CIP Benchmarking Study

California Multi-Agency CIP Benchmarking Study

Annual Report - Update 2012

Seal of the City and County of San Francisco

Department of PUBLICWORKS CITY OF SACRAMENTO

OAKLAND PUBLIC WORKS AGENCY

CITY OF SAN JOSE CAPITAL OF SILICON VALLEY

City of Los Angeles Founded 1781

CITY OF LONG BEACH

The City of San Diego State of California Semper Vigilans

September 2012

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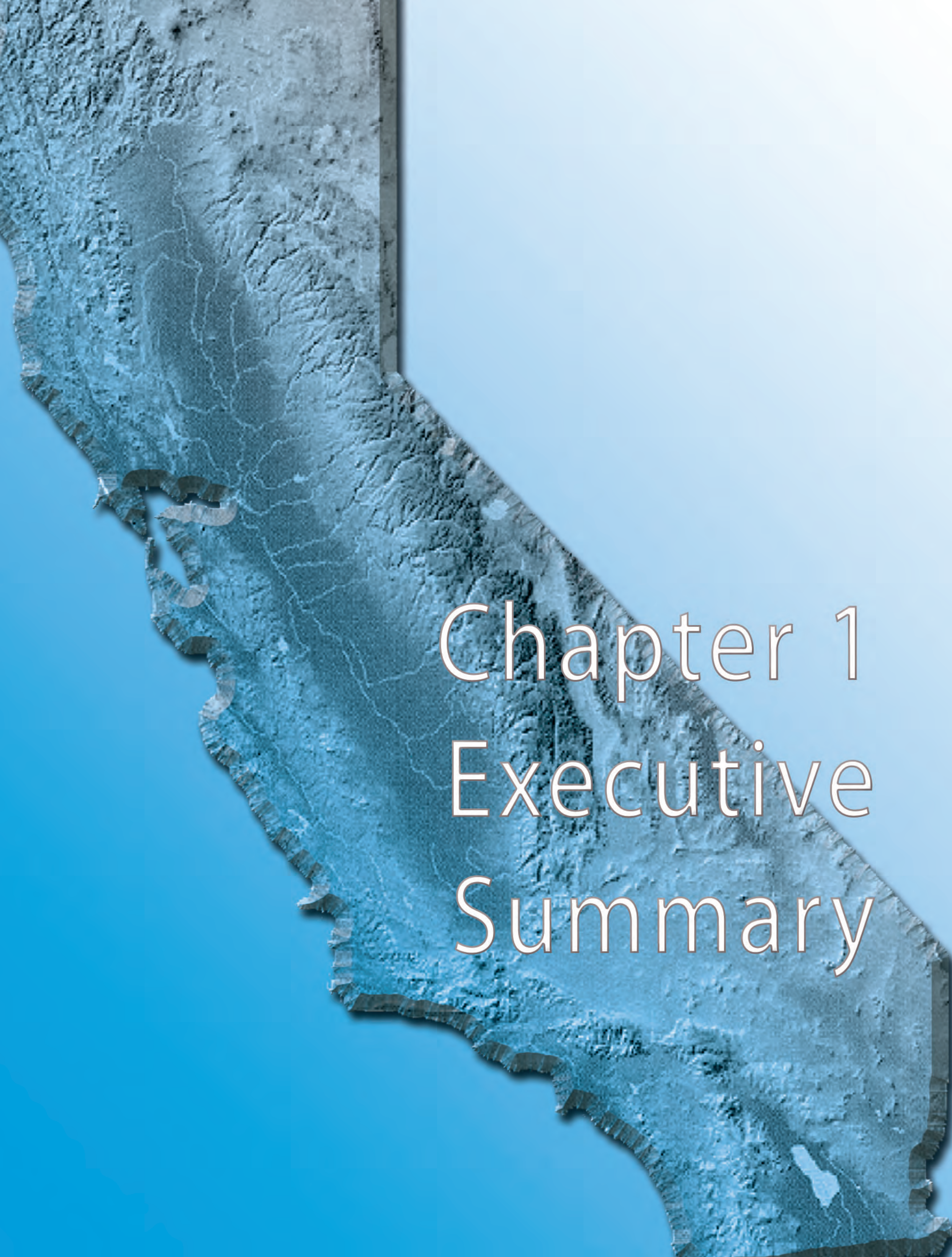

Chapter 1 Executive Summary

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A. INTRODUCTION

As the recession continues in the US, governmental agencies continue to face budget cuts, reduced capital improvement programs (CIPs), and staff reductions. Municipal agencies in California are 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. During these highly challenging economic times, 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 eleventh 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 compared bids received from contractors to the engineer's estimates for construction costs for the 2009-2011 period. In addition, the agencies also reviewed change orders as a percentage of total construction cost for the same period. The intent of these analyses is to further investigate the impacts of "below market rate bids" on project delivery percentages. The agencies also developed a new Best Management Practice (BMP) for tracking project schedule.

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 used for the current analysis contains 661 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 661 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 1-1 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 seven projects have been excluded as outliers in the *Update 2012 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.

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 < 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	1	0	157	51	2	104
VIII	155	0	155	2	4	149	21	1	127
IX	174	10	184	2	1	171	8	3	160
X	122	15	137	1	0	121	0	3	118
XI	160	15	175	0	0	160	1	7	152
Total	**2101**	**40**	**2141**	**51**	**145**	**1905**	**1228**	**16**	**661**

[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, and X = 2011.
[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 661 projects selected for analysis in the Update 2012 Study.

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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.

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)
2007	24	55	52	14	145	$3.03	$0.99	23%	17%	40%
2008	15	47	49	15	126	$2.35	$0.90	25%	18%	43%
2009	25	73	55	10	163	$2.44	$0.82	22%	18%	41%
2010	16	46	61	8	131	$2.73	$1.11	23%	21%	45%
2011	17	39	32	8	96	$2.06	$0.75	30%	22%	53%
Total/ Average	**97**	**260**	**249**	**55**	**661**	**$2.55**	**$0.91**	**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 661 projects selected for analysis in the Update 2012 Study.

As indicated in **Table 1-2**, median project size has fluctuated considerably since 2007. The median project size declined approximately 18 percent between 2007 and 2009. After declining in 2009, there was a significant increase in median project size in 2010 with an approximately 35 percent increase over 2009 levels. The median project size dropped approximately 33 percent between 2010 and 2011. 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.

While project delivery costs measured as a percentage of the TCC have remained relatively stable in the past, this percentage has increased 8 percentage points from 2010 to 2011. 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 *Update 2013 Study* may consider a Special *Study* that will focus on the effects of "below market rate" bids 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	20%	15%	35%	4.32	97
Parks	28%	18%	45%	0.45	55
Pipe Systems	22%	19%	40%	1.07	249
Streets	27%	21%	47%	0.68	260
Average	**24%**	**19%**	**43%**	**0.91**	**661**

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 661 projects selected for analysis in the Update 2012 Study.

Projects belonging to the Municipal and the Pipes categories have the lowest average project delivery percentage. Projects belonging to the Municipal category

The Streets category has the maximum number of projects (n = 260) in the *Update 2012* database. The Pipes category also has a similar number of projects in the database (n = 249). Along with the Parks category, the Streets category also exhibits the highest average project delivery cost. The influence of low project delivery cost from Pipes projects is balanced by the influence of high project delivery cost from Streets projects. The average project delivery percentage for the overall dataset is approximately 43 percent.

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 1-4 shows project delivery costs by each of the four project types in the *Study* for the smaller projects subset of TCC (Note: In *Update 2009*, the concept of looking at a smaller subset of projects was introduced. This smaller subset generally characterizes the smaller projects in the type or classification being examined.

Table 1-4
Average 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	20%	17%	37%	1.78	80
Parks	29%	20%	48%	0.37	53
Pipe Systems	27%	21%	47%	0.70	182
Streets	30%	22%	52%	0.50	199
Average	**27%**	**21%**	**48%**	**0.51**	**514**

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 661 projects selected for analysis in the Update 2012 Study.

This step was taken as it was generally believed that smaller projects project delivery for smaller projects was different than for larger projects.). The trends in the project delivery costs for the projects in the smaller project 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 smaller project subset of TCC.

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.

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	37.6	52%	35.3	48%	26%	42.0	64%	23.6	36%	17%	79.6	57%	58.9	43%	43%	3.3	1.2
Agency B	6.1	57%	4.6	43%	28%	4.6	61%	2.9	39%	17%	10.6	59%	7.5	41%	45%	1.1	0.4
Agency C	32.0	96%	1.2	4%	18%	38.6	99%	0.2	1%	17%	70.6	98%	1.4	2%	35%	2.0	1.4
Agency D	42.3	60%	28.6	40%	22%	72.5	85%	12.7	15%	24%	114.8	74%	41.3	26%	46%	5.1	1.8
Agency E	4.3	28%	10.9	72%	18%	7.1	48%	7.7	52%	15%	11.4	38%	18.6	62%	33%	1.8	0.8
Agency F	24.4	54%	21.1	46%	30%	42.2	85%	7.2	15%	28%	66.7	70%	28.3	30%	58%	2.3	0.4
Agency G	13.4	63%	7.8	37%	26%	7.8	100%	0.0	0%	9%	21.2	73%	7.9	27%	35%	1.1	0.4
OVERALL	160.2	59%	109.6	41%	24%	214.8	80%	54.4	20%	19%	375.0	70%	164.0	30%	43%	2.6	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.

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.

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 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. The agencies also investigated change orders as a percentage of total construction cost for the 2007-2012 period. The agencies noted that the average change order amount expressed as a percentage of TCC had almost doubled for that period.

Project delivery percentages also increased due to the reduced construction bids. However, using such delivery percentages for budgeting a program of projects in the future may be misleading as construction costs are likely to increase improvement in the economy.

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.

E. BEST MANAGEMENT PRACTICES

At the onset 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). Every 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. Agency implementation of these selected practices has been, and 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 2012*, 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 a follow-up conference call. The new BMP is:

- 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.

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.

F. ONLINE DISCUSSION FORUM

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

- Local Business and Employment Programs
- New Construction General Permit (CGP) Requirements
- Electronic Submission of Bids
- Stop Notices
- Prioritization of CIP Projects
- Project Delivery Control

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

G. CONCLUSIONS

Performance Benchmarking

Performance Benchmarking for the *Update 2012 Study* involved analysis of 661 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 2012. There are 40 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 2012 Study* varied between the following values for the full range and the smaller project subset of TCC respectively:

Table 1-6
Update 2012 Project Delivery Percentages

Type	Project Delivery Percentages
Municipal Projects:	35% - 37%
Parks Projects:	45% - 48%
Pipes Projects:	40% - 47%
Streets Projects:	47% - 52%

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. The agencies also investigated change orders as a percentage of total construction cost for the 2007-2012 period. The agencies noted that the average change order amount expressed as a percentage of TCC had almost doubled for that period.

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 2012*, 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 2012*, the Project Team added one new BMP:

- 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.

These new BMPs along with the existing BMPs are believed to directly influence cost, schedule, quality, communication, environment or customer service aspects of 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 by the continued current state of the economy, 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.

To support the linking of BMPs to performance improvements, BMP implementation by the agencies are tracked. As of *Update 2012*, and including the addition of new BMPs, the Agencies have fully implemented about 69 percent of all BMPs. Six (6) 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.

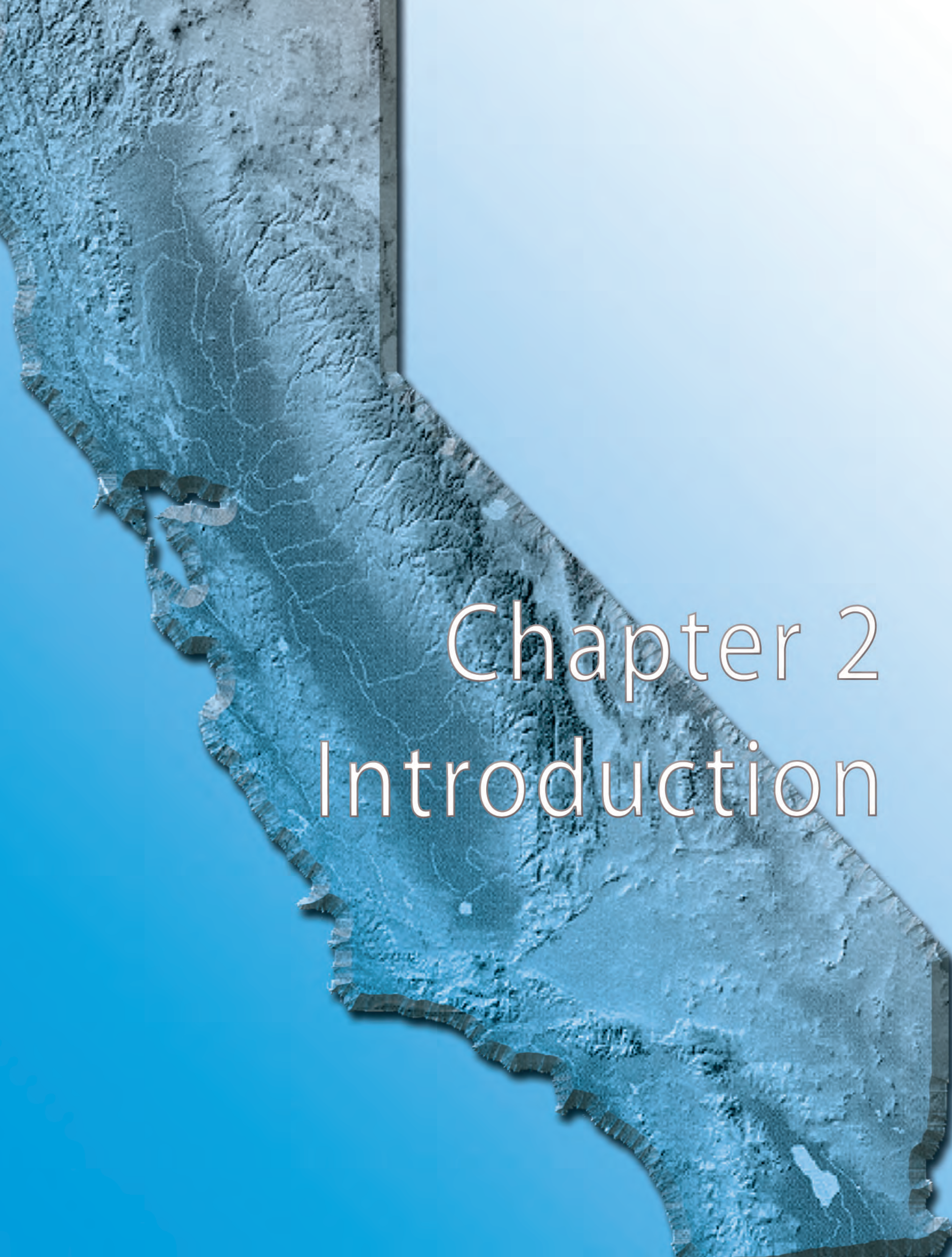
Online Discussion Forum

In *Update 2012*, 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.

Planning for Update 2012

Over the course of *Update 2012*, the Project Team identified a number of activities to consider including next year in *Update 2013*. These activities include:

- Perform a Special *Study* that evaluates the impacts of low construction bids on project delivery percentages;
- Continue collecting data on projects delivered via alternative delivery techniques;
- Develop new BMPs and tracking the implementation of adopted BMPs;
- Continue discussion on current topics via the round-table discussion forum; and
- Continue meaningful exchanges on the Online Discussion Forum via the SharePoint website.



Chapter 2 Introduction

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As the recession continues in the US, governmental agencies continue to face budget cuts, reduced capital improvement programs (CIPs), and staff reductions. Municipal agencies in California are 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. During these highly challenging economic times, 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 eleventh 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 compared bids received from contractors to the engineer's estimates for construction costs for the 2009-2011 period. In addition, the agencies also reviewed change orders as a percentage of total construction cost for the same period. The intent of these analyses is to further investigate the impacts of "below market rate bids" on project delivery percentages. The agencies also developed a new Best Management Practice (BMP) for tracking project schedule.

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

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

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, especially with regard to newer topics that impact capital project delivery such as LEED [Leadership in Energy and Environmental Design] and "green building" initiatives and alternative contracting methods (e.g., design-build). San Jose also offers: "What is great is that we learn new things at every meeting that lead to ways we can challenge ourselves to improve our processes and procedures. The online forum has also proved to be a very valuable tool between meetings and has generated some very informative discussions on a broad range of topics."

Table 2-1
Agencies' Overall Information

Information	Population[2]	Area (sq. mi.)	Website	Government Form
Long Beach	463,393	50	http://www.longbeach.gov	Council-Manager-Charter[1]
Los Angeles	3,806,411	469	http://eng.lacity.org	Mayor-Council
Oakland	392,333	66	http://www2. oaklandnet.com/	Mayor-Council-Administrator
Sacramento Dept. of Transportation Dept. of Utilities	469,477	99	http://www. cityofsacramento.org	Council-Manager
San Diego	1,309,784	342	http://www.sandiego.gov	Mayor-Council
San Francisco	808,768	49	http://www.sfdpw.org	Mayor-Board of Supervisors (11 members)
San Jose	957,369	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, 2011 and 2012, California Department of Finance

- The City and County of San Francisco uses 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 7 cities' data 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. Since the mortgage lending and auto company economic crisis, 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 "in addition to the general benefits that we have described in past years and continue to receive from participation in the Benchmarking group, 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. It is very helpful to hear these comments, and to discover that others are going through similar budget tightening measures."

- The City of Long Beach offers this comment: "Cities in California continue to experience major budget and staffing reductions that are having significant impacts in their ability to deliver capital improvement projects. Understanding the consequences of these resource cuts and learning how to cope with them has become a major challenge for municipal managers. 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 delivery benchmarks. Although it is well understood that the data changes from year to year based on factors which affect construction costs, the five year state-wide averages are a gauge to our own delivery costs. The statistical models from the report continue to be refined and provide a good starting point for estimating our program delivery goals. We are excited that the *Study* is now collecting data on alternative delivery processes such as design-build. San Diego is increasingly using this method of delivery in our effort to provide cost efficiencies and we are eager to start seeing results in future years, when more data is available. We continue to take advantage of our quarterly meetings and discussion forum, which provide the means to obtain very useful information on processes and standards from the other participating agencies".

- 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".

C. STUDY FOCUS

This year, the participating agencies investigated the impacts of “below market rate bids” on project delivery percentages. Preliminary analysis was conducted to quantify the effects of “below market rate bids” on project delivery percentages by comparing engineer’s estimates for construction costs versus actual construction bids. A brief discussion on this topic is presented in **Chapter 3 Performance Benchmarking** of this report. The agencies also developed a new Best Management Practice (BMP) for tracking project schedule. The new BMP is presented below:

- 5.III.j – 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.

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 2012 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 2012. However, the agencies decided that these projects will not be analyzed until a sufficient number of projects are collected to facilitate meaningful analyses.

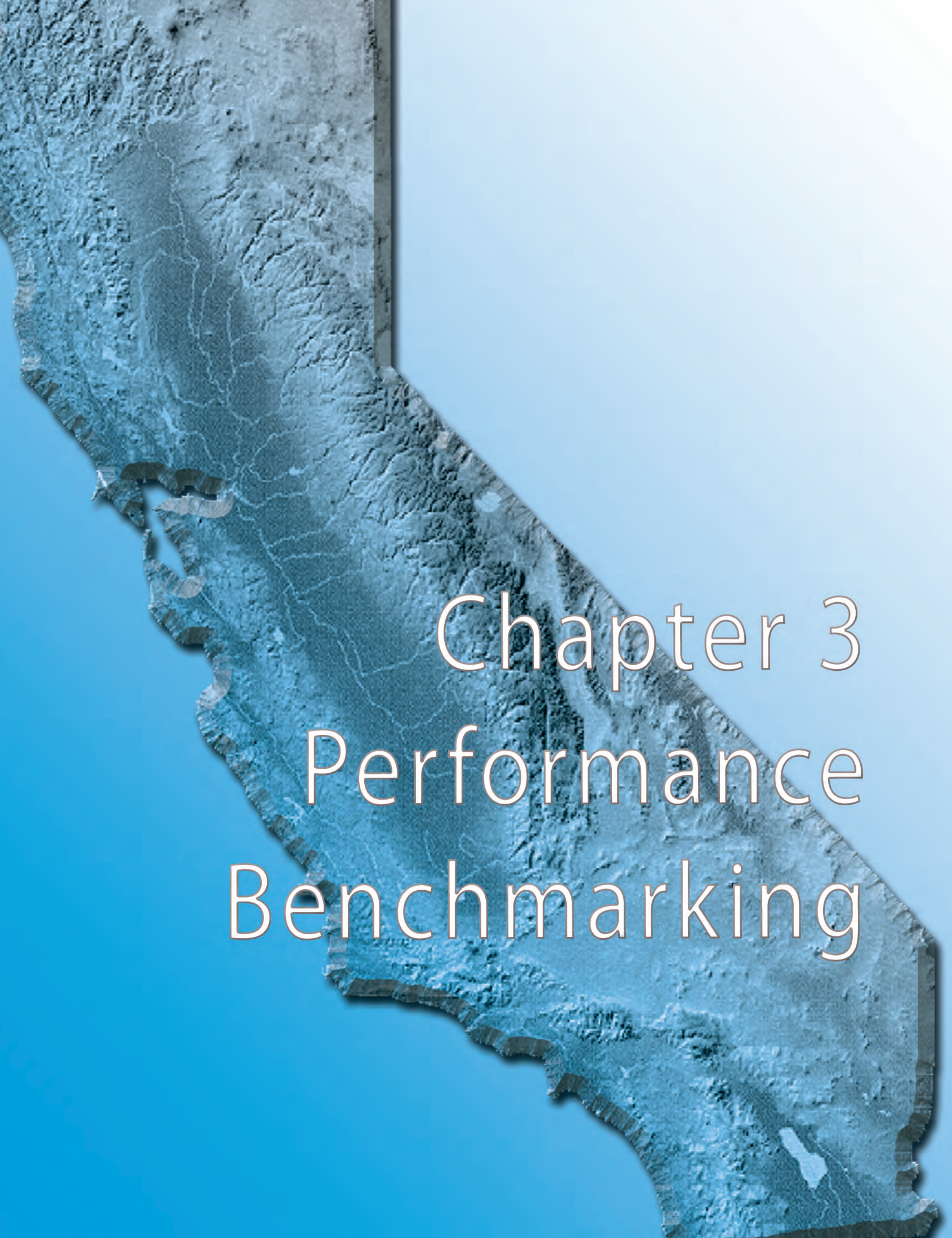
2. **Conduct roundtable discussions on Special Topics.** Continuing the trend from Update 2009, during each meeting roundtable discussions were held on current events. These sessions included discussions on stormwater pollution prevent plan practices, average chargeability across categories and classifications, organization of the agencies, lessons learned from project execution, impacts of the dissolution of RDAs, budgetary trends, and copper thefts.

3. **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.

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

5. **Continue efficient information sharing with one another through the online discussion forum.** In Update 2012, 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 2012* performance benchmarking analyses:

- **Total 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.

- **Completion Date –** Projects included in the *Study* analyses were completed on or after January 1, 2007. 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:

  $y=m \pm 3\sigma$, 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 2008*, 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 committed 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 2012 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 661 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 661 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 seven projects have been excluded as outliers in the *Update 2012 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 2012* 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-Representative	(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	1	0	157	51	2	104
VIII	155	0	155	2	4	149	21	1	127
IX	174	10	184	2	1	171	8	3	160
X	122	15	137	1	0	121	0	3	118
XI	160	15	175	0	0	160	1	7	152
Total	**2101**	**40**	**2141**	**51**	**145**	**1905**	**1228**	**16**	**661**

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, and XI = 2012.

[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 661 projects selected for analysis in the Update 2012 Study.

Table 3-4
Projects Distribution Matrix

Agency	San Diego	Sacramento	San Francisco	Los Angeles	Long Beach	San Jose	Oakland	Total[3]
Municipal Facilities	**17**	**2**	**11**	**19**	**9**	**23**	**16**	**97**
Comm./Rec. Center/ Child Care/Gyms	1	1	3	4	1	4	10	24
Libraries	3		3		1	11	2	20
Other Municipal Facilities[2]	13	1	5	6	6	2	2	35
Police/Fire Stations				9	1	6	2	18
Parks	**9**	**1**	**5**	**2**	**1**	**19**	**18**	**55**
Playgrounds	4	1	4	1	1	15	12	38
Restrooms	1					2	2	5
Sportfields	4		1	1		2	4	12
Pipe Systems	**59**	**13**	**30**	**63**	**5**	**42**	**37**	**249**
Gravity Systems (Storm Drains/Sewers)	27	8	28	61	1	41	37	203
Other Pipes	1	1		1	1			4
Pressure Systems	24	4	2					30
Pump Stations	7			1	3	1		12
Streets	**26**	**39**	**52**	**26**	**37**	**49**	**31**	**260**
Bike/Pedestrian/ Streetscapes	13	22	7	2	1	13	16	74
Bridges (New/Retrofit)	2	2		9	2	4		19
Reconstructions	3	1	40	7	31	6	8	96
Signals	1	6	4		3	21	7	42
Widening/New/ Grade Separations	7	8	1	8		5		29
Total[1]	**111**	**55**	**98**	**110**	**52**	**133**	**102**	**661**

Notes:
[1] Total refers to the projects included in the Update 2012 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 661 projects selected for analysis in the Update 2012 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 2007. The median project size declined approximately 18 percent between 2007 and 2009. After declining in 2009, there was a significant increase in median project size in 2010 with an approximately 35 percent increase over 2009 levels. The median project size dropped approximately 33 percent between 2010 and 2011. 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)
2007	24	55	52	14	145	$3.03	$0.99	23%	17%	40%
2008	15	47	49	15	126	$2.35	$0.90	25%	18%	43%
2009	25	73	55	10	163	$2.44	$0.82	22%	18%	41%
2010	16	46	61	8	131	$2.73	$1.11	23%	21%	45%
2011	17	39	32	8	96	$2.06	$0.75	30%	22%	53%
Total/ Average	**97**	**260**	**249**	**55**	**661**	**$2.55**	**$0.91**	**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 661 projects selected for analysis in the Update 2012 Study.

While project delivery costs measured as a percentage of the TCC have remained relatively stable in the past, this percentage has increased 8 percentage points from 2010 to 2011. This may 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 *Update 2013 Study* may consider a Special Study that will focus on the effects of "below market rate" bids on project delivery percentages.

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 and the Pipes categories have the lowest average project delivery percentage. Projects belonging to the Municipal category

The Streets category has the maximum number of projects (n = 260) in the *Update 2012* database. The Pipes category also

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	20%	15%	35%	4.32	97
Parks	28%	18%	45%	0.45	55
Pipe Systems	22%	19%	40%	1.07	249
Streets	27%	21%	47%	0.68	260
Average	**24%**	**19%**	**43%**	**0.91**	**661**

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 661 projects selected for analysis in the Update 2012 Study.

has a similar number of projects in the database (n = 249). Along with the Parks category, the Streets category also exhibits the highest average project delivery cost. The influence of low project delivery cost from Pipes projects is balanced by the influence of high project delivery cost from Streets projects. The average project delivery percentage for the overall dataset is approximately 43 percent.

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 smaller projects subset of TCC (Note: In *Update 2009*, the concept of looking at a smaller subset of projects was introduced. This smaller subset generally characterizes the smaller projects in the type or classification being examined. This step was taken as it was generally believed that smaller projects project delivery for smaller projects was different than for larger projects.). The trends in the project delivery costs for the projects in the smaller project 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 smaller project 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	20%	17%	37%	1.78	80
Parks	29%	20%	48%	0.37	53
Pipe Systems	27%	21%	47%	0.70	182
Streets	30%	22%	52%	0.50	199
Average	**27%**	**21%**	**48%**	**0.51**	**514**

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 661 projects selected for analysis in the Update 2012 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			In-House		Consultants			In-House		Consultants				
	($M)	% of Design	($M)	% of Design	Total % of TCC[2]	($M)	% of CM	($M)	% of CM	Total % of TCC	($M)	% of PD	($M)	% of PD	Total % of TCC	Average	Median
Agency A	37.6	52%	35.3	48%	26%	42.0	64%	23.6	36%	17%	79.6	57%	58.9	43%	43%	3.3	1.2
Agency B	6.1	57%	4.6	43%	28%	4.6	61%	2.9	39%	17%	10.6	59%	7.5	41%	45%	1.1	0.4
Agency C	32.0	96%	1.2	4%	18%	38.6	99%	0.2	1%	17%	70.6	98%	1.4	2%	35%	2.0	1.4
Agency D	42.3	60%	28.6	40%	22%	72.5	85%	12.7	15%	24%	114.8	74%	41.3	26%	46%	5.1	1.8
Agency E	4.3	28%	10.9	72%	18%	7.1	48%	7.7	52%	15%	11.4	38%	18.6	62%	33%	1.8	0.8
Agency F	24.4	54%	21.1	46%	30%	42.2	85%	7.2	15%	28%	66.7	70%	28.3	30%	58%	2.3	0.4
Agency G	13.4	63%	7.8	37%	26%	7.8	100%	0.0	0%	9%	21.2	73%	7.9	27%	35%	1.1	0.4
OVERALL	**160.2**	**59%**	**109.6**	**41%**	**24%**	**214.8**	**80%**	**54.4**	**20%**	**19%**	**375.0**	**70%**	**164.0**	**30%**	**43%**	**2.6**	**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 smaller 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. 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 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. The agencies also investigated change orders as a percentage of total construction cost for the 2007-2012 period. The agencies noted that the average change order amount expressed as a percentage of TCC had almost doubled for that period.

Project delivery percentages also increased due to the reduced construction bids. However, using such delivery percentages for budgeting a program of projects in the future may be misleading as construction costs are likely to increase improvement in the economy.

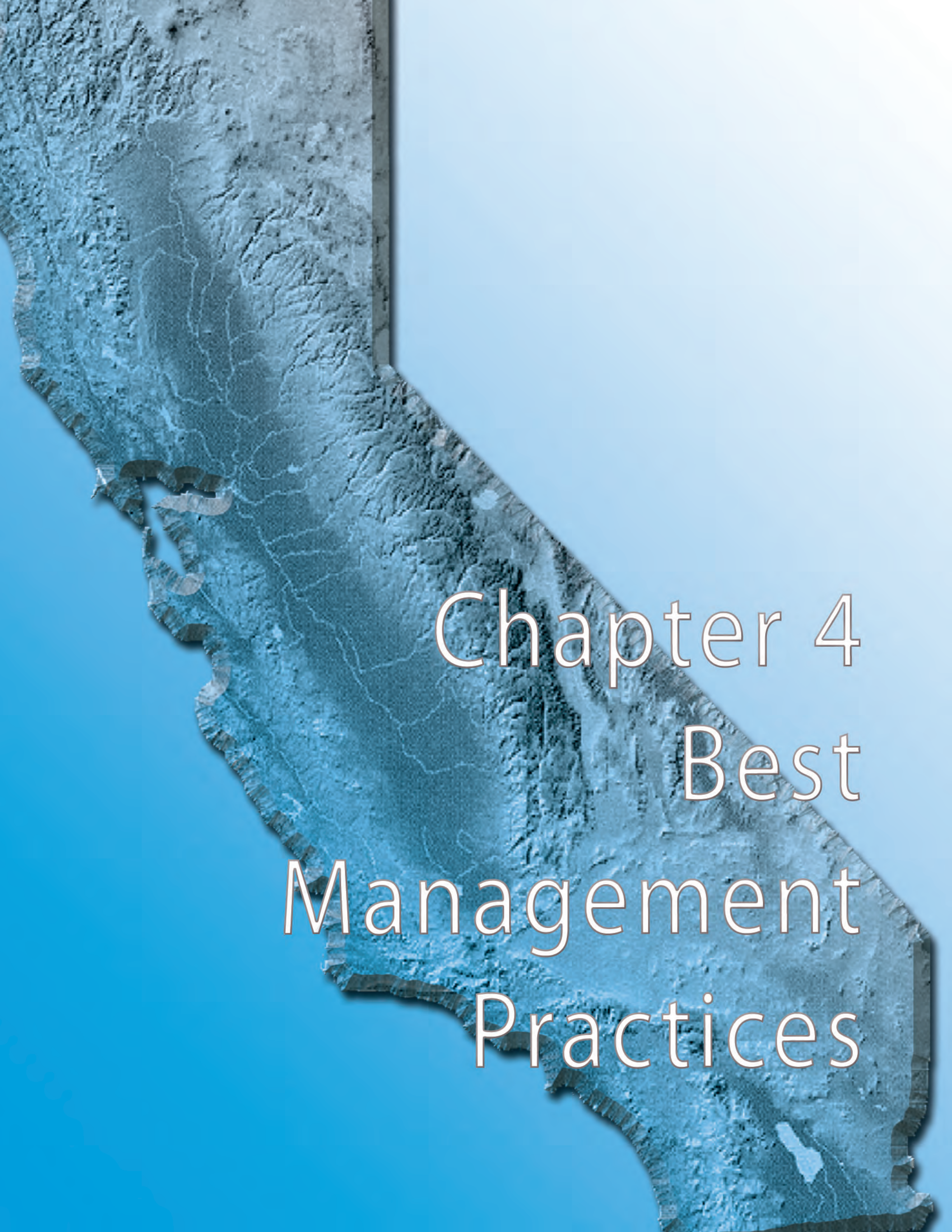
Size of the Database

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 onset 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). Every 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. Agency implementation of these selected practices has been, and 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

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 2012*, 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 a follow-up conference call. The new BMP is:

- 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.

- 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

The *Study 2002* report included descriptions of the BMPs that the Project Team felt were most critical to improving project delivery performance. These descriptions, presented in **Table 4-1**, have been updated to reflect 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) - 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	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 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	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.	✓	✓				
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 2012, by using networking opportunities during the face-to-face meetings, team discussions during conference calls, and the online discussion forum. Agencies continue to share experiences and provide feedback to update BMPs that have been fully implemented for several years. Agencies continue to pursue 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 the current state of the economy, 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. As of Update 2012, and including the addition of the new BMP, the agencies have fully implemented about 69 percent of all BMPs. Six (6) 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 2011 are summarized below.

I. City of Los Angeles

Implemented from June 2011 to September 2012:	Targeted October 2012 Onward:
• 2.t. 2011 Lessen time period between design completion and issuance of notice to proceed. (fully implemented) • 4.IV.c. 2010 Agency should file as-built drawings within 6 months of project completion.	• 2.r. 2011 Use of electronic signatures to do direct conversion from CAD to PDF. • 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 2011 to September 2012:	Targeted October 2012 Onward:
	• 3.I.a. Develop and use a standardized Project Delivery Manual (partially implemented).

III. City of Oakland

Implemented from June 2011 to September 2012:	Targeted October 2012 Onward:
• 7.a Identify the environmental benefits of the project at the time of award.	

IV. City of Sacramento

Implemented from June 2011 to September 2012:	Targeted October 2012 Onward:
Department of Transportation • 5.III.g 2006 Monitor "earned value" versus budgeted and actual expenditures during project delivery. • 7.a Identify the environmental benefits of the project at the time of award. Department of Utilities	Department of Transportation • 2.o. 2007 Establish criteria for obtaining independent cost estimates which take in consideration both project characteristics and volatility of the market. (partially implemented) Department of Utilities

V. City of San Diego

Implemented from June 2011 to September 2012:	Targeted October 2012 Onward:
• 4.IV.c. 2010 Agency should file as-built drawings within 6 months of project completion. (partially implemented) • 5.III.g 2006 Monitor "earned value" versus budgeted and actual expenditures during project delivery. (partially implemented)	

VI. City and County of San Francisco

Implemented from June 2011 to September 2012:	Targeted October 2012 Onward:
	• 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).

VII. City of San Jose

Implemented from June 2011 to September 2012:	Targeted October 2012 Onward:
• 2.p.2008 Establish criteria for responsible charge design approval such that it occurs at the lowest appropriate organizational level in order to expedite design completion. • 3.III.l.2007 Designate a responsible person for and establish a process of notifications and milestones for utility relocations. • 6.g Implement and use a consultant rating system that identifies quality of consultant performance.	• 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.

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 DT	SC DU	SD	SF	SJ	Notes
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 Management 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.
	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 Divisions only.
	2.i.	Adapt successful designs to project sites, whenever possible (e.g. fire stations, gymnasiums, etc).	✓	✓	✓	✓	✓	NI	✓	✓	
	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 DT	SC DU	SD	SF	SJ	Notes
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.
	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 consulting service agreements in various disciplines.
	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	2012	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	✓	✓	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	Establish criteria for responsible charge design approval such that it occurs at the lowest appropriate organizational level in order to expedite design completion.	NI	PI	PI	NI	TBD	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.	2012	TBD	NI	TBD	TBD	✓	TBD	TBD	
	2.s. 2011	Have awarding authority to approve plans, advertisement and award of contract in one board/council action.	NI	✓	✓	✓	TBD	✓	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.

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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.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, 2012	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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Table 4-2
Implementation of BMPs (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC DT	SC DU	SD	SF	SJ	Notes
Quality Assurance/ Quality Control	3.II.b.	Perform a formal Value Engineering Study for projects larger than $1 million.	✓	✓	NI	✓	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 2012	SD: Some Divisions 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	TBD	✓	✓	✓	✓	✓	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, 2012	SD: all standard documents are posted on the Department SharePoint for staff use.

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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.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 < $200,000 SF: At Bureau level SJ: Individual CO < $100,000
	4.I.m.	Classify types of change orders.	✓	✓	✓	✓	✓	✓	✓	✓	LA: Draft Special Order prepared.
	4.II.a.	Include a formal Dispute Resolution Procedure in all contract agreements.	✓	NI	✓	✓	✓	✓	✓	✓	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 Bank of America.

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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.IV.c 2010	Agency should file As-built drawings within 6 months of project completion.	✓	PI	PI	✓	TBD	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	✓	✓	✓	
	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.	✓	✓	✓	✓	NI	✓	✓	✓	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, 2009	✓	✓	✓	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	✓	✓	TBD	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	✓	2012	TBD	
	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.	2012	✓	✓	✓	NI	✓	✓	TBD	
	5.III.g 2006	Monitor "earned value" versus budgeted and actual expenditures during project delivery.	2012	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	TBD	✓	NI	✓	NI	✓	SF: No additional ROW required outside military base closure.
	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.	TBD	NI	✓	TBD	TBD	TBD	PI	TBD	SF: Developed a nascent database called the Enterprise Project Management system (EPM). MS Project schedule is imported into the EPM. Project Leads are responsible for creating and tracking actual schedules to baseline schedules. Since new, monitoring protocols are still progressing.
	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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Table 4-2
Implementation of BMPs (cont'd)

Category	Ref:*	BMP	LA	LB	OK	SC DT	SC DU	SD	SF	SJ	Notes
Consultant Selection and Use	6.c.	Include a standard consultant contract in the RFQ/RFP with an indemnification clause.	✓	✓	✓	✓	✓	✓	✓	✓	SD: Some Divisions only.
	6.e.	Delegate authority to the Public Works Director/City Engineer to approve consultant contracts under $250,000 when a formal RFP selection process is used.	NI	NI	NI	NI	NI	✓	✓	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.	✓	✓	✓	✓	PI	✓	✓	✓	
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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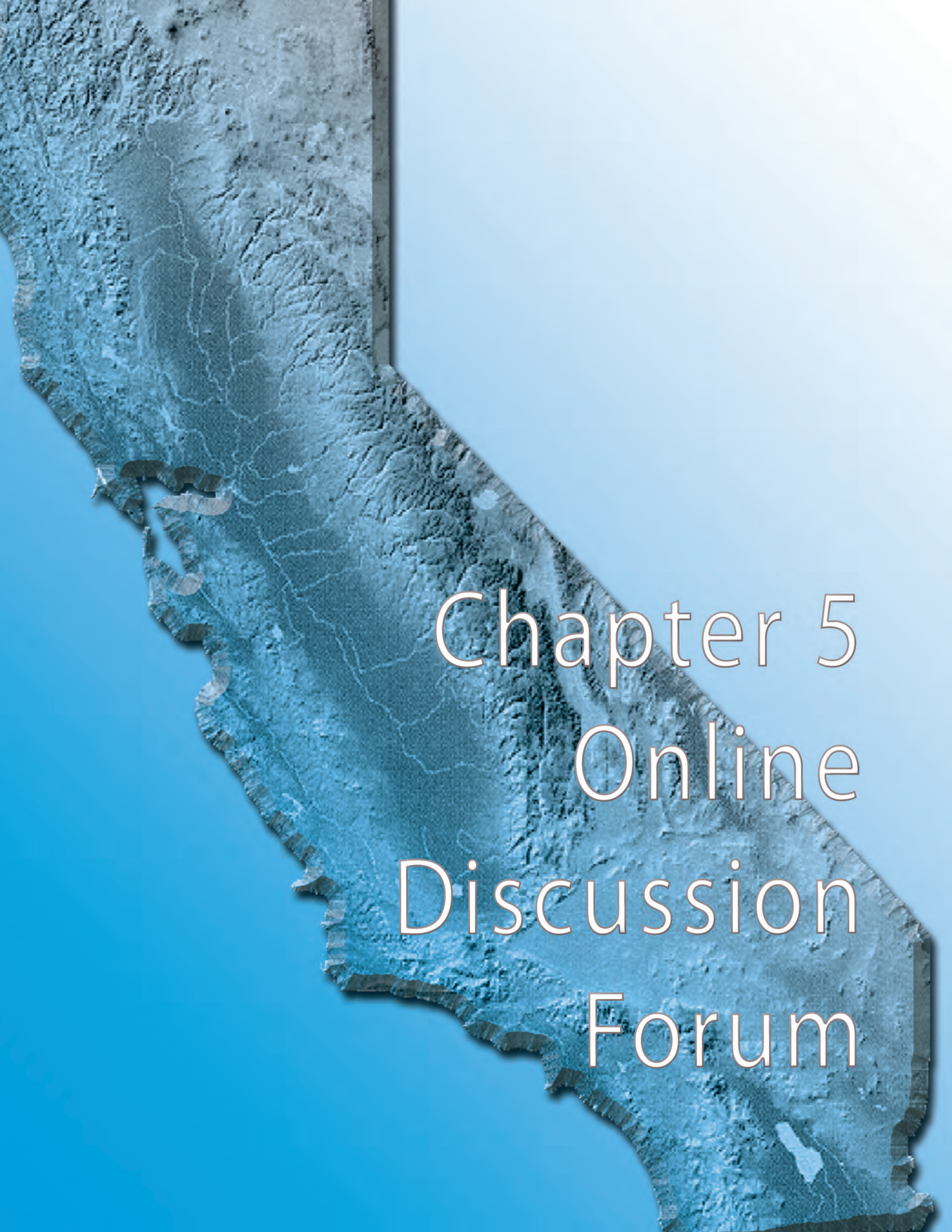


Chapter 5 Online Discussion Forum

CHAPTER 5 Online Discussion Forum

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 eight topics were discussed during *Update 2011*. From this set of discussions, the following six topics are presented as an example of the types of informational exchanges that occurred within the *Update 2011* Online Discussion Forum.

- Local Business and Employment Programs
- New Construction General Permit (CGP) Requirements
- Electronic Submission of Bids
- Stop Notices
- Prioritization of CIP Projects
- Project Delivery Control

A. LOCAL BUSINESS AND EMPLOYMENT PROGRAMS

The City of Oakland has several local business programs implemented. To gain a better understanding of what programs other cities have implemented, they asked the following series of questions to the Benchmark Team:

1. Does your city have a required minimum level of participation for local businesses on construction or consultant contracts?
2. If so, what is the minimum participation level?
3. Is there a separate participation requirement for Small Local Businesses?
4. Does the program include a "Good Faith Effort" allowance?
5. Do you give bid preference for Local Business Participation and, if so, what percentage and what maximum?

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

Table 5-1 City of Oakland
Local Business and Employment Programs

Questions	1. Does your city have a required minimum level of participation for local businesses on construction or consultant contracts?	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?	4. Does the program include a "Good Faith Effort" allowance?	5. Do you give bid preference for Local Business Participation and, if so, what percentage and what maximum?
City of Long Beach	The City of Long Beach does have a defined SBE program which was provided.	No required minimum level.	This City's program includes both small and local businesses.	Yes.	Yes, 5% for contracts less than $100,000.
City of Los Angeles BOE	The City of Los Angeles has several local business programs focused small, minority and women owned businesses. This same focus is included in Project Labor Agreements.		All part of the Business Inclusion Program.	Yes.	Yes, 8% for local firms.
City of Oakland	Yes.	25% SLBE and 25% LBE.	Yes, 25%.	No.	2% or 2 points for 25% LBE and 25% SLBE up to 5% or 5 points for 40% LBE and 40% SLBE. Percentages apply to construction contracts and points apply to consultant contracts.
City of Sacramento	This City of Sacramento does not have a local hire program. However, they do have an Emerging and Small Business Development Program.	20% on 100% locally funded projects at time of bid opening.	Yes, see answer to question 1.	No. Must meet the 20% goal or deemed non-responsive.	Yes, 5% discount for determining low bidder.

Table 5-1 City of Oakland
Local Business and Employment Programs (cont'd)

Questions	1. Does your city have a required minimum level of participation for local businesses on construction or consultant contracts?	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?	4. Does the program include a "Good Faith Effort" allowance?	5. Do you give bid preference for Local Business Participation and, if so, what percentage and what maximum?
City of San Francisco	As stated in San Francisco's Chapter 14B, Small and Local Business Enterprises (LBE) Ordinance, a participation goal is established on projects greater than $10,000.	The goal level is determined by the scope of the project. There is no set minimum. A waiver is suggested if no HRC Certified firms available.	There are no separate participation requirements for small and local businesses. However, there are LBE Micro Set-Aside bids that are restricted to only HRC Certified Micro LBEs.	Yes. Good Faith Effort is in addition to meeting the goal. However, GFE is waived if Prime Contractor exceeds goal by 35%.	Yes. HRC certified Small, Micro-LBEs and non-profits are eligible for a 10% bid discount. If LBE joint ventures with a non LBE, they receive a 7.5% discount if they have 40% share and 5% if it is 35%.
City of San Jose	No.	N/A.	No.	No.	San Jose has an ordinance which applies to consultant contracts where 5% of the points used in an evaluative rating for the procurement can be given to those who meet Small and Local criteria.
City of San Diego	Yes the City has a Small and Emerging Local Business Enterprise program for construction and consulting services.	The voluntary goal is 20% for SLBEs or ELBEs for contracts valued at $50,000 or more.	There is no separate program.	Yes.	Yes, it varies. Generally a 2% discount is granted for SLBE or ELBE as a prime and non SLBE or ELBE Prime achieving the voluntary 20% goal.

B. NEW CONSTRUCTION GENERAL PERMIT (CGP) REQUIREMENTS

As of July 1, 2010, the State Construction General Permit became fully effective, requiring the Stormwater Pollution Prevention Program (SWPPP) be prepared by a certified Personnel (Qualified SWPPP Developer); a legally Responsible Person (LRP) to ensure compliance with the CGP. In light of this, the City of Oakland asked the following series of questions to the Benchmark Team:

1. Who is the LRP (must be a city employee) for the project?
2. Who prepares the SWPPP for the project (i.e., in-house, consultant or the contractor)? Are there any reasons why you choose one over the other?
3. Who reviews the SWPPP and all the other compliance documents?
4. Who is responsible for updating/uploading the information into the SMART system?

Responses were received from seven agencies. The detailed responses can be found in **Table 5-2** below.

Table 5-2 City of Oakland
New Construction General Permit (CGP) Requirements

Questions	1. Who is the LRP (must be a city employee) for the project?	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?	4. Does the program include a "Good Faith Effort" allowance?
City of Long Beach	Stormwater Officer	Depending on the project, they are either prepared by the design consultant and included in the bid package, or they are done by the contractor as a requirement of the construction contract.	Stormwater Officer and his/her staff.	Stormwater Officer and his/her staff.
City of Los Angeles BOE	Deputy City Engineer of Bureau of Engineering	General contractor to prepare the SWPPP and submit it to the City for review and approval per contract specifications. When the WDID number is required in advance of the general contractor being on board, the BOE's designer would prepare the SWPPP.	In-house under the direction of a certified QSP/QSD.	The general contractor would be listed as the Data Entry Person.
City of Oakland	Project Manager	On most projects, the City requires the Contractor to prepare the SWPPP since they know how and what BMPs they want to implement.	Consultant	Contractor
City of Sacramento	The Director of Transportation	The Consultant	The City DOT Project Manager.	The City DOT Project Manager.
City of San Francisco	PUC-BERM	The contractor typically prepares this.	PUC-BERM reviews it.	Contractor
City of San Jose	There are 2 LRPs that have been designated. These LRPs are Deputy Directors that manage distinct programs encompassing all of the construction projects for the Public Works Department.	Contractors and Consultants which are prepared by a registered QSD.	By in-house QSDs.	It will be individuals that are either a QSD/QSP or someone working under their authority.
City of San Diego	The City Engineer who has delegated those responsibilities to the Deputy City Engineer/ Deputy Director of Construction Division.	The contractor utilizing certified staff since they are the ones who are responsible for items like construction planning, schedule, phasing, sequencing, rate of production and control of workers are related to the effectiveness of a SWPPP.	QSD (contractor), and City Staff.	QSD (contractor)

C. ELECTRONIC SUBMISSION OF BIDS

The City of San Diego was experiencing the growing demand for use of technology surrounding the submission of bids. The City reached out to the Benchmarking Team to request their input. They wanted to know if there was a city that was already allowing electronic submission of bids (i.e. on-line bidding), or if they knew of any agency that was allowed such electronic submissions of bids.

The City of Long Beach has accepted electronic submission of construction project bids (line items only) through the PlanetBids (BidsOnline) website. So far they have only been used on smaller, non-federal projects that include no alternates. The City of Long Beach currently does not have the capability of allowing for electronic signatures, bid bonds, notarization or document uploads by bidders. This requires all other documents to be mailed or couriered to City Hall prior to the bid opening.

The City of Los Angeles does not have a system for accepting bids electronically. However, bid documents are made available online either through a system called the Business Assistance Virtual Network (BAVN) at http://www.labvn.org or through an electronic room (eRoom). All bids still must be delivered in hard copy to the Board of Public Works.

The City of Oakland does not currently have an electronic system for the submission of bids. However, they are very interested in pursuing and implementing such a system.

The City of Sacramento does not have an electronic bidding process nor do they allow bids to be submitted electronically. It was suggested that the City of Atlanta has an electronic bidding process. However according to their webpage, it appears that only post bidding documents can be submitted on-line while the actual bid submittal is done in a sealed envelope and physically delivered to City Hall.

The City of San Francisco does not have electronic bidding at this time. However, other contractor related activities are now electronic.

The City of San Jose does not currently allow for electronic submission of bids, however, they use a third party internet vendor (BidSync) for their construction contract and consultant procurements. While construction contracts are currently submitted on paper, BidSync has electronic bid submission capability and the City of San Jose is moving in that direction.

The City of San Diego does not currently allow electronic bidding but is considering it and working on a preliminary study of the feasibility of such a program.

D. STOP NOTICES

At a request from their Attorney's Office, the City of San Diego asked the following series of questions to the Benchmark Team:

1. What is your process of handling stop notices or notice to withhold funds on public projects?
2. Where are notices served?

For the City of San Diego, they are experiencing receiving such notices mostly from vendors and/or subs of subs who do not have a direct contractual relationship with the prime contractor. They tend to get these notices directly to their field office and sometimes to their Controller or other City offices. When taking a closer look, it was determined there was no written policy or standard process which will now be developed after discussion with the Benchmarking Team.

The City of Long Beach responded that all stop payment notices are forwarded to the project manager. The project manager forwards them to the City Attorney to be validated. If it is a correctly issued stop notice, the next step would be to forward it to the City Auditor's office who would then withhold 125% of the next progress payment into a special holding account. Once the Stop Notice has been released, the Auditor's office would release the held funds to the contractor.

The City of Los Angeles follows the timelines and requirements in California Civil Code Sections 3179 through 3214. Stop notices are typically received by the Board of Public Works. Below are the steps the Board takes:

1. Subcontractors are required to provide the project title, the subcontractor's name, address, contact number, and the dollar amount and types of services or supplies that they provided on the project with the stop notice.

2. All stop notices received for Department of Public Works projects are placed onto the Board agenda and are "acknowledged" as communications received by the Board.

3. The Board then sends instructions to the Office of Accounting to withhold 125% of the stop notice amount.

4. Finally, the Board then acknowledges the release of the stop notice on their regular agendas when a release notice is received from the subcontractors or suppliers.

Also supplied was an excerpt from Jones & Day on "California Construction Law Changes" for topics including retention, prompt payment, stop notices, mechanics liens, and others.

For the City of Oakland, most instances, stop notices are served within the Contract Services Unit within Public Works. They are then distributed to the City Attorney, fiscal services, project manager and resident engineer. On some occasions, stop notices can be served directly to any of the above individuals.

The City of Sacramento, Department of Transportation, gives all stop notices to their Construction Contracts Officer who advises the Project Manager. The Construction Contracts Officer will coordinate with fiscal administration to withhold the amount of the stop notice from the next Progress Payment. After the stop notice is released, payment will be made to the contractor.

The Controller's Office, for the City of San Francisco, is the official department for receiving 20-day Preliminary Notices, $2 notification fees (for notification when Notice of Completion is filed), stop notices and releases. Usually the Controller's Office works directly with each contracting department. However, if warranted, the Controller's Office will reach out to the City Attorney. At the Department of Public Works, they forward all stop notices received to the Controller (original) and if a release bond is submitted by the prime, they review if for the Controller and copy the City Attorney on their recommendations. Accounts Payable is also notified. They put funds on immediate hold on progress payments and wait for further instructions. For release, the Controller's Office notifies Accounts Payable who will then release the withheld funds.

The majority of the stop notices are mailed to the City of San Jose Public Works Department via certified mail. Once received by the Project Manager, it is then forwarded to the finance department. 125% is then withheld on any money due to the contractor. There are a few ways that stop notices are resolved.

1. Ideally, the contractor deals with it by paying the subcontractor and the subcontractor releases the stop notice which releases withheld funds.

2. If the contractor can't'/doesn't pay the subcontractor.

a. The contractor pays the subcontractor with the progress payment funds, less 125%, which then allows the subcontractor to release their stop notice.

b. The finance department issues two checks, both to the contractor. One is in the amount owed the subcontractor. The contractor endorses the check in the presence of the City Attorney and Project Manager and hands it over to the subcontractor. At the same time the subcontractor releases the stop notice. The contractor keeps the second check.

c. The contractor bonds around the stop notice which guarantees payment to the subcontractor if it is found to be owed.

d. Litigation: State law provides an expedited process for the contractor to challenge the validity of the stop notice in court. This same process is also made available to subcontractors to enforce the stop notice.

E. PRIOITIZATION OF CIP PROJECTS

The City of San Diego was conducting an audit of their capital projects. Certain questions during the audit prompted the City to ask the following questions to the Benchmark Team:

1. How do you prioritize capital improvement projects: sewer, water, parks, buildings, transportation, and storm water facilities?
2. How do you prioritize projects competing for the same type of fund (eligible for the same type of fund only)?
3. How do you prioritize projects competing for several fun sources or grants (eligible for various types of funds)?

Responses were received from six agencies. The detailed responses can be found in **Table 5-3** below.

Table 5-3 City of San Diego Prioritization of CIP Projects

Questions	1. How do you prioritize capital improvement projects: sewer, water, parks, buildings, transportation, and storm water facilities?	2. How do you prioritize projects competing for the same type of fund (eligible for the same type of fund only)?	3. How do you prioritize projects competing for several fund sources or grants (eligible for the various types of funds)?
City of Long Beach	For Long Beach, the process involves the following considerations: - Availability of funding, considering particular funding restrictions. - Condition assessment of existing facilities, as expressed in various master planning reports and the City's Pavement Management System. - Equitable distribution of projects among the City's 9 council districts. - Concerns by citizens. - Coordination with work by utility companies and other agencies. - The above notwithstanding, we try to take advantage of special opportunities, such as the sudden availability of, say, collected development traffic impact mitigation fees.	- Condition assessment of existing facilities, as expressed in various master planning reports and the City's Pavement Management System. - Equitable distribution of projects among the City's 9 council districts	- Funding for projects is planned to provide the best fit between the various projects and funding sources, to most effectively use all funds in all funding sources available.

Table 5-3 City of San Diego Prioritization of CIP Projects (cont'd)

Questions	1. How do you prioritize capital improvement projects: sewer, water, parks, buildings, transportation, and storm water facilities?	2. How do you prioritize projects competing for the same type of fund (eligible for the same type of fund only)?	3. How do you prioritize projects competing for several fund sources or grants (eligible for the various types of funds)?
City of Los Angeles BOE	Does not have an official CIP prioritization policy. However, they work with client-departments to deliver projects based on their needs and considering staff availability and project workloads. A project may be given priority in instance where funding may be in jeopardy or upon a special request.	Priority is set based on the time frame for delivering the project as identified on the master project schedule for each program (i.e., wastewater, municipal facilities, streets, storm water, storm damage repair, etc.).	Projects are prioritized based on the critical nature for completing the work. The Program Manager will rank projects in priority based on client need or considering the greatest effect on public safety, protecting the public right of way, and considering staff availability.
City of Oakland	There is no CIP program for storm water and water is not a city service. For sewers, projects follow the Water Board cease and desist order. Transportation projects are prioritized to match the plans for "Priority Development Areas," designated areas for transit-oriented development, continued implementation of Specific Plans, and to match specific grant requirements. Parks and grounds staff recommends 3 projects from each Council District for their adoption every 2 years. For buildings, it depends on the readiness and competitiveness of specific grants.	Staff recommends projects to Council that best match the grant criteria and requirements.	Staff recommends projects to Council that best match the grant criteria and requirements.
City of Sacramento	The Department of Transportation has developed a "Transportation Programming Guide" (TPG) which prioritizes projects. The document is updated and published bi-annually. It has 11 chapters, each prioritizing a different category of projects. Each chapter has unique criteria on which prioritization is based. The criteria are approved by the City Council, as is the final document.	The Consultant.	The City DOT Project Manager.

Table 5-3 City of San Diego
Prioritization of CIP Projects (cont'd)

Questions	1. How do you prioritize capital improvement projects: sewer, water, parks, buildings, transportation, and storm water facilities?	2. How do you prioritize projects competing for the same type of fund (eligible for the same type of fund only)?	3. How do you prioritize projects competing for several fund sources or grants (eligible for the various types of funds)?
City of San Diego	The City adopted a policy with an objective process for ranking CIP Projects. This policy is not intended to alter the obligations of a specific CIP project to be completed with a specified deadline. For Transportation projects, there were 7 scoring factors developed which total 100% score. For all other project types there were 8. See the upload policy for details.	The default it to take a project to the highest TPG ranking. Some grants criteria supersede the TPG criteria, or requires evaluation of projects which are not in the TPG at all. For these instances, a review panel is formed to evaluate the various projects competing for the funding to identify a preferred candidate project. If time allows, the staff report is taken to City Council to disclose what the candidate project is and why it was chosen.	Same as response to question 2.
City of San Francisco	The City has a capital planning process that includes ongoing assessments of capital infrastructure needs. Capital Program staff meets with key department heads monthly, through which a rolling "10-year Capital Plan" is developed. The plan outlines proposed capital expenditures, provides assessment of critical infrastructure needs, the investments required to meet the needs, and a finance plan.	Project programs are planned for the various departments and General Obligation Bonds are planned for them by ballot measures over the rolling 10-year period. Projects funded by the General Fund or by grants are schedule and resourced into the DPW Building/Infrastructure Design and Construction Divisions based on availability.	Same as response to question 2.
City of San Jose	The City of San Jose's CIP is broken down into Programs and each Program is shaped by a City Service Area (CSA), which is a cross-Departmental committee focused on specialty subjects (i.e. Environment and Utility Services, Transportation and Aviation, etc.). The CSAs have a role in prioritizing projects in their respective areas and do so in an informal way, particularly as the CIP budget is assembled for the next fiscal year. In certain Programs such as the Sanitary Sewer Program, projects can be prioritized using a master planning and/or Condition Assessment methodology, or by informal discussion between engineering and operating staff as to where the critical situations exist.	When projects compete for the same funding source, consensus regarding priorities is usually achieved amongst stakeholder Departments in the CSA setting.	In general, the same response as for question 2.

F. PROJECT DELIVERY CONTROL

During meeting number 2, the City of Long Beach, in an effort to gain better control of the entire process of a project, asked the Benchmarking Team to discuss whether services supporting an element were done within their department, within another department, or shared. Below are the 12 elements that were looked at:

1. Project Planning
2. CEQA Clearance
3. Right of Way Acquisition
4. Utility Coordination
5. Plan Checking and Permits for Vertical Construction
6. Contract Specification Preparation and Approval
7. Bidding
8. Contract Award
9. Contract Execution
10. Issuance of a Purchase Order
11. Issuance of Contractor Payments
12. Contract Close-out

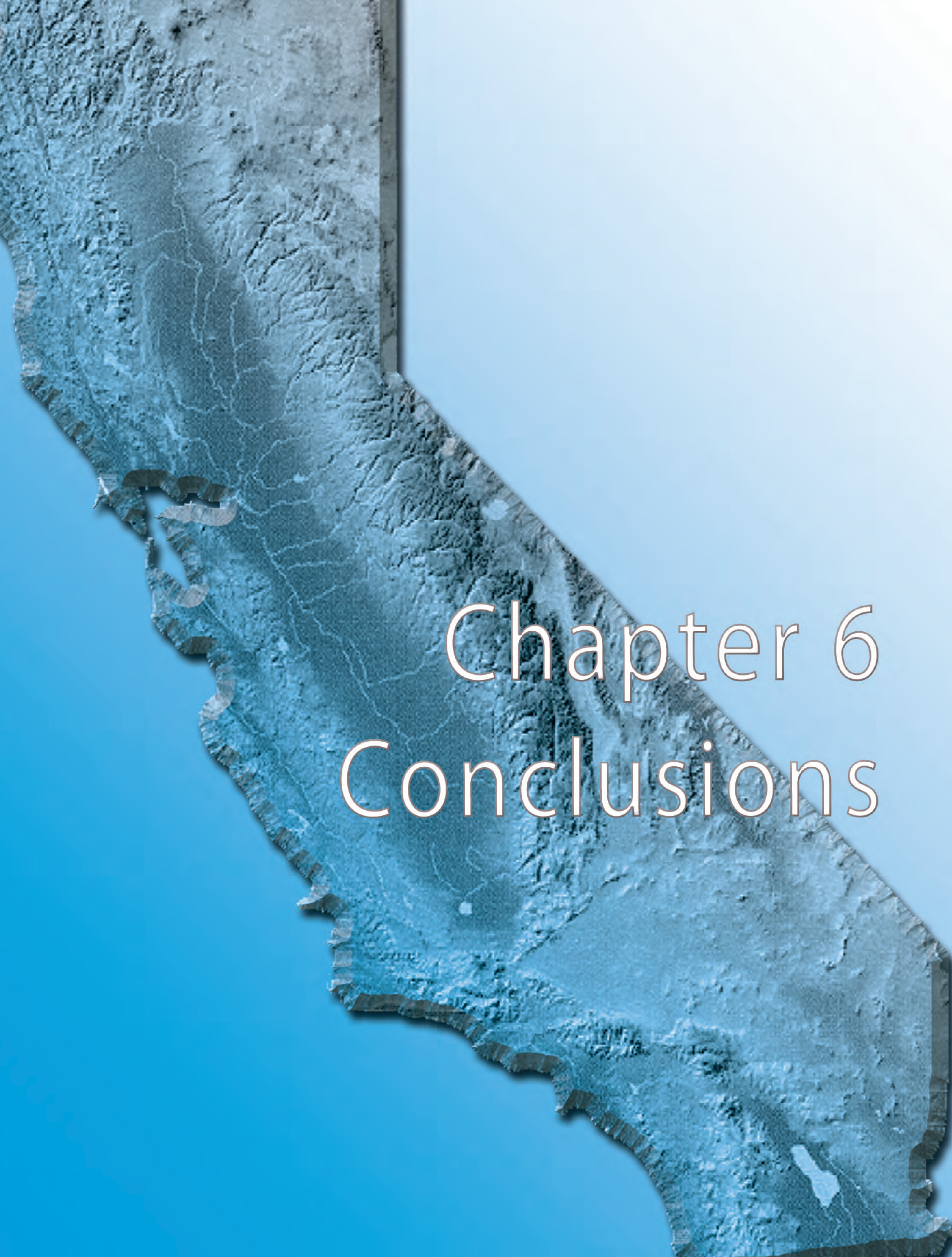
All agencies responded to topic. **Table 5-4** provides a summary of each agency's response.

Table 5-4
Project Delivery Control

Questions	Long Beach	Los Angeles	Oakland	Sacramento DOT	San Diego	San Francisco	San Jose
Project Planning	50% PW and 50% Client Department	75% In-House and 25% Other Departments	50% In-House	100% In-House	35% In-House and 65% Other Departments	50% DPW and 50% City Planning	50% PW and 50% Other Department
CEQA Clearance	25% PW and 75% Environmental Officer	100% In-House	0% In-House	20% In-House and 80% Other Departments	100% Other Department	100% City Planning	100% Other Department
Right of Way Acquisition	0% PW	85% In-House and 15% Other Departments (DGS, Asset Mgmt. Div. or City Attorney may be necessary in some situations)	0% In-House	20% In-House and 80% Other Departments	100% Other Department	100% Caltrans	100% Other Department
Utility Coordination	100% PW	100% In-House	50% In-House	100% In-House	100% In-House	50% DPW and 50% Other Agencies	100% PW
Plan Checking and Permits for Vertical Construction	0% PW	100% Building & Safety Department	0% In-House	100% Other Departments	60% In-House and 40% Other Departments	100% DBI	100% PW
Contract Specification Preparation and Approval	80% PW and 20% Attorney's Office	100% In-House	100% In-House	100% In-House	97% In-House and 3% Other Departments	100% DPW	100% PW

Table 5-4
Project Delivery Control (cont'd)

Questions	Long Beach	Los Angeles	Oakland	Sacramento DOT	San Diego	San Francisco	San Jose
Bidding	100% PW	95% In-House and 5% Other Departments. Bids are received and opened by the Board of Public Works	100% In-House	100% In-House	100% In-House	100% DPW	100% PW
Contract Award	100% PW	75% In-House and 25% Other Departments. In conjunction with the Board of Public Works	100% In-House	80% In-House and 20% Other Departments	100% In-House	50% DPW and 50% Clients	100% PW (Director Award)
Contract Execution	100% PW	100% Other Departments. In conjunction with the Board of Public Works and the City Council	100% In-House	80% In-House and 20% Other Departments	97% In-House and 3% Other Departments	100% DPW	100% PW (Director Award) and 100% (Council Award)
Issuance of a Purchase Order	0% PW and 100% Finance Department	50% In-House and 50% Other Department	0% In-House	80% In-House and 20% Other Departments	90% In-House and 10% Other Departments	50% DPW and 50% Controller's Office	100% PW
Issuance of Contractor Payments	50% PW	100% Other Department	90% In-House	80% In-House and 20% Other Departments	90% In-House and 10% Other Departments	50% DPW and 50% Controller's Office	75% PW and 25% Other Department
Contract Close-out	50% PW	65% In-House and 35% Bureau of Contract Administration	90% In-House	100% In-House	75% In-House and 25% Other Departments	50% DPW and 50% Other Project Sponsors	75% PW and 25% Other Department



Chapter 6 Conclusions

CHAPTER 6 Conclusions

A. PERFORMANCE BENCHMARKING

Performance Benchmarking for the *Update 2012 Study* involved analysis of 661 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 2012. There are 40 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 2012 Study* varied between the following values for the full range and the smaller project subset of TCC respectively:

Table 6-1
Update 2012 Project Delivery Percentages

Type	Project Delivery Percentages
Municipal Projects	35% - 37%
Parks Projects	45% - 48%
Pipes Projects	40% - 47%
Streets Projects	47% - 52%

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 6-1** validated the agencies' concerns published in previous *Study* years regarding the impact of depressed construction bids on project delivery percentages. The agencies also investigated change orders as a percentage of total construction cost for the 2007-2012 period. The agencies noted that the average change order amount expressed as a percentage of TCC had almost doubled for that period.

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.

B. BEST MANAGEMENT PRACTICES

In *Update 2012*, 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 2012,* the Project Team added one new BMP:

- 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.

These new BMPs along with the existing BMPs are believed to directly influence cost, schedule, quality, communication, environment or customer service aspects of 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 by the continued current state of the economy, 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.

To support the linking of BMPs to performance improvements, BMP implementation by the agencies are tracked. As of *Update 2012*, and including the addition of new BMPs, the Agencies have fully implemented about 69 percent of all BMPs. Six (6) 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.

C. ONLINE DISCUSSION FORUM

In *Update 2012*, 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.

D. PLANNING FOR UPDATE 2013

Over the course of *Update 2012*, the Project Team identified a number of activities to consider including next year in *Update 2013*. These activities include:

- Perform a Special *Study* that evaluates the impacts of low construction bids on project delivery percentages;
- Continue collecting data on projects delivered via alternative delivery techniques;
- Develop new BMPs and tracking the implementation of adopted BMPs;
- Continue discussion on current topics via the round-table discussion forum; and
- Continue meaningful exchanges on the Online Discussion Forum via the SharePoint website.

E. ACKNOWLEDGEMENTS

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

Update 2012 Project Team

Study Team:

Nicholas Theocharides,
Engineering Services
Division Manager
City of Sacramento, Department
of Transportation
915 I Street, Room 2000
Sacramento CA 95814
(916) 808-5065
(916) 808-8281 (fax)
nicholas@cityofsacramento.org

Donal Bassett, P.E.,
Principal-in-Charge
MWH
618 Michillinda Avenue, Suite 200
Arcadia, CA 91007
(626) 568-6643
(626) 568-6101 (fax)
donal.bassett@mwhglobal.com

Ganesh Krishnamurthy, P.E.,
Project Manager
MWH
618 Michillinda Avenue, Suite 200
Arcadia, CA 91107
(626) 568-6170
(626) 568-6101 (fax)
ganesh.krishnamurthy@mwhglobal.com

Robert Flory,
Consultant
Vanir Construction Management, Inc.
1000 Broadway, Suite 475
Oakland, CA. 94607
(510) 663-1800 (office)
(510) 867-4560 (mobile)
(510) 663-1881 (fax)
robert.flory@vanir.com

Project Team:

Michael Conway,
Director
City of Long Beach,
Department of Public Works
333 W. Ocean Blvd., 9th Floor
Long Beach, CA 90802
(562) 570-6522
(562) 570-6012 (fax)
Michael.Conway@longbeach.gov

Mark Whitaker,
Administrative Analyst
City of Long Beach, Department
of Public Works
333 W. Ocean Blvd., 9th Floor
Long Beach, CA 90802
(562) 570-6465
(562) 570-6012 (fax)
Mark.Whitaker@longbeach.gov

Derek Weiske,
Assistant City Engineer
City of Long Beach, Department
of Public Works
333 W. Ocean Blvd., 9th Floor
Long Beach, CA 90802
(562) 570-6386
(562) 570-6012 (fax)
Derek.weiske@longbeach.gov

Gary Lee Moore, P.E.,
City Engineer
City of Los Angeles,
Department of Public Works,
Bureau of Engineering
1149 S. Broadway, Suite 700
Los Angeles, CA 90015
(213) 485-4935
(213) 485-4923 (fax)
gary.lee.moore@lacity.org

Vincent Jones, P.E.,
Deputy City Engineer
City of Los Angeles,
Department of Public Works,
Bureau of Engineering
1149 S. Broadway, Suite 700
Los Angeles, CA 90015
(213) 485-4915
(213) 485-4923 (fax)
vince.jones@lacity.org

Ted Allen, P.E.,
Acting Division Manager
City of Los Angeles,
Department of Public Works,
Bureau of Engineering
Project Award and Control Division
1149 S. Broadway, Suite 140
Los Angeles, CA 90015
(213) 847-0577
(213) 847-0703 (fax)
ted.allen@lacity.org

Vitaly B. Troyan,
Director
City of Oakland
Public Works Agency
250 Frank H. Ogawa Plaza, Suite 4314
Oakland, CA 94612
(510) 238-4470
(510) 238-6412 (fax)
vtroyan@oaklandnet.com

Michael Neary, P.E.,
Assistant Director
City of Oakland
Public Works Agency
Department of Engineering
& Construction
250 Frank H. Ogawa Plaza, Suite 4314
Oakland, CA 94612
(510) 238-6659
(510) 238-7227 (fax)
mjneary@oaklandnet.com

David Lau, P.E.,
Project Delivery Manager
City of Oakland
Public Works Agency
Department of Engineering & Construction
250 Frank H. Ogawa Plaza, Suite 4314
Oakland, CA 94612
(510) 238-7131
(510) 238-2085 (fax)
dwlau@oaklandnet.com

Gus Amirzehni, P.E.,
Engineering Design Manager
City of Oakland
Public Works Agency
Department of Engineering
& Construction
250 Frank H. Ogawa Plaza, Suite 4314
Oakland, CA 94612
(510) 238-6601
(510) 238-7227 (fax)
gamirzehni@oaklandnet.com

David Ng, P.E.,
Civil Engineer
City of Oakland
Public Works Agency
Department of Engineering
& Construction
250 Frank H. Ogawa Plaza, Suite 4314
Oakland, CA 94612
(510) 238-7267
(510) 238-7227 (fax)
dng@oaklandnet.com

Tim Mar, P.E.,
Supervising Engineer
City of Sacramento,
Department of Transportation
915 I Street, Room 2000
Sacramento CA 95814
(916) 808-7531
(916) 808-8281 (fax)
tmar@cityofsacramento.org

Ryan Moore, P.E.,
Supervising Engineer
City of Sacramento,
Department of Transportation
915 I Street, Room 2000
Sacramento CA 95814
(916) 808-8279
(916) 808-8281 (fax)
rtmoore@cityofsacramento.org

Nicole Henderson,
Supervising Financial Analyst
City of Sacramento,
Department of Transportation
915 I Street, Room 2000
Sacramento CA 95814
(916) 808-8242
(916) 808-8281 (fax)
nhenderson@cityofsacramento.org

Toni Heinrichs, Director
City of San Diego
Engineering & Capital
Projects Department
202 C Street, MS 9B
San Diego, CA 92101
(619) 236-6274
(619) 533-4736 (Fax)
THeinrichs@sandiego.gov

Myrna Dayton, P.E.,
Senior Civil Engineer
City of San Diego
Engineering and Capital
Projects Department
Project Implementation and
Technical Services Division
600 B Street, Suite 800
San Diego, CA 92101
(619) 533-6671
(619) 533-4666 (fax)
MDayton@sandiego.gov

Alex Garcia, P.E.,
Senior Civil Engineer
City of San Diego
Engineering and Capital
Projects Department
Architectural Engineering
and Parks Division
600 B St, Suite 800
San Diego, CA 92101
(619) 533-4640
(619) 533-4666 (fax)
AGarcia@sandiego.gov

Rania Amen, P.E.,
Senior Civil Engineer
City of San Diego
Engineering and Capital
Projects Department
Right-of-Way Design Division
600 B St, Suite 800
San Diego, CA 92101
(619) 533-5492
(619) 533-4666 (fax)
RAmen@sandiego.gov

George Qsar, P.E.,
Senior Civil Engineer
City of San Diego
Public Works Department
Field Engineering Division
9485 Aero Drive
San Diego, CA 92123
(858) 627-3240
(858) 627-3297 (fax)
GQsar@sandiego.gov

Fuad Sweiss, P.E.,
City Engineer and Deputy
Director of Engineering
City and County of San Francisco,
Department of Public Works
City Hall Room 348
1 Carlton B. Goodlett Place
San Francisco, CA 94102
(415) 554-6920
(415) 554-6944 (fax)
Fuad.Sweiss@sfdpw.org

Patrick Rivera, P.E.,
Bureau Manager
City and County of San Francisco,
Department of Public Works,
Bureau of Engineering
30 Van Ness Avenue, 5th Floor
San Francisco, CA 94102
(415) 558-40001
(415) 558-4519 (fax)
Patrick.Rivera@sfdpw.org

Peg Divine, P.E.,
Deputy Bureau Manager
City and County of San Francisco,
Department of Public Works,
Bureau of Engineering
30 Van Ness Avenue, 5th Floor
San Francisco, CA 94102
(415) 558-4084
(415) 558-4519 (fax)
Peg.Divine@sfdpw.org

Ramon Kong, P.E.,
Manager, Streets & Highways Section
City and County of San Francisco,
Department of Public Works,
Bureau of Engineering
1680 Mission Street, 3rd Floor
San Francisco, CA 94102
(415) 554-8280
(415) 554-8243 (fax)
Ramon.Kong@sfdpw.org

Oscar Gee,
Assistant Engineer
City and County of San Francisco,
Department of Public Works,
Bureau of Engineering
30 Van Ness Avenue, 5th Floor
San Francisco, CA 94102
(415) 558-4582
(415) 558-4519 (fax)
Oscar.Gee@sfdpw.org

Don Eng, P.E.,
Bureau Manager
City and County of San Francisco,
Department of Public Works, Bureau
of Construction Management
1680 Mission Street, 4th Floor
San Francisco, CA 94103
(415) 554-8216
(415) 554-8218 (fax)
Don.Eng@sfdpw.org

Mark Dorian, A.I.A.,
Assistant Bureau Manager
City and County of San Francisco,
Department of Public Works,
Bureau of Architecture
30 Van Ness Avenue, 4th Floor
San Francisco, CA 94102
(415) 557-4719
(415) 522-7777 (fax)
Mark.Dorian@sfdpw.org

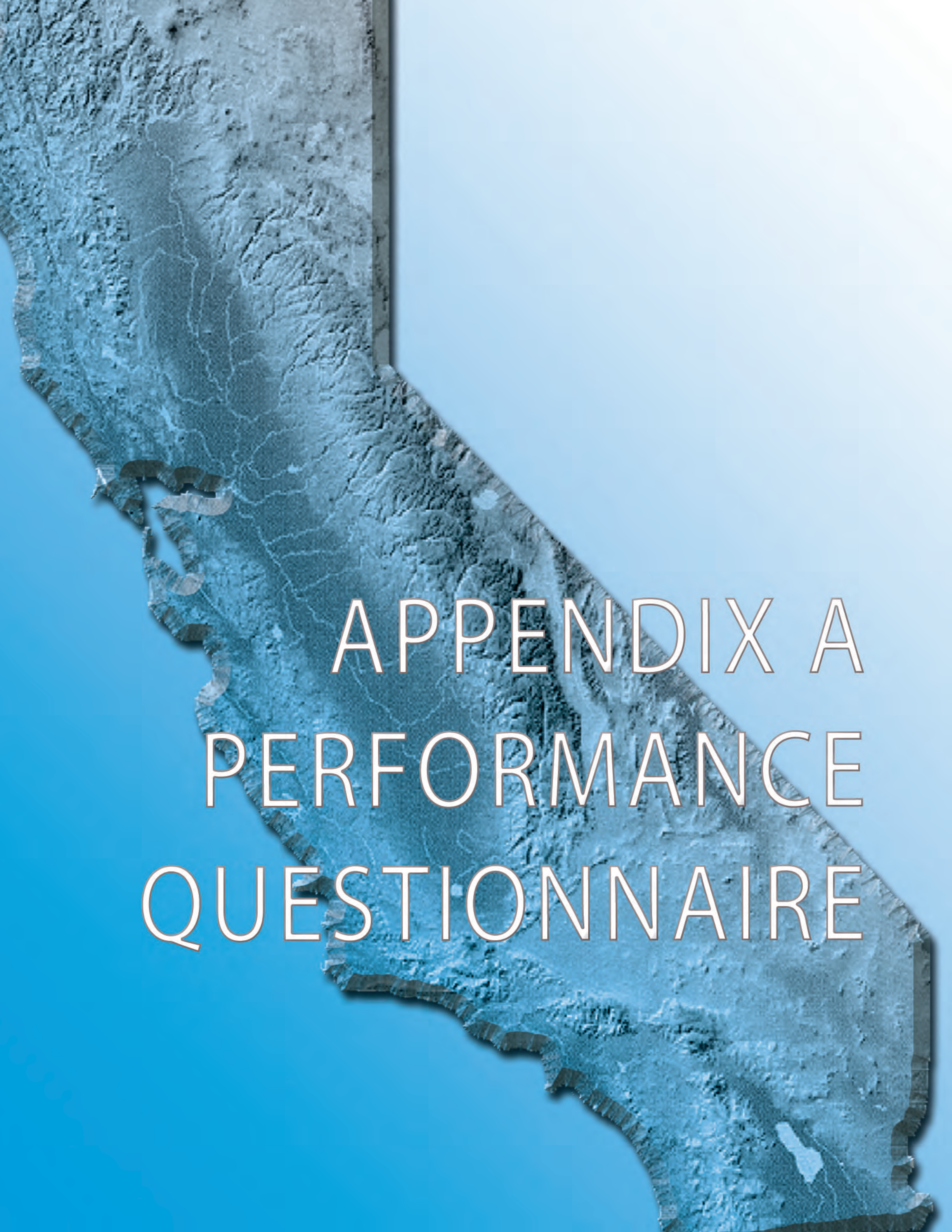
David D. Sykes, P.E.,
Director
City of San Jose,
Department of Public Works
200 E. Santa Clara St.
5th Fl. Tower
San Jose, CA 95113
(408) 535-8440
(408) 292-6296 (fax)
david.sykes@sanjoseca.gov

Barry Ng, P.E., L.S.,
Deputy Director
City of San Jose,
Department of Public Works
200 E. Santa Clara St.
5th Floor Tower
San Jose, CA 95113
(408) 535-8477
(408) 292-6296 (fax)
barry.ng@sanjoseca.gov

Michael O'Connell, P.E.,
Deputy Director
City of San Jose,
Department of Public Works
200 E. Santa Clara St.
5th Floor Tower
San Jose, CA 95113
(408) 975-7333
(408) 292-6288 (fax)
michael.oconnell@sanjoseca.gov

Ashwini Kantak, AIA, LEED AP,
Assistant to the City Manager
City of San Jose,
Office of the City Manager
200 E. Santa Clara St.
16th Floor Tower
San Jose, CA 95113
(408) 535-8147
(408) 292-6724 (fax)
ashwini.kantak@sanjoseca.gov

APPENDICES



APPENDIX A
PERFORMANCE QUESTIONNAIRE

APPENDIX A

Performance Questionnaire

California Multi-Agency Benchmarking Study Update 2012 Performance Questionnaire

Agency:

Project Name:

Project Type:

☐ LEED Green Building

☐ Project Financial Elements Closed and Complete

New/Rehab Index:

Alternative Project Delivery:

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

The results of the regression analyses are discussed in the remainder of this section. The results of the regression analyses are summarized in **Table 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 smaller project 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 smaller 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 smaller project subset of TCC. Similarly, project delivery percentages for projects belonging to the Streets category exhibit an eight percent increase. Projects under the Municipal category exhibit a minor increase (one percent) while projects under the Parks category show a seventeen percent change in their project delivery percentages for projects evaluated in the smaller project subset of TCC. 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 and p-values are higher than in previous *Study* phases, the reader is cautioned that this table only be used as a reference and not for prediction of performance. Readers are urged to review the curves in 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	**97**	**12%**	**11%-13%**	**0.73**	**4.6E-35**	**13%**	**11%-15%**	**0.59**	**8.11E-25**	**26%**	**23%-28%**	**0.69**	**1.09E-31**
Libraries	24	14%	13%-16%	0.87	5.33E-15	15%	13%-16%	0.83	1.04E-12	29%	27%-31%	0.95	8.45E-19
Police/Fire Stations	20	9%	8%-10%	0.93	2.24E-13	8%	6%-9%	0.80	5.62E-10	16%	15%-18%	0.90	1.63E-12
Comm./Rec.Center/ Child Care/Gyms	35	13%	12%-14%	0.91	1.93E-16	12%	10%-13%	0.91	1.49E-15	24%	23%-26%	0.95	2.44E-19
Other Municipal	18	14%	11%-17%	0.73	1.19E-12	17%	13%-21%	0.64	2.96E-10	31%	25%-37%	0.72	3.35E-12
Streets Projects	**260**	**13%**	**12%-14%**	**0.75**	**5.11E-94**	**19%**	**18%-19%**	**0.94**	**1.2E-167**	**32%**	**31%-32%**	**0.94**	**3.4E-167**
Widening/New/ Grade Separations	74	12%	10%-14%	0.83	4.83E-14	20%	10%-21%	0.99	8.55E-30	32%	30%-33%	0.98	2.8E-26
Bridges	19	17%	14%-21%	0.62	1.25E-8	15%	12%-18%	0.68	1.7E-8	32%	27%-38%	0.77	1.66E-10
Reconstructions	96	14%	12%-15%	0.32	4.4E-28	14%	13%-16%	0.57	1.42E-35	28%	25%-30%	0.53	2.34E-36
Bike/Pedestrian/ Streetscapes	42	22%	19%-26%	0.58	3.56E-22	13%	11%-15%	0.57	5.54E-23	35%	31%-40%	0.64	4.94E-25
Signals	29	13%	9%-16%	-0.59	3.11E-8	19%	16%-22%	0.44	1.28E-15	32%	26%-37%	0.04	2.22E-14
Pipes Projects	**249**	**10%**	**9%-10%**	**0.69**	**3.13E-88**	**16%**	**16%-17%**	**0.93**	**1.6E-155**	**26%**	**25%-27%**	**0.92**	**2.4E-154**
Gravity Mains	203	9%	8%-10%	0.74	4.94E-79	17%	16%-17%	0.94	2.1E-136	26%	25%-26%	0.94	7.8E-135
Pressure Systems	30	19%	17%-21%	0.89	2.34E-18	15%	13%-17%	0.84	2.38E-15	34%	30%-37%	0.89	3.05E-18
Pump Stations	12	10%	8%-13%	0.75	3.4E-6	13%	10%-16%	0.87	3.76E-7	23%	20%-27%	0.92	1.37E-8
Parks Projects	**55**	**18%**	**15%-21%**	**0.18**	**1.14E-15**	**15%**	**13%-18%**	**0.56**	**3.43E-17**	**33%**	**29%-37%**	**0.61**	**1.39E-23**
Playgrounds	38	26%	23%-29%	0.69	2.47E-19	14%	11%-17%	0.36	9.78E-13	40%	35%-45%	0.66	3.12E-19
Sportfields	5	12%	7%-18%	0.16	4.76E-4	16%	10%-23%	0.60	1.74E-4	28%	21%-34%	0.75	2.62E-6
Restrooms	12	46%	19%-73%	0.66	8.99E-3	15%	-2%-32%	-0.23	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 2012 Study.

Table B-2
Summary of Performance Models (Smaller Project Subset 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	**81**	**15%**	**14%-16%**	**0.77**	**5.9E-39**	**12%**	**11%-13%**	**0.65**	**3.49E-30**	**27%**	**25%-29%**	**0.84**	**2.09E-45**
Libraries	17	16%	14%-18%	0.81	2.33E-12	13%	11%-15%	0.76	4.45E-11	29%	26%-31%	0.88	4.68E-14
Police/Fire Stations	15	12%	9%-14%	0.54	1.7E-7	13%	11%-16%	0.81	1.73E-9	25%	22%-28%	0.84	1.24E-10
Comm./Rec.Center/ Child Care/Gyms	20	15%	13%-18%	0.79	1.7E-10	9%	7%-10%	0.69	1.02E-8	24%	20%-27%	0.84	1.24E-11
Other Municipal	29	22%	18%-26%	0.77	1.74E-12	29%	13%-44%	0.29	6.5E-4	51%	32%-70%	0.45	6.96E-6
Streets Projects	**207**	**22%**	**20%-24%**	**0.33**	**3.35E-55**	**18%**	**16%-19%**	**0.42**	**2.44E-62**	**40%**	**37%-43%**	**0.45**	**6.17E-69**
Widening/New/ Grade Separations	24	30%	23%-36%	0.66	1.03E-9	17%	12%-22%	0.29	8.36E-7	47%	39%-54%	0.72	1.01E-11
Bridges	16	28%	24%-32%	0.85	4.25E-10	17%	11%-23%	0.37	4E-5	45%	36%-53%	0.76	7.46E-9
Reconstructions	76	19%	17%-21%	0.46	4.74E-27	16%	15%-18%	0.52	2.85E-28	36%	32%-39%	0.54	7.45E-31
Bike/Pedestrian/ Streetscapes	57	25%	21%-29%	0.04	6.38E-18	18%	15%-22%	0.19	3.43E-16	43%	37%-50%	0.15	2.95E-20
Signals	**34**	27%	22%-32%	-0.04	1.18E-13	30%	25%-35%	0.29	9.5E-14	57%	50%-64%	0.27	1.24E-17
Pipes Projects	195	**18%**	**16%-20%**	**0.28**	**1.09E-56**	**17%**	**16%-18%**	**0.42**	**1.34E-62**	**35%**	**33%-37%**	**0.47**	**2.99E-76**
Gravity Mains	160	18%	16%-20%	0.28	3.46E-44	19%	17%-21%	0.47	3.04E-53	37%	35%-40%	0.49	4.63E-62
Pressure Systems	25	17%	15%-19%	0.61	2.23E-13	12%	10%-13%	0.75	6.48E-15	29%	26%-32%	0.77	1.69E-16
Pump Stations	**10**	15%	5%-25%	-0.06	7.15E-3	20%	17%-24%	0.91	3.26E-7	35%	24%-46%	0.65	4.97E-5
Parks Projects	44	**31%**	**27%-35%**	**0.52**	**1.89E-19**	**19%**	**15%-22%**	**0.28**	**2.42E-14**	**50%**	**44%-56%**	**0.53**	**8.88E-21**
Playgrounds	31	31%	26%-35%	0.50	2.69E-14	20%	15%-24%	0.28	6.37E-10	50%	43%-58%	0.48	5.59E-14
Sportfields	9	10%	3%-17%	-5.8	1.03E-2	11%	6%-16%	0.15	5.95E-4	21%	10%-33%	-2.08	2.29E-3
Restrooms	4	30%	-5%-65%	0.10	7.35E-2	19%	-14%-52%	-0.15	1.61E-1	49%	-18%-1154%	-0.03	1.01E-1

Notes:

[1] TCC = 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, R2 values, and N values for more details. Highlighted values indicate those for which R^2 values were low (below 0.50).

[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 661 projects selected for analysis in the Update 2012 Study.

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 three 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 smaller project 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 smaller 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

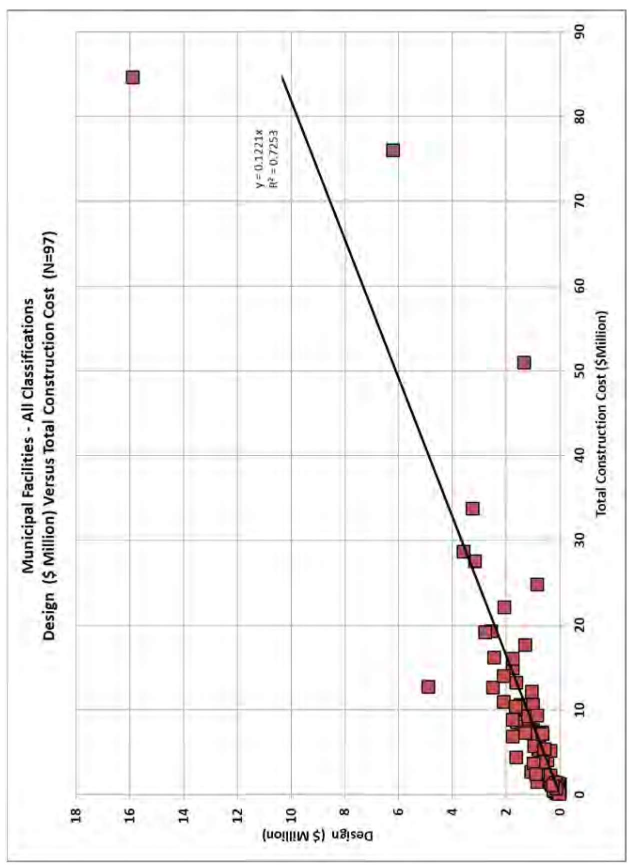
Project Type or Classification	Design Cost ($) vs. TCC($) Full Range of TCC	Design Cost ($) vs. TCC($) Smaller Project Subset of TCC	CM Cost ($) vs. TCC($) Full Range of TCC	CM Cost ($) vs. TCC($) Smaller Project Subset of TCC	Project Delivery Cost ($) vs. TCC($) Full Range of TCC	Project Delivery Cost ($) vs. TCC($) Smaller Project Subset of TCC
Municipal Projects	**y=0.1221x**	**y=0.1513x**	**y=0.1331x**	**y=0.1194x**	**y=0.3024x**	**y=0.2791x**
Libraries	y=0.1445x	y=0.1585x	y=0.1456x	y=0.1284x	y=0.2845x	y=0.2902x
Police/Fire Stations	y=0.0879x	y=0.1172x	y=0.0771x	y=0.1340x	y=0.2493x	y=0.2956x
Comm./Rec. Center/	y=0.1293x	y=0.1530x	y=0.1152x	y=0.0851x	y=0.2574x	y=0.290x
Other Municipal	y=0.1408x	y=0.2232x	y=0.1709x	y=0.2862x	y=0.3167x	y=0.2418x
Streets Projects	**y=0.1296x**	**y=0.3303x**	**y=0.1856x**	**y=0.1763x**	**y=0.3129x**	**y=0.3721x**
Widening/New/ Grade Separations	y=0.1185x	y=0.2956x	y=0.1976x	y=0.1708x	y=0.3144x	y=0.4152x
Bridges	y=0.1739x	y=0.2798x	y=0.1490x	y=0.1676x	y=0.3326x	y=0.5269x
Reconstructions	y=0.1358x	y=0.1902x	y=0.1417x	y=0.1647x	y=0.2696x	y=0.3361x
Bike/Pedestrian/ Streetscapes	y=0.2239x	y=0.0354x	y=0.1309x	y=0.1844x	y=0.3054x	y=0.4138x
Signals	**y=0.1265x**	y=0.2696x	y=0.1859x	y=0.2985x	y=0.3124x	y=0.5139x
Pipes Projects	y=0.0985x	**y=0.1803x**	**y=0.1619x**	**y=0.1700x**	**y=0.2490x**	**y=0.3288x**
Gravity Mains	y=0.7387x	y=0.1828x	y=0.1644x	y=0.1900x	y=0.2483x	y=0.3349x
Pressure Systems	y=0.1866x	y=0.1706x	y=0.1527x	y=0.1184x	y=0.3324x	y=0.2311x
Pump Stations	**y=0.1030x**	y=0.1495x	y=0.1290x	y=0.2034x	y=0.2320x	y=0.4584x
Parks Projects	y=0.1785x	**y=0.3103x**	**y=0.1532x**	**y=0.1863x**	**y=0.3506x**	**y=0.4494x**
Playgrounds	y=0.2581x	y=0.3060x	y=0.1408x	y=0.1983x	y=0.3715x	y=0.4491x
Sportfields	y=0.1166x	y=0.1009x	y=0.1614x	y=0.1136x	y=0.340x	y=0.2211x
Restrooms	y=0.4584x	y=0.2983x	y=0.1502x	y=0.1910x	y=0.714x	y=0.7375x

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

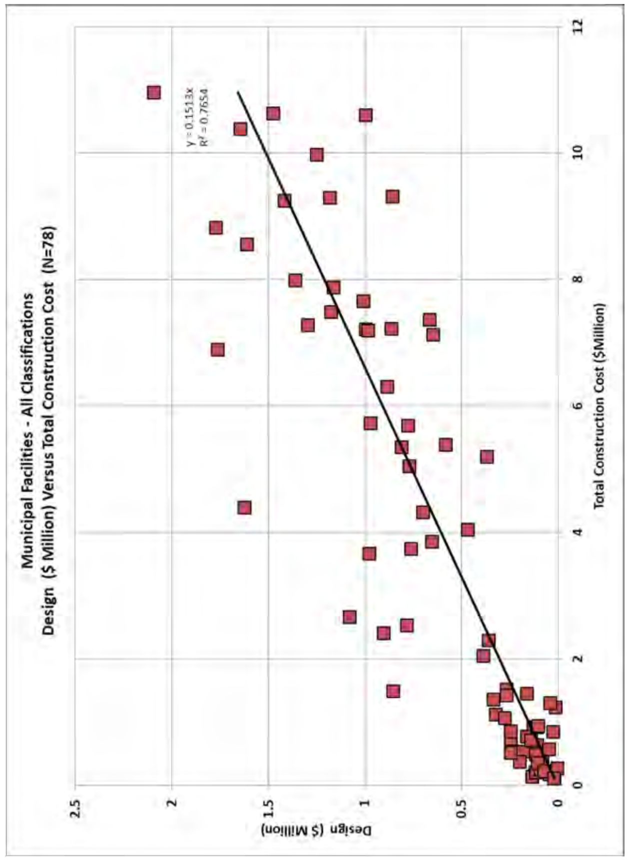
CURVES GROUP 1

Design Cost
vs
Total Construction Cost

All Projects



Smaller Projects



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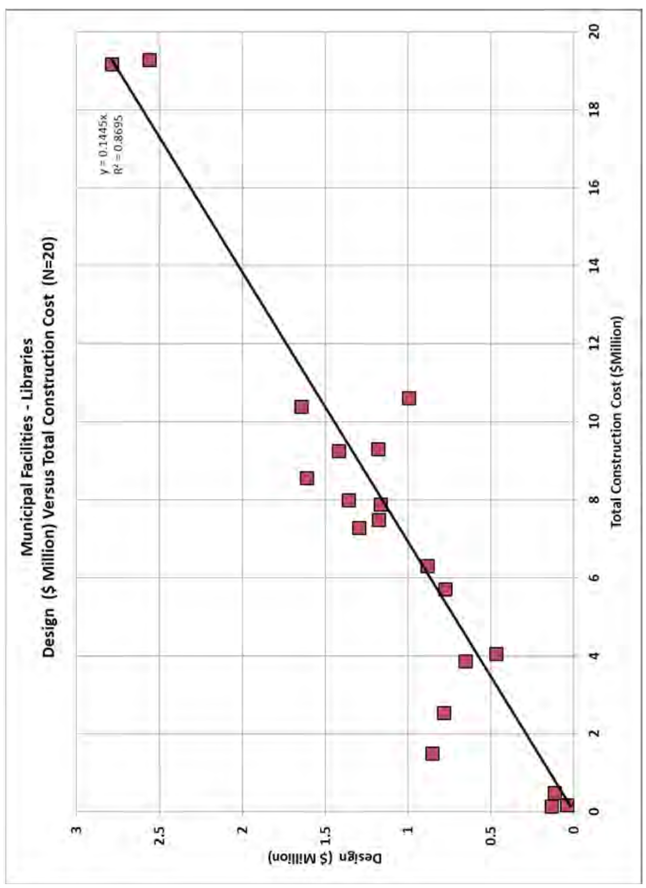

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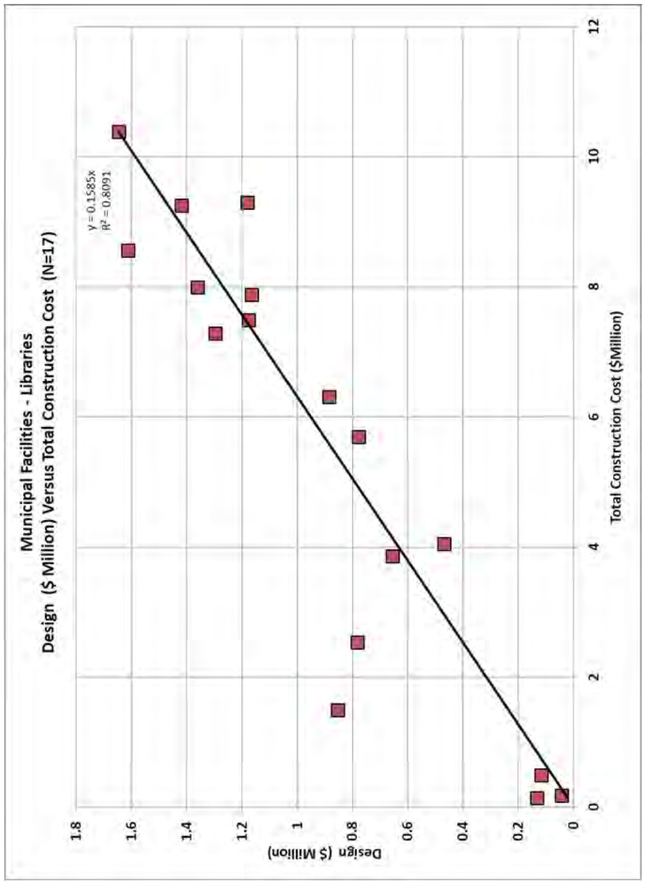

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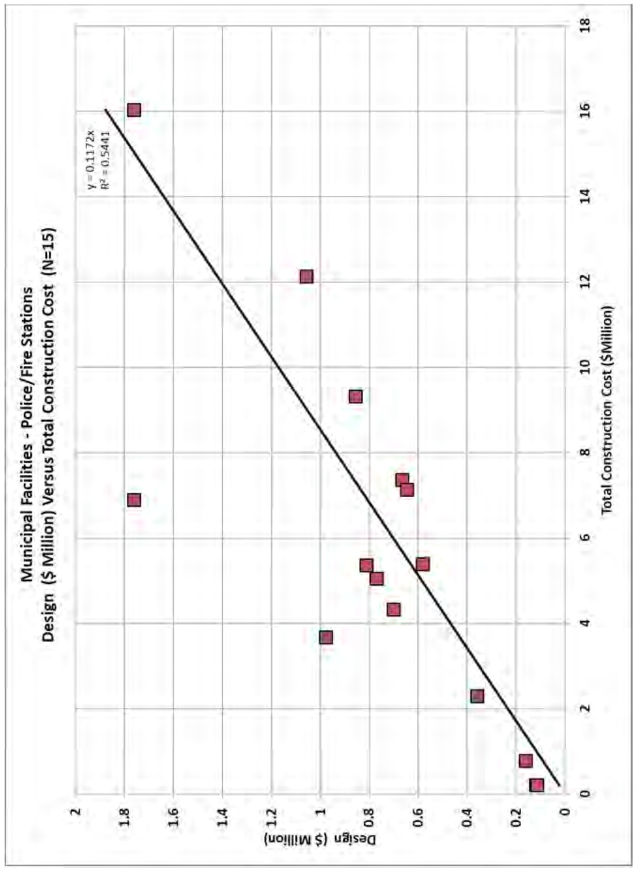

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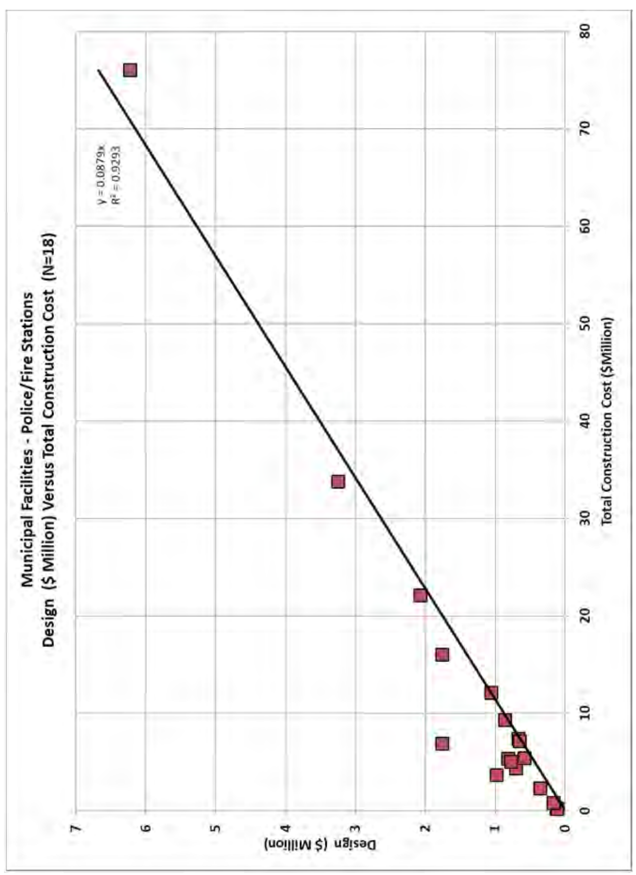

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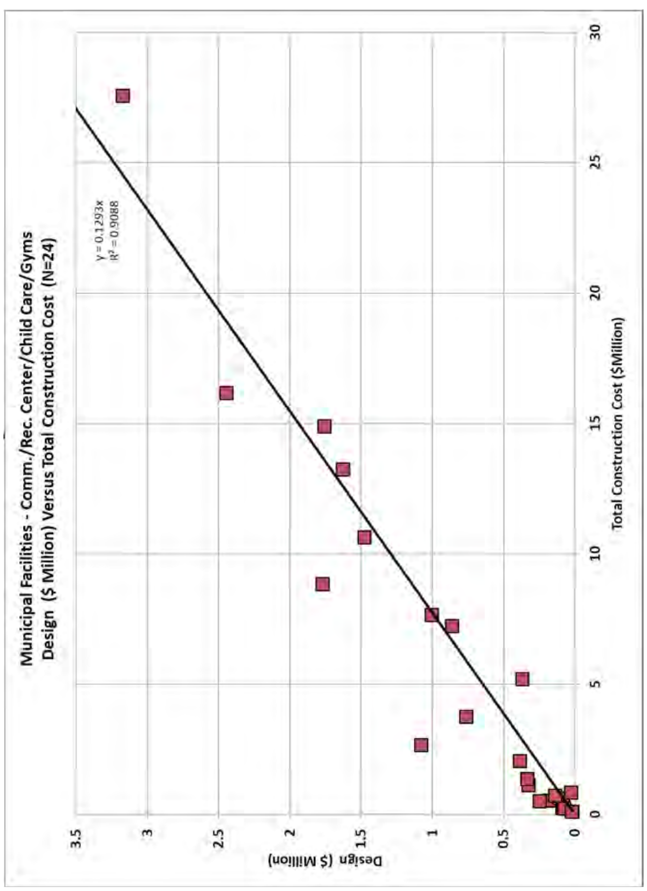
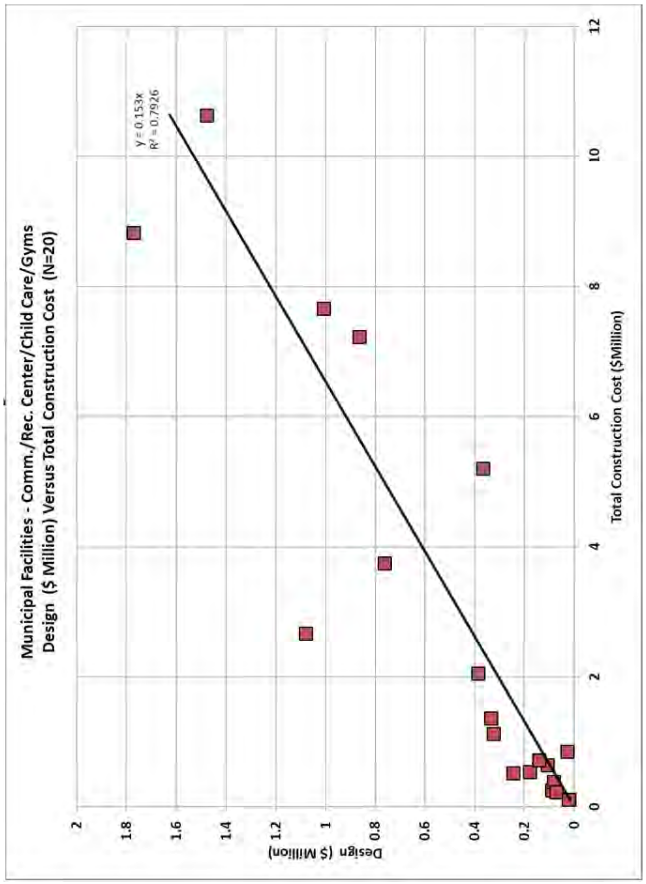
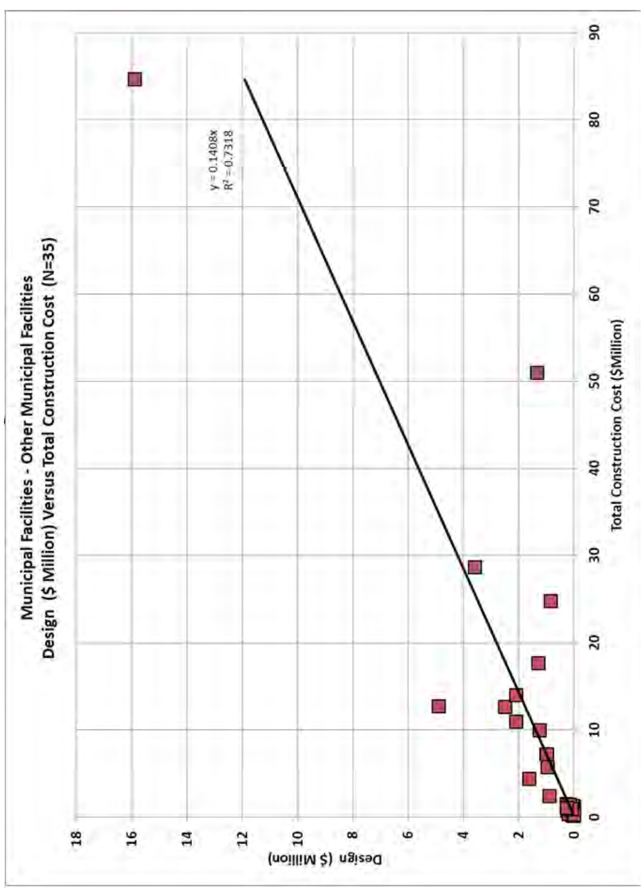


Smaller Projects



All Projects



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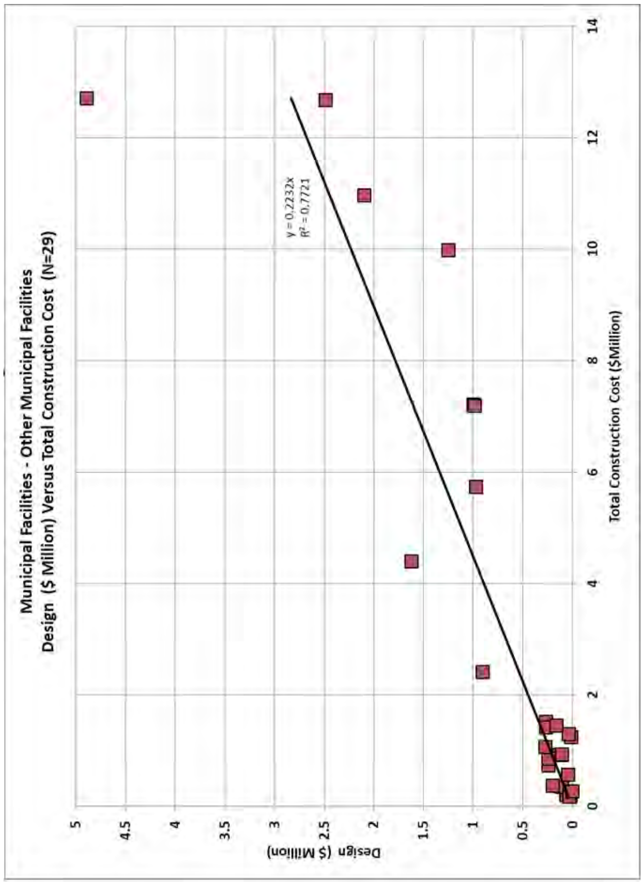

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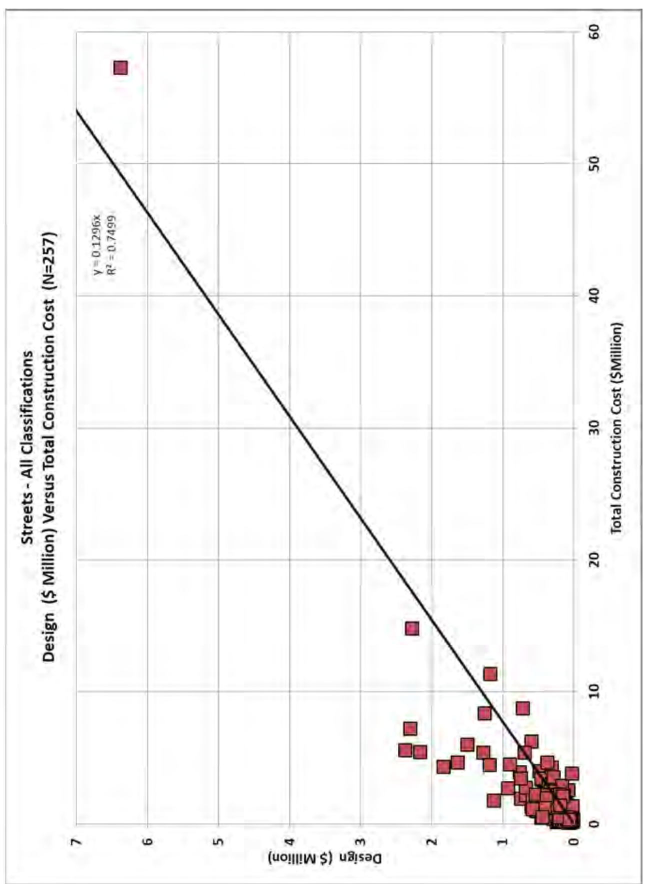

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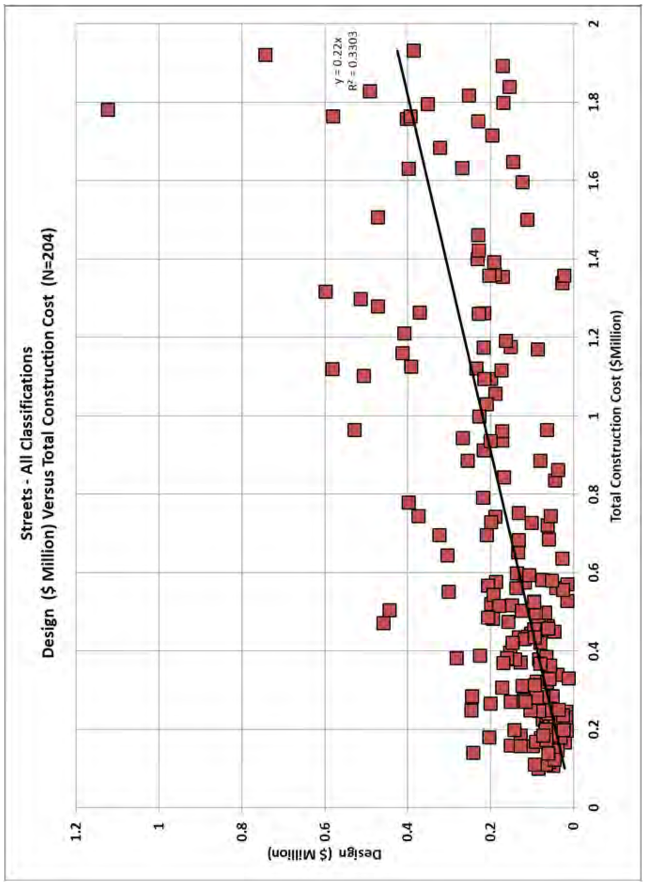

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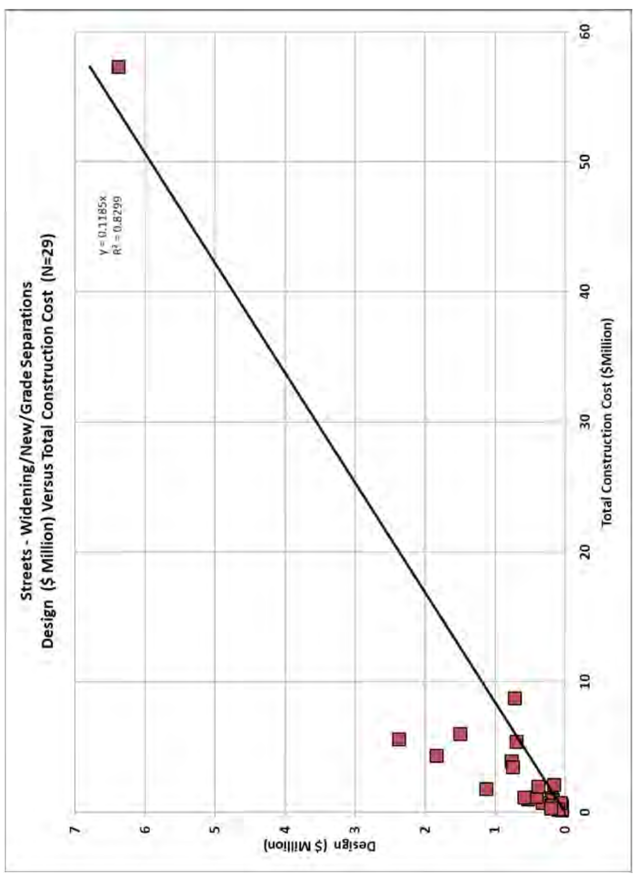

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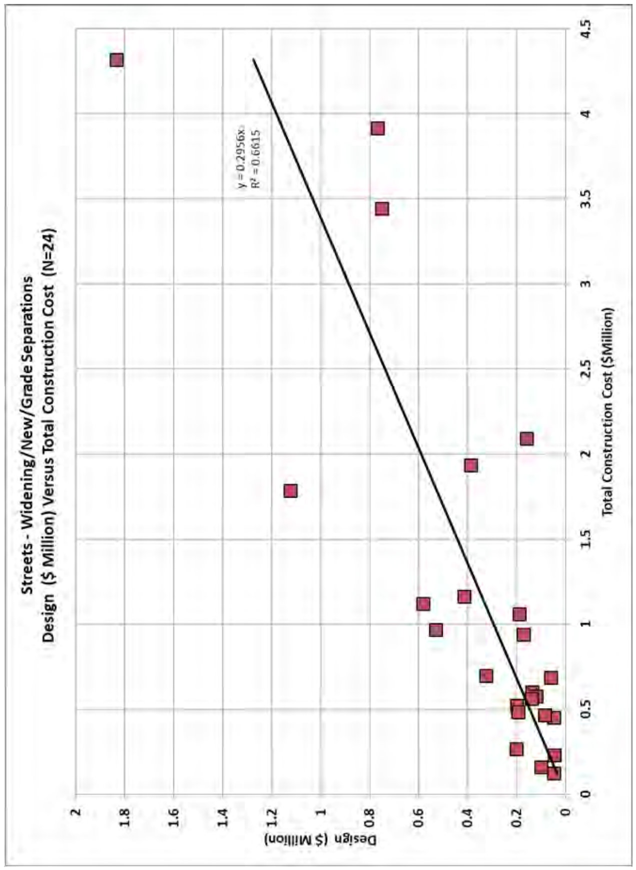

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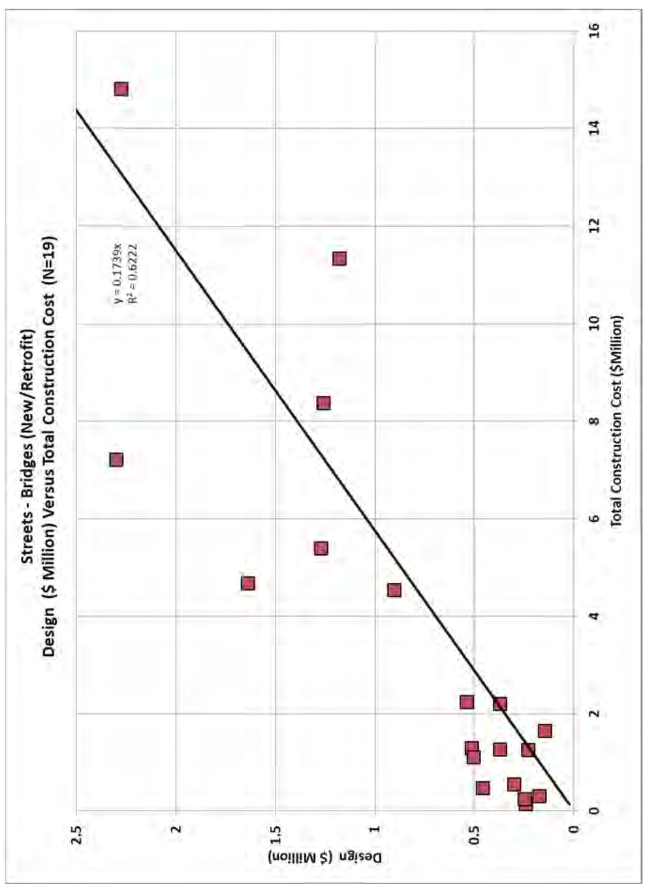

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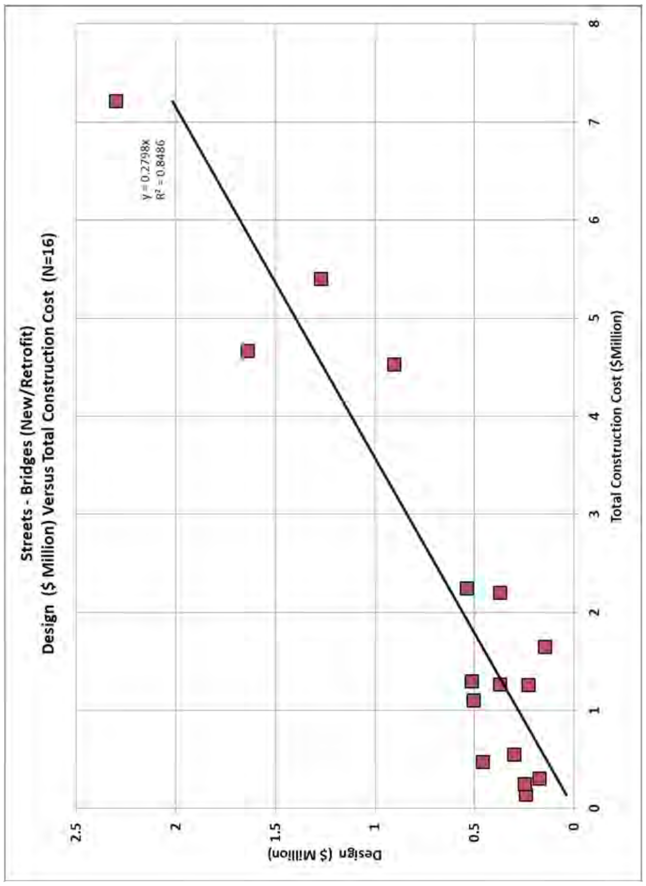

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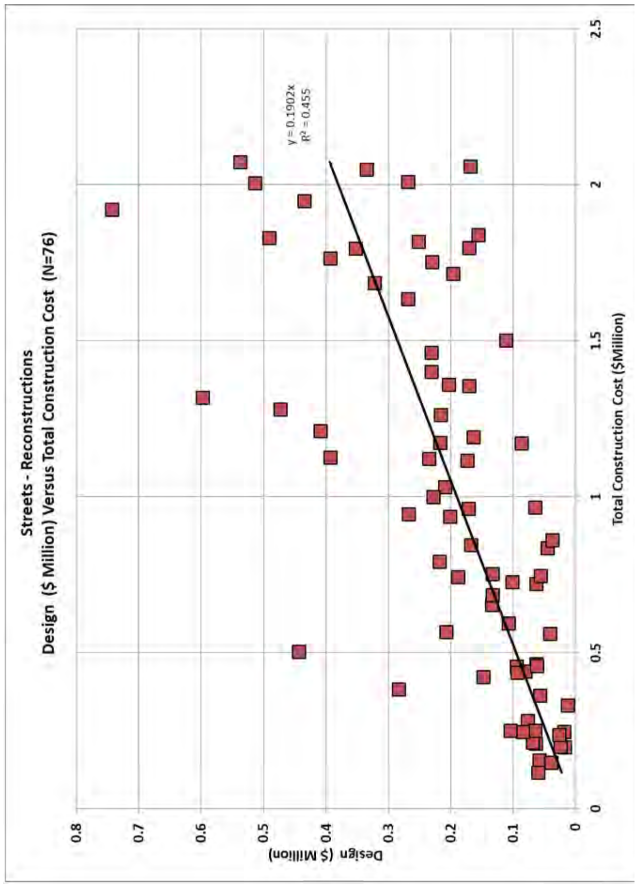

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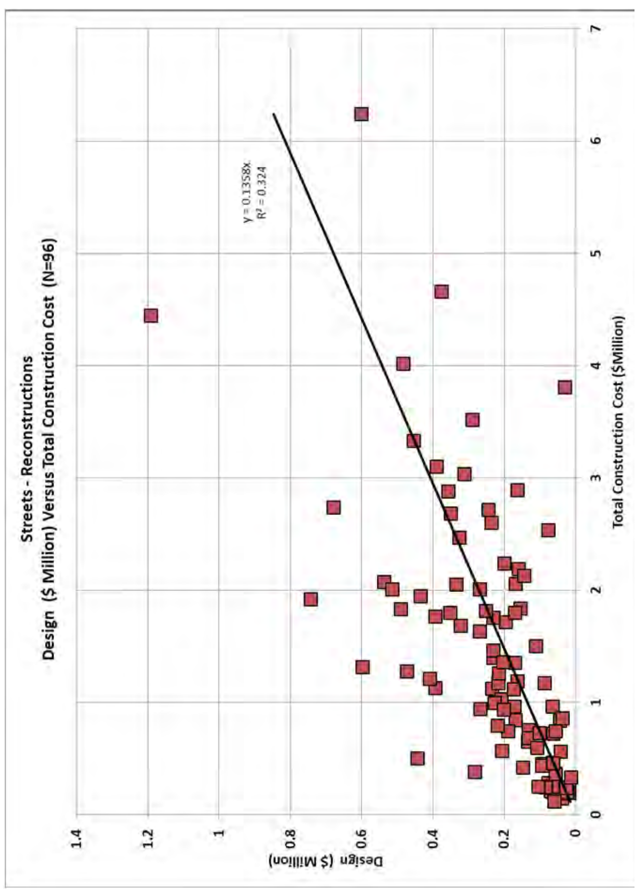

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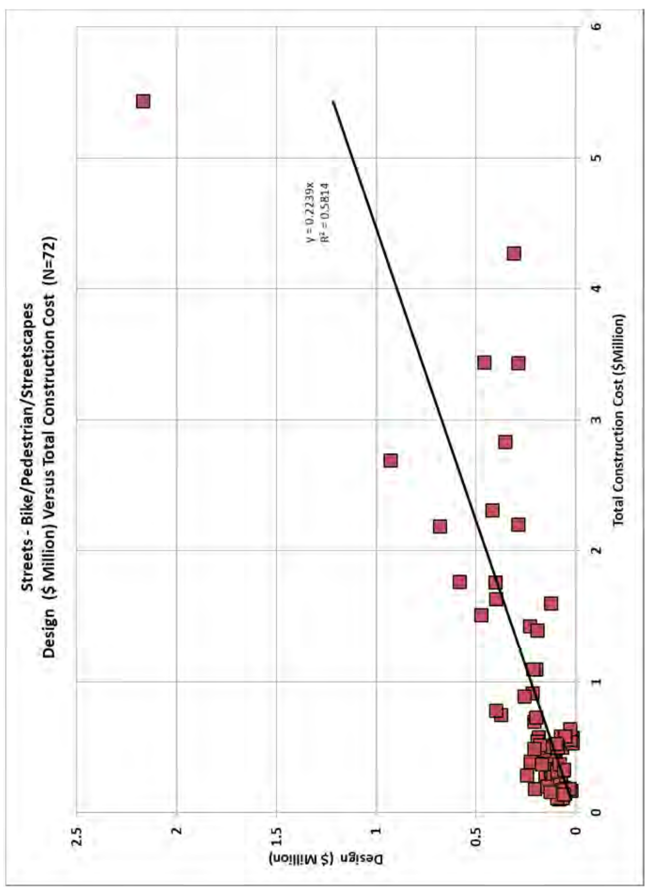

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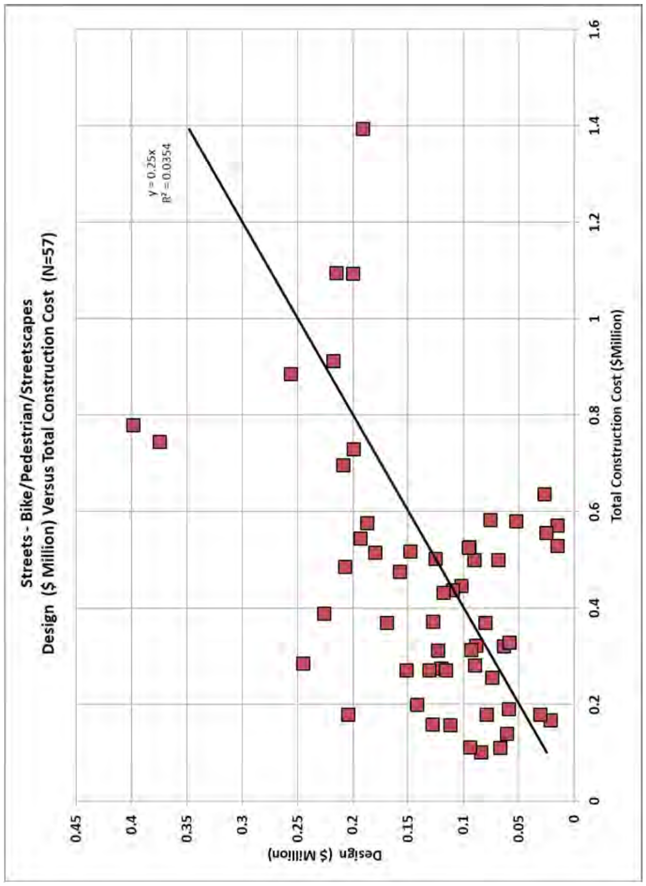

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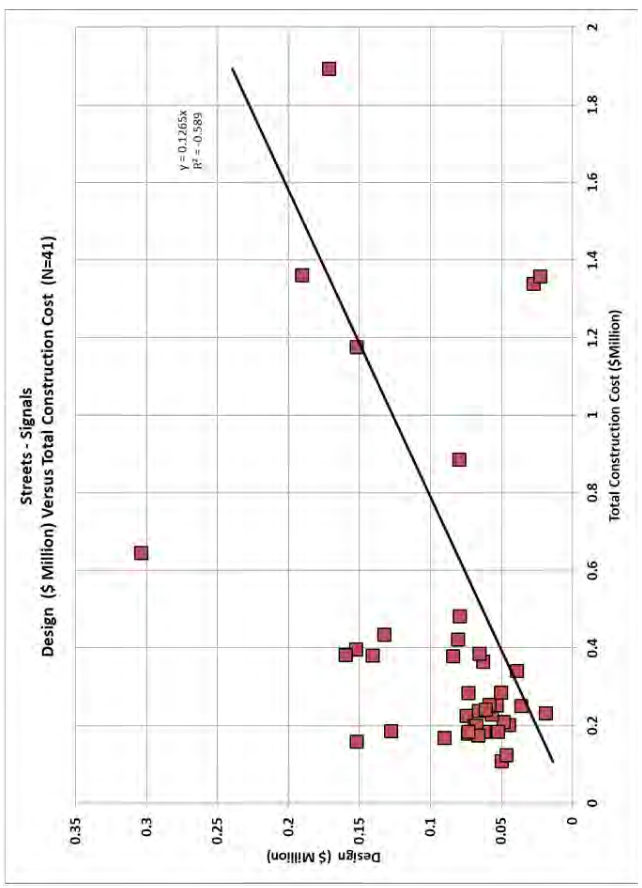

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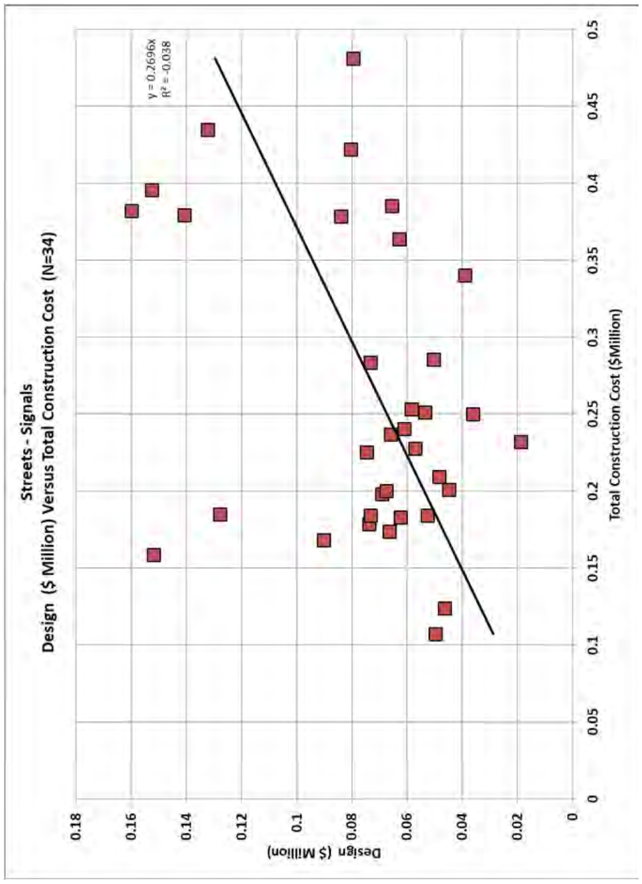

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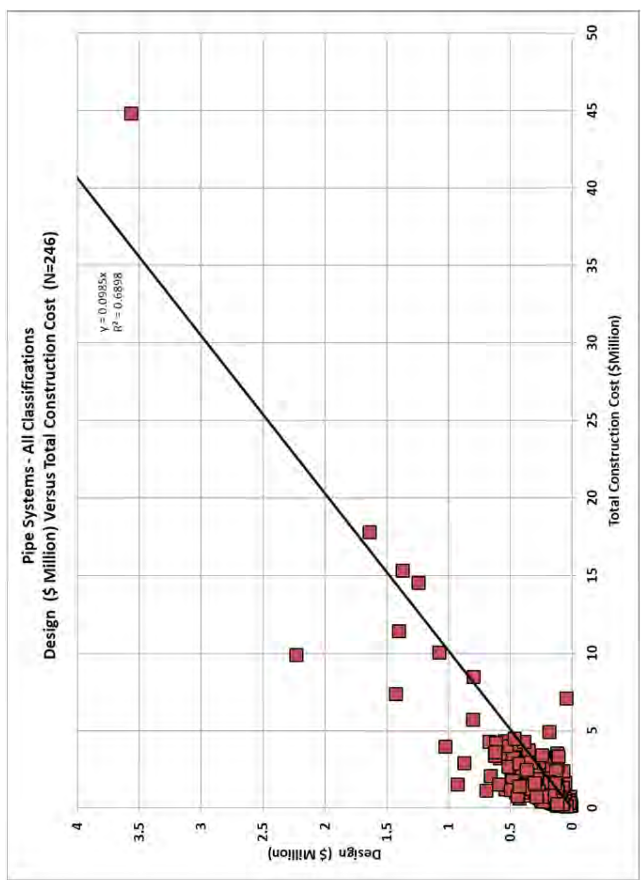

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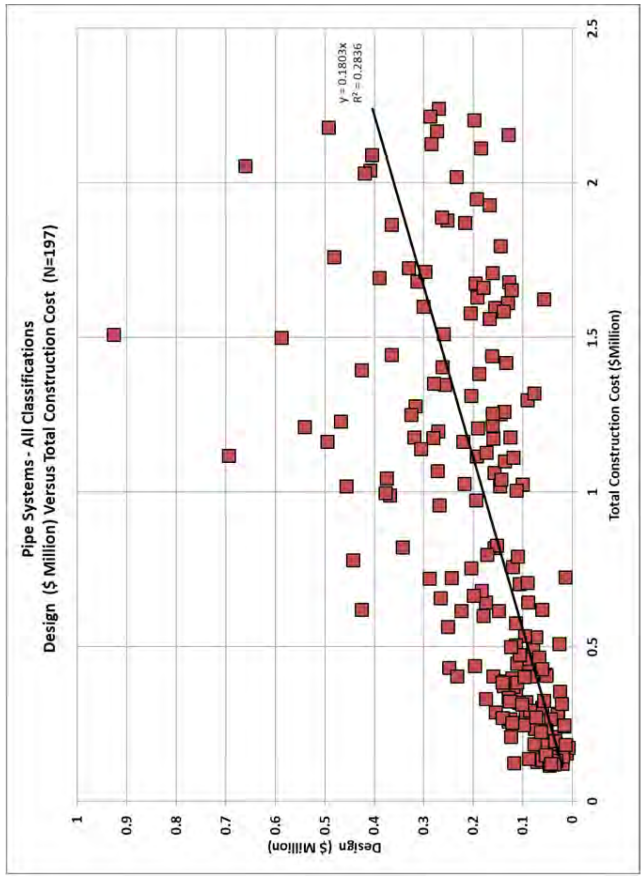

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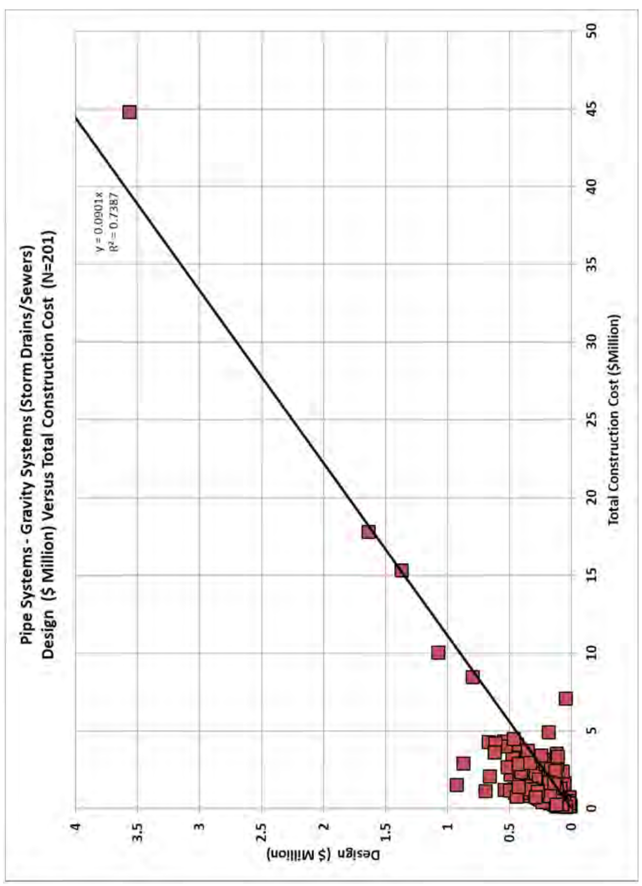

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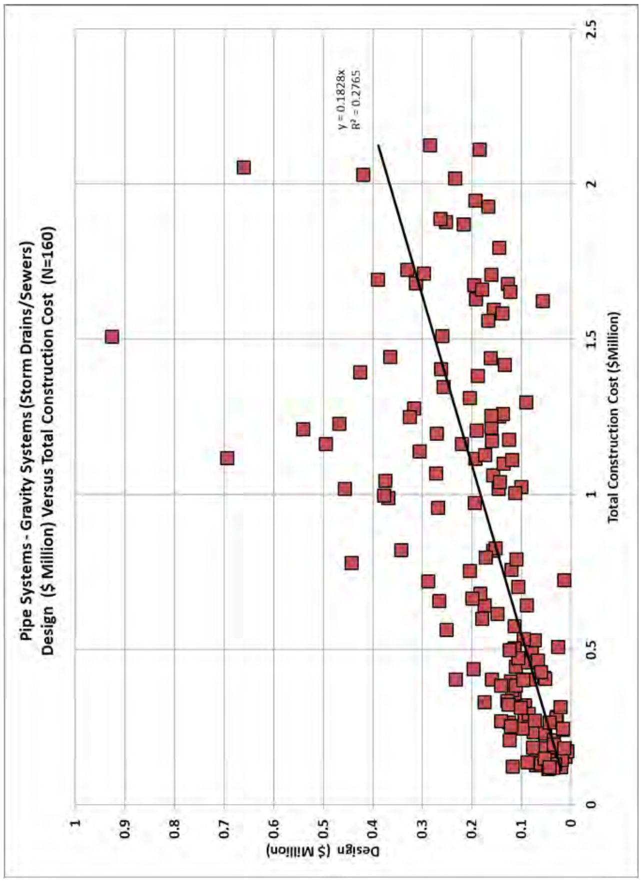

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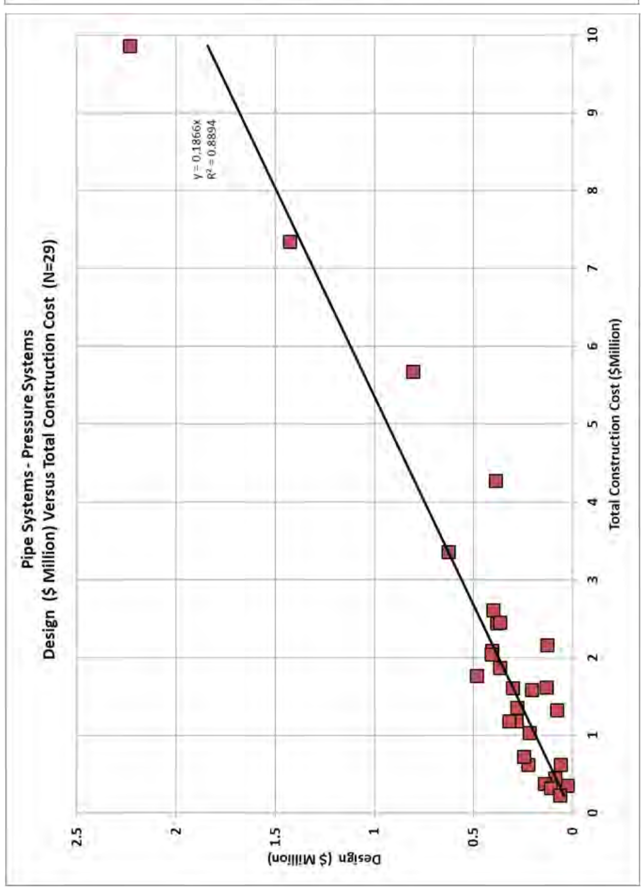

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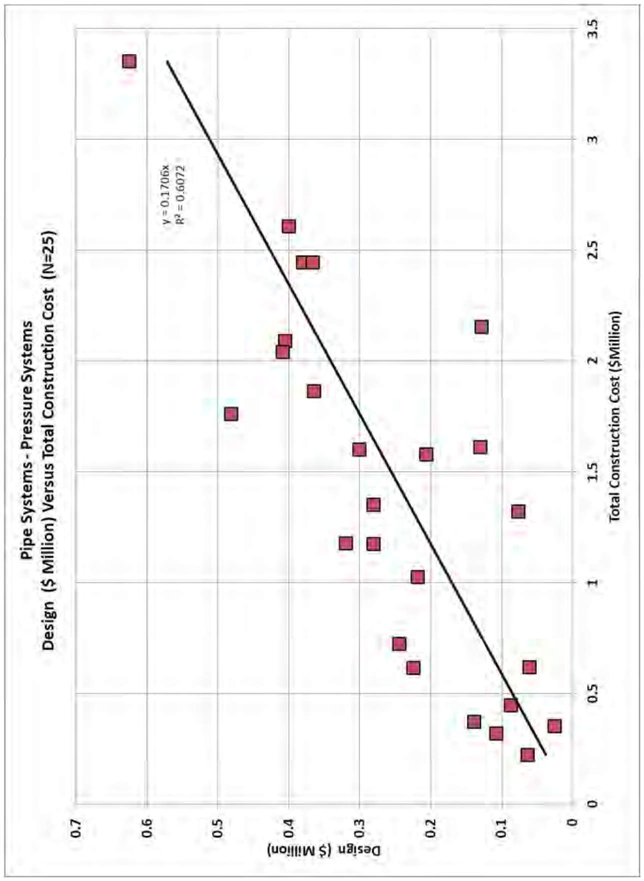

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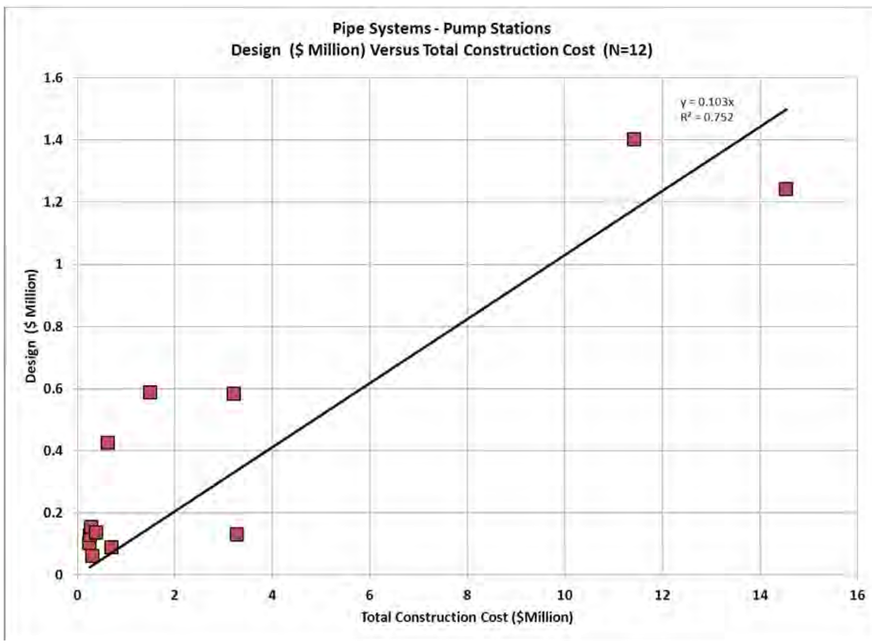

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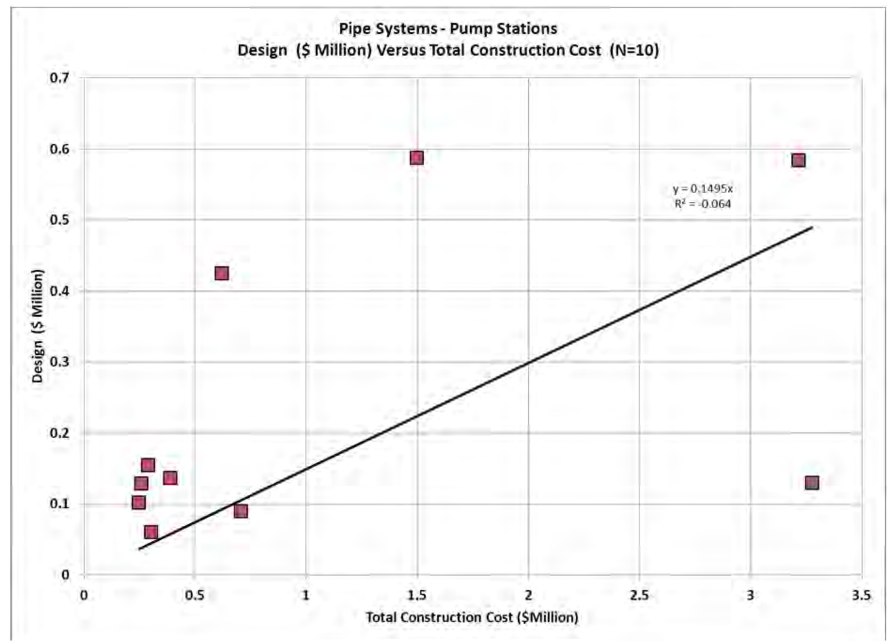

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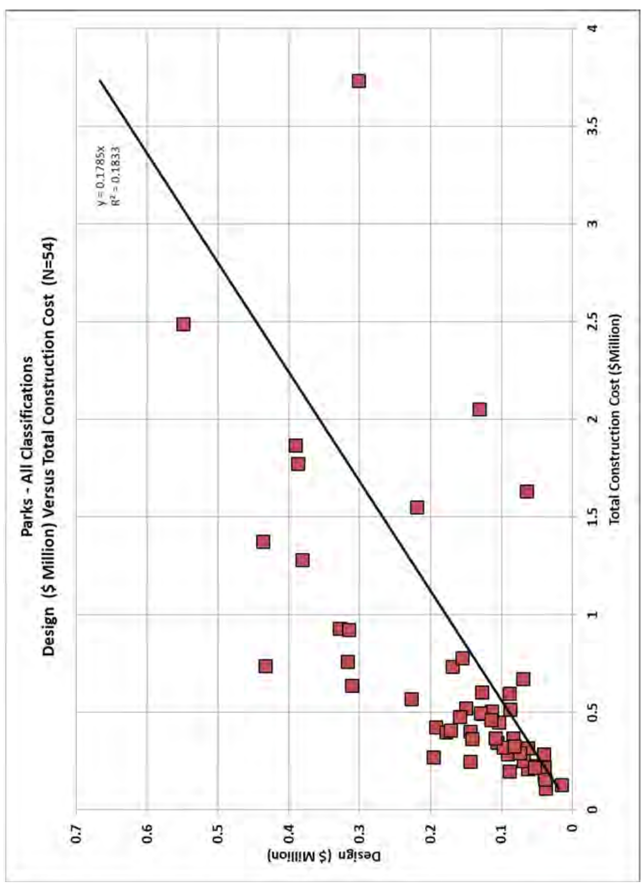

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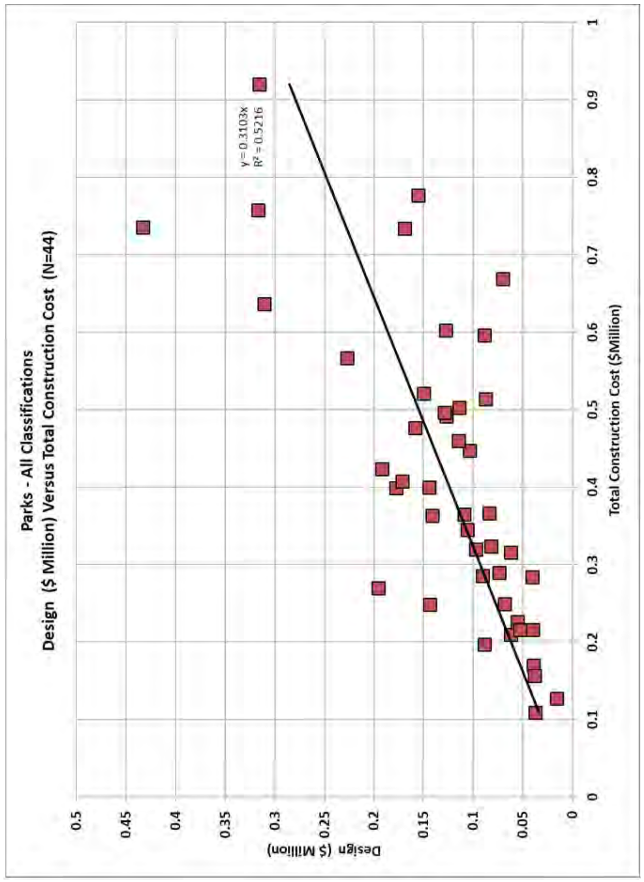

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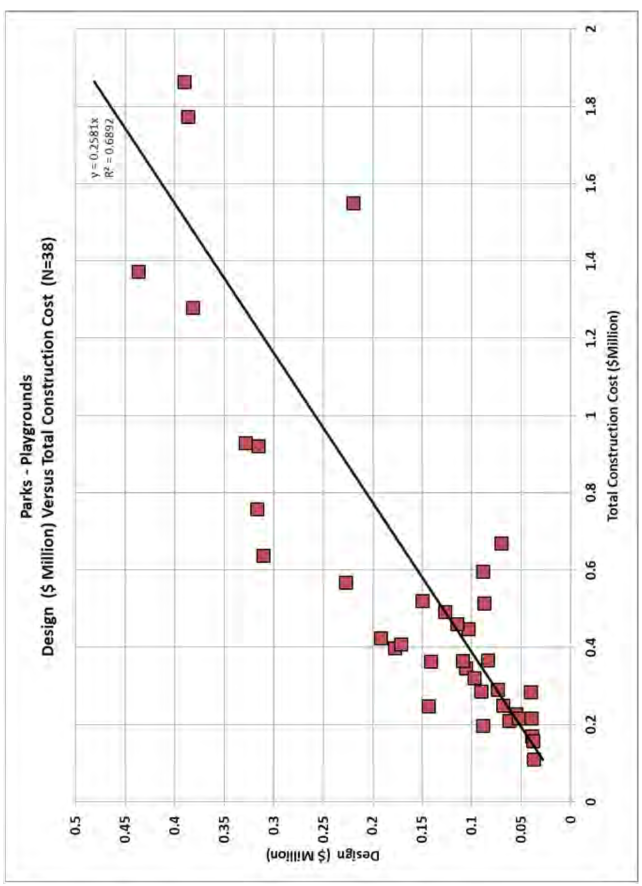

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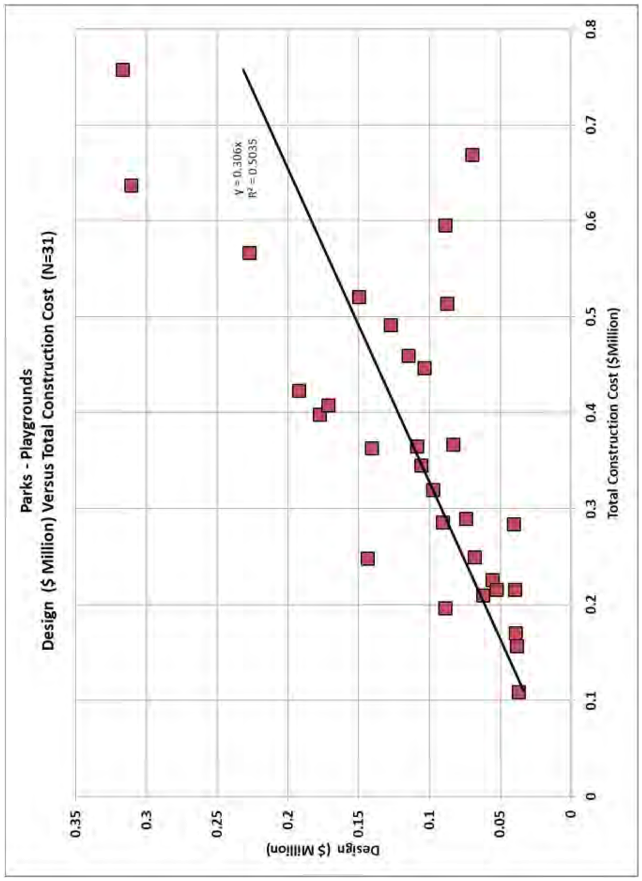

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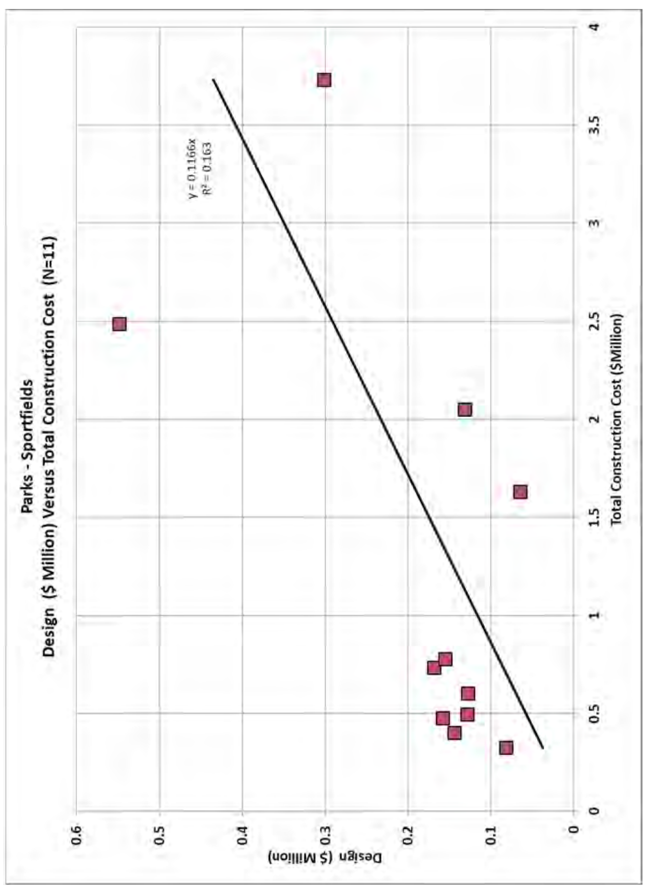

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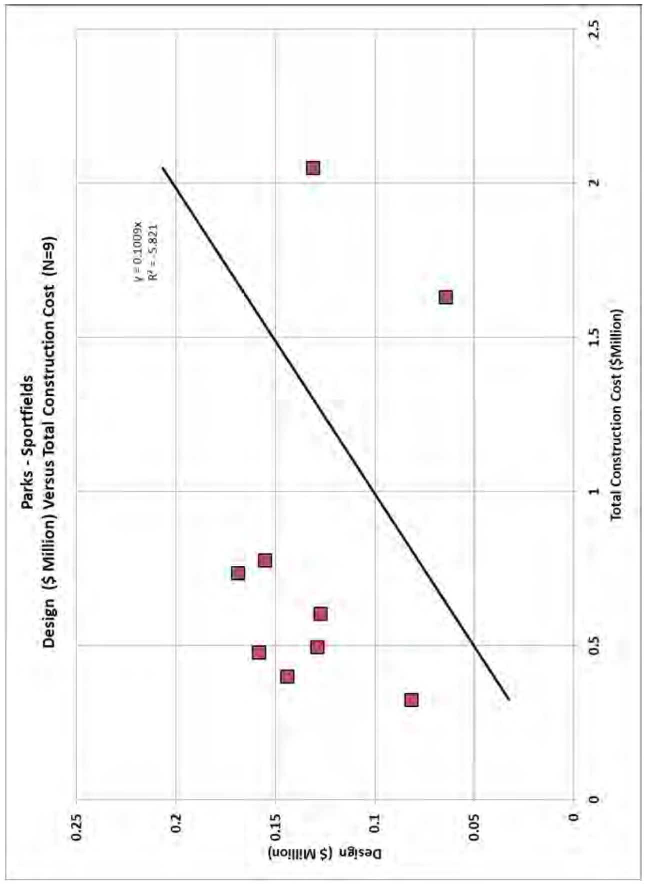

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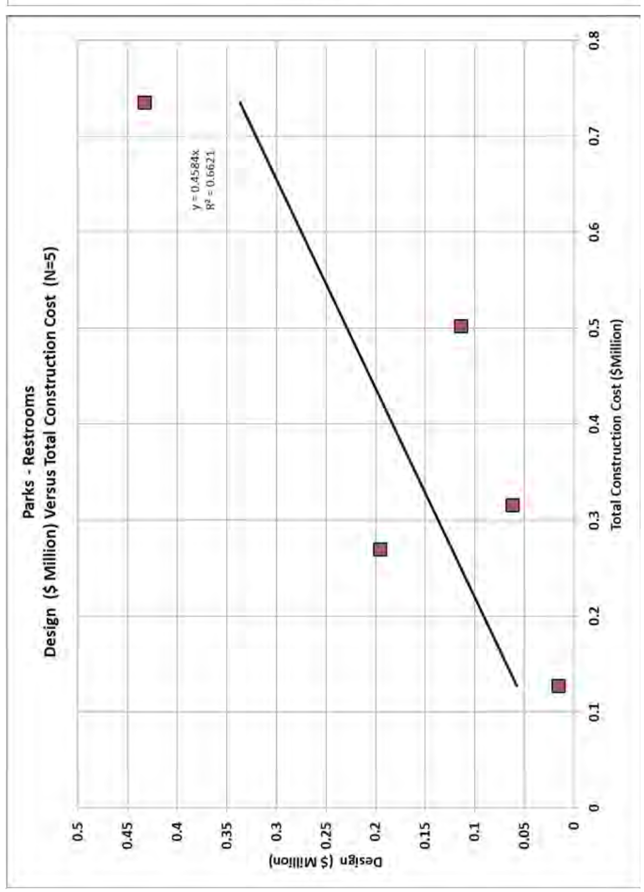

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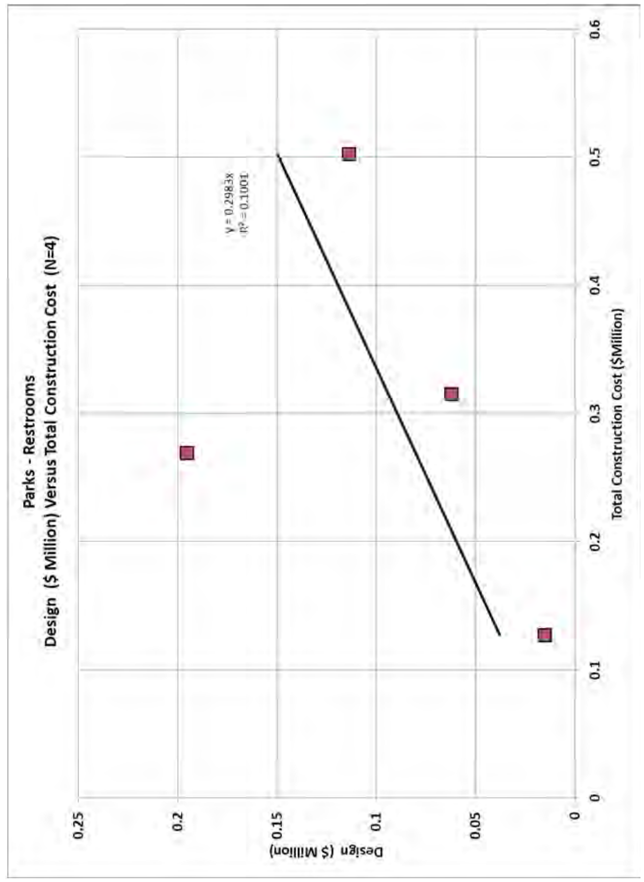
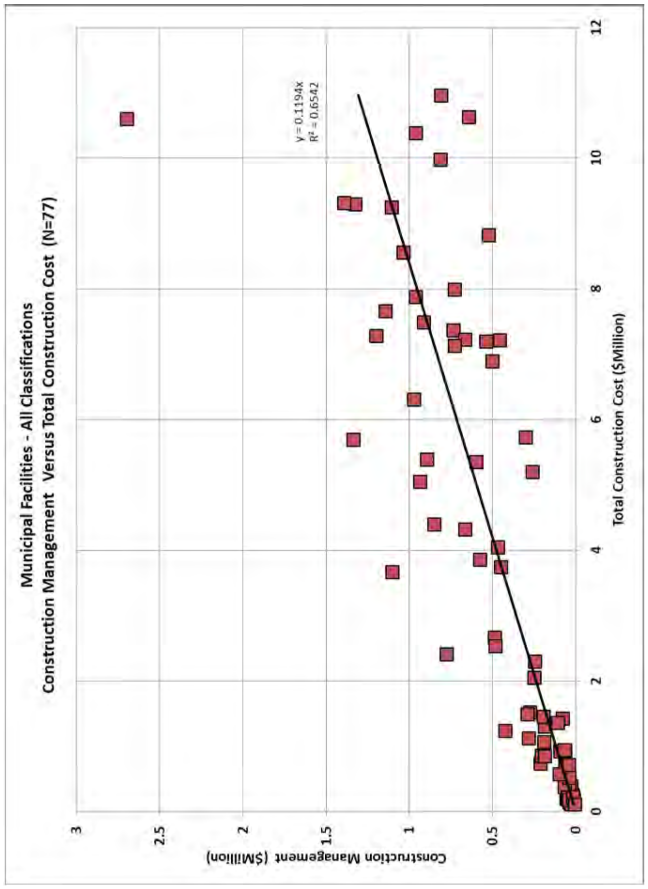


CURVES GROUP 2

Construction Management Cost
vs
Total Construction Cost

Smaller Projects



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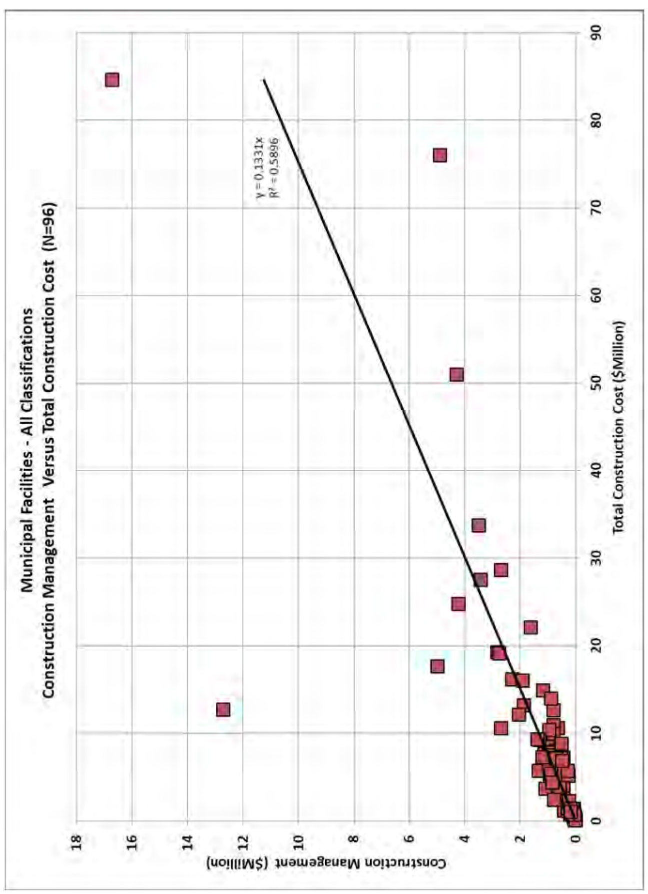

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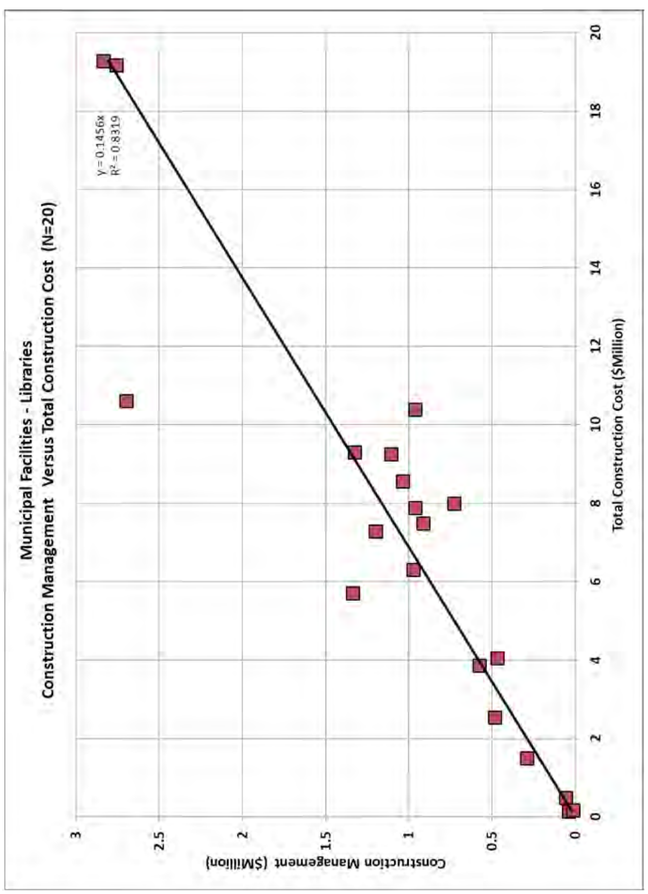

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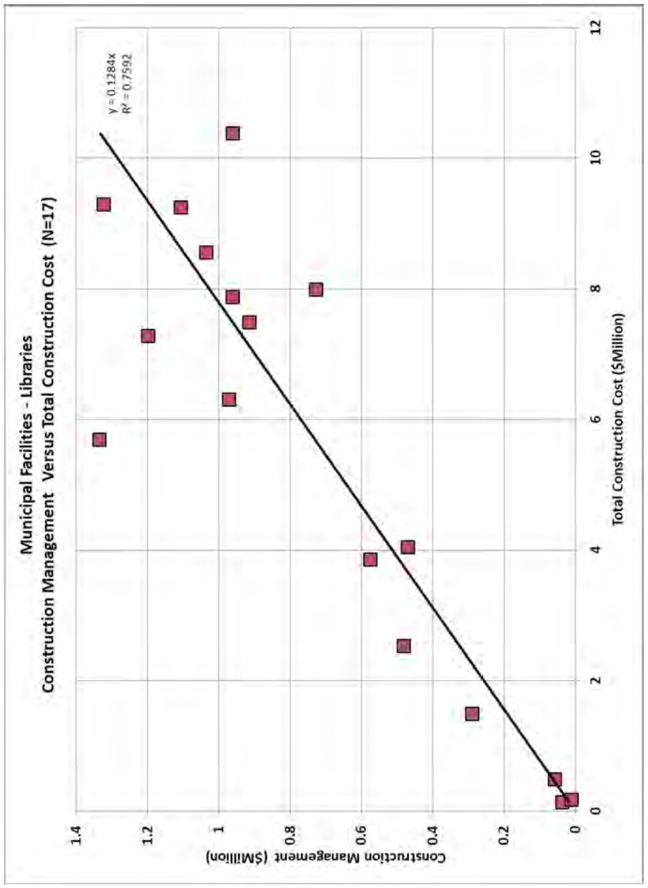

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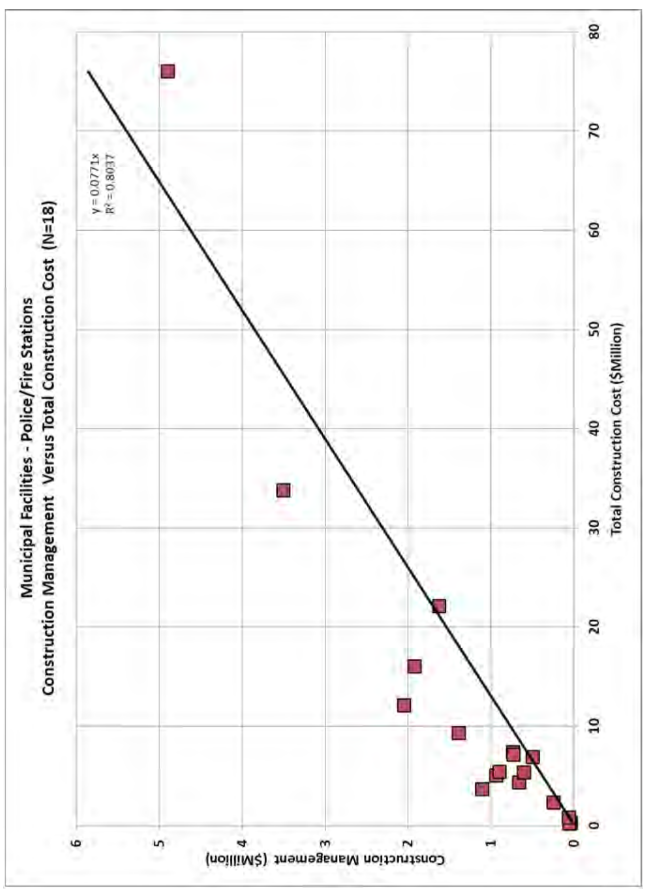

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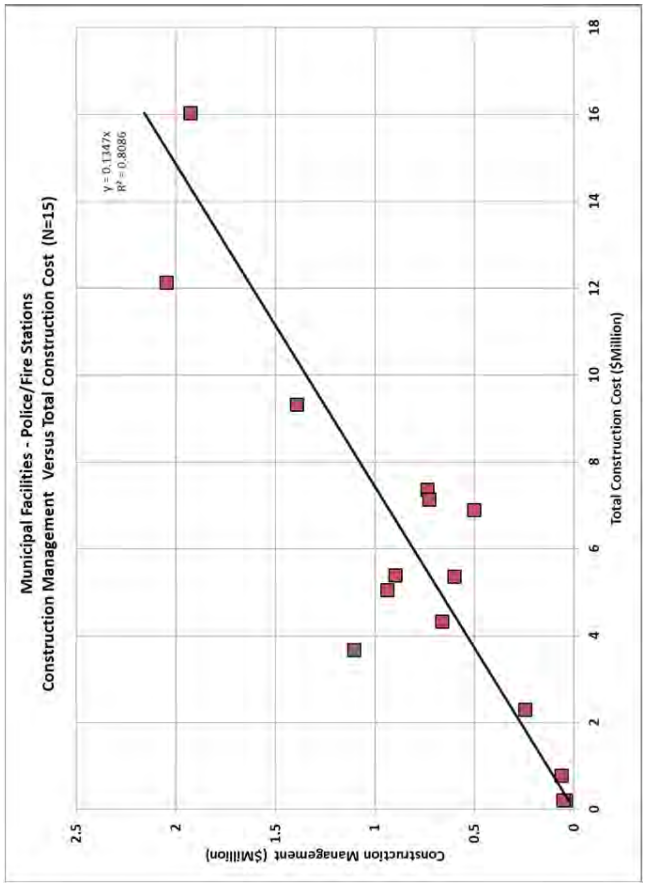

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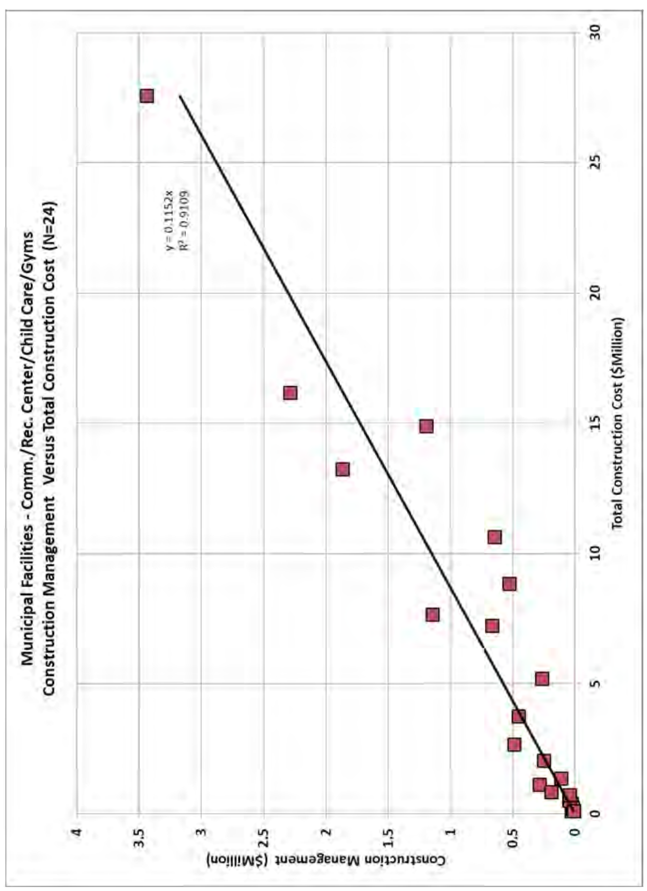

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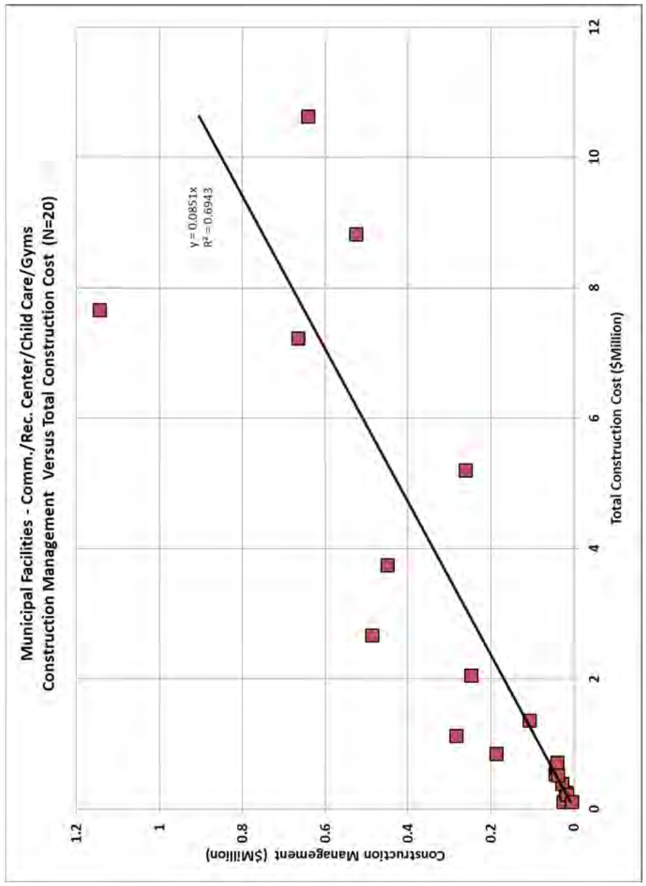

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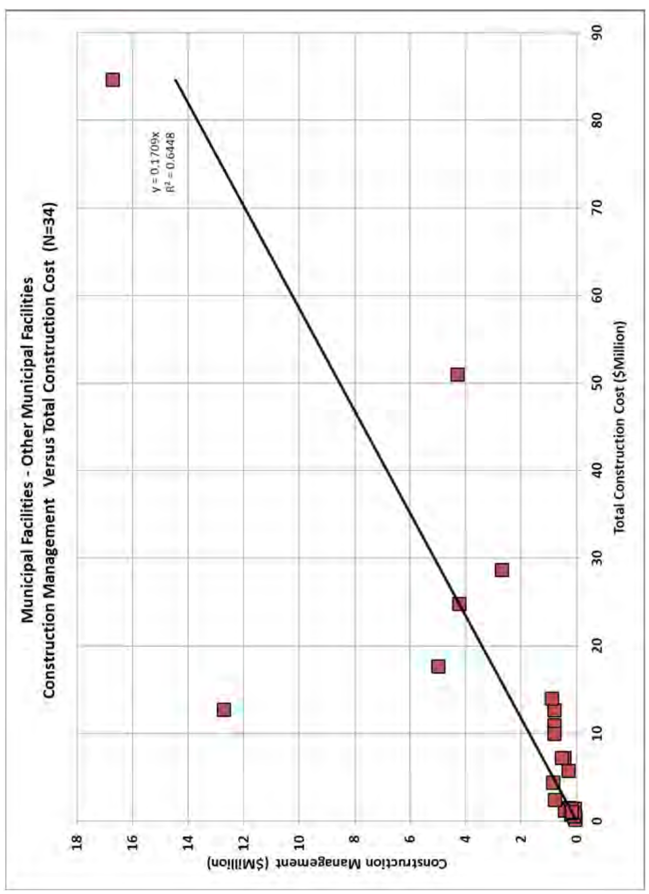

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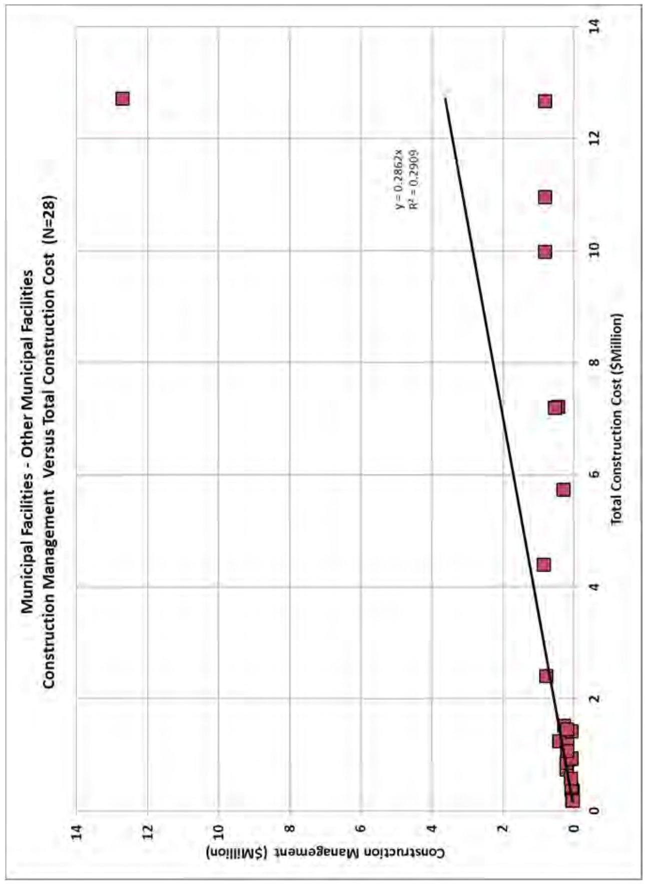

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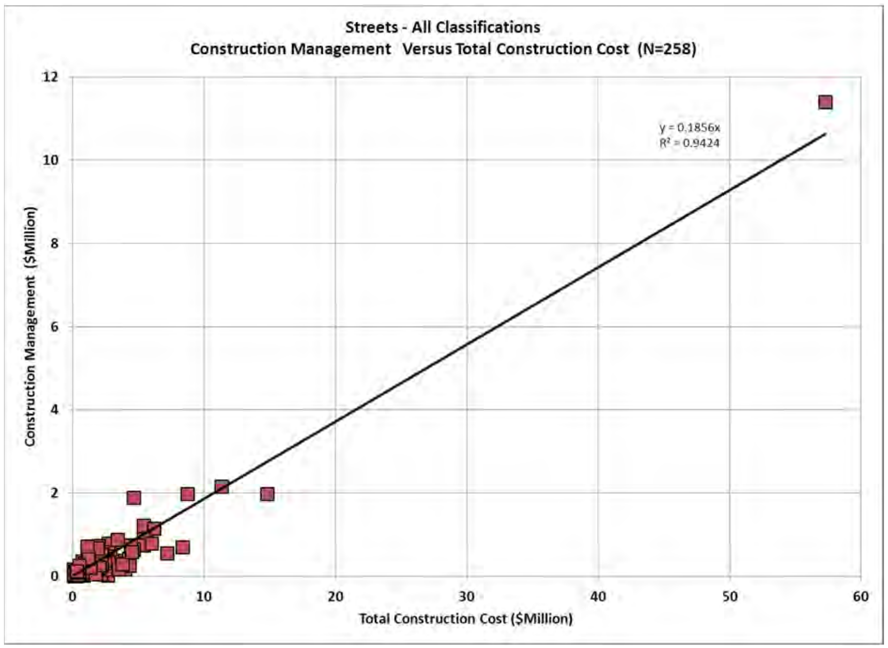

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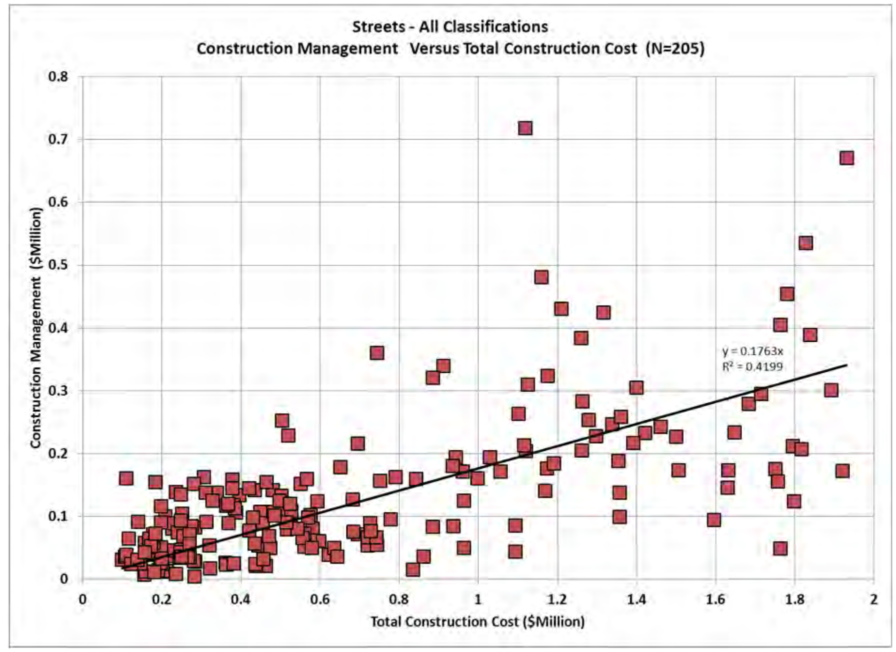

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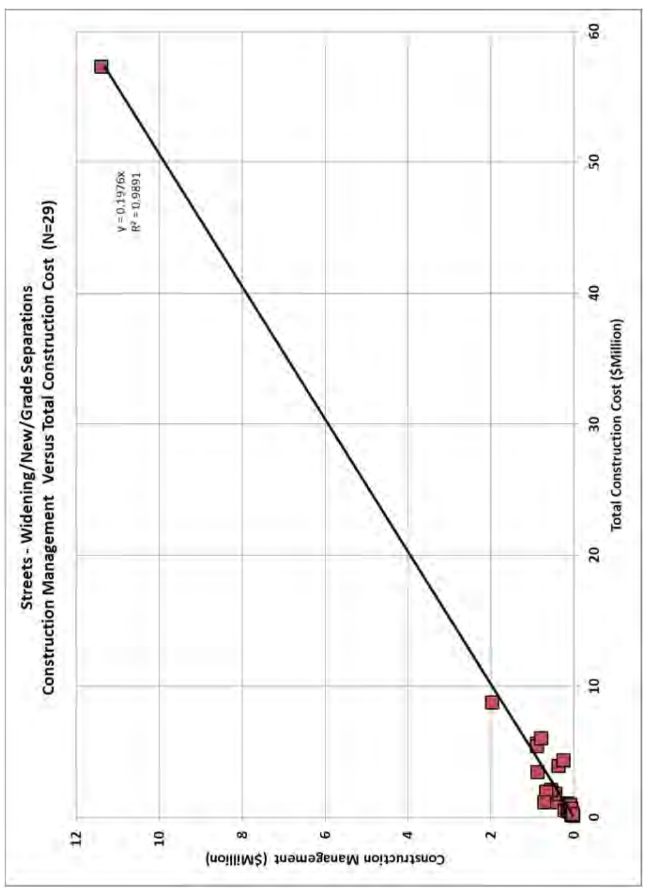

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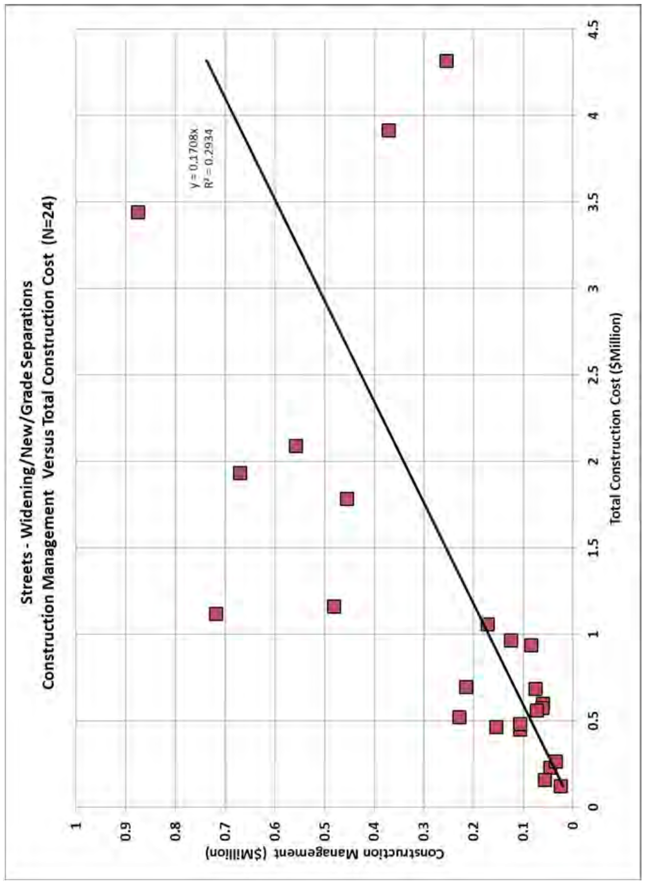

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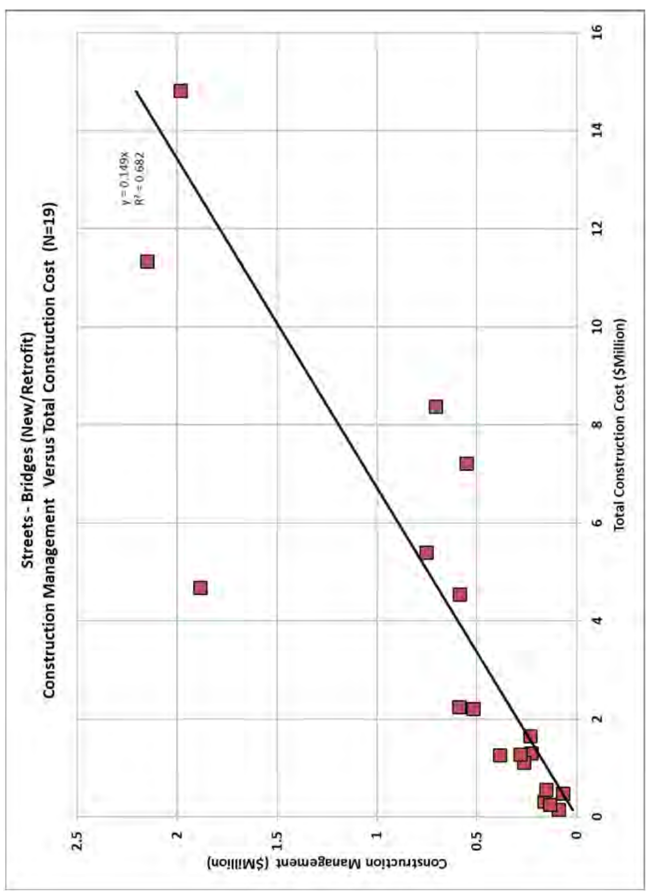

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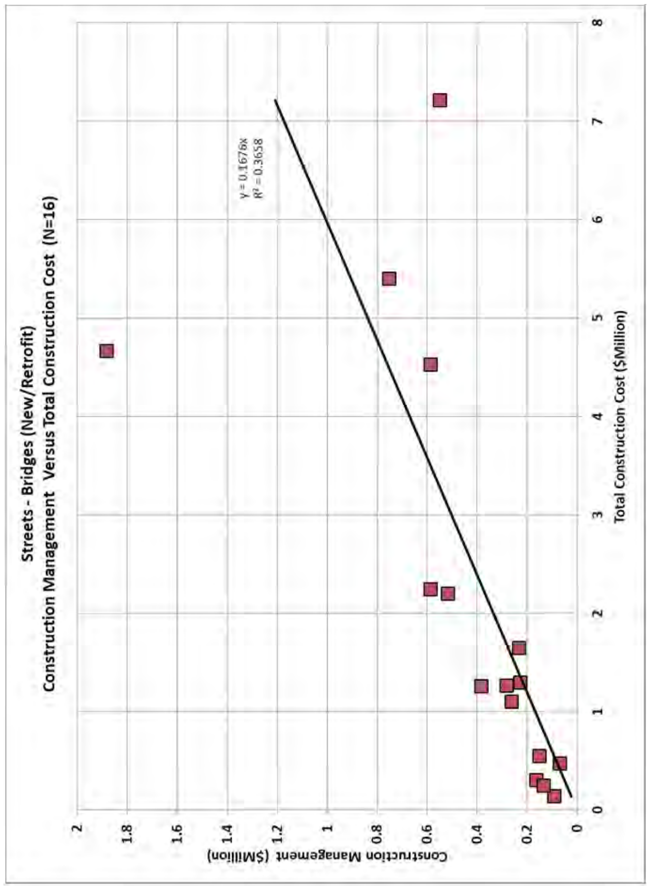

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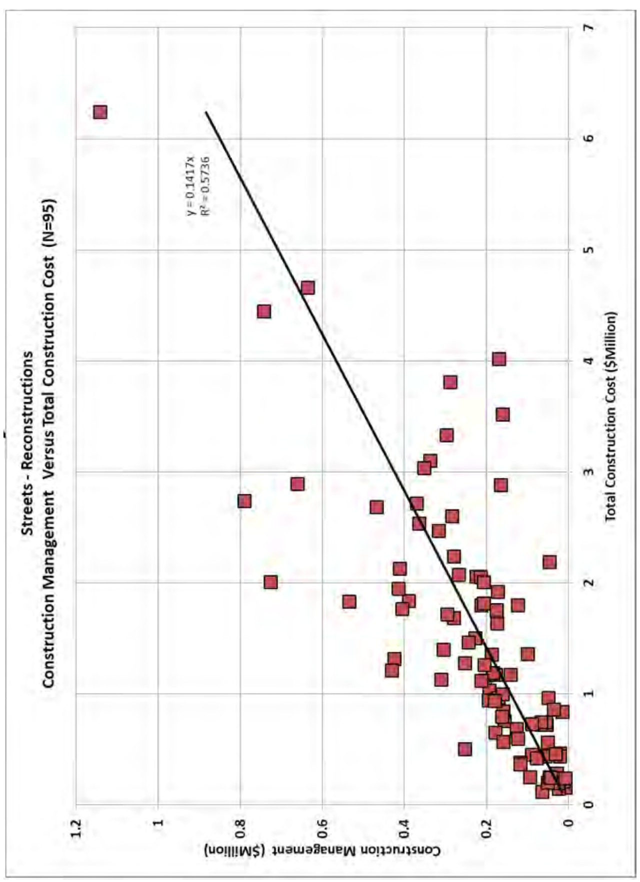

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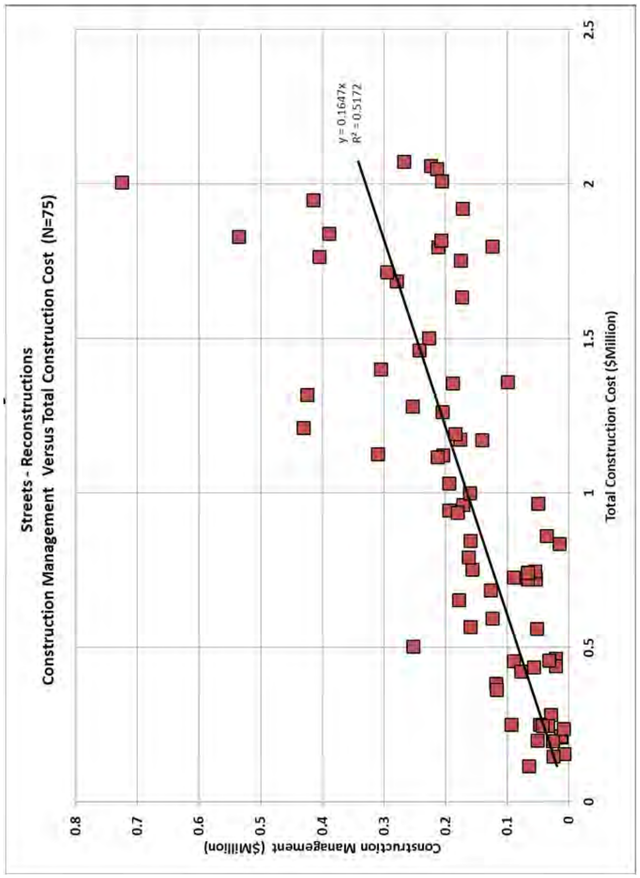

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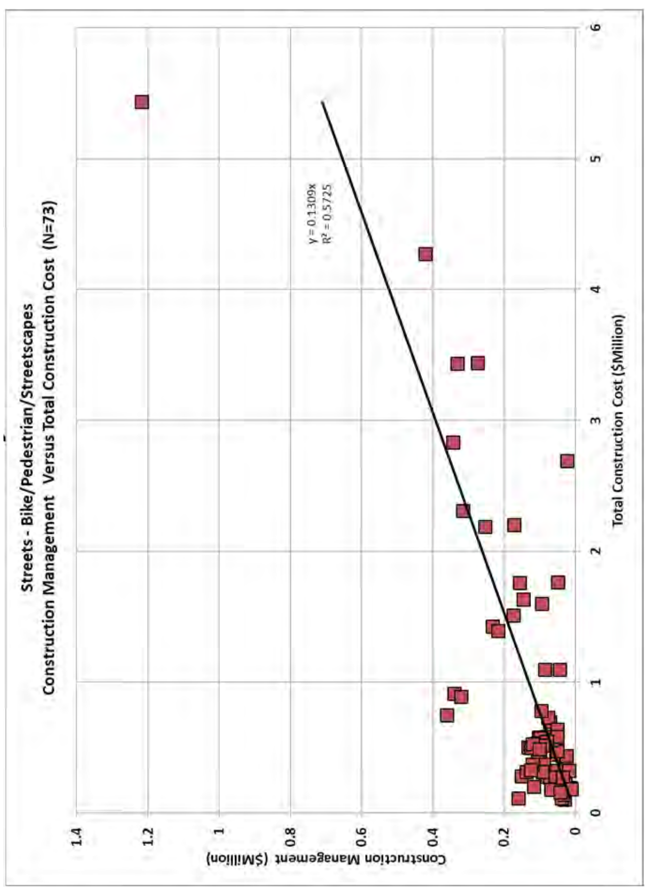

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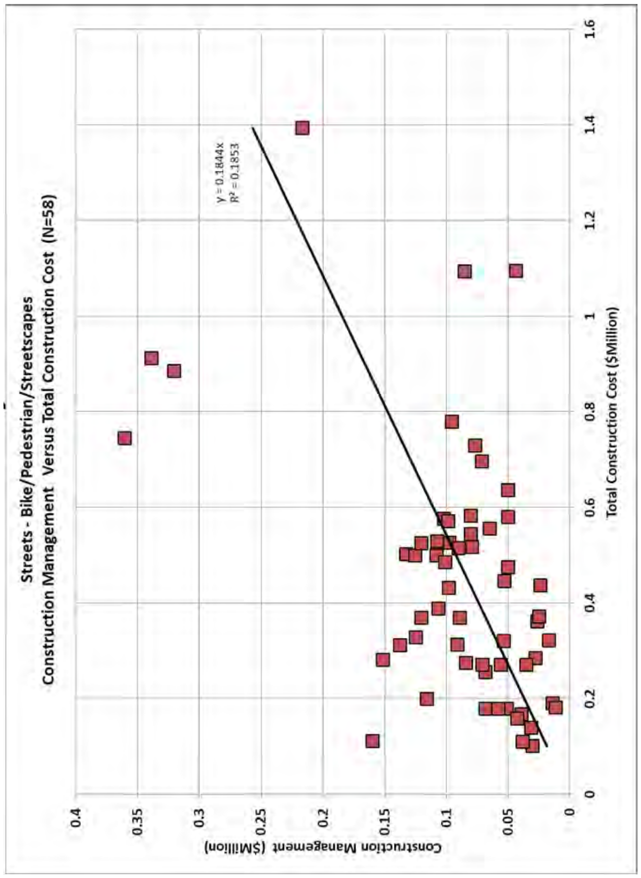

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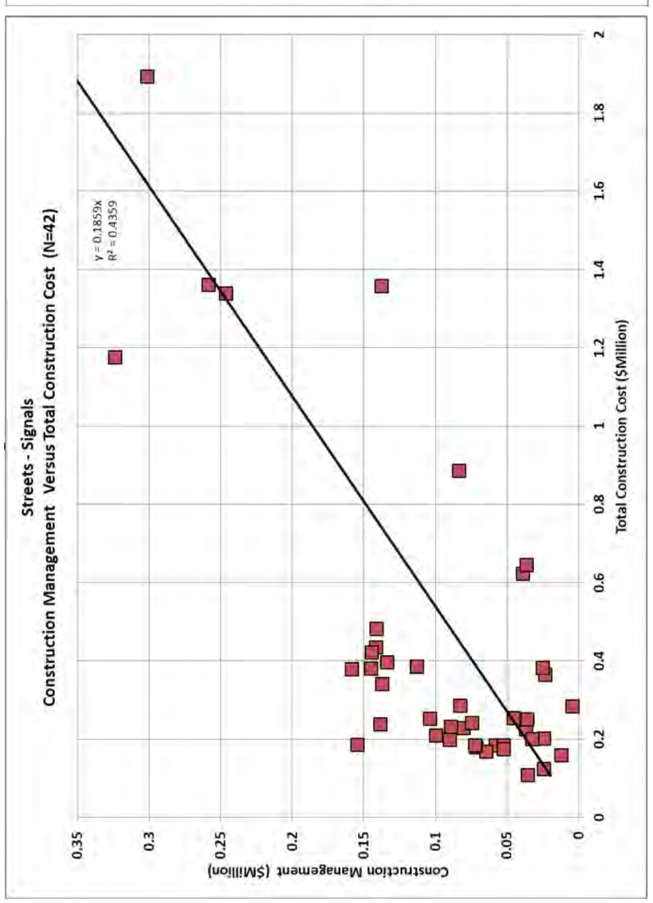

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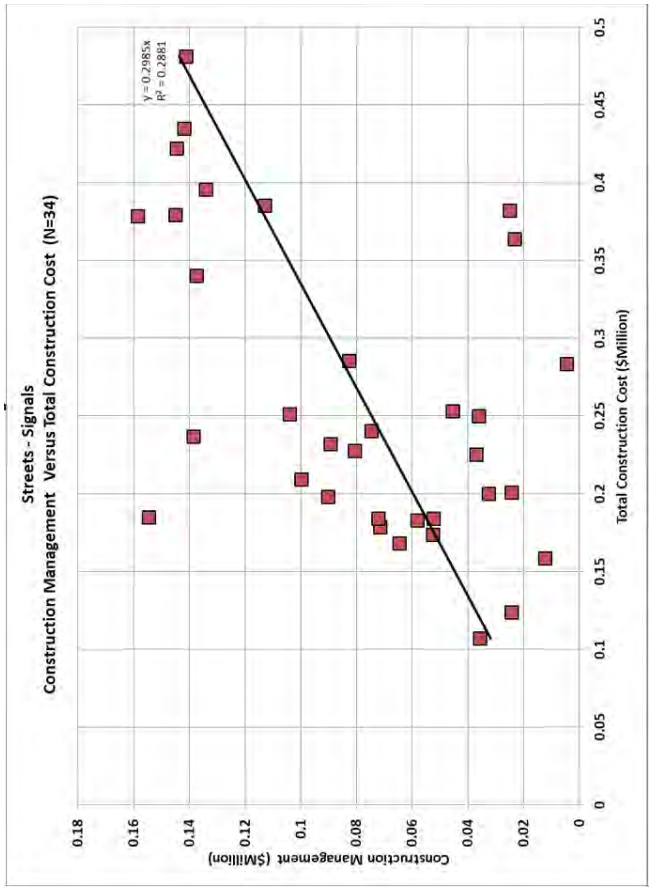

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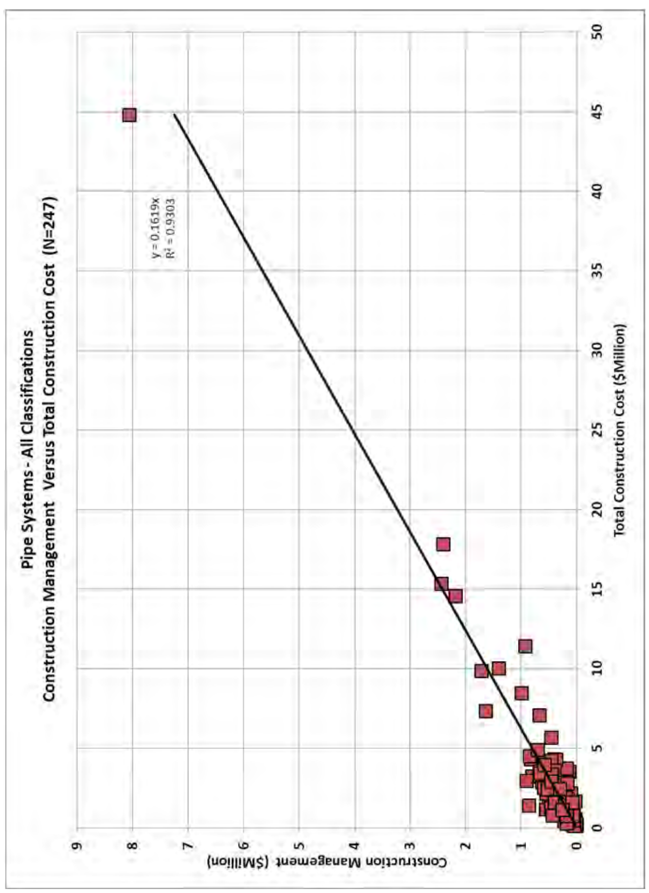

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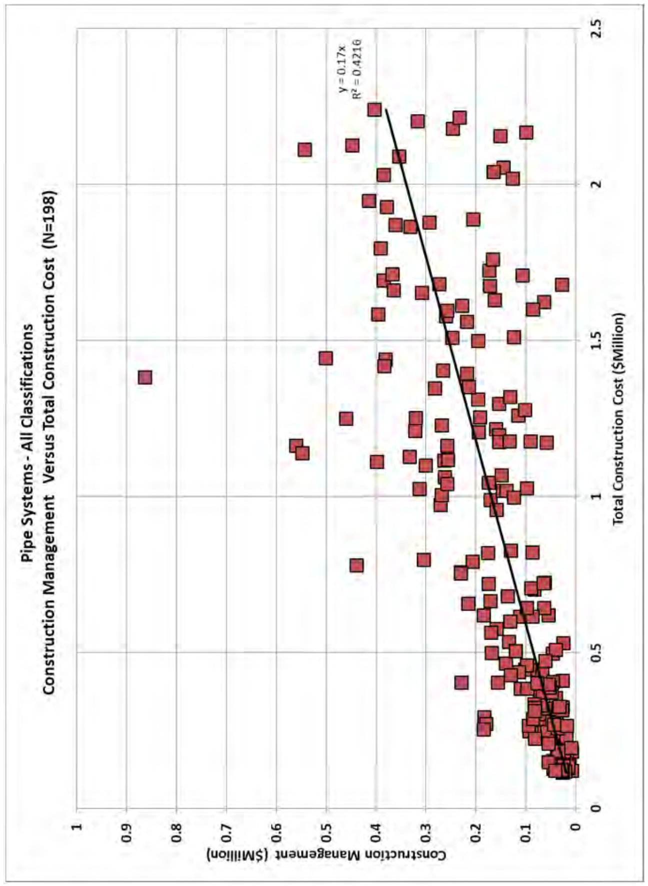

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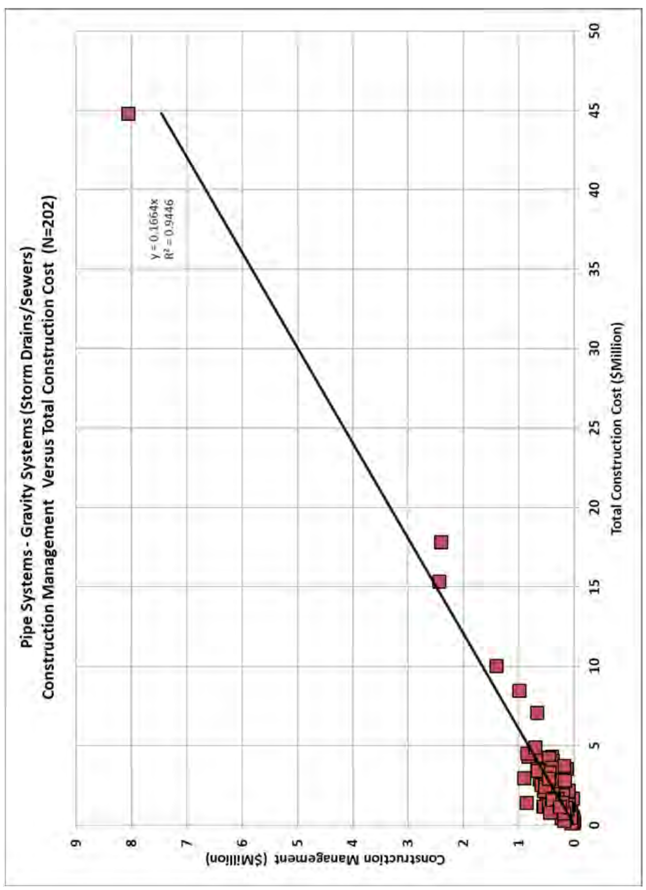

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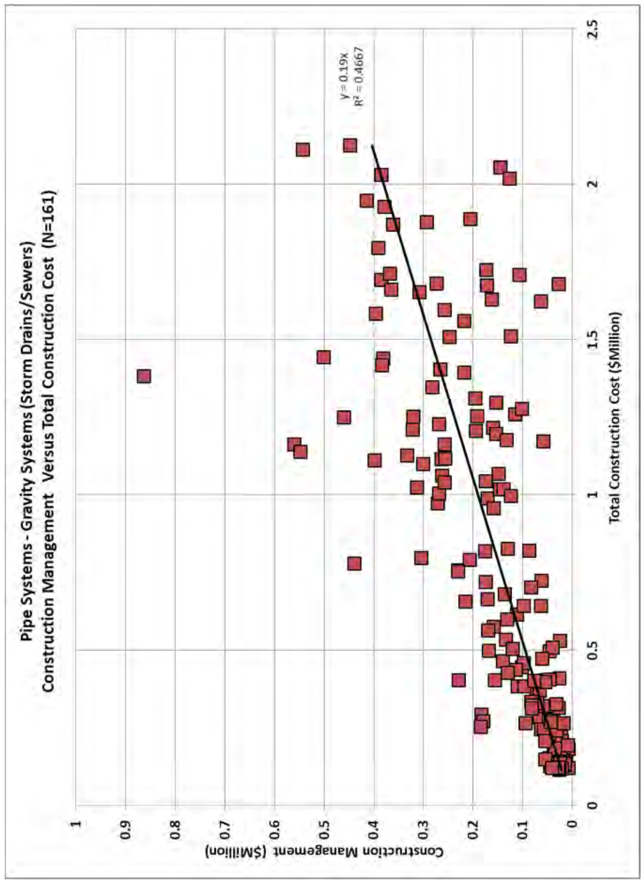

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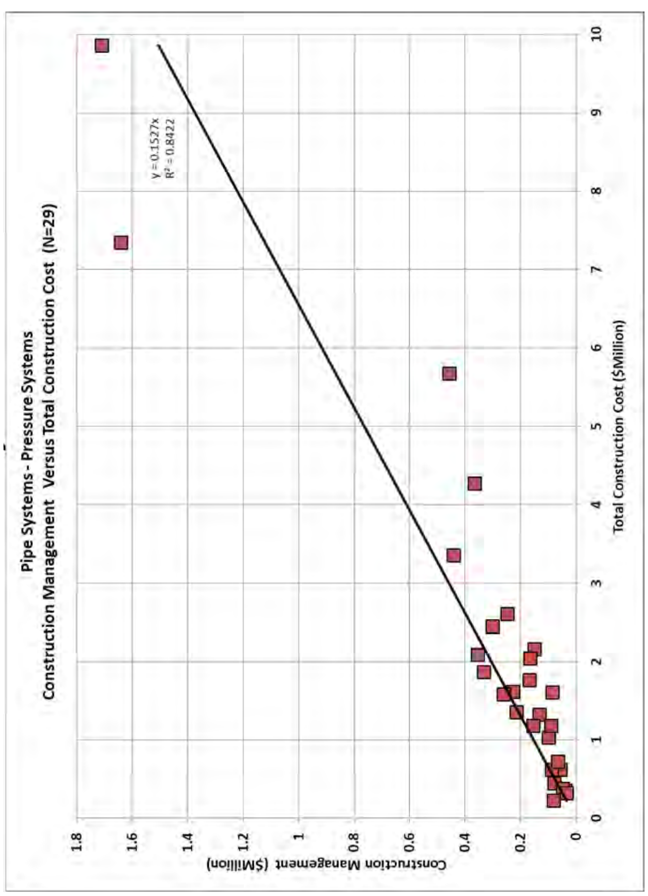

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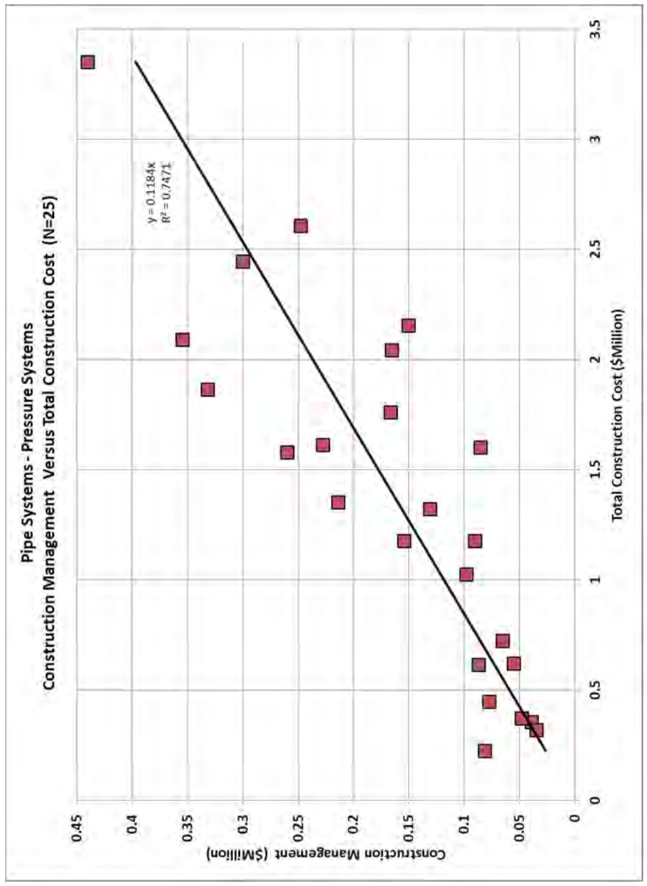

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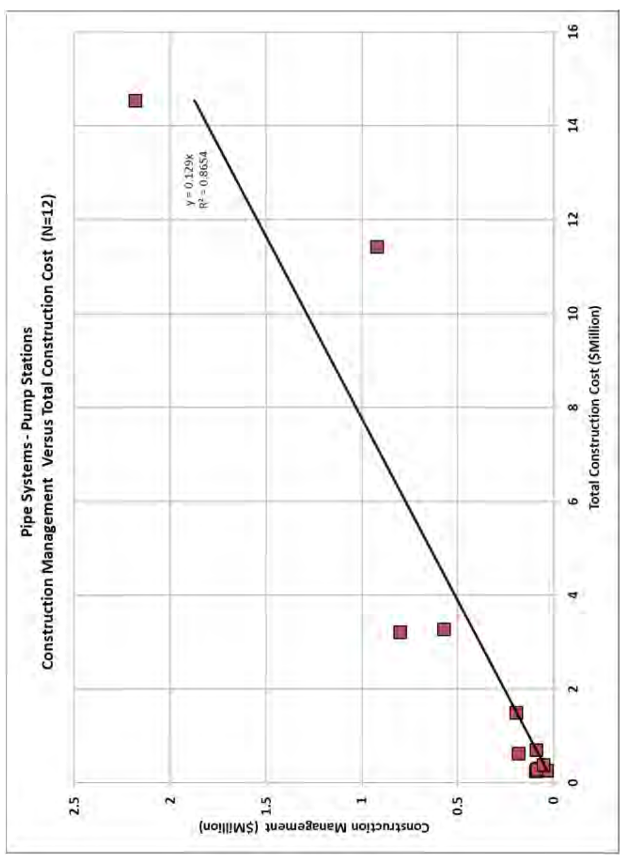

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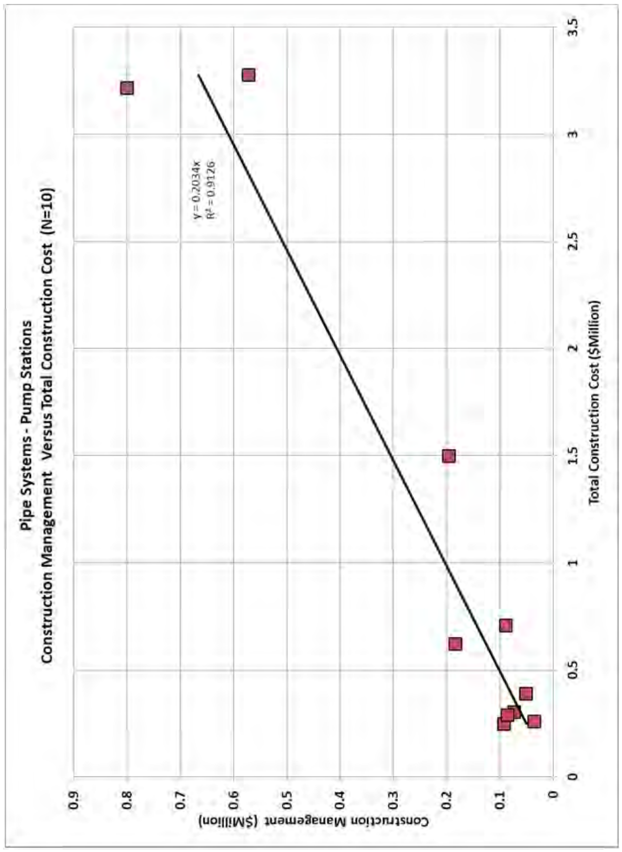

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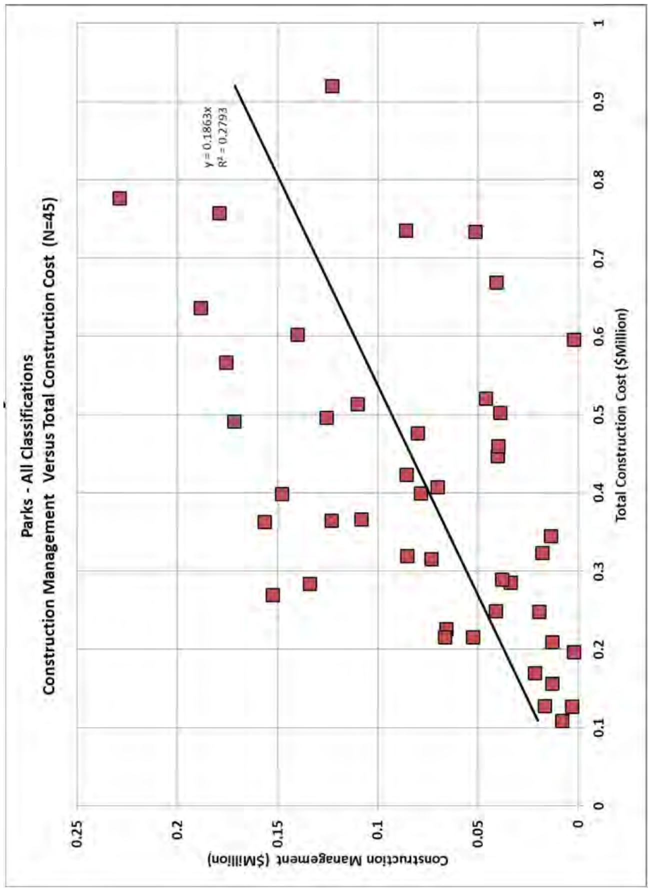

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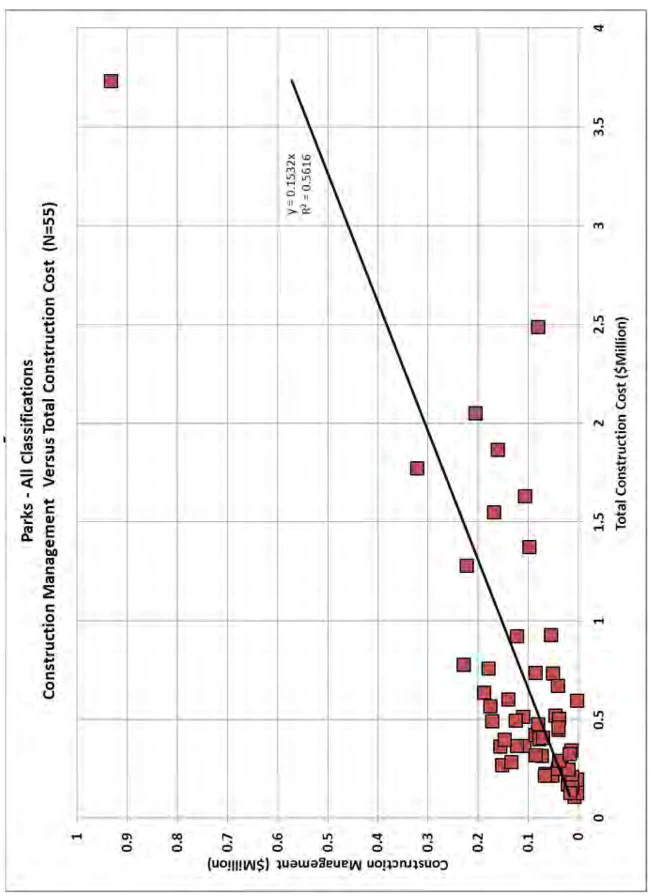

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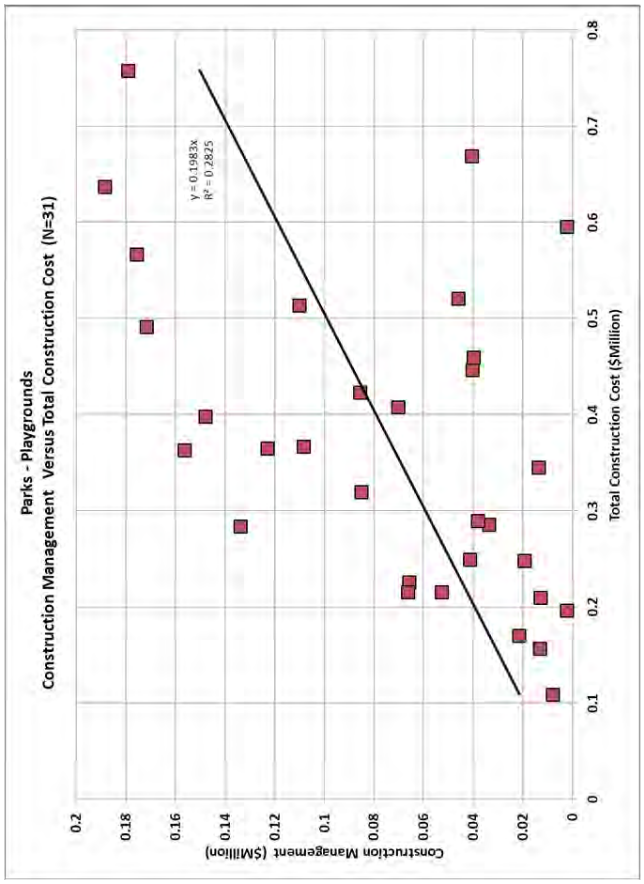

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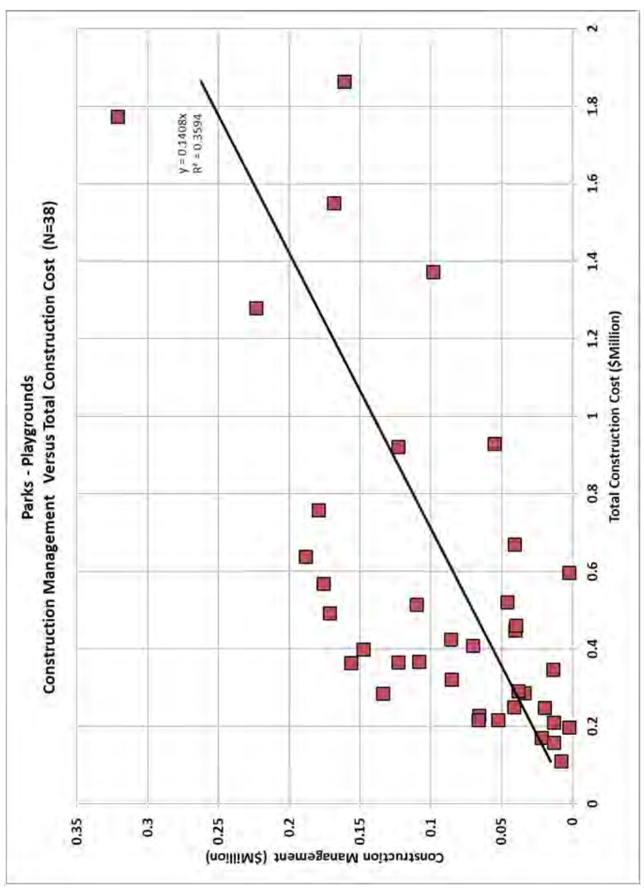

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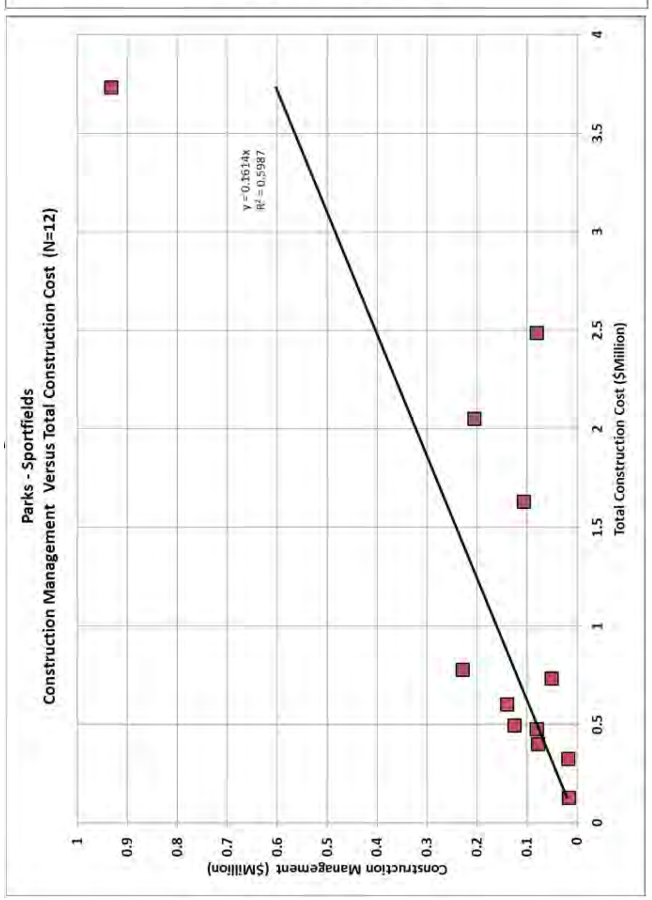

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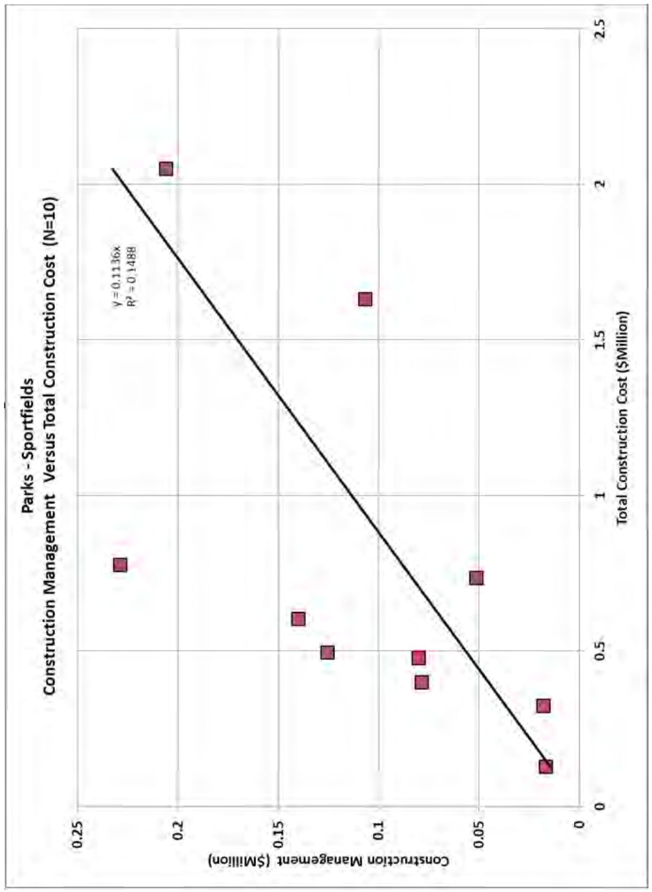

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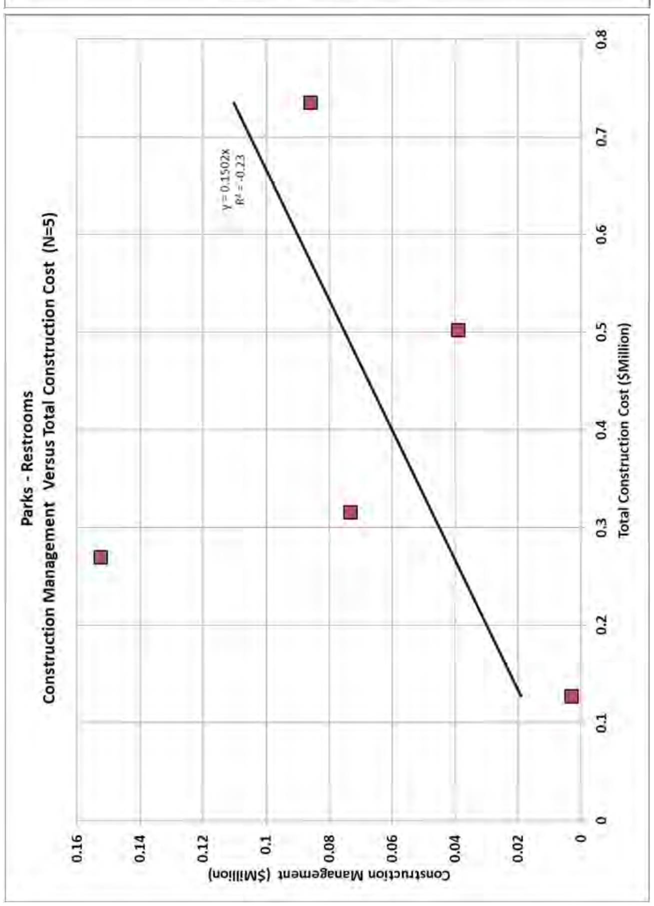

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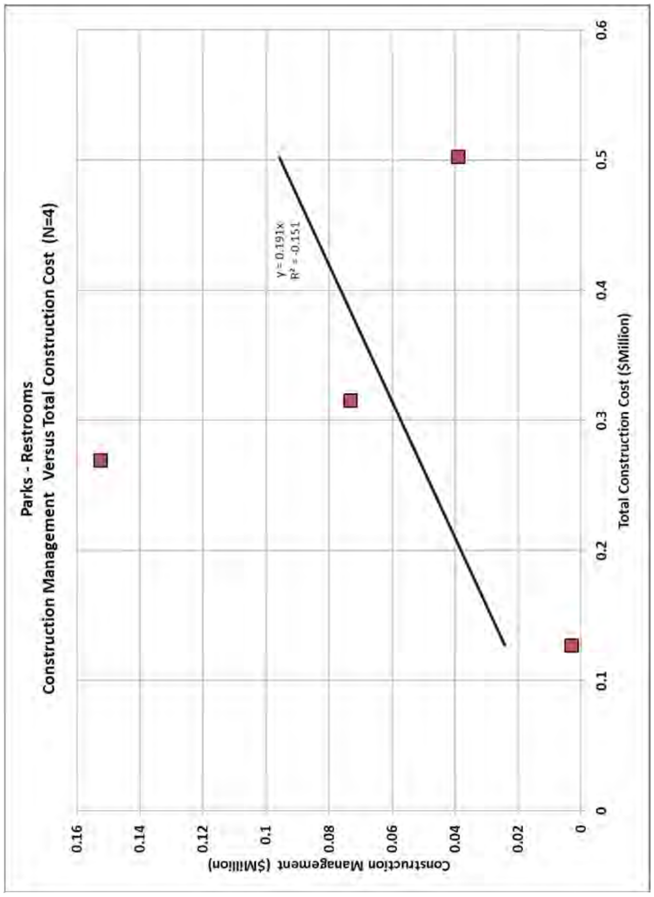
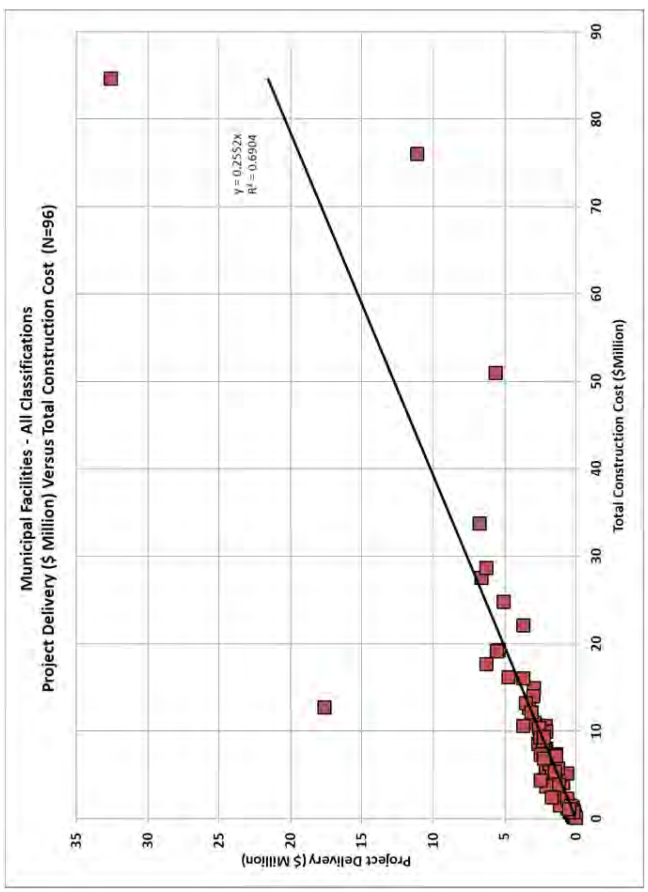


CURVES GROUP 3

Project Delivery Cost
vs
Total Construction Cost

All Projects



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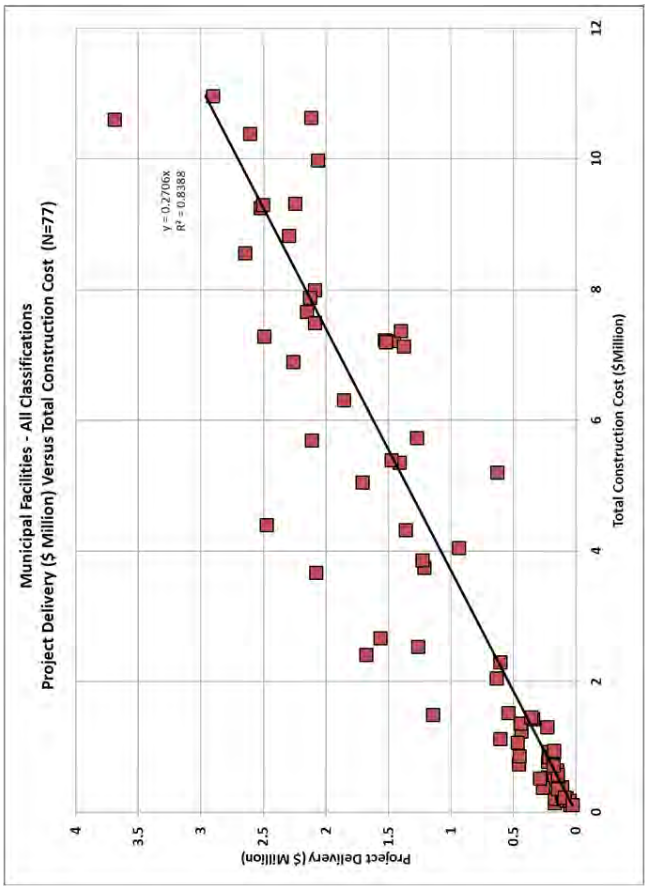
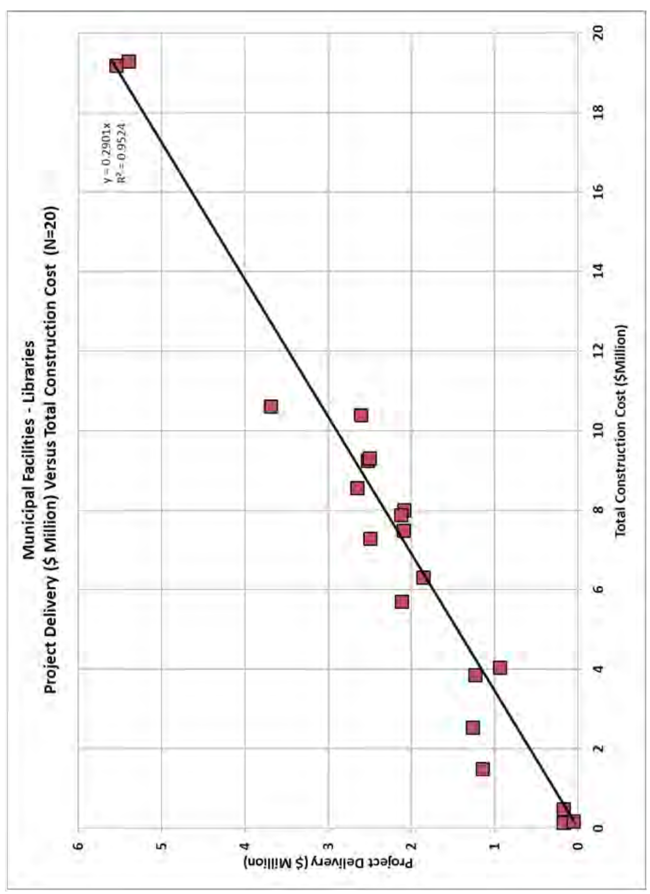


All Projects



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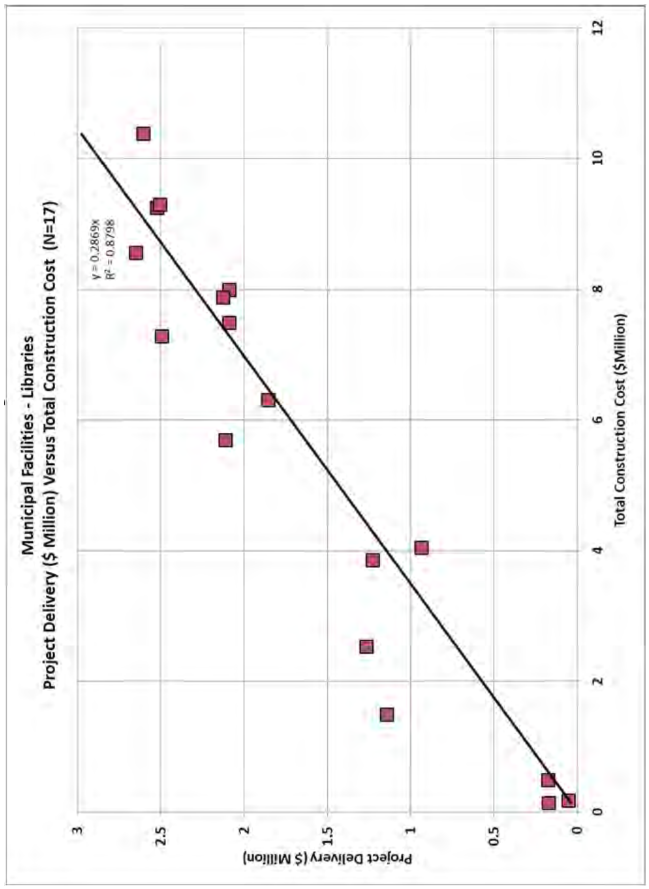

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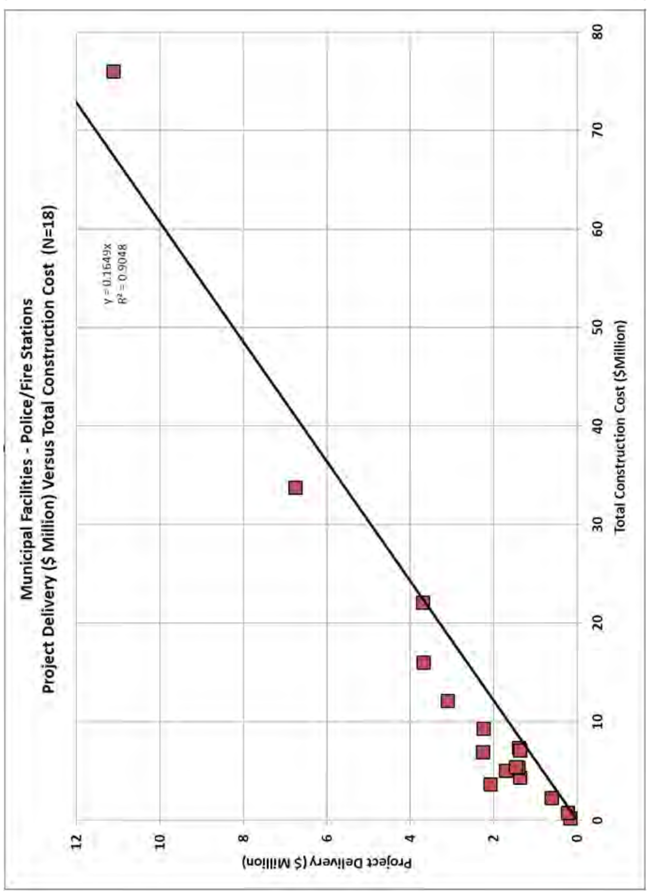

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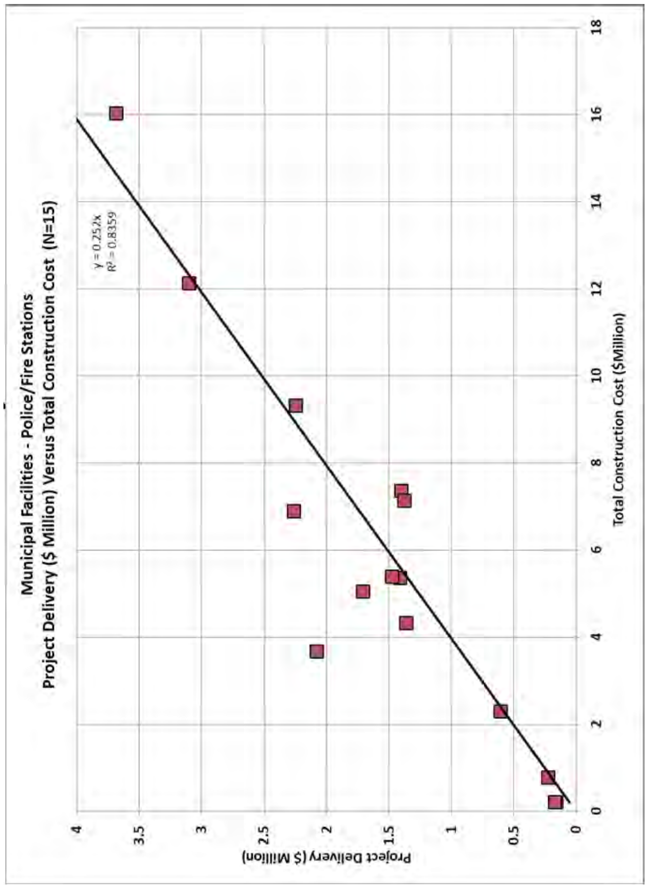

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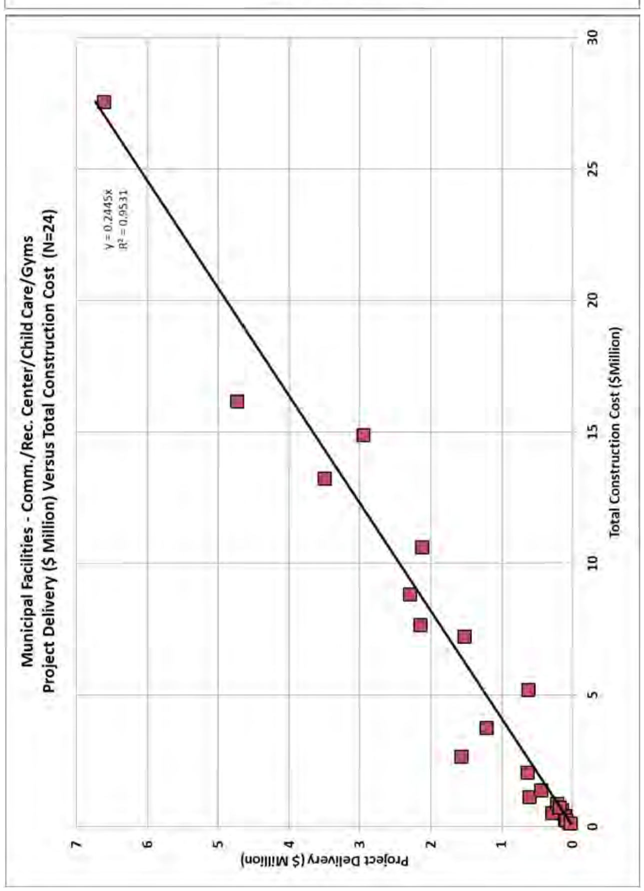

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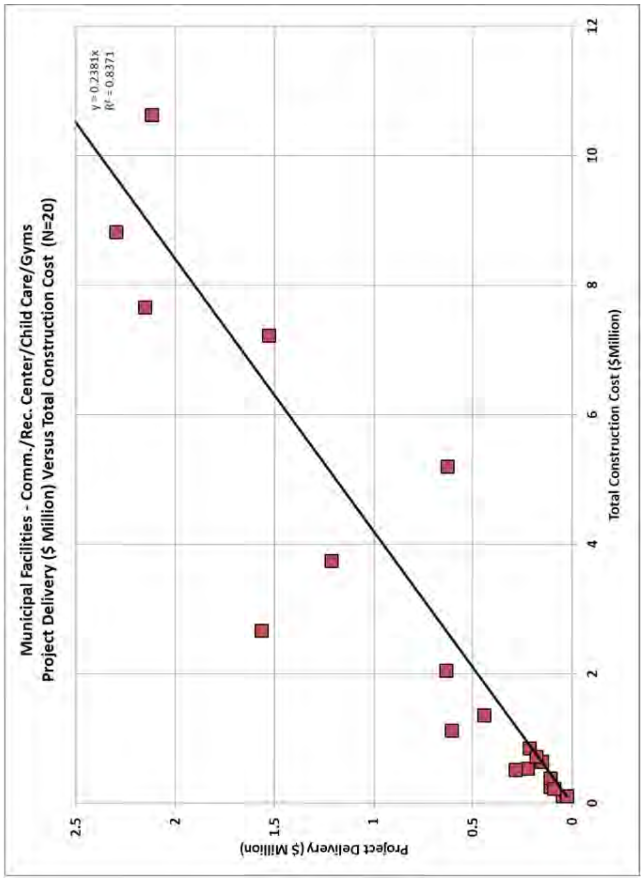

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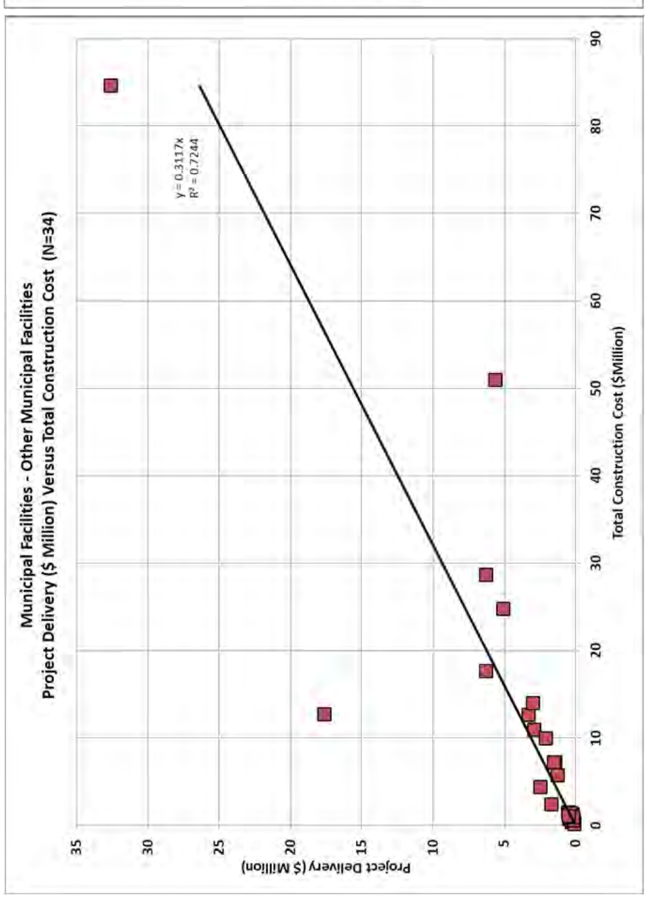

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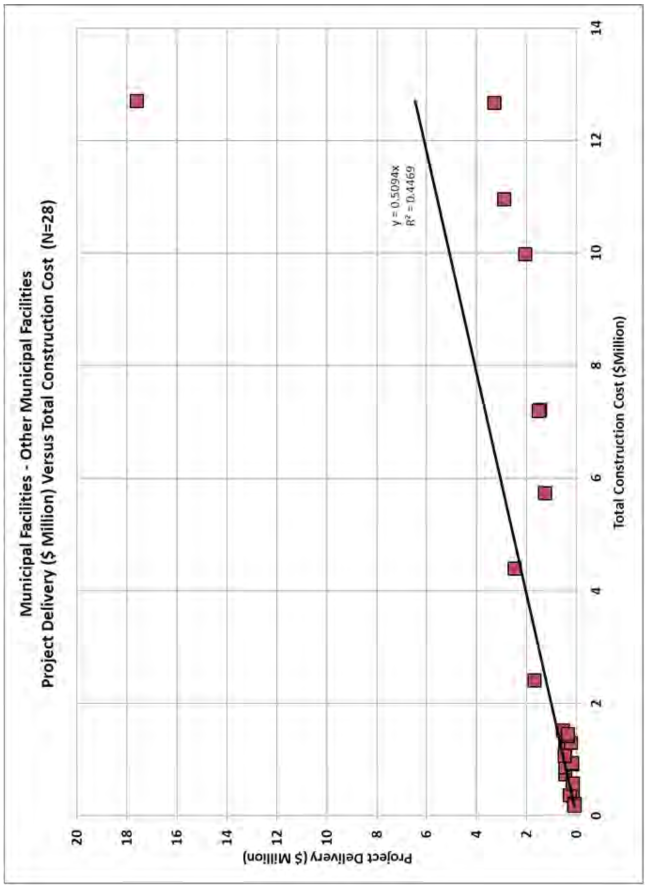

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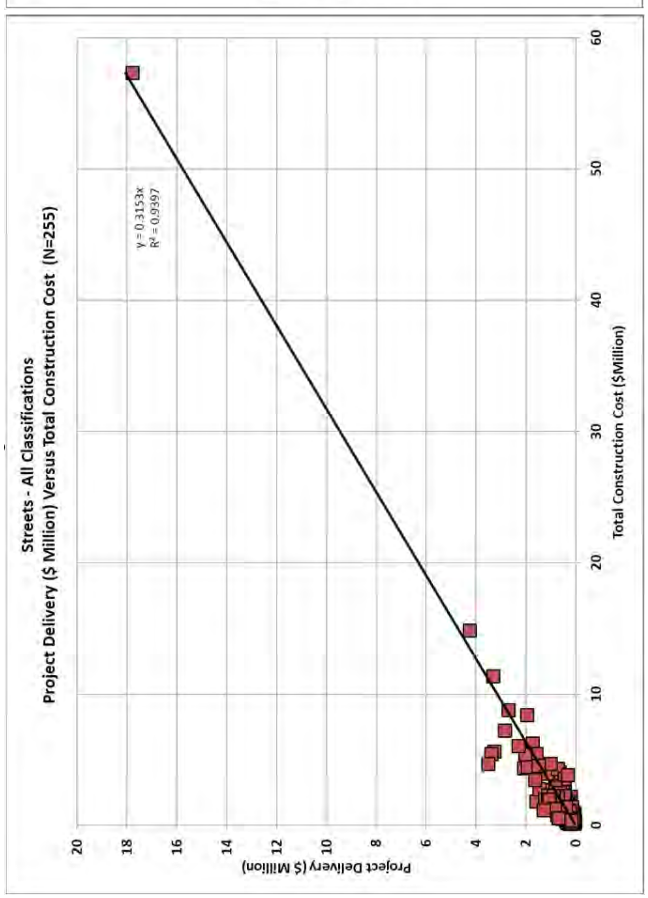

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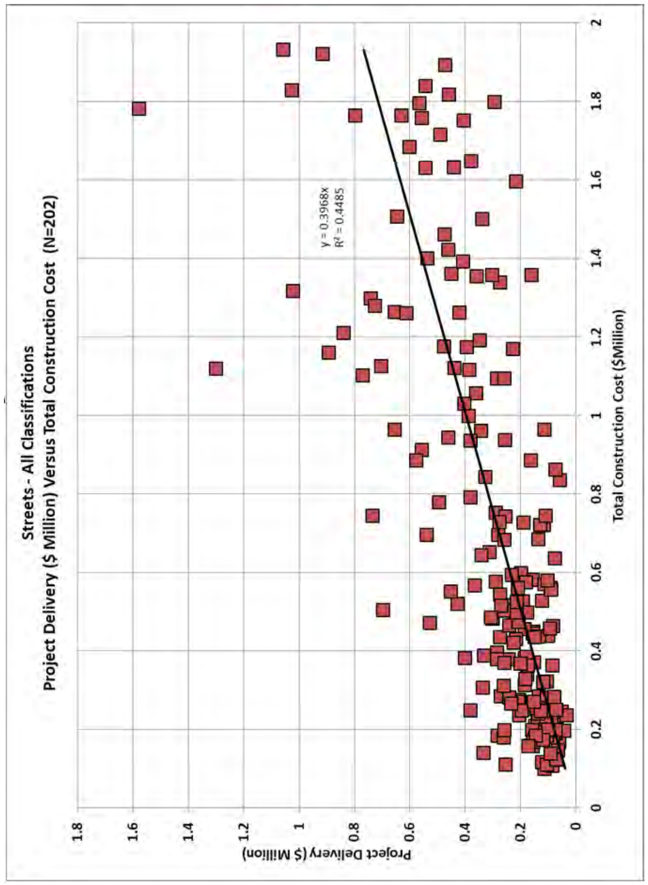

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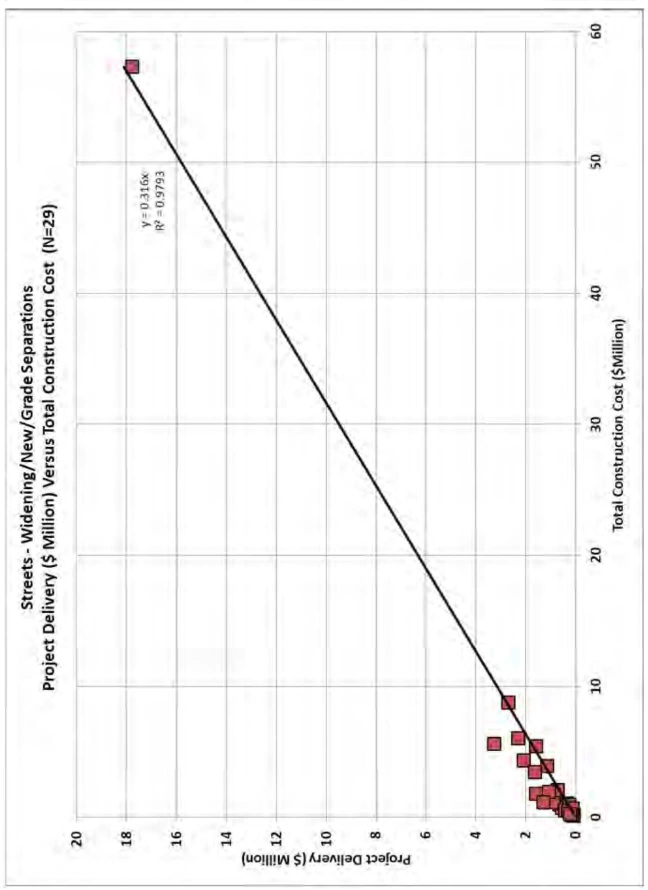

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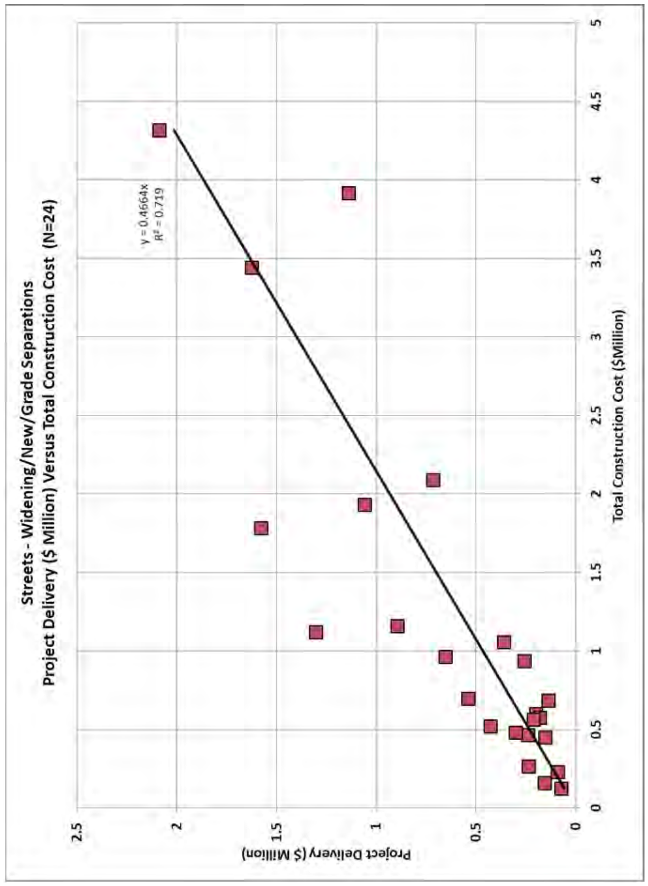

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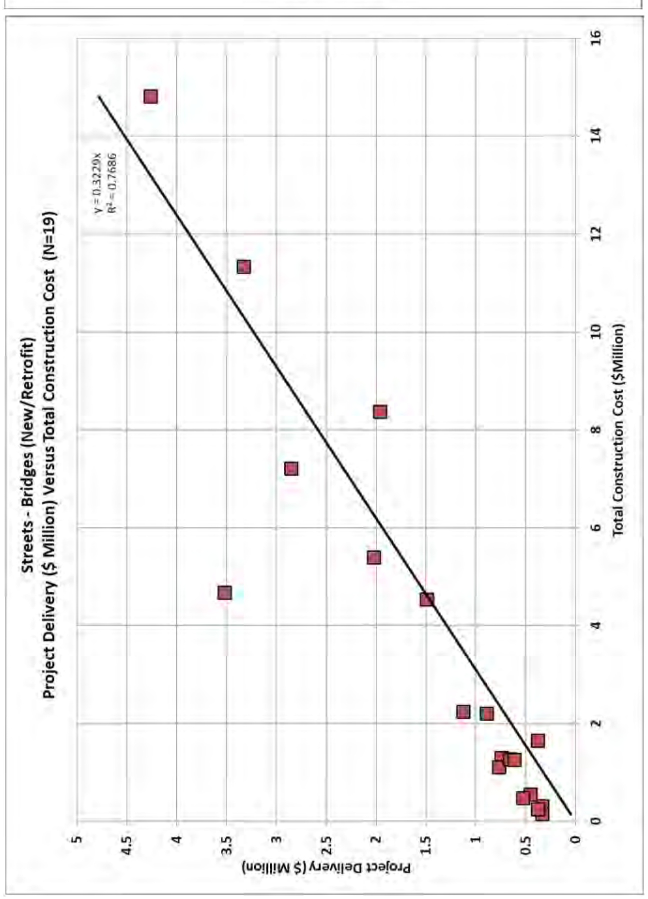

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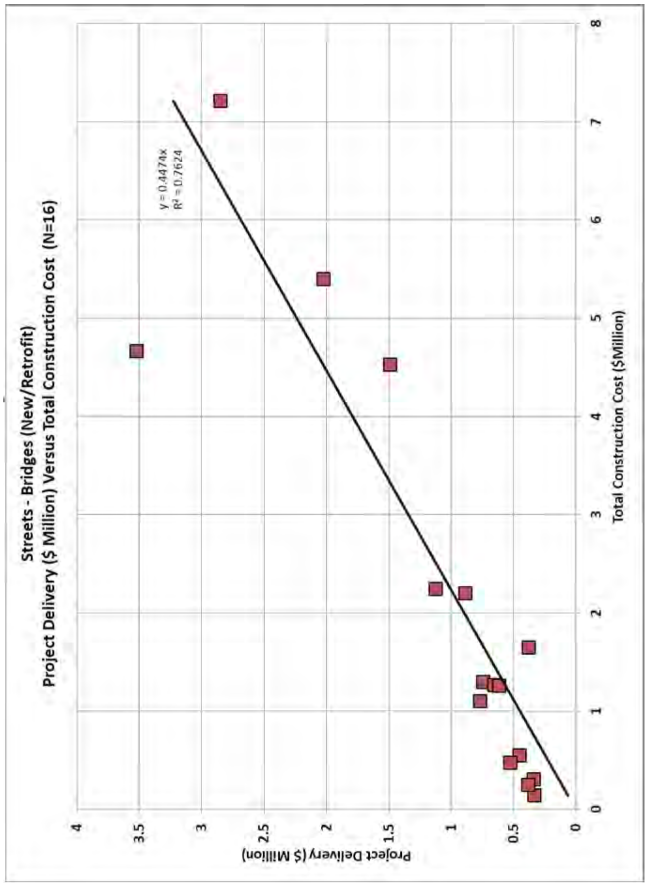

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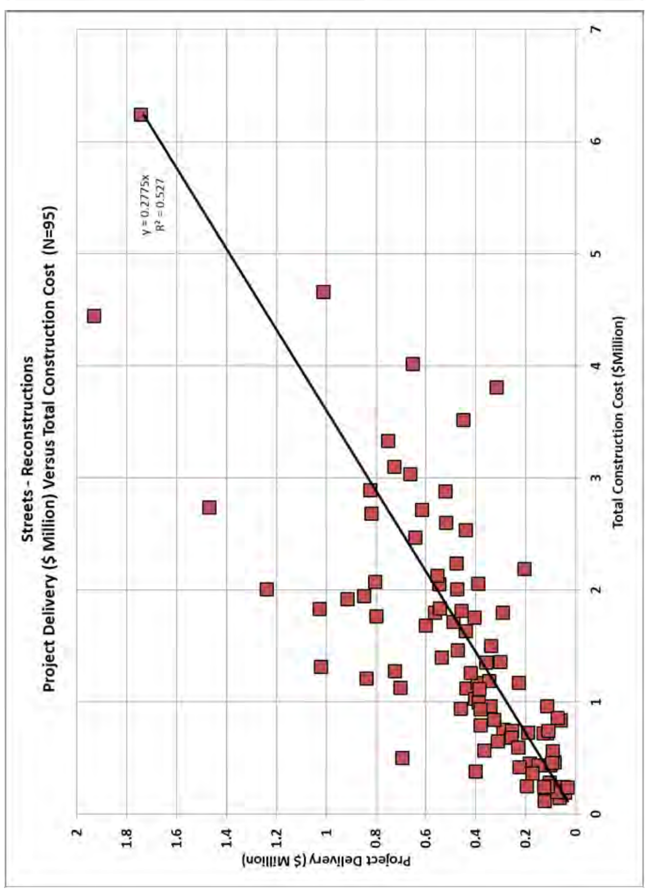

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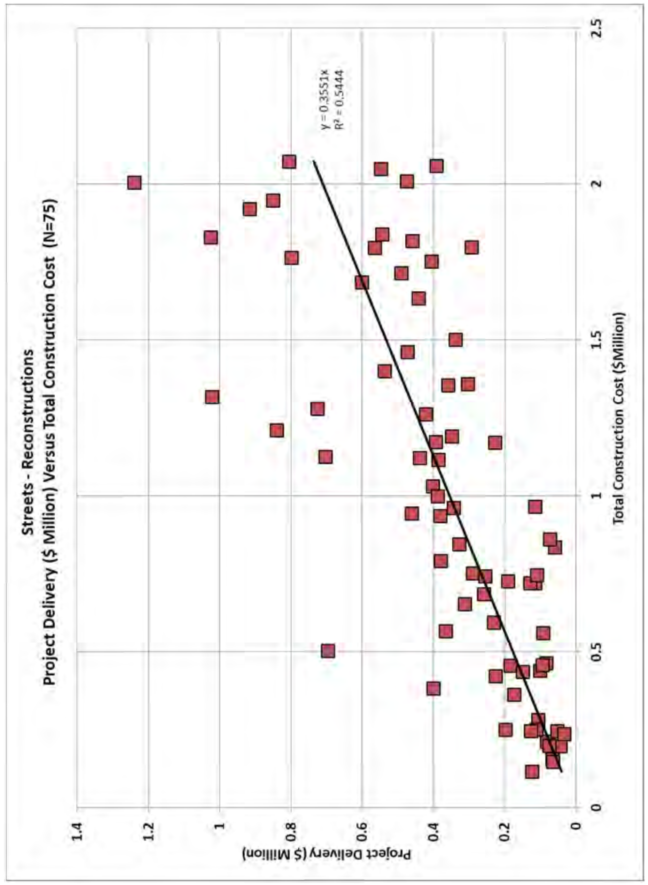

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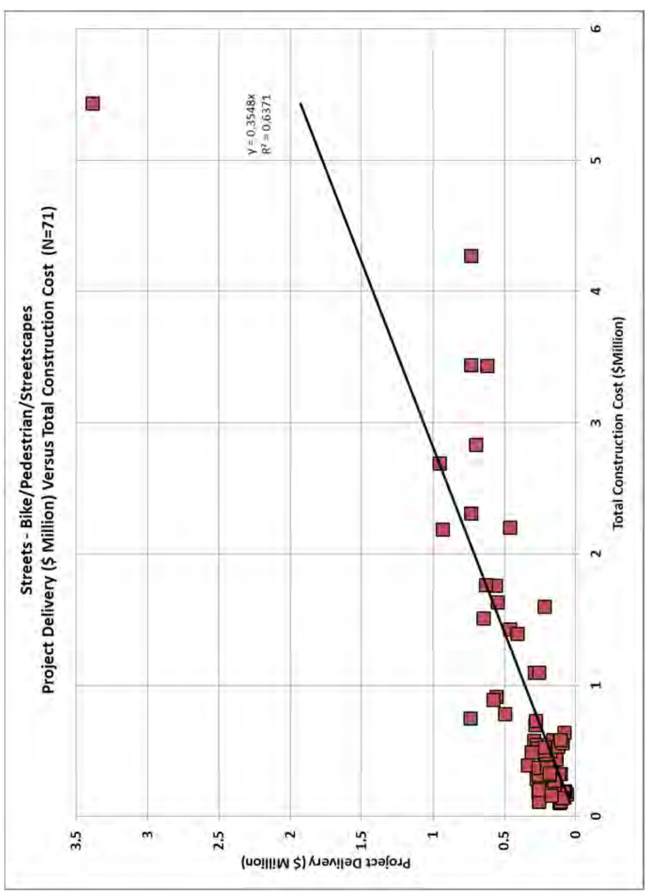

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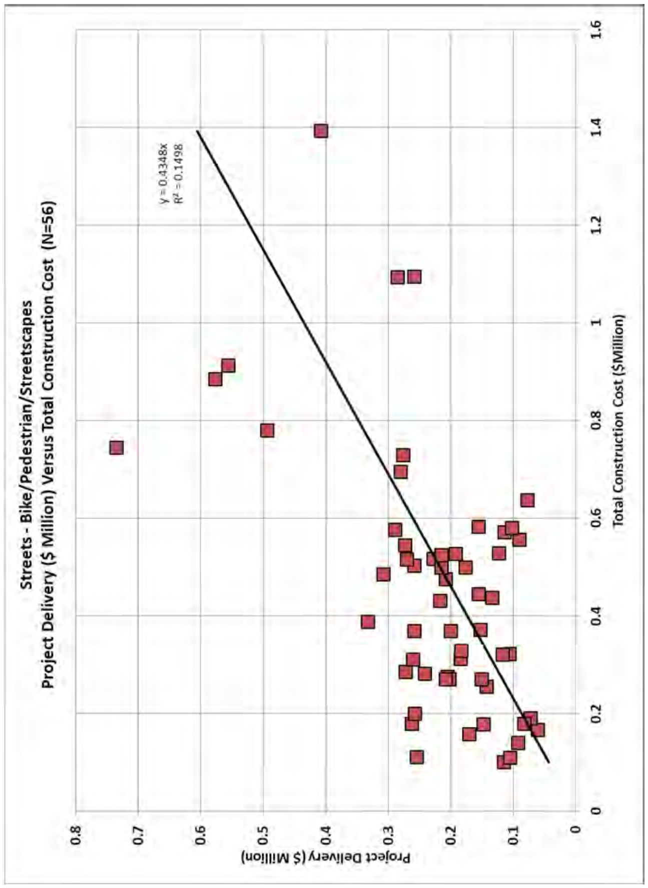

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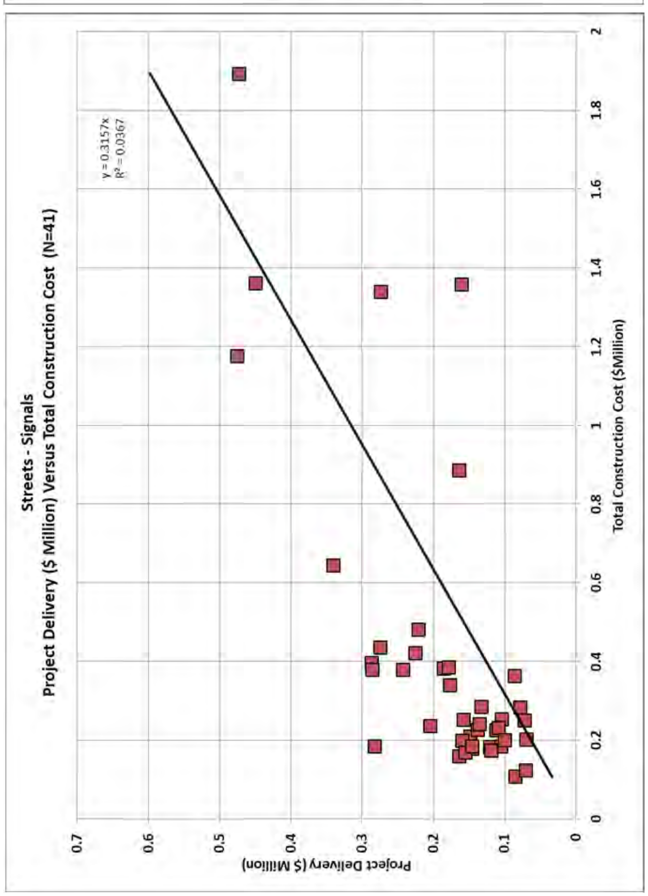

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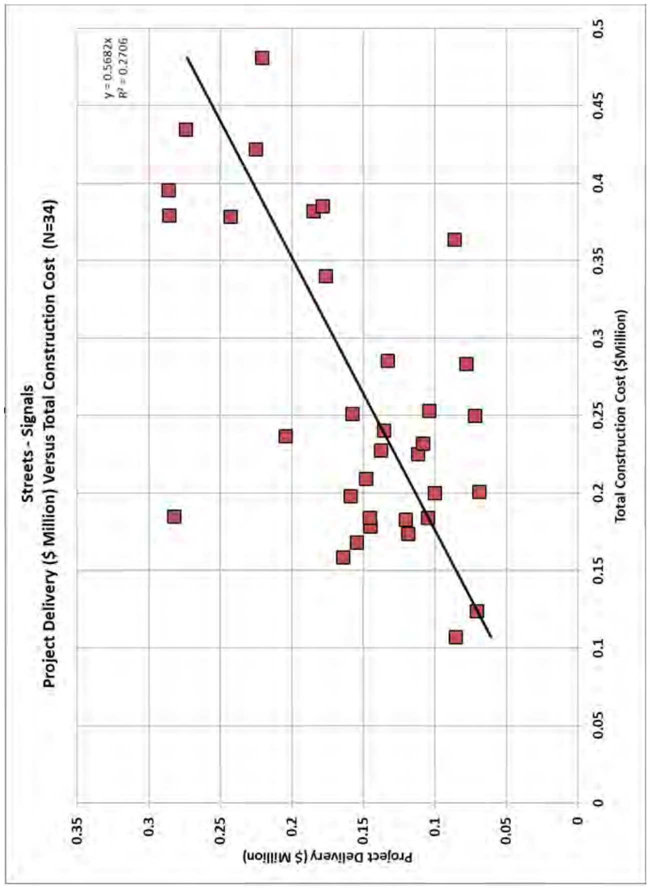

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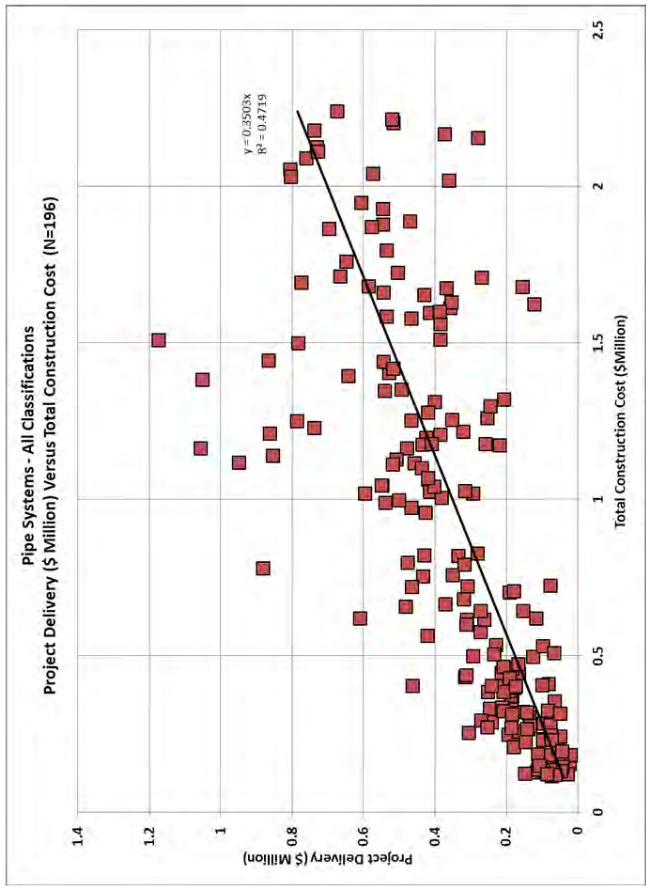

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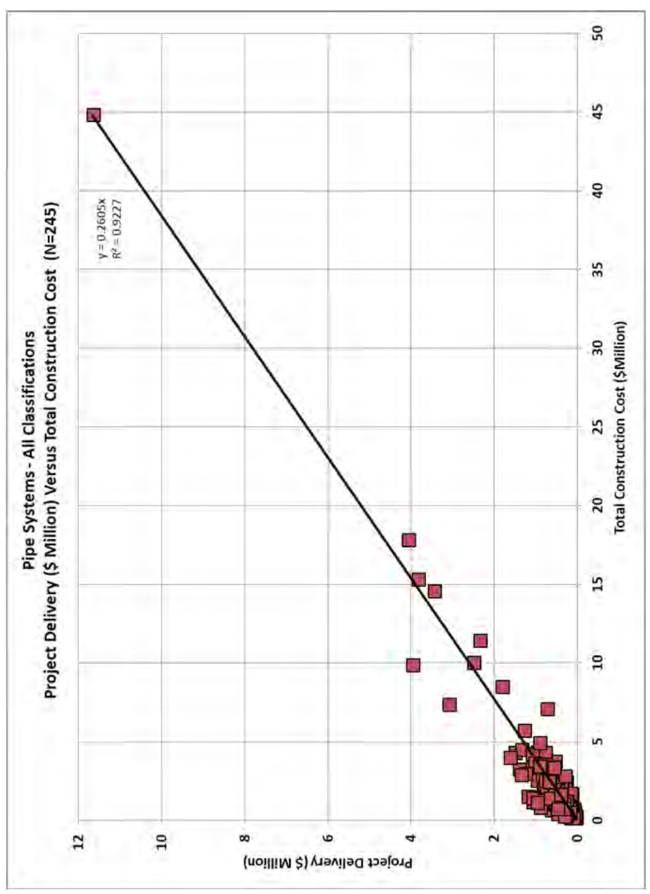

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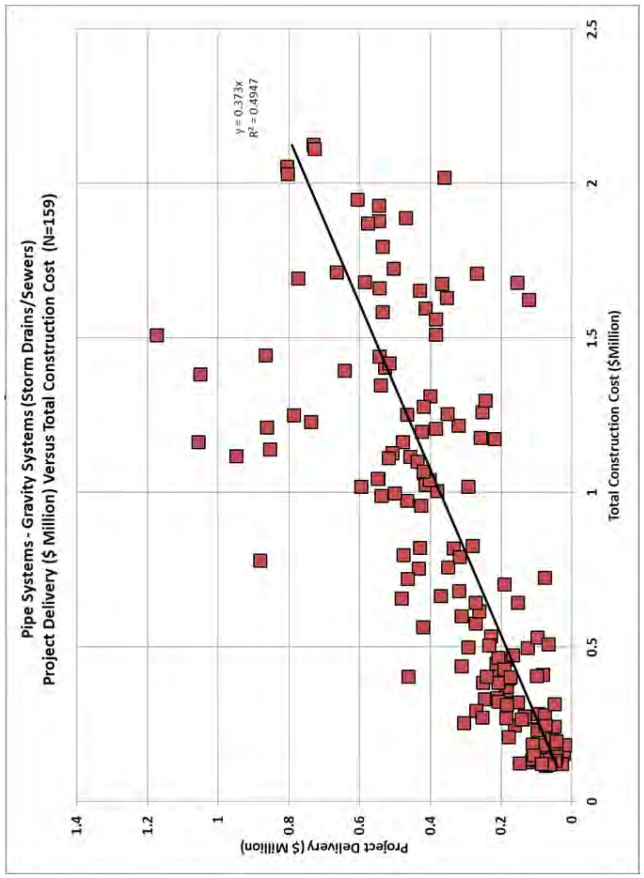

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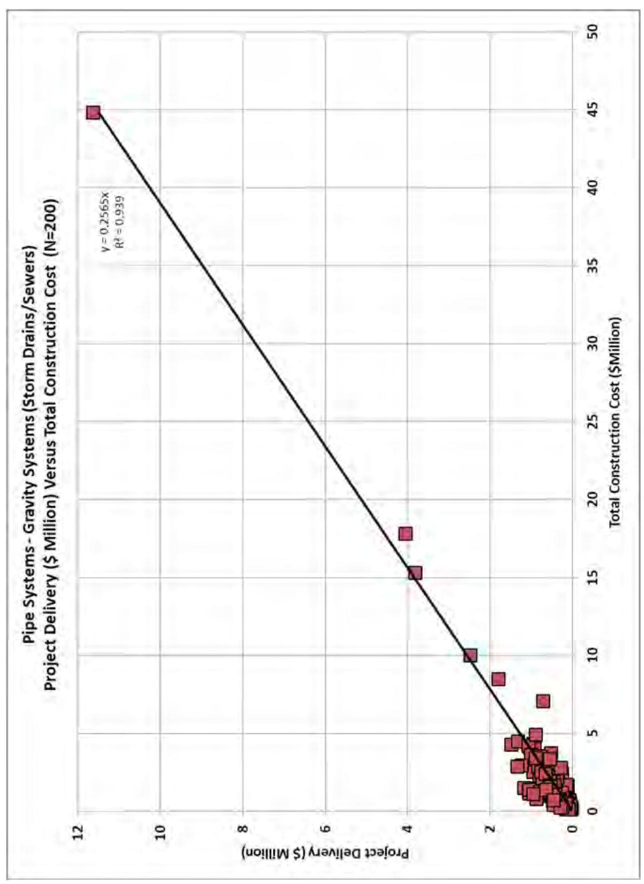

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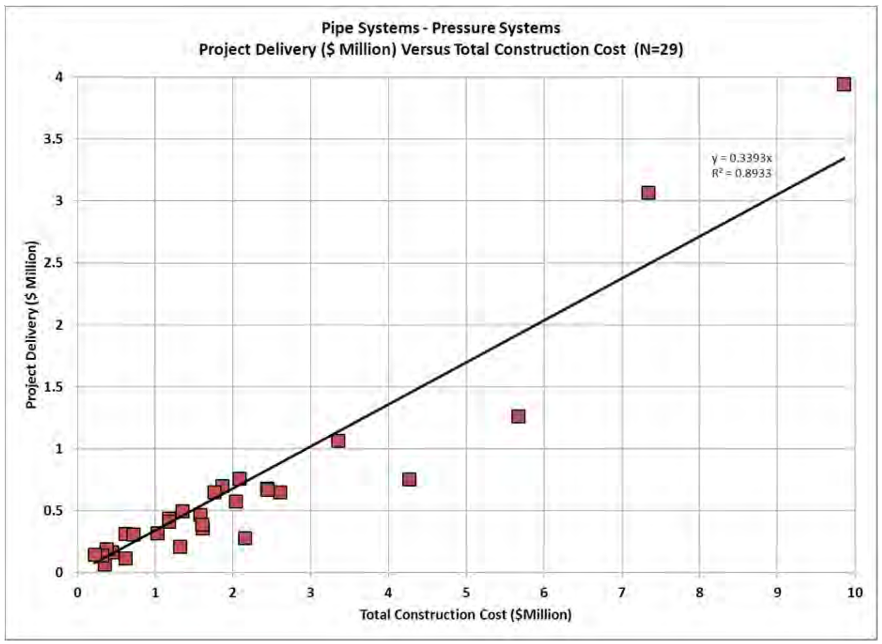

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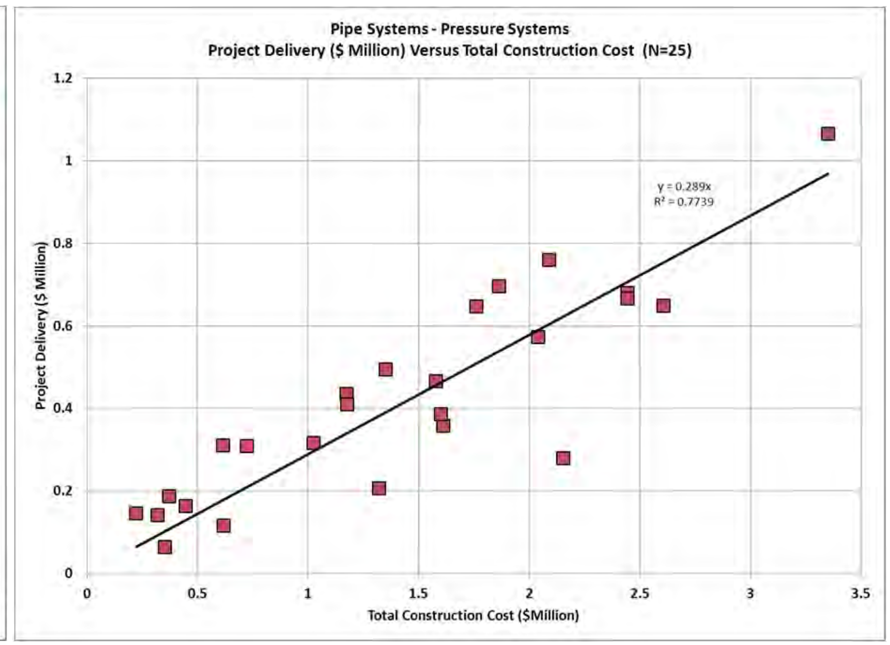

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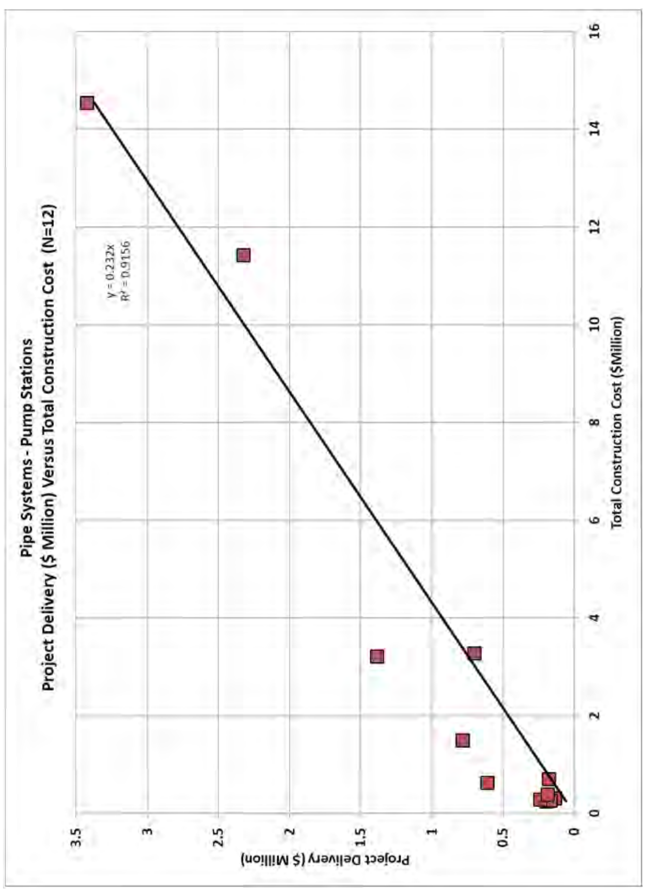

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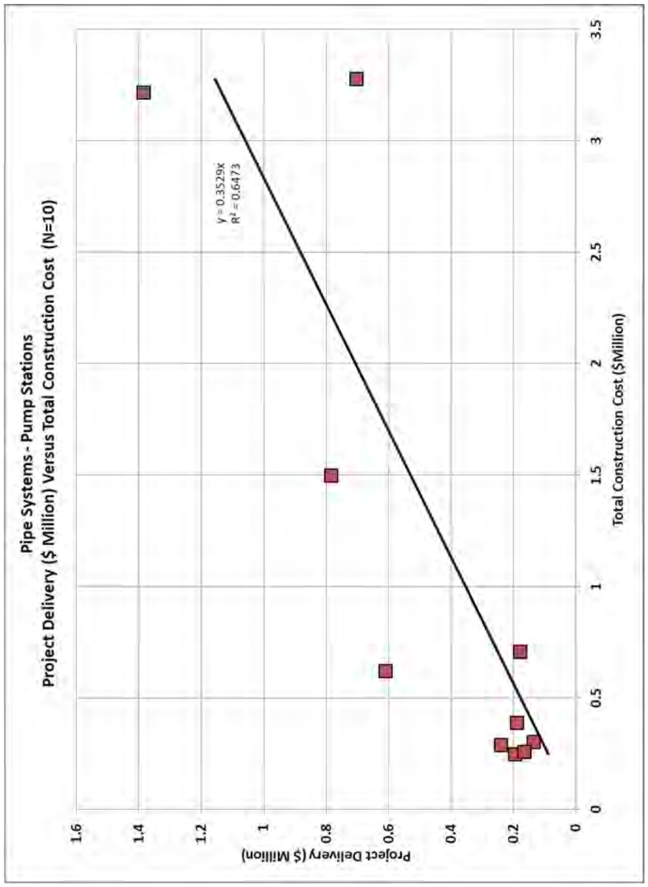

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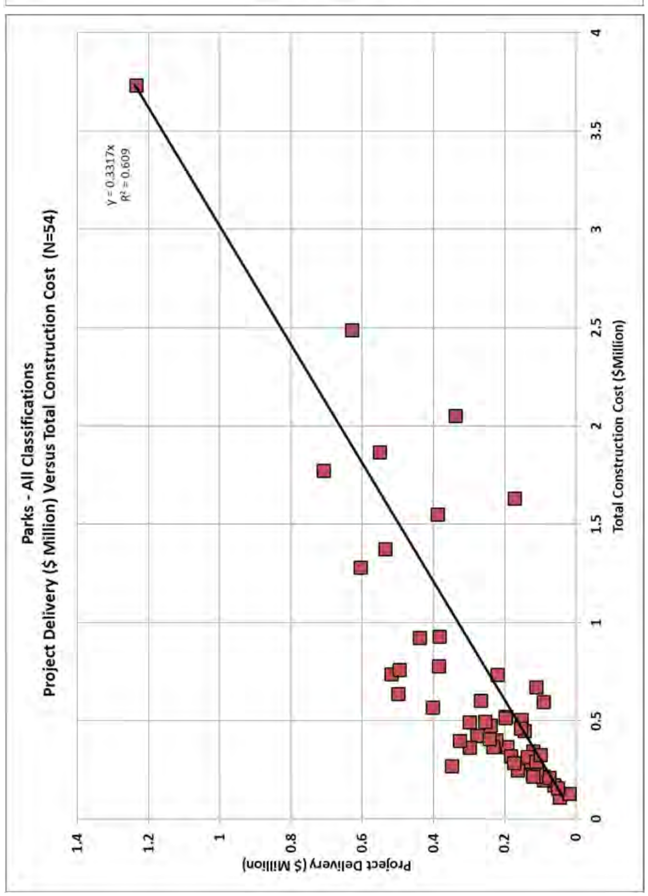

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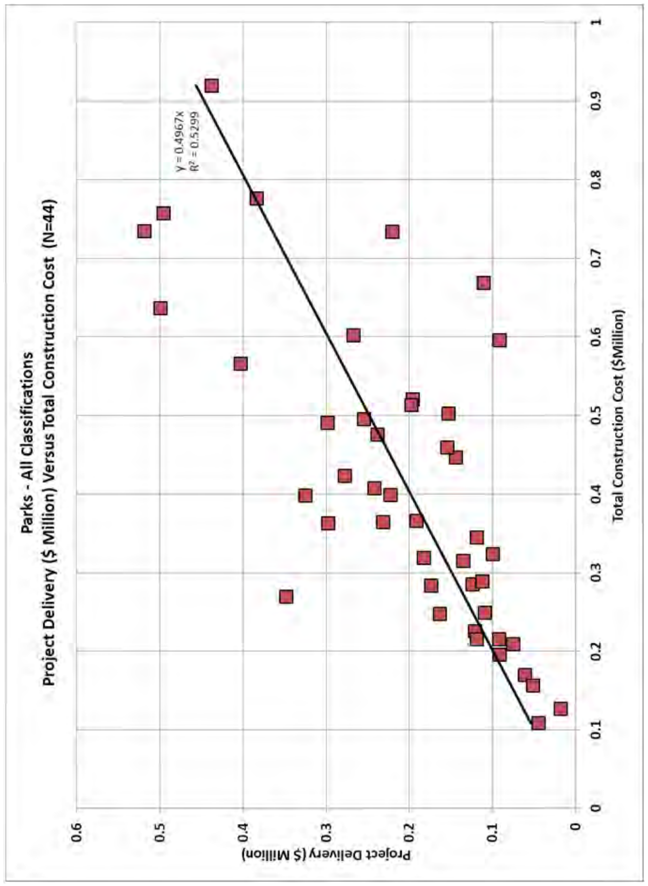

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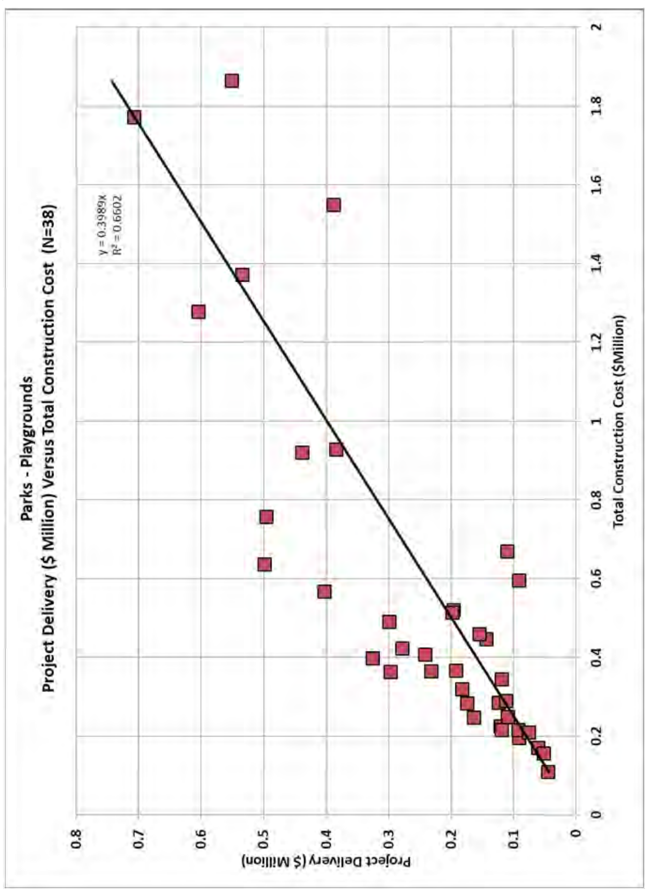

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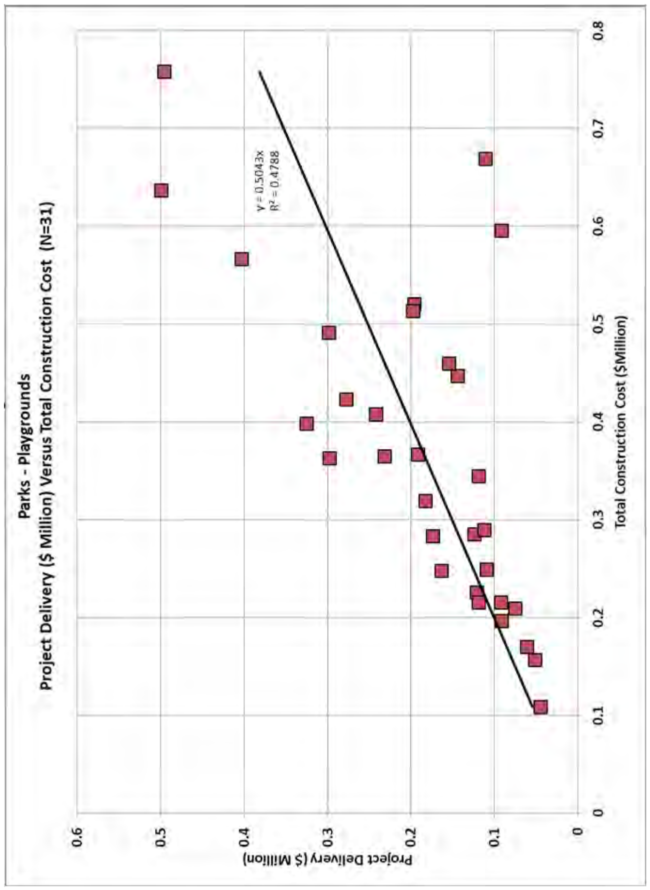

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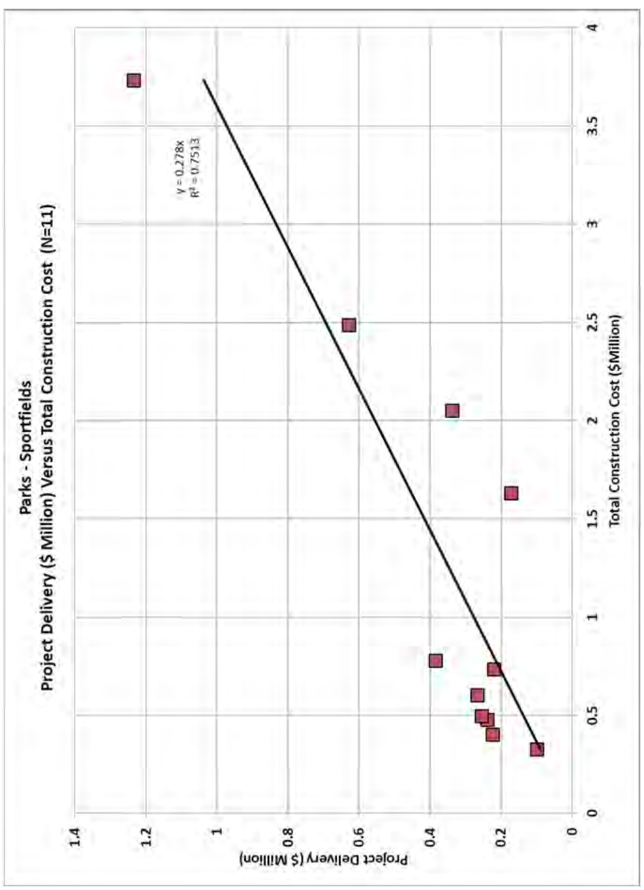

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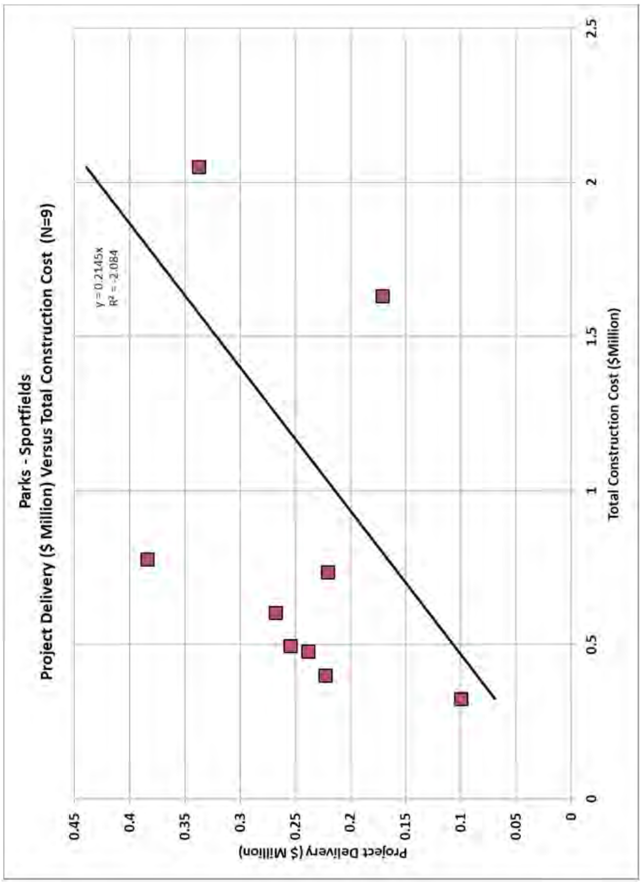

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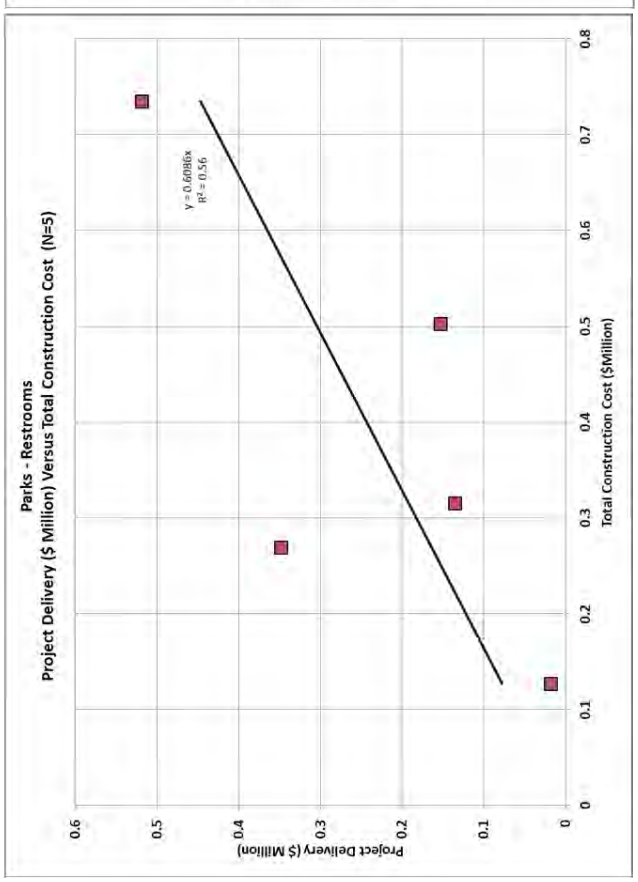

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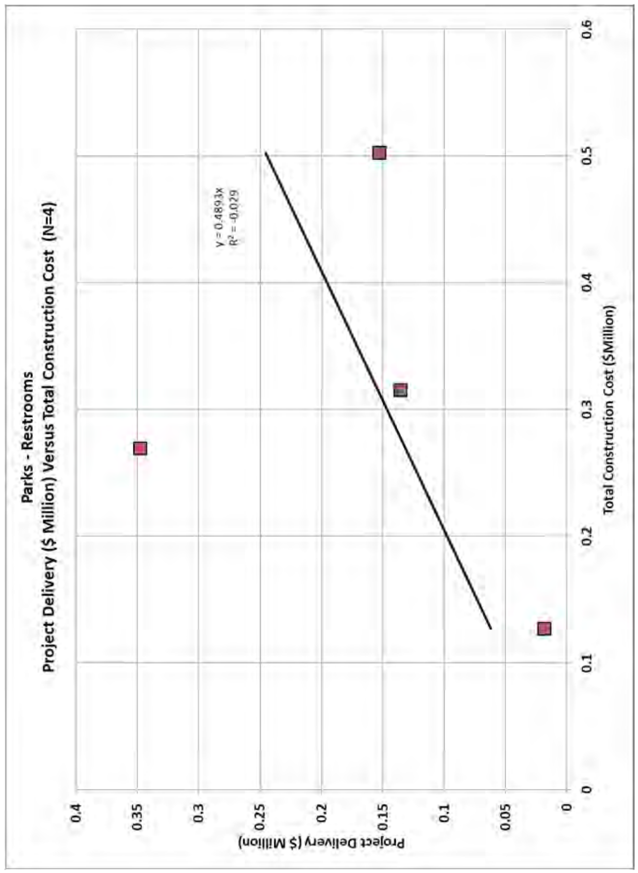

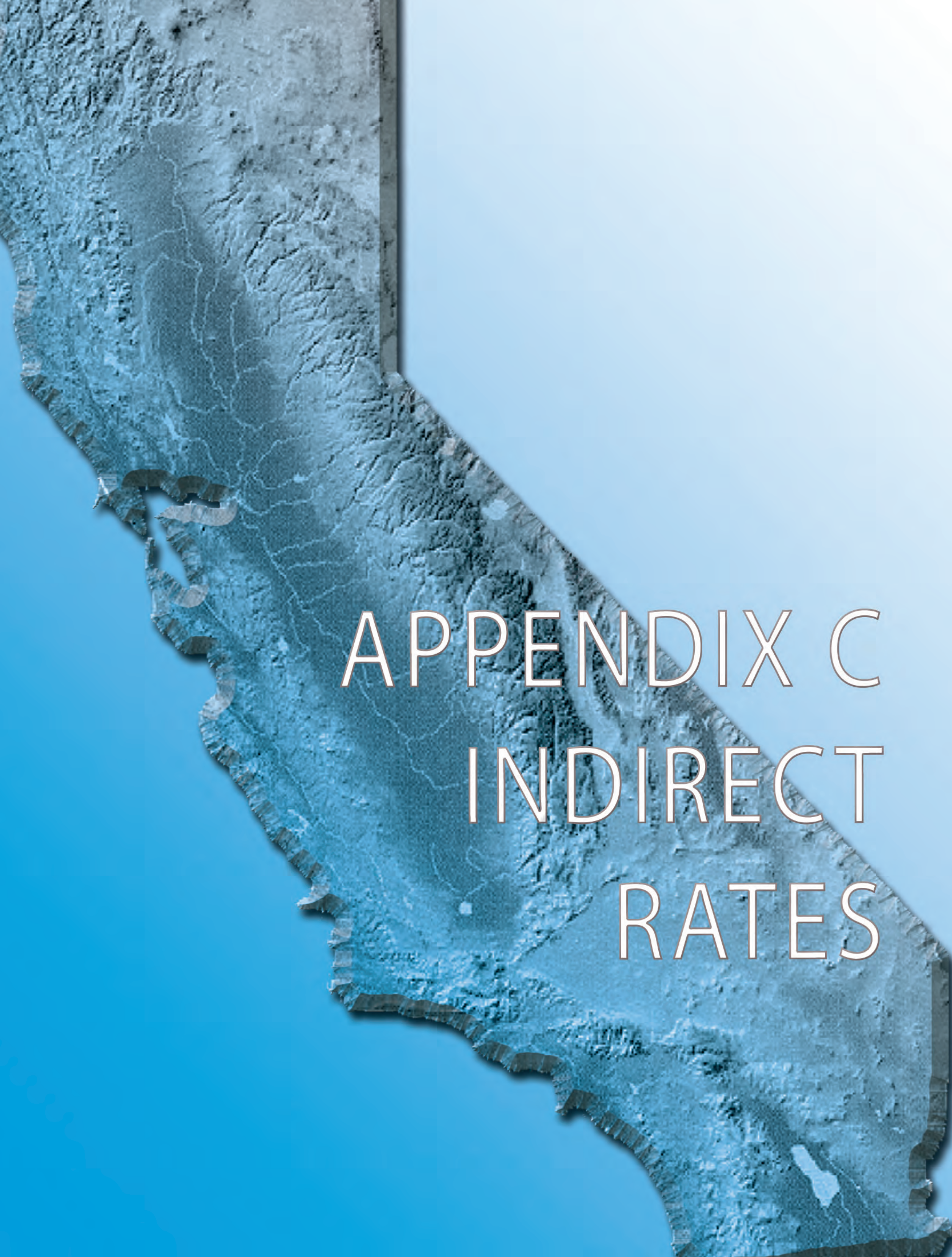

APPENDIX C
INDIRECT RATES

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%	5.53%	49.21%	149.63%	YES
City of Los Angeles Department of Public Works Bureau of Engineering[3]	32.08%	19.65%	20.81%	17.01%	61.43%	150.98%	YES
City of Oakland Department of Engineering & Construction	54.14%	21.65%	24.12%	28.95%	17.31%	146.17%	NO
City of Sacramento							NO
Department of Transportation (FY13 Budgeted)	42.28%	17.04%	28.36%	16.64%	73.40%	157.13%	
Department of Utilities	37.17%	18.70%	108.59%			164.46%	
City of San Diego Engineering and Capital Projects	61.75%	16.70%	0%	0%	90.80%	169.25%	NO
City and County of San Francisco Department of Public Works Bureau of Engineering Bureau of Construction Management Bureau of Architecture	36.00%	31.20%	0%	44.08%	60.23%	171.51%	NO
City of San Jose Department of Public Works (FY11-12)	62.63%	35.00%	40.83%	81.55%	Included	192.81%	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 2010 rates.
[3] Based on averages of all Bureau program overhead rates provided under CAP 32.

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/