CIP Benchmarking Study

California Multi-Agency CIP Benchmarking Study

Annual Report - Update 2010







Department of PUBLIC WORKS 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 2010

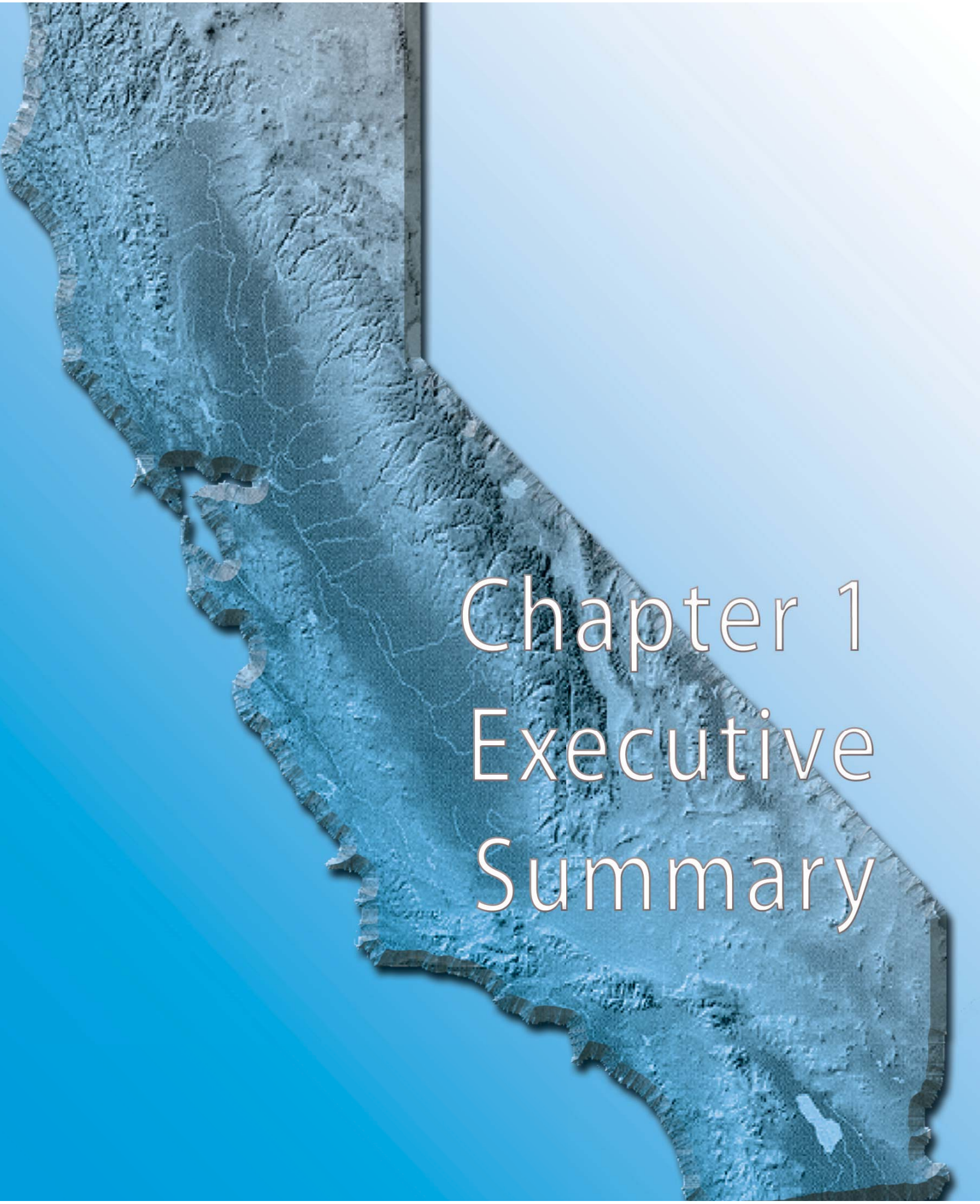
TOC

Table of Contents

CHAPTER 5 ONLINE DISCUSSION FORUM

CHAPTER 6 CONCLUSIONS

TABLES



Chapter 1 Executive Summary

CHAPTER 1 Executive Summary

A. INTRODUCTION

Governmental Agencies throughout the state and nation have endured a second consecutive year of difficult economic times characterized by budget cuts, diminished capital improvement programs (CIPs), and various forms of staff reductions ranging from hiring freezes to furloughs and from early retirements to layoffs. 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 ninth 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.

This year, the participating Agencies spent a substantial amount of effort sharing approaches to continue to provide high value implementation of their capital programs in the most efficient manner possible in the face of unprecedented fiscal hardships. The *Study* provides a forum for the Agencies to share information amongst themselves via quarterly 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. Through these acts of collaboration, often times an optimum solution is found that can be translated into a Best Management Practice (BMP) for the group.

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.

In this ninth year of the *Study*, the *Update 2010* participants have continued to pursue on-going endeavors, as well as taken on new ones:

- Continuation of the "Special Topic" roundtable discussion forums at Quarterly Meetings to explore areas of potential positive impact in relation to the current fiscal challenges;
- Continued use of the online discussion forum for efficient information sharing;
- Continued project performance data collection and analysis using improved techniques developed in the previous year;
- Collection of project data on alternative project delivery methods such as Design-Build, CM@Risk and Job Order Contracts (JOC);
- Delineation of BMPs amongst six perceived value categories;

- Tracking the adoption of BMPs; and

- Creating new BMPs targeted to common issues.

B. PERFORMANCE BENCHMARKING

Performance benchmarking involves collecting documented project costs and creating data models of the component costs of project delivery versus the total construction cost (TCC). Project delivery costs are defined as the sum of all Agency and consultant costs associated with project planning, design, bid, award, construction management, and closeout activities. The *Update 2010* performance curves have been developed from data on projects completed on or after January 1, 2005.

Performance Model

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 751 projects. All projects 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.
The Agencies received funding from the American Recovery and Reinvestment Act (ARRA) of 2009 for various projects. Since those projects were still on-going at the time of compiling project costs data for the *Update 2010 Study*, those projects are not included in the *Update 2010* database. It is expected that the Agencies would submit projects funded by the ARRA for analysis during the *Update 2011 Study*.

The performance database excludes project data older than five years or projects identified as outliers in the analysis. Projects identified as outliers are not included in the performance data analysis but are retained in the performance database.

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 18 projects have been excluded as outliers in the *Update 2010 Study* as compared to the elimination of 147 projects in *Update 2007* and 113 projects in *Update 2006*.

Table 1-1
Growth of Database

Study Phase[1]	Submitted	Deleted		Count After Deletions	Excluded		Net
	(a) Total	(b) TCC <$100K	(c) Non-Repre-sentative[2]	(d)=(a)-(b)-(c)	(e) Project Completion Date < 2004	(f) Outliers[3]	Projects in Analyses (g)= (d)-(e)-(f)
I	239	27	44	168	168	0	0
II	285	0	35	250	250	0	0
III	262	0	29	233	233	0	0
IV	173	18	21	134	126	4	4
V	182	0	3	179	52	3	124
VI	191	0	2	189	10	3	176
VII	158	0	2	156	12	3	141
VIII	155	2	4	149	7	2	140
IX	184	2	10[4]+1[5]	171	2	3	166
Total	**1,829**	**49**	**151**	**1,629**	**860**	**18**	**751**

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, and IX = 2010.

[2,5] 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.

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. The database application was used to select data and generate regression curves for the *Study*.

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% of the values are above and 50% 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)
2005	27	71	80	18	196	$1.72	$0.65	23%	17%	40%
2006	36	54	67	9	166	$2.76	$0.87	22%	17%	39%
2007	24	52	50	14	140	$2.95	$0.95	24%	17%	40%
2008	15	43	46	15	119	$2.40	$0.86	24%	17%	41%
2009	19	59	42	10	130	$1.65	$0.73	22%	17%	39%
Total	**121**	**279**	**285**	**66**	**751**	**$2.27**	**$0.76**	**23%**	**17%**	**40%**

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.

As indicated in **Table 1-2**, project size (measured as median TCC), increased significantly between 2005 and 2006 with an increase of approximately 30 percent. After spiking in 2006, median project size has declined approximately 15 percent between 2006 and 2009. The average TCC also declined steadily between 2006 and 2009, with a large decline of 43 percent from 2008 to 2009. This 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. Project delivery costs measured as a percentage of the TCC declined slightly from 2005 to 2006, but then increased back to 2005 levels in 2007. The project delivery percentages have remained stable since 2007.

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.

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 market competition. For example, presently actual bid amounts have been depressed by competitive forces associated with the current recession. This will result in the rise of delivery cost as a percentage of TCC as TCC is depressed. The result may be noticed in the coming years as these projects are completed and reported into the database. The Agencies acknowledged that the impacts of low-construction bids on project delivery costs needs to be analyzed during future *Study* years as the numbers of projects completed during the recession increase in the database.

Table 1-3
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	21%	15%	35%	3.09	216
Parks	25%	16%	41%	0.37	66
Pipe Systems	19%	16%	35%	0.73	285
Streets	27%	19%	45%	0.56	279
Average	**23%**	**17%**	**40%**	**0.68**	**751**

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.

Projects belonging to the Pipes and the Municipal categories have the lowest average project delivery cost. The Pipes category has the maximum number of projects (n = 279) in the *Update 2010* database. The Streets category also has a similar number of projects in the database (n = 285). 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 40 percent.

Over the course of the *Study*, the gencies 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. This step was taken as it was generally believed that project delivery efficiencies for larger projects were different than for smaller 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 1-4
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	23%	16%	38%	3.09	97
Parks	26%	17%	43%	0.37	53
Pipe Systems	20%	17%	38%	0.73	228
Streets	28%	20%	48%	0.56	223
Average	**24%**	**18%**	**42%**	**0.68**	**601**

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.

Consultant Usage Analysis

Project delivery performance and consultant usage by Agency are presented in **Table 1-5**. The table indicates that approximately 56 percent of the design work and approximately 81 percent of the construction management efforts are completed in-house by the participating Agencies. Consultants account for approximately 32 percent of the total project delivery costs while in-house efforts by the participating Agencies accounts for the remaining 68 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[2,3]	In-House		Consultants		Total % of TCC	In-House		Consultants		Total % of TCC by Project[4]	Total % of TCC by Program[5]	Average	Median
	($M)	% of Design[1]	($M)	% of Design		($M)	% of CM	($M)	% of CM		($M)	% of PD	($M)	% of PD				
Agency A	28.6	47%	31.8	53%	26%	30.8	67%	15.2	33%	16%	59.4	56%	47.0	44%	42%	36%	3.4	0.7
Agency B	10.1	50%	10.2	50%	17%	11.1	65%	5.9	35%	12%	21.2	57%	16.0	43%	30%	27%	1.4	0.5
Agency C	26.4	91%	2.6	9%	17%	25.9	98%	0.6	2%	16%	52.3	94%	3.2	6%	34%	32%	1.6	1.2
Agency D	52.9	54%	44.4	46%	24%	72.9	81%	16.9	19%	19%	125.7	67%	61.3	33%	43%	30%	4.4	1.4
Agency E	3.3	31%	7.3	69%	11%	6.7	74%	2.4	26%	11%	9.9	51%	9.7	49%	22%	32%	2.3	0.7
Agency F	31.1	58%	22.5	42%	26%	42.3	87%	6.4	13%	24%	73.4	72%	28.9	28%	50%	32%	1.9	0.4
Agency G	11.6	60%	7.6	40%	26%	7.5	100%	0.0	0%	12%	19.1	71%	7.7	29%	38%	31%	0.8	0.4
OVERALL	**163.9**	**56%**	**126.3**	**44%**	**23%**	**197.2**	**81%**	**47.4**	**19%**	**17%**	**361.1**	**68%**	**173.8**	**32%**	**40%**	**31%**	**2.3**	**0.7**

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.

[4] Represents project delivery percentages which are the arithmetic averages of the project delivery percentages for the individual projects in the database. Refer to **Appendix B** for detailed explanation on how the percentages are computed.

[5] Represents project delivery percentages for a program of projects. Refer to **Appendix B** for detailed explanation on how the percentages are computed.

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 higher 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**. Given all these improvements to the analysis of the data, the reader is advised that direct comparison of results between *Update 2010* and previous years may be more difficult due to these improvements.

Regarding the evaluation of projects in different size ranges, in most cases, the results reflect the Agencies' experience. On a percentage basis, projects with lower TCCs are more expensive to deliver than projects with higher TCCs. Only four 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 current downturn in the economy, Agencies are receiving bids that are significantly below market rates. The following discussion summarizes the trends observed in recent construction bids for some of the participating Agencies.

- The City of Los Angeles noticed a decline in the rehabilitation cost per linear feet of sewer pipe for their sewer program.

- The City of Sacramento utilizes Rubberized Asphalt Concrete (RAC) for all Street Overlays. The City noticed that RAC costs have declined from $120 per ton in 2008 to $87 per ton in 2010. Similarly, the City also noticed that costs for concrete sidewalks (4-inches thick) have declined from $9 per square feet to $5 per square feet over the past few years.

- The City of Long Beach has noticed an approximately 12% drop in current bid prices over those received two years ago. This would include street work, park construction as well as small facilities such as restrooms, teen centers, fire stations, etc.

- The City of San Jose has been experiencing "below-market-rate" bids since late 2007/early 2008. In studying the trend, the City found that during the period from July 2008 to June 2009, the City received an average of about 8 bids per project and on an average the low bid was approximately 21 percent lower than the engineer's estimate. From July 2009 to June 2010, the City received an average of about 10 bids per project and on an average the low bid was approximately 27 percent lower than the engineer's estimate. In addition to these data, the City has noticed an increase in bid protests.

- The City and County of San Francisco has noticed that bids have dropped from being 109 percent of the engineer's estimate in 2005 to approximately 79 percent of the engineer's estimate in 2010 for their joint sewer and paving projects.

- The City of Oakland also noticed a decline in construction costs over the past few years.

The impacts of these low construction bids on project delivery percentages need to be evaluated. It is very likely that project delivery percentages might increase 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 bound to increase with a reversal in the economy.

Project Database Challenges

In addition, 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 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.

The Project Team will identify and evaluate ways to address these issues as the *Study* continues in future phases.

E. BEST MANAGEMENT PRACTICES

At the start of the *Study*, nine years ago, the Agencies examined over 100 practices used in project delivery. Included in the *Study* are those practices that the *study* participants did not commonly use at that time, but believed should be implemented as BMPs. Each year new BMPs are added, and in some cases existing BMPs are reworked by the Agencies to address specific challenges they encounter. BMPs are also added or modified to reflect relevant experiences by the participants. Agency implementation of these selected practices has been and will continue to be tracked during the *Study*.

New to this year's report is the addition of Perceived Values of each BMP. While an exact measurement of each BMP's value to each Agency may not be achievable, the Agencies felt the need to document what they believe the perceived value was to them. In this year's first quarterly meeting, the *Study* Team identified the following Perceived Value categories:

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

In *Update 2010*, the Project Team added three new BMPs to the BMP tracking list. The BMPs were developed during quarterly meetings or via on-line discussions held throughout the year. The new BMPs are:

- 2.q.2010 – Receive bids electronically.
- 4.IV.b.2010 – Implement electronic contract payment process.
- 4.IV.c.2010 – Agency should file As-built drawings within 6 months of project completion.

These BMPs are believed to directly influence cost, schedule, quality, communication, environment, or 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.

- Allowable Contractor Mark-ups on Change Orders
- Electronic Bidding, Security Measures, and Contract Processing
- Exceptions to Design Standards
- Traffic Control Plan

- Checking Authenticity of Bonds
- Mobilization
- Consultant Rate Reductions
- Posting of Prevailing Wage Rates in Bid Specifications

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

G. CONCLUSIONS

A. Performance Benchmarking

Performance Benchmarking for the *Update 2010 Study* involved analysis of 751 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. For the *Update 2010 Study*, the Agencies decided to collect costs data for projects delivered via alternative methods and analyze them at a later date when sufficient numbers of projects are collected to facilitate meaningful analyses. Projects funded by the American Recovery and Reinvestment Act (ARRA) of 2009 are not included in the *Update 2010* database because those projects were still on-going at the time of compiling project costs data for the *Update 2010 Study*.

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 2010 Study* varied between the following values for the full range and the smaller project subset of TCC respectively:

Table 1-6
Update 2010 Project Delivery Percentages

Type	Project Delivery Percentages
Municipal Projects	35% - 38%
Parks Projects	41% - 43%
Pipes Projects	35% - 38%
Streets Projects	45% - 48%

Although the results of the performance analyses are based on historical data provided by the participating Agencies, there are several factors that 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 low-bid environment, it is recommended that the reader use best judgment in the context of the current economic crisis while using the *Study* results for planning and budgeting.

Increasing the size of the project database is a major challenge posed to the *Study*. 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 Agencies acknowledge that 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.

The Agencies recognize the need to evaluate the impacts of low construction bids on project delivery percentages. It is very likely that project delivery percentages might increase due to the reduced construction bids prevalent in the current economy. However, using such delivery percentages for budgeting a program of projects in the future may be misleading as construction costs are bound to increase with a reversal in the economy.

B. Best Management Practices

The Agencies have continued to fully implement selected BMPs. As of *Update 2010*, and with the addition of new BMPs, the Agencies have fully implemented about 68 percent of the adopted BMPs. Several BMPs have been partially implemented with the goal of complete implementation in the near-future. Each Agency outlined their plan for fully implementing their adopted BMPs.

In *Update 2010*, the Project Team added three new BMPs. 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.

While an exact measurement of each BMP's value to each Agency may not be achievable, the Agencies felt the need to document what they believe the perceived value was to them. This was accomplished by assigning a "perceived value" to the adopted BMPs from the following categories:

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

Upon reviewing the assigned perceived values to the BMPs, it was observed that the majority of the BMPs were 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.

C. Online Discussion Forum

In *Update 2010*, the Online Discussion Forum continues to be an important feature for *Study* participants, with active exchanges occurring frequently and important issues being addressed with changes to policy, approach, or BMP implementation. Participants continue sharing information through the Online Discussion Forum and during the quarterly 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 advantage to all participants.

D. Planning for Update 2011

Over the course of *Update 2010*, the Project Team identified a number of activities to consider including next year in *Update 2011*. These activities include:

- Reducing the number of annual meetings from four to two to save staff time and travel costs in light of the challenging economic situation. The Agencies would hold two abbreviated conference calls to continue their round-table discussion on current topics in lieu of the two eliminated meetings.

- Collecting data on projects delivered via alternative delivery techniques. It is expected that a sufficient number of projects will be available to facilitate meaningful analyses.

- Developing project delivery percentages (arithmetic averages only) for projects having a TCC ranging from $100,000 to $500,000.

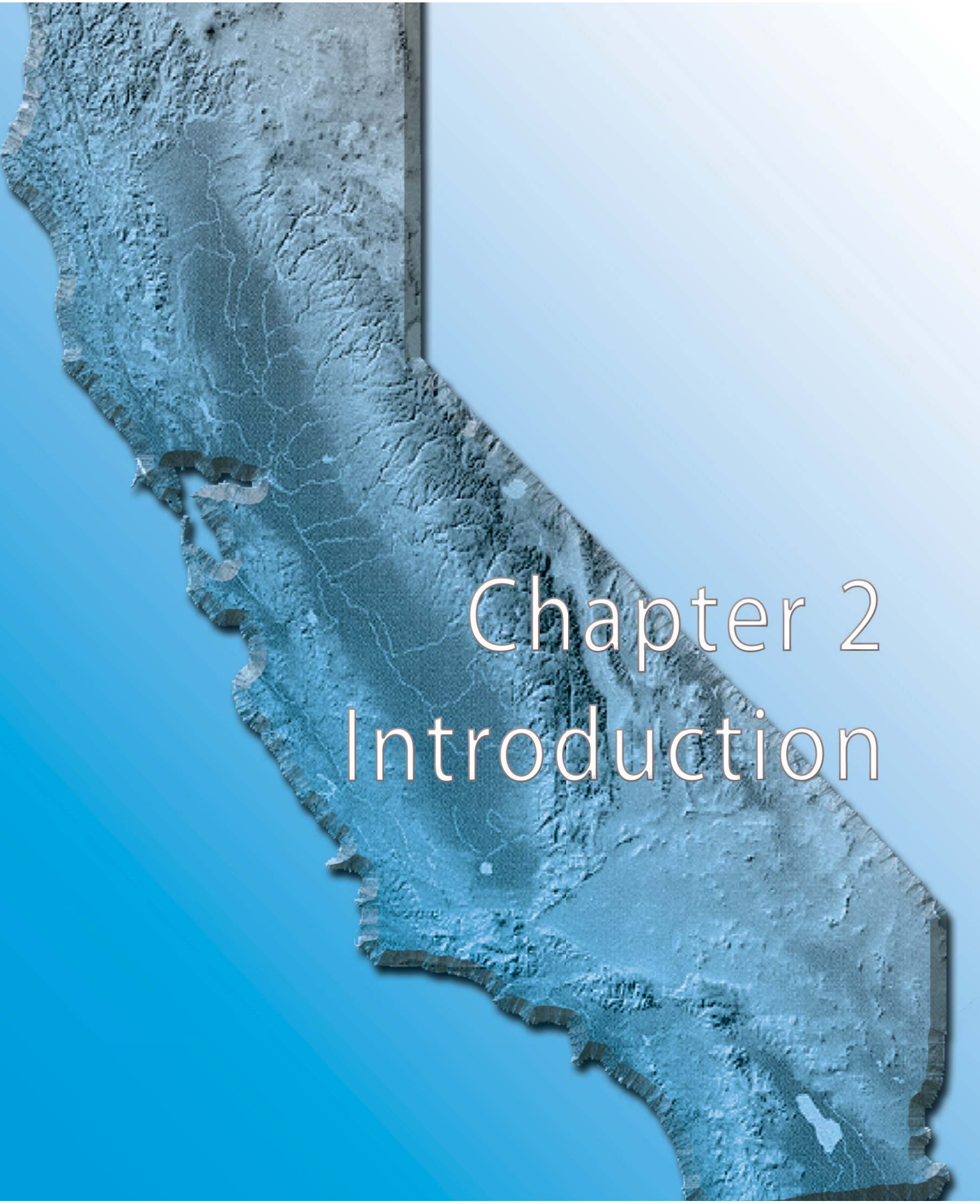
- Exploring the impacts of reduced construction bids on project delivery costs.

- Adding projects delivered by ARRA funds to the projects database for inclusion in the analysis.

- Developing new BMPs and tracking the implementation of adopted BMPs

- Continuing discussion on current topics via the round-table discussion forum.

- Continuing meaningful exchanges on the Online Discussion Forum via a new SharePoint website.



Chapter 2
Introduction

CHAPTER 2

Introduction

Governmental Agencies throughout the state and nation have endured a second consecutive year of difficult economic times characterized by budget cuts, diminished capital improvement programs (CIPs), and various forms of staff reductions ranging from hiring freezes to furloughs and from early retirements to layoffs. 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 ninth 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.

This year, the participating Agencies spent a substantial amount of effort sharing approaches to continue to provide high value implementation of their capital programs in the most efficient manner possible in the face of unprecedented fiscal hardships. The *Study* provides a forum for the Agencies to share information amongst themselves via quarterly 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. Through these acts of collaboration, often times an optimum solution is found that can be translated into a Best Management Practice (BMP) for the group.

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.
In this ninth year of the *Study*, the *Update 2010* participants have continued to pursue on-going endeavors, as well as taken on new ones:

- Continuation of the "Special Topic" roundtable discussion forums at Quarterly Meetings to explore areas of potential positive impact in relation to the current fiscal challenges;
- Continued use of the online discussion forum for efficient information sharing;
- Continued project performance data collection and analysis using improved techniques developed in the previous year;

- Collection of project data on alternative project delivery methods such as Design-Build, CM@Risk and Job Order Contracts (JOC);
- Delineation of BMPs amongst six perceived value categories;
- Tracking the adoption of BMPs; and
- Creating new BMPs targeted to common issues.

A. BACKGROUND

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

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

- City of Long Beach, Department of Public Works
- City of Los Angeles, Department of Public Works, Bureau of Engineering
- City of Oakland, Department of Public Works
- City of Sacramento, 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.

Table 2-1
Agencies' Overall Information

Information	Population[2]	Area (sq. mi.)	Website	Government Form
Long Beach	494,709	50	http://www.longbeach.gov	Council-Manager-Charter[1]
Los Angeles	4,094,764	469	http://eng.lacity.org	Mayor-Council
Oakland	430,666	66	www.oaklandnet.com	Mayor-Council-Administrator
Sacramento	486,189	99	http://www.cityofsacramento.org	Council-Manager
Dept. of General Services				
Dept. of Transportation				
Dept. of Utilities				
San Diego	1,376,173	342	http://www.sandiego.gov	Mayor-Council
San Francisco	856,095	49	http://www.sfdpw.org	Mayor-Board of Supervisors (11 members)
San Jose	1,023,083	178	http://www.sanjoseca.gov	Mayor-Council-Manager

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

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 offers this comment ."The City of San Jose places a high value on its participation in the California CIP Benchmarking *Study*. The dynamic data surrounding project delivery costs provides ongoing feedback toward improvement of San Jose's Capital Improvement Program. The *Study's* continuous development and refinement of Best Management Practices also greatly assists in optimizing San Jose's project delivery approach. Perhaps most importantly, the special topics that the *Study* will be addressing, such as the effect of "below-market-rate bids" and the intrinsic higher delivery costs associated with smaller projects will help those who read the *Study* better understand the current challenges of public sector capital project delivery."

- The City of San Francisco offers this comment "The City and County of San Francisco uses the benchmarking *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 Benchmarking *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. For instance, our City is considering the feasibility of reducing the cost of personal services contracts through rate reductions. We received helpful feedback from other Agencies that have also considered this or have already implemented some sort of fee reduction agreement with their consultants. Also, many Agencies had either implemented furloughs, or were planning to in the near future. It was 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 are currently experiencing 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 "continues to find the *Study* extremely useful in validating our Engineering Department's performance and in setting benchmarks and goals. Participation in the quarterly meetings allows us to share information on new processes that we or the other Agencies are implementing, and we always get new or better ideas to improve our project delivery. The discussion forum is a great way to keep the momentum between meetings and to share detailed information on processes."

- The City of Oakland offers this comment. "Besides the obvious benefits of validating our project delivery costs and improving our project delivery processes through implementation of the BMPs, the participation in the *Study* allows Oakland to network with our peers and draw upon their expertise on how other cities in California manage their challenges that seem to be universal for all major cities. With the shrinking capital budgets and mandatory furloughs, the *Study* becomes even more valuable since the need to improve our delivery costs and processes are now greater than ever before."

C. STUDY FOCUS

Since the inception of the *Study*, the Agencies have examined over 100 practices used in the delivery of projects. Practices that were not commonly used but whose implementation was believed to benefit overall project delivery have been adopted as BMPs. Each year new BMPs are added, and in some cases existing BMPs are modified by the Agencies to address specific challenges they encounter. 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*.

Over the course of the *Study*, the Agencies have considered whether the value added by the implementation of the BMPs can be quantified. Although the Agencies acknowledged that quantifying the BMPs may not be achievable, the Agencies felt the need to document their perception of a BMP towards project delivery. Therefore, this year, special attention was given to assign a "perceived value" to each BMP. The Agencies developed six categories under which the BMPs developed over the course of the *Study* would be classified. These categories include:

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

The Agencies then assigned a "perceived value" to each BMP. The results of this exercise revealed that Cost and Schedule were the perceived values associated with the majority of the BMPs. Details regarding the outcome of this exercise are provided 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 2010* the Agencies made progress on several goals:

1. **Include projects delivered by alternative delivery techniques in the performance database.** In prior *Study* years, project costs data were only collected and analyzed for projects

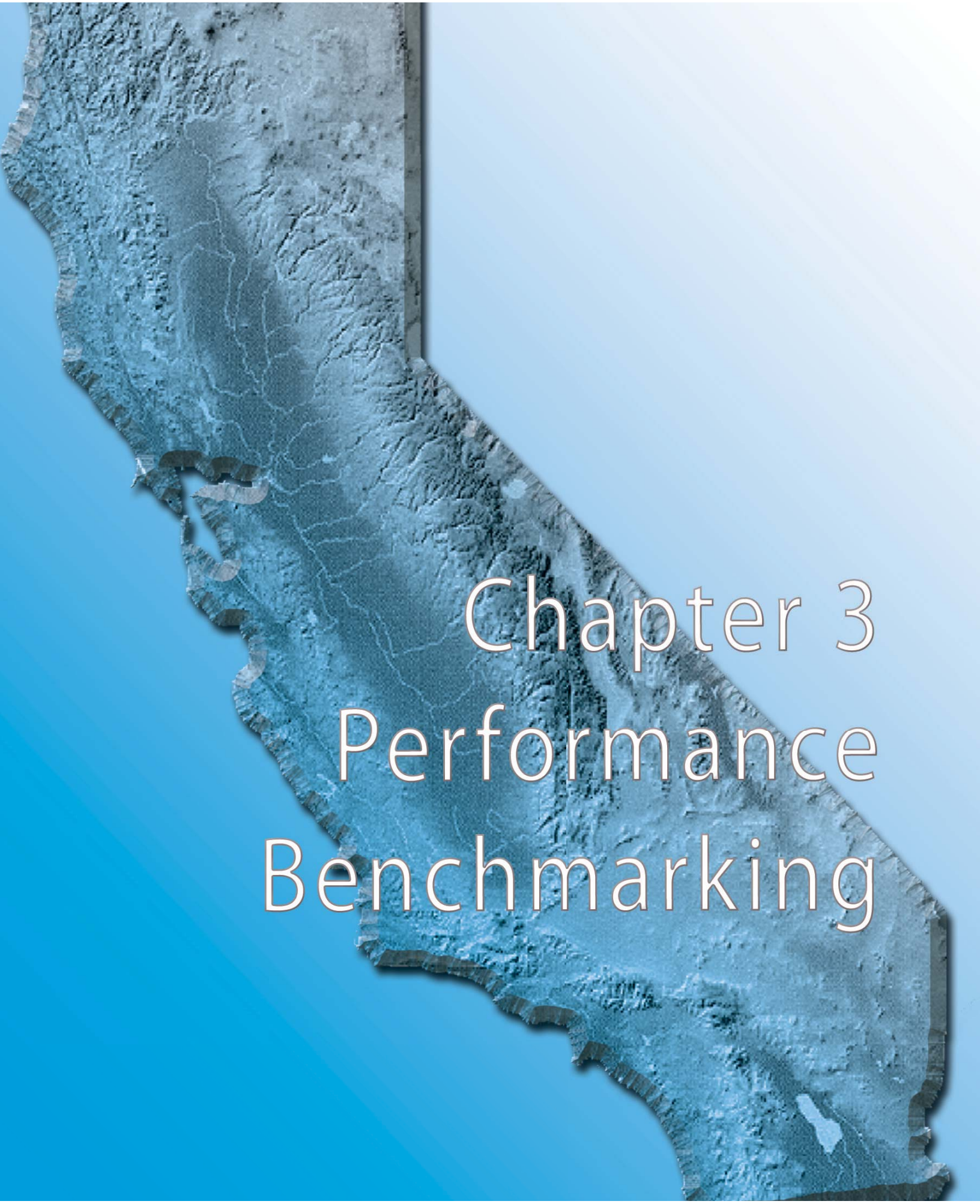
delivered using the traditional design-bid-build method. Over the years, the participating Agencies have executed several projects using alternative delivery methods such as design-build and job-order-contracting yielding benefits in areas such as cost, schedule, and overall project delivery. In order 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.

2. **Conduct roundtable discussions on Special Topics.** Continuing the trend from *Update 2009*, during each quarterly meeting roundtable discussions were held on current events. These sessions included discussions on trademarked and/or sole-sourced products, as-built drawings, re-development Agency projects, proposed changes in Proposition 42, usage of consultants during budget cuts, internal accounting audits, cost accounting practices, changes to bidding processes during the recession, and employee morale/ productivity during the recession.

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

4. **Create new BMPs targeted to address commonly held problem areas.** The Project Team continued to discuss common challenges and share ideas for addressing those challenges during the quarterly meetings as well as in the online discussion forum. Three new BMPs were 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 2010*, 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 vast 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 2010* 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, 2005. Projects with earlier completion dates were kept in the database, but excluded from the analyses.

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

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

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

It should be noted that this approach, which was first adopted in Update 2008, allows for the inclusion of more data than in previous years. Previously, other methods including visual inspection were used for the elimination of outlier data points. This change was in part allowed by the improved modeling techniques that has 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 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. No projects were submitted by the Agencies for the "Other Pipes" category in *Update 2008*. In *Update 2009* and *2010*, four projects were submitted for the "Other Pipes" category. 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

Notes:
[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 2010 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 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 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 751 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. 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 numbers of non-representative projects and projects with TCC less than $100K have decreased. In addition, only 18 projects have been excluded as outliers in the *Update 2010 Study* as compared to the elimination of 147 projects in *Update 2007* and 113 projects in *Update 2006*.

For the *Update 2010 Study*, a total of 11 projects were identified as non-representative projects. Out of these 11 projects, 10 projects were 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. Only one project did not meet the project selection criteria and was deemed non-representative.

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. 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 3-3
Growth of Database

Study Phase[1]	Submitted	Deleted		Count After Deletions	Excluded		Net
	(a) Total	(b) TCC <$100K	(c) Non-Repre-sentative[2]	(d)=(a)-(b)-(c)	(e) Project Completion Date <2004	(f) Outliers[3]	Projects in Analyses (h)= (d)-(e)-(f)-(g)
I	239	27	44	168	168	0	0
II	285	0	35	250	250	0	0
III	262	0	29	233	233	0	0
IV	173	18	21	134	126	4	4
V	182	0	3	179	52	3	124
VI	191	0	2	189	10	3	176
VII	158	0	2	156	12	3	141
VIII	155	2	4	149	7	2	140
IX	184	2	10[4]+1[5]	171	2	3	166
Total	**1,829**	**49**	**151**	**1,629**	**860**	**18**	**751**

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, and IX = 2010.

[2,5] 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.

Table 3-4
Projects Distribution Matrix

Agency	Long Beach	Los Angeles	Oakland	Sacramento	San Diego	San Francisco	San Jose	Total
Municipal Facilities	**5**	**37**	**14**	**8**	**13**	**11**	**33**	**121**
Libraries	0	3	1	0	3	0	11	**18**
Police/Fire Stations	1	13	0	5	4	2	8	**33**
Comm./Rec. Center/ Child Care/Gyms	1	16	11	2	1	4	12	**47**
Other Municipal Facilities[2]	3	5	2	1	5	5	2	**23**
Streets	**19**	**19**	**41**	**58**	**31**	**45**	**66**	**279**
Widening/New/ Grade Separations	0	5	0	14	4	1	9	**33**
Bridges (New/Retrofit)	0	7	0	3	2	0	4	**16**
Reconstructions	18	4	13	3	4	28	11	**81**
Bike/Pedestrian/ Streetscapes	0	3	18	28	9	4	13	**75**
Signals	1	0	10	10	12	12	29	**74**
Pipe Systems	**0**	**82**	**37**	**36**	**45**	**40**	**45**	**287**
Gravity Systems (Storm Drains/Sewers)	0	78	37	27	22	34	40	**238**
Pressure Systems	0	0	0	7	14	6	2	**29**
Pump Stations	0	1	0	1	9	0	3	**14**
Other Pipes	0	3	0	1	0	0	0	4
Parks	**2**	**6**	**21**	**1**	**2**	**10**	**24**	**66**
Playgrounds	2	3	15	1	1	10	18	**50**
Sportfields	0	3	4	0	1	0	4	**12**
Restrooms	0	0	2	0	0	0	2	**4**
Total[1]	**26**	**144**	**113**	**103**	**91**	**106**	**168**	**751**

Notes:

[1] Total refers to the projects included in the Update 2010 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.

The Agencies received funding from the American Recovery and Reinvestment Act (ARRA) of 2009 for various projects. Since those projects were still on-going at the time of compiling project costs data for the *Update 2010 Study*, those projects are not included in the *Update 2010* database. It is expected that the Agencies would submit projects funded by the ARRA for analysis during the *Update 2011 Study*.

The Agencies acknowledged that it is vital to the success of the *Study* to continue increasing the size of the data set, thereby increasing the confidence, consistency, and reliability of results. As previously indicated, there are 4 project types (Municipal Facilities, Streets, Pipe Systems, and Parks) and 16 project classifications included in this *Study*. **Table 3-4** summarizes the distribution of projects included in the *Update 2010* analyses.

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

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)
2005	27	71	80	18	196	$1.72	$0.65	23%	17%	40%
2006	36	54	67	9	166	$2.76	$0.87	22%	17%	39%
2007	24	52	50	14	140	$2.95	$0.95	24%	17%	40%
2008	15	43	46	15	119	$2.40	$0.86	24%	17%	41%
2009	19	59	42	10	130	$1.65	$0.73	22%	17%	39%
Total	**121**	**279**	**285**	**66**	**751**	**$2.27**	**$0.76**	**23%**	**17%**	**40%**

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.

As indicated in **Table 3-5**, project size (measured as median TCC), increased significantly between 2005 and 2006 with an increase of approximately 30 percent. After spiking in 2006, median project size has declined approximately 15 percent between 2006 and 2009. The average TCC also declined steadily between 2006 and 2009, with a large decline of 43 percent from 2008 to 2009. This 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. Project delivery costs measured as a percentage of the TCC declined slightly from 2005 to 2006, but then increased back to 2005 levels in 2007. The project delivery percentages have remained stable since 2007.

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.

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 market competition. For example, presently actual bid amounts have been depressed by competitive forces associated with the current recession. This will result in the rise of delivery cost as a percentage of TCC as TCC is depressed. The result may be noticed in the coming years as these projects are completed and reported into the database. The Agencies acknowledged that the impacts of low-construction bids on project delivery costs needs to be analyzed during future *Study* years as the numbers of projects completed during the recession increase in the database.

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

Type	Design	Construction Management	Project Delivery (Total)	Median Total Construction Cost ($M)	Number of Projects (N)
Municipal Facilities	21%	15%	35%	3.09	216
Parks	25%	16%	41%	0.37	66
Pipe Systems	19%	16%	35%	0.73	285
Streets	27%	19%	45%	0.56	279
Average	**23%**	**17%**	**40%**	**0.68**	**751**

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.

Projects belonging to the Pipes and the Municipal categories have the lowest average project delivery cost. The Pipes category has the maximum number of projects (n = 279) in the *Update 2010* database. The Streets category also has a similar number of projects in the database (n = 285). 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 40 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	23%	16%	38%	3.09	97
Parks	26%	17%	43%	0.37	53
Pipe Systems	20%	17%	38%	0.73	228
Streets	28%	20%	48%	0.56	223
Average	**24%**	**18%**	**42%**	**0.68**	**601**

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.

Consultant Usage Analysis

Project delivery performance and consultant usage by Agency are presented in **Table 3-8**. The table indicates that approximately 56 percent of the design work and approximately 81 percent of the construction management efforts are completed in-house by the participating Agencies. Consultants account for approximately 32 percent of the total project delivery costs while in-house efforts by the participating Agencies accounts for the remaining 68 percent of the project delivery costs. For the available data, a clear relationship between the level of in-house effort and project delivery costs cannot be established.

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

AGENCY	DESIGN					CONSTRUCTION MANAGEMENT					PROJECT DELIVERY						TCC	
	In-House		Consultants		Total % of TCC[2,3]	In-House		Consultants		Total % of TCC	In-House		Consultants		Total % of TCC by Project[4]	Total % of TCC by Program[5]	Average	Median
	($M)	% of Design[1]	($M)	% of Design		($M)	% of CM	($M)	% of CM		($M)	% of PD	($M)	% of PD				
Agency A	28.6	47%	31.8	53%	26%	30.8	67%	15.2	33%	16%	59.4	56%	47.0	44%	42%	36%	3.4	0.7
Agency B	10.1	50%	10.2	50%	17%	11.1	65%	5.9	35%	12%	21.2	57%	16.0	43%	30%	27%	1.4	0.5
Agency C	26.4	91%	2.6	9%	17%	25.9	98%	0.6	2%	16%	52.3	94%	3.2	6%	34%	32%	1.6	1.2
Agency D	52.9	54%	44.4	46%	24%	72.9	81%	16.9	19%	19%	125.7	67%	61.3	33%	43%	30%	4.4	1.4
Agency E	3.3	31%	7.3	69%	11%	6.7	74%	2.4	26%	11%	9.9	51%	9.7	49%	22%	32%	2.3	0.7
Agency F	31.1	58%	22.5	42%	26%	42.3	87%	6.4	13%	24%	73.4	72%	28.9	28%	50%	32%	1.9	0.4
Agency G	11.6	60%	7.6	40%	26%	7.5	100%	0.0	0%	12%	19.1	71%	7.7	29%	38%	31%	0.8	0.4
OVERALL	**163.9**	**56%**	**126.3**	**44%**	**23%**	**197.2**	**81%**	**47.4**	**19%**	**17%**	**361.1**	**68%**	**173.8**	**32%**	**40%**	**31%**	**2.3**	**0.7**

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.

[4] Represents project delivery percentages which are the arithmetic averages of the project delivery percentages for the individual projects in the database. Refer to **Appendix B** for detailed explanation on how the percentages are computed.

[5] Represents project delivery percentages for a program of projects. Refer to **Appendix B** for detailed explanation on how the percentages are computed.

E. 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**. Given all these improvements to the analysis of the data, the reader is advised that direct comparison of results between *Update 2010* and previous years may be more difficult due to these improvements.

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 four 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 current downturn in the economy, Agencies are receiving bids that are significantly lower than the engineer's estimates. The following discussion summarizes the trends observed in recent construction bids for some of the participating Agencies.

- The City of Los Angeles noticed a decline in the rehabilitation cost per linear feet of sewer pipe for their sewer program.

- The City of Sacramento utilizes Rubberized Asphalt Concrete (RAC) for all Street Overlays. The City noticed that RAC costs have declined from $120 per ton in 2008 to $87 per ton in 2010. Similarly, the City also noticed that costs for concrete sidewalks (4-inches thick) have declined from $9 per square feet to $5 per square feet over the past few years.

- The City of Long Beach has noticed an approximately 12% drop in current bid prices over those received two years ago. This would include street work, park construction as well as small facilities such as restrooms, teen centers, fire stations, etc.

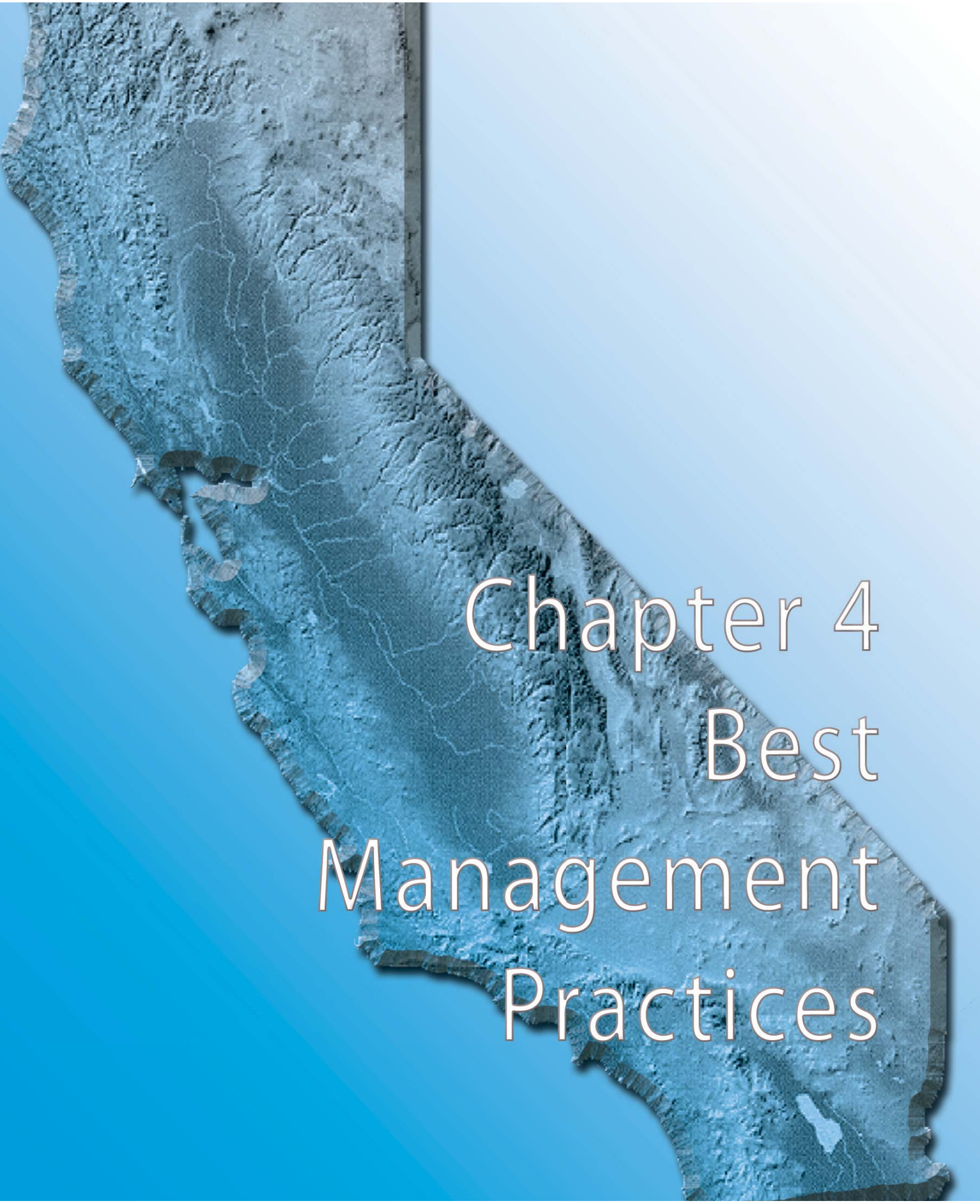
- The City of San Jose has been experiencing "below-market-rate" bids since late 2007/early 2008. In studying the trend, the City found that during the period from July 2008 to June 2009, the City received an average of about 8 bids per project and on an average the low bid was approximately 21 percent lower than the engineer's estimate. From July 2009 to June 2010, the City received an average of about 10 bids per project and on an average the low bid was approximately 27 percent lower than the engineer's estimate. In addition to these data, the City has noticed an increase in bid protests.

- The City and County of San Francisco has noticed that bids have dropped from being 109 percent of the engineer's estimate in 2005 to approximately 79 percent of the engineer's estimate in 2010 for their joint sewer and paving projects.

- The City of Oakland also noticed a decline in construction costs over the past few years.

The impacts of these low construction bids on project delivery percentages need to be evaluated. It is very likely that project delivery percentages might increase 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 bound to increase with a reversal in the economy.

In addition, 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 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.



Chapter 4 Best Management Practices

CHAPTER 4 Best Management Practices

At the start of the *Study*, nine years ago, the Agencies examined over 100 practices used in project delivery. Included in the *Study* are those practices that the *study* participants did not commonly use at that time, but believed should be implemented as BMPs. Each year new BMPs are added, and in some cases existing BMPs are reworked by the Agencies to address specific challenges they encounter. BMPs are also added or modified to reflect relevant experiences by the participants. Agency implementation of these selected practices has been and will continue to be tracked during the *Study*. Three new BMPs were added to the list this year.

New to this year's report is the addition of Perceived Values of each BMP. While an exact measurement of each BMP's value to each Agency may not be achievable, the Agencies felt the need to document what they believe the perceived value was to them. In this year's first quarterly meeting, the *Study* Team identified the following Perceived Value categories:

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

To determine the predominant Perceived Values associated with each BMP, the *Study* Team undertook a rating exercise. Each Agency evaluated each BMP against the six Perceived Values and selected all the ones that they found applicable to their Agency for that individual BMP. The Agencies' responses were then tabulated. If a Perceived Value received three or more votes relative to a BMP, that Perceived Value was judged of significance and received a check mark shown in **Table 4-1**. While a check mark might not be shown, it doesn't mean that a BMP isn't of value in that Perceived Value category. The check marks only reflect that a significant number of Agencies found that a Perceived Value to be particularly applicable to the BMP in question. Upon reviewing the assigned perceived values to the BMPs, it was observed that the majority of the BMPs were 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 2010*, the Project Team added three new BMPs to the BMP implementation tracking list. The new BMPs were developed through meeting roundtables or on-line discussions held throughout the year. The new BMPs are:

- 2.q.2010 - Receive bids electronically.
- 4.IV.b.2010 – Implement Electronic Contract Payment Process.
- 4.IV.c.2010 – Agency should file As-built drawings within 6 months of project completion.

These BMPs are believed to directly influence cost, schedule, quality, communication, environment or 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 changes in interpretation of those BMPs, as well as additions since 2002 to the BMP list.

Table 4-1
Description of Best Management Practices

Category	Ref:*	BMP	Description	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.	✓	✓				
	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.		✓		✓		

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.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.				✓		✓
Quality Assurance / Quality Control	3.I.a.	Develop and use a standardized Project Delivery Manual.	Standardized procedures streamline project design, bidding, and construction processes. Standardized design management procedures will reduce scope creep and delays in construction document preparation. During construction, standard procedures will reduce response times on RFIs, and add overall clarity and efficiency to the construction management process. Having a standard manual will also reduce the time necessary for project documentation training.	✓	✓	✓			
	3.II.b.	Perform a formal Value Engineering *Study* for projects larger than $1 million.	Value Engineering identifies life cycle costs of design elements included in a project and certain alternatives. While the cost of the value engineering process may initially add costs to project delivery, overall project costs will be reduced.	✓					

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

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

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

Category	Ref:*	BMP	Description	Perceived Value					
				Cost	Schedule	Quality	Communication	Environment	Customer Satisfaction
Quality Assurance / Quality Control	3.III.m 2008	Maintain and regularly update electronic standard contract specifications and related documents, as well as technical/special provisions.	Standard contract specifications and technical special provisions need to be regularly maintained and updated in order to reduce the amount of time required to create contract bid documents. If a City implements new requirements, the standards should be modified for every project one time instead of each manager having to modify these documents of every project.	✓	✓	✓			
Construction Management	4.I.a.	Delegate authority to the City Engineer/Public Works Director or other departments to approve change orders to the contingency amount.	Change order work should be authorized as soon as is practically possible in order to avoid potential delays to critical work. Scheduling a significant change order for review and authorization by the Board may delay project progress, even though it may be within the contingency amount allowed in the project budget. Authorization of the City Engineer/Public Works Director to approve changes within the contingency budgeted for changes will ensure that critical changes are acted on promptly and that delays are minimized.	✓	✓				
	4.I.m.	Classify types of change orders.	Classification of change orders into categories such as changed conditions, unforeseen conditions, owner requests, or design changes for owner use improves understanding of the project and lessons learned from the data may improve project delivery on similar projects.			✓			
	4.II.a.	Include a formal Dispute Resolution Procedure in all contract agreements.	Construction is acknowledged as a dispute prone industry. As such, it makes sense to provide options in the contract documents to avoid litigation and to expedite disputes resolution using alternatives to litigation.	✓	✓		✓		

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.III.a.	Use a team building process for projects greater than $5 million.	Partnering is a team-building process that has a proven record of improving working relationships and production, and reducing claims and disputes on construction projects. It is one of several team-building processes that should be used in the interest of reducing conflict and facilitating project delivery.	✓	✓		✓		✓
	4.IV.a.	Involve the Construction Management Team prior to completion of design.	Experienced contractors and construction managers should be included in the design process to make designs more constructible and lower cost. Construction managers and contractors are frequently more experienced about the products and/or equipment as well as construction methods that are readily available. Their contributions to selections and decisions during the design process will facilitate construction procurement, means and methods.	✓		✓	✓		
	4.IV.b 2010	Implement Electronic Contract Payment Process.	Many approvals are required to process contract payments. Using electronic procedures provides an avenue to expedite the necessary approvals.	✓					✓
	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.	✓	✓				

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.V.b 2003	Establish a pre-qualification process for contractors on large, complex projects.	Prequalification helps screen contractors for prior performance on similar projects, safety and financial capability thus reducing risk and, ultimately, project delivery cost.		✓	✓			
	4.V.c 2003	Make bid documents available online.	Making bid documents available on line will reduce Agency printing costs. It may also increase bidder participation by making documents easily available to a larger pool of potential bidders and subcontractors.	✓			✓		
Project Management	5.I.f.	Assign a client representative to every project.	Client (end user) representation during the life of the project will expedite decisions on submittals, substitutions, and changes. Their involvement will also help determine intent and streamline the commissioning and occupancy process.		✓		✓		✓
	5.I.j 2003	Create in-house project management team for small projects.	It has been documented that the cost of project delivery of small projects is a higher percentage of the construction cost. Establishing a project management team that specializes in smaller projects may lead to economies such as grouping similar projects during permitting and bidding thus reducing project delivery cost.	✓					
	5.I.k 2004	Institutionalize Project Manager performance and accountability.	Recognize that professional project management requires specific education, training, and experience. Provide for PMI, CCM, or other formal training and certification and establish performance measures for project delivery personnel.			✓			
	5.II.a	Provide formal training for Project Managers on a regular basis.	Project Managers come to projects with varying degrees of skill and familiarity with Agency procedures. Orientation and training will improve their ability to deliver the project on the intended schedule. It is also important that updated training is available at least on an annual basis.			✓			

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

Category	Ref:*	BMP	Description	Perceived Value					
				Cost	Schedule	Quality	Communication	Environment	Customer Satisfaction
Project Management	5.II.d 2006	Implement verification procedures to ensure that PM training includes Agency policies, procedures, forms, and standards of practice (scheduling, budgeting, claims avoidance, risk analysis, etc).	The success of a project is influenced significantly by the education and skills of the project manager. Agencies should verify that PM's know and use the tools available within an Agency and that they are current with industry practices.		✓	✓			
	5.III.a.	Adopt and use a Project Control System on all projects.	A web-based project control system will improve collaboration and documentation during the design and construction process. Questions, answers, proposals, and decisions can be expedited using a collaborative system.	✓	✓		✓		
	5.III.e 2006	Implement a financial system that tracks expenditures by category to monitor project hard and soft costs during project delivery.	It is recommended that a system that identifies actual expenditures against planned budgets be made available to project managers to be used as a performance measurement tool.	✓					
	5.III.f 2006	Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables.	Getting accurate data on the cost of project delivery depends upon being able to capture and classify expenses to the phases of construction on each project. Ideally, costs would be identified by each of five project delivery phases and coded to particular milestones or deliverables.	✓	✓				
	5.III.g 2006	Monitor "earned value" versus budgeted and actual expenditures during project delivery.	Soft costs "burn rate" should be proportionate to percent complete during the design and construction phases. Using a program which measures and relates soft cost expenses to earned values permits better tracking and control during project delivery.	✓					
	5.III.h 2007	Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments.	Prolonged ROW acquisition can be avoided if all stakeholders agree on milestones to complete the acquisitions.		✓				
	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.	✓					

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.IV.a 2006	Bundle small projects whenever possible.	Bundling small projects so that they are designed, bid, and constructed together will reduce project delivery cost proportionately.	✓	✓				
	5.IV.b 2007	Have a coordinator with expertise in the environmental process within the department delivering the engineering/capital project.	Identifying an environmental specialist within the project delivery team who is familiar with procedures and contacts within the approving entities will reduce permit procurement time and costs.	✓	✓			✓	
Consultant Selection and Use	6.c.	Include a standard consultant contract in the RFQ/ RFP with an indemnification clause.	The negotiation of the design contract can be expedited if the consultant understands and agrees to the conditions of the contract at the time a proposal is submitted.	✓	✓				
	6.e.	Delegate authority to the Public Works Director/City Engineer to approve consultant contracts under $250,000 when a formal RFP selection process is used.	Authorization for the Public Works Director/ City Engineer to award consulting contracts ensures earlier start of design and construction management activities and will reduce consultant selection process costs.		✓				
	6.g.	Implement and use a consultant rating system that identifies quality of consultant performance.	The performance of consultants should be tracked so that those who deliver quality services at reasonable costs can be adequately considered for future awards.			✓			
	6.m 2006	Implement as-needed, rotating, or on-call contracts for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects.	Establishing an on-call list of qualified consultants with expertise in a variety of design disciplines will expedite the start of the design process.	✓	✓				
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

In *Update 2010*, the Agencies continued to exchange ideas regarding strategies for implementing various BMPs using both the networking opportunities at the quarterly meetings and the online discussion forum. Agencies have started to review and update those BMPs that have been fully implemented for several years based on feedback received over the years. Agencies continue to pursue full implementation of BMPs although many remain only partially implemented. Some Agencies take BMPs as far as possible given their own constraints. In those instances, a partially implemented BMP is considered complete by that Agency. Given the continued current state of the economy and due to staff reductions, furloughs, and the management's increased involvement in resolving budgetary issues, progress on fully implementing BMPs has been impacted. The Agencies have focused their efforts on monitoring adherence to BMPs that have been implemented and are judged to provide efficiencies in project delivery processes for participating departments. As of *Update 2010* and with the addition of new BMPs, the Agencies have fully implemented about 68 percent of all BMPs. Another 4 percent has been partially implemented by the Agencies. Many of the remaining BMPs require multiple department involvement and are more complicated to implement than other BMPs.

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

BMPs targeted for future implementation and progress on actual BMP implementation since the *Update 2009* are summarized below.

I. City of Los Angeles

Implemented from June 2009 to September 2010:	Targeted October 2010 Onward:
	• 4.V.c. 2003 Make bid documents available online. • 5.III.f 2006 Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables. • 5.III.g 2006 Monitor "earned value" versus budgeted and actual expenditures during project delivery. • 5.III.h 2007 Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments (partially implemented).

II. City of Long Beach

Implemented from June 2009 to September 2010:	Targeted October 2010 Onward:
• 3.III.b Perform and use post-project reviews to identify lessons learned (partially implemented). • 3.III.m.2008 Maintain and regularly update electronic standard contract specifications and related documents as well as technical/special provisions. • 5.I.j 2003 Create in-house project management team for small projects. • 5.III.h Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments. (partially implemented) • 6.g. Implement and use a consultant rating system that identifies quality of consultant performance (partially implemented).	• 3.I.a. Develop and use a standardized Project Delivery Manual (partially implemented). • 3.III.a. Use a formal Quality Management System (partially implemented).

III. City of Oakland

Implemented from June 2009 to September 2010:	Targeted October 2010 Onward:
• 1.d Utilize a Board/Council project prioritization system. • 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). • 4.V.c. 2003 Make bid documents available online. (partially implemented)	• 4.V.c. 2003 Make bid documents available online. (fully implemented) • 7.a Identify the environmental benefits of the project at the time of award

IV. City of Sacramento

Implemented from June 2009 to September 2010:	Targeted October 2010 Onward:
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) • 5.I.k 2004 Institutionalize Project Manager performance and accountability. Department of Utilities • 6.m. 2006 Implement as-needed, rotating, or on-call contracts for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects.	Department of Transportation • 5.III.f 2006 Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables. (partially implemented) • 5.III.g 2006 Monitor "earned value" versus budgeted and actual expenditures during project delivery. (partially implemented) Department of Utilities • 1.d Utilize a Board/Council project prioritization system. (partially implemented)

V. City of San Diego

Implemented from June 2009 to September 2010:	Targeted October 2010 Onward:
• 5.III.e 2006 Implement a financial system that tracks expenditures by category to monitor project hard and soft costs during project delivery	• 5.III.g 2006 Monitor "earned value" versus budgeted and actual expenditures during project delivery. (partially implemented)

VI. City and County of San Francisco

Implemented from June 2009 to September 2010:	Targeted October 2010 Onward:
• 1.e. Resource load all CIP projects for design and construction. • 1.f. Include a Master Schedule in the CIP that identifies start and finish dates for projects. • 4.V.c. 2003 Make bid documents available online. • 5.III.f. 2006 Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables. • 5.III.g 2006 Monitor "earned value" versus budgeted and actual expenditures during project delivery.	• 5.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 2009 to September 2010:	Targeted October 2010 Onward:
• 3.III.l 2007 Designate a responsible person or group and establish a process of notifications and milestones for utility relocations (partially implemented). • 5.I.k 2004 Institutionalize Project Manager performance and accountability. • 5.IV.b 2007 Have a coordinator with expertise in the environmental process within the department delivering the engineering/capital project.	• 3.1.a Develop and use a standardized Project Delivery Manual (partially implemented) • 3.III.a. Use a formal Quality Management System. (partially implemented) • 3.III.m.2008 Maintain and regularly update electronic standard contract specifications and related documents as well as technical/special provisions. • 5.II.a Provide formal training for Project Managers on a regular basis. • 5.II.d 2006 Implement verification procedures to ensure that PM training includes Agency policies, procedures, forms, and standards of practice (scheduling, budgeting, claims avoidance, risk analysis, etc).

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

Table 4-2
Implementation of BMPs

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Planning	1.a.	Define capital projects well with respect to scope and budget including community and client approval at the end of the planning phase.	✓	✓	✓	✓	✓	✓	✓	✓	SC DU: Community involved after project is better-defined, typically at 30% design.
	1.b.	Complete Feasibility Studies on projects prior to defining budget and scope.	✓	✓	✓	✓	✓	✓	✓	✓	LB: When applicable SC DU: Only on complex projects that require a Feasibility *Study*
	1.d.	Utilize a Board/Council project prioritization system.	✓	NI	✓	✓	PI, 2009	✓	✓	NI	LA: Council allows Streets, Bridges and Stormwater programs a project priority system. SC DU: Getting closer to approved Asset Mgt system that would facilitate this BMP, but project drivers vary (permit requirements, projects in other departments, etc) SD: Result of CIP Benchmarking SF: Capital plan developed City-wide and priorities set by City-wide committee of major department heads.
	1.e.	Resource load all CIP projects for design and construction.	✓	NI	✓	✓	✓	✓	✓	✓	SC DU: Estimate drafting only.
	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.
	1.g 2007	Make an early determination on which environmental document is required and incorporate into the schedule.	✓	✓	✓	✓	✓	✓	✓	✓	

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

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

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Planning	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
	2.l. 2004	Limit Scope Changes to early stages of design.	✓	✓	✓	✓	NI	✓	✓	✓	SC DU: 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	✓	✓	✓	

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

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

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Design	2.n. 2006	Implement a rotating Request for Quote process for contracting small projects to streamline the bidding and award process during construction. (Include criteria for exemptions from formal Council approval.)	NI	✓	✓	NI	NI	✓	✓	✓	SC DT: Maintains on-call consultant list for various engineering, traffic, landscape, architecture, and geotechnical services. SF: As-needed job order contracting (JOC)
	2.o 2007	Establish criteria for obtaining independent cost estimates which take in consideration both project characteristics and volatility of the market.	TBD	PI, TBD	TBD	2011	NI	TBD	✓	PI	LA will likely implement this in some fashion, but is still working out the details. We are considering only implementing this on projects over $10M. 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	✓	PI, 2010	
	2.q 2010	Receive bids electronically.	TBD	PI	TBD	NI	TBD	TBD	NI	2011	LB: Currently receive bids for projects less than $100k
Quality Assurance/ Quality Control	3.I.a.	Develop and use a standardized Project Delivery Manual.	✓	PI, 2011	✓	✓	✓	✓	✓	PI, 2011	SC DU: Badly needs updating. LB: Staffing cuts have delayed completion

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

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

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
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 SJ: For projects > $5 million
	3.III.a.	Use a formal Quality Management System.	✓	PI, 2011	✓	✓	NI	✓	✓	PI, 2011	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 adhoc 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	✓	✓	✓	✓	PI	LB: PM remains responsible for all utility work on their projects SJ: Various Divisions/Sections have a utility coordinator and processes as needed
	3.III.m 2008	Maintain and regularly update electronic standard contract specifications and related documents as well as technical/ special provision.	✓	✓	✓	✓	✓	✓	✓	2010	

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

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

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						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: Some Divisions only
	4.IV.b 2010	Implement Electronic Contract Payment Process.	TBD	PI	TBD	NI	TBD	TBD	PI	TBD	LB: Currently done for some street related projects. SF: We are doing payments electronically via our first generation system which was demonstrated back in San Diego around 2008. We pay within the Mayor's directive of 10 to 15 days. And direct deposit is already available to the contractors through BofA.

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

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

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Construction Management	4.IV.c 2010	Agency should file As-built drawings within 6 months of project completion.	TBD	PI	TBD	✓	TBD	TBD	✓	PI	LB: being done on a go forward basis. Past projects still backlogged. SJ: Generally yes, however, it depends on post-construction circumstances.
	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.	2010	✓	PI, 2010	✓	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
Project Management	5.I.f.	Assign a client representative to every project.	✓	✓	✓	✓	✓	✓	✓	✓	SD: Only for large projects
	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.
	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.

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

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

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Project Management	5.II.a	Provide formal training for Project Managers on a regular basis.	✓	TBD	✓	✓	NI	✓	✓	2010	LB: 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	✓	2010	2010	
	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.	2011	✓	✓	PI, 2011	NI	✓	✓	TBD	SC DT: Working to/ Update: Provide Microsoft Project to all Project Managers and produce schedules with tasks/ sub-task schedules

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

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

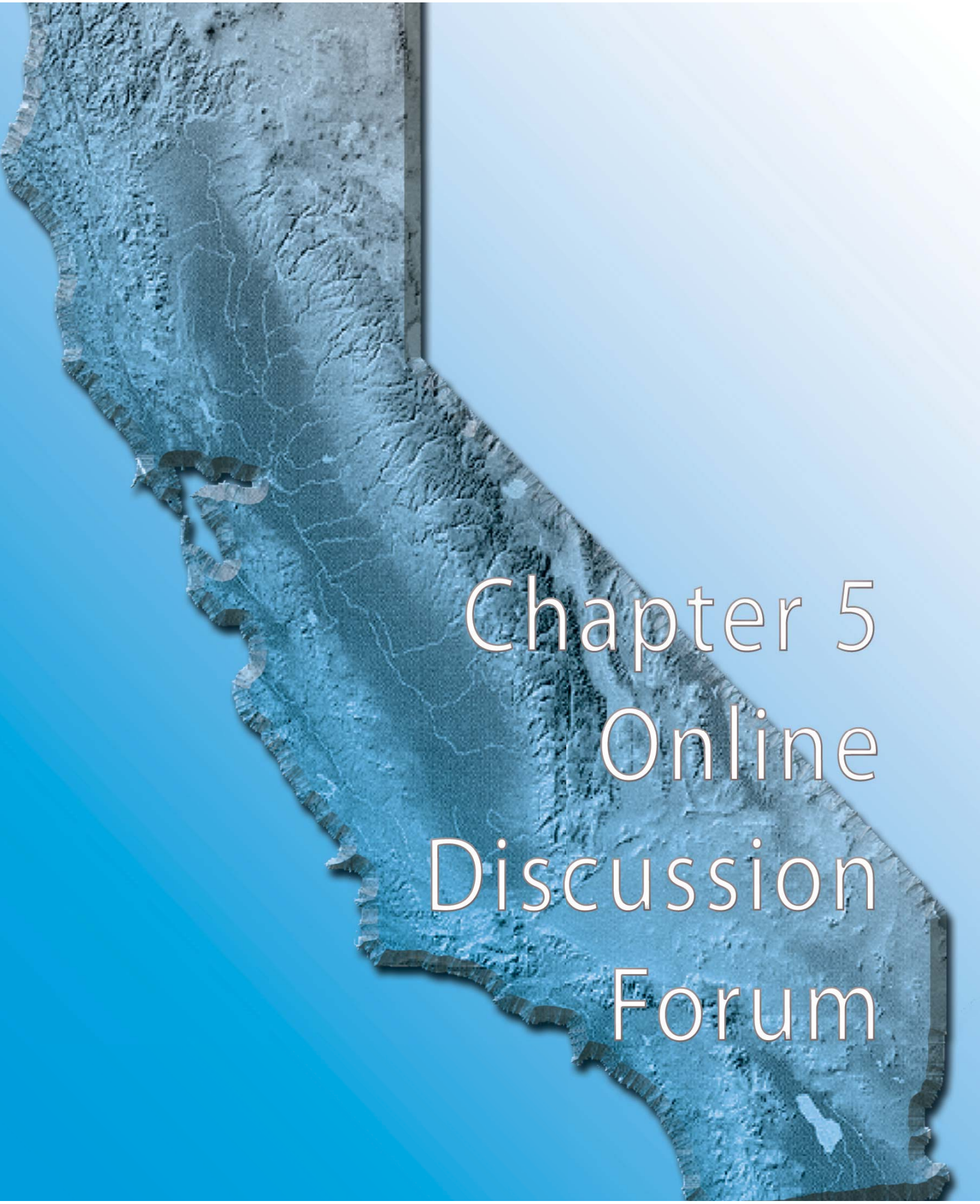
Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Project Management	5.III.g 2006	Monitor "earned value" versus budgeted and actual expenditures during project delivery.	2011	NI	✓	PI, 2011	NI	PI, 2011	✓	NI	
	5.III.h 2007	Include a fixed ROW acquisition milestone schedule and obtain commitments from participating City departments.	PI	PI	TBD	✓	NI	NI	NI	✓	SF: No additional ROW required outside military base closure.
	5.III.i 2008	Implement an electronic progress payment system to improve efficiency.	TBD	NI	TBD	NI	NI	TBD	✓	TBD	LB: Current accounting system cannot accommodate a fully electronic approval process
	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
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	✓	✓	TBD	SC DU: Threshold is $100,000. LB: City Manager retains authority up to $100k

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

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

Category	Ref:*	BMP	LA	LB	OK	SC		SD	SF	SJ	Notes
						DT	DU				
Consultant Selection and Use	6.g.	Implement and use a consultant rating system that identifies quality of consultant performance.	✓	PI	✓	NI	NI	✓	✓	TBD	SC DU: Track performance for those selected for "support services." SJ: Need to incorporate more post-project review. 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	2011	✓	PI, 2010	TBD	TBD	TBD	PI, TBD	2010	

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



Chapter 5
Online Discussion Forum

CHAPTER 5 Online Discussion Forum

One of the *Study* benefits most appreciated by the Project Team is the ability to share issues or concerns in a web based forum and receive input from their fellow team members. After last year's report cutoff date and throughout this *Study* year, a total of 23 topics were discussed. From these sets of discussions, the following 8 topics are presented as an example of the types of informational exchanges that took place within the *Update 2010* online discussion forum.

- Allowable contractor mark-ups on change orders
- Electronic bidding, security measures, and contract processing
- Exceptions to design standards
- Traffic control plan
- Checking authenticity of bonds
- Mobilization
- Consultant rate reductions
- Posting of prevailing wage rates in bid specifications

A. ALLOWABLE CONTRACTOR MARK-UPS ON CHANGE ORDERS

The City of Long Beach was in the process of updating their specifications and wanted to see how the other Agencies dealt with contractor's mark-ups on change orders. The City currently specifies the following allowable mark-ups on contract change orders in its construction contracts:

Item	Percent Mark-up
Labor	20
Materials	15
Equipment and rentals	15
Items not listed above	15
Bond premium	01
Subcontractor work less than $5,000	10
Subcontractor work greater than $5,000	05

The City of Los Angeles provided a copy of General Requirements Section 01254 for all cities to review. There mark-ups were generally similar.

Item	Percent Mark-up
Labor	20
Materials & Equipment	15
Subcontractor (any tier) direct labor	20
Subcontractor (any tier) direct mat. & equip.	15
Contractor admin fee	05
Bond/insurance	01

The City of Sacramento, Department of Transportation responded that they only allow a 15% mark-up on material. For labor, they pay 1.33, partially burdened ((hourly wage + fringes) + 0.24 (hourly wage + fringes)). A 15% mark-up on material and freight charges is allowed. A Contractor can only have a 5% mark-up on a subcontractor.

The City of San Diego provided language from their specifications, Section 3-3.2.3. Their mark-ups were generally similar to Los Angeles and Long Beach.

Item	Percent Mark-up
Labor	20
Materials & Equipment	15
Subcontractors	05

The City of Oakland allowable markups based on their contract specifications are as follows:

Item	Percent Mark-up
Contractor Direct Labor	33
Contractor Direct Materials	15
Contractor Equipment & Rentals	15
Subcontractor work less than $5,000	15
Bond Premium included in 33% labor markup	7.5
Items not listed above are not included in the Specifications, however, 15% is considered reasonable	

The City of San Francisco is in the process of updating their specifications. According to the City and County of San Francisco's General Conditions, Section 700-6.06, their allowable mark-ups on contract change orders are as follows:

Item	Percent Mark-up
Contractor Direct Labor	33
Contractor Direct Materials	15
Contractor Equipment	15
Subcontractor Direct Labor	33
Subcontractor Direct Materials	15
Subcontractor Equipment	15

The City of San Jose does not have specific caps on mark-ups for negotiated lump sum change orders. For time and materials (force account) situations, allowable mark-ups are detailed in their standard specifications. They are as follows:

Item	Percent Mark-up
Labor	33
Materials	15
Equipment and rentals	15
Specialty work beyond contractor and subcontractor	15
Subcontractor	05

B. ELECTRONIC BIDDING, SECURITY MEASURES, AND CONTRACT PROCESSING

With the growing use of technology and the internet, the industry has seen a rise in the submission of bids electronically via the internet. Seeing this increase, the City of San Francisco, Bureau of Engineering and the City of San Jose proposed similar questions regarding on-line bidding. This City of San Francisco posed security questions and the City of San Jose posed contract processing questions. In preparing this report, the two topics were complimentary and were thus combined into a consolidated list of questions below:

1. Does any City use electronic bidding?
2. What service provider do you use for such electronic bidding?
3. What are any pluses or minuses based on your experiences?
4. Do you process contracts electronically with the successful bidder? If yes, do you process your contracts through a service provider?
5. If you do not process your contracts electronically, please describe your current contract processing?
6. Do you have any security concerns?
7. Do you have any Homeland Security concerns?
8. Do you require registration of prospective bidder seeking plans and specs to ensure that the prospective bidders are legitimate?
9. Any other comments?

The City of Long Beach utilizes electronic bidding for projects less than $100,000 that do not require bid bonds or City council approval. For larger projects, they post the plans, specifications, and addendums on-line, but require a written bid submission. Their service provider is Planet Bids. Their chief concern has been bid bond electronic signature issues. Once this issue is resolved, the City of Long Beach plans to go to full on-line bidding. It is their understanding that the only city in California that has fully moved into e-bidding is Riverside. Contract processing is still done the traditional way with mailed paper copies and wet signatures.

The City of Oakland does not currently employ electronic bidding. Plans have been established to implement an electronic system this coming October. Oracle's Procure-to-pay will be their service provider. Contracts are currently printed and routed for signature.

The City of Los Angeles does not utilize electronic bidding. Bid opportunity announcements and tracking of MBE/WBE Good Faith Effort outreach is handled electronically through an application developed by the Mayor's office. Plans and specifications are distributed via a CD instead of paper copy. All other processes, including contracts, are still done via traditional methodologies.

The City of Sacramento Department of Transportation does not have an electronic bidding or contract process.

The City of San Diego uploads bidding information, including plans and specifications, to an online internet service "eBidboard" for bidders to access and download. Contracts may be downloaded electronically but are still processed through traditional methods.

The City of San Francisco Bureau of Architecture e-bid system is strictly used for the uploading of plans, specifications, and addendum for free downloading. There is no e-bidding system at this time. The City of San Francisco DPW has begun development of an e-contract system but implementation has been hampered by not being able to resolve the issue of electronic signatures. The contract process remains traditional until this can be resolved. The only electronic contract process in place is the initial sending of the contract to the successful contractor via e-mail.

The City of San Jose does not use electronic bidding currently; however, they are looking into the possibility of doing so through their procurement vendor BidSync.

C. EXCEPTIONS TO DESIGN STANDARDS

The City of San Diego was in the process of developing standard operation procedures so it posed the following series of questions to the Project Team regarding how they address exceptions to design standards:

1. Does your Agency have a process or guideline for exceptions/ deviations to design standards?

2. If yes, does this process establish a threshold?

3. Does it apply only to new design, retrofit conditions or both?

4. What is the Authority of the Engineer of Record?

5. Does your process require mitigation measures when deviations occur?

The City of San Francisco Bureau of Engineering responded to each of the five questions. The following are their responses:

1. Yes, if supported by engineering principles and not inconsistent with laws and codes. Most items are handled by submittals and letters. There are Directors Hearings and an Appeal Board that deal with developer demolition and tree placement amongst other issues.

2. All exceptions from developers require a submittal. For City sponsored projects, the engineering discipline manager will make the decision. Bureau Manager or City Engineer are involved for exceptions that represent a major change to technical policy or scope.

3. This process applies to both new designs and retrofits.

4. The Engineer of Record has the authority to make technical decisions consistent with laws and regulations. Authority for exceptions is limited to the appropriate engineering discipline manager.

5. Mitigation measures are required when the situation merits.

The other Agencies responded that exceptions to design standards are dealt with on a case by case basis. Decisions are made at appropriate levels within the Agencies including: project managers, City Engineer, person in responsible charge, and key stakeholders such as maintenance, fire, etc.

D. TRAFFIC CONTROL PLAN

The City of San Francisco Bureau of Engineering polled the Agencies on whether they prepared and included complete traffic control plans in their specifications or if they required the contractors to submit traffic control plans for approval. While the response of each city was similar, each had a slight variation in their response.

For the City of Long Beach, the manner in which traffic control plans are addressed depends upon the project. If the traffic engineering staff believes there is only one way to handle traffic during construction, then they will prepare and include a traffic control plan in the specifications. If multiple scenarios are possible, depending upon how the contractor decides to construct the improvements, then they only provide general guidelines and require that the contractor submit a traffic control plan for approval prior to initiating any work on the project.

The City of Los Angeles Bureau of Engineering provides only major traffic control parameters in the plans and specifications and requires the contractor to develop the detailed traffic control plan to meet these parameters. The traffic control plans are approved through Los Angeles Department of Transportation.

The City of Oakland requires contractors to submit traffic control plans for review and approval. Project specifications specify work hours and the minimum number of lanes needed to be maintained. They also require that closures, detours, and signage comply with the WATCH handbook (Work Area Traffic Control Handbook).

The City of Sacramento Department of Transportation response was similar to Oakland's requiring the contractor to submit a plan for approval based upon requirements contained in the plans and specifications. On rare instances, like State Highway projects, Staged Traffic Control Plans are prepared and included in the plans and specifications for the contractor to follow.

The City of Sacramento Department of Utilities specifies that the contractor provide a traffic control plan based upon California's "Manual on Uniform Traffic Control Devices." In some cases, when they expect either detours or significant impact on traffic, they will include the traffic control plan in the Contract documents. Also, if there may be public consternation, they will include this information in public meetings prior to the beginning of construction.

The City of San Jose requires the contractors to submit traffic control plans as a project submittal before work proceeds on a project. They have a Traffic Control Manual that the contractor must generally conform to. This manual includes general diagrams for certain situations which should be modified by the contractor to fit the exact situation encountered on their project. Their manual can be viewed at **http://www.sanjoseca.gov/publicworks/laneclosure/tcmanual/index.asp.**

E. CHECKING AUTHENTICITY OF BONDS

The City of Sacramento Department of Utilities this past year uncovered a situation where the low bid contractor had supplied counterfeit bonds for a construction project. These counterfeit bonds were from a legitimate A. M. Best rated, well standing bonding company inclusive of the corporate seal. However, when the bonding company was called for verification, the bond that had been supplied was in fact not from this bonding company. New protocols will be established by the Department of Utilities to avoid this situation in the future. The City's Department of Transportation will also follow these new protocols. Encountering this situation, the City asked the following questions:

1. What steps are typically taken by your Agencies to QA/QC supplied bonds?

2. Does your responsible bidder guidelines and review procedures include steps that would catch contractors that have filed for bankruptcy or have had tax problems in the past?

Responding to Sacramento's questions, the City of Long Beach stated that they require bonds and insurance to be submitted within 15 days of notice of award in a format included in the contract specifications. Upon receipt, the City's Risk Manager and City Attorney review the submittal for form and legality, but do not contact the surety if all looks in order. The City does verify contractor's license and requires a valid city business license, but tax problems and/or bankruptcy filings are not checked.

Bonds are checked by The City of Los Angeles' Board of Public Works staff and then officially by the City Attorney. In addition, the Bureau of Contract Administration checks the contractor responsibility questionnaire which can be obtained through their website.

The City of Oakland does not have a system in place to check for bankruptcy and tax problems. They noted that a Dunn and Bradstreet number is required for all ARRA projects. Regarding bonds and licenses, they take the following steps:

1. Contacts the surety for verification of bonds.

2. Checks A.M. Best website to see if the bonds are with a company that has a bond rating based on criteria from the Division of Risk Management.

3. City Attorney reviews for form and legality

4. Checks to see if the contractor's license is valid.

Under the City of San Diego's Municipal Code 22.3224(a), contractors who desire to submit a bid as a prime contractor on public works projects valued at over $250,000 must be pre-qualified for financial resources, technical expertise, experience, a satisfactory record of past performance and compliance with the law. The Contractor Pre-Qualification Program, last updated in September 2009, was generated for this purpose. To obtain further information, visit **http://www.sandiego.gov/engineering-cip/services/consultcontract/prequal.shtml.** In addition, Purchasing and Contracting staff looks up the bond surety company on the A.M. Best Rating Service website where one can determine validity of the bonding agent/bonds, or identify issues with the bonding firm.

The City and County of San Francisco typically reviews bonds to ensure that they are originals, having proper notarized signatures and embossed seals. Additionally, when a contract is awarded, a congratulatory cover letter is sent to the Contractor with a copy sent to the surety which established the first notice should they need to enforce a claim against the bid bond. This process essentially acts as a confirmation to the surety that they have issued a bond on the project.

The City of San Jose's Attorney's Office only checks whether the bond issuer is registered with the State of California at the time the executed contract was given a final review. San Jose plans to have project staff validate the authenticity of bonds with the surety companies during the contract execution process.

F. MOBILIZATION

The City of San Diego is in the process of updating their bid items list for construction contracts. They posed two questions to the Agencies. Responses were received from five Agencies. The detailed responses can be found in **Table 5-1** below.

Table 5-1
City of San Diego Survey

Questions	1. Do you pay separate bid item for Mobilization?	2. If yes, do you cap the bid item for Mobilization so that bidders do not exceed a fixed amount of percentage of the Contract Price?
City of Long Beach	Yes, we use mobilization as a bid item on some projects.	We have in the past limited mobilization in the bid specifications to no more than 5%, but generally the amount is not restricted.
City of Los Angeles	Yes, usually, but not always, mobilization is a bid item.	When mobilization is a bid item, we will include a note stating that if the amount is greater than the specified amount in the specifications, it will be paid at the completion of the project. The stated amount is not a preset percentage but what is deemed reasonable by the Project Manager. Examples of their specifications were provided.
City of Oakland	A mobilization bid item is included on some projects where needed. It is decided by the Project Manager on a project by project basis.	A cap amount/percentage is determined by the Project Manager. On a recent bridge and street project, mobilization was capped at 6%.
City of Sacramento-DOT	Not on their projects. For large projects within Caltrans right-of-way that are funded by the City, a mobilization bid item had been included.	Have a cap of 10%.
City of San Francisco	Yes, we use mobilization as a bid item on projects.	Mobilization is generally restricted to 5% of the total amount of the unit bid items (excluding allowances and alternates).
City of San Jose	Yes, for civil-type projects.	For building types mobilization is typically a lump sum unit with a cap of 3-5% of base bid amount.

G. CONSULTANT RATE REDUCTIONS

Recently, all Departments within the City of Los Angeles received instructions to attempt to obtain 10% rate reductions in consultant contracts. In kicking off this process the Bureau of Engineering, wanted to check to see if other cities had undertaken similar programs (the City of Long Beach was known to have implemented such a program) and if so, how it has generally been implemented. For example, what rate reduction was sought, were legally binding agreements established or was it voluntary. They asked how lump sum tasks or contracts were handled that were already underway. Were the discounts only on remaining work? Also, they wanted to know if non-conforming contracts were terminated or discontinued.

As mentioned above, last year the City of Long Beach sent out a letter (example posted on line) requesting a 5% reduction on all consultant contracts held by the City. The reductions were to be reflected on future billings. The letter was to be signed and returned acknowledging their concurrence with this request. This reduction applied to future progress billings for lump sum work as well as those billed on a time and material (hourly) basis.

The City of Sacramento Department of Transportation has not sought such a rate reduction on existing contracts nor do they foresee doing so in the near future. For new contracts, Department of Transportation is negotiating for the lowest rates, cost and best value.

The City of Oakland is also seeking 10% voluntary reduction from all of their vendors, in general. A letter from the City Administrator requesting the reduction was sent to all the vendors and some did provide a discount to the billings.

The City of San Diego contemplated a similar strategy to that of Los Angeles' during their last budget reduction cycle targeting vendors and contractors. However, they have not initiated this process.

The City of San Francisco is not attempting to seek a rate reduction but instead is freezing consultant rates by legislating that the COLA for the FY 2010/11 and 2011/12 be a zero percent increase.

The City of San Jose Public Works is analyzing their active consultant agreements to determine which contracts/agreements have the potential for downward negotiation. The criteria they are applying to narrow the field is whether the contract/agreement will expire soon or whether they are 85% or more expended, both of which would be excluded. Also, they will probably exclude lump sum contracts, for which price already was an awarding factor.

H. POSTING OF PREVAILING WAGE RATES IN BID SPECIFICATIONS

Section 1773.2 of the State Labor Code requires that a call for bids include a listing of the general required wage rates by classification or that a copy of said listings be available for review at its principle office and be posted at the jobsite. However, the posting of Prevailing Wage Rates online is now common place. Noting this, the City of Long Beach asked the following questions:

1. Does your Agency include the wage rates in the bid specifications or just reference the appropriate website for wage information?

2. Do you just maintain a copy in the office?

3. Do you still require jobsite posting of wage rates?

The City of Los Angeles includes instructions to bidders in the Bid Package (Boiler Plate) regarding wage rates; however, the actual wage rates are not listed in the specifications. The Bid Package instructions state that the wage rates are kept on file in the City's Bureau of Contract Administration, Office of Contract Compliance. Contractors are required to post a copy of the General Prevailing Wage Rates at the jobsite. The Bureau of Contract Administration also has a link to the wage rates on their website.

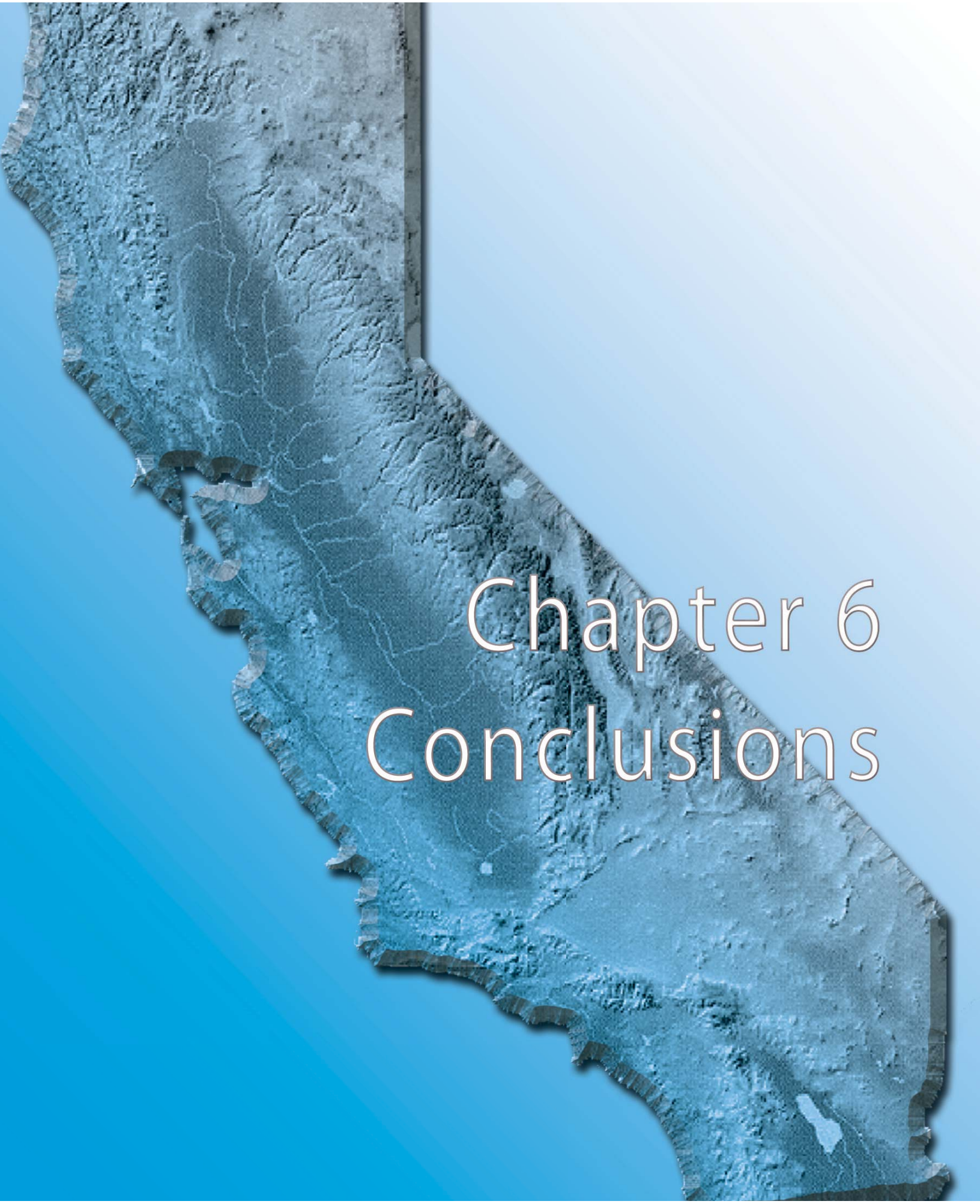
The City of Sacramento Department of Transportation stated that for locally funded projects, the Notice to Bidders references general wage rates of the State Labor Code and advises the contractor that the latest wage rates are available at the City Clerk's office. For projects involving Federal or Sacramento Housing and Redevelopment Agency (SHRA) CDBG funds, the general wage rates are included in the contract bid specifications.

The City of Sacramento Department of Utilities does not include wage rates in their specifications. The Notice to Contractors refers bidders to the City Clerk's office for hard copies, but mostly they refer bidders to the DIR website. As part of Labor Compliance, the contractor/employers are required to have DIR postings made available to employees both at home office and the work site and to make sure all employees are made aware of the posting locations. Some contractor/employers are required to post in both English and Spanish.

The City of San Diego provided a portion of their specification which refers the contractor to the State website and requires posting of the rates at the jobsite.

The City of San Francisco Bureau of Engineering, references the State and Federal wage rates in their specifications and provides a digital copy of the Federal wage rates on CD copies of the bid documents. They also provide a hard copy of the Federal wage rates with the final contract. Their specifications also reference the Federal website for Federal contracts and the San Francisco website for the San Francisco living wage rates which are 2.5% to 3% above the Federal minimum wage rate. Hard copies are both in the office and at the jobsite since they are included in the contracts and contracts are kept in both locations.

The City of San Jose's bid specifications does not include the DIR Wage Index. It states that the Index is available in the City's Office of Equality Assurance (OEA). The City does not allow certain classifications to be used on public works construction projects which they identify by including a cover sheet to the Wage Index. Hard copies of all wage indexes are maintained in OEA. Additionally, the awarded prime contractor receives a letter from OEA with the appropriate wage index and predetermined wage increases, labor compliance forms and instructions. The City also requires the prime contractor to sign a certification of posting and distribution.



Chapter 6
Conclusions

CHAPTER 6 Conclusions

A. PERFORMANCE BENCHMARKING

Performance Benchmarking for the *Update 2010 Study* involved analysis of 751 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. For the *Update 2010 Study*, the Agencies decided to collect costs data for projects delivered via alternative methods and analyze them at a later date when sufficient numbers of projects are collected to facilitate meaningful analyses. Projects funded by the American Recovery and Reinvestment Act (ARRA) of 2009 are not yet included in the *Update 2010* database because those projects were still on-going at the time of compiling project costs data for the *Update 2010 Study*.

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 2010 Study* varied between the following values for the full range and the smaller project subset of TCC respectively:

Table 6-1
Update 2010 Project Delivery Percentages

Type	Project Delivery Percentages
Municipal Projects	35% - 38%
Parks Projects	41% - 43%
Pipes Projects	35% - 38%
Streets Projects	45% - 48%

Although the results of the performance analyses are based on historical data provided by the participating Agencies, there are several factors that affect project delivery and are not captured in the performance model. These external factors include personnel turnover in the Agencies, competitive bids etc. 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 low-bid environment, it is recommended that the reader use best judgment in the context of the current economic crisis while using the *Study* results for planning and budgeting.

Increasing the size of the project database is a major challenge posed to the *Study*. 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 Agencies acknowledged that 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.

The Agencies recognize the need to evaluate the impacts of low construction bids on project delivery percentages. It is very likely that project delivery percentages might increase due to the reduced construction bids prevalent in the current economy. However, using such delivery percentages for budgeting a program of projects in the future may be misleading as construction costs are bound to increase with a reversal in the economy.

B. BEST MANAGEMENT PRACTICES

The Agencies have continued to fully implement selected BMPs. As of *Update 2010*, and with the addition of new BMPs, the Agencies have fully implemented about 68 percent of the adopted BMPs. Several BMPs have been partially implemented with the goal of complete implementation in the near-future. Each Agency outlined their plan for fully implementing their adopted BMPs.

In *Update 2010*, the Project Team added three new BMPs. 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.

While an exact measurement of each BMP's value to each Agency may not be achievable, the Agencies felt the need to document what they believe the perceived value was to them. This was accomplished by assigning a "perceived value" to the adopted BMPs from the following categories:

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

Upon reviewing the assigned perceived values to the BMPs, it was observed that the majority of the BMPs were 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.

C. ONLINE DISCUSSION FORUM

In *Update 2010*, the Online Discussion Forum continues to be an important feature for *Study* participants, with active exchanges occurring frequently and important issues being addressed with changes to policy, approach, or BMP implementation. Participants continue sharing information through the Online Discussion Forum and during the quarterly 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 advantage to all participants.

D. PLANNING FOR UPDATE 2011

Over the course of *Update 2010*, the Project Team identified a number of activities to consider including next year in *Update 2011*. These activities include:

- Reducing the number of annual meetings from four to two to save staff time and travel costs in light of the challenging economic situation. The Agencies would hold two abbreviated conference calls to continue their round-table discussion on current topics in lieu of the two eliminated meetings.
- Collecting data on projects delivered via alternative delivery techniques. It is expected that a sufficient number of projects will be available to facilitate meaningful analyses.
- Developing project delivery percentages (arithmetic averages only) for projects having a TCC ranging from $100,000 to $500,000.
- Exploring the impacts of reduced construction bids on project delivery costs.
- Adding projects delivered by ARRA funds to the projects database for inclusion in the analysis.
- Developing new BMPs and tracking the implementation of adopted BMPs
- Continuing discussion on current topics via the round-table discussion forum.
- Continuing meaningful exchanges on the Online Discussion Forum via a new 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 2010 Project Team

Study Team:

Mark Christoffels, P.E.,
Deputy Director/City Engineer
City of Long Beach,
Department of Public Works
333 W. Ocean Blvd., 9th Floor
Long Beach, CA 90802
(562) 570-6771
(562) 570-6012 (fax)
Mark.Christoffels@longbeach.gov

Joseph Wojslaw, P.E.,
Consultant Manager
MWH
618 Michillinda Avenue, Suite 200
Arcadia, CA 91007
(626) 568-6194
(626) 568-6101 (fax)
joseph.a.wojslaw@mwhglobal.com

Ganesh Krishnamurthy,
Consultant
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, P.E.,
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

Edward Villanueva,
Capital Projects Coordinator
City of Long Beach,
Department of Public Works
333 W. Ocean Blvd., 10th Floor
Long Beach, CA 90802
(562) 570-5793
(562) 570-6012 (fax)
Edward.Villanueva@longbeach.gov

J.R. "Rich" Suit,
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)
Rich.Suit@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.,
Principal Civil Engineer
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) 847-0546
(213) 847-0703 (fax)
vince.jones@lacity.org

Ted Allen, P.E.,
Assistant 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, P.E.,
Interim 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.,
Deputy 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

Nicholas Theocharides, P.E.,
Engineering 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

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

Richard S. Batha, P.E.,
Supervising Engineer
City of Sacramento,
Department of Utilities,
Engineering Services
1395 35th Avenue
Sacramento, CA 95822
(916) 808-1448
(916) 808-1497 (fax)
rbatha@cityofsacramento.org

Patti Boekamp, T.E.,
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)
pboekamp@sandiego.gov

Afshin Oskoui, P.E.,
City Engineer and Assistant Director
City of San Diego
Engineering & Capital
Projects Department
600 B Street, Suite 800, MS 908A
San Diego, CA 92101
(619) 533-5110
(619) 533-4666 (fax)
aoskoui@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
Engineering and Capital
Projects 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 Pl
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

Edgar Lopez, AIA,
Bureau Manager
City and County of San Francisco,
Department of Public Works,
Bureau of Project Management
30 Van Ness Avenue, 4th Floor
San Francisco, CA 94102
(415) 557-4675
(415) 558-4519 (fax)
Edgar.Lopez@sfdpw.org

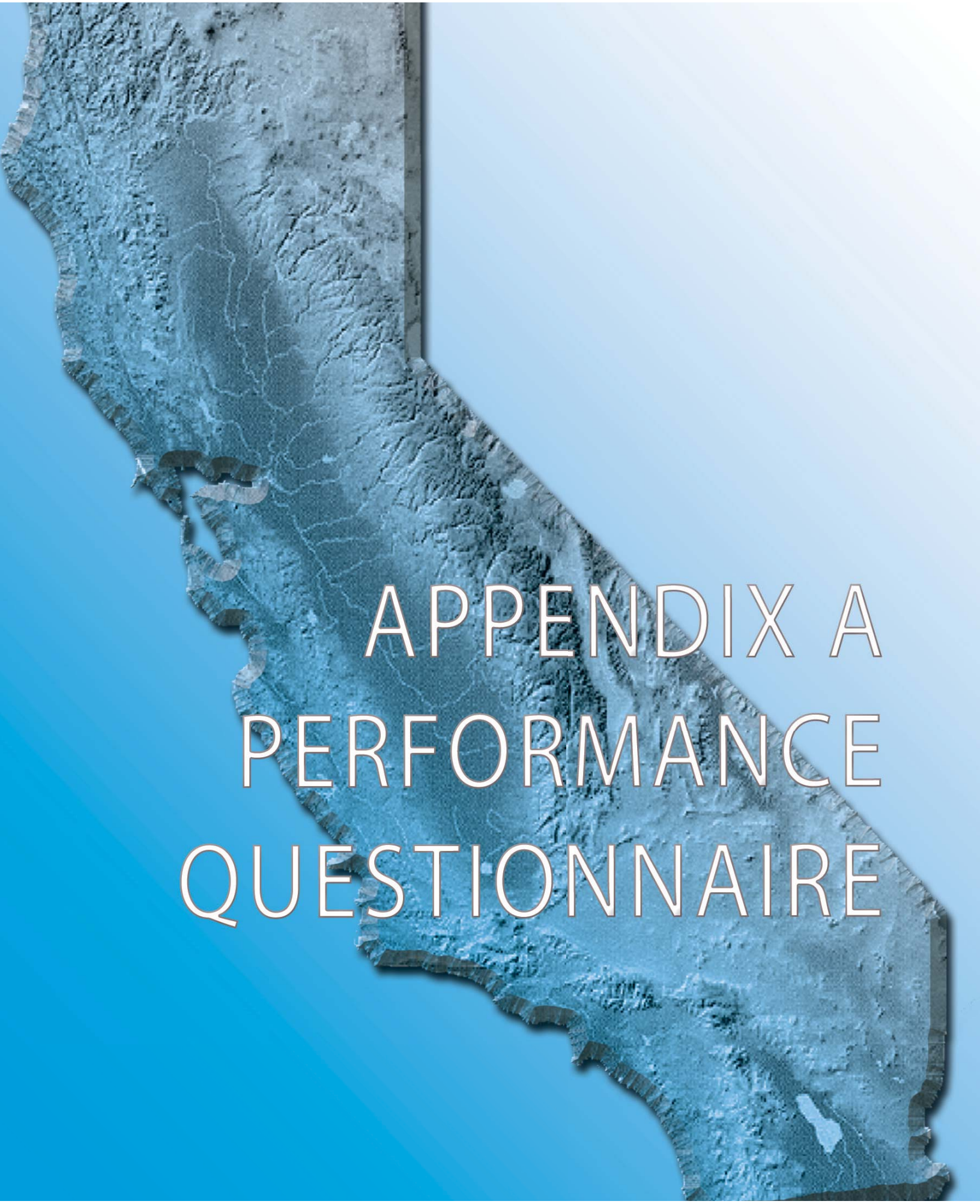
David D. Sykes, P.E.,
Assistant Director
City of San Jose,
Department of Public Works
200 E. Santa Clara St.
5th Fl. Tower
San Jose, CA 95113
(408) 535-8440
(408) 292-6268 (fax)
david.sykes@sanjoseca.gov

Barry Ng, P.E., L.S.,
Division Manager,
Engineering Services 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

Katy Allen, P.E.,
Director
City of San Jose,
Department of Public Works
200 E. Santa Clara St.
5th Fl. Tower
San Jose, CA 95113
(408) 535-8444
(408) 292-6268 (fax)
katy.allen@sanjoseca.gov

Ashwini Kantak, AIA, LEED AP,
CIP Team Leader
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 2010 Performance Questionnaire

Agency: | Project Name:

Project type:

New/Rehab Index:

Alternative Project Delivery:

☐ LEED Green Building

☐ Project Financial Elements Closed and Complete

Description:

Comments:

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

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

(1) Agency costs include other direct costs and can be listed underneath.
This value is locked and it is calculated from its items (Rows 15 - 19)

APPENDIX B
PERFORMANCE CURVES

APPENDIX B Performance Curves

REGRESSION ANALYSIS RESULTS

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

REGRESSION DEFINITIONS

Prior to discussing the analysis results for *Update 2010*, a brief overview of the relevant statistical terminology and their definitions is provided.

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

The regression trendline 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 usually used as the maximum desirable value.

For the purposes of this *Study*, a critical p-value of 0.10 was selected. Thus, any result where $p \leq 0.10$ is considered statistically significant. There is no difference between a p-value slightly below 0.10 as one that is far below 0.10. Both results are considered to have equal statistical significance.

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

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

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 project delivery costs and b1, b2, b3, b4, and b5 as their TCC respectively. The arithmetic average of the project delivery percentages would be represented as:

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

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 a fashion that is more similar to the following formula which represents the average slope of the least squares fit.

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

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 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 four 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 a significant increase (approximately eight 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 a six percent increase. Projects under the Municipal category exhibit a minor increase while projects under the Parks category show no change in their project delivery percentages for projects evaluated in the smaller project subset of TCC. Comparing the results summarized in T**able 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	**121**	**17%**	**16%-18%**	**0.89**	**8.03E-60**	**17%**	**17%-19%**	**0.89**	**2.85E-60**	**34%**	**33%-37%**	**0.92**	**1.07E-67**
Libraries	18	15%	11%-16%	0.89	8.69E-10	13%	9%-16%	0.76	2.15E-06	28%	22%-30%	0.92	1.3E-10
Police/Fire Stations	33	16%	12%-20%	0.74	3.26E-10	15%	11%-19%	0.70	2E-09	31%	25%-38%	0.77	5.43E-11
Comm./Rec.Center/ Child Care/Gyms	47	15%	12%-16%	0.85	6.27E-21	11%	9%-12%	0.80	6.32E-18	26%	22%-27%	0.88	2.17E-23
Other Municipal	23	17%	16%-20%	0.94	1.72E-14	18%	18%-21%	0.96	2.35E-17	36%	34%-40%	0.97	4.24E-18
Streets Projects	**279**	**16%**	**14%-17%**	**0.61**	**1.45E-59**	**18%**	**18%-19%**	**0.93**	**2.3E-164**	**34%**	**32%-35%**	**0.90**	**4.2E-137**
Widening/New/ Grade Separations	33	13%	9%-13%	0.73	7.5E-13	19%	18%-21%	0.98	1.61E-27	32%	29%-33%	0.97	1.84E-27
Bridges	16	30%	17%-42%	0.63	2.26E-4	14%	9%-17%	0.78	2.74E-06	44%	31%-55%	0.81	2.13E-06
Reconstructions	81	21%	21%-28%	0.65	2.04E-21	17%	16%-21%	0.74	3.91E-25	38%	38%-48%	0.74	1.67E-26
Bike/Pedestrian/ Streetscapes	75	18%	13%-20%	0.51	3.75E-13	13%	10%-14%	0.63	9.15E-18	31%	23%-34%	0.60	1.49E-16
Signals	74	15%	8%-14%	0.33	6.21E-11	19%	14%-19%	0.67	9.42E-21	34%	24%-31%	0.69	1.23E-25
Pipes Projects	**285**	**15%**	**14%-15%**	**0.99**	**1.1E-272**	**10%**	**10%-10%**	**0.95**	**3.5E-189**	**25%**	**24%-25%**	**0.99**	**8.5E-270**
Gravity Mains	238	15%	14%-15%	0.99	1.7E-243	10%	10%-10%	0.95	9.7E-162	25%	24%-25%	0.99	6.9E-229
Pressure Systems	29	11%	4%-14%	0.31	9.47E-4	11%	7%-13%	0.60	3.68E-07	22%	11%-26%	0.48	1.54E-05
Pump Stations	14	14%	10%-17%	0.87	8.52E-07	10%	6%-12%	0.79	7.68E-06	24%	20%-25%	0.96	9.58E-11
Parks Projects	**66**	**24%**	**22%-28%**	**0.78**	**1.27E-22**	**12%**	**8%-13%**	**0.49**	**1.67E-11**	**36%**	**33%-38%**	**0.91**	**3.91E-35**
Playgrounds	50	22%	19%-23%	0.90	1.9E-26	15%	13%-16%	0.85	3.52E-21	37%	33%-39%	0.91	1.95E-27
Sportfields	12	26%	20%-45%	0.74	2.6E-4	8%	0%-15%	0.13	1.56E-1	35%	30%-45%	0.93	9.63E-07
Restrooms	4	54%	-	0.83	6.65E-2	18%	-	0	7.10E-1	71%	-	0.75	1.35E-1

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. 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).

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

Project Type or Classification	TCC Upper Bound ($ Millions)	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	**7.8**	**96**	**15%**	**12%-15%**	**0.72**	**1.73E-29**	**13%**	**10%-13%**	**0.68**	**2.73E-26**	**28%**	**22%-27%**	**0.78**	**4.75E-35**
Libraries	9.1	15	17%	12%-20%	0.87	4.2E-7	12%	3%-15%	0.36	7.39E-3	29%	18%-32%	0.81	2.3E-6
Police/Fire Stations	15.1	26	15%	10%-17%	0.71	2.12E-8	18%	16%-25%	0.75	4.79E-9	33%	27%-42%	0.78	2.26E-9
Comm./Rec.Center/ Child Care/Gyms	4.2	38	17%	10%-18%	0.51	1.17E-7	14%	10%-15%	0.73	2.72E-12	31%	21%-32%	0.71	6.23E-12
Other Municipal	11.1	19	15%	13%-18%	0.92	1.09E-10	9%	5%-10%	0.65	6.56E-6	24%	19%-26%	0.92	3.4E-11
Streets Projects	**1.7**	**221**	**21%**	**13%-19%**	**0.29**	**1.1E-22**	**19%**	**14%-20%**	**0.37**	**6.73E-24**	**40%**	**29%-38%**	**0.46**	**4.61E-34**
Widening/New/ Grade Separations	5.6	27	31%	22%-39%	0.69	9.1E-8	15%	9%-17%	0.62	4.5E-7	46%	34%-53%	0.77	1.81E-9
Bridges	5.2	12	36%	24%-37%	0.82	8.68E-7	35%	30%-47%	0.89	1.1E-6	71%	57%-81%	0.94	2.16E-7
Reconstructions	2.1	65	18%	11%-20%	0.39	1.22E-8	16%	8%-21%	0.25	2.21E-5	34%	22%-38%	0.45	5.87E-10
Bike/Pedestrian/ Streetscapes	1.4	59	24%	13%-24%	0.36	3.39E-8	20%	16%-26%	0.57	2.92E-12	44%	31%-49%	0.57	2.92E-12
Signals	**0.5**	59	26%	14%-31%	0.33	1.21E-6	25%	14%-33%	0.30	7.37E-6	51%	35%-59%	0.51	1.25E-10
Pipes Projects	1.7	**227**	**17%**	**11%-16%**	**0.29**	**1.64E-20**	**16%**	**14%-17%**	**0.56**	**2.05E-42**	**33%**	**25%-32%**	**0.51**	**3.24E-38**
Gravity Mains	1.6	190	17%	10%-16%	0.29	1.36E-17	17%	14%-18%	0.54	2.22E-34	33%	25%-33%	0.51	2.89E-32
Pressure Systems	1.8	23	11%	1%-13%	0.13	2.24E-2	13%	10%-15%	0.81	5.02E-9	24%	12%-28%	0.54	2.42E-5
Pump Stations	**11.2**	11	16%	0%-22%	0.08	9.75E-2	20%	15%-25%	0.89	1.12E-5	36%	16%-44%	0.66	1.07E-3
Parks Projects	1.2	**52**	**24%**	**13%-27%**	**0.35**	**1.89E-6**	**14%**	**6%-15%**	**0.23**	**5.04E-5**	**38%**	**21%-40%**	**0.41**	**4.53E-8**
Playgrounds	1.1	40	26%	17%-31%	0.55	3.89E-8	14%	4%-16%	0.17	2.11E-3	39%	24%-44%	0.54	3.56E-8
Sportfields	2.7	9	16%	4%-32%	0.55	2.08E-2	8%	0%-8%	0	7.45E-1	24%	1%-33%	0.37	4.09E-2
Restrooms	0.4	3	39%	-	0.25	6.55E-1	34%	-	0.42	5.06E-1	74%	-	0.33	5.89E-1

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. 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).

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).

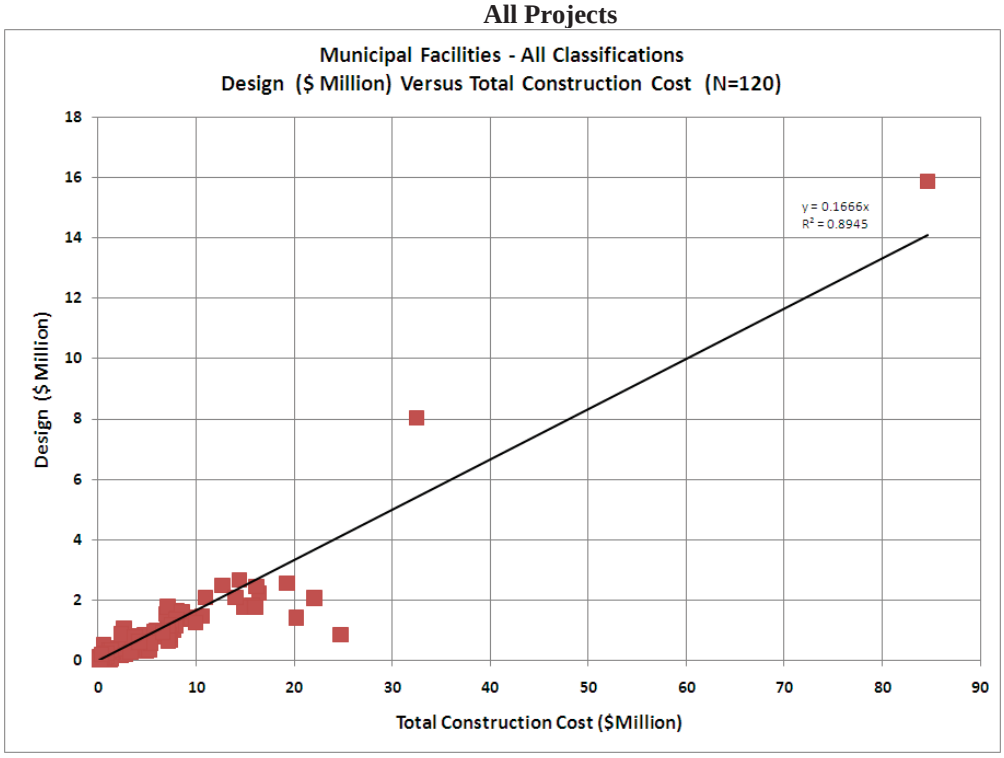
APPENDIX B

Performance Curves

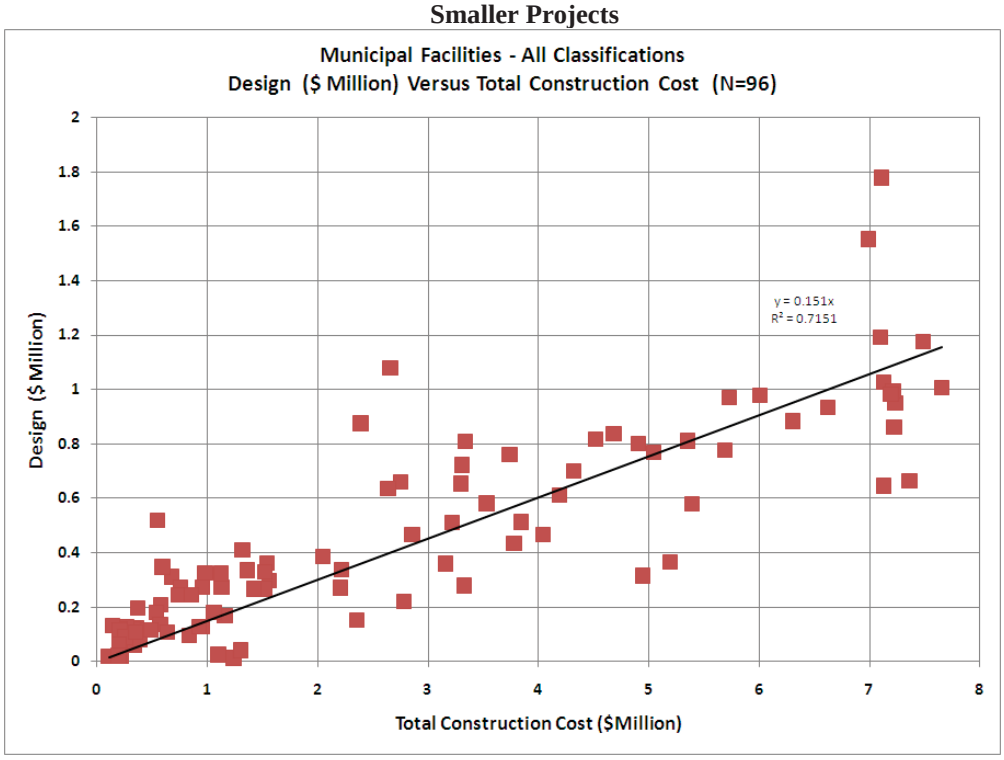
CURVES GROUP 1

Design Cost
vs
Total Construction Cost

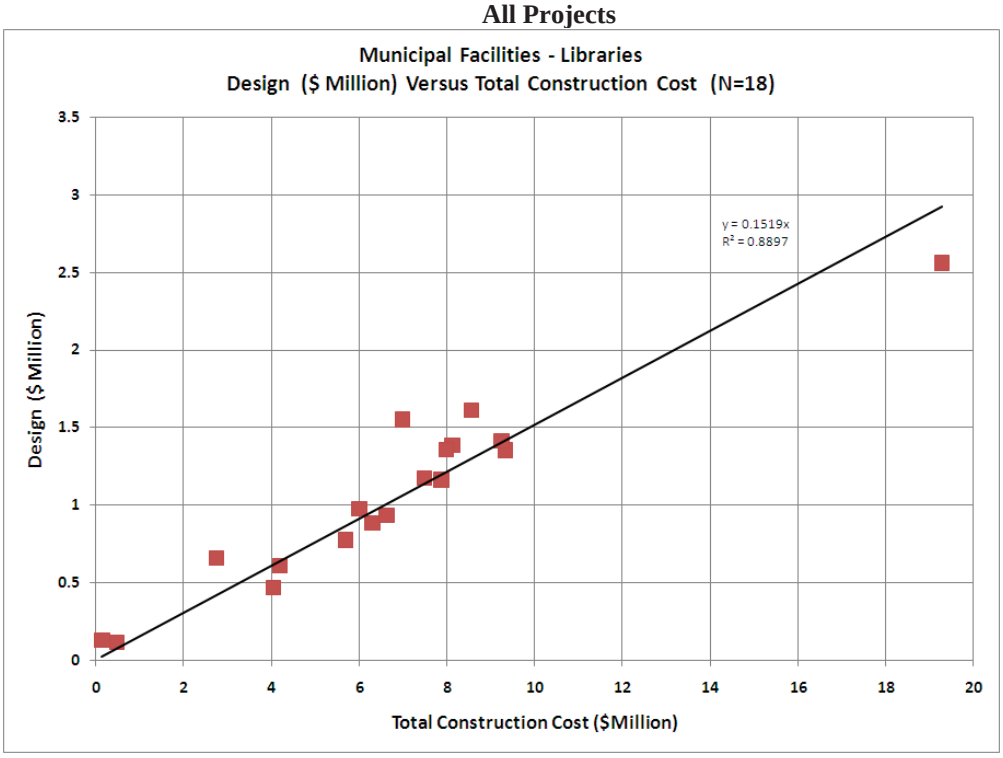
All Projects



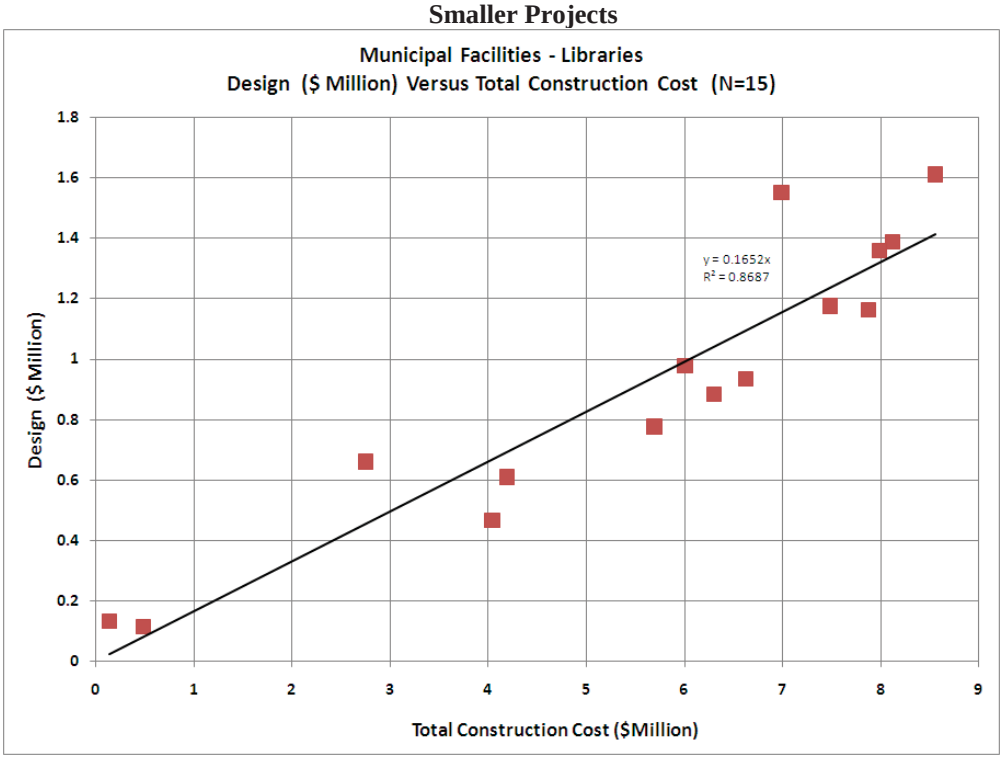
Smaller Projects



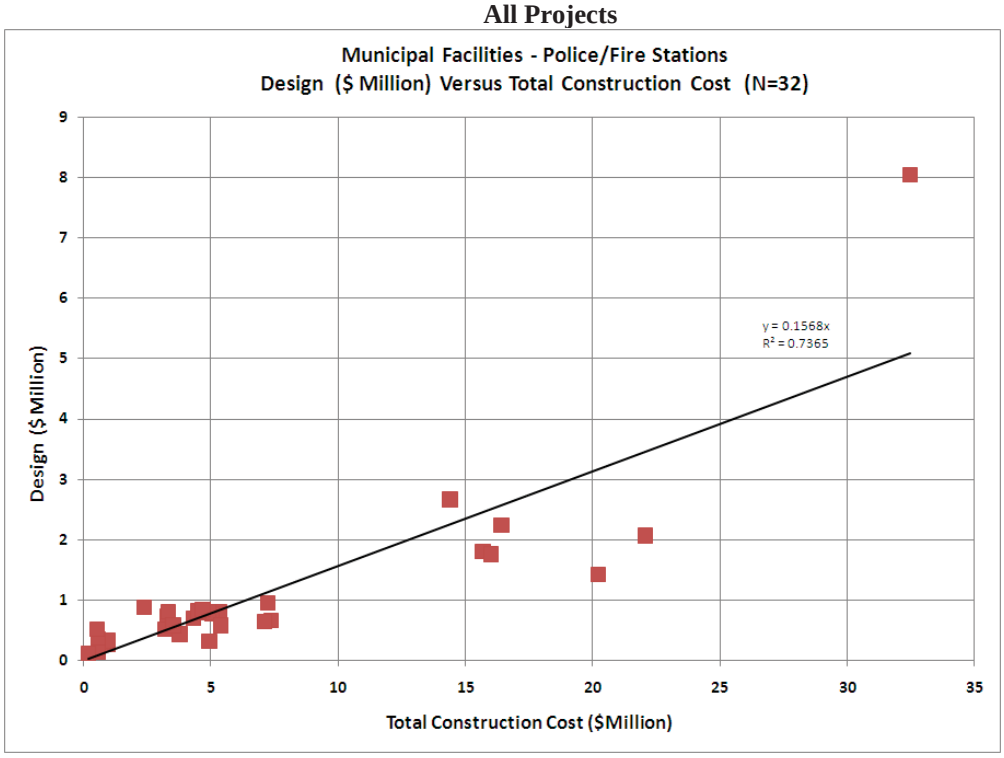
All Projects



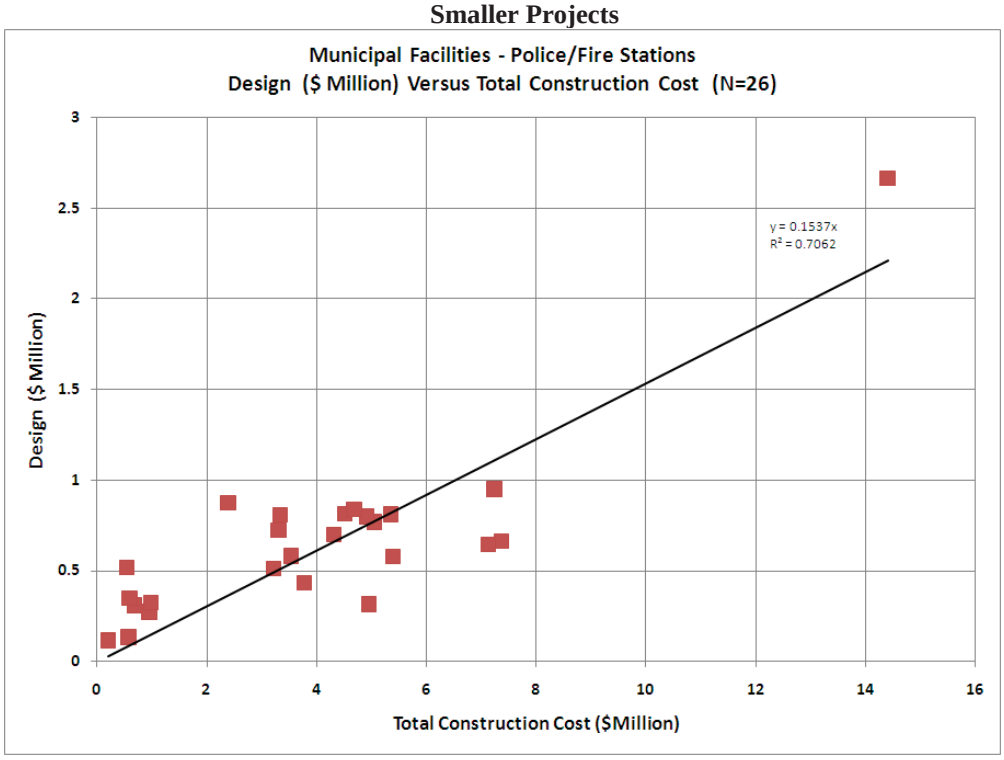
Smaller Projects



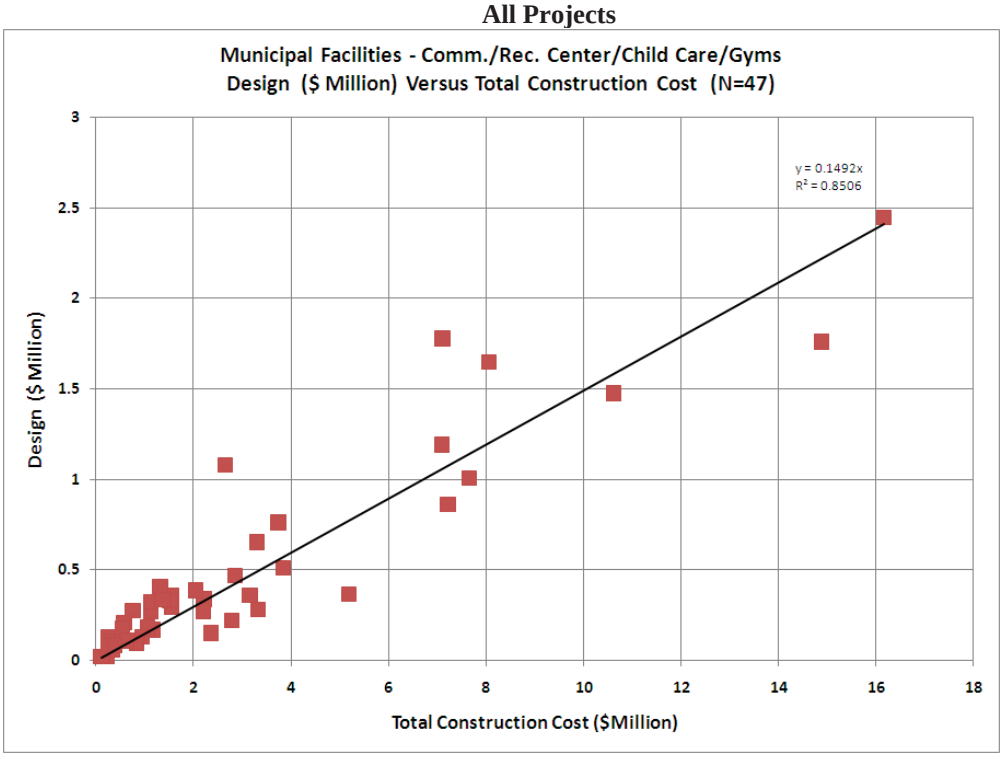
All Projects



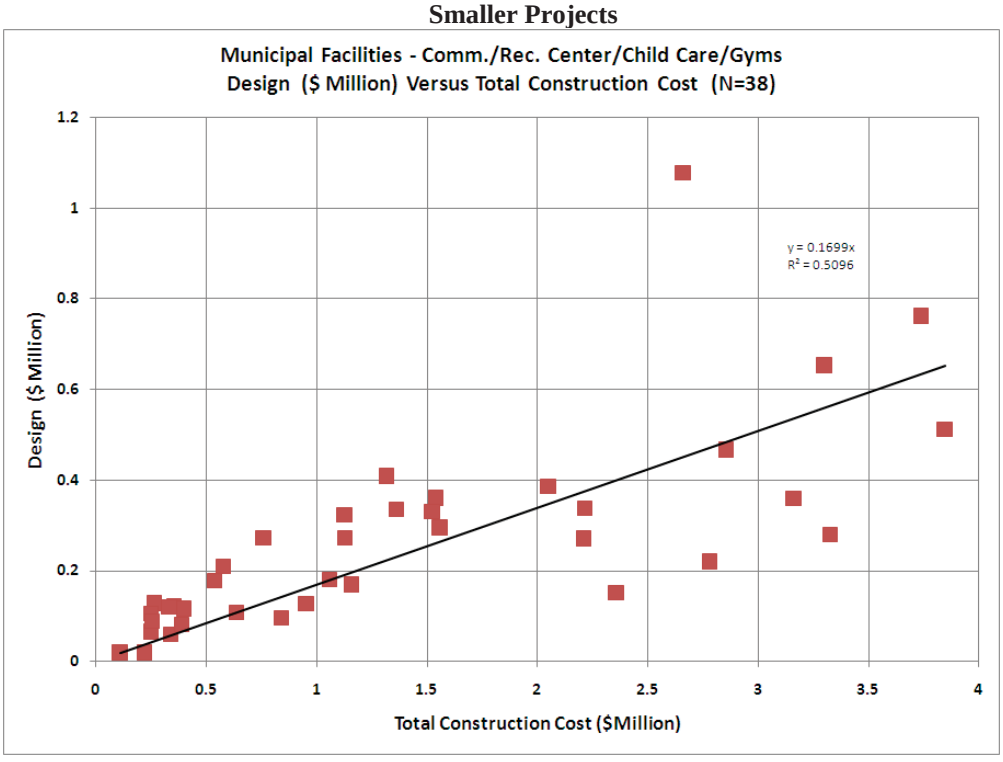
Smaller Projects



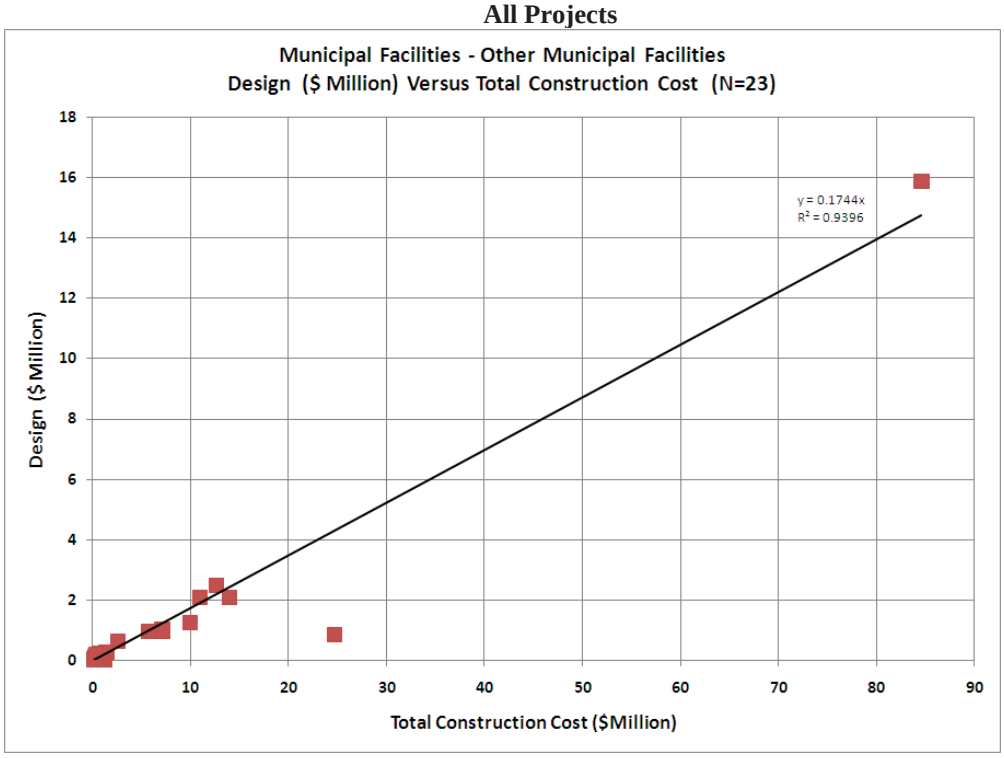
All Projects



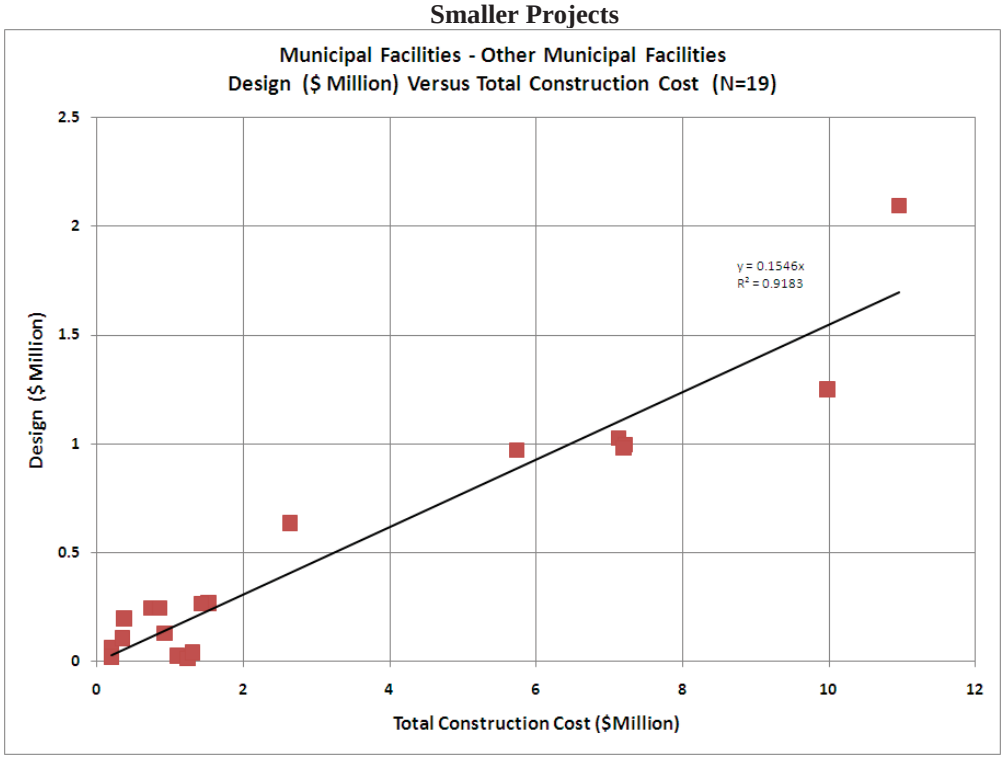
Smaller Projects



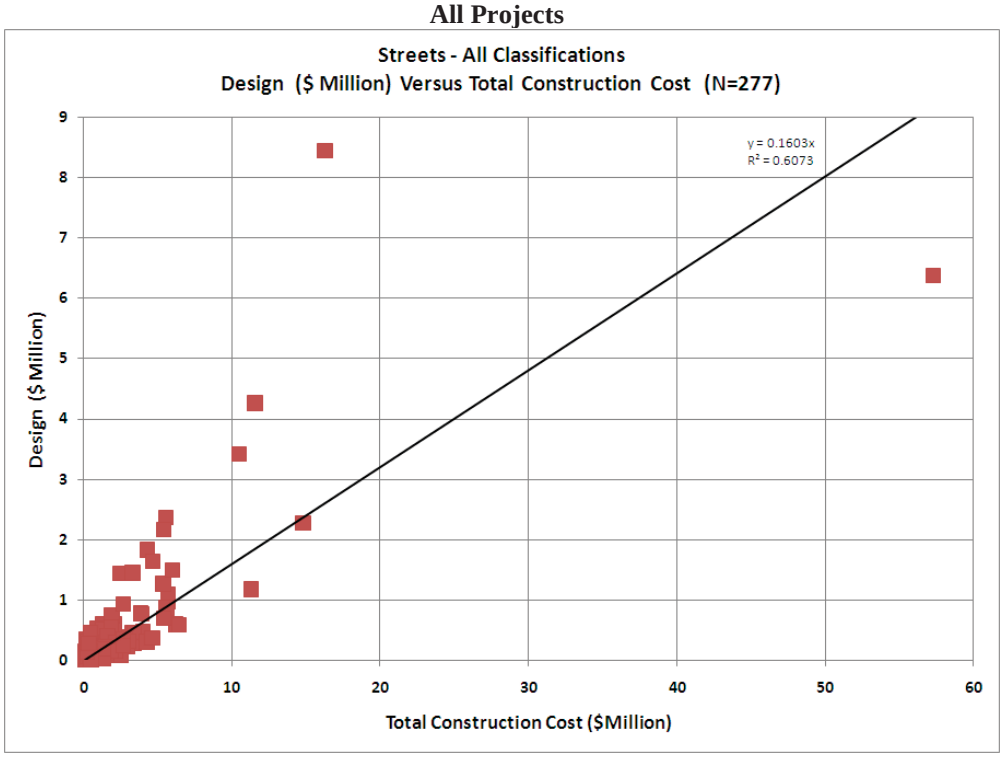
All Projects



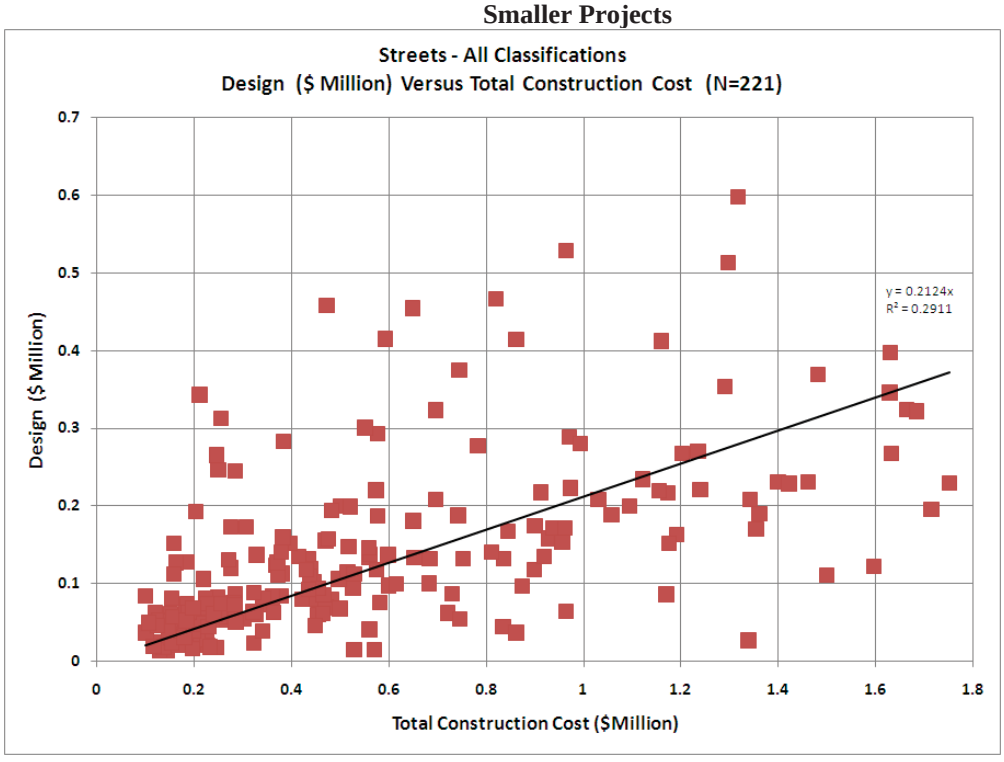
Smaller Projects



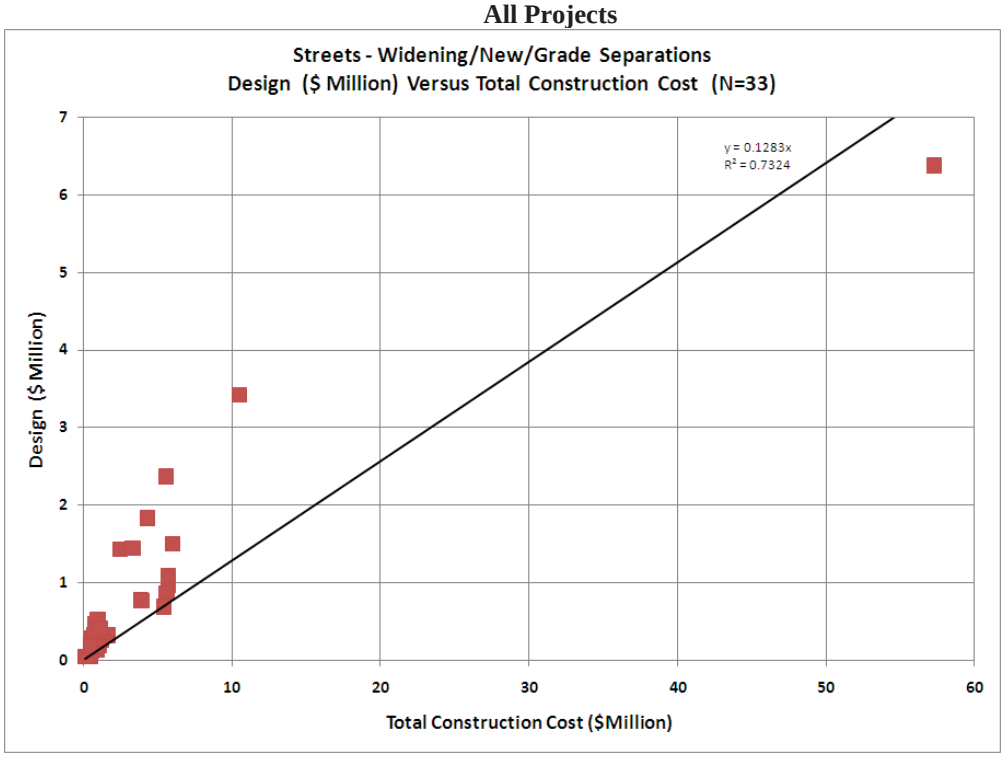
All Projects



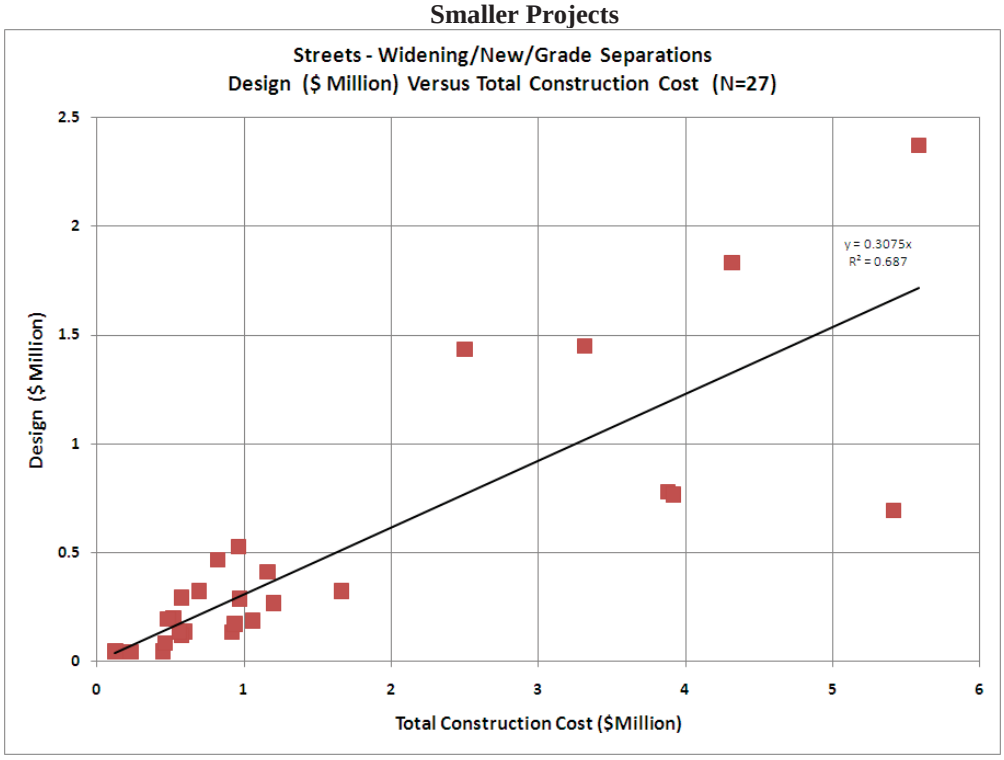
Smaller Projects



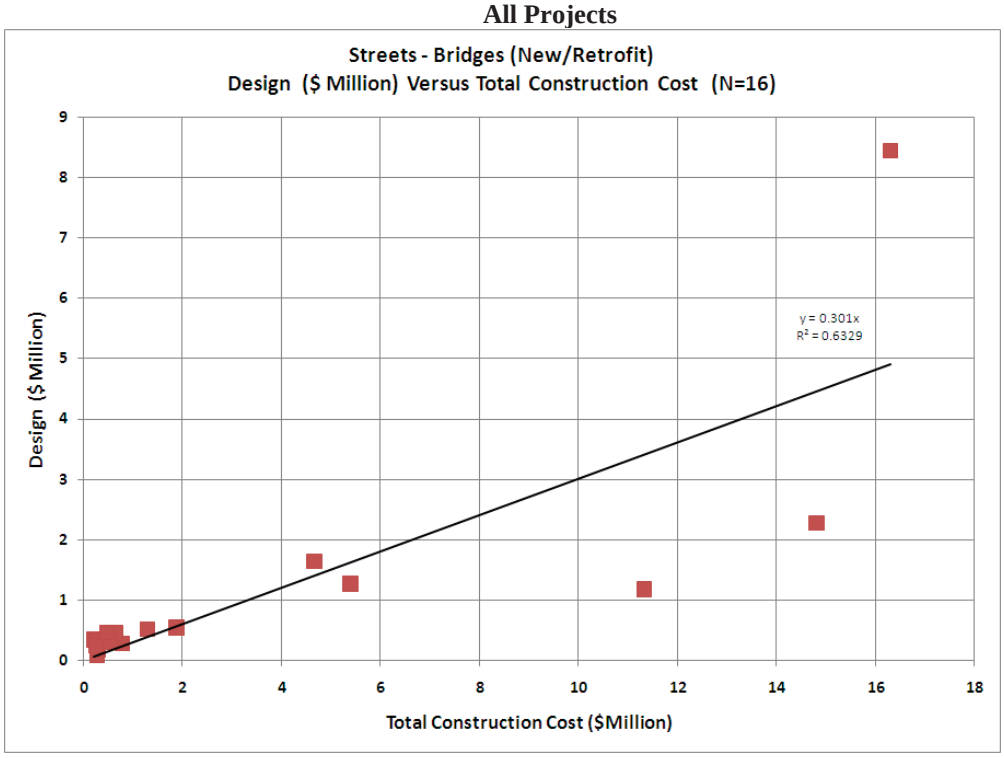
All Projects



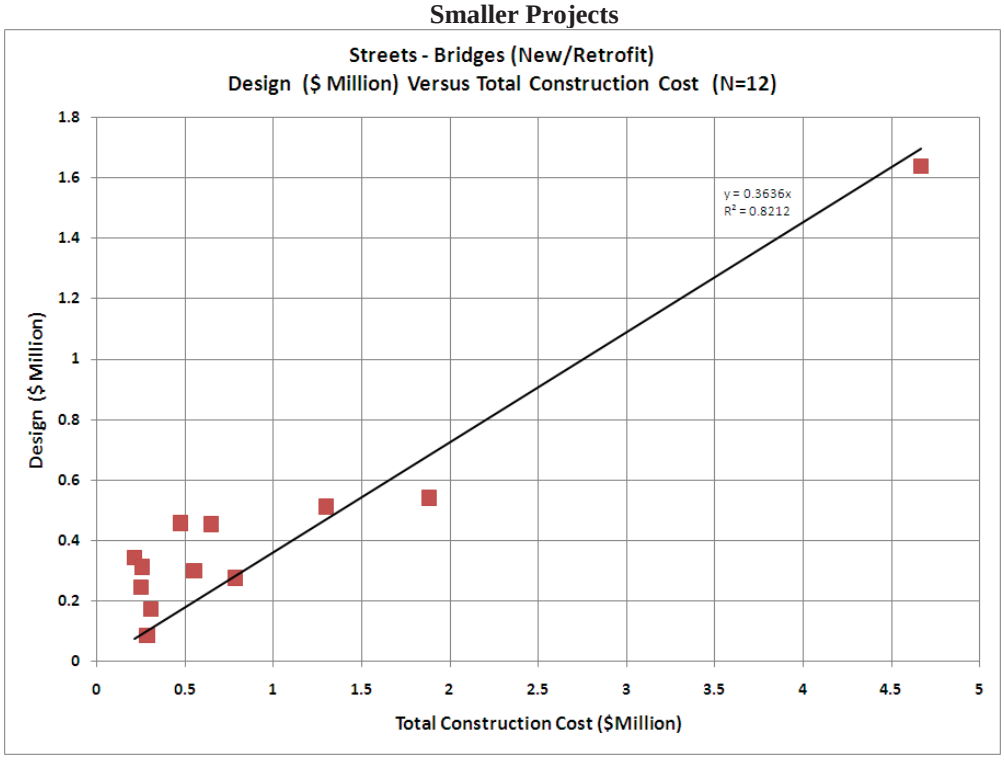
Smaller Projects



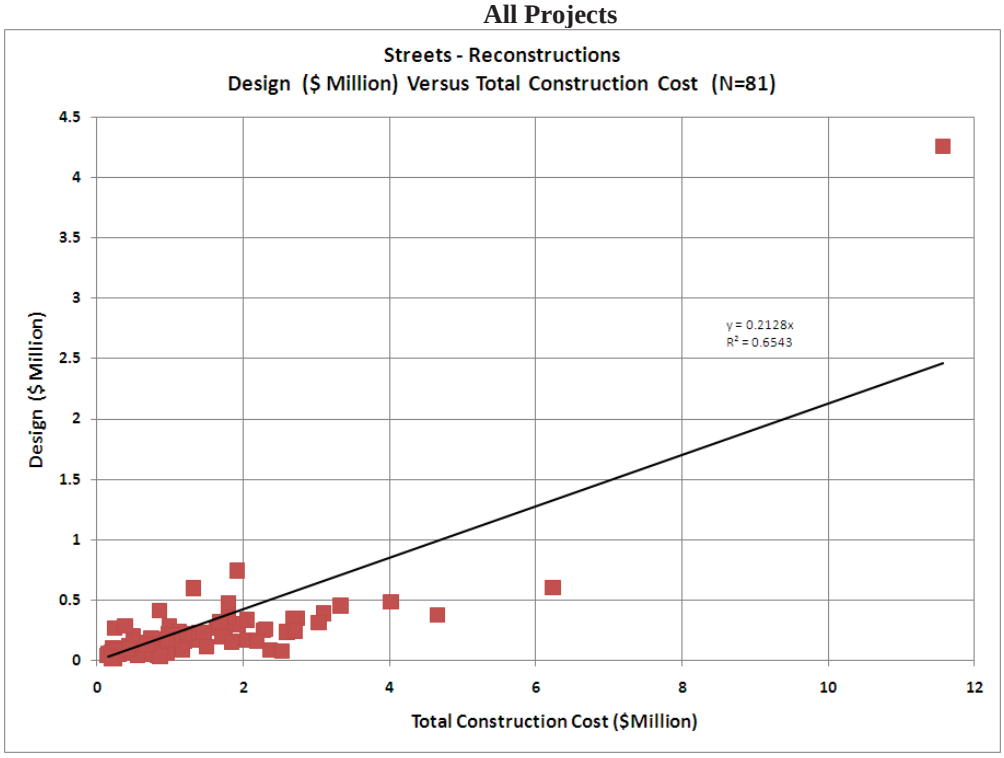
All Projects



Smaller Projects

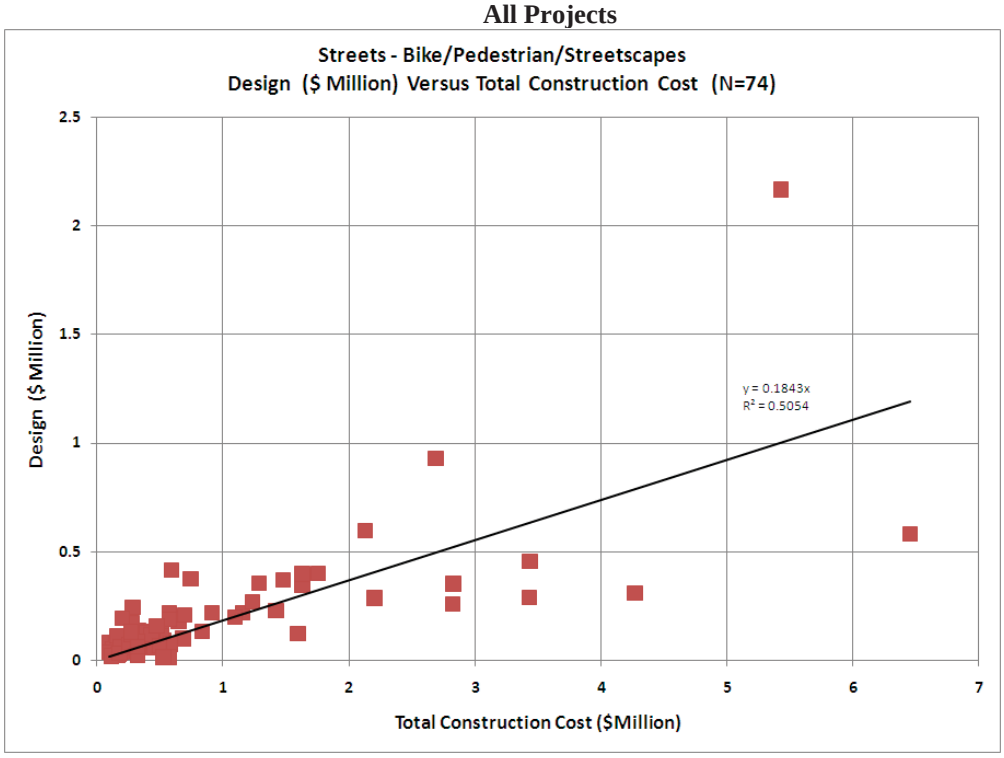


All Projects

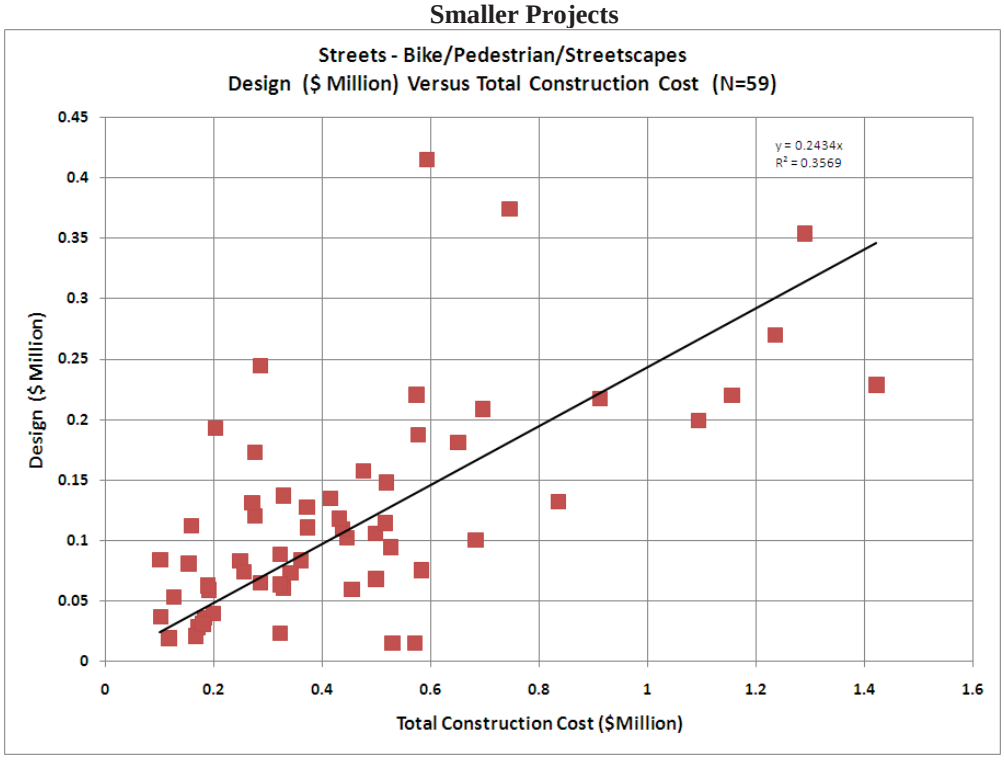


Smaller Projects

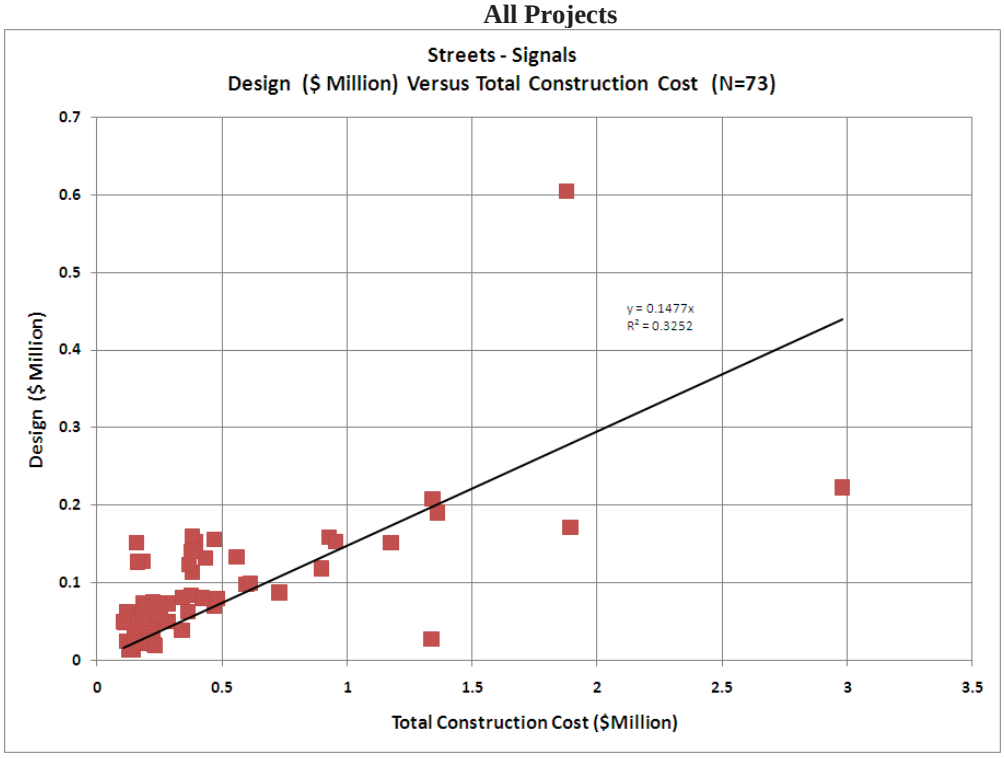
All Projects



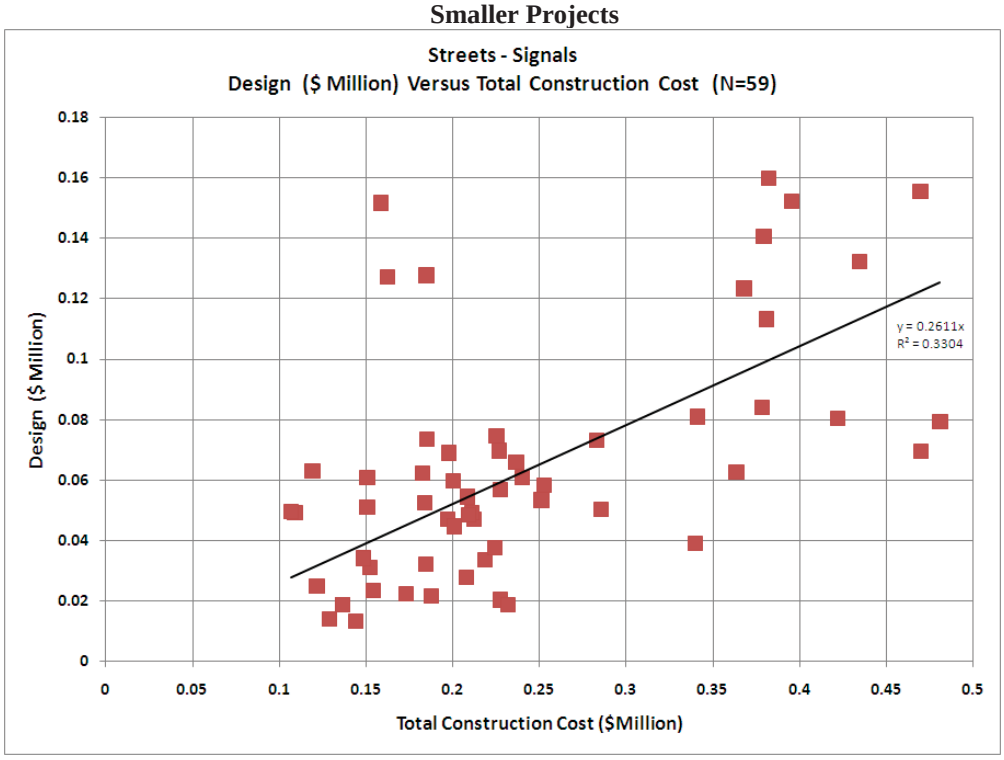
Smaller Projects



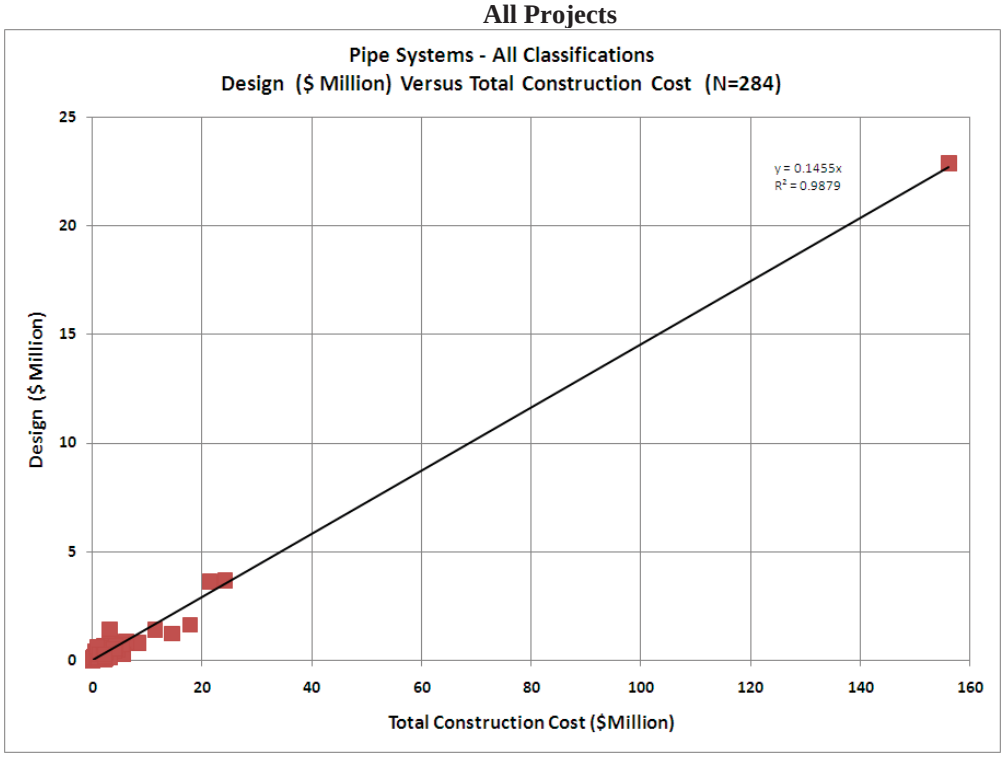
All Projects



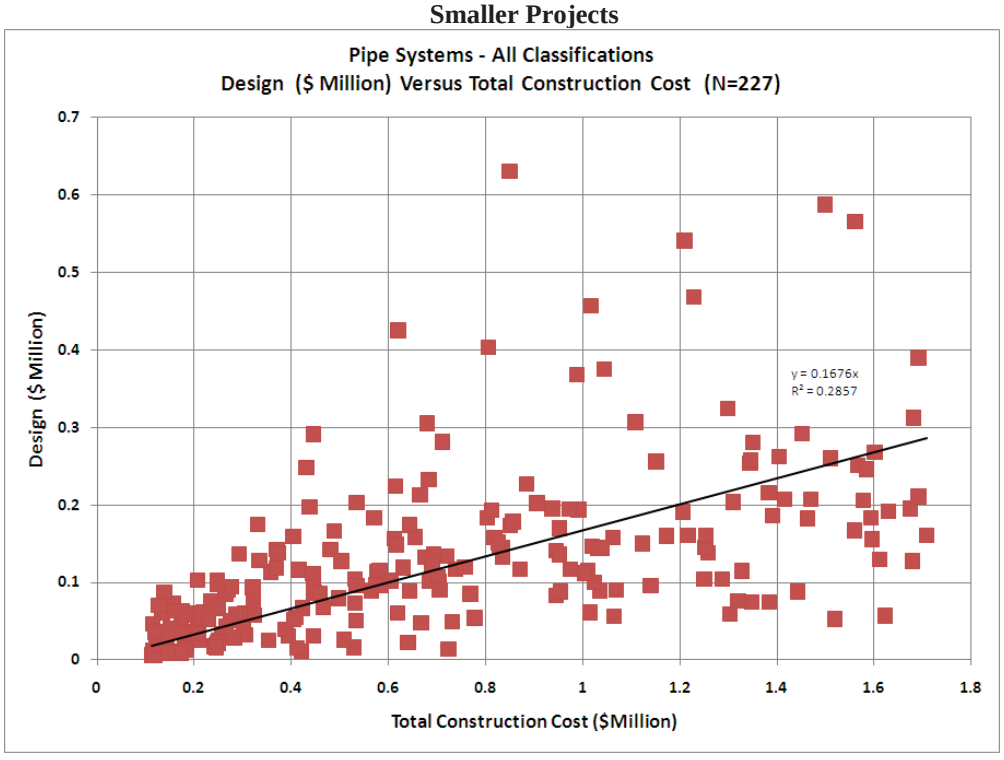
Smaller Projects



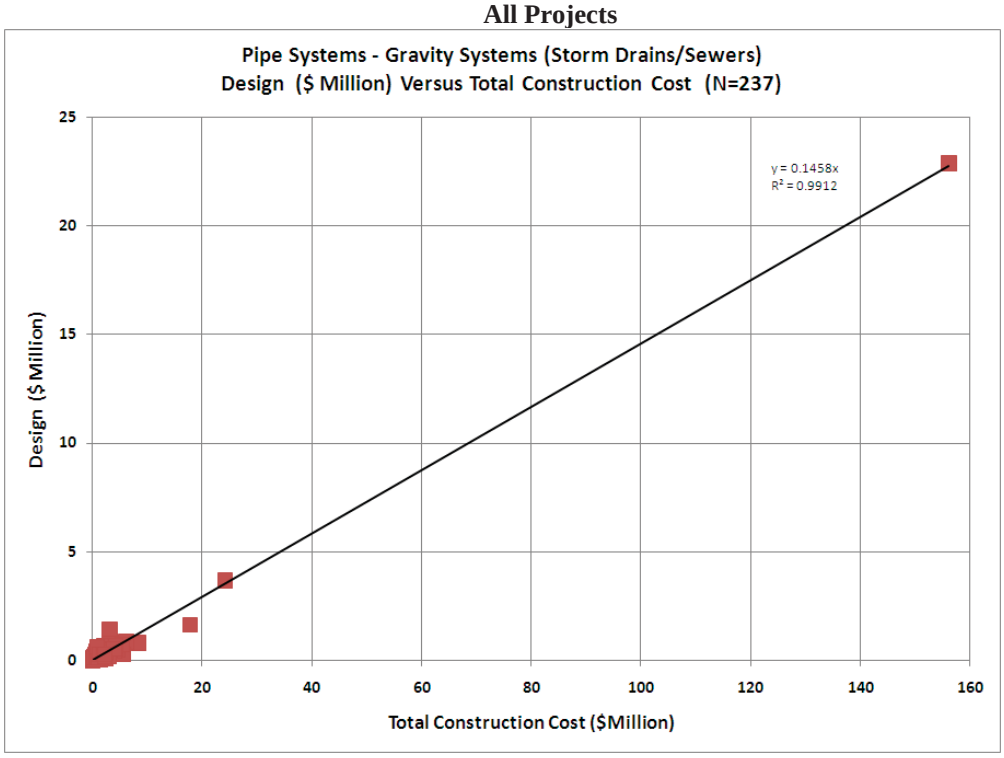
All Projects



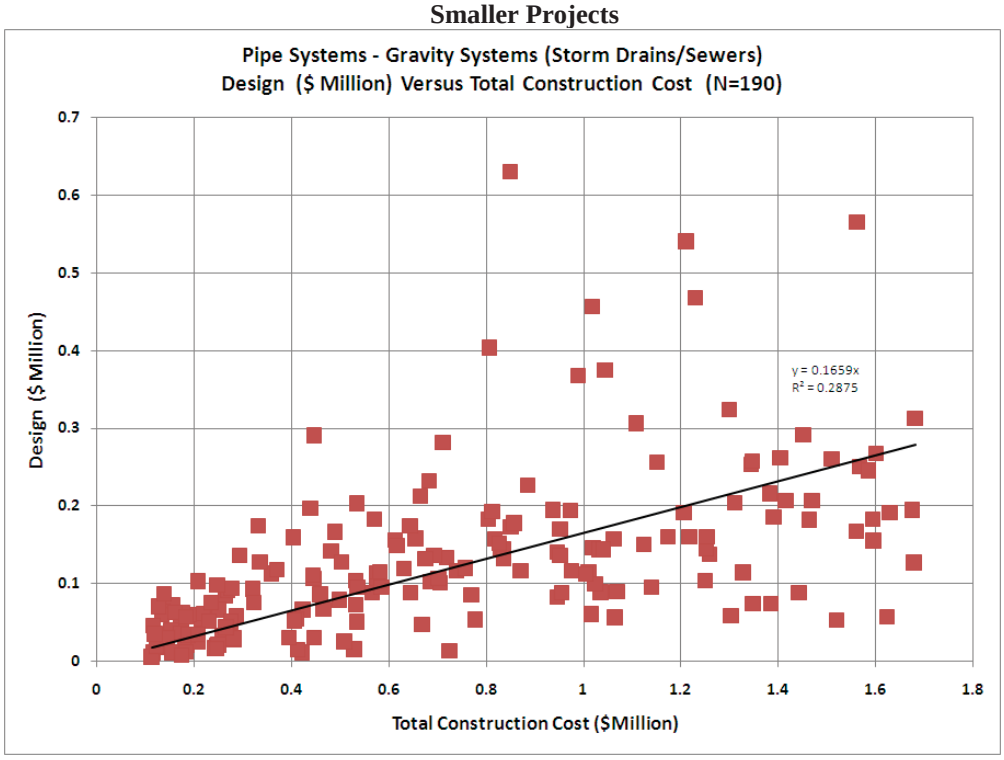
Smaller Projects



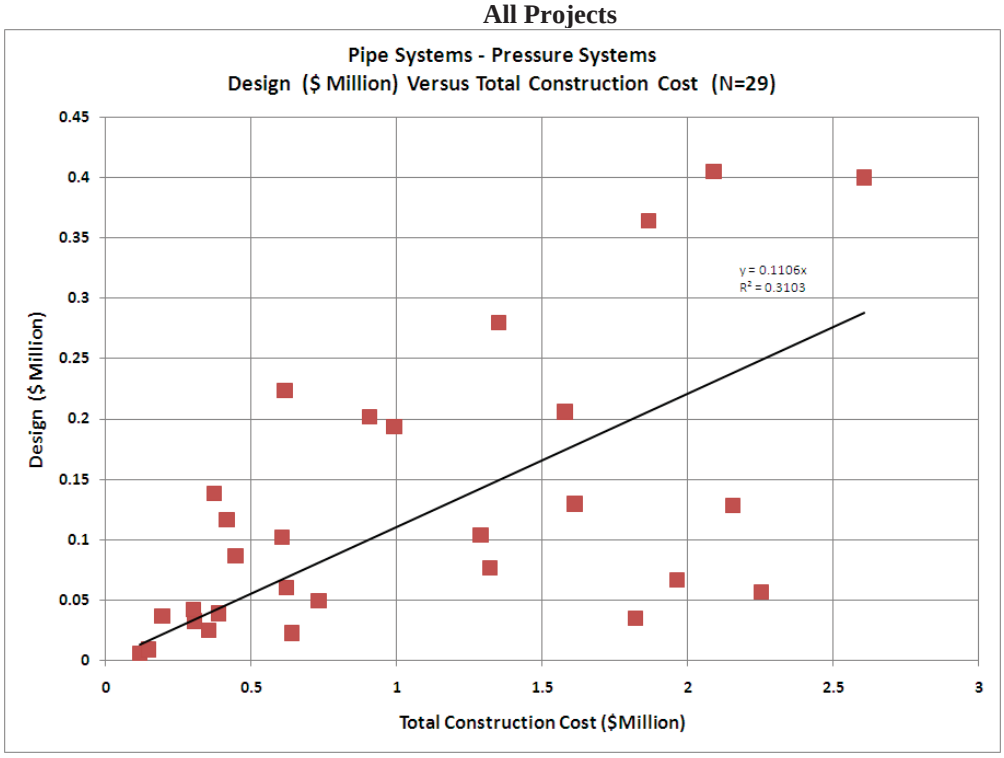
All Projects



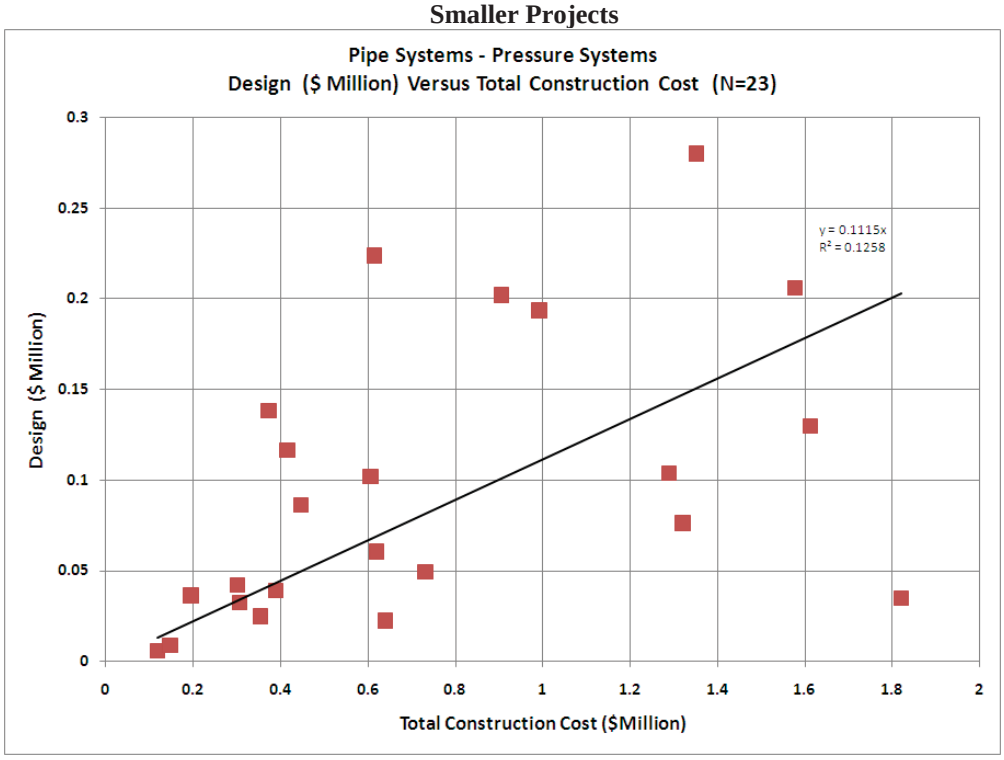
Smaller Projects



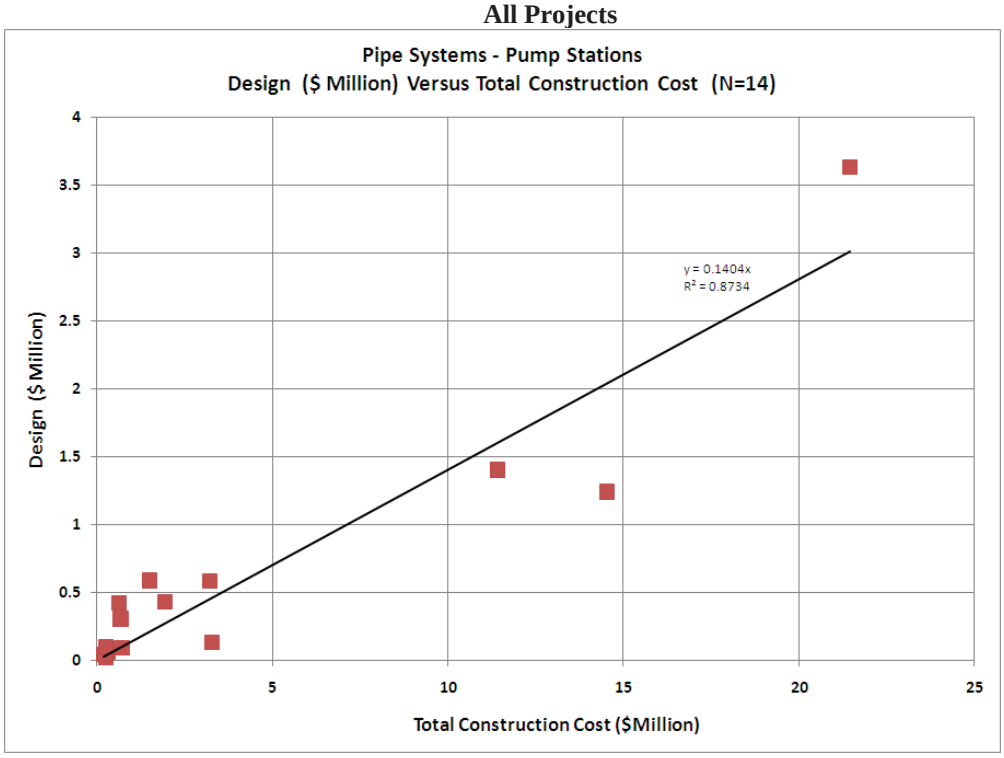
All Projects



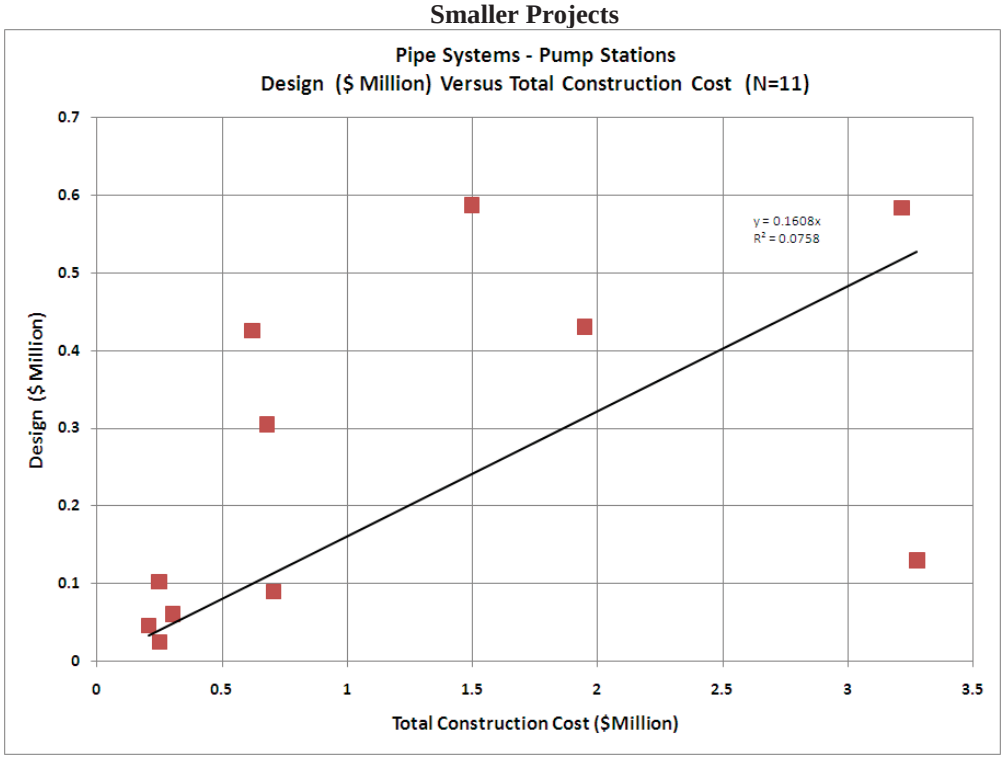
Smaller Projects



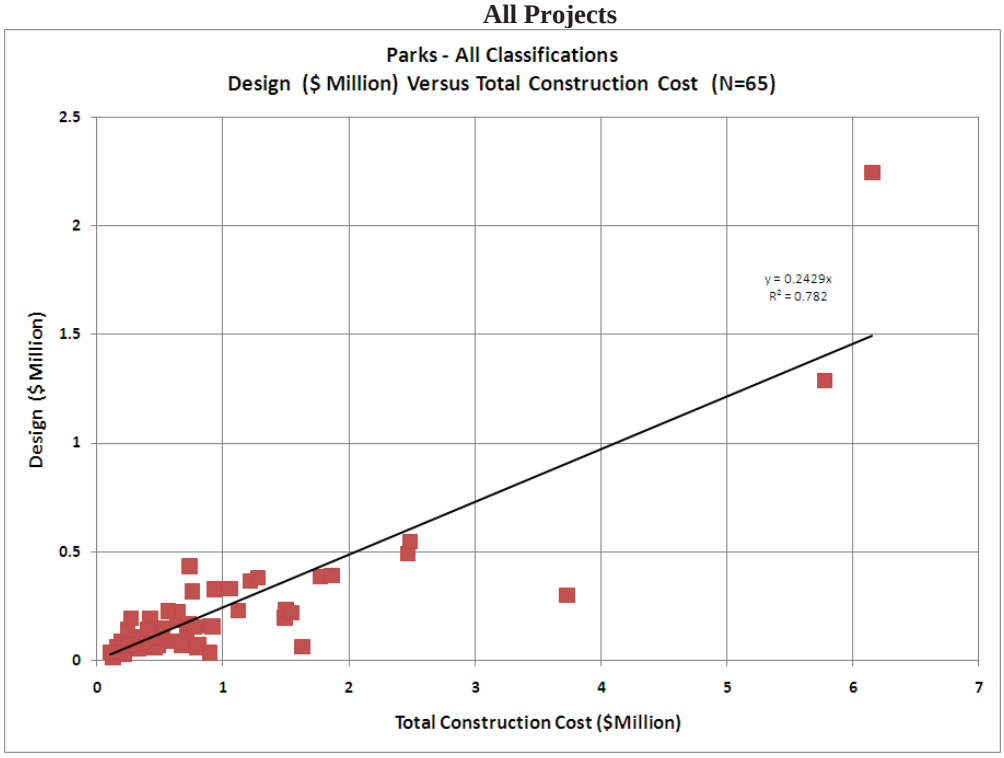
All Projects



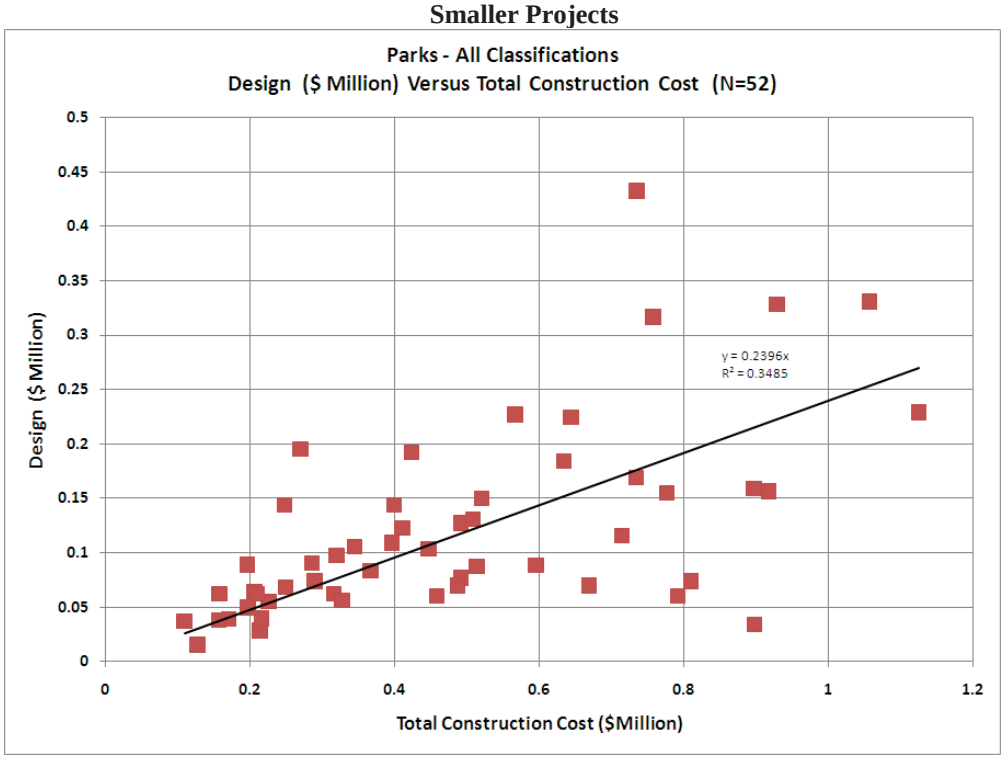
Smaller Projects



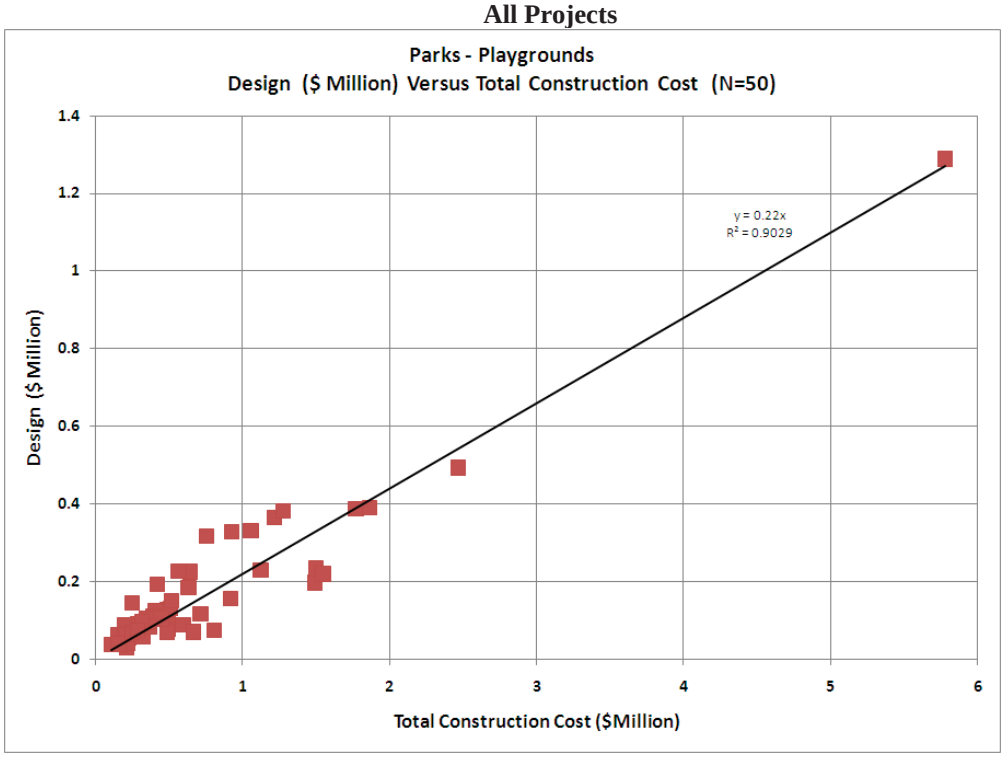
All Projects



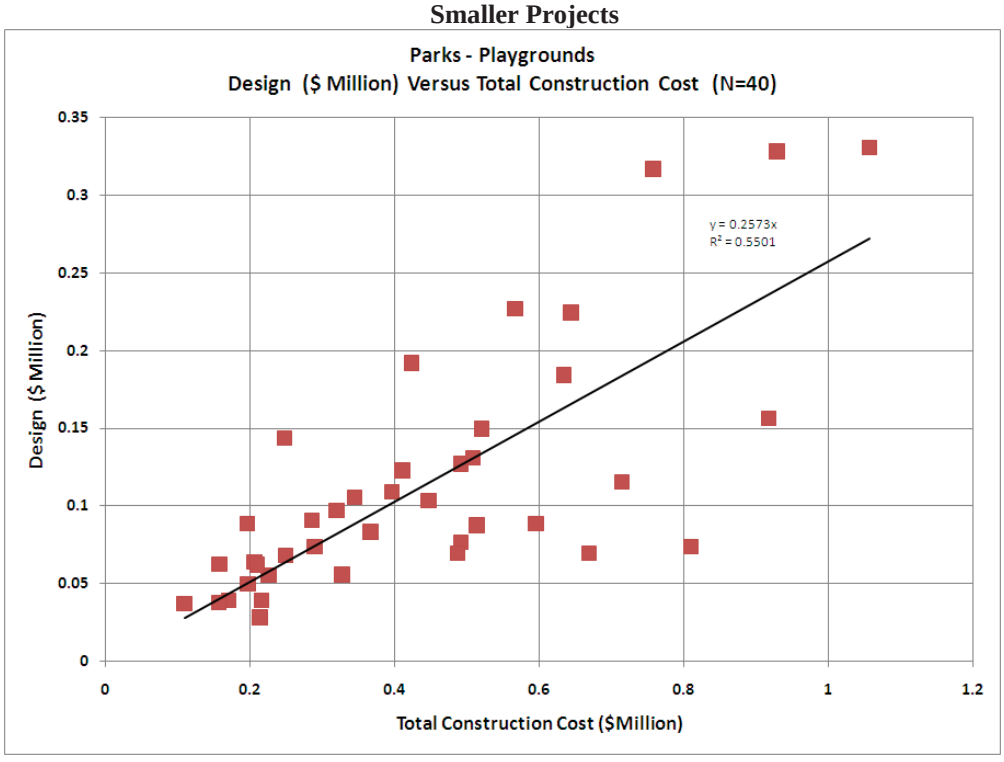
Smaller Projects



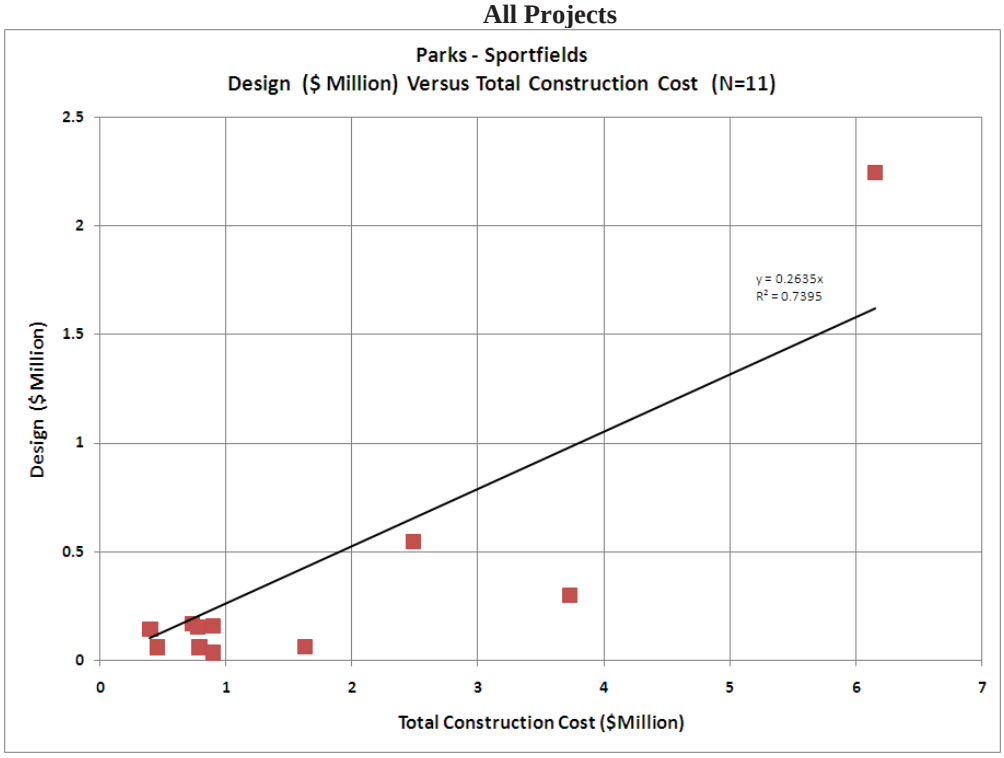
All Projects



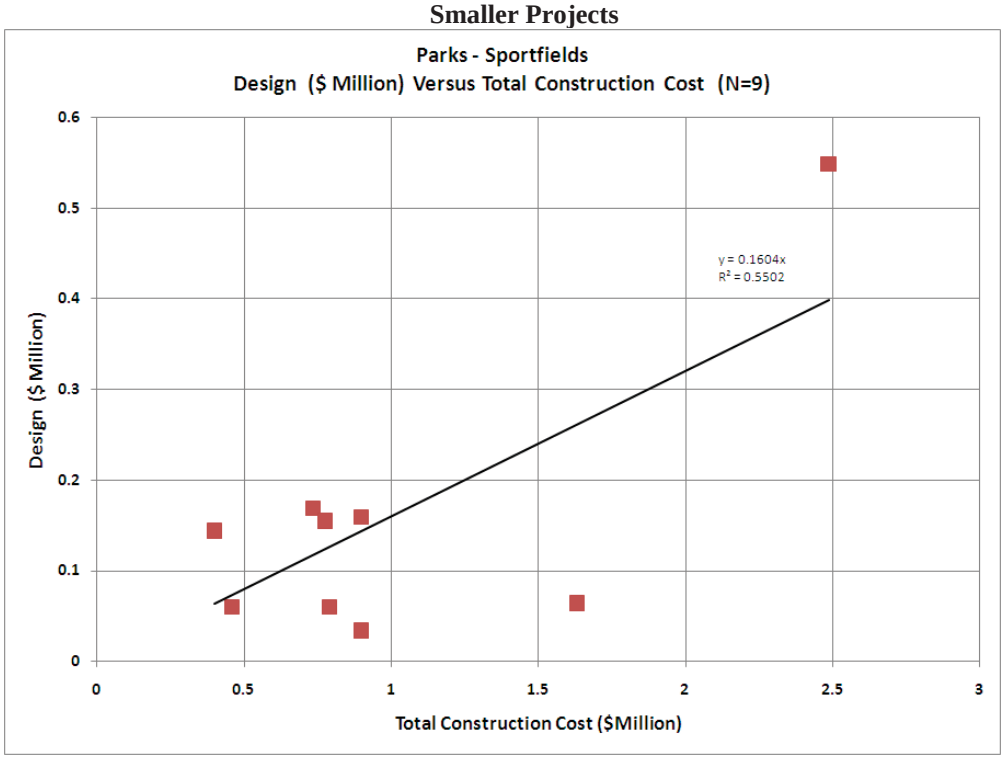
Smaller Projects



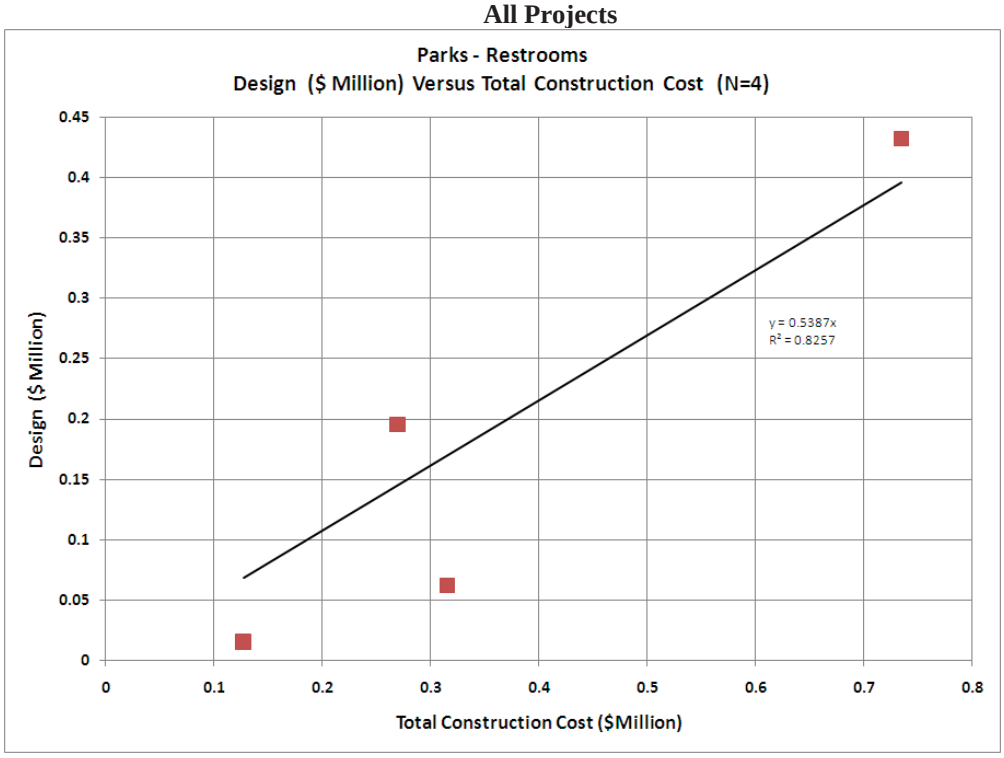
All Projects



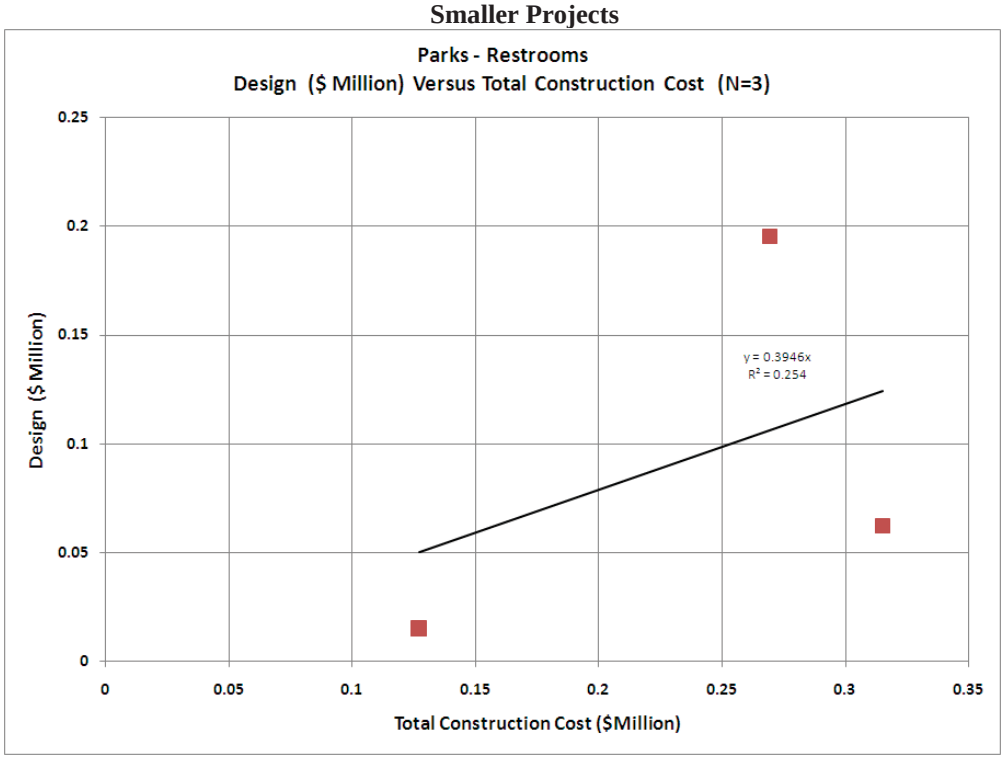
Smaller Projects



All Projects



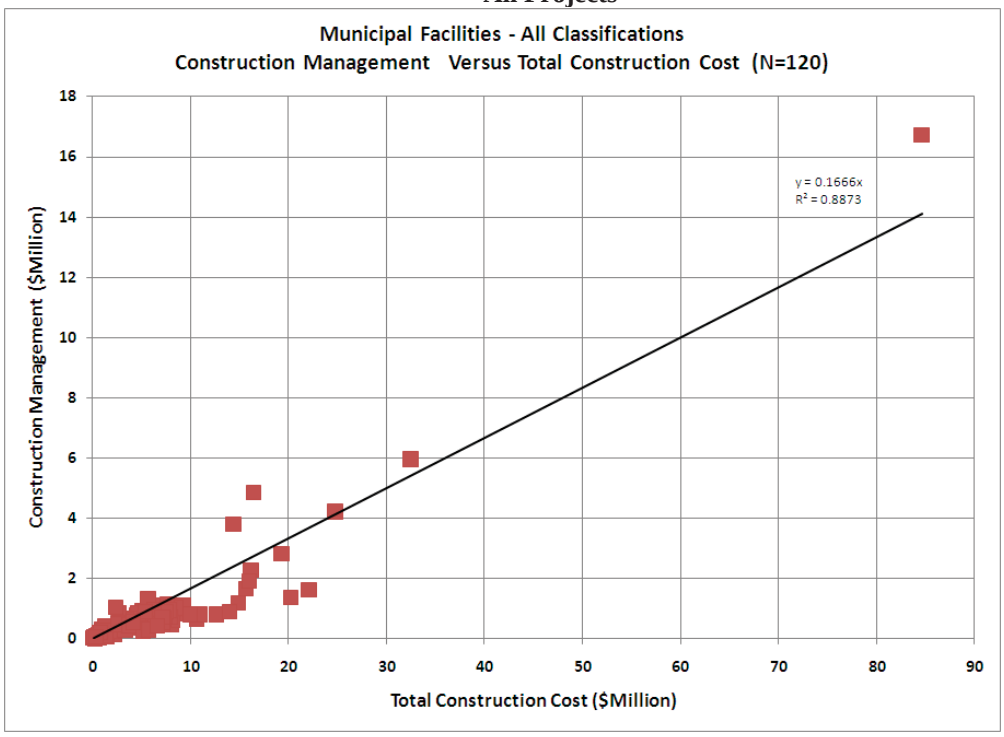
Smaller Projects



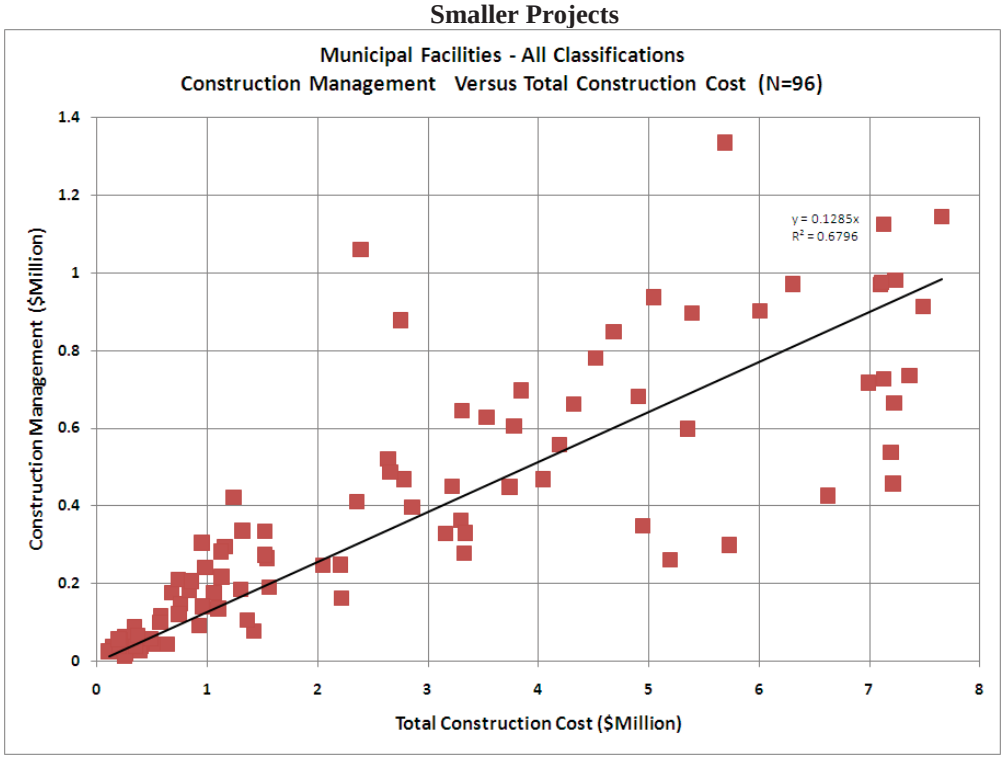
CURVES GROUP 2

Construction Management Cost
vs
Total Construction Cost

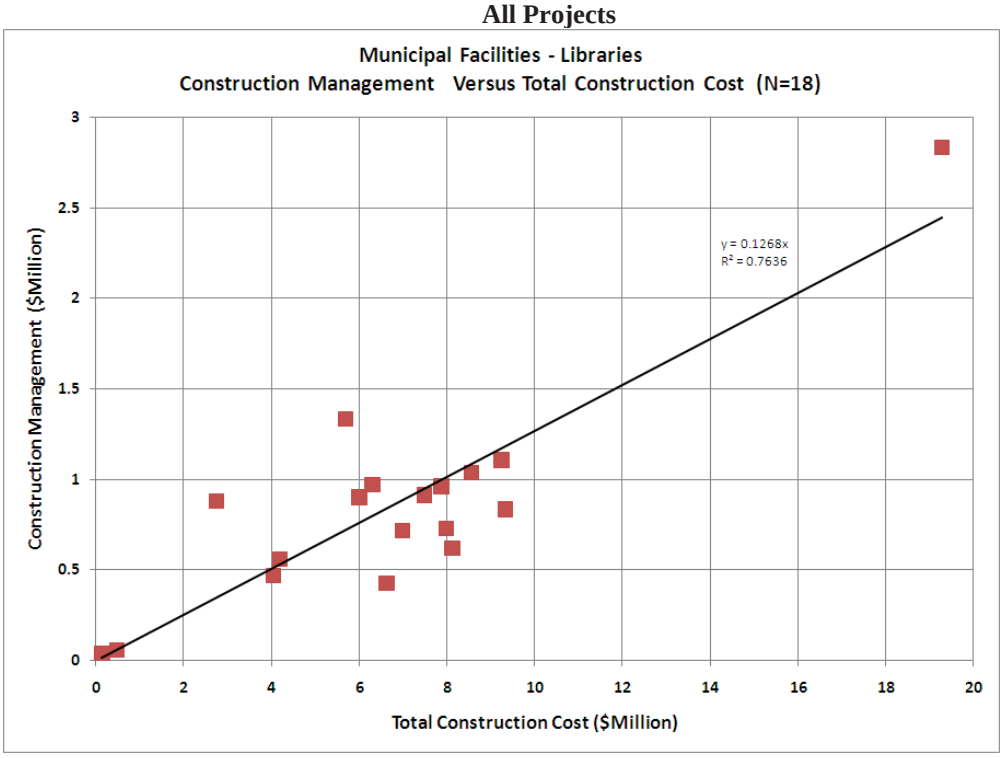
All Projects



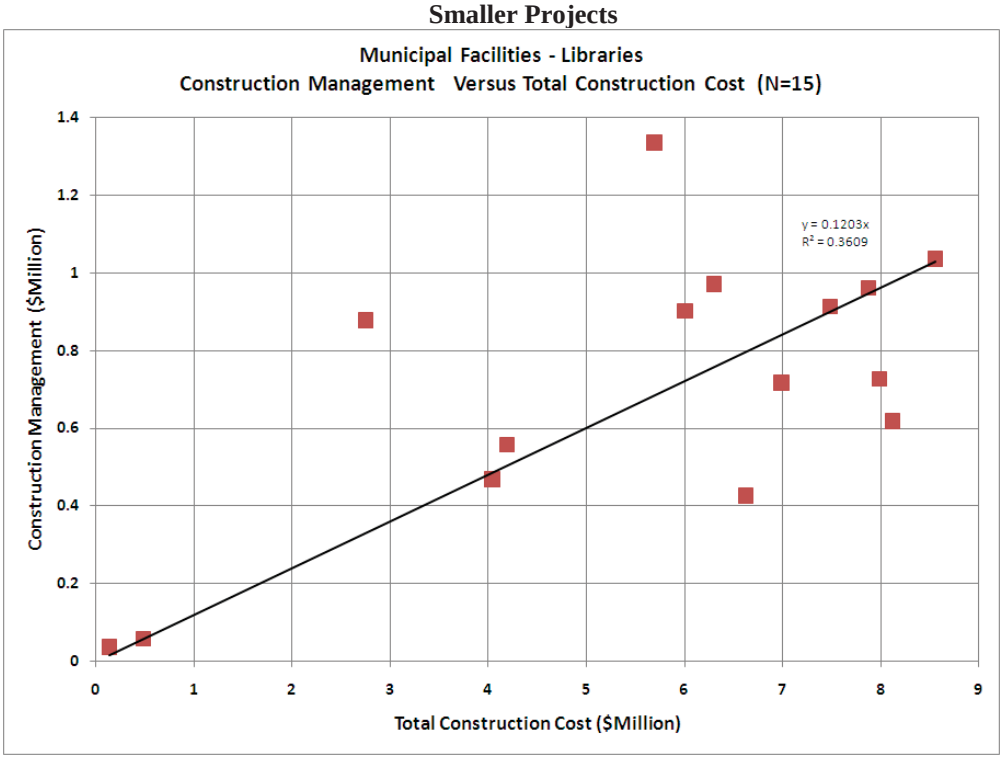
Smaller Projects



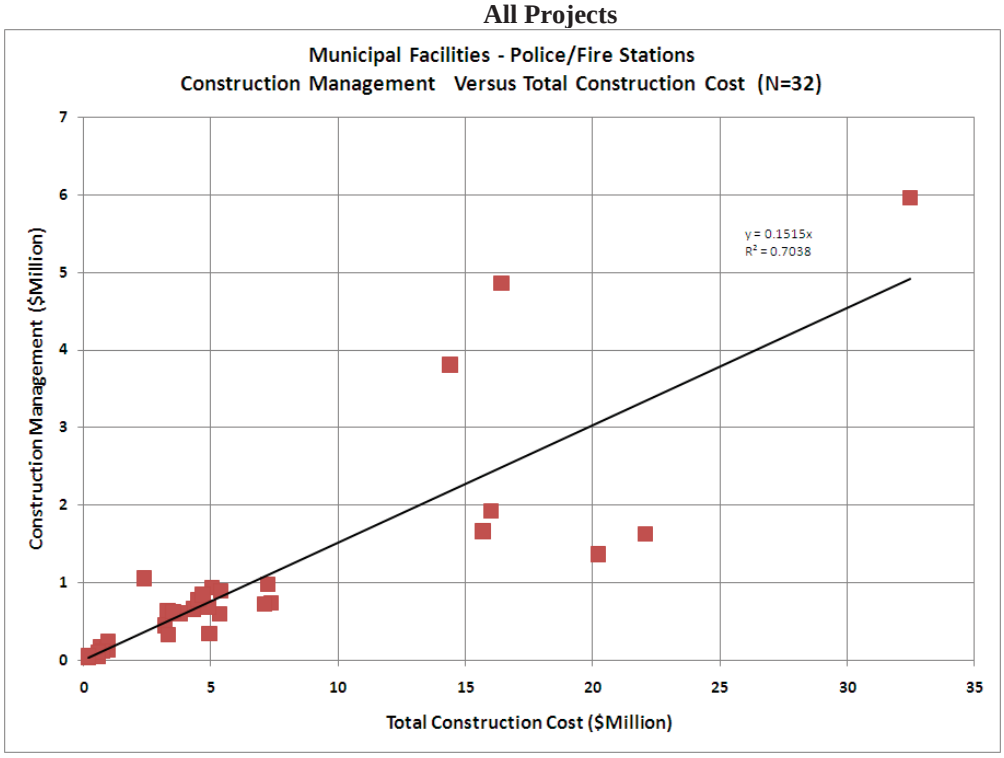
All Projects



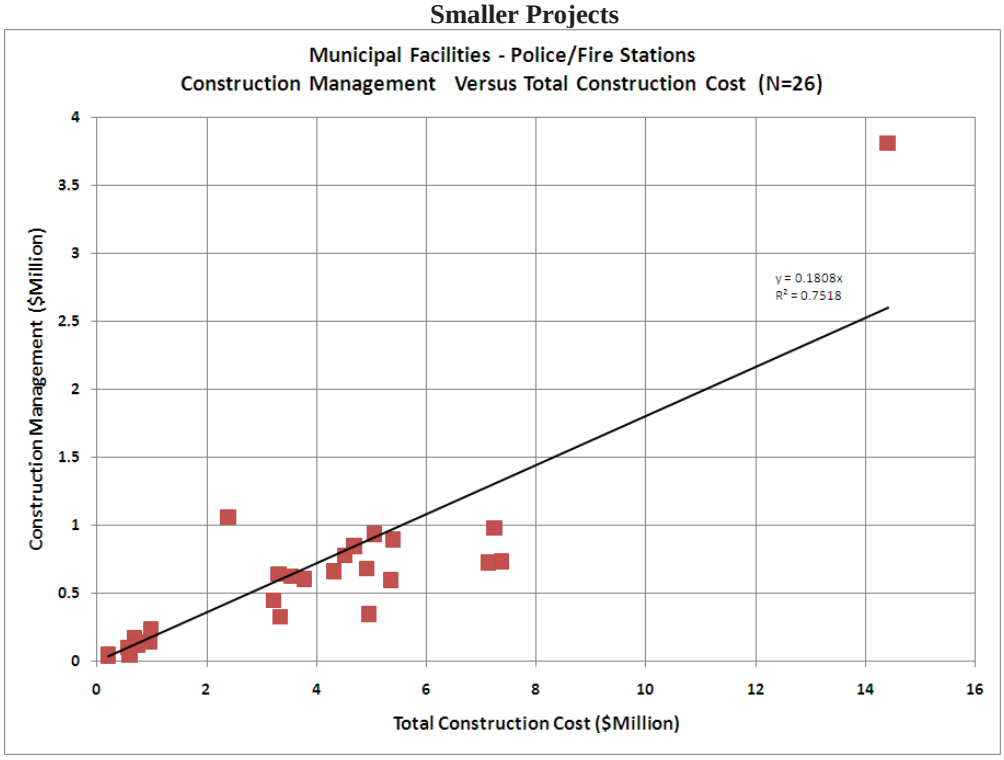
Smaller Projects



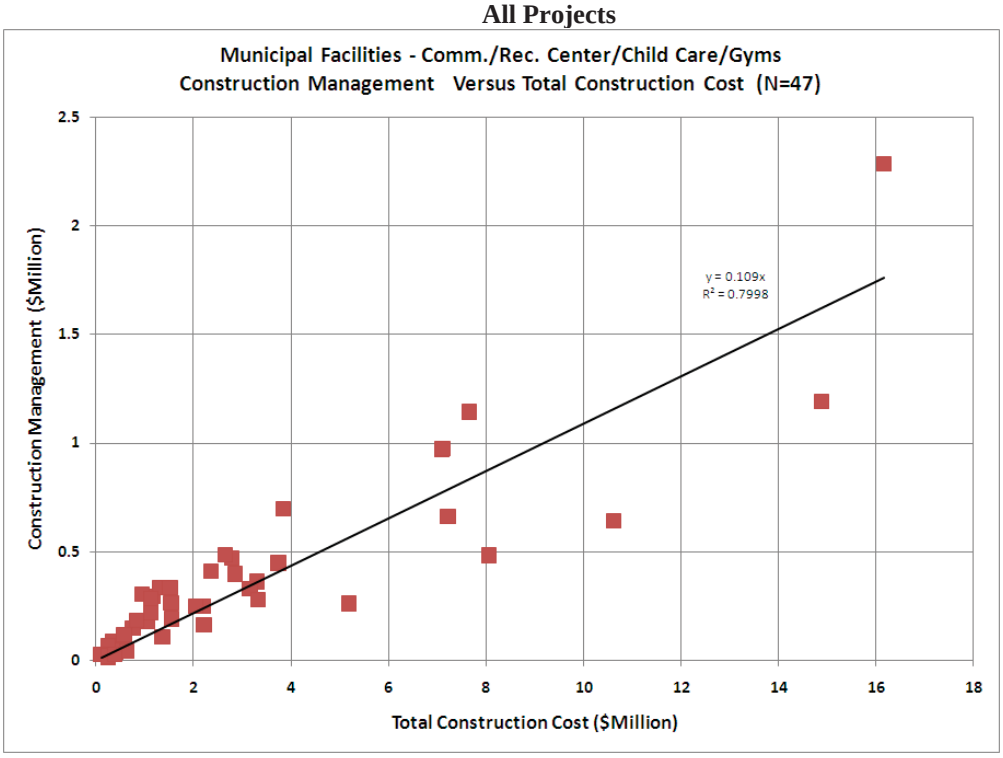
All Projects



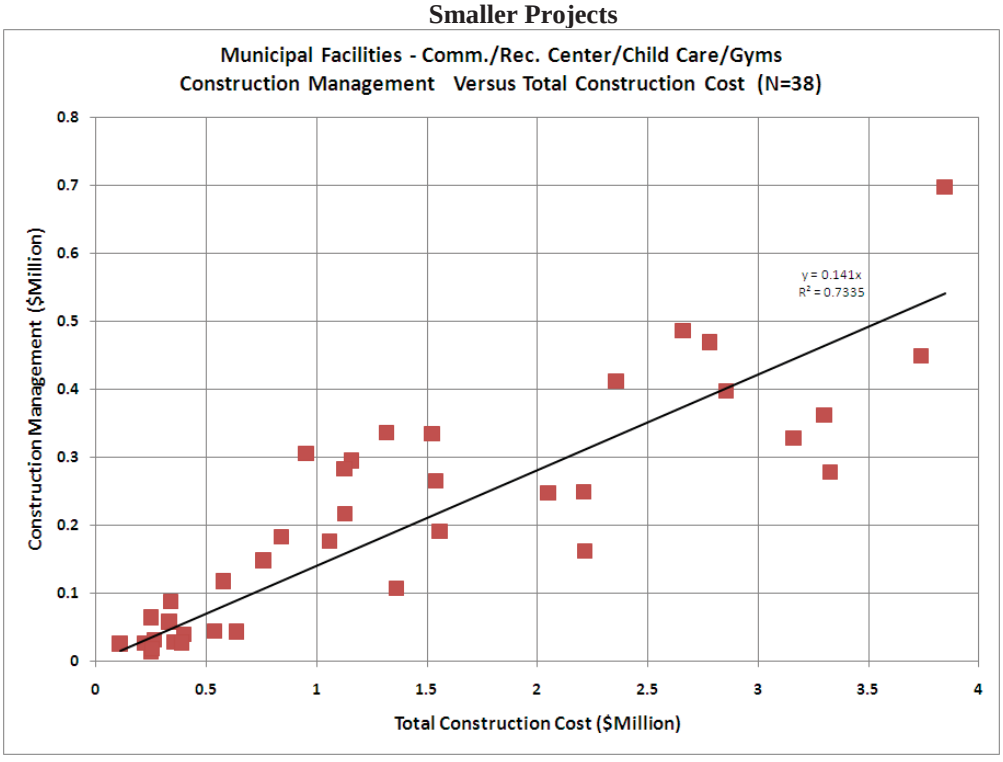
Smaller Projects



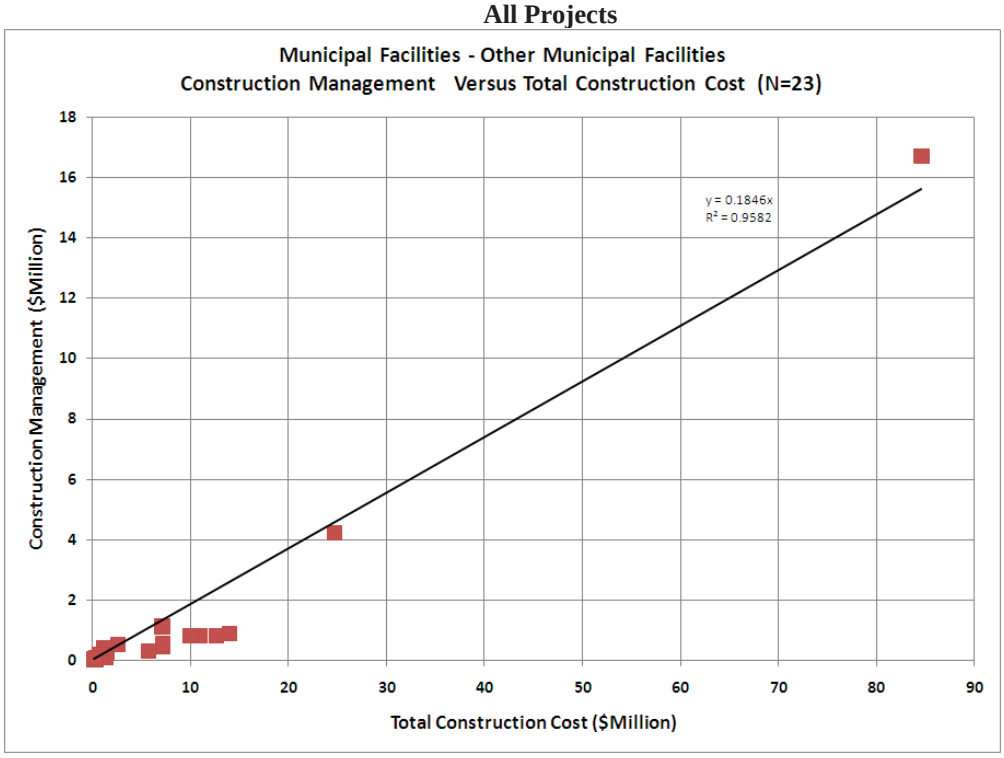
All Projects



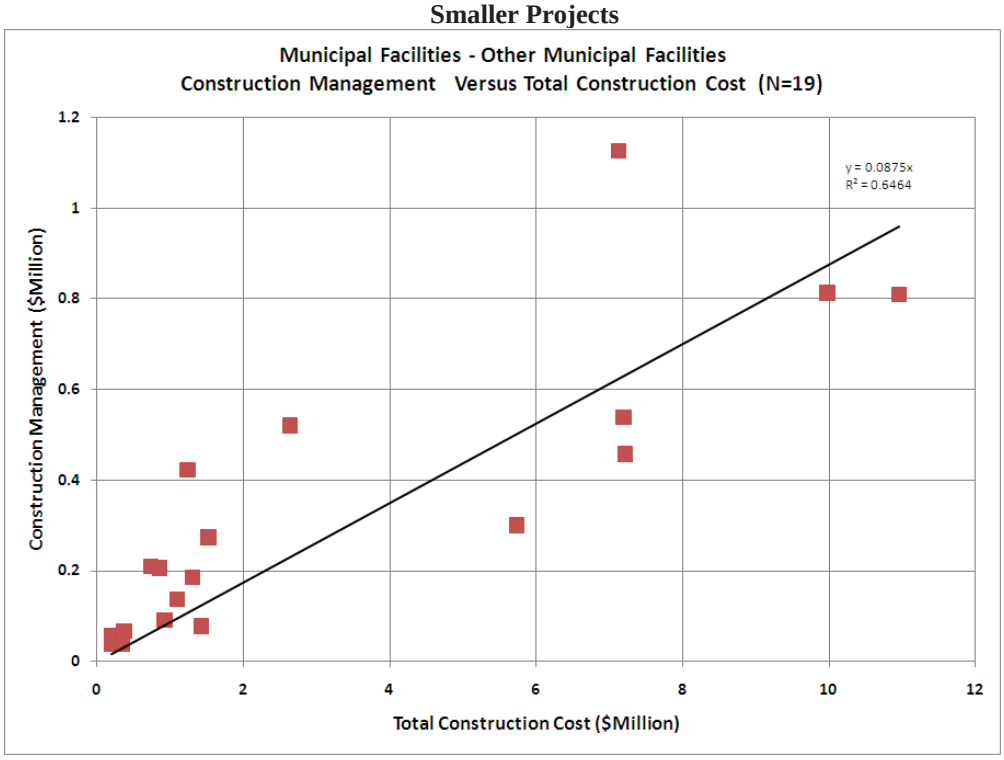
Smaller Projects



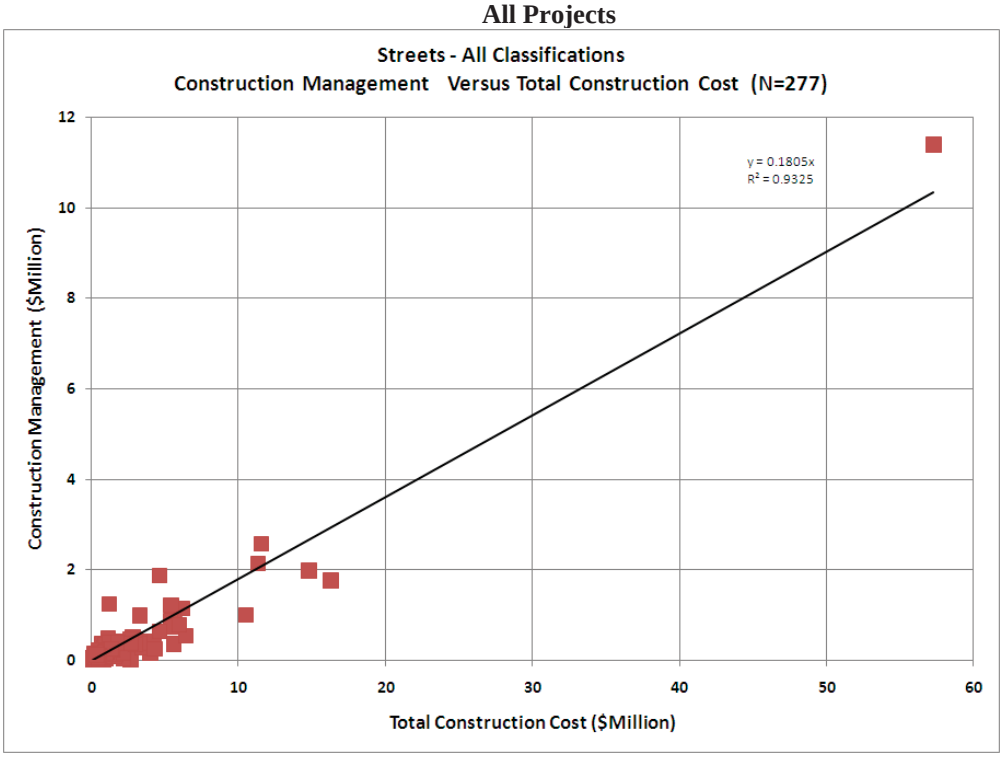
All Projects



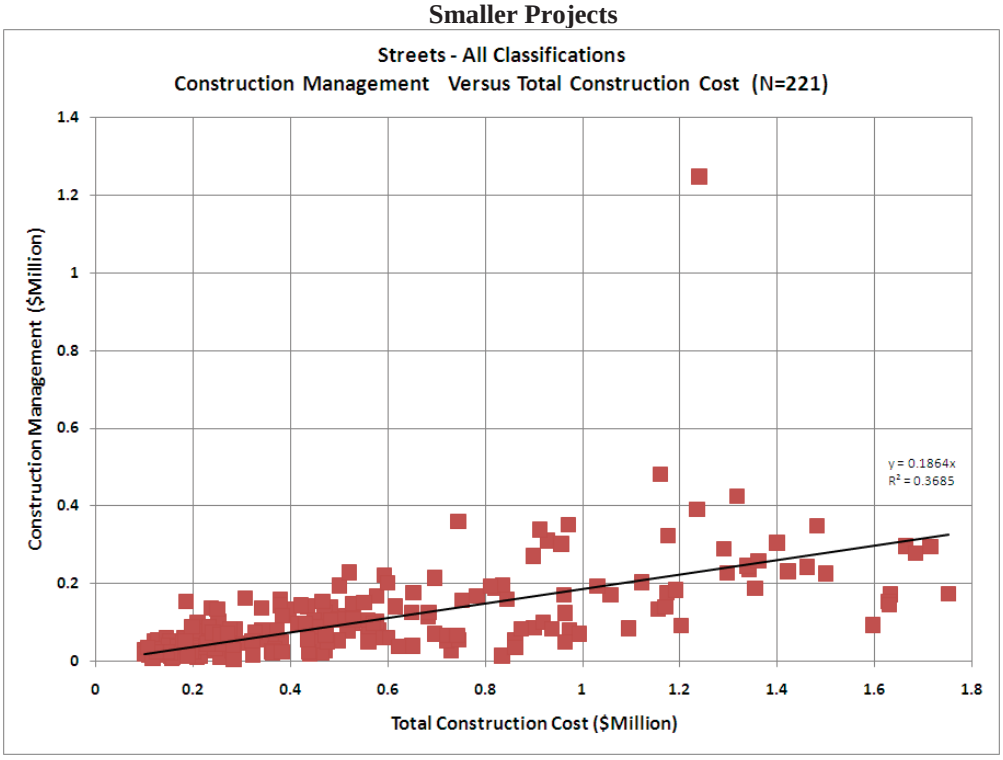
Smaller Projects



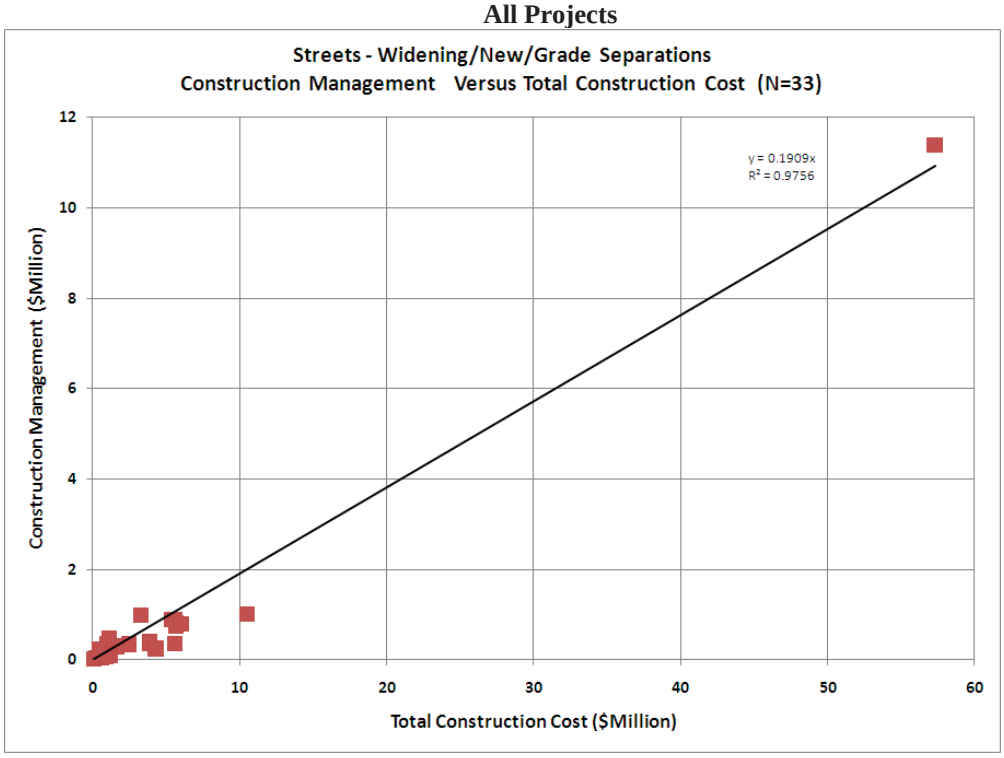
All Projects



Smaller Projects

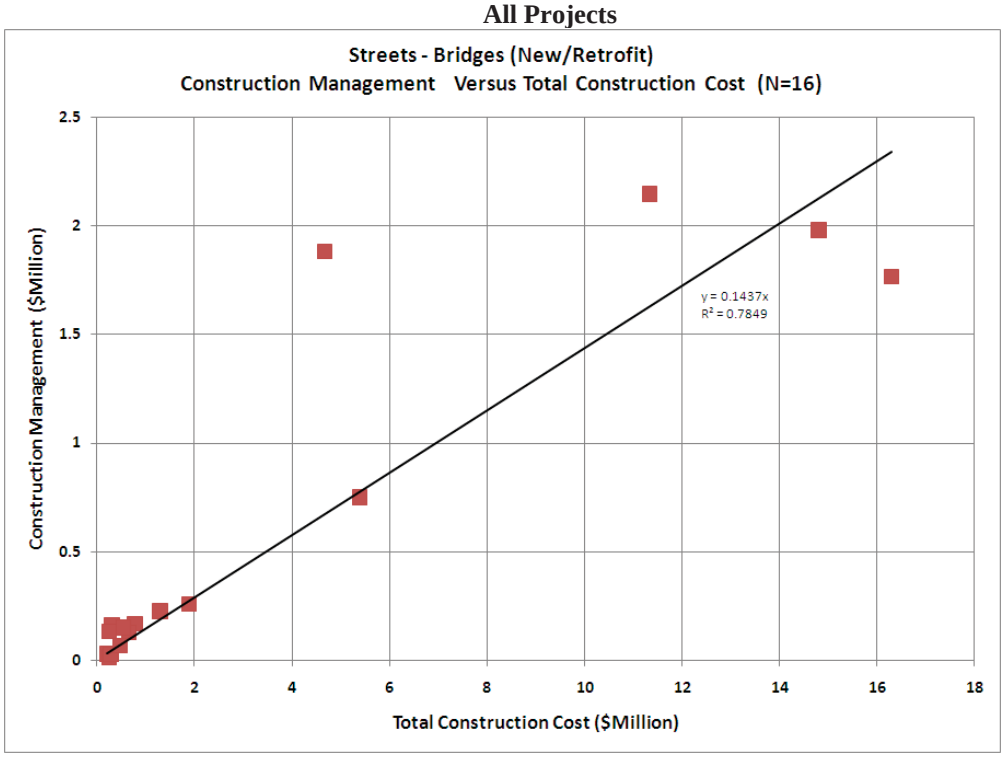


All Projects

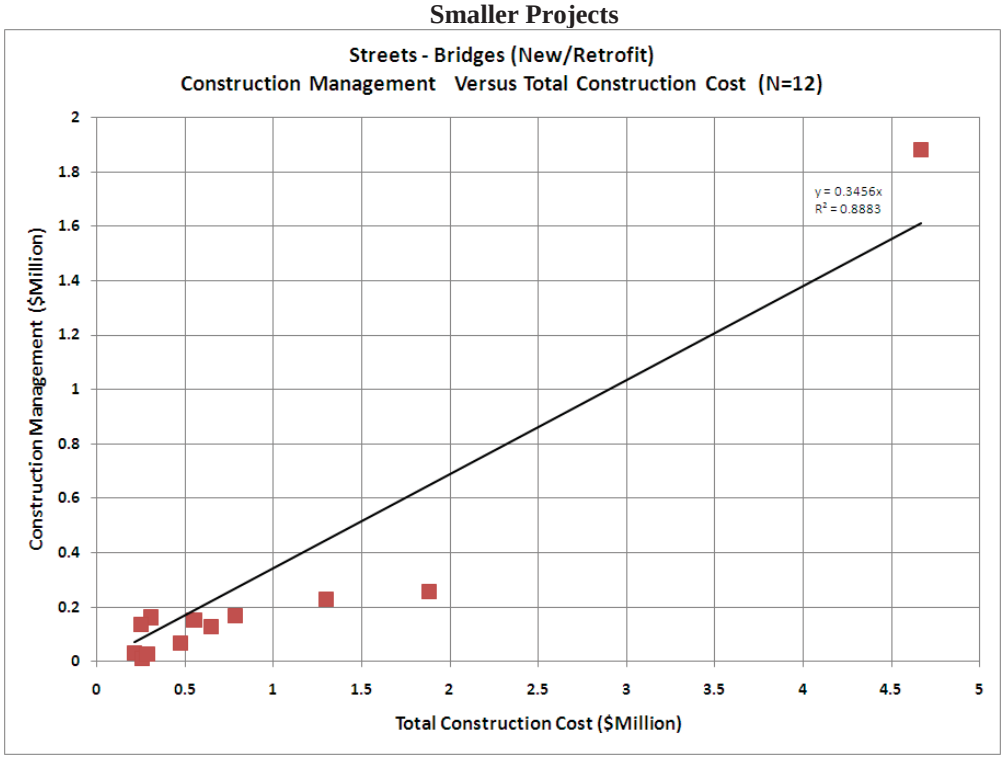


Smaller Projects

All Projects

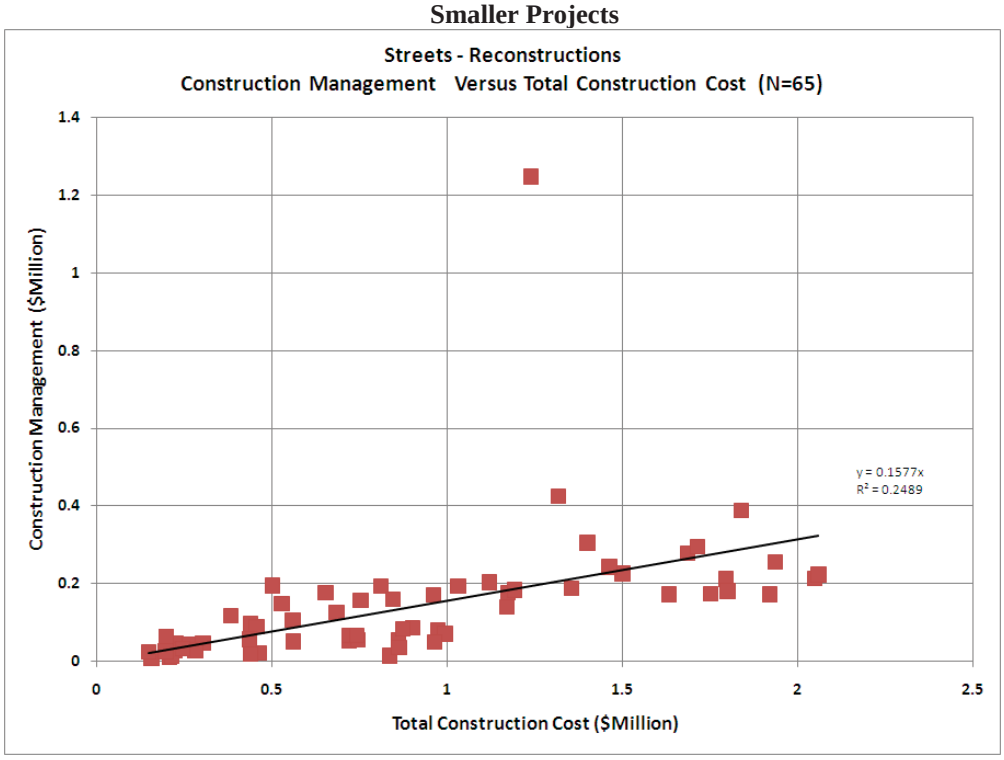


Smaller Projects

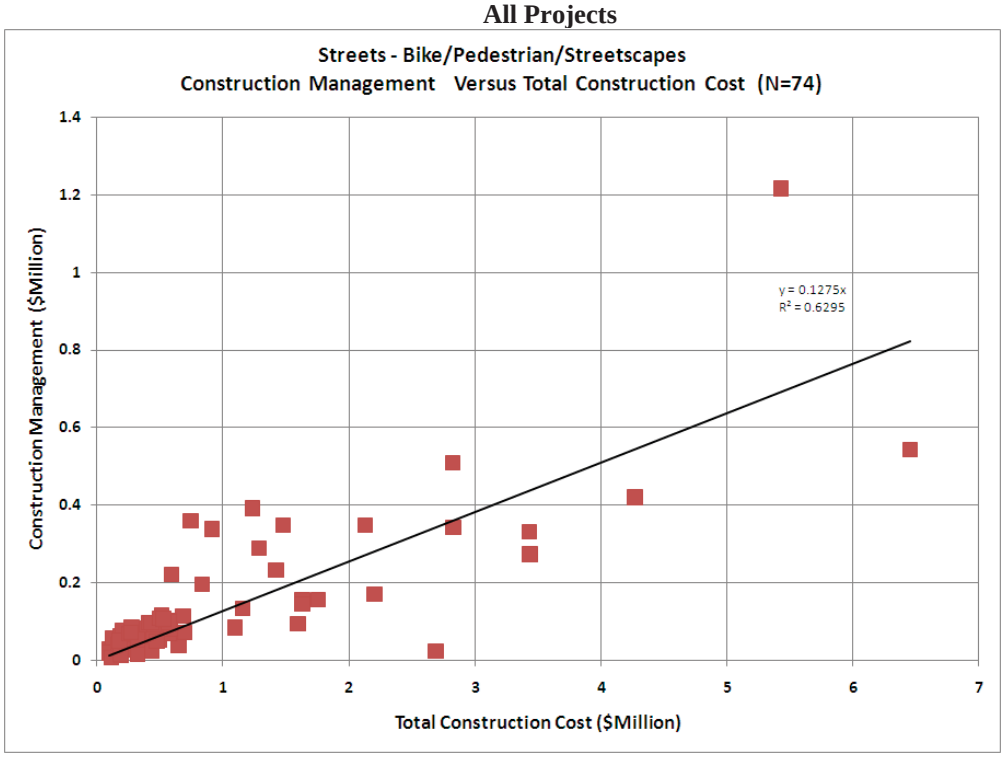


All Projects

Smaller Projects

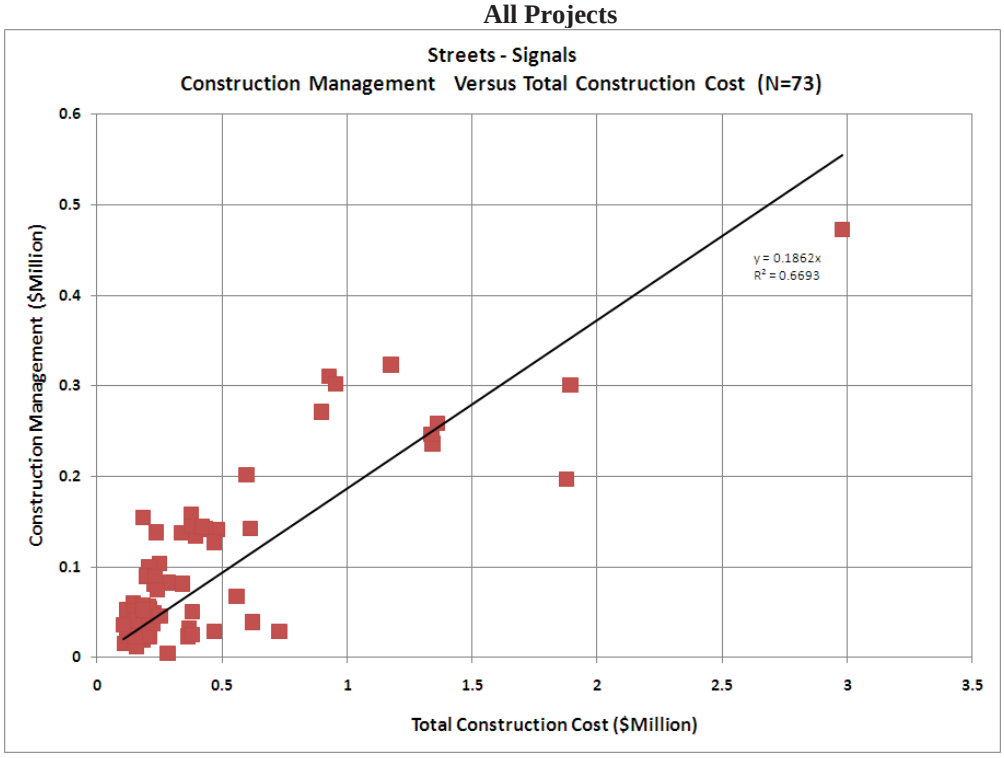


All Projects

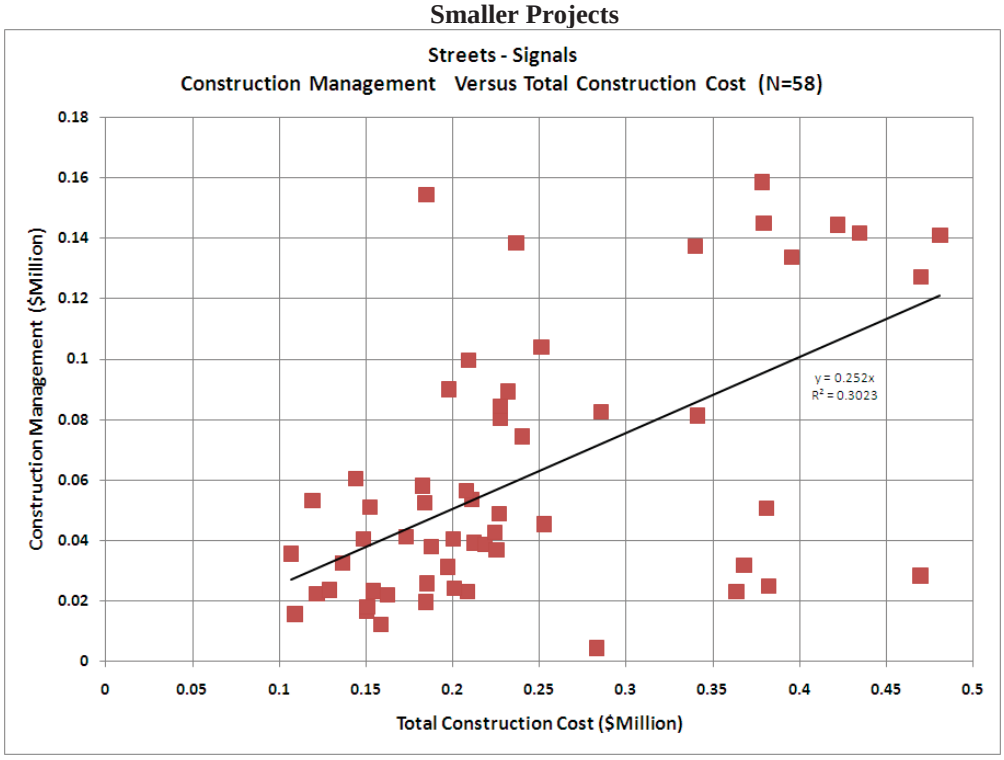


Smaller Projects

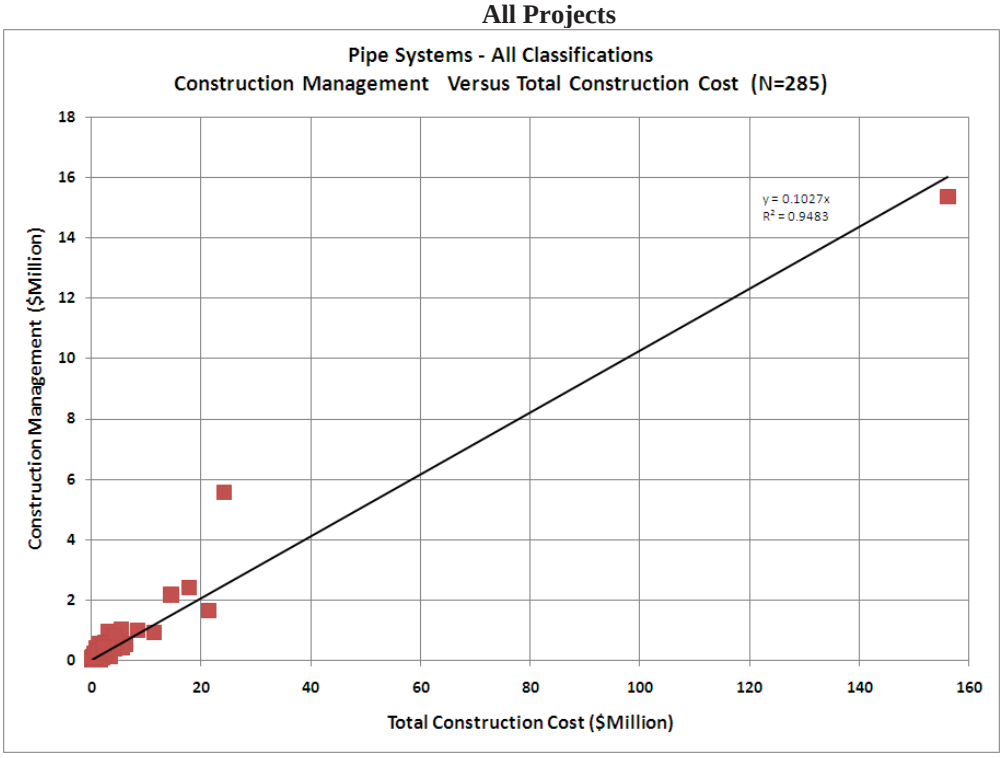
All Projects



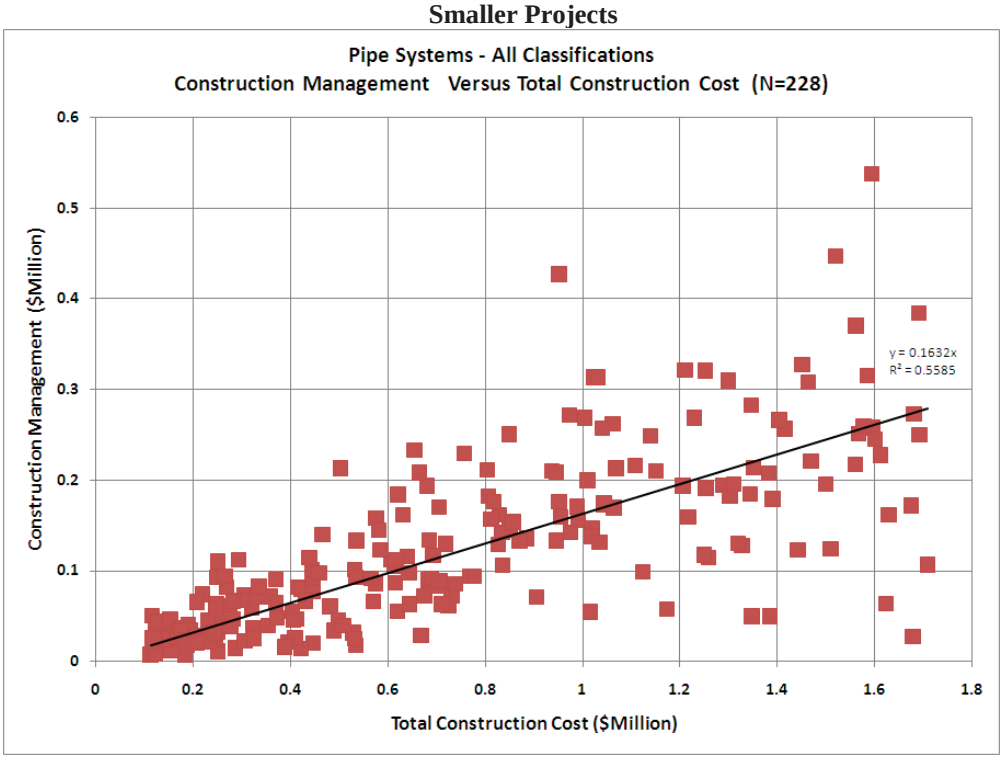
Smaller Projects



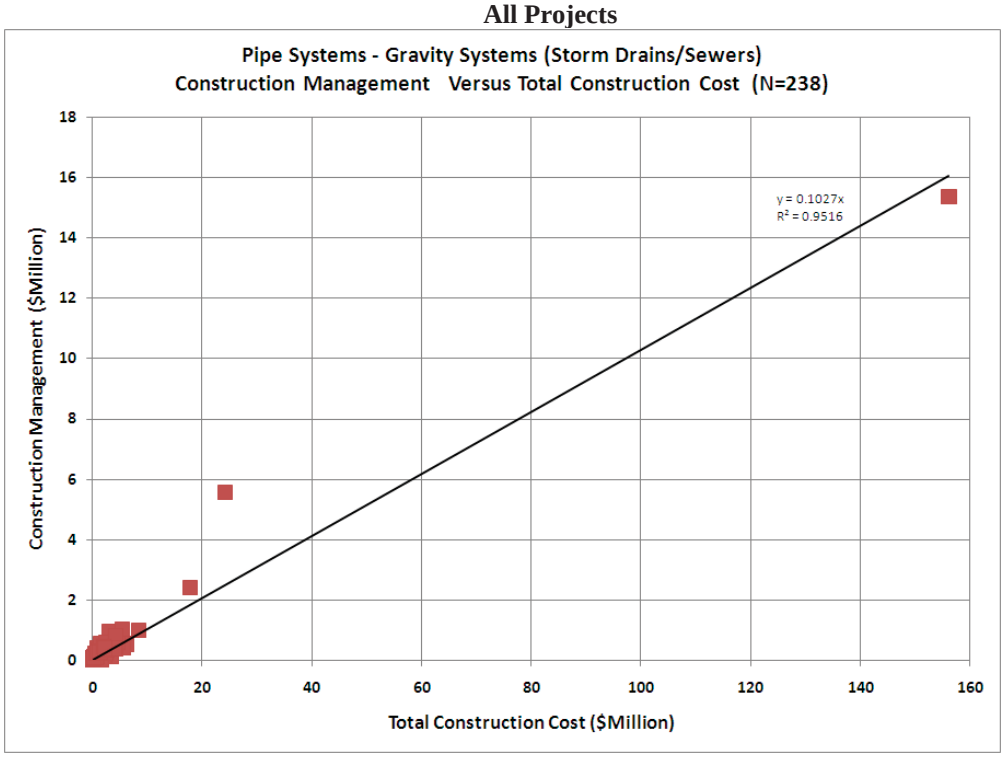
All Projects



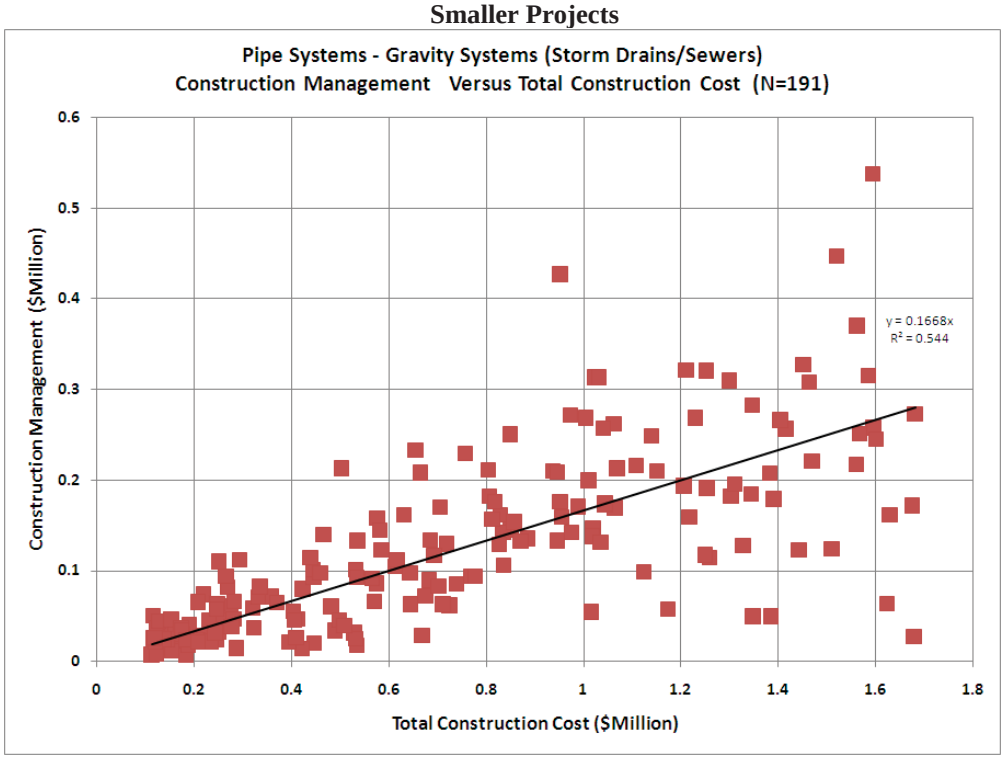
Smaller Projects



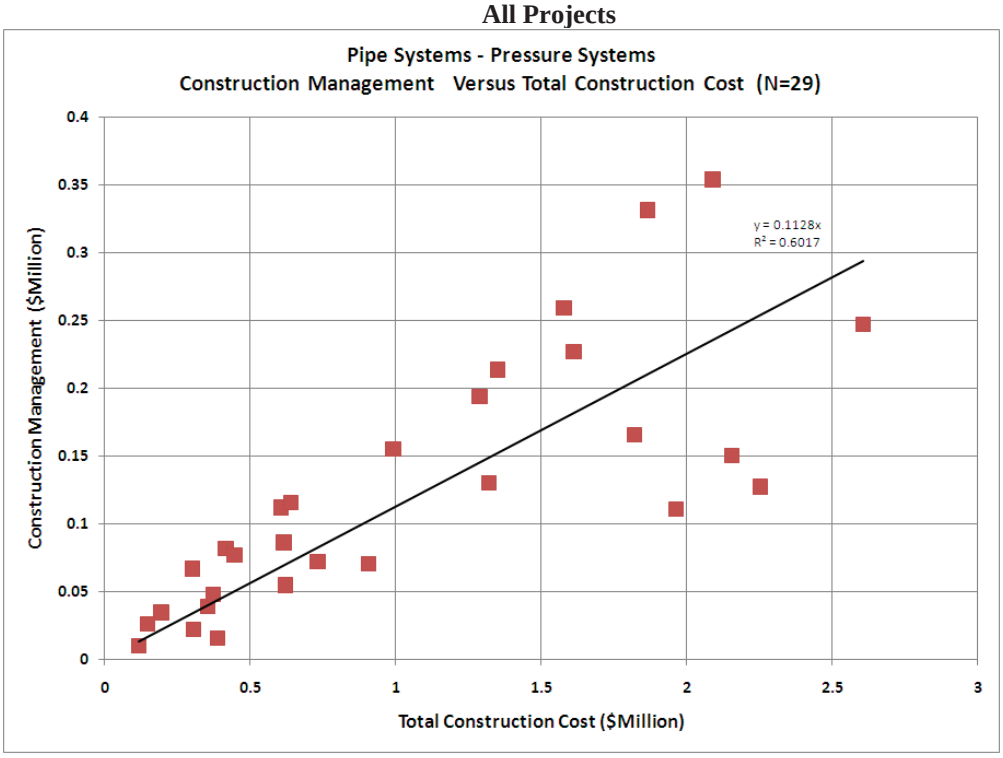
All Projects



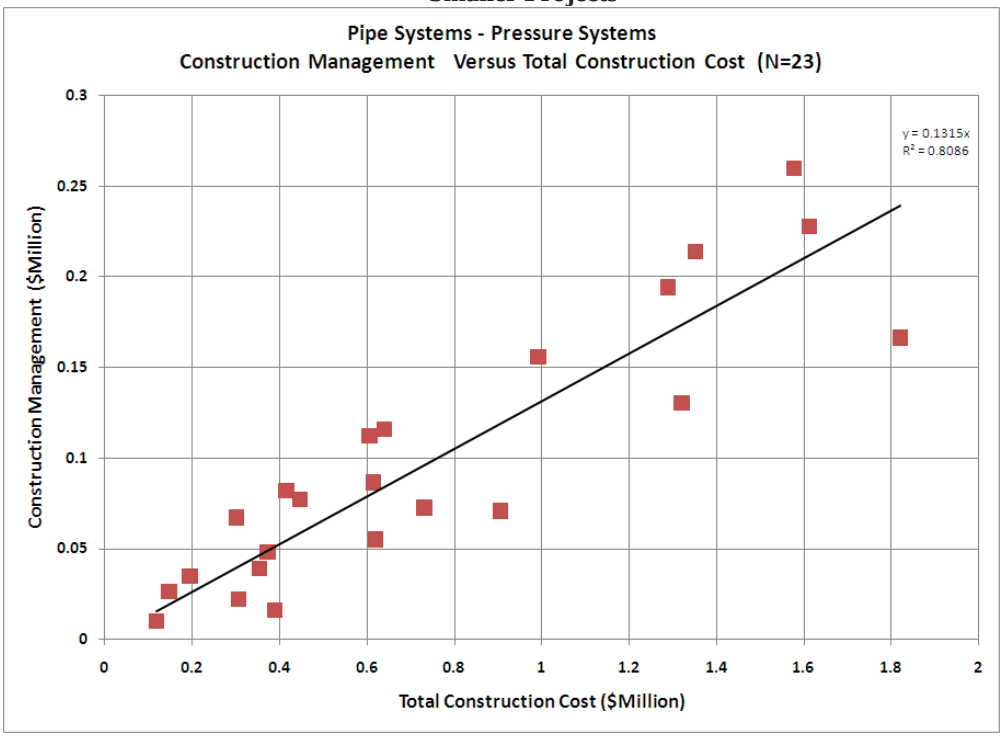
Smaller Projects



All Projects

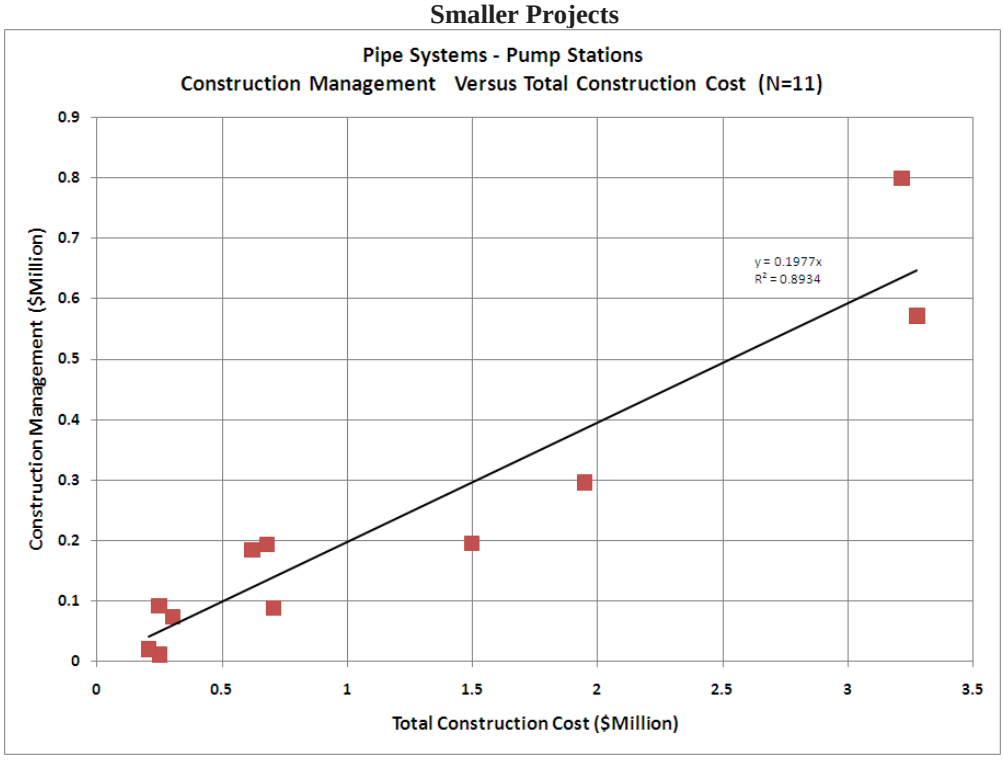


Smaller Projects

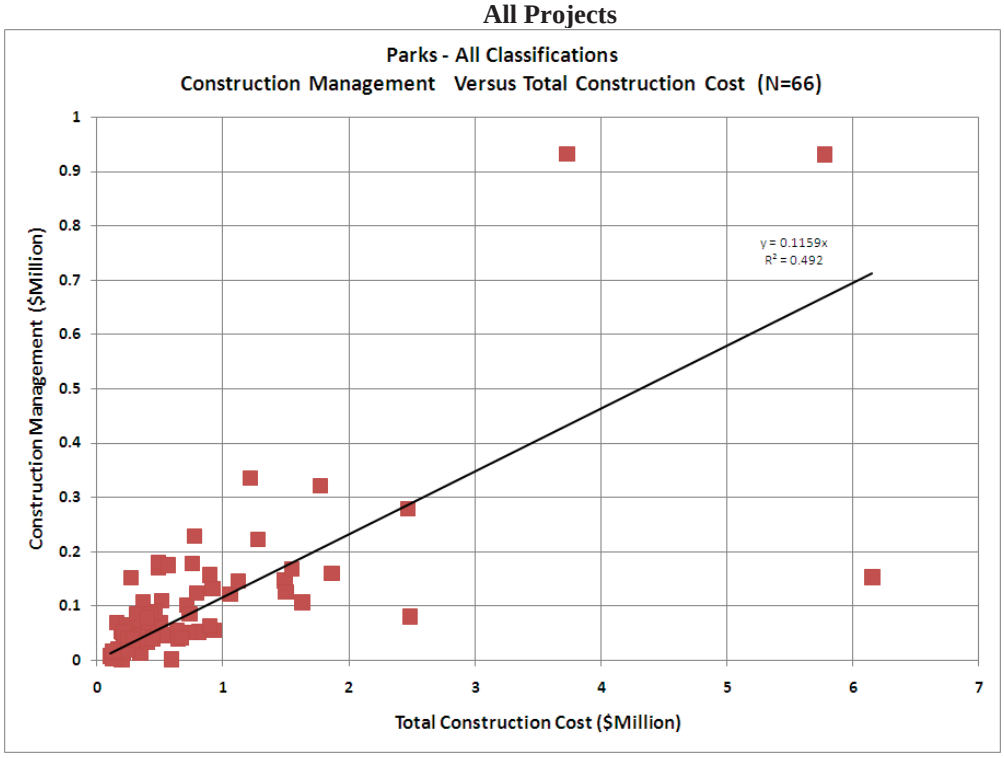


All Projects

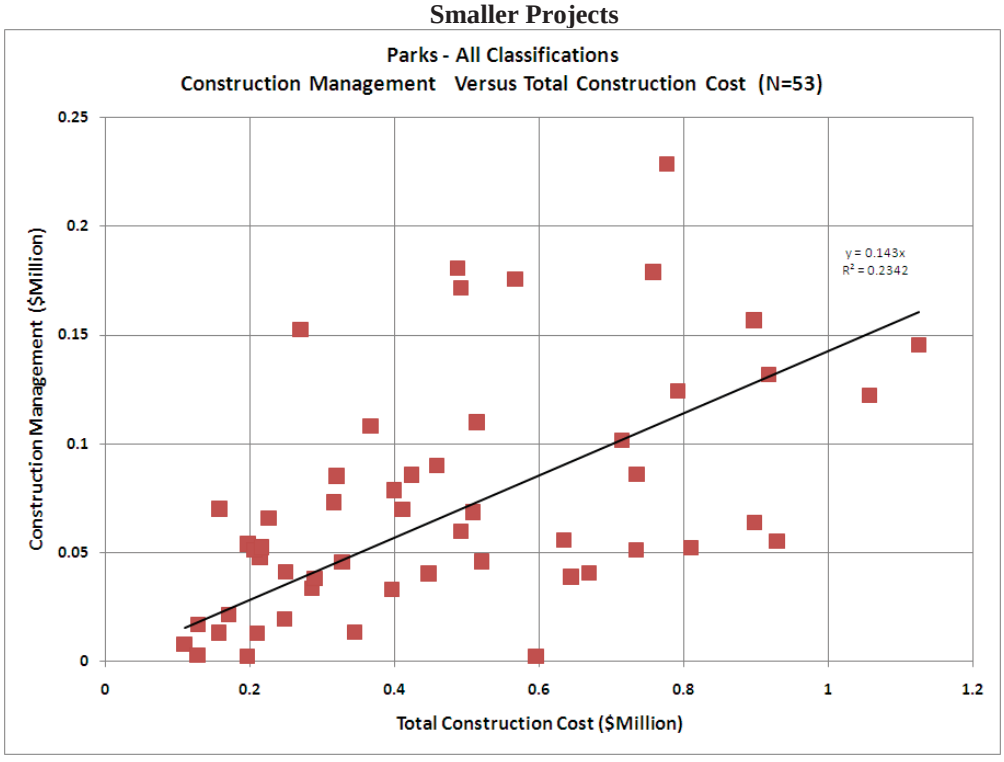
Smaller Projects



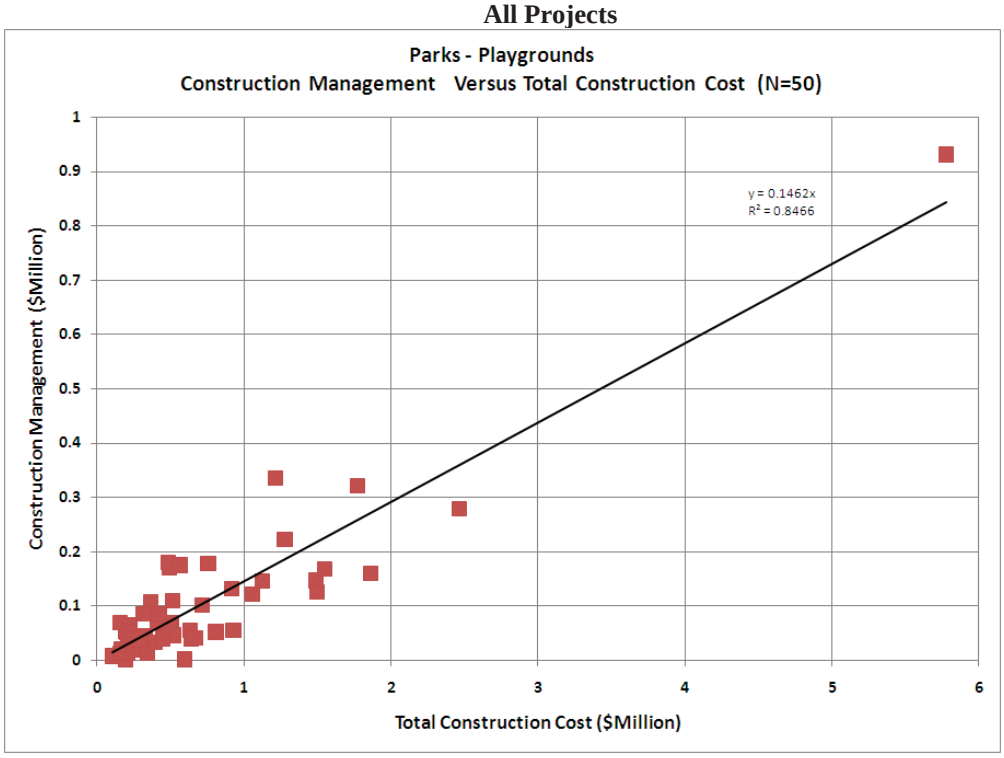
All Projects



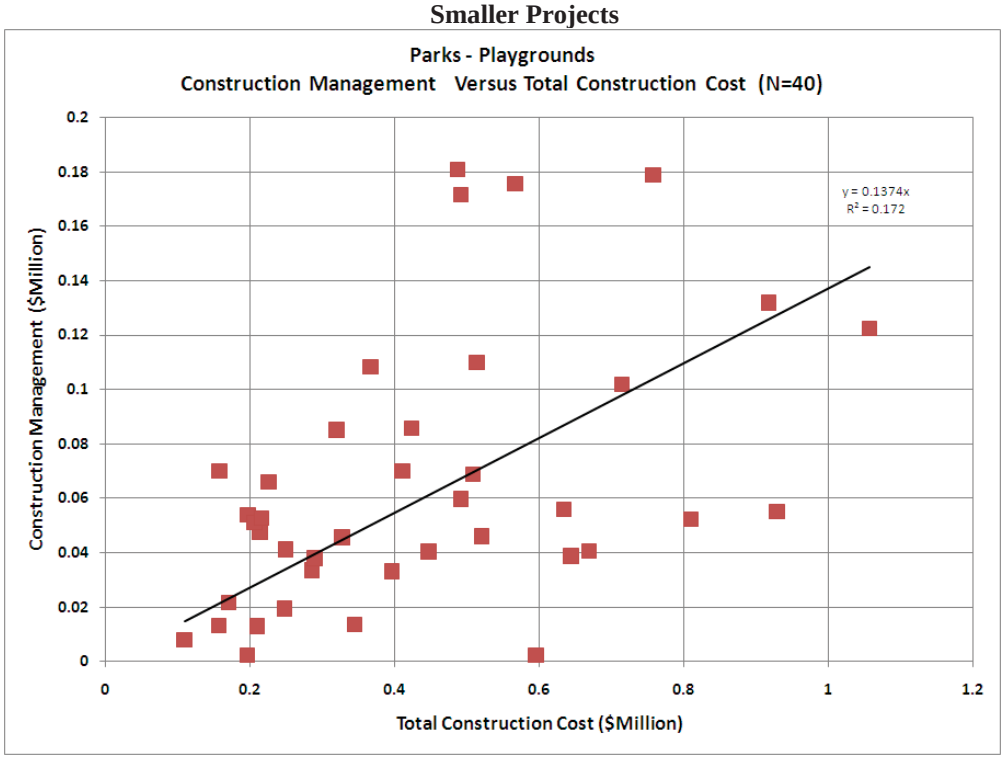
Smaller Projects



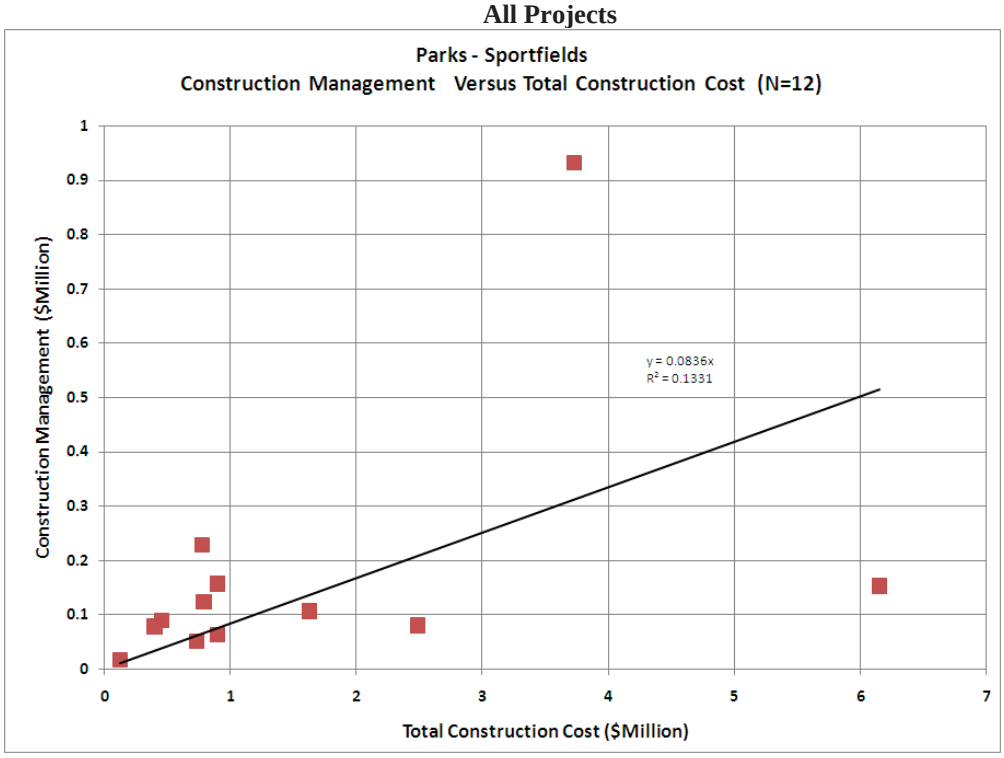
All Projects



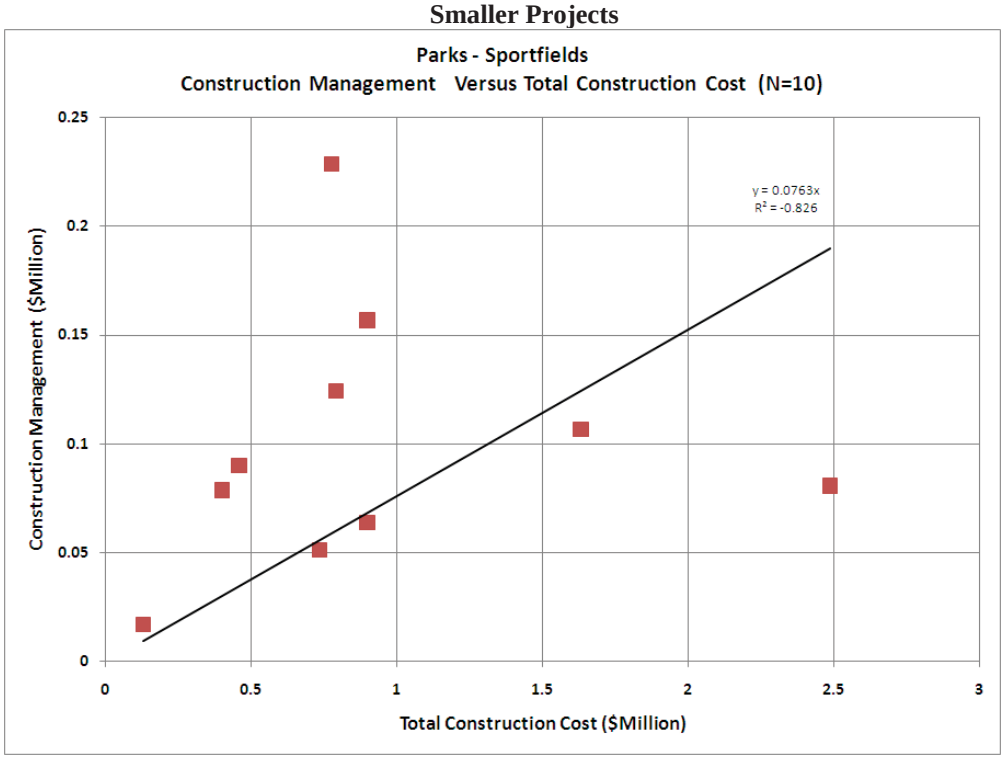
Smaller Projects



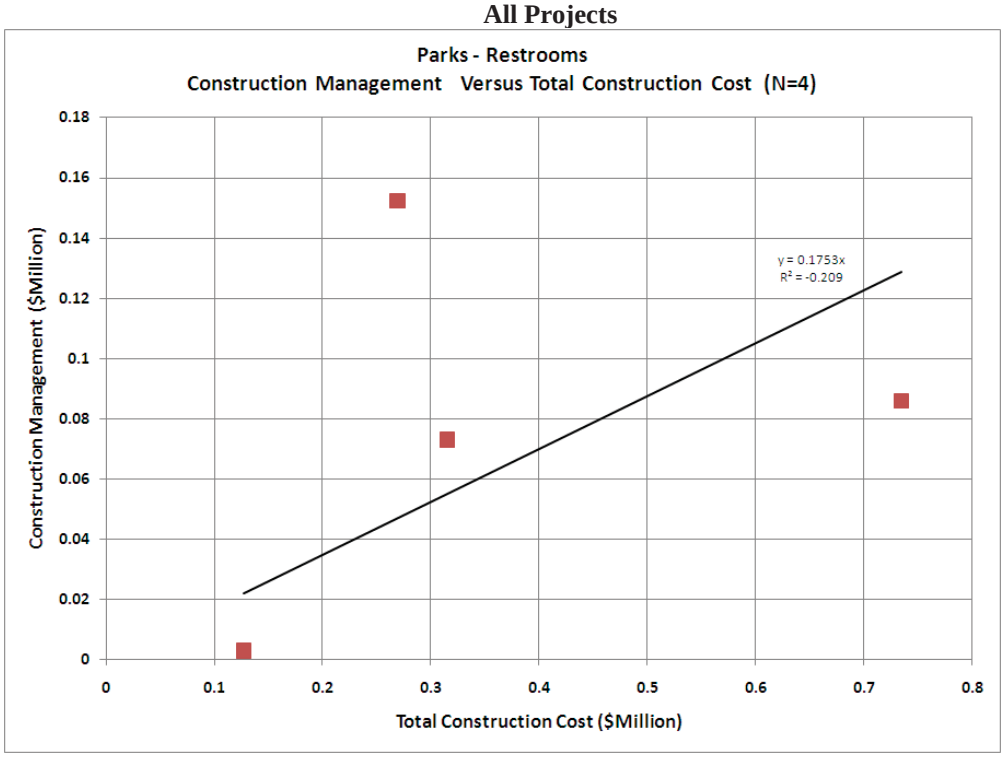
All Projects



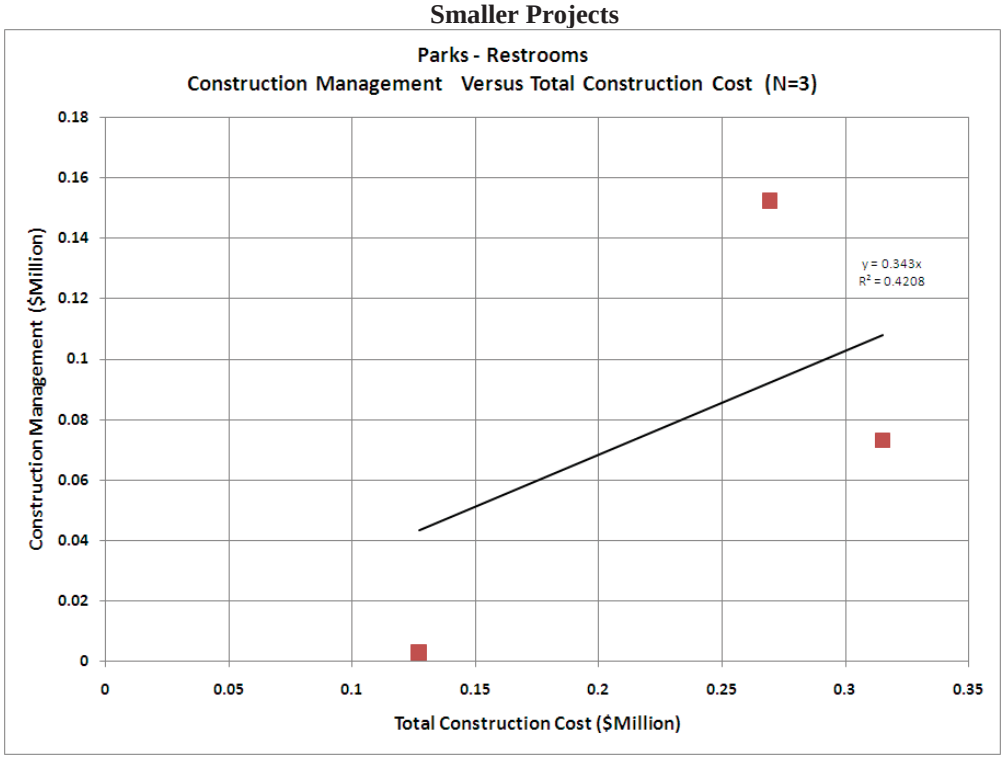
Smaller Projects



All Projects



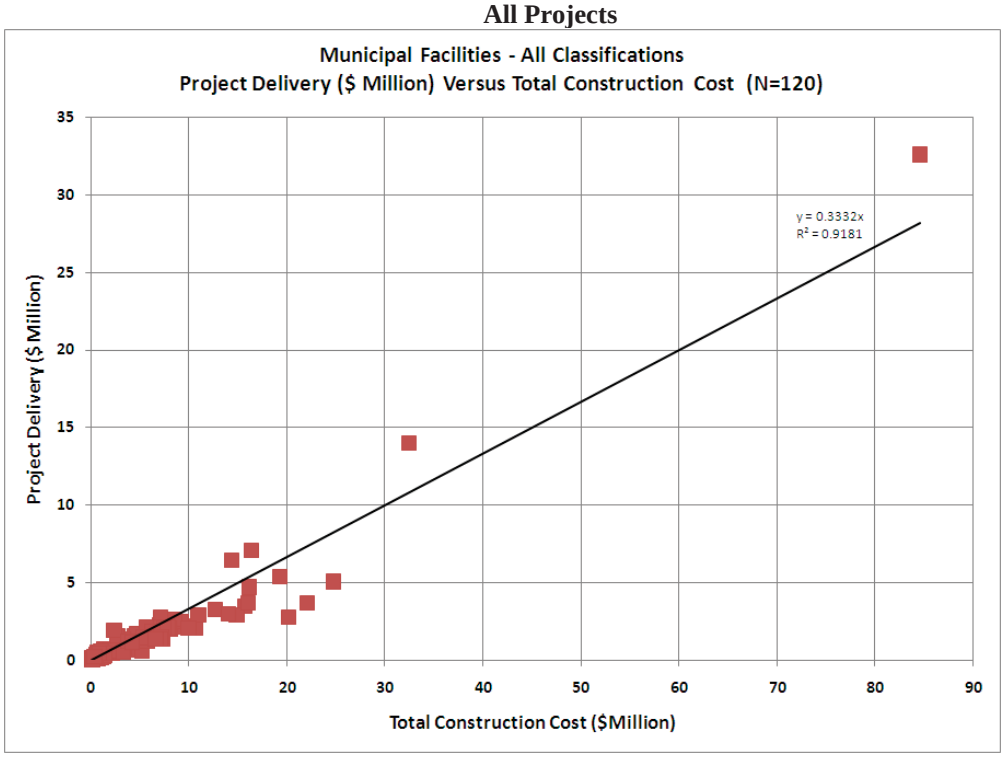
Smaller Projects



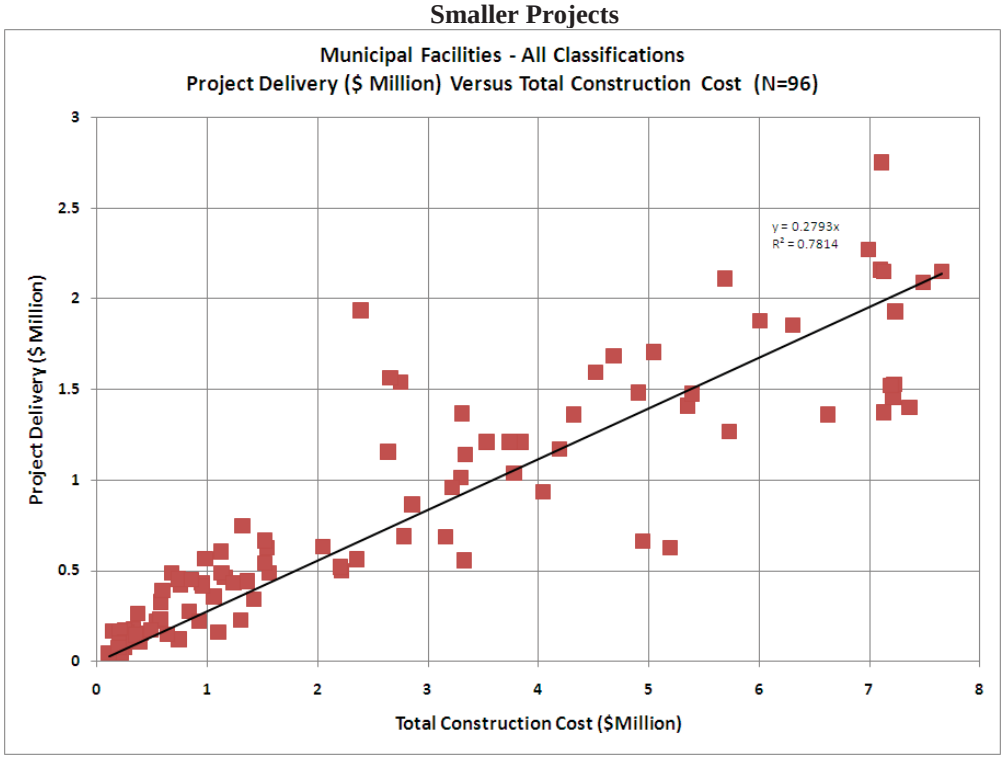
CURVES GROUP 3

Project Delivery Cost
vs
Total Construction Cost

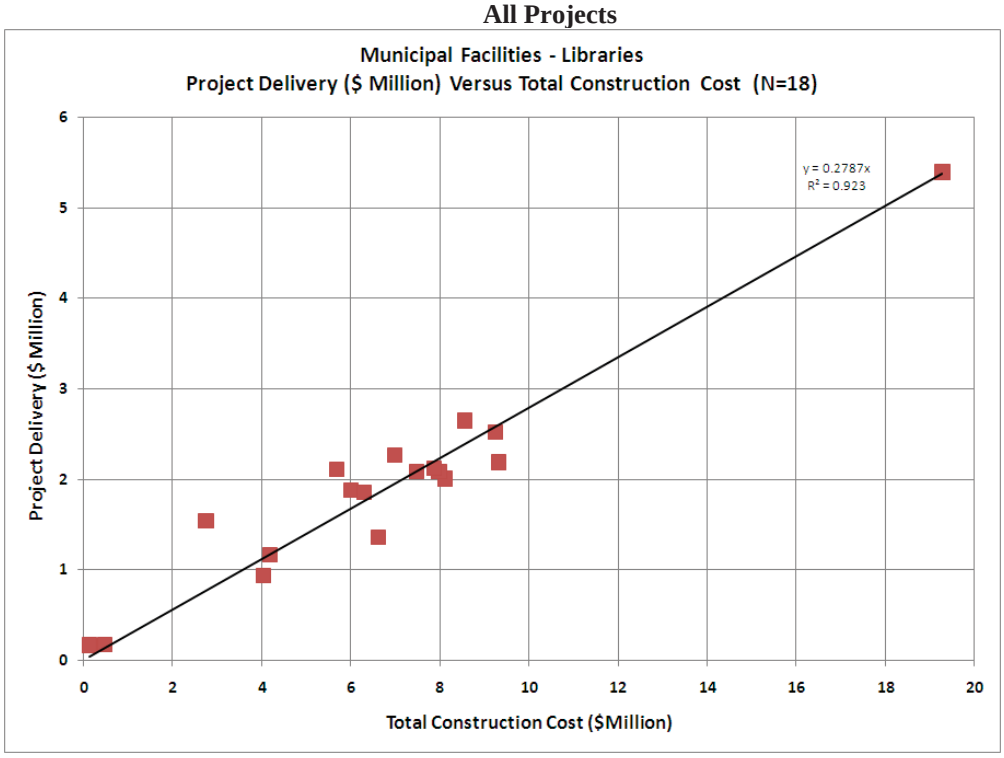
All Projects



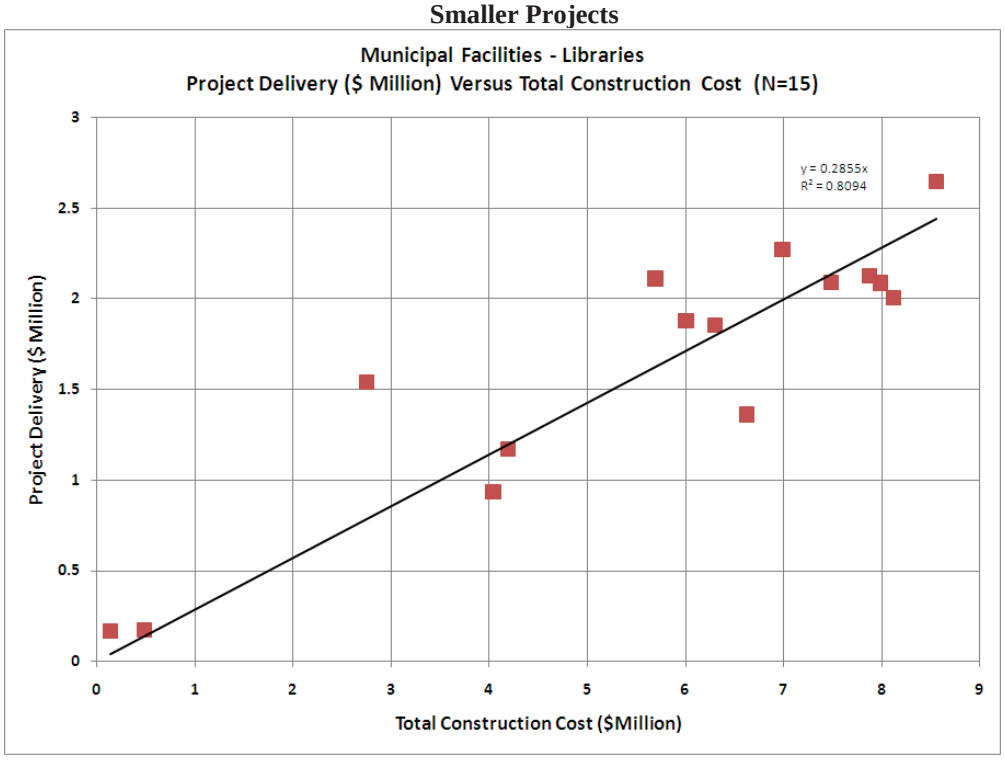
Smaller Projects



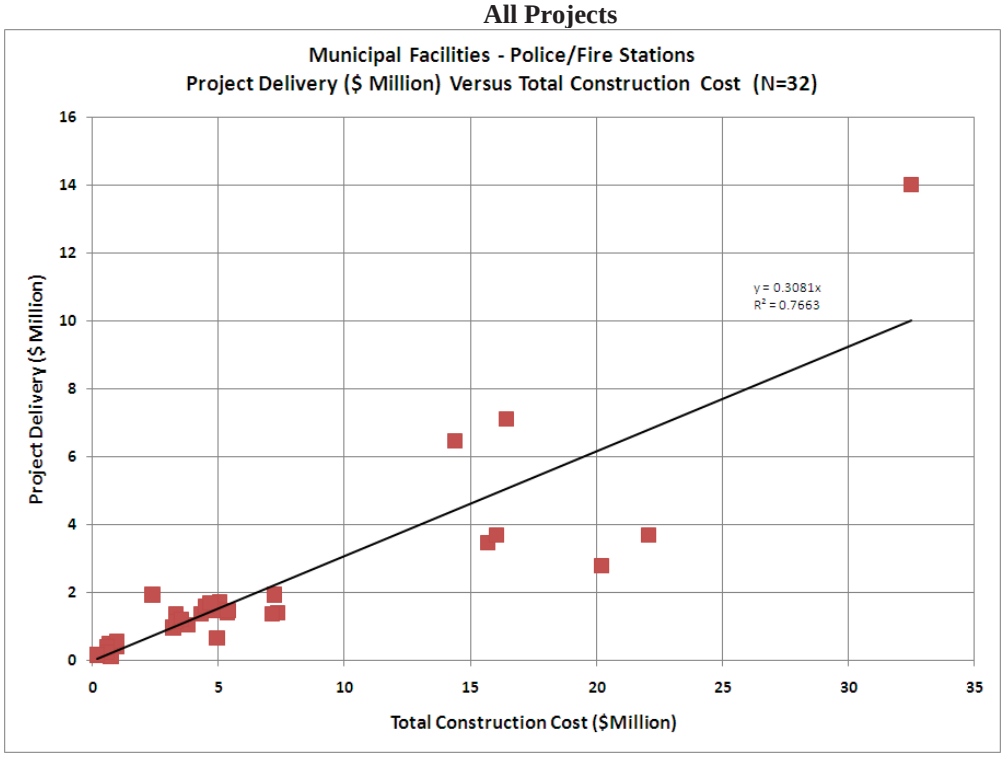
All Projects



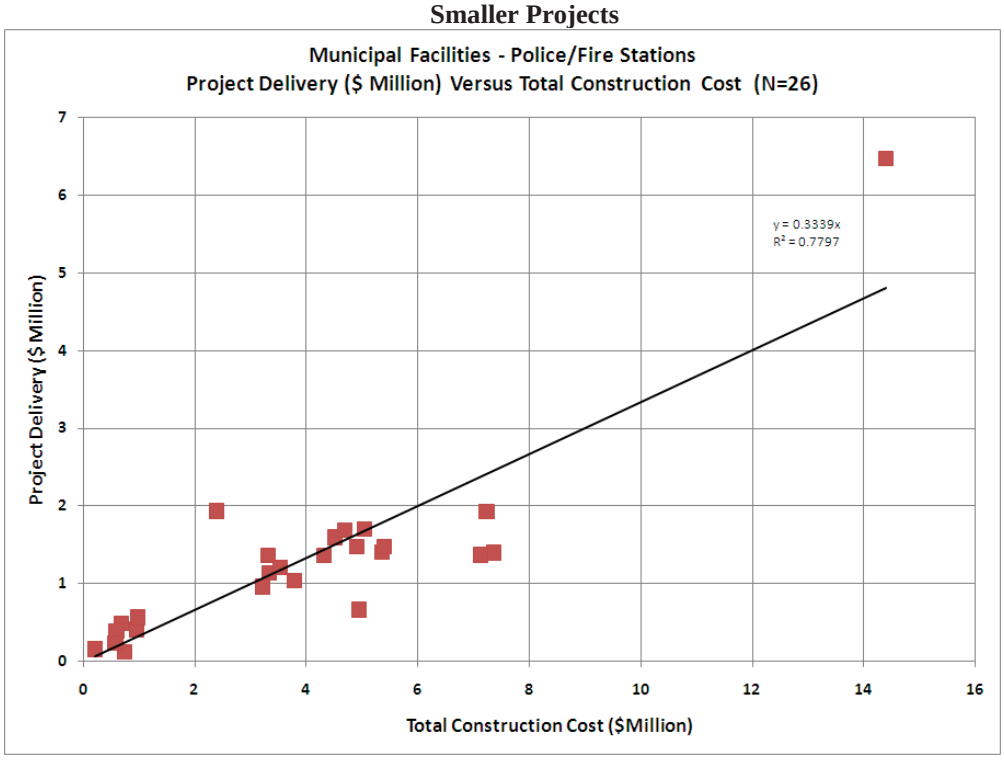
Smaller Projects



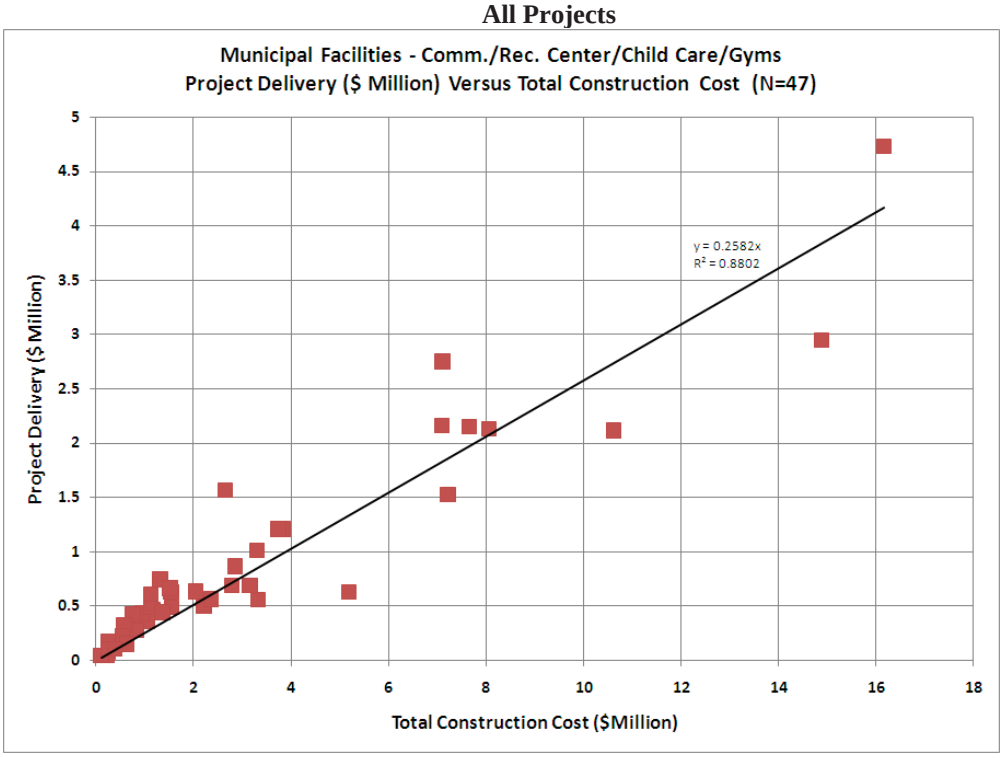
All Projects



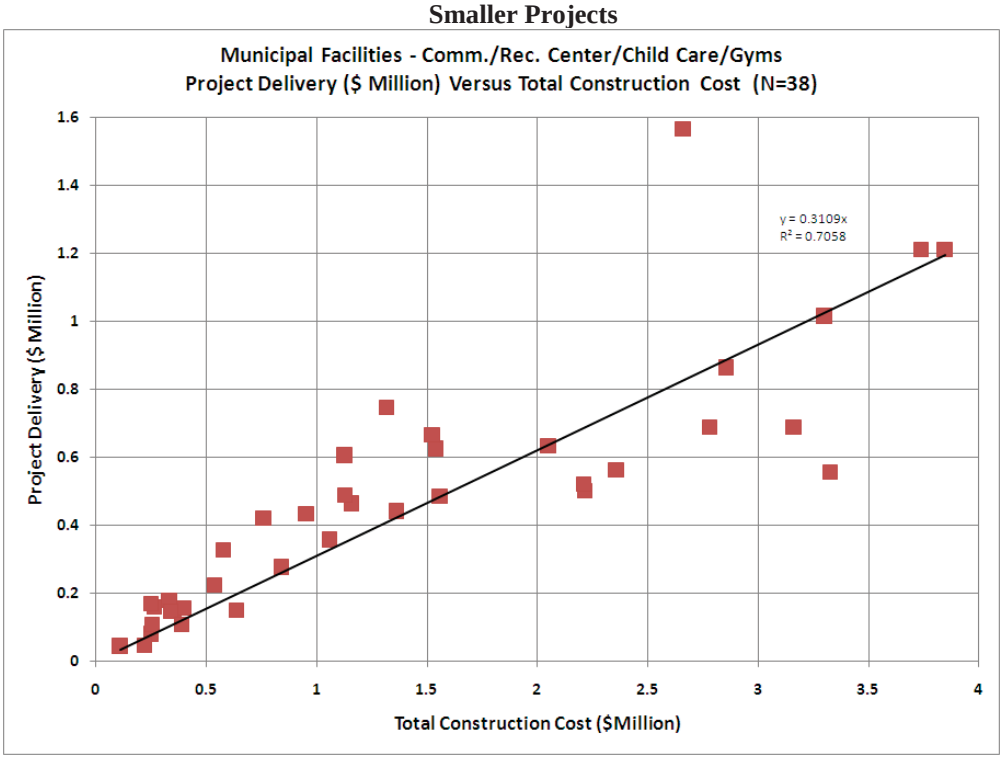
Smaller Projects



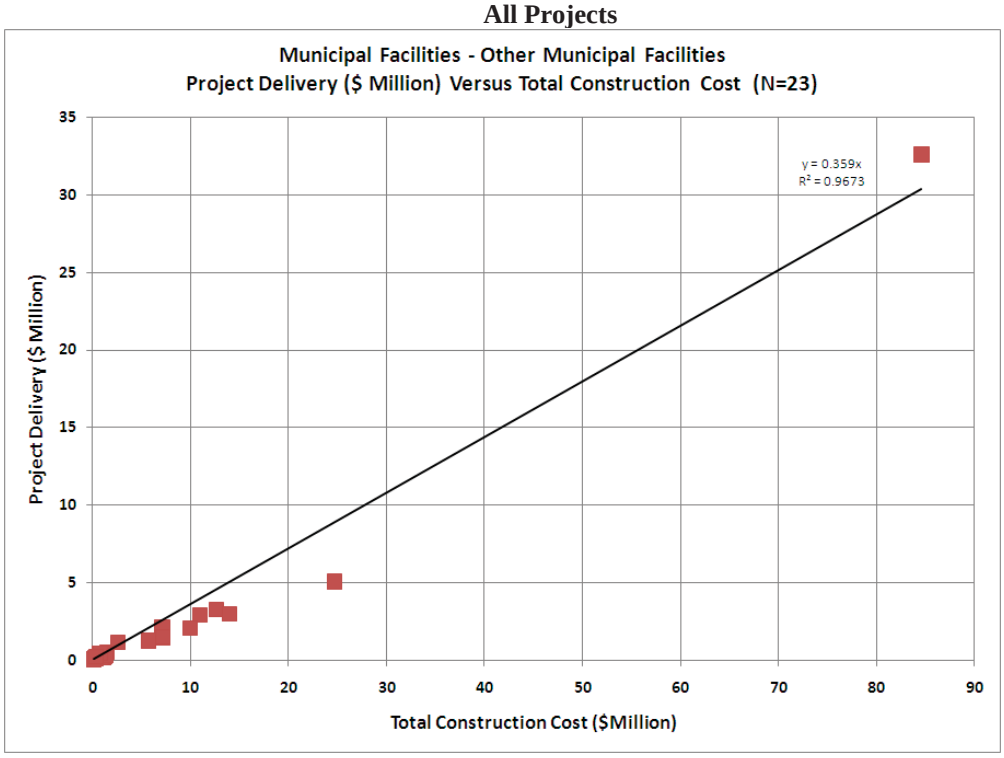
All Projects



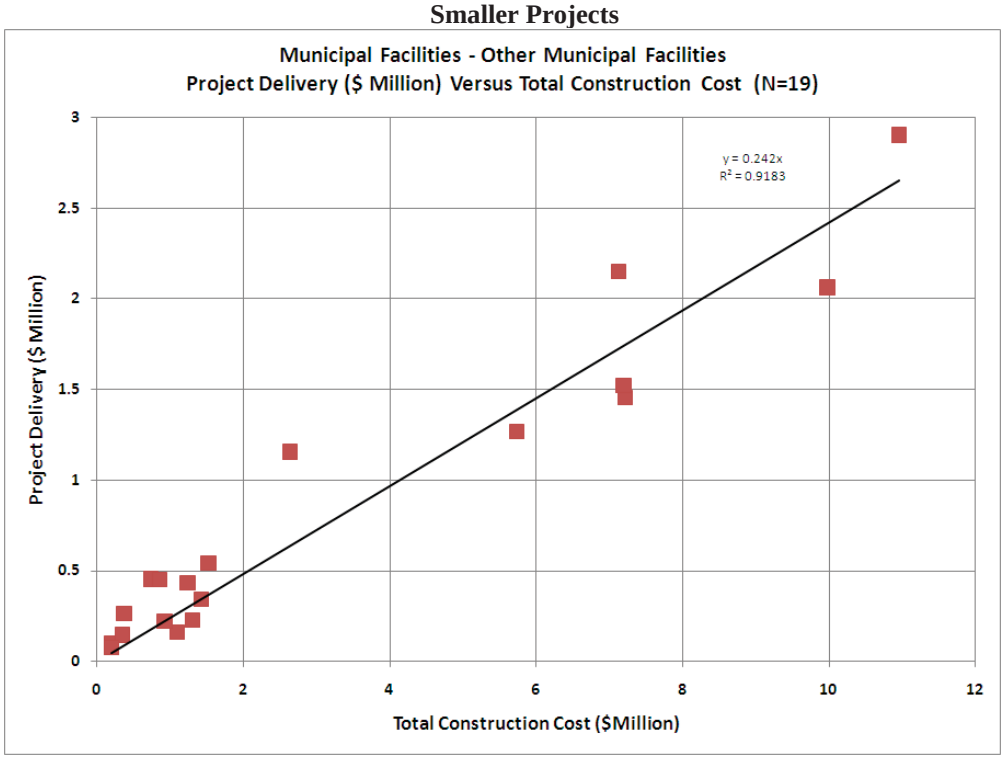
Smaller Projects



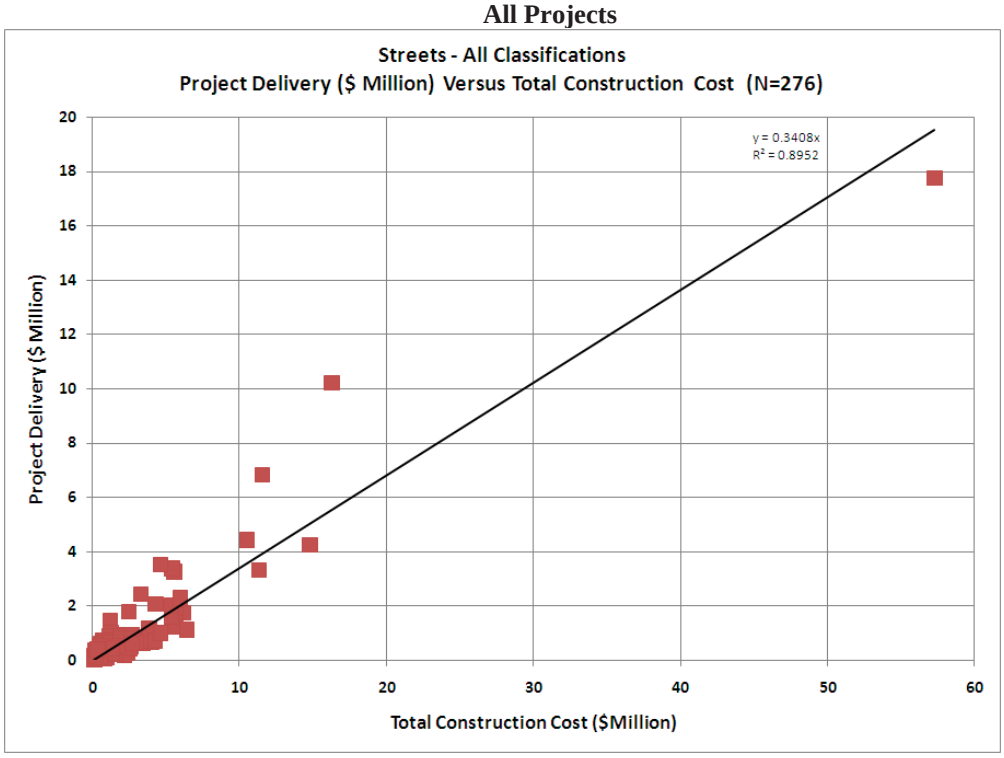
All Projects



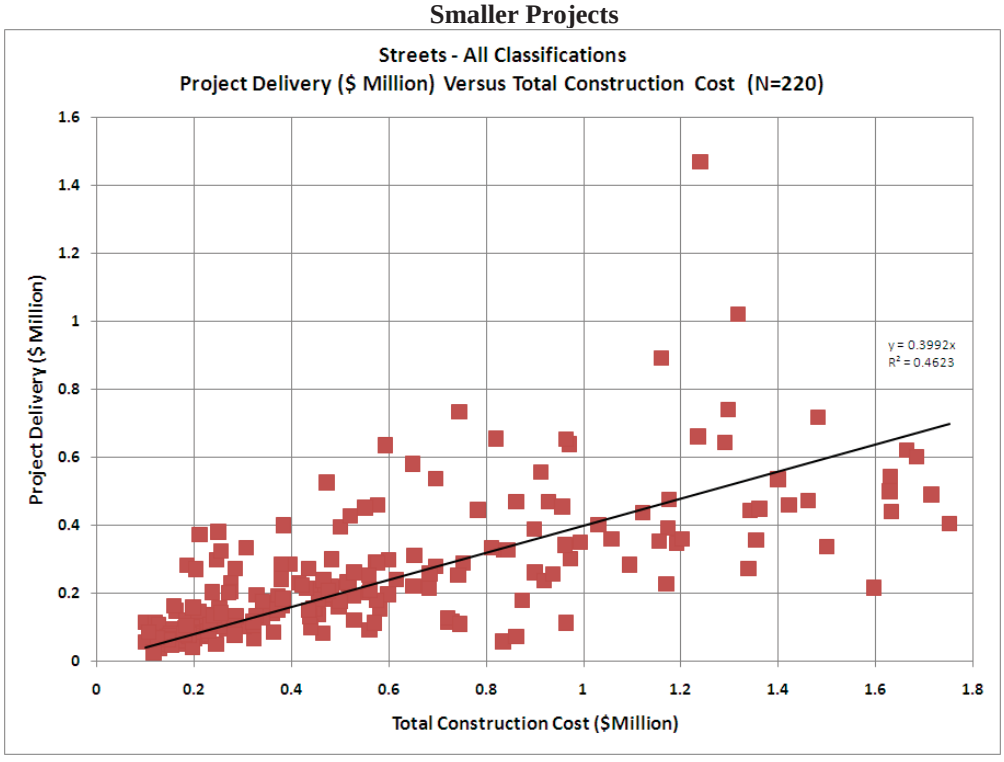
Smaller Projects



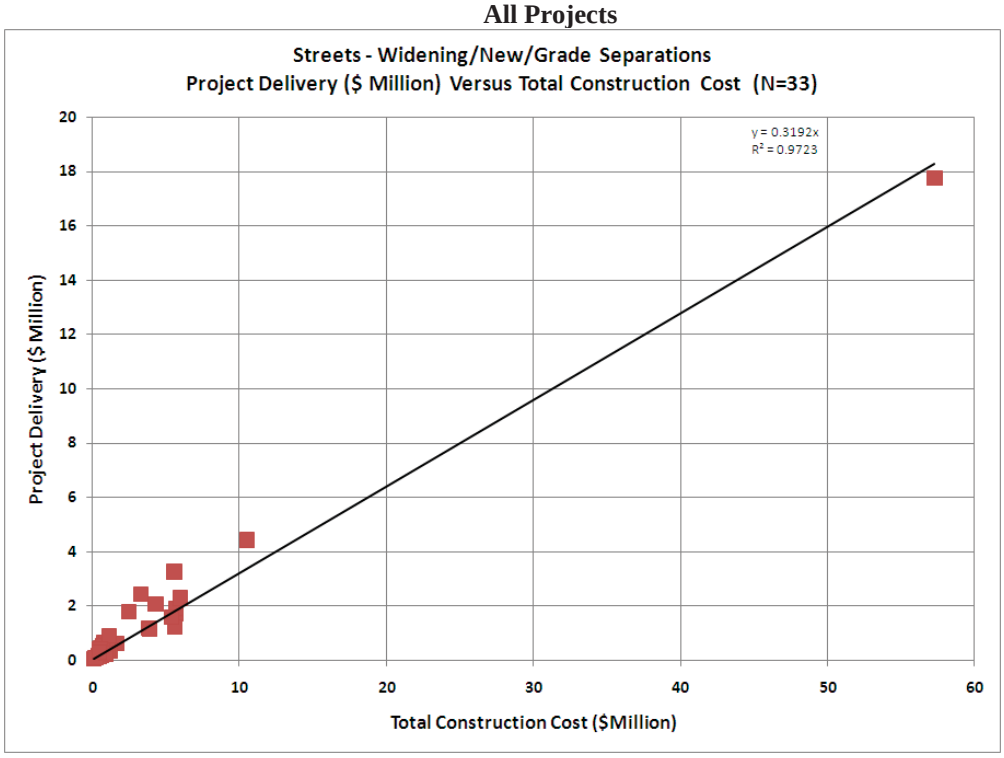
All Projects



Smaller Projects

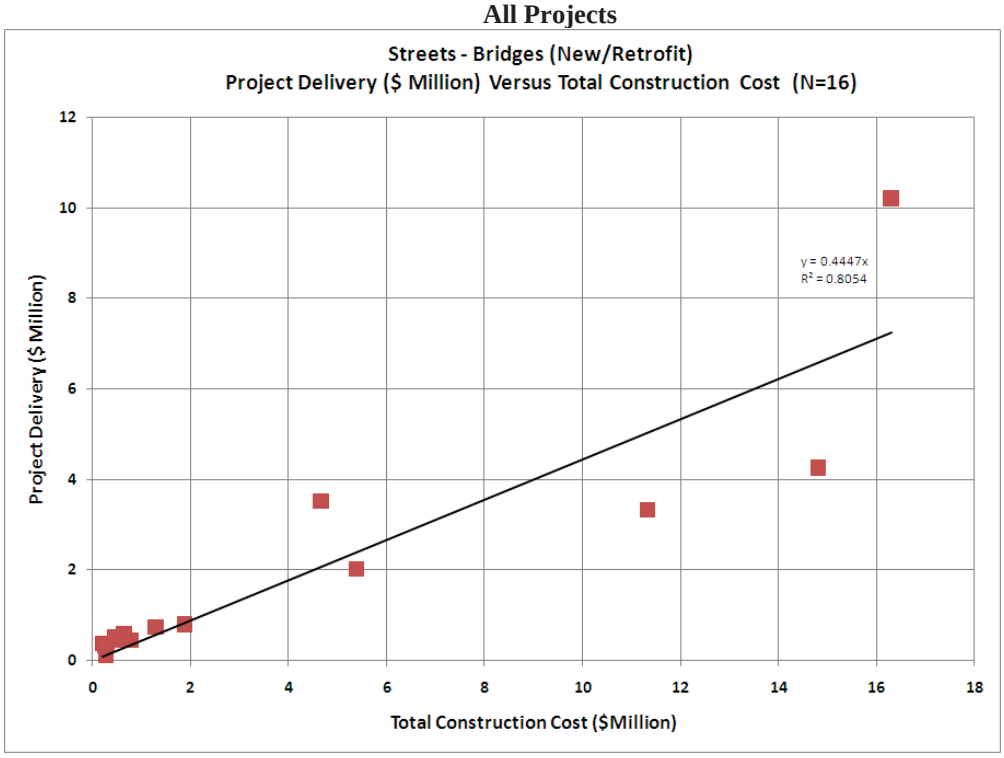


All Projects

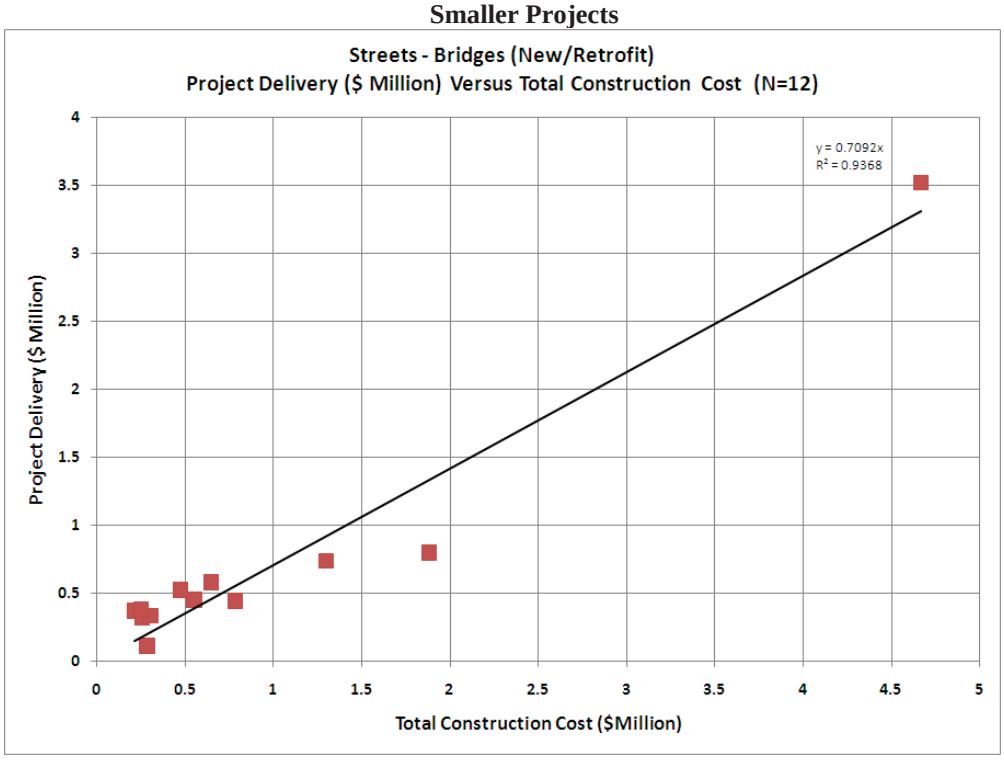


Smaller Projects

All Projects

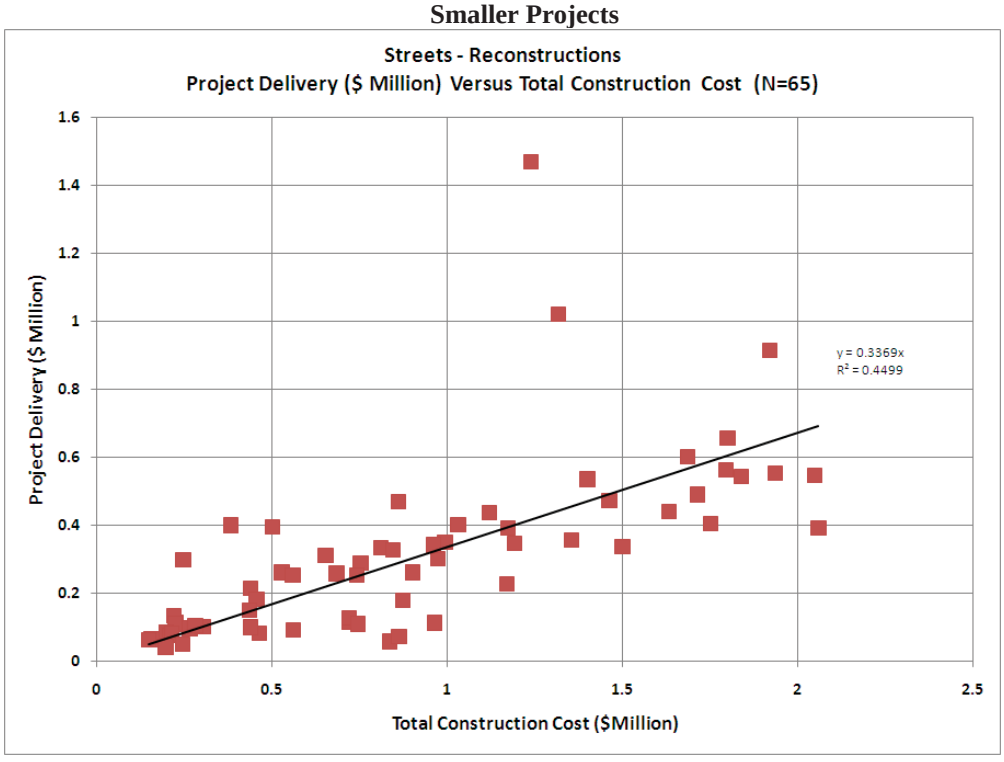


Smaller Projects

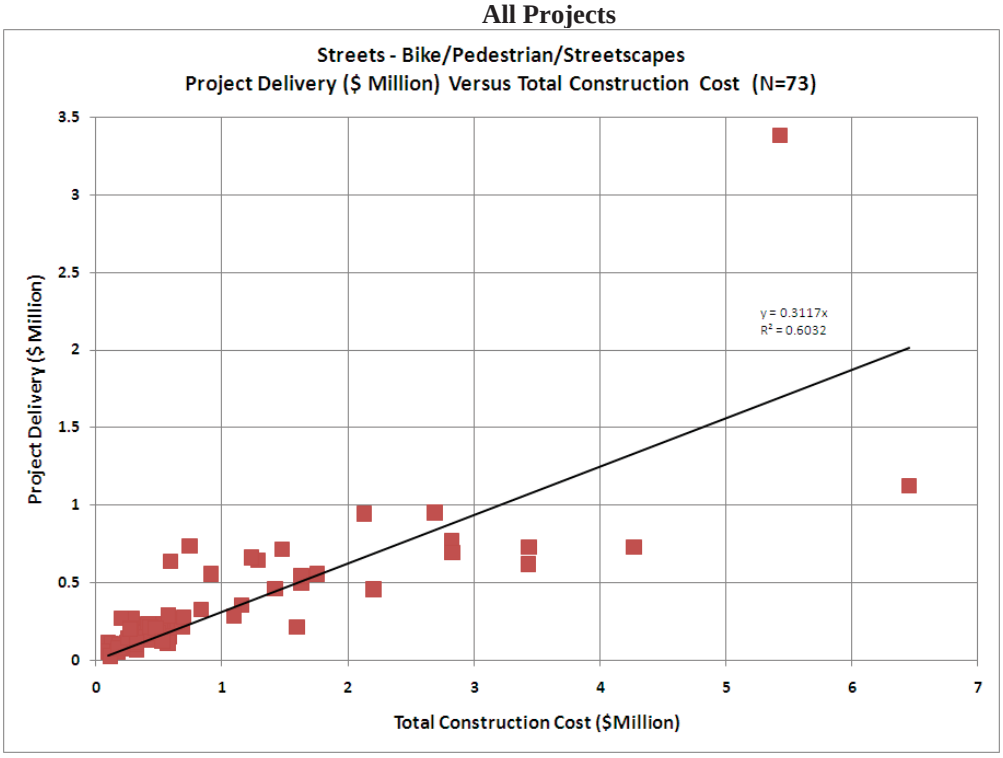


All Projects

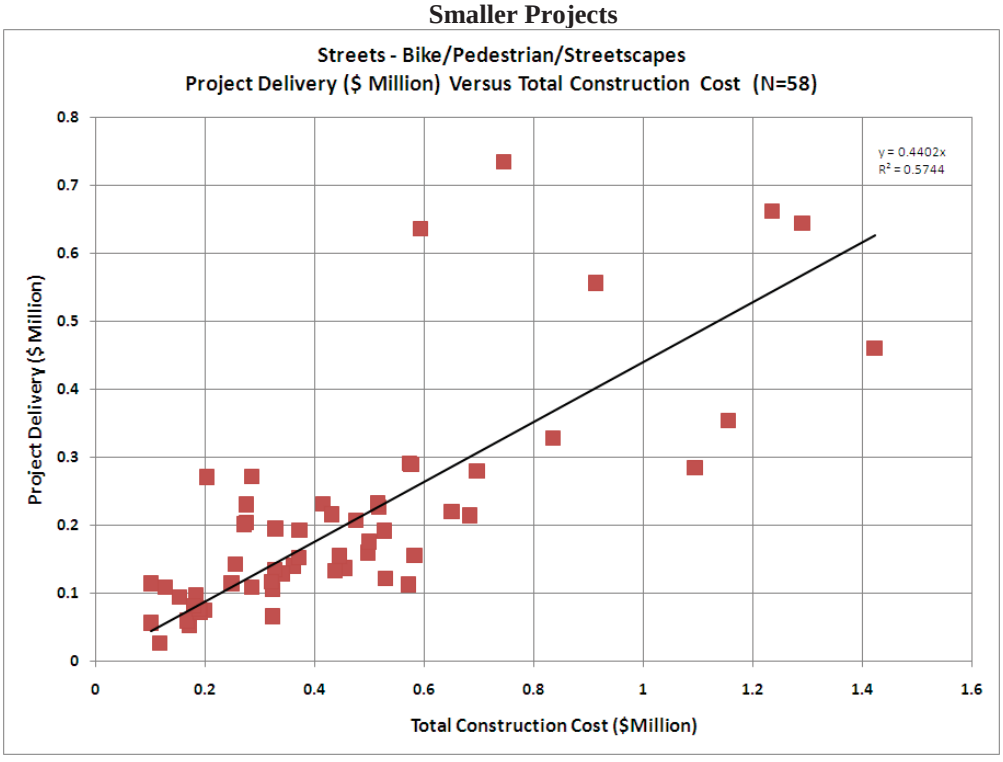
Smaller Projects



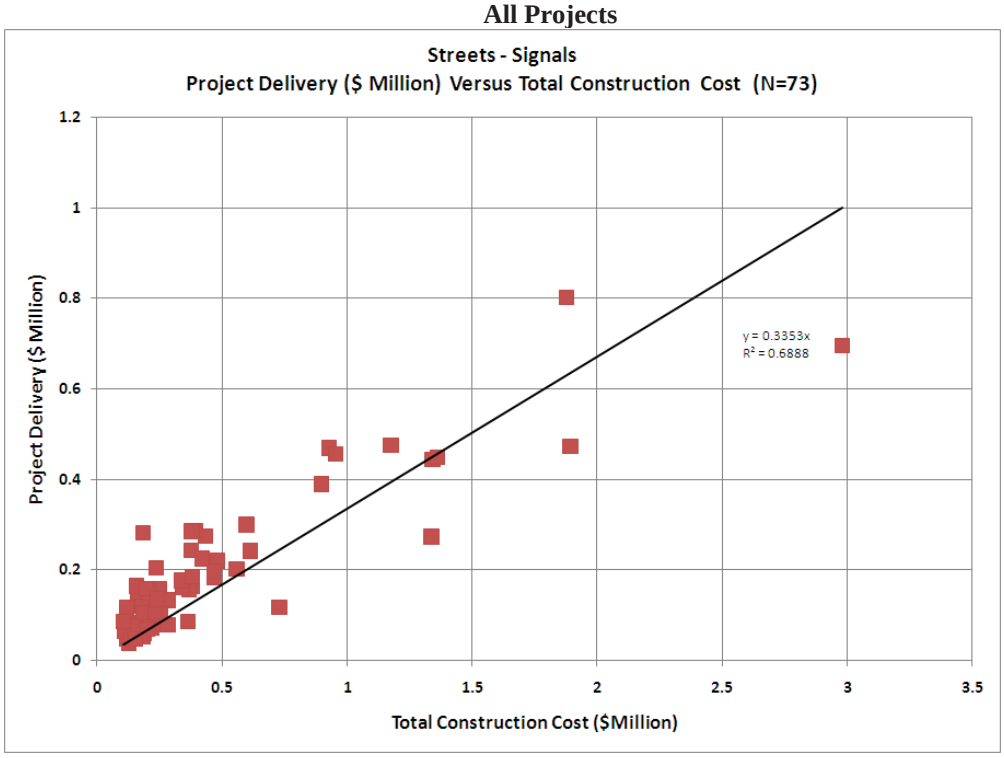
All Projects



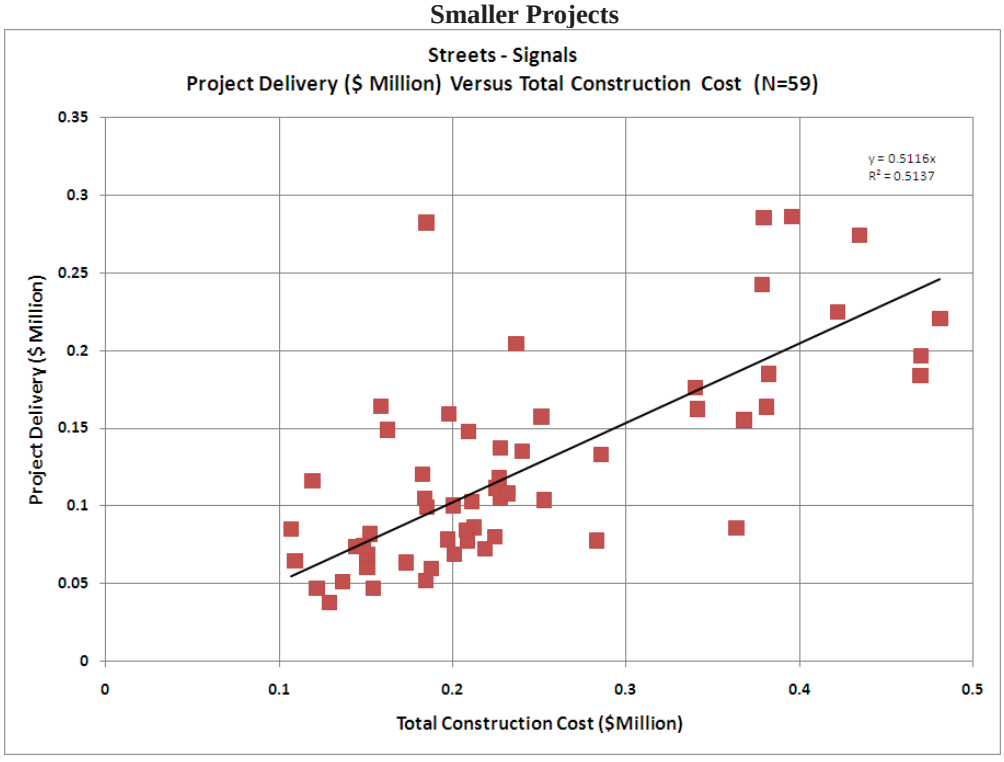
Smaller Projects



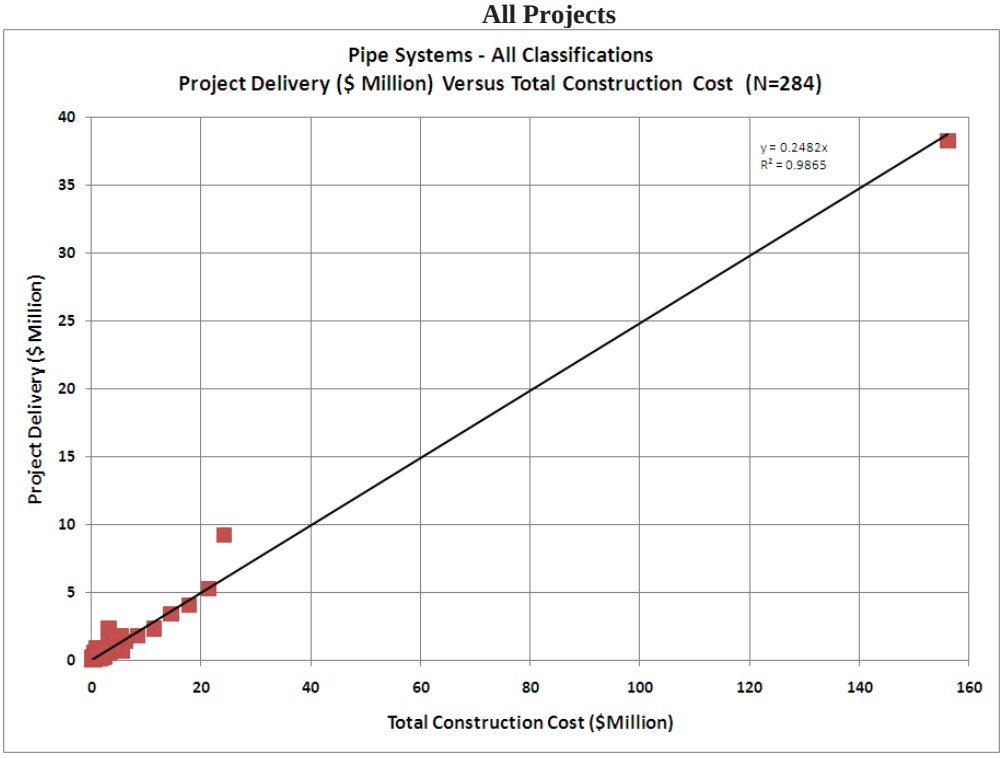
All Projects



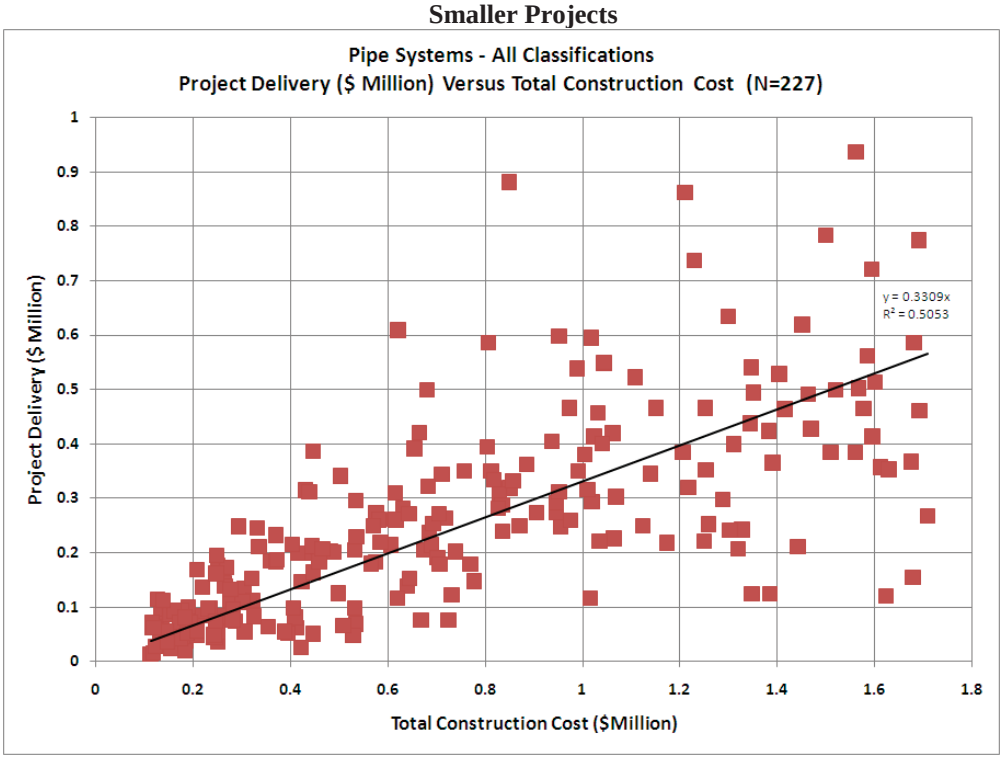
Smaller Projects



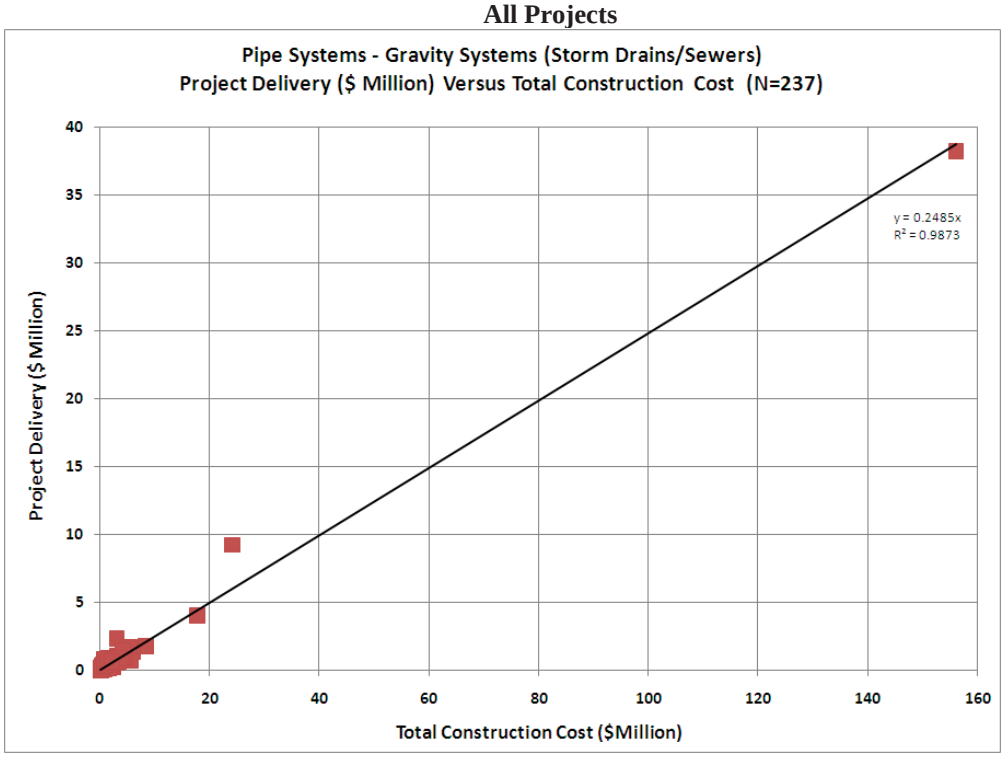
All Projects



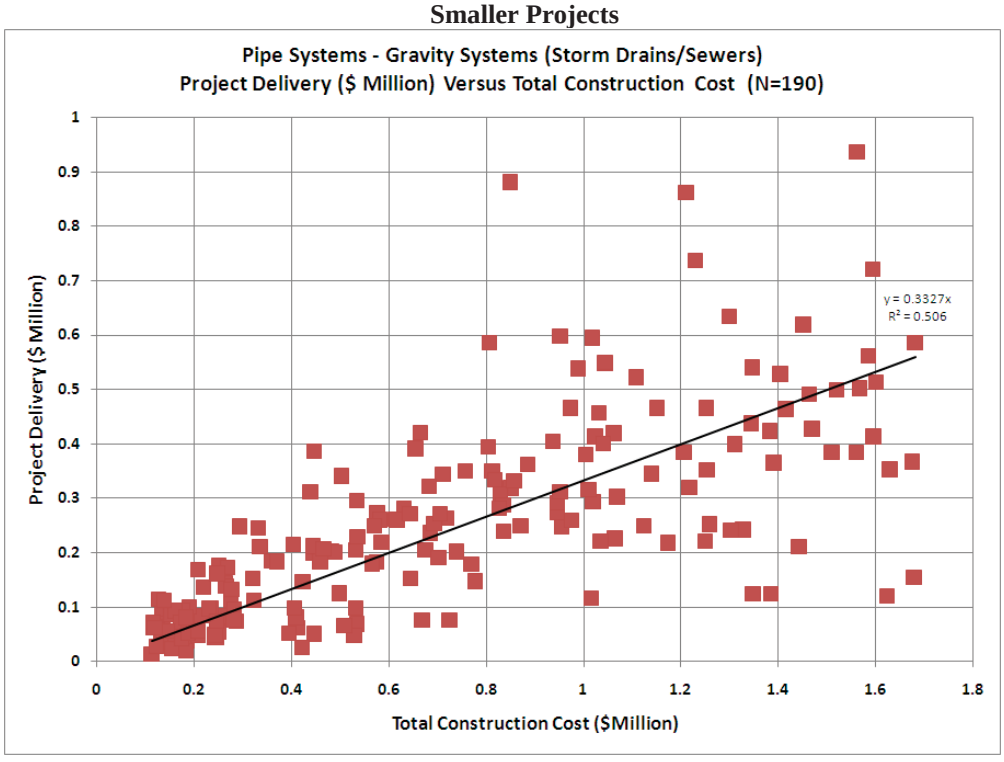
Smaller Projects



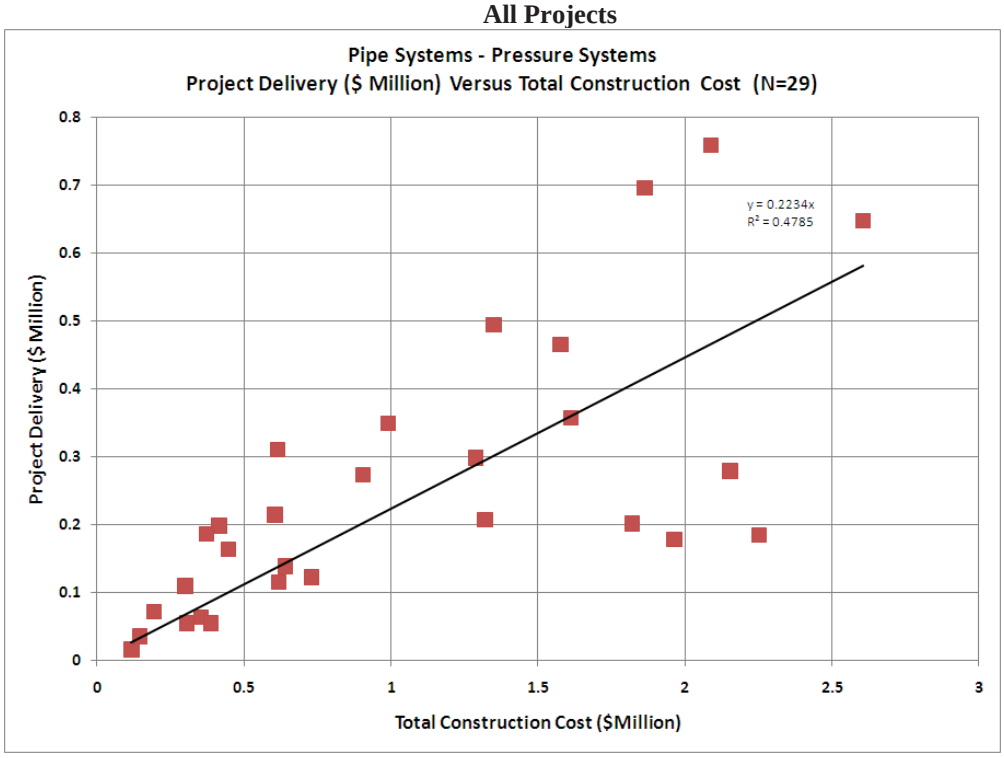
All Projects



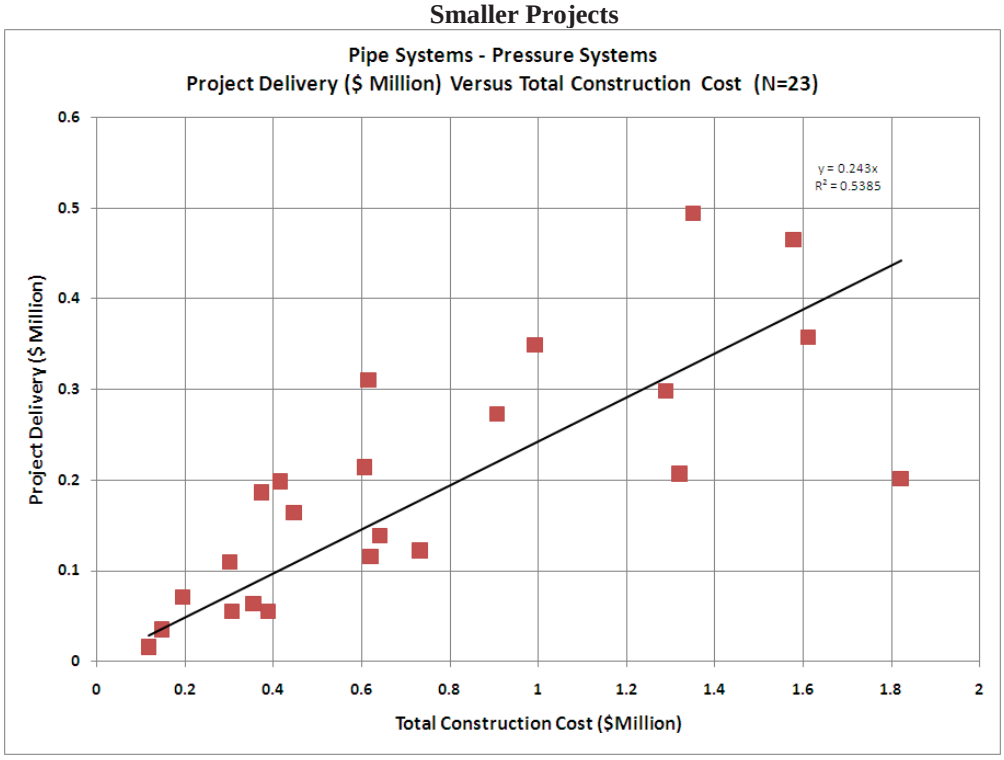
Smaller Projects



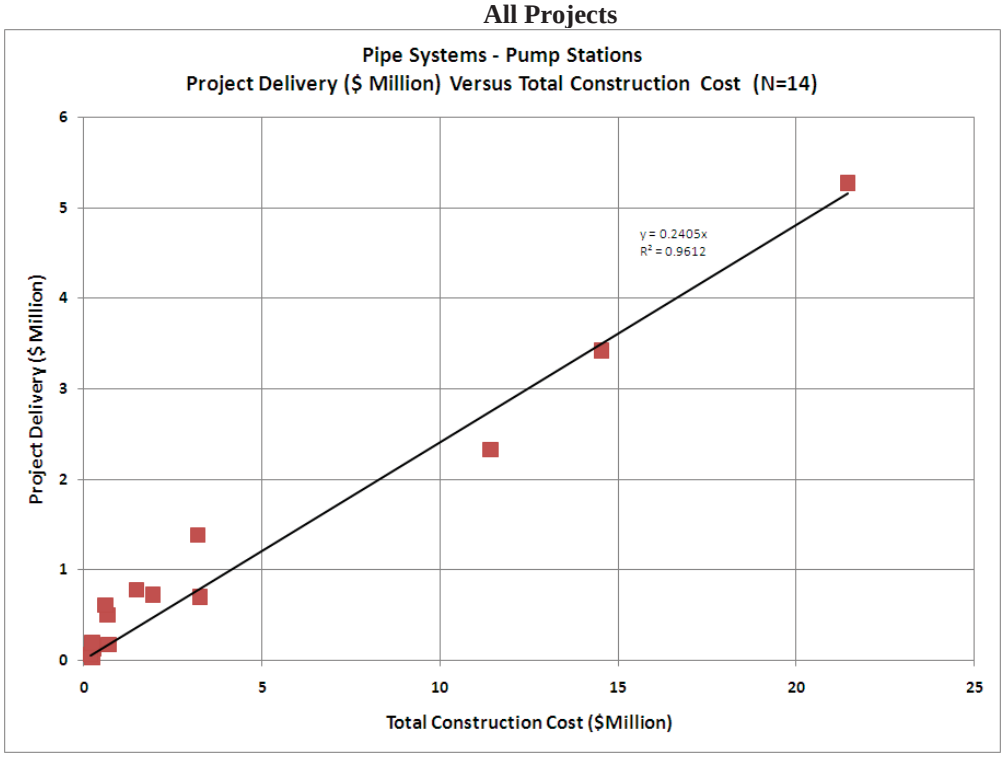
All Projects



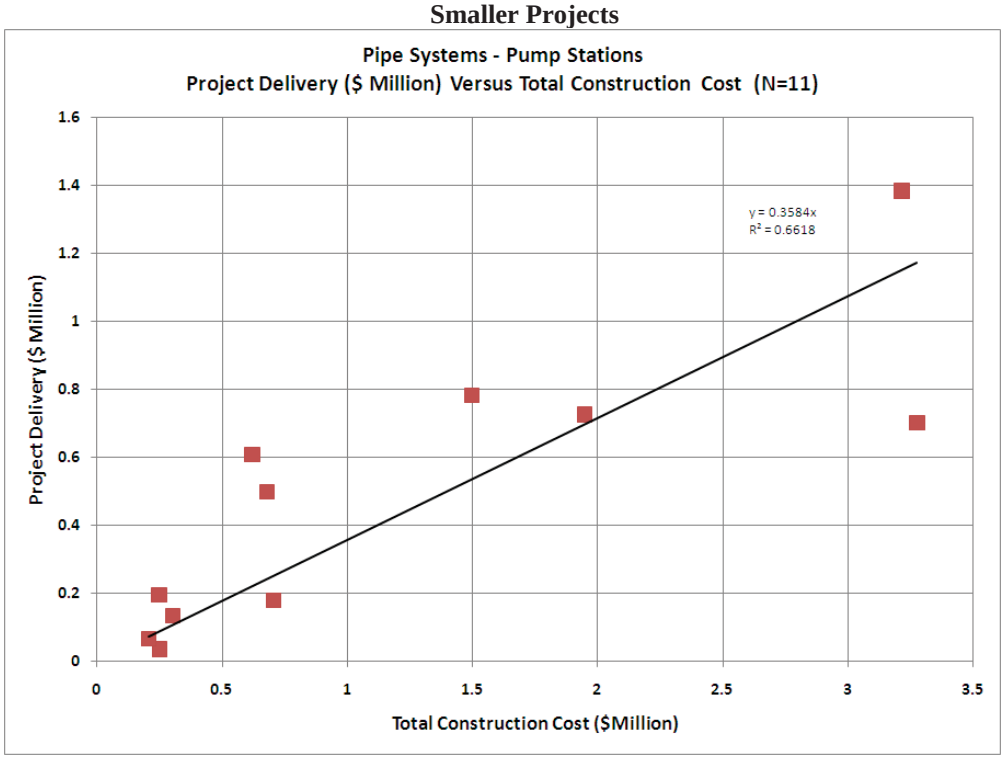
Smaller Projects



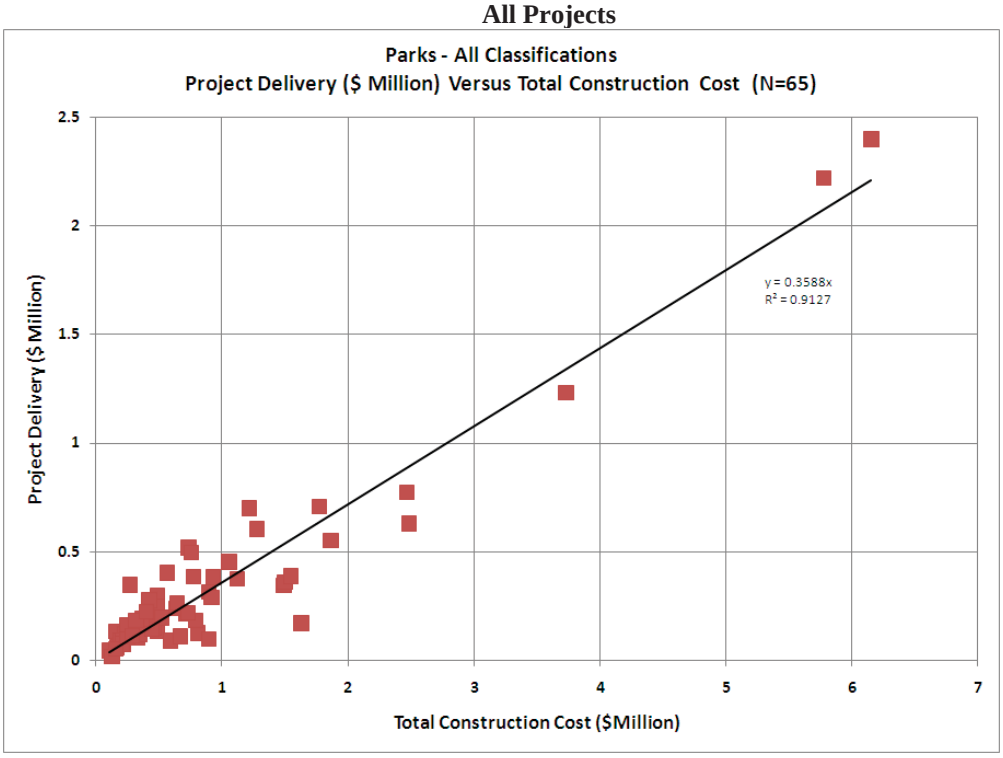
All Projects



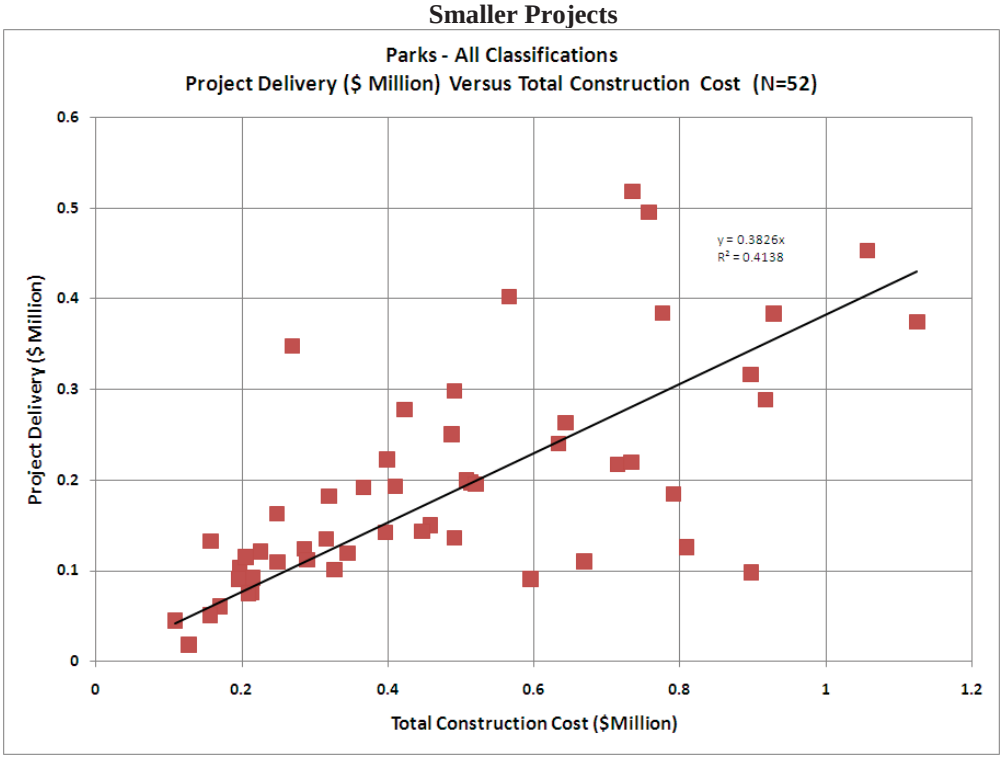
Smaller Projects



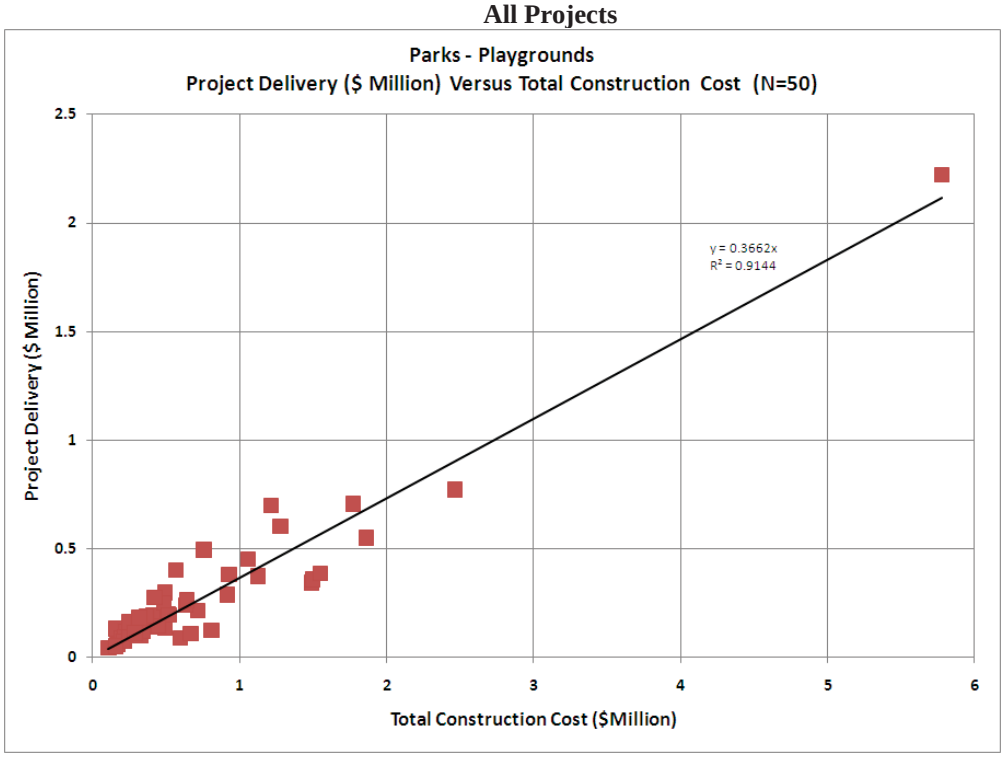
All Projects



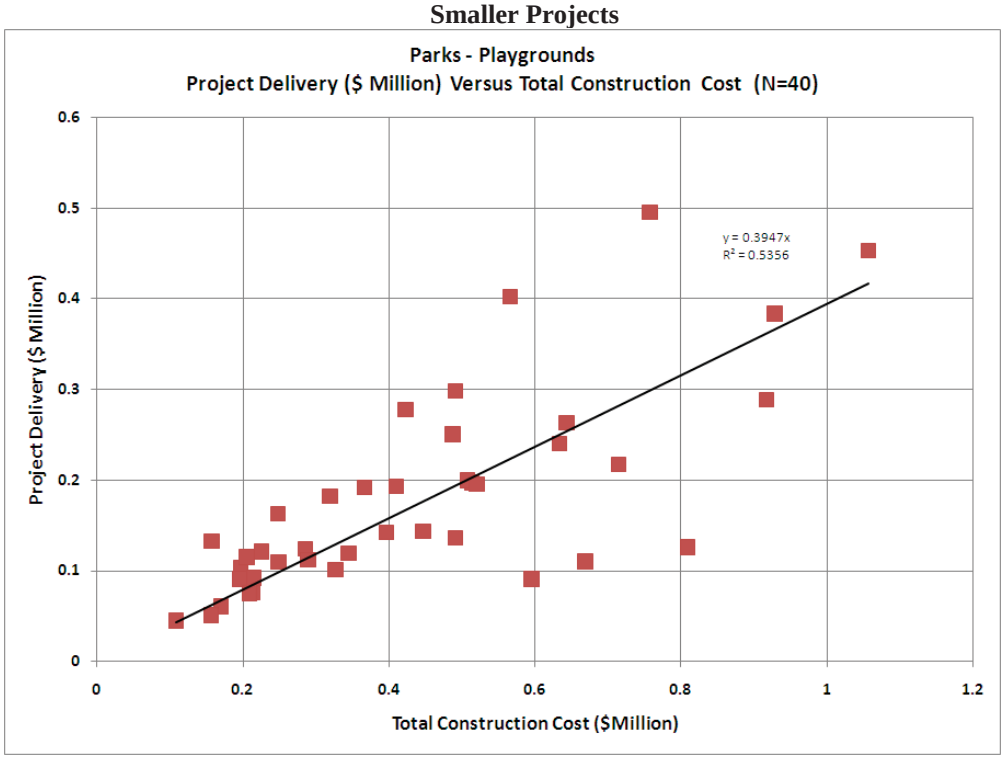
Smaller Projects



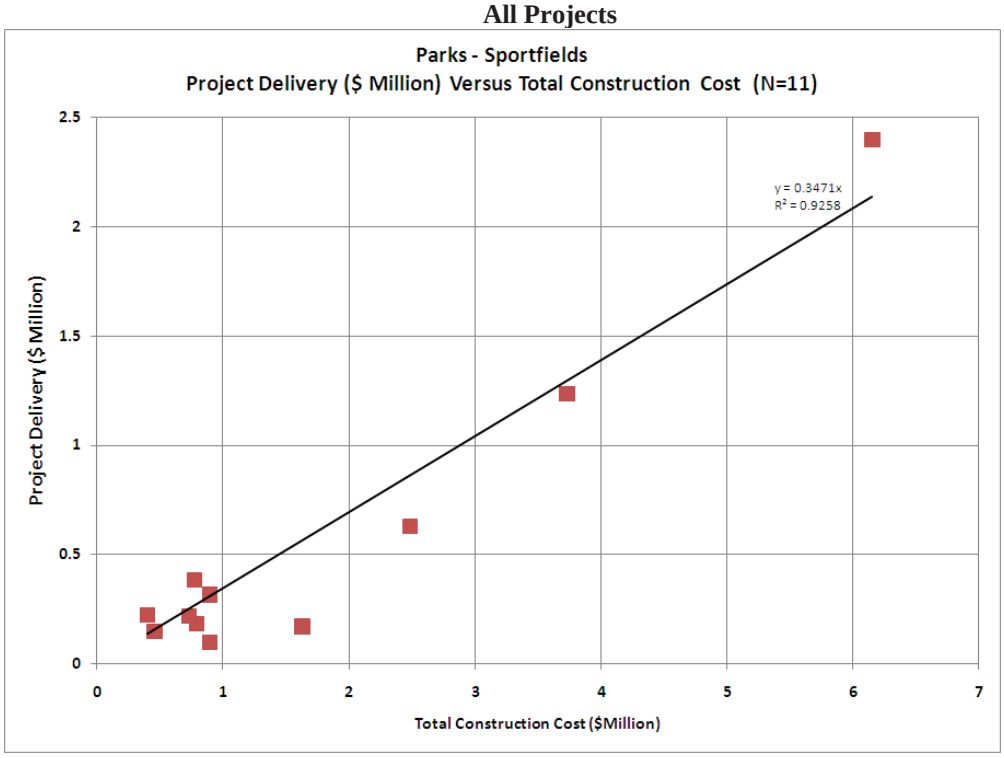
All Projects



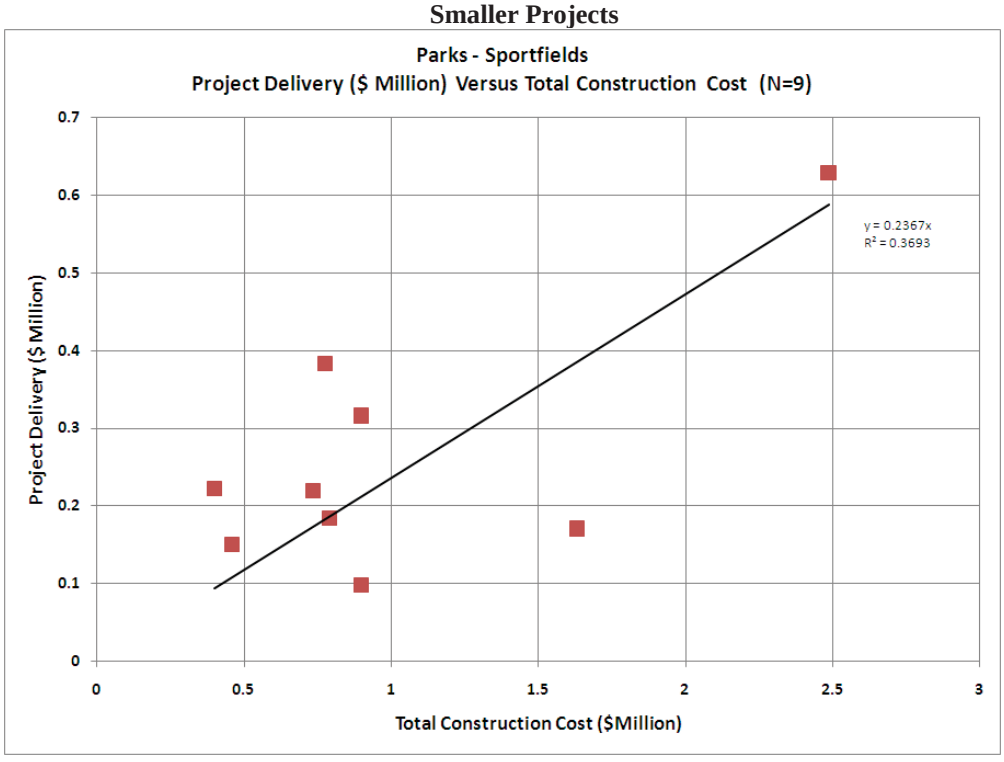
Smaller Projects



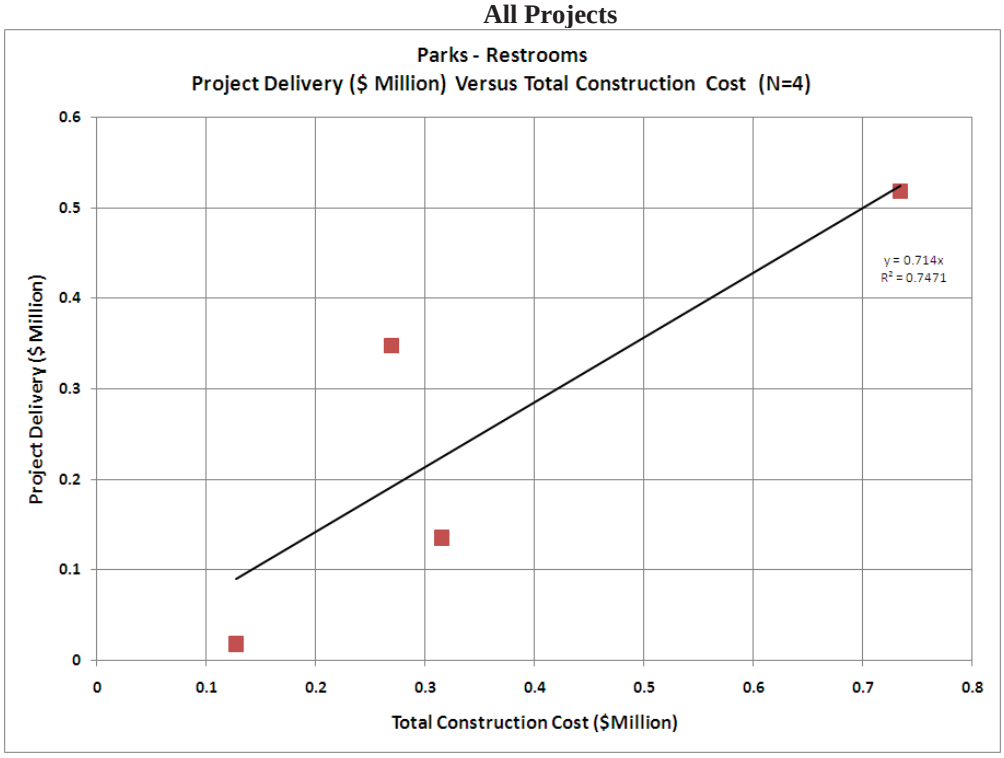
All Projects



Smaller Projects



All Projects



Smaller Projects

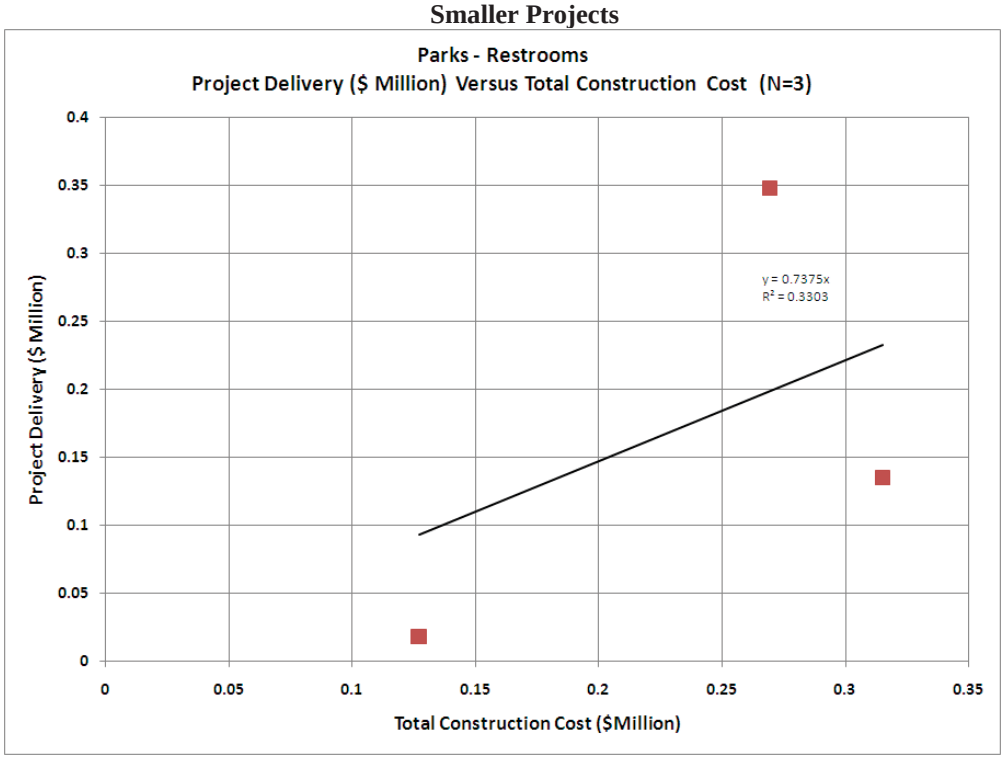
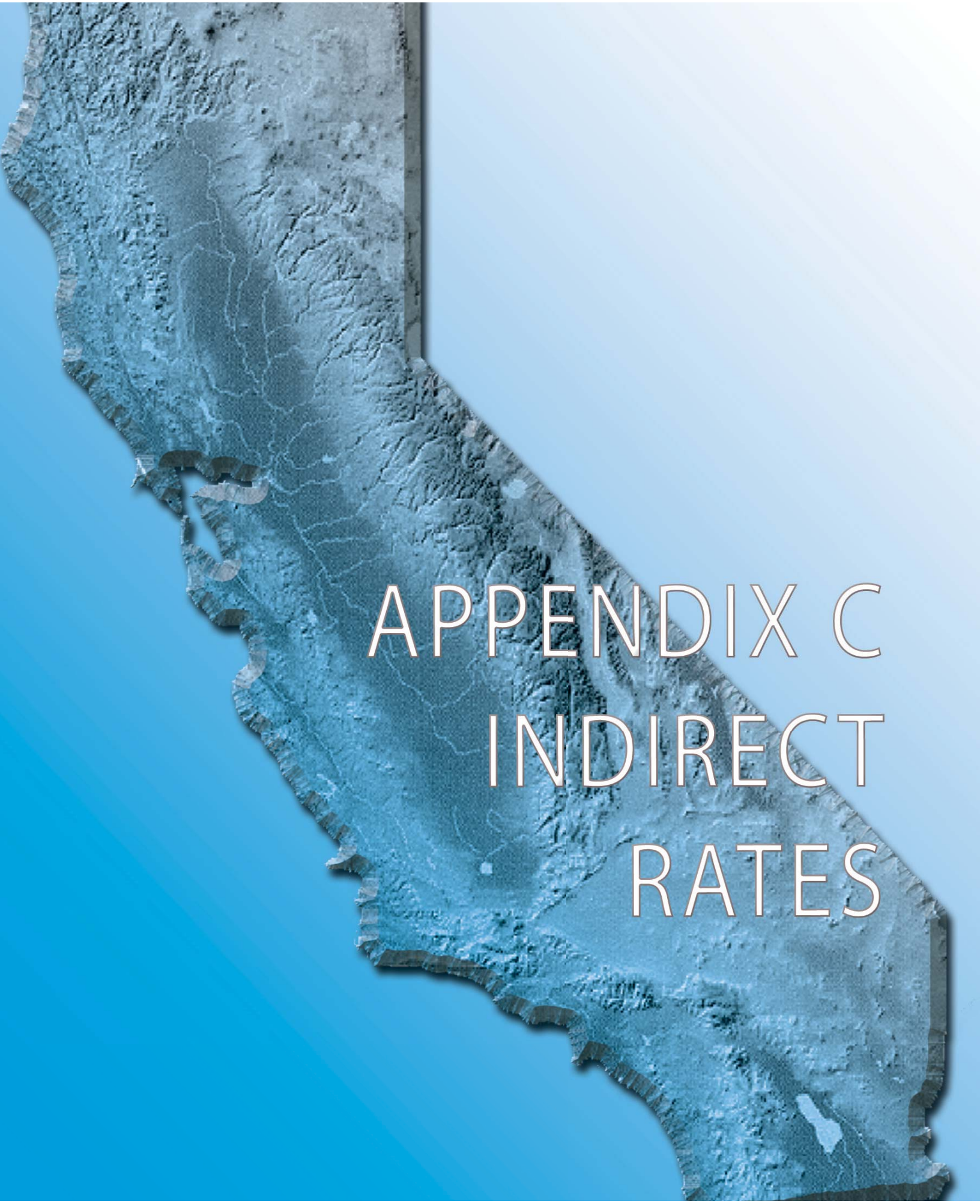


Table B-3
Summary of Regression Equations

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=0.1666x	y=0.151x	y=0.1666x	y=0.1285x	y=0.3332x	y=0.2793x
Libraries	y=0.1519x	y=0.1652x	y=0.1268x	y=0.1203x	y=0.2787x	y=0.2855x
Police/Fire Stations	y=0.1568x	y=0.1537x	y=0.1515x	y=0.1808x	y=0.3081x	y=0.3339x
Comm./Rec.Center/ Child Care/Gyms	y=0.1492x	y=0.1699x	y=0.109x	y=0.141x	y=0.2582x	y=0.3109x
Other Municipal	y=0.1744x	y=0.1546x	y=0.1846x	y=0.0875x	y=0.359x	y=0.242x
Streets Projects	y=0.2124x	y=0.1603x	y=0.1805x	y=0.1864x	y=0.3408x	y=0.3992x
Widening/New/ Grade Separations	y=0.1283x	y=0.3075x	y=0.1909x	y=0.1486x	y=0.3192x	y=0.4562x
Bridges	y=0.301x	y=0.3636x	y=0.1437x	y=0.3456x	y=0.4447x	y=0.7092x
Reconstructions	y=0.2128x	y=0.1792x	y=0.1686x	y=0.1577x	y=0.3814x	y=0.3369x
Bike/Pedestrian/ Streetscapes	y=0.1843x	y=0.2434x	y=0.1275x	y=0.1966x	y=0.3117x	y=0.4402x
Signals	y=0.1477x	y=0.2611x	y=0.1862x	y=0.252x	y=0.3353x	y=0.5116x
Pipes Projects	y=0.1455x	y=0.1676x	y=0.1027x	y=0.1632x	y=0.2482x	y=0.3309x
Gravity Mains	y=0.1458x	y=0.1659x	y=0.1027x	y=0.1668x	y=0.2485x	y=0.3327x
Pressure Systems	y=0.1106x	y=0.1115x	y=0.1128x	y=0.1315x	y=0.2234x	y=0.243x
Pump Stations	y=0.1404x	y=0.1608x	y=0.1001x	y=0.1977x	y=0.2405x	y=0.3584x
Parks	y=0.2429x	y=0.2396x	y=0.1159x	y=0.143x	y=0.3588x	y=0.3826x
Playgrounds	y=0.22x	y=0.2573x	y=0.1462x	y=0.1374x	y=0.3662x	y=0.3947x
Sportfields	y=0.2635x	y=0.1604x	y=0.0836x	y=0.0763x	y=0.3471x	y=0.2367x
Restrooms	y=0.5387x	y=0.3946x	y=0.1753x	y=0.343x	y=0.714x	y=0.7375x

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



APPENDIX C
INDIRECT RATES

Table C-1
Indirect Rates Applied to Capital Projects

Agency	Fringe Benefits	Compensated Time Off	City Overhead	Department Overhead	Agency Overhead	Indirect Rate Factor[1]	Receive General Fund Support For CIP
City of Long Beach Department of Public Works	41.92%	19.40%	0%	5.53%	49.21%	149.63%	YES
City of Los Angeles Department of Public Works Bureau of Engineering[2]	31.48%	20.31%	16.48%	16.07%	62.67%	147.01%	YES
City of Oakland Department of Engineering & Construction	69.48%	20.96%	24.89%	39.57%	0%	154.90%	NO
City of Sacramento Department of Transportation Department of Utilities							NO
	37.80%	18.70%	9.10%	8.20%	83.06%	156.86%	
	37.17%	18.70%	108.59%			164.46%	
City of San Diego[4] Architectural Engineering and Parks Division Transportation Engineering Operations Division Right of Way Design Division							NO
City and County of San Francisco Department of Public Works Bureau of Engineering Bureau of Construction Management Bureau of Architecture	31.32%	30.76%	0%	40.29%	59.43%	161.80%	NO
City of San Jose Department of Public Works	35.50%	31.50%	34.33% 8.26%[3]	20.24%	Included	129.83%	NO

Notes:

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

[2] Based on averages of all Bureau program overhead rates provided under CAP 31.

[3] .83% is the rate applied to Capital Project labor charges; 9.27% is the rate applied to Compensated Time Off

[4] The City of San Diego went through an accounting system conversion during this year. Adjustments in their overhead rates occurred through the year and final numbers are not yet available.

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 General Services
Department of Transportation
Department of Utilities

City of San Diego
Engineering & Capital Projects

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

City of San Jose
Department of Public Works

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