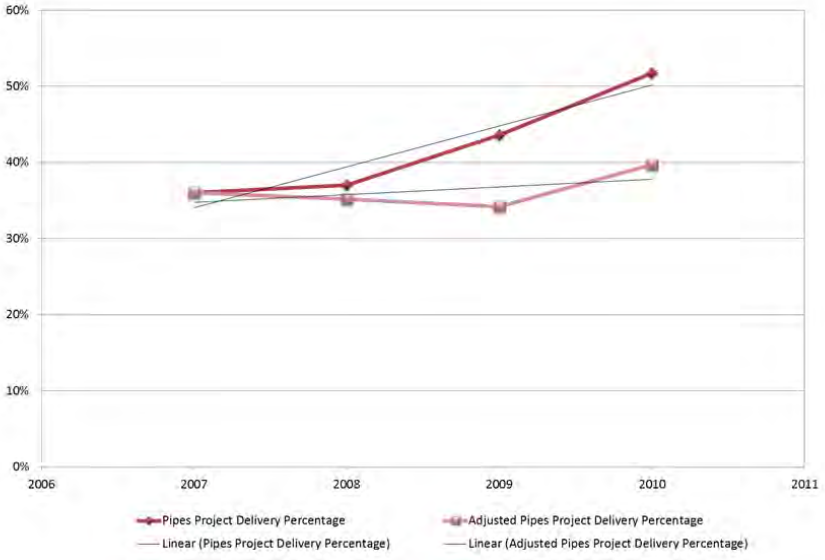

Figure D-5
Project Delivery Percentages – Parks Projects

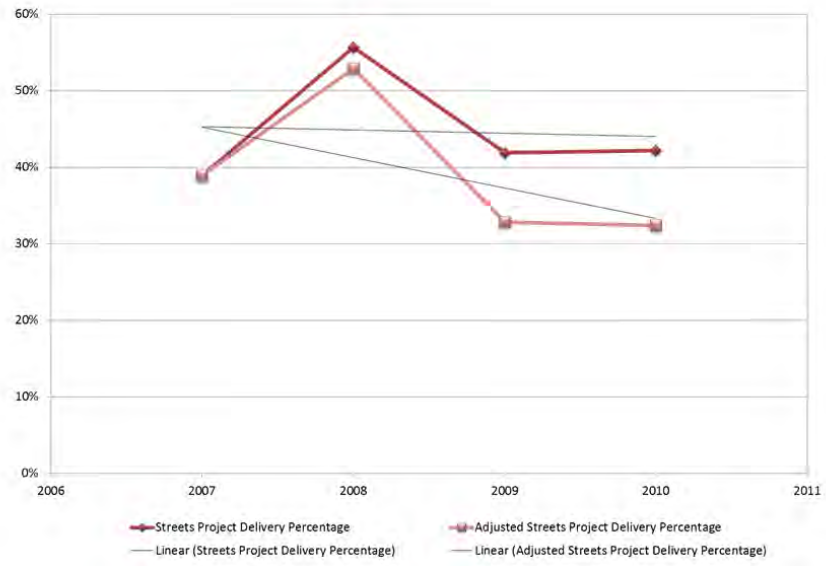

Figure D-1 presents a comparison between the unadjusted and adjusted project delivery percentages for all projects in the database. The unadjusted project delivery percentages range from 36 percent to 47 percent. However, upon adjustment using the price index, the adjusted project delivery percentages ranging between 33 percent and 42 percent are in line with the historical project delivery percentages observed in the Study in the past. Trend analysis on the adjusted project delivery percentages indicates a decreasing slope for all projects when viewed as a whole.

By observing the trend line presented for the unadjusted project delivery percentages in **Figure D-1**, it can be inferred that project delivery percentages increased from approximately 39 percent in year 2007 to approximately 47 percent in year 2010 for a total of 8 percent. The trend line for the adjusted project delivery percentages indicates that the decrease in construction costs of 12 percent over this period accounts for the entire increase in project delivery percentages in year 2010, as averaged over all project types. The same analysis for each project type is summarized in **Table D-2**. Based on a review of the numbers presented in **Table D-2**, it can be concluded that the increase in project delivery costs is fully accounted for by the decrease in construction costs for all project types except municipal and pipes. For municipal and pipes projects, 4 percent to 5 percent of the increase can be attributed to factors other than construction costs.

Table D-2
Change in Project Delivery Percentages Due to Reduced Construction Costs Based on Linear Regression

Project Type	2007 (Bid Year) PD%	2010 (Bid Year) PD %	Percentage Due to Reduced Construction Costs	Percentage Due to Other Factors
All	39%	47%	12 %	-4 %
Municipal	29%	45%	11%	5%
Parks	42%	54%	13%	-1%
Pipes	34%	51%	13%	4%
Streets	45%	44%	11%	-12%

A careful observation of the plots for individual project types (**Figure D-2 - Figure D-5, Table D-2**), shows the decrease in construction costs has had a big effect on project delivery percentages. While the adjusted project delivery cost decreased when all projects types are considered, project delivery percentages increased for municipal and pipe projects, decreased significantly for streets projects, and decreased slightly for parks projects. This variation in project delivery cost trends across the different project types may be attributed to the set of projects that make up the Special Study, as each of the years analyzed includes a different number of projects and a different mix of small projects and large projects by project type. It is expected that an analysis of a larger set of projects would likely reduce the variance in project delivery cost trends. Due to the temporary nature of depressed construction costs however, it is not possible to capture data from a larger data set.

PARTICIPATING AGENCIES

City of Long Beach
Department of Public Works

City of Los Angeles
Department of Public Works
Bureau of Engineering

City of Oakland
Public Works Agency

City of Sacramento
Department of 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/