

**CONSTRUCTION PROJECT PARTNERING IN TEXAS' PUBLIC
UNIVERSITIES**

A Thesis

by

PAUL FRANCIS

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2007

Major Subject: Construction Management

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Approved by:

Chair of Committee,	Charles W. Graham
Committee Members,	David Bilbo Anat Geva
Head of Department,	Charles W. Graham

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ABSTRACT

Construction Project Partnering in Texas' Public Universities. (May 2007)

Paul Francis, B. Arch., Bangalore University

Chair of Advisory Committee: Dr. Charles W. Graham

Partnering is a tool used in the construction industry to reduce claims and litigations and also to deliver a quality product in a cost efficient and timely manner. This research analyzes the impact of the partnering process on the outcome of construction projects in Texas' public universities. For this study project specific data were obtained from 218 buildings built between 1996 and 2006. Parametric and non-parametric statistical tests were used to measure and explain the project performances of partnered and non-partnered projects on four different building types in terms of cost overrun, schedule change, change orders and claims.

One of the variables that had a significant effect on the outcome of the project performance parameters was the initial cost of the project. It was found that projects that utilized partnering were less likely to have claims than non-partnered projects. Partnered projects also had fewer change orders than non-partnered projects for two of the four building types that were analyzed. The results of this study can be used in the successful planning and execution of construction projects by organizations involved in the construction procurement processes for Texas' public universities.

To my parents

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Special thanks to Mr. Rene Ramirez of the Facilities Planning and Construction Department, Texas A&M University System, for the time and advice on data collection procedures. I would also like to extend my gratitude to Mr. Jeff D. Treichel at the Texas Higher Education Coordinating Board, Ms. Terri H. Parker at The Texas A&M University System, Ms. Carol Longoria at The University of Texas System, Ms. Janus Buss at Midwestern State University, Ms. Lynda Langham at Stephen F. Austin State University, Mr. Renaldo L. Stowers and Ms. Tina Sikes at University of North Texas System, Mr. Victor Mellinger at Texas Tech University System, Mr. John Lawhon at Texas Woman's' University, Ms. Gita Bolt at Texas Southern University, Ms. A.B. "Deedie" Gentry at University of Houston System, Mr. Peter E. Graves and Ms. Paula Castanon at Texas State University System, and, Mr. John McCroskey and Ms. Debra A. Kleppelid at the Sam Houston State University Physical Plant, for their generous time and assistance during my data collection stage.

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TABLE OF CONTENTS

	Page
ABSTRACT	iii
DEDICATION	iv
ACKNOWLEDGEMENTS	v
TABLE OF CONTENTS	vi
LIST OF FIGURES.....	viii
LIST OF TABLES	ix
NOMENCLATURE.....	x
INTRODUCTION.....	1
Background	1
Problem Statement	3
Research Questions	3
Definitions.....	3
Limitations/Delimitations.....	7
Thesis Organization.....	8
LITERATURE REVIEW	9
Introduction	9
Construction Procurement in Texas’ Public Universities	9
Construction Project Partnering	10
Differences in Public Sector and Private Sector Partnering.....	13
Summary	14
RESEARCH METHODOLOGY	15
Data Type	15
Required Data.....	15
Data Collection Method	16
Data Sources.....	16
Data Collection Procedures	18
Data Collection Results	20
Normalization of Data.....	21

	Page
DATA ANALYSIS	23
Data Description.....	23
Box Plots	24
Descriptive Statistics.....	24
Research Hypothesis	25
Hypothesis Testing.....	26
Results for Building Type 1 and Building Type 3	27
Results for Building Type 6 and Building Type 7	29
Results for Claims	31
CONCLUSION	33
Results	33
Significance.....	33
Recommendations for Future Research	34
REFERENCES	36
APPENDIX A	38
APPENDIX B	39
APPENDIX C	47
APPENDIX D	54
APPENDIX E.....	63
APPENDIX F	73
APPENDIX G	76
VITA	78

LIST OF FIGURES

FIGURE	Page
1. THECB Facilities Inventory Database.....	17
2. THECB Facilities Inventory Database – Drop Down Menu.....	19

LIST OF TABLES

TABLE	Page
1. Results of Data Collection Efforts	21
2. Projects by Partnered/Non-Partnered and Building Types.....	23
3. Projects Used in Data Analysis	23
4. Skewness of Data	25
5 List of Public Universities in Texas	38
6. Project Specific Data for 268 Construction Projects.....	40
7. Project Performance Measures of 167 Construction Projects	48

NOMENCLATURE

THECB	Texas Higher Education Coordinating Board
CII	Construction Industry Institute
MANOVA	Multivariate Analysis of Variance
GMP	Guaranteed Maximum Price
P	Significance value

INTRODUCTION

Background

“Closing the Gaps by 2015”, the State of Texas’ higher education plan, adopted in 2000, established goals to enroll an additional 500,000 students and increase the number of nationally recognized programs by the year 2015. Thus, to meet the goals set forth by the State’s education plan, public universities in the State of Texas need to construct additional facilities and maintain the existing spaces (Texas Higher Education Coordinating Board, 2004).

For the fiscal year 2006, spending by public universities for construction of new facilities in the State of Texas was estimated at \$1.06 billion (Texas Contractor, 2006). Prior to 1997, the procurement of construction projects was by the traditional design-bid-build construction project delivery method. However, in 1997 the State of Texas modified the Education Code that allowed educational institutes to manage their finances better during the construction of new facilities by opting for newer methods of construction project delivery methods over the traditional design-bid-build method (Senate Bill No. 583, 1997; Texas Education Agency, 1998).

However, many of the public agencies that were allowed to procure construction by alternate methods of construction project delivery were not sophisticated enough, which led to a lack of clarity as to the roles and responsibilities of the parties involved in the

This thesis follows the style and format of the *Journal of Construction Engineering and Management*.

construction procurement process. The different working procedures, the lack of communication and coordination, thus led to changes and alterations during the construction process which resulted in an increase in the cost of the projects and also a reduction in the performance and quality of the built product. The increase in construction costs thus reduced the contractor's profit, and the reduction in the quality and performance of the built product left the client/owner dissatisfied with the built product. This led to expensive claims, litigations and created an adversarial relationship among all the parties involved in the construction procurement process (Chan et al. 2004; Larson, 1997).

Partnering was thus one of the innovative tools developed to deliver a project efficiently while reducing disputes among the parties involved. The Construction Industry Institute defines partnering as relationship based on trust, and mutual understanding so as to achieve the objectives of the parties involved in the construction process. This requires the parties involved to change from an existing adversarial relationship to a relationship based on a shared culture without organizational boundaries (Chan et al. 2004; Construction Industry Institute, 1991).

In the past few years there has been a lot of improvement in the construction industry due to the use of partnering, which helps in fostering a change from an adversarial to a cooperative relationship, and also creates a win/win situation for all the parties involved in the construction procurement process.

Problem Statement

This research seeks to analyze the impact of the partnering process on the outcome of construction projects in Texas' public university systems.

Research Questions

This research seeks to answer the following questions:

1. What impact does the partnering process have on the schedule, cost and claims for projects undertaken by Texas' public universities?
2. What impact does the partnering process have on the construction of different building types undertaken by Texas' public universities?

Definitions

The following definitions will be used in this research:

Partnering: Partnering maybe a long-term commitment between two or more organizations as in an alliance or it may be applied to a shorter period of time such as the duration of a project. The purpose of partnering is to achieve specific business objectives by maximizing the effectiveness of each participant's resources. This requires changing traditional relationships to a shared culture without regard to organizational boundaries. This relationship is based on trust, dedication to common goals and the understanding of each other's individual expectations and values (CII, 2002).

Building Types: The building types that are considered for the research are categorized as defined by the Texas Higher Education Coordinating board (THECB, 2004).

Building Type 1: Building Type 1 comprises of general purpose buildings. This building type includes classrooms, laboratories, offices, research buildings, and any building related to administration of these functions.

Building Type 2: Building Type 2 comprises of academic and residence buildings. This building type includes buildings that are a combination of academic and administrative or residential space.

Building Type 3: Building Type 3 comprises of auxiliary services. This building type includes student unions, infirmaries, bookstores, intercollegiate athletics buildings, parking garages, etc.

Building Type 4: Building Type 4 comprises of physical plant buildings. This building type includes power plants, maintenance facilities, and all buildings related to the physical plant.

Building Type 5: Building Type 5 comprises of agricultural services buildings. This building type includes barns, silos, hog pens, chicken houses, etc.

Building Type 6: Building Type 6 comprises of single residence space. This building type includes dorms, fraternity houses, sorority houses, etc.

Building Type 7: Building Type 7 comprises of family residences. This building type includes apartments, family homes, etc.

Building Type 8: Building Type 8 comprises of non-institutional agency buildings. This building type includes institution-owned buildings that are leased or otherwise provided to another public agency as a service.

Building Type 9: Building Type 9 comprises of rental property. This building type includes buildings that are institution owned and rented out for profit.

Building Type H: Building Type H comprises of hospitals and/or clinical facilities.

Building Type R: Building Type R comprises of buildings that are taken out of service because of major renovations.

Project Delivery System: Project delivery systems are the various contractual agreements possible between the client, architect and builder for the completion of a construction project. In this study the delivery systems considered are the competitive sealed

proposal, construction management agency, construction management @ risk, design-bid-build and design-build.

Competitive Sealed Proposal (CSP): A project delivery method in which the owner first selects an architect to design the project, and once the construction documents are fully complete, they (the owner in consultation with the architect) request competitive sealed proposals from contractors to perform the work. Here the selection is not based on the lowest bid, but on a combination of price and qualifications that provide the best value to the owner.

Construction Management Agency (CMA): Construction Management Agency or Agent is a project delivery system which consists of a construction management agent, who serves as an agent for the owner, and provides administrative and management services during the design/construction process. The work is performed by multiple contractors who contract directly with the owner and the construction management agent holds no subcontract and assumes no risk.

Construction Management @ Risk (CMR): This delivery system consists of a construction manager who serves as a general contractor providing administration and management services during the design and construction phases of the project. The construction manager contracts with the subcontractors and is responsible for the

delivery of the project within a fixed schedule and within the fixed guaranteed maximum price.

Design-Bid-Build (D/B/B): Also called the traditional method, is a project delivery method in which the owner sequentially awards separate contracts, the first for architectural and engineering services to design the project, and the second for construction of the project according to the design prepared by the architectural/engineering firm.

Design-Build (D/B): A project delivery method in which the owner contracts with a single entity to perform both the design and construction phases' of the project under a single design-build contract, thus creating a single point of responsibility.

Owner's representative: A person or organization designated with the responsibility of giving definition to the owner's aesthetic and functional requirements. The owner's representative is also responsible for the preparation of contract documents needed in the selection of the designer/builder.

Limitations/Delimitations

1. The research is delimited to construction projects at public universities in the state of Texas.

2. Due to the availability of data, the research is limited to 4 building types;
 - Building Type 1 (General Purpose Buildings) = 104 buildings
 - Building Type 3 (Auxiliary Services) = 42 Buildings
 - Building Type 6 (Residences, Single) = 39 Buildings
 - Building Type 7 (Residence, Family) = 43 Buildings
3. Only construction projects over \$1,000,000 are considered for the research study.

Thesis Organization

This thesis is organized into 5 sections and appendices with supporting data. The second part of the thesis contains a literature review that focuses on construction procurement in Texas' public universities and the benefits of partnering. Part three of the thesis discusses the research methodology of this study. The research methodology describes the process involved in defining the parameters to measure partnering and the procedures employed to collect the data. Section 4 contains the results of the data collection efforts, the descriptive statistics of the collected data and the data analysis. Section 5 contains the results of the hypothesis testing and a summary of the results with recommendations for future research. The seven appendices contain information regarding the data used in this study and also the results of the hypothesis testing.

LITERATURE REVIEW

Introduction

The literature review comprises of three parts; the history of construction procurement used by the public university systems in Texas, construction project partnering and its benefits, and lastly, the differences in public sector and private sector partnering.

Construction Procurement in Texas' Public Universities

Pre-1995 the alternate methods of project delivery were restricted to the private sector as federal and state laws did not allow federal/public agencies to opt for alternate methods of project delivery due to the Brooks Architect-Engineer's Act of 1972. Thus, the only construction project procurement available to the universities was the traditional design-bid-build method of project delivery (Loulakis, 2003).

In 1994, the Texas Office of the State Auditor submitted a report to the State Legislative Audit Committee recommending the use of alternate project delivery systems to manage the state's budget fund better. The report estimated that if the savings realized were 1% of the construction costs, the state would save \$40 million. One of the recommendations of the report was to encourage the use of constructability programs during the early stages of the planning process so as to reduce costly project re-designs and re-bids (Texas Office of the State Auditor, 1994). Senate Bill No. 583, passed by the Texas Legislature in 1997, allowed the use of the alternate project delivery system in the

institutes of higher education in Texas (Senate Bill No. 583, 1997; Texas Education Agency, 1998).

Studies showed that the alternate methods of construction delivery methods provided the client with better quality buildings, which were within the budget and completed on schedule (Songer and Molenaar, 1996). Thus, universities were encouraged to switch over to the alternate methods of construction delivery that were now available to them so as to get the best value for their money.

The new laws gave the institutes of higher education in the State of Texas the right to decide on the selection of the construction project delivery system that they would use based on the best value system. Thus over a period of time each public university system in the State of Texas has developed its own criteria for deciding on the method of construction project delivery to be used based on the cost, size and technical needs of the building to be built (Texas Education Code, 2001).

Construction Project Partnering

Construction project partnering was initially used by the U.S. Army Corps of Engineers in the 1980's more as a means to reduce the number of contract disputes caused due to extra costs incurred for unexpected risks. The partnering process was incorporated into the construction procurement process from the initial stages of the project itself and involved all the project participants: the owner (The U.S. Army Corps of Engineers), the design team, the prime contractor, and the subcontractors. All the parties involved in the construction process had to agree to specific management procedures and develop a

working relationship before the construction project got underway. It was found that the projects that used the partnering process had a lower cost growth, lesser contract modifications, increased savings due to value engineering, and also helped to build up trust among all the participants involved (Glagola and Sheedy, 2002; Loulakis, 2003; Hills, 1992).

An assessment by the Construction Industry Institute, in 2002, of completed construction projects found that projects that utilized the partnering process were more efficient than projects that did not utilize the partnering process. The projects that utilized the partnering process were shown to be more cost effective for all the parties involved and there was also a better utilization of resources. Also, the owners and contractors had more opportunities to be innovative in improving the quality of the final built product (CII 2002).

The study by the Construction Industry Institute on the benefits of partnering (CII 2002) found that there was a better value to be realized by all the parties in terms of

1. Cost:

- Total project cost was found to be 10 % less in projects that utilized the partnering process.
- There was an 87% reduction in claims as a percentage of total project cost for partnered projects.

2. Schedule:

- There was a 20% reduction in time needed for overall project completion for partnered projects.

- Schedule compliance increased from 85% to 100% in partnered projects.
3. Change Orders/Rework:
 - There was a reduction by 80% in change orders for partnered projects.
 - The rework due to poor quality was reduced by 50% in partnered projects.
 4. Claims:
 - The number of claims reduced by 83% on partnered projects.
 - The number of projects with claims reduced to 68 % on partnered projects.

However, it must be noted here that since partnering was used more in the private sector than in the public sector the results of the CII study are skewed due to the large number of private sector projects that are included in the study (Glagola and Sheedy, 2002).

Partnering thus creates an environment to minimize cost growths and schedule overruns, establish good working relationships between stakeholders, and most importantly create a “win-win” situation for all the parties involved in the construction procurement process (Chan et al. 2004; Crowley and Karim, 1995). Though partnering may not be able to resolve all the problems arising during the construction process it helps to create an effective framework to reduce litigation, improve communication, resolve conflicts, and contain costs on potential overruns. It was also found that the parties who committed to the partnering process were rewarded in that they were able to develop strategic relationships which were mutually beneficial to them in cultivating their business (Chan et al, 2004).

Differences in Public Sector and Private Sector Partnering

Partnering in the private sector would typically start before the pre-planning phase of a construction project. The motive of the participants in a private sector partnering process were to reduce disputes and deliver an efficient project, while at the same time build a strategic alliance to work together on future projects. The main aim of the partnering process in the private sector is to build trustworthiness, establish a channel for communication, understand the other party's motivation and set goals for the timely and successful completion of the project (Grajek, Gibson and Tucker 2000; Gransberg, Dillon, Reynolds and Jack, 1999).

Partnering in the public sector normally begins only after the bid has been awarded for construction. The public sector is also hindered by rules and regulation that govern the presence of fair competition for the procurement of construction/civil work. There is also a perception, especially among the public agencies, if the additional cost for the partnering process is beneficial in the final outcome of the built project. Among the contractors there is the belief that since the partnering program will be a one time affair, since repeat work is not guaranteed in the public sector, the partnering process may not be as successful as it is in the private sector. In addition, for the contractors, there was no reward for doing more than what was minimally required while working on public sector projects (Glagola and Sheedy, 2002; Grajek, Gibson and Tucker, 2000).

Partnering as defined by the Construction Industry Institute is a "long term commitment" which is more ideally suited to the private sector. However, studies have shown that despite these constraints, public agencies have managed to reduce litigation

costs, increase owner satisfaction and reduce conflicts between the parties while partnering on a project to project basis (Chan et al. 2004; CII, 1991; Grajek, Gibson and Tucker 2000).

Summary

The review of literature is the first step in deciding the organization of the current research. Since this research is a quantitative study the literature review helped to identify the main parameters by which partnered project performance is measured, namely cost, schedule and claims on a project (CII, 2002; Gransberg, Dillon, Reynolds and Boyd, 1999).

RESEARCH METHODOLOGY

Data Type

Since this research is a quantitative study, the variables identified as factors of project performance were of a nature that could be measured. The project performance measures used in this study are:

1. Cost growth
2. Schedule change
3. Number of change orders
4. Average cost of change orders
5. Change order cost as percentage of original cost
6. Number of claims
7. Average cost of claims
8. Claims cost as percentage of original cost

Required Data

To measure the project performance factors for completed construction projects in Texas' public universities, between the years of 1996 and 2006, the data required for the research were:

1. Project Name
2. Building Type
3. Partnering used or not

4. Original contract amount
5. Final contract amount
6. Time allotted for completion of project (original contract)
7. Actual time for completion of project
8. Number of change orders
9. Cost of change orders
10. Number of claims
11. Claim amounts

Data Collection Method

Unobtrusive research methods were employed for the collection of data required for this research. Unobtrusive research involves the investigation of data without the investigator interfering into whatever is being studied (Babbie, 1992). Since, this study uses existing data and content analysis of existing documents, the use of unobtrusive research methods was ideal.

Data Sources

Data needed for this research were obtained from the Texas Higher Education Coordinating Board (THECB) and the public universities in the state of Texas. The THECB is a governmental body responsible for the approval of building projects on campuses in Texas' public universities costing more than \$1,000,000. The THECB also

maintains a “Facilities Inventory” database (Fig. 1) of all buildings on campuses in Texas’ public universities.

TEXAS HIGHER EDUCATION COORDINATING BOARD

Campus Planning

Search Facilities Inventory - Buildings
 Enter search criteria below, then click on *Search Facilities Inventory* to view the results.

Reporting Year:	<input type="text" value="2006"/>
Institution:	<input type="text" value="Abilene Christian University"/>
Building Name:	<input type="text"/>
Type:	<input type="text" value="(All)"/>
Location:	<input type="text" value="(All)"/>
Ownership:	<input type="text" value="(All)"/>
Condition:	<input type="text" value="(All)"/>
Total Cost Greater Than:	\$ <input type="text" value="0"/>
Perimeter Greater Than:	<input type="text" value="0"/>
GSF Greater Than:	<input type="text" value="0"/>
NASF Greater Than:	<input type="text" value="0"/>
E&G Greater Than:	<input type="text" value="0"/>
Order Results by:	<input type="text" value="Building Number"/> then by <input type="text" value="Building Number"/>
Results Output:	<input type="text" value="Screen"/>

Fig. 1. THECB Facilities Inventory Database
 (Source: <http://www.thecb.state.tx.us/InteractiveTools/FacInv/FacSearchBldg.cfm>)

Among the public universities, the Office of Facilities Planning and Construction (OFPC) are responsible for overseeing the planning and construction of built projects on their respective campuses. In the state of Texas there are 44 public universities (Appendix A). In the case of universities which belong to a university system, construction projects above \$1,000,000 are normally overseen at the systems level. Thus, data for projects located on universities that are part of a university system were obtained from the university systems office. For this research data was obtained from:

1. Midwestern State University
2. Stephen F. Austin State University
3. Texas Southern University
4. Texas Woman's University
5. Texas A&M University System
6. Texas State University System
7. Texas Tech University System
8. The University of Texas System
9. University of Houston System
10. University of North Texas System

Data Collection Procedures

The initial step in the data collection procedure was to get a list of projects constructed during the 1996 to 2006 period that cost more than \$1,000,000. This was obtained from the Facilities Inventory database of the THECB. This is done by selecting one campus at

a time from the drop down menu under ‘Institution:’ (Fig. 2). In the ‘Order Results by’ box, ‘Year’ was chosen which would sort the output result by ascending year of construction. In the ‘Results Output’ box, ‘Excel’ was chosen which would give the output in an excel spreadsheet format.

TEXAS HIGHER EDUCATION COORDINATING BOARD

Campus Planning

Search Facilities Inventory - Buildings
Enter search criteria below, then click on *Search Facilities Inventory* to view the results.

Reporting Year:	2006
Institution:	Texas A&M University-Commerce
Building Name:	Texas A&M International University
Type:	Texas A&M University
Location:	Texas A&M University - College of Veterinary Medicine
Ownership:	Texas A&M University Agricultural Experiment Station
Condition:	Texas A&M University at Galveston
Total Cost Greater Than:	Texas A&M University Cooperative Extension
Perimeter Greater Than:	Texas A&M University Engineering Experiment Station
GSF Greater Than:	0
NASF Greater Than:	0
E&G Greater Than:	0
Order Results by:	Year then by Building Number
Results Output:	Excel

Fig. 2. THECB Facilities Inventory Database – Drop Down Menu
(Source: <http://www.thecb.state.tx.us/InteractiveTools/FacInv/FacSearchBldg.cfm>)

Once the lists of buildings on all the campuses were obtained in Excel format the relevant data was extracted. This was done by using the sort function in Microsoft Excel. The results were sorted by year and cost, and then all projects less than \$1,000,000 and completed before 1996 were filtered out. A total of 368 buildings of interest were obtained for which data had to be obtained. The THECB Facilities Inventory output also included the building type which was one of the data items that was required.

Though the THECB Facilities Inventory contains the initial cost, year and building type for every building on campuses it does not include detailed documentation of the construction costs, construction schedules and change orders associated with these buildings. Thus the rest of the data pertaining to the buildings had to be obtained from the respective universities or university systems.

Data Collection Results

Data regarding construction costs, construction schedules, change orders and claims were then obtained from the university/university system's offices. Table 1 shows the results of the data collection efforts. Of the 367 buildings for which data were requested, data could only be obtained for 257 buildings (70%). However, on examining the data, there were certain buildings which needed to be eliminated either because they did not meet the criteria set forth when the research started (buildings had to be constructed after 1996, cost over \$1,000,000 and belong to building type 1,3, 6 or 7) or because they were not construction projects. After removing the projects acquisitions and other building types 218 projects were left which could be used in the data analysis. (Appendix B)

Table 1. Results of Data Collection Efforts

University System	Requested	Response	Useful
Midwestern State University	5	4	2
University of North Texas System	22	13	10
Texas Woman's University	10	9	8
Stephen F. Austin State University	9	9	8
Texas Southern University	8	8	6
Texas Tech University System	10	12	5
University of Houston System	28	3	2
Texas State University System	57	13	13
Texas A&M University System	52	40	39
University of Texas System	166	146	125
Total	367	257	218

Normalization of Data

Once the data had been collected, it was analyzed for the separate performance measures used to measure partnering project success. These performance measures are:

- Cost Growth = $\frac{\text{Final Contract Amount} - \text{Original Contract Amount}}{\text{Original Contract Amount}}$
- Schedule Change = $\frac{\text{Actual Time} - \text{Time Allotted}}{\text{Time Allotted}}$
- Average Cost of Change Orders = $\frac{\text{Total Change Order Amount}}{\text{Number of Change Orders}}$
- No. of Change Orders = Original Change Orders – Change Orders to set GMP
- C.O. Cost as Percentage of Original Cost = $\frac{\text{Total Change Order Amount}}{\text{Original Contract Amount}}$
- Average Cost of Claims = $\frac{\text{Total Claims Amount}}{\text{Number of Claims}}$

- Claims Cost as Percentage of Original Cost = $\frac{\text{Total Cost of Claims}}{\text{Original Contract Amount}}$

Except for the number of change orders and claims, the rest of the performance measure are normalized to the original contract amount and time to account for the differences in the type and scale of the projects (Appendix C).

DATA ANALYSIS

Data Description

Though the useful data obtained was for 228 buildings (Table 2), for data analysis only 167 buildings were used (Table 3). This was due to missing data in a few instances and also instances of multiple buildings being constructed under a single contract. Table 2 and Table 3 show the break up of the buildings by partnered or non-partnered, and by building types.

Table 2. Projects by Partnered/Non-Partnered and Building Types

Building Type	Partnered	Non-Partnered	Total for Type
Building Type 1	61	43	104
Building Type 3	17	25	42
Building Type 6	19	20	39
Building Type 7	31	12	43
Total	128	100	N = 228

Table 3. Projects Used in Data Analysis

Building Type	Partnered	Non-Partnered	Total for Type
Building Type 1	60	42	102
Building Type 3	18	22	40
Building Type 6	7	6	13
Building Type 7	9	3	12
Total	94	73	N = 167

Box Plots

Box plots are used to get a summary of the distribution of variables associated with each building type and partnered/non-partnered projects. Box plots are also useful to identify outliers that may cause significant deviations in the distribution of the variables. Box plots were made to look at the data for final project costs, final time, cost overruns, time overruns and change order cost as percentage of initial cost for separate building types and also for partnered/non-partnered projects (Appendix D)

In almost all the box plots there are outliers (values more than 1.5 box length from the 25th and 75th percentile) and extremes (values more than 3 box length from the 75th percentile). A note is made of the outliers and extremes as they may need to be identified later while testing the hypothesis if they tend to cause the significant deviations in the variables that may affect the outcome of the tests.

Descriptive Statistics

The descriptive statistics of the performance measures help us to identify if there is normal distribution in the data. The normal distribution is an important factor in selecting the statistical procedures to be used for hypothesis testing. From Table 4 we can see that the skewness factor for number of claims and claims cost is higher than ± 1.96 . Thus we would have to use non-parametric tests where claims are involved.

Table 4. Skewness of Data

	N	Statistic	Error
Initial cost	166	2.003	0.188
Cost overrun	166	-1.179	0.188
Time overrun	155	1.856	0.195
No. of Change orders	166	1.555	0.188
Change order/Initial cost	166	-1.102	0.188
No. of Claims	166	5.811	0.188
Claims Cost	164	7.284	0.190
Valid N	153		

Research Hypothesis

Since the goal of this research was a statistical inference of differences between groups, the data was analyzed by testing hypothesis that answered the research questions. This was achieved by developing the “null hypothesis” (H_0), that there are no significant differences between the groups, and the “alternate hypothesis” (H_a), that there is a significant difference between the groups (Kerr, Hall and Kozub, 2002). Thus, to answer the two research questions the hypotheses that would have to be tested are:

Hypothesis I

H₀: There is no significant difference between the mean performances of partnered and non partnered construction projects in Texas’ public universities.

H_a: There is a significant difference between the mean performance of partnered and non-partnered construction projects in Texas’ public universities.

Hypothesis II

Ho: There is no significant difference between the mean performances of different building types in Texas' public universities.

Ha: There is a significant difference between the mean performances of different building types in Texas' public universities.

Hypothesis III

Ho: There is no significant difference between the mean performances of different building types on partnered construction projects in Texas' public universities.

Ha: There is a significant difference between the mean performances of different building types on partnered construction projects in Texas' public universities.

The value of significance is the probability of rejecting the null hypothesis when it is in fact true (Kerr, Hall and Kozub, 2002). Since this research was an exploratory study a preset value of alpha at .10 was used. Thus, if the probability of p value was less than .10 the null hypothesis would be rejected due to significant differences in the means.

Hypothesis Testing

The hypothesis is tested by using the Multivariate Analysis of Variance (MANOVA) tests, which is an extension of the Analysis of Variance (ANOVA). This is used since there are more than one dependent variable and also because the dependent variables

may be related with each other (i.e. cost and schedule). MANOVA thus helps to identify if changes in the independent variable has a significant effect on the dependent variables. MANOVA also identifies if there is any interaction between the independent or dependent variables amongst themselves.

However, from examining the data and the descriptive statistics it can be seen that there is a large difference between the number of cases between partnered and non-partnered projects for building types 6 and 7. Thus, it was decided to do the hypothesis testing in three parts. The first would be using the MANOVA for building type 1 and 3, the second would be using the Sign Rank test (Mann-Whitney U) for building type 6 and 7 due to the differences in the number of cases, and the third would be using cross tabulations to test for claims. Claims is analyzed as categorical data (0 = no claims, 1= Claims) due to the fact that a large number of projects do not have claims and the presence of zeros in the claims columns would create an error while running MANOVA.

Results for Building Type 1 and Building Type 3

A MANOVA was conducted to test if there were any significant differences between the construction project performance measures on partnered and non partnered projects along with the different building types. For this test the initial project cost was used as a covariate and partnering and building types were used as fixed factors. The project performances measured were the cost overrun, schedule change, number of change orders, average cost of change orders and change order cost as a percentage of initial project cost. The detailed results of the MANOVA test are included as Appendix E.

Result for Hypothesis I

Ho: There is no significant difference between the mean performances of partnered and non partnered construction projects in Texas' public universities.

Ha: There is a significant difference between the mean performance of partnered and non-partnered construction projects in Texas' public universities.

For the multivariate tests there was a significant difference in the project performance measures for partnered projects ($p=.028$). Thus the null hypothesis was rejected. For tests of between subjects partnering had an effect on the number of change orders ($p=.008$). There were no significant effects of partnering on any other projects performance measures

Hypothesis II

Ho: There is no significant difference between the mean project performances of construction projects for different building types in Texas' public universities.

Ha: There is a significant difference between the mean project performances of construction projects for different building types in Texas' public universities.

For the multivariate tests there was no significant difference for the project performance measures of the different building types ($p=.822$). Thus the null hypothesis was not rejected. Since, there was no significant difference between the means the between subjects test results were not considered.

Hypothesis III

Ho: There is no significant difference between the mean performances of different building types on partnered construction projects in Texas' public universities.

Ha: There is a significant difference between the mean performances of different building types on partnered construction projects in Texas' public universities.

For the multivariate tests there was no significant difference on the project performance measures when the effect of the interaction of project partnering and building types was considered ($p = .350$). Thus the null hypothesis was not rejected and the test of between subjects was not considered.

Results for Building Type 6 and Building Type 7

A Mann-Whitney U test was performed twice, first with partnering as the grouping variable (0 = non partnered and 1 = partnered) and then with the building type as the grouping variable (6 = Building Type 6 and 7 = Building Type 7). However, since this was a non-parametric test, it could not be tested for the interaction of both partnering/non-partnering and building types at the same time. The detailed results of the Mann-Whitney U tests are included in Appendix F.

Hypothesis I

Ho: There is no significant difference between the mean performances of partnered and non partnered construction projects in Texas' public universities.

Ha: There is a significant difference between the mean performance of partnered and non-partnered construction projects in Texas' public universities.

For the Mann-Whitney U tests there were no significant differences for partnered projects on any of the project performance measures. Thus the null hypothesis was not rejected.

Hypothesis II

Ho: There is no significant difference between the mean project performances of construction projects for different building types in Texas' public universities.

Ha: There is a significant difference between the mean project performances of construction projects for different building types in Texas' public universities.

For the Mann-Whitney U tests there were no significant differences for the different building types on the projects performance measures. Thus the null hypothesis was not rejected.

Hypothesis III

Ho: There is no significant difference between the mean performances of different building types on partnered construction projects in Texas' public universities.

Ha: There is a significant difference between the mean performances of different building types on partnered construction projects in Texas' public universities.

Since multivariate analysis of non-parametric tests were beyond the scope of this research the interaction of partnering and building types on project performance measures were not tested.

Results for Claims

Chi-Square tests were used to test for differences between claims on partnered and non-partnered projects and also to test for differences on claims due to the different building type. The detailed results of the Chi-Square tests are included in Appendix G.

Hypothesis I

Ho: There is no significant difference between the mean performances of partnered and non-partnered construction projects in Texas' public universities.

Ha: There is a significant difference between the mean performance of partnered and non-partnered construction projects in Texas' public universities.

The Pearson Chi-Square result ($p < .001$) showed that there was a significant difference on claims between partnered and non-partnered projects. Thus the null hypothesis was rejected. Non-partnered projects were more likely to have claims than partnered projects ($p=.028$).

Hypothesis II

Ho: There is no significant difference between the mean project performances of construction projects for different building types in Texas' public universities.

Ha: There is a significant difference between the mean project performances of construction projects for different building types in Texas' public universities.

The Pearson Chi-Square result ($p = .758$) showed that there was no significant difference on claims due to the different building types. However, this was due to the fact that one of the cells in the test had a cell count less than 5 and also because projects of Building Type 6 and 7 did not have any claims. Thus no statistics were computed for Building Type 6 and Building Type 7 since the claims were constant (Claim on a project = 0).

Hypothesis III

Ho: There is no significant difference between the mean performances of different building types on partnered construction projects in Texas' public universities.

Ha: There is a significant difference between the mean performances of different building types on partnered construction projects in Texas' public universities.

Since multivariate analysis of non-parametric tests were beyond the scope of this research the interaction of partnering and building types on claims was not tested.

CONCLUSION

Results

During the MANOVA test the initial cost was used as a covariate while partnering and building type were used as fixed factors. The MANOVA test results showed that the initial project cost had a significant effect ($p < .001$) on the project performance of the built project. Within subjects the initial cost of the project had effect on the number of change orders ($p < .001$) and on the average cost of a change order ($p = 0.18$).

For building types 1 and 3 partnered projects had an average of 4 fewer change orders than non-partnered projects. Though it was not statistically significant, for building types 1 and 3, partnered projects had an effect on the schedule change performance measure ($p = .165$) by 6%. Partnered projects were also less likely to have claims than non-partnered projects.

For building types 6 and 7, the tests are left inconclusive due to the lack of sufficient projects. However, once enough data can be collected for building types 6 and 7 more tests would be recommended for future research.

Significance

In recent years the use of partnering on construction projects has been increasing not only as a tool to reduce claims and litigation, but also to deliver a quality product in a cost efficient and timely manner. The findings from this research would be useful for organizations involved in the construction procurement process for the public sector, as

it would give them more alternatives in the successful planning and execution of construction projects.

Recommendations for Further Research

Though this research looked at the impact of partnering sessions and building types on project performance measures further studies are recommended regarding:

1. Since this study was a quantitative study it did not look into the quality of the partnering process. Thus further studies are required to analyze the impact of the partnering session duration on project performance measures.
2. One of the results of the MANOVA test was the significant effect that the initial project cost had on project performance measure ($p < .001$). During the data collection efforts it was found the university systems preferred to have longer partnering sessions on larger and more complex projects. Universities who did not use partnering on their projects were starting to conduct partnering sessions only for larger and more complex projects. Thus further studies are needed as to the impact of the initial project cost on the duration of the partnering sessions.
3. Though data was collected for the project delivery method used in procuring the built project, the variable was not used during data analysis because it was beyond the scope of this study. Thus studies

may be needed to see if the project delivery method has any impact on the project performance measures.

4. The Building Types 1 and Building Types 3 comprises of a wide variety of buildings. Building Type 1 consists of classrooms and office spaces to more complex building like laboratories. Thus a more detailed study would be recommended to study the impact of partnering within each category.

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APPENDIX A

Table 5. List of Public Universities in Texas

Institution Name	System Name	City
Angelo State University	Texas State University System	San Angelo
Lamar University	Texas State University System	Beaumont
Midwestern State University		Wichita Falls
Prairie View A&M University	Texas A&M University System	Prairie View
Sam Houston State University	Texas State University System	Huntsville
Stephen F. Austin State University		Nacogdoches
Sul Ross State University	Texas State University System	Alpine
Sul Ross State University Rio Grande College	Texas State University System	Eagle Pass
Tarleton State University	Texas A&M University System	Stephenville
Texas A&M International University	Texas A&M University System	Laredo
Texas A&M University	Texas A&M University System	College Station
Texas A&M University at Galveston	Texas A&M University System	Galveston
Texas A&M University System	Texas A&M University System	College Station
Texas A&M University-Commerce	Texas A&M University System	Commerce
Texas A&M University-Corpus Christi	Texas A&M University System	Corpus Christi
Texas A&M University-Kingsville	Texas A&M University System	Kingsville
Texas A&M University-Texarkana	Texas A&M University System	Texarkana
Texas Southern University		Houston
Texas State University System	Texas State University System	Austin
Texas State University-San Marcos	Texas State University System	San Marcos
Texas Tech University	Texas Tech University System	Lubbock
Texas Tech University System	Texas Tech University System	Lubbock
Texas Woman's University		Denton
The University of Texas at Arlington	The University of Texas System	Arlington
The University of Texas at Austin	The University of Texas System	Austin
The University of Texas at Brownsville	The University of Texas System	Brownsville
The University of Texas at Dallas	The University of Texas System	Richardson
The University of Texas at El Paso	The University of Texas System	El Paso
The University of Texas at San Antonio	The University of Texas System	San Antonio
The University of Texas at Tyler	The University of Texas System	Tyler
The University of Texas of the Permian Basin	The University of Texas System	Odessa
The University of Texas System	The University of Texas System	Austin
The University of Texas-Pan American	The University of Texas System	Edinburg
University of Houston	University of Houston System	Houston
University of Houston System	University of Houston System	Houston
University of Houston-Clear Lake	University of Houston System	Houston
University of Houston-Downtown	University of Houston System	Houston
University of Houston-Victoria	University of Houston System	
University of North Texas	University of North Texas System	Denton
University of North Texas System	University of North Texas System	Denton
West Texas A&M University	Texas A&M University System	Canyon
Texas Tech University Health Sciences Center	Texas Tech University System	Lubbock
The Texas A&M University System Health Science Center	Texas A&M University System	College Station
The University of Texas Health Center at Tyler	The University of Texas System	Tyler
The University of Texas Health Science Center at Houston	The University of Texas System	Houston
The University of Texas Health Science Center at San Antonio	The University of Texas System	San Antonio
The University of Texas M.D. Anderson Cancer Center	The University of Texas System	Houston
The University of Texas Medical Branch at Galveston	The University of Texas System	Galveston
The University of Texas Southwestern Medical Center at Dallas	The University of Texas System	Dallas
University of North Texas Health Science Center at Fort Worth	University of North Texas System	Fort Worth

APPENDIX B

268 project specific data was obtained for building built from 1996 to 2006 and costing more than \$1,000,000 by public universities in the state of Texas.

Table 6. Project Specific Data for 268 Construction Projects

ID	Bldg#	Building Name	Inst	Year	T	P.D.M.	P/N	Original Cost (\$)	Final Cost (\$)	O Days	F Days	CO	Cost of C.O.	CI	Cost of Claims
1	4	Bridwell Hall	MSU	1998	1	CSP	N	5,191,936.00	5,267,828.00	495	525	7	75,892.00	0	0.00
2	2	Dillard College of Business AD Bldg.	MSU	2006	2	CMR	N	14,151,931.00	14,116,221.00	720	660	3	78,352.00	0	0.00
3	57	Seismometer Building*	MSU	2003	1		N	23,495.00	23,495.00	60	60	0	0.00	0	0.00
4	537	Sports Medicine / Academic Center*	SFASU	2004	3	CMR	N	897,725.00	759,193.00	249	279	1	-138,532.00	0	0.00
5	522	Lumberjack Lodge ¹	SFASU	2006	6	D/B	N	15,734,915.00	15,689,866.00	174	174	3	-45,049.00	0	0.00
6	544	Aikman Drive Parking Garage ¹	SFASU	2006	3	D/B	N								
7	545	Lumberjack Village 1 ²	SFASU	2006	6	D/B	N	33,892,670.00	34,288,558.00	455	455	6	395,888.00	0	0.00
8	546	Lumberjack Village 2 ²	SFASU	2006	6	D/B	N								
9	547	Lumberjack Village 3 ²	SFASU	2006	6	D/B	N								
10	548	Lumberjack Village Com. Bldg. ²	SFASU	2006	6	D/B	N								
11	549	Lumberjack Village Garage ²	SFASU	2006	3	D/B	N								
12	543	Student Center Garage	SFASU	2006	3	CMR	N	5,143,629.00	5,061,084.00	204	229	3	82,545.00	0	0.00
13	3205	A&M System Building	TAMUS	2003	1	CSP	N	7,632,283.00	8,087,085.00	240	289	12	454,802.00	2	18,802.00
14	790	New Science Building	PVAMU	2001	1	CSP	N	22,934,396.00	23,354,002.00	570	571	15	419,606.00	0	0.00
15	779	Memorial Student Center	PVAMU	2003	3	D/B	N	20,008,653.00	20,682,232.00	662	792	18	673,579.00	0	0.00
16	783	Architectural Building	PVAMU	2005	1	CSP	N	18,223,009.00	19,592,304.00	550	745	24	1,369,295.00	2	2,818.00
17	793	New Electrical Engineering Bldg.	PVAMU	2005	1	CSP	N	9,821,209.00	10,173,599.00	450	451	9	352,390.00	2	29,400.00
18	789	Juvenile Justice Building	PVAMU	2006	1	CSP	N	12,213,000.00	12,756,146.00	450	543	13	543,146.00	6	47,870.00
19	833	New Nursing Building	PVAMU	2006	1	CSP	N	31,296,674.00	33,707,652.00	565	859	22	2,410,978.00	9	697,829.00
20	919	Science Building	TSU	2001	1	CSP	N	25,307,445.00	26,727,243.00	669	768	16	1,419,798.00	0	0.00
21	952	Texan Village Apartments ³	TSU	2002	7	D/B	N	4,407,627.00	4,455,367.00	300	320	1	47,740.00	0	0.00
22	952	Texan Village Apartments ³	TSU	2002	7	D/B	N								
23	953	Texan Village Apartments ³	TSU	2002	7	D/B	N								
24	960	Centennial Hall ⁴	TSU	2004	7	D/B	N	5,650,000.00	6,071,688.00	267	269	3	421,688.00	0	0.00
25	959	Texan Village Apartments ⁴	TSU	2004	7	D/B	N								
26	509	Math Building	TSU	2005	1	CSP	N	14,099,366.00	14,445,044.00	690	613	13	345,678.00	0	0.00
27	12	Fine Arts	TAMIU	2001	1	CSP	N	14,239,132.00	18,453,461.00	500	804	20	4,214,329.00	0	0.00
28	11	Student Development Center	TAMIU	2001	3	CSP	N	12,977,405.00	13,979,200.00	630	778	19	1,001,795.00	0	0.00
29	8	Western Hemisphere Trade Center	TAMIU	2001	1	CSP	N	7,945,852.00	8,167,567.00	630	606	14	221,715.00	0	0.00
30	13	Lamar Bruni Vergara Science Center	TAMIU	2005	1	CSP	N	17,033,054.00	17,636,878.00	485	688	12	603,824.00	2	11,042.00
31	1561	George P. Mitchell 40 Outdoor Tenn	TAMU	1998	3	D/B/B	N	3,453,304.00	3,557,424.00	330	319	8	104,120.00	0	0.00
32	469	Central Campus Parking Garage	TAMU	1999	3	D/B/B	N	31,955,000.00	31,790,410.00	789	749	22	-164,590.00	1	6,310.00
33	1277	Easterwood Rescue and Fire Facility	TAMU	1999	3	D/B/B	N	1,560,000.00	1,600,778.00	450	400	8	40,778.00	0	0.00
34	1512	Southern Crop Improvement Greenhouse	TAMU	2001	1	D/B/B	N	4,705,000.00	4,673,712.00	380	427	13	-31,288.00	0	0.00
35	3198	University Apartments Community Center	TAMU	2001	3	D/B/B	N	1,956,400.00	2,002,633.00	365	308	6	46,233.00	0	0.00

Table 6. Continued.

ID	Bldg#	Building Name	Inst	Year	T	P.D.M.	P/N	Original Cost (\$)	Final Cost (\$)	O Days	F Days	CO	Cost of C.O.	CI	Cost of Claims
36	361	Bright Football Complex	TAMU	2003	1	CSP	N	17,538,497.00	18,294,738.00	540	621	19	756,241.00	0	0.00
37	1610	Coastal Engineering Lab	TAMU	2003	1	CSP	N	4,257,199.00	4,652,042.00	400	453	11	394,843.00	0	0.00
38	1565	Training/Track Building	TAMU	2003	3	CSP	N	4,317,133.00	4,545,770.00	365	434	13	228,637.00	0	0.00
39	1559	West Campus Parking Garage	TAMU	2003	3	CSP	N	27,856,200.00	28,990,813.00	690	721	26	1,134,613.00	0	0.00
40	386	Jack E. Brown Chemical Engineering	TAMU	2004	1	CSP	N	27,959,484.00	30,734,988.00	585	742	19	2,775,504.00	0	0.00
41	699	Science and Technology Center	TAMUC	2006	1	CSP	N	18,585,000.00	19,518,160.00	531	588	19	933,160.00	0	0.00
42	133	University Center	TAMUCC	1999	3	D/B/B	N	12,749,000.00	13,044,082.00	670	696	21	295,082.00	0	0.00
43	151	Science & Technology	TAMUCC	2001	1	CSP	N	9,256,414.00	9,576,929.00	444	436	12	320,515.00	0	0.00
44	159	Bay Hall	TAMUCC	2005	1	CSP	N	11,074,827.00	11,359,360.00	455	562	17	284,533.00	1	13,747.00
45	158	Harte Research Institute Building	TAMUCC	2005	1	CSP	N	13,367,027.00	13,734,786.00	550	857	16	367,759.00	0	0.00
46	152	Performing Arts Ctr.	TAMUCC	2005	1	CSP	N	14,258,171.00	15,151,822.00	570	849	20	893,651.00	0	0.00
47	560	Engineering Complex	TAMUK	2001	1	CSP	N	12,015,373.00	12,442,544.00	450	516	16	427,171.00	0	0.00
48	513	Irma Lerma Rangel College of Pharma*	TAMUK	2005	8	CSP	N	11,839,943.00	12,399,030.00	555	724	18	559,087.00	0	0.00
49	3	Academic Building	TAMUT	1999	1	D/B/B	N	3,463,884.00	3,663,675.00	400	495	12	199,791.00	0	0.00
50	3502	Medical Research Building	TAMUSHSC	2000	1	D/B/B	N	9,811,000.00	9,933,077.00	547	549	15	122,077.00	0	0.00
51	680	Event Center	WTAMU	2002	3	D/B/B	N	10,241,023.00	11,575,488.00	416	439	10	1,334,465.00	0	0.00
52	682	New Fine Arts	WTAMU	2006	1	CSP	N	22,749,838.00	26,418,519.00	610	1,173	16	3,668,681.00	0	0.00
53	164	H & PE Building	TSOU	1988	1	D/B/B	N	10,518,000.00	11,015,557.00	500	700	52	497,557.00	1	X
54	150	J.H. Jones Business Building	TSOU	1998	1	D/B/B	N	10,441,545.30	10,850,160.30	400	420	7	408,615.00	1	7,780.00
55	135	Health Center	TSOU	2001	3	JOC	N	1,380,085.00	1,550,420.00	300	315	21	170,335.00	1	440.00
56	111	Recreation Center	TSOU	2002	3	D/B	N	12,020,396.00	11,941,811.00	485	885	2	130,435.00	11	X
57	134	Richfield Manor*	TSOU	2003	9	JOC	N	1,900,000.00	2,387,823.30	X	X	23	1.00	12	340,906.20
58	136	Smiley KTSU Media Ccenter*	TSOU	2004	2	D/B/B	N	5,324,561.00	5,324,561.00	90	100	10	0.00	10	307,402.11
59	166	Pharmacy & Health Sciences @ TMC	TSOU	2005	1	JOC	N	2,940,000.00	2,645,167.00	100	90	0	0.00	4	599,568.71
60	165	New Science Classroom & Research FA	TSOU	2006	1	D/B/B	N	29,679,209.08	28,827,478.57	1,095	999	24	480,275.00	10	599,568.71
61	51	Lowry Woods- Austin Hall ⁵	TWU	2005	7		N	11,957,628.00	12,127,903.45	319	339	2	170,275.00	0	0.00
62	50	Lowry Woods- Capps Hall ⁵	TWU	2005	7										
63	48	Lowry Woods- Fitzgerald Hall ⁵	TWU	2005	7										
64	55	Lowry Woods- Mary Hufford Hall ⁵	TWU	2005	7										
65	49	Lowry Woods- Reagan Houston Hall ⁵	TWU	2005	7										
66	46	Lowry Woods- Sayers Hall ⁵	TWU	2005	7										
67	47	Lowry Woods- Smith Carroll Hall ⁵	TWU	2005	7										
68	704	Institute of Health Science-Houston Center	TWU	2006	1		N	27,710,000.00	27,910,000.00	550	559	1	200,000.00	0	0.00
69	161	Gateway Center	UNTS	2001	1	CMR	N	14,619,927.00	15,503,223.00	461	647	15	883,296.00	0	0.00
70	517	Facilities Management Bldg.*	UNTHSCFW	2000	4			847,579.00							

Table 6. Continued.

ID	Bldg#	Building Name	Inst	Year	T	P.D.M.	P/N	Original Cost (\$)	Final Cost (\$)	O Days	F Days	CO	Cost of C.O.	CI	Cost of Claims
71	516	Parking Garage	UNTHSCFW	2001	3	CMR	N	9,212,856.00	9,810,018.00	392	468	2	597,162.00	0	0.00
72	518	Center for Biohealth	UNTHSCFW	2004	1	CMR	N	21,337,000.00	22,493,231.00	552	552	4	1,156,231.00	0	0.00
73		Residence Hall #1*	UNT	2003	6	D/B	N	7,778,578.00							
74	350	Sorority House	UNT	2004	6	CMR	N	3,613,844.00	3,840,153.17	221	281	4	226,309.17	0	0.00
75	332	Speech & Hearing Clinic	UNT	1999	1		N	1,627,250.00	1,502,449.00	289	289	1	-124,801.00	0	0.00
76	304	EP Warranch Tennis Complex	UNT	2005	3	CMR	N	2,135,790.00	2,183,358.96	X0	X0	2	47,568.96	0	0.00
77	320	EP Athletic Center	UNT	2005	3	CMR	N	13,092,000.00	12,908,963.00	395	395	8	-183,037.00	0	0.00
78	190	Research Park Bldg.*	UNT	2001	1	CMR	N	5,600,000.00							
79	160	Environmental Science Bldg	UNT	1998	1	D/B/B	N	11,340,200.00	11,917,470.00	455	469	8	577,270.00	0	0.00
80	112	Chemistry Bldg.	UNT	2004	1	CMR	N	15,413,955.00	16,422,858.00	399	605	8	1,008,903.00	0	0.00
81	118	Student Recreation Center	UNT	2003	3		N	24,175,921.00	24,052,349.13	X	X	8	-123,571.87	0	0.00
82	419	Marsha Sharp Center for Student Athletes	TTU	2004	1		P	2,653,300.00	2,863,555.85	217	217	4	210,255.85	0	0.00
83	397	Animal & Food Science Facility	TTU	2005	1	CMR	P	12,929,976.00	13,138,980.13	450	619	3	209,004.13	0	0.00
84	605	Extended Studies	TTU	2000	1	CMR	P	5,976,162.00	6,026,162.00	286	364	1	50,000.00	0	0.00
85	393	English & Philosophy Bldg.	TTU	2002	1		P	28,214,880.00	34,206,213.00	851	851	4	5,991,333.00	0	0.00
86	1002	HSC Academic Classroom Bldg.	TTUHSC	2003	1	CMR	P	11,888,000.00	11,794,800.00	702	702	1	-93,200.00	0	0.00
87	1301	Larry Combest Community Health & Wellness Center*	TTUHSC	2006	H		P	1,190,100.00	1,236,959.00	296	336	4	46,859.00	0	0.00
88		El Paso Clinic Addition*	TTUHSC	2006	H		P	5,770,000.00	7,275,117.34	591	803	7	1,505,117.34	0	0.00
89	701	Arlington Hall	UTAR	2000	6	D/B	P	17,953,260.00	18,675,526.00	318	357	10	1,052,186.00	0	0.00
90	538	Arbor Oaks Apartments	UTAR	2002	7	D/B	P	20,597,094.00	20,289,744.00	523	711	8	-307,350.00	0	0.00
91	551	Meadow Run Apartments	UTAR	2003	7	CSP	P	6,051,998.00	6,089,865.00	280	318	5	37,867.00	0	0.00
92	582	Continuing Ed. And Workforce De.	UTAR	2004	1	CSP	P	6,778,600.00	6,780,814.00	343	363	9	2,214.00	0	0.00
93	697	Kalpna Chawla Hall	UTAR	2004	7	CMR	P	14,376,631.00	14,376,631.00	318	359	6	0.00	0	0.00
94	615	Studio Arts Center	UTAR	2004	1	CSP	P	4,375,802.00	4,496,449.00	245	299	5	120,647.00	0	0.00
95	520	Chemistry & Physics Building	UTAR	2006	1	CSP	P	33,603,750.00	34,867,165.00	636	688	41	1,263,415.00	0	0.00
96	600	Brazos Garage	UTA	1997	3	D/B/B	P	8,858,000.00	8,740,654.00	395	395	7	-117,346.00	0	0.00
97	740	Moffett Molecular Biology Bldg.	UTA	1997	1	D/B/B	P	22,892,000.00	26,128,445.00	720	826	11	3,236,445.00	0	0.00
98	9832	Red and Charline McCombs Field	UTA	1997	3	D/B/B	P	3,278,900.00	3,372,543.00	270	442	7	93,643.00	0	0.00
99	980	Student Services Building	UTA	1997	1	D/B/B	P	19,346,000.00	19,541,672.00	730	798	29	195,672.00	0	0.00
100	164	Univ. Interscholastic ic League Bldg.	UTA	1998	1	D/B/B	P	3,651,350.00	3,648,585.00	365	390	8	-2,765.00	0	0.00
101	981	27th Street Garage	UTA	1999	3	CMR	P	7,794,000.00	7,903,040.00	347	347	8	109,040.00	0	0.00
102	9712	Mike A. Myers Track & Soccer Stadium	UTA	1999	3	CSP	P	21,037,000.00	21,871,753.00	463	524	16	834,753.00	0	0.00
103	198	Arl Bldg.35 McKinney Wing(PRC 190)	UTA	2000	1	CSP	P	2,493,000.00	2,653,887.00	220	225	6	160,887.00	0	0.00
104	603	Connally Center for Justice	UTA	2000	1	CSP	P	6,948,708.00	7,002,328.00	480	641	10	53,620.00	0	0.00
105	502	San Jacinto Residence Hall	UTA	2000	6	D/B	P	43,980,205.00	44,274,234.00	526	574	12	838,736.00	0	0.00

Table 6. Continued.

ID	Bldg#	Building Name	Inst	Year	T	P.D.M.	P/N	Original Cost (\$)	Final Cost (\$)	O Days	F Days	CO	Cost of C.O.	CI	Cost of Claims
106	982	Speedway Garage	UTA	2000	3	CMR	P	20,378,841.00	22,447,506.00	358	364	16	2,068,665.00	0	0.00
107	A263	Frank N. Bash Visitors Ctr. at MCD	UTA	2002	3	CSP	P	3,473,000.00	3,534,728.00	365	499	10	61,728.00	0	0.00
108	9714	Indoor Practice Facility	UTA	2002	3	CSP	P	3,428,000.00	3,549,923.00	170	170	3	121,923.00	0	0.00
109	985	Sarah M & Charles E. Seay Building	UTA	2002	1	CMR	P	41,725,000.00	41,769,378.00	721	971	20	44,378.00	0	0.00
110	424	Trinity Garage	UTA	2002	3	D/B	P	18,866,975.00	19,722,343.00	740	740	6	855,368.00	0	0.00
111	275	Gregory Aquatic Pool Control Bldg.	UTA	2005	3	CMR	P	11,481,895.00	12,749,832.00	414	721	11	1,267,937.00	0	0.00
112	903	Imaging Research Center (PRC 197)	UTA	2005	1	CMR	P	3,152,760.00	3,152,760.00	315	387	6	0.00	0	0.00
113	741	Neural and Molecular Science Bldg.	UTA	2005	1	CMR	P	40,336,420.00	44,287,941.00	796	1,033	25	3,951,521.00	0	0.00
114	114A	Jack. S. Blanton Museum of Art-A	UTA	2006	1	CMR	P	42,543,931.00	43,582,524.00	866	954	10	1,038,593.00	0	0.00
115	114B	Jack. S. Blanton Museum of Art-B	UTA	2006	1	CMR	P	19,863,833.00	19,990,992.00	485	485	7	127,159.00	0	0.00
116	242	Nano Science and Technology Bldg.	UTA	2006	1	CMR	P	28,949,999.00	29,756,903.00	467	559	11	806,904.00	0	0.00
117	SETB	Science Engr & Tech. #41	UTB	1997	1	D/B/B	P	2,447,000.00	2,226,655.36	439	439	5	-220,344.64	0	0.00
118	EDBC	Education & Business Cmplx #63	UTB	2005	1	CMR	P	21,660,236.00	23,516,330.00	840	995	12	1,856,094.00	0	0.00
119	CR	Callier Richardson	UTD	2003	1	CSP	P	3,564,400.00	3,510,251.00	365	365	5	-54,149.00	0	0.00
120	SOM	School of Management Building	UTD	2003	1	CMR	P	30,670,152.00	29,536,788.00	515	551	28	-1,133,364.00	0	0.00
121	WV43	Waterview 43 Phase VI ⁶	UTD	1998	7	D/B	P	4,000,000.00	4,028,634.00	192	192	3	28,634.00	0	0.00
122	WV44	Waterview 44 Phase VI ⁶	UTD	1998	7	D/B	P								
123	WV45	Waterview 45 Phase VI ⁶	UTD	1998	7	D/B	P								
124	WV46	Waterview 46 Phase VI ⁶	UTD	1998	7	D/B	P								
125	WV48	Waterview 48 Phase VII ⁷	UTD	1998	7	D/B	P	3,930,000.00	3,908,297.00	164	164	2	-21,703.00	0	0.00
126	WV49	Waterview 49 Phase VII ⁷	UTD	1998	7	D/B	P								
127	WV50	Waterview 50 Phase VII ⁷	UTD	1998	7	D/B	P								
128	WV51	Waterview 51 Phase VII ⁷	UTD	1998	7	D/B	P								
129	WV53	Waterview 53 Phase VIII ⁸	UTD	2001	7	D/B	P	10,257,450.00	11,966,327.00	624	624	13	1,708,877.00	0	0.00
130	WV54	Waterview 54 Phase VIII ⁸	UTD	2004	7	D/B	P								
131	WV55	Waterview 55 Phase VIII ⁸	UTD	2001	7	D/B	P								
132	WV56	Waterview 56 Phase VIII ⁸	UTD	2001	7	D/B	P								
133	WV57	Waterview 57 Phase VIII ⁸	UTD	2001	7	D/B	P								
134	WV58	Waterview 58 Phase VIII ⁸	UTD	2001	7	D/B	P								
135	WV59	Waterview 59 Phase VIII ⁸	UTD	2001	7	D/B	P								
136	WV61	Waterview 61 Phase VIII ⁸	UTD	2002	7	D/B	P								
137	WV62	Waterview 62 Phase VIII ⁸	UTD	2002	7	D/B	P								
138	WV63	Waterview 63 Phase VIII ⁸	UTD	2002	7	D/B	P								
139	WV65	Waterview 65 Phase IX ⁹	UTD	2004	7	CSP	P	3,399,999.00	3,282,779.00	194	197	2	-117,220.00	0	0.00
140	WV66	Waterview 66 Phase IX ⁹	UTD	2004	7	CSP	P								

Table 6. Continued.

ID	Bldg#	Building Name	Inst	Year	T	P.D.M.	P/N	Original Cost (\$)	Final Cost (\$)	O Days	F Days	CO	Cost of C.O.	CI	Cost of Claims
141	WV67	Waterview 67 Phase IX ⁹	UTD	2004	7	CSP	P								
142	ECSS	Engineering Computer Science South	UTD	2002	1		P	25,640,000.00	23,859,524.00	519	547	12	-1,780,476.00	0	0.00
143	094B	Miner Village B Sacramento ¹⁰	UTEP	2001	7	D/B	P	12,136,519.00	11,838,529.62	346	333	4	-297,989.38	0	0.00
144	094D	Miner Village D Hueco ¹⁰	UTEP	2001	7	D/B	P								
145	094E	Miner Village E Guadalupe ¹⁰	UTEP	2001	7	D/B	P								
146	094F	Miner Village F Franklin ¹⁰	UTEP	2001	7	D/B	P								
147	094K	Miner Village K Del Norte ¹⁰	UTEP	2001	7	D/B	P								
148	094L	Miner Village L Capitan ¹⁰	UTEP	2001	7	D/B	P								
149	22	Larry K Durham Center	UTEP	2002	3	D/B	P	7,877,860.00	7,984,327.00	486	565	7	106,467.00	0	0.00
150	38	Academic Services Building	UTEP	2005	1	CSP	P	7,459,000.00	7,762,330.00	486	598	9	303,330.00	0	0.00
151	99	Classroom Bldg.	UTEP	1997	1	D/B/B	P	14,046,500.00	14,361,753.00	540	661	12	315,253.00	0	0.00
152	610	Frio Street Building	UTSA	1997	1	D/B/B	P	15,611,000.00	16,179,659.00	460	460	13	568,659.00	0	0.00
153	620	Buena Vista Street Building	UTSA	1999	1	D/B/B	P	21,669,000.00	22,200,816.00	570	628	17	531,816.00	0	0.00
154	531	Recreation Wellness Center	UTSA	2002	3	D/B	P	14,039,319.00	13,636,389.00	408	423	12	-402,930.00	0	0.00
155	640	Durango Addition	UTSA	2003	1	CSP	P	26,764,780.00	22,807,626.00	517	655	14	-3,376,595.00	0	0.00
156	640A	Durango Addition-Add.	UTSA	2003	1	CSP	P	4,332,000.00	4,273,738.00	390	436	8	-58,262.00	0	0.00
157	543	Main Building-Parking Garage	UTSA	2004	1	D/B	P	44,630,710.00	44,116,648.00	956	1,019	15	-514,062.00	0	0.00
158	555	Biotechnology Sciences and Engineering	UTSA	2005	1	CSP	P	60,210,000.00	67,703,466.00	719	954	21	7,493,466.00	0	0.00
159	555A	Biotechnology Sciences & Engineering -A	UTSA	2005	1	CSP	P	8,265,788.00	8,377,229.00	338	412	7	111,441.00	0	0.00
160	3050	Roadrunner Café	UTSA	2005	3	CSP	P	5,505,514.00	5,456,100.00	255	454	9	-49,414.00	0	0.00
161	17	Cowan Fine Arts Center	UTT	1997	1	D/B/B	P	19,298,000.00	18,942,288.00	600	822	26	-355,715.00	0	0.00
162	30	Longview University Center	UTT	2000	1	CMR	P	3,942,836.00	3,970,550.00	412	452	11	27,714.00	0	0.00
163	19	Braithwaite Building	UTT	2003	1	CSP	P	4,743,200.00	5,416,022.00	396	423	15	672,822.00	0	0.00
164	20	Herrington Patriot Center	UTT	2003	3	CSP	P	16,266,000.00	16,629,374.00	551	624	14	363,374.00	0	0.00
165	32	Patriot Village Building 1 ¹¹	UTT	2004	6	D/B	P	5,600,000.00	6,184,035.00	206	234	7	584,035.00	0	0.00
166	33	Patriot Village Building 2 ¹¹	UTT	2004	6	D/B	P								
167	36	Ornelas Residence Hall	UTT	2006	6	CSP	P	12,017,321.00	12,422,421.00	540	659	6	405,100.00	0	0.00
168	34	Ratliff Building South	UTT	2006	1	CSP	p	27,979,305.00	29,392,491.00	500	727	17	1,413,186.00	0	0.00
169	0SONA	School of Nursing and Student Commu	UTHSCH	2004	1	CMR	P	4,722,408.00	4,798,911.00	265	499	8	905,609.00	0	0.00
170	0SONB	School of Nursing and Student Commu	UTHSCH	2004	1	CMR	P	36,119,525.00	41,110,145.00	735	837	21	4,990,620.00	0	0.00
171	0UHA	University Housing Apartments	UTHSCH	2005	7	CMR	P	19,252,741.00	18,801,098.00	386	389	21	-451,643.00	0	0.00
172	0SRB	Fayez S. Sarofim Research Building	UTHSCH	2006	1	CMR	P	83,350,305.00	83,848,511.00	663	796	18	498,206.00	0	0.00
173		Brownsville RAHC	UTHSCH	2002	1		P	4,210,000.00	4,226,871.00	300	392	7	16,871.00	0	0.00
174	302	Allied Health/Research Bldg.	UTHSCSA	1998	1	D/B/B	P	14,239,000.00	14,191,772.50	600	773	18	-47,228.00	0	0.00
175	32	Parking Garage - Lot 4	UTHSCSA	1999	3	CSP	P	7,822,504.00	7,822,504.00	273	382	3	0.00	0	0.00

Table 6. Continued.

ID	Bldg#	Building Name	Inst	Year	T	P.D.M.	P/N	Original Cost (\$)	Final Cost (\$)	O Days	F Days	CO	Cost of C.O.	CI	Cost of Claims
176	402	S Tx Ctrs for Biol in Medicine	UTHSCSA	2000	1	CSP	P	16,601,348.00	16,283,461.00	550	550	8	-317,887.00	0	0.00
177	404	Cafeteria @ Tx Res Park	UTHSCSA	2001	3	CSP	P	973,116.00	1,149,169.00	165	165	2	176,053.00	0	0.00
178	404A	Cafeteria @ Tx Res Park - A*	UTHSCSA	2001	X	CSP	P	2,072,000.00	2,281,640.19	180	303	5	209,640.19	0	0.00
179	702	D.D. Hachar Bld. (Laredo, Tx)	UTHSCSA	2002	1	CSP	P	5,924,058.00	6,082,484.00	426	506	7	158,426.00	0	0.00
180	701	Harlingen RAHC (Harlingen, Tx)	UTHSCSA	2002	1	CMR	P	18,061,068.00	18,061,068.00	545	545	3	0.00	0	0.00
181	303	Central Energy Plant- North Campus*	UTHSCSA	2003	4	D/B	P	6,162,000.00	6,144,521.00	490	490	8	-17,479.00	0	0.00
182	304	Children S CA Research Institute	UTHSCSA	2003	1	D/B	P	39,386,066.00	39,335,413.00	668	774	20	-50,653.00	0	0.00
183	35	Academic & Administration Bld.	UTHSCSA	2004	1	CMR	P	13,309,029.00	15,701,174.00	405	657	17	2,392,145.00	0	0.00
184	405	Sam & Ann Barshop Aging Institute	UTHSCSA	2005	1	CMR	P	15,259,202.00	14,778,078.00	563	682	14	-481,124.00	0	0.00
185	703	Edinburg Regional Acad. Hlth. Ctr.	UTHSCSA	2006	1	CSP	P	15,540,152.00	16,322,858.00	540	926	14	782,706.00	0	0.00
186	100T	Dock Building	UTMDACC	1998	1	D/B/B	P	5,445,000.00	6,047,916.00	365	574	15	602,916.00	0	0.00
187	100T-A	Dock Building - A	UTMDACC	1998	1	D/B/B	P	6,059,000.00	5,942,262.00	320	366	7	-116,738.00	0	0.00
188	100U	Gimbel Mechanical*	UTMDACC	1998	4	D/B/B	P	7,590,189.00	6,981,209.00	414	549	9	-608,980.00	0	0.00
189	100U-A	Gimbel Mechanical - A*	UTMDACC	1998	4	D/B/B	P	20,008,780.00	20,692,761.00	549	549	55	683,981.00	0	0.00
190	129	Faculty Center	UTMDACC	2000	1	D/B	P	38,234,144.00	37,511,077.00	365	437	14	-497,315.00	0	0.00
191	132	South Campus Research Building I	UTMDACC	2002	1	D/B	P	30,882,023.00	31,293,296.00	561	651	7	411,273.00	0	0.00
192	131	Pressler Street Garage	UTMDACC	2003	3	D/B	P	18,319,456.00	18,003,151.01	412	476	10	-316,305.00	0	0.00
193	137A	Cancer Prevention Building*	UTMDACC	2004	H	D/B	P			539	705				
194	100V	George and Cynthia Mitchell Basic S	UTMDACC	2004	1	CMR	P	7,143,666.00	4,120,465.00	281	645	14	-3,023,201.00	0	0.00
195	531	Visual Arts Studios	UTPB	1999	1	CSP	P	3,234,200.00	3,359,850.00	300	352	7	125,650.00	0	0.00
196	532	Library/Lecture Center	UTPB	2000	1	CSP	P	11,654,400.00	12,669,701.00	500	659	11	1,015,301.00	0	0.00
197	533	Presidential Museum*	UTPB	2002	8	CSP	P	2,097,998.00	2,229,415.00	340	447	6	131,417.00	0	0.00
198	584	SH Phase II Residence Hall - 1 ¹²	UTPB	2004	6	CSP	P	7,265,933.00	7,151,423.00	265	310	6	-114,510.00	0	0.00
199	585	SH Phase II Residence Hall - 2 ¹²	UTPB	2004	6	CSP	P								
200	586	SH Phase II Residence Hall - 3 ¹²	UTPB	2004	6	CSP	P								
201	587	SH Phase II Residence Hall - 4 ¹²	UTPB	2004	6	CSP	P								
202	588	SH Phase II Residence Hall - 5 ¹²	UTPB	2004	6	CSP	P								
203	589	SH Phase II Residence Hall - 6 ¹²	UTPB	2004	6	CSP	P								
204	593	SH Phase III Residence Hall - 1 ¹³	UTPB	2005	6	CSP	P	5,833,000.00	5,734,845.00	268	268	1	-98,155.00	0	0.00
205	595	SH Phase III Residence Hall - 2 ¹³	UTPB	2005	6	CSP	P								
206	596	SH Phase III Residence Hall - 3 ¹³	UTPB	2005	6	CSP	P								
207	597	SH Phase III Residence Hall - 4 ¹³	UTPB	2005	6	CSP	P								
208	598	SH Phase III Residence Hall - 5 ¹³	UTPB	2005	6	CSP	P								
209	599	SH Phase III Residence Hall - 6 ¹³	UTPB	2005	6	CSP	P								
210	MA	Bryan Williams Center	UTSMCD	2002	1	D/B	P	6,506,722.00	6,454,072.00	364	426	9	-52,650.00	0	0.00

Table 6. Continued.

ID	Bldg#	Building Name	Inst	Year	T	P.D.M.	P/N	Original Cost (\$)	Final Cost (\$)	O Days	F Days	CO	Cost of C.O.	CI	Cost of Claims
211	105	Science Building	UTPA	1997	1	D/B/B	P	20,330,000.00	21,325,340.00	545	607	8	995,340.00	0	0.00
212	125	International Trade and Technology	UTPA	1998	1	D/B/B	P	2,570,000.00	2,566,023.00	310	310	4	-3,977.00	0	0.00
213	75	Bronc Village Complex A ¹⁴	UTPA	2000	6	D/B	P	4,300,000.00	4,175,655.00	158	158	2	-124,345.00	0	0.00
214	78	Bronc Village Complex D ¹⁴	UTPA	2000	6	D/B	P								
215	61	Student Union	UTPA	2000	3	D/B	P	5,364,890.00	5,364,789.00	404	419	4	13,633.10	0	0.00
216	355	Mathematics & General Classroom ¹⁵	UTPA	2001	1	D/B	P	13,600,000.00	13,599,136.00	439	537	6	-864.00	0	0.00
217	356	New Computer Center ¹⁵	UTPA	2001	1	D/B	P								
218	205	Unity Hall*	UTPA	2006	2	CMR	P	10,550,000.00	11,264,081.00	293	330	4	714,081.00	0	0.00
219	520	John & Reb. Moores Sch. Of Music	UH	1997	1		N	17,501,500.00	18,805,765.00			20	1,304,265.00	0	0.00
220	536	Center for Public Broadcasting	UH	2000	1		N	8,497,800.00	9,170,049.00	498	498	34	672,249.00	0	0.00
221	242	Bill Blackwood Lemit	SHSU	2000	1	D/B/B	N	5,585,580.00	5,898,070.95			9	-68,235.00	0	0.00
222	10	Academic Building IV	SHSU	2002	1	D/B/B	N	9,810,000.00	10,234,319.58			14	248,310.36	0	0.00
223	275	Bearkat Village C Apt 54-71 ¹⁶	SHSU	2003	6	D/B	N	14,500,000.00	14,395,001.34			2	-33,432.68	0	0.00
224	273	Bearkat Village A Apt 1-18 ¹⁶	SHSU	2003	6	D/B	N								
225	274	Bearkat Village B Apt 19-53 ¹⁶	SHSU	2003	6	D/B	N								
226	276	Bearkat Village D Apt 72-107 ¹⁶	SHSU	2003	6	D/B	N								
227	278	Bearkat Village F Apt 108-143 ¹⁶	SHSU	2003	6	D/B	N								
228	279	Bearkat Village G Apt 144-161 ¹⁶	SHSU	2003	6	D/B	N								
229	280	Bearkat Village H Apt 162-185 ¹⁶	SHSU	2003	6	D/B	N								
230	281	Bearkat Village I Apt 186-203 ¹⁶	SHSU	2003	6	D/B	N								
231	282	Bearkat Village J Apt 204-221 ¹⁶	SHSU	2003	6	D/B	N								
232	283	Bearkat Village K Apt 222-244 ¹⁶	SHSU	2003	6	D/B	N								
233	284	Bearkat Village L Apt 245-262 ¹⁶	SHSU	2003	6	D/B	N								
234	303	Counselor Education Center	SHSU	2004	1	CSP	N	1,402,500.00	1,414,767.89			8	11,523.24	0	0.00
235	301	Sam Houston Parking Garage	SHSU	2004	3	D/B	N	4,500,000.00	4,656,452.73			8	-4,627.00	0	0.00
236	299	Sam Houston Village	SHSU	2004	6	D/B	N	19,301,732.00	19,284,104.46			9	231,799.00	0	0.00
237	270	South Paw	SHSU	2004	3	CSP	N	2,000,000.00	1,757,376.34			6	9,586.02	0	0.00
238	289	Basebal/Softball Facility	SHSU	2005	3	CSP	N	5,900,000.00	5,947,764.60			12	174,435.00	0	0.00
239	300	Chemistry and Forensic Science	SHSU	2005	1	CSP	N	18,000,000.00	17,683,885.99			18	2,464,569.00	0	0.00
240	302	Recreational Sports	SHSU	2005	3	CSP	N	6,250,000.00	6,452,946.99			14	73,785.00	0	0.00
241	321	Raven Village	SHSU	2006	6	CSP	N	16,851,000.00	16,814,490.11	474	424	7	-689,783.00	0	0.00
242	320	Weight Training Center	SHSU	2006	3	CSP	N	1,150,000.00	1,023,987.30	272	231	2	-21,038.48	0	0.00
243	271	Visitor and Alumni Center	SHSU	2006	1	CSP	N	3,200,000.00	3,446,331.25	478	494	5	122,622.00	0	0.00

APPENDIX C

The list of 167 projects for which entire data was available was used for data analysis and hypothesis testing.

Table 7. Project Performance Measures of 167 Construction Projects

ID	Bldg#	Building Name	Inst	Inst. Code	Year	T	P.D.M. CODE	P/N CODE	Original Cost (\$)	Final Cost (\$)	Cost over	Original Days	Actual Days	Time over	# of C.O.	AvgCOcost	CO asPer	# of Claims	claim yes or no	Cost of Claims
1	4	Bridwell Hall	MSU	1	1998	1	2	0	5,191,936.00	5,267,828.00	1.46	495	525	6	7	10,841.71	1.46	0	0	0.00
5	522	Lumberjack Lodge ¹	SFASU	2	2006	6	3	0	15,734,915.00	15,689,866.00	-0.29	174	174	0	3	-15,016.33	-0.29	0	0	0.00
7	545	Lumberjack Village ^{1 2}	SFASU	2	2006	6	3	0	33,892,670.00	34,288,558.00	1.17	455	455	0	6	65,981.33	1.17	0	0	0.00
12	543	Student Center Garage	SFASU	2	2006	3	1	0	5,143,629.00	5,061,084.00	-1.60	204	229	12	3	27,515.00	1.60	0	0	0.00
13	3205	A&M System Building	TAMUS	3	2003	1	2	0	7,632,283.00	8,087,085.00	5.96	240	289	20	12	37,900.17	5.96	2	1	18,802.00
14	790	New Science Building	PVAMU	3	2001	1	2	0	22,934,396.00	23,354,002.00	1.83	570	571	0	15	27,973.73	1.83	0	0	0.00
15	779	Memorial Student Center	PVAMU	3	2003	3	3	0	20,008,653.00	20,682,232.00	3.37	662	792	20	18	37,421.06	3.37	0	0	0.00
16	783	Architectural Building	PVAMU	3	2005	1	2	0	18,223,009.00	19,592,304.00	7.51	550	745	35	24	57,053.96	7.51	2	1	2,818.00
17	793	New Electrical Engineering Bldg.	PVAMU	3	2005	1	2	0	9,821,209.00	10,173,599.00	3.59	450	451	0	9	39,154.44	3.59	2	1	29,400.00
18	789	Juvenile Justice Building	PVAMU	3	2006	1	2	0	12,213,000.00	12,756,146.00	4.45	450	543	21	13	41,780.46	4.45	6	1	47,870.00
19	833	New Nursing Building	PVAMU	3	2006	1	2	0	31,296,674.00	33,707,652.00	7.70	565	859	52	22	109,589.91	7.70	9	1	697,829.00
20	919	Science Building	TSU	3	2001	1	2	0	25,307,445.00	26,727,243.00	5.61	669	768	15	16	88,737.38	5.61	0	0	0.00
21	952	Texan Village Apartments ³	TSU	3	2002	7	3	0	4,407,627.00	4,455,367.00	1.08	300	320	7	1	47,740.00	1.08	0	0	0.00
24	960	Centennial Hall ⁴	TSU	3	2004	7	3	0	5,650,000.00	6,071,688.00	7.46	267	269	1	3	140,562.67	7.46	0	0	0.00
26	509	Math Building	TSU	3	2005	1	2	0	14,099,366.00	14,445,044.00	2.45	690	613	-11	13	26,590.62	2.45	0	0	0.00
27	12	Fine Arts	TAMIU	3	2001	1	2	0	14,239,132.00	18,453,461.00	29.60	500	804	61	20	210,716.45	29.60	0	0	0.00
28	11	Student Development Center	TAMIU	3	2001	3	2	0	12,977,405.00	13,979,200.00	7.72	630	778	23	19	52,726.05	7.72	0	0	0.00
29	8	Western Hemisphere Trade Center	TAMIU	3	2001	1	2	0	7,945,852.00	8,167,567.00	2.79	630	606	-4	14	15,836.79	2.79	0	0	0.00
30	13	Lamar Bruni Vergara Science Center	TAMIU	3	2005	1	2	0	17,033,054.00	17,636,878.00	3.55	485	688	42	12	50,318.67	3.55	2	1	11,042.00
31	1561	George P. Mitchell 40 Outdoor Tenn	TAMU	3	1998	3	4	0	3,453,304.00	3,557,424.00	3.02	330	319	-3	8	13,015.00	3.02	0	0	0.00
32	469	Central Campus Parking Garage	TAMU	3	1999	3	4	0	31,955,000.00	31,790,410.00	-0.52	789	749	-5	22	-7,481.36	-0.52	1	1	6,310.00
33	1277	Easterwood Rescue and Fire Facility	TAMU	3	1999	3	4	0	1,560,000.00	1,600,778.00	2.61	450	400	-11	8	5,097.25	2.61	0	0	0.00
34	1512	Southern Crop Improvement Greenhouse	TAMU	3	2001	1	4	0	4,705,000.00	4,673,712.00	-0.66	380	427	12	13	-2,406.77	-0.66	0	0	0.00
35	3198	University Apartments Community Center	TAMU	3	2001	3	4	0	1,956,400.00	2,002,633.00	2.36	365	308	-16	6	7,705.50	2.36	0	0	0.00
36	361	Bright Football Complex	TAMU	3	2003	1	2	0	17,538,497.00	18,294,738.00	4.31	540	621	15	19	39,802.16	4.31	0	0	0.00
37	1610	Coastal Engineering Lab	TAMU	3	2003	1	2	0	4,257,199.00	4,652,042.00	9.27	400	453	13	11	35,894.82	9.27	0	0	0.00
38	1565	Training/Track Building	TAMU	3	2003	3	2	0	4,317,133.00	4,545,770.00	5.30	365	434	19	13	17,587.46	5.30	0	0	0.00
39	1559	West Campus Parking Garage	TAMU	3	2003	3	2	0	27,856,200.00	28,990,813.00	4.07	690	721	4	26	43,638.96	4.07	0	0	0.00
40	386	Jack E. Brown Chemical Engineering	TAMU	3	2004	1	2	0	27,959,484.00	30,734,988.00	9.93	585	742	27	19	146,079.16	9.93	0	0	0.00
41	699	Science and Technology Center	TAMUC	3	2006	1	2	0	18,585,000.00	19,518,160.00	5.02	531	588	11	19	49,113.68	5.02	0	0	0.00

Table 7. Continued.

ID	Bldg#	Building Name	Inst	Inst. Code	Year	T	P.D.M. CODE	P/N CODE	Original Cost (\$)	Final Cost (\$)	Cost over	Original Days	Actual Days	Time over	# of C.O.	AvgCOcost	CO asPer	# of Claims	claim yes or no	Cost of Claims
42	133	University Center	TAMUCC	3	1999	3	4	0	12,749,000.00	13,044,082.00	2.31	670	696	4	21	14,051.52	2.31	0	0	0.00
43	151	Science & Technology	TAMUCC	3	2001	1	2	0	9,256,414.00	9,576,929.00	3.46	444	436	-2	12	26,709.58	3.46	0	0	0.00
44	159	Bay Hall	TAMUCC	3	2005	1	2	0	11,074,827.00	11,359,360.00	2.57	455	562	24	17	16,737.24	2.57	1	1	13,747.00
45	158	Harte Research Institute Building	TAMUCC	3	2005	1	2	0	13,367,027.00	13,734,786.00	2.75	550	857	56	16	22,984.94	2.75	0	0	0.00
46	152	Performing Arts Ctr.	TAMUCC	3	2005	1	2	0	14,258,171.00	15,151,822.00	6.27	570	849	49	20	44,682.55	6.27	0	0	0.00
47	560	Engineering Complex	TAMUK	3	2001	1	2	0	12,015,373.00	12,442,544.00	3.56	450	516	15	16	26,698.19	3.56	0	0	0.00
49	3	Academic Building	TAMUT	3	1999	1	4	0	3,463,884.00	3,663,675.00	5.77	400	495	24	12	16,649.25	5.77	0	0	0.00
50	3502	Medical Research Building	TAMUSHSC	3	2000	1	4	0	9,811,000.00	9,933,077.00	1.24	547	549	0	15	8,138.47	1.24	0	0	0.00
51	680	Event Center	WTAMU	3	2002	3	4	0	10,241,023.00	11,575,488.00	13.03	416	439	6	10	133,446.50	13.03	0	0	0.00
52	682	New Fine Arts	WTAMU	3	2006	1	2	0	22,749,838.00	26,418,519.00	16.13	610	1,173	92	16	229,292.56	16.13	0	0	0.00
53	164	H & PE Building	TSOU	4	1988	1	4	0	10,518,000.00	11,015,557.00	4.73	500	700	40	52	9,568.40	4.73	1	1	X
54	150	J.H. Jones Business Building	TSOU	4	1998	1	4	0	10,441,545.30	10,850,160.30	3.91	400	420	5	7	58,373.57	3.91	1	1	7,780.00
55	135	Health Center	TSOU	4	2001	3	5	0	1,380,085.00	1,550,420.00	12.34	300	315	5	21	8,111.19	12.34	1	1	440.00
56	111	Recreation Center	TSOU	4	2002	3	3	0	12,020,396.00	11,941,811.00	-0.65	485	885	82	2	65,217.50	1.09	11	1	X
59	166	Pharmacy & Health Sciences @ TMC	TSOU	4	2005	1	5	0	2,940,000.00	2,645,167.00	10.03	100	90	-10	0	#DIV/0!	0.00	4	1	599,568.71
60	165	New Science Classroom & Research FA	TSOU	4	2006	1	4	0	29,679,209.08	28,827,478.57	-2.87	1,095	999	-9	24	20,011.46	1.62	10	1	599,568.71
61	51	Lowry Woods- Austin Hall ⁵	TWU	5	2005	7		0	11,957,628.00	12,127,903.45	1.42	319	339	6	2	85,137.50	1.42	0	0	0.00
68	704	Institute of Health Science-Houston Center	TWU	5	2006	1		0	27,710,000.00	27,910,000.00	0.72	550	559	2	1	200,000.00	0.72	0	0	0.00
69	161	Gateway Center	UNTS	6	2001	1	1	0	14,619,927.00	15,503,223.00	6.04	461	647	40	15	58,886.40	6.04	0	0	0.00
71	516	Parking Garage	UNTHSCFW	6	2001	3	1	0	9,212,856.00	9,810,018.00	6.48	392	468	19	2	298,581.00	6.48	0	0	0.00
72	518	Center for Biohealth	UNTHSCFW	6	2004	1	1	0	21,337,000.00	22,493,231.00	5.42	552	552	0	4	289,057.75	5.42	0	0	0.00
74	350	Sorority House	UNT	6	2004	6	1	0	3,613,844.00	3,840,153.17	6.26	221	281	27	4	56,577.29	6.26	0	0	0.00
75	332	Speech & Hearing Clinic	UNT	6	1999	1		0	1,627,250.00	1,502,449.00	-7.67	289	289	0	1	-124,801.00	-7.67	0	0	0.00
76	304	EP Warranch Tennis Complex	UNT	6	2005	3	1	0	2,135,790.00	2,183,358.96	2.23				2	23,784.48	2.23	0	0	0.00
77	320	EP Athletic Center	UNT	6	2005	3	1	0	13,092,000.00	12,908,963.00	-1.40	395	395	0	8	-22,879.63	-1.40	0	0	0.00
79	160	Environmental Science Bldg	UNT	6	1998	1	4	0	11,340,200.00	11,917,470.00	5.09	455	469	3	8	72,158.75	5.09	0	0	0.00
80	112	Chemistry Bldg.	UNT	6	2004	1	1	0	15,413,955.00	16,422,858.00	6.55	399	605	52	8	126,112.88	6.55	0	0	0.00
81	118	Student Recreation Center	UNT	6	2003	3		0	24,175,921.00	24,052,349.13	-0.51				8	-15,446.48	-0.51	0	0	0.00
82	419	Marsha Sharp Center for Student Athletes	TTU	7	2004	1		1	2,653,300.00	2,863,555.85	7.92	217	217	0	4	52,563.96	7.92	0	0	0.00
83	397	Animal & Food Science Facility	TTU	7	2005	1	1	1	12,929,976.00	13,138,980.13	1.62	450	619	38	3	69,668.04	1.62	0	0	0.00

Table 7. Continued.

ID	Bldg#	Building Name	Inst	Inst. Code	Year	T	P.D.M. CODE	P/N CODE	Original Cost (\$)	Final Cost (\$)	Cost over	Original Days	Actual Days	Time over	# of C.O.	AvgCOcost	CO asPer	# of Claims	claim yes or no	Cost of Claims
84	605	Extended Studies	TTU	7	2000	1	1	1	5,976,162.00	6,026,162.00	0.84	286	364	27	1	50,000.00	0.84	0	0	0.00
85	393	English & Philosophy Bldg.	TTU	7	2002	1		1	28,214,880.00	34,206,213.00	21.23	851	851	0	4	1,497,833.25	21.23	0	0	0.00
86	1002	HSC Academic Classroom Bldg.	TTUHSC	7	2003	1	1	1	11,888,000.00	11,794,800.00	-0.78	702	702	0	1	-93,200.00	-0.78	0	0	0.00
89	701	Arlington Hall	UTAR	8	2000	6	3	1	17,953,260.00	18,675,526.00	4.02	318	357	12	10	105,218.60	5.86	0	0	0.00
90	538	Arbor Oaks Apartments	UTAR	8	2002	7	3	1	20,597,094.00	20,289,744.00	-1.49	523	711	36	8	-38,418.75	-1.49	0	0	0.00
91	551	Meadow Run Apartments	UTAR	8	2003	7	2	1	6,051,998.00	6,089,865.00	0.63	280	318	14	5	7,573.40	0.63	0	0	0.00
92	582	Continuing Ed. And Workforce De.	UTAR	8	2004	1	2	1	6,778,600.00	6,780,814.00	0.03	343	363	6	9	246.00	0.03	0	0	0.00
93	697	Kalpana Chawla Hall	UTAR	8	2004	7	1	1	14,376,631.00	14,376,631.00	0.00	318	359	13	6	0.00	0.00	0	0	0.00
94	615	Studio Arts Center	UTAR	8	2004	1	2	1	4,375,802.00	4,496,449.00	2.76	245	299	22	5	24,129.40	2.76	0	0	0.00
95	520	Chemistry & Physics Building	UTAR	8	2006	1	2	1	33,603,750.00	34,867,165.00	3.76	636	688	8	41	30,815.00	3.76	0	0	0.00
96	600	Brazos Garage	UTA	8	1997	3	4	1	8,858,000.00	8,740,654.00	-1.32	395	395	0	7	-16,763.71	-1.32	0	0	0.00
97	740	Moffett Molecular Biology Bldg.	UTA	8	1997	1	4	1	22,892,000.00	26,128,445.00	14.14	720	826	15	11	294,222.27	14.14	0	0	0.00
98	9832	Red and Charline McCombs Field	UTA	8	1997	3	4	1	3,278,900.00	3,372,543.00	2.86	270	442	64	7	13,377.57	2.86	0	0	0.00
99	980	Student Services Building	UTA	8	1997	1	4	1	19,346,000.00	19,541,672.00	1.01	730	798	9	29	6,747.31	1.01	0	0	0.00
100	164	Univ. Interscholastic League Bldg.	UTA	8	1998	1	4	1	3,651,350.00	3,648,585.00	-0.08	365	390	7	8	-345.63	-0.08	0	0	0.00
101	981	27th Street Garage	UTA	8	1999	3	1	1	7,794,000.00	7,903,040.00	1.40	347	347	0	8	13,630.00	1.40	0	0	0.00
102	9712	Mike A. Myers Track & Soccer Stadium	UTA	8	1999	3	2	1	21,037,000.00	21,871,753.00	3.97	463	524	13	16	52,172.06	3.97	0	0	0.00
103	198	Arl Bldg.35 McKinney Wing(PRC 190)	UTA	8	2000	1	2	1	2,493,000.00	2,653,887.00	6.45	220	225	2	6	26,814.50	6.45	0	0	0.00
104	603	Connally Center for Justice	UTA	8	2000	1	2	1	6,948,708.00	7,002,328.00	0.77	480	641	34	10	5,362.00	0.77	0	0	0.00
105	502	San Jacinto Residence Hall	UTA	8	2000	6	3	1	43,980,205.00	44,274,234.00	0.67	526	574	9	12	69,894.67	1.91	0	0	0.00
106	982	Speedway Garage	UTA	8	2000	3	1	1	20,378,841.00	22,447,506.00	10.15	358	364	2	16	129,291.56	10.15	0	0	0.00
107	A263	Frank N. Bash Visitors Ctr. at MCD	UTA	8	2002	3	2	1	3,473,000.00	3,534,728.00	1.78	365	499	37	10	6,172.80	1.78	0	0	0.00
108	9714	Indoor Practice Facility	UTA	8	2002	3	2	1	3,428,000.00	3,549,923.00	3.56	170	170	0	3	40,641.00	3.56	0	0	0.00
109	985	Sarah M & Charles E. Seay Building	UTA	8	2002	1	1	1	41,725,000.00	41,769,378.00	0.11	721	971	35	20	2,218.90	0.11	0	0	0.00
110	424	Trinity Garage	UTA	8	2002	3	3	1	18,866,975.00	19,722,343.00	4.53	740	740	0	6	142,561.33	4.53	0	0	0.00
111	275	Gregory Aquatic Pool Control Bldg.	UTA	8	2005	3	1	1	11,481,895.00	12,749,832.00	11.04	414	721	74	11	115,267.00	11.04	0	0	0.00
112	903	Imaging Research Center (PRC 197)	UTA	8	2005	1	1	1	3,152,760.00	3,152,760.00	0.00	315	387	23	6	0.00	0.00	0	0	0.00
113	741	Neural and Molecular Science Bldg.	UTA	8	2005	1	1	1	40,336,420.00	44,287,941.00	9.80	796	1,033	30	25	158,060.84	9.80	0	0	0.00
114	114A	Jack. S. Blanton Museum of Art-A	UTA	8	2006	1	1	1	42,543,931.00	43,582,524.00	2.44	866	954	10	10	103,859.30	2.44	0	0	0.00
115	114B	Jack. S. Blanton Museum of Art-B	UTA	8	2006	1	1	1	19,863,833.00	19,990,992.00	0.64	485	485	0	7	18,165.57	0.64	0	0	0.00

Table 7. Continued.

ID	Bldg#	Building Name	Inst	Inst. Code	Year	T	P.D.M. CODE	P/N CODE	Original Cost (\$)	Final Cost (\$)	Cost over	Original Days	Actual Days	Time over	# of C.O.	AvgCOcost	CO asPer	# of Claims	claim yes or no	Cost of Claims
116	242	Nano Science and Technology Bldg.	UTA	8	2006	1	1	1	28,949,999.00	29,756,903.00	2.79	467	559	20	11	73,354.91	2.79	0	0	0.00
117	SETB	Science Engr & Tech. #41	UTB	8	1997	1	4	1	2,447,000.00	2,226,655.36	-9.00	439	439	0	5	-44,068.93	-9.00	0	0	0.00
118	EDBC	Education & Business Cmplx #63	UTB	8	2005	1	1	1	21,660,236.00	23,516,330.00	8.57	840	995	18	12	154,674.50	8.57	0	0	0.00
119	CR	Callier Richardson	UTD	8	2003	1	2	1	3,564,400.00	3,510,251.00	-1.52	365	365	0	5	-10,829.80	-1.52	0	0	0.00
120	SOM	School of Management Building	UTD	8	2003	1	1	1	30,670,152.00	29,536,788.00	-3.70	515	551	7	28	-40,477.29	-3.70	0	0	0.00
121	WV43	Waterview 43 Phase VI ⁶	UTD	8	1998	7	3	1	4,000,000.00	4,028,634.00	0.72	192	192	0	3	9,544.67	0.72	0	0	0.00
125	WV48	Waterview 48 Phase VII ⁷	UTD	8	1998	7	3	1	3,930,000.00	3,908,297.00	-0.55	164	164	0	2	-10,851.50	-0.55	0	0	0.00
129	WV53	Waterview 53 Phase VIII ⁸	UTD	8	2001	7	3	1	10,257,450.00	11,966,327.00	16.66	624	624	0	13	131,452.08	16.66	0	0	0.00
139	WV65	Waterview 65 Phase IX ⁹	UTD	8	2004	7	2	1	3,399,999.00	3,282,779.00	-3.45	194	197	2	2	-58,610.00	-3.45	0	0	0.00
142	ECSS	Engineering Computer Science South	UTD	8	2002	1		1	25,640,000.00	23,859,524.00	-6.94	519	547	5	12	-148,373.00	-6.94	0	0	0.00
143	094B	Miner Village B Sacramento ¹⁰	UTEP	8	2001	7	3	1	12,136,519.00	11,838,529.62	-2.46	346	333	-4	4	-74,497.35	-2.46	0	0	0.00
149	22	Larry K Durham Center	UTEP	8	2002	3	3	1	7,877,860.00	7,984,327.00	1.35	486	565	16	7	15,209.57	1.35	0	0	0.00
150	38	Academic Services Building	UTEP	8	2005	1	2	1	7,459,000.00	7,762,330.00	4.07	486	598	23	9	33,703.33	4.07	0	0	0.00
151	99	Classroom Bldg.	UTEP	8	1997	1	4	1	14,046,500.00	14,361,753.00	2.24	540	661	22	12	26,271.08	2.24	0	0	0.00
152	610	Frio Street Building	UTSA	8	1997	1	4	1	15,611,000.00	16,179,659.00	3.64	460	460	0	13	43,743.00	3.64	0	0	0.00
153	620	Buena Vista Street Building	UTSA	8	1999	1	4	1	21,669,000.00	22,200,816.00	2.45	570	628	10	17	31,283.29	2.45	0	0	0.00
154	531	Recreation Wellness Center	UTSA	8	2002	3	3	1	14,039,319.00	13,636,389.00	-2.87	408	423	4	12	-33,577.50	-2.87	0	0	0.00
155	640	Durango Addition	UTSA	8	2003	1	2	1	26,764,780.00	22,807,626.00	-14.78	517	655	27	14	-241,185.36	-12.62	0	0	0.00
156	640A	Durango Addition-Add.	UTSA	8	2003	1	2	1	4,332,000.00	4,273,738.00	-1.34	390	436	12	8	-7,282.75	-1.34	0	0	0.00
157	543	Main Building-Parking Garage	UTSA	8	2004	1	3	1	44,630,710.00	44,116,648.00	-1.15	956	1,019	7	15	-34,270.80	-1.15	0	0	0.00
158	555	Biotechnology Sciences and Engineering	UTSA	8	2005	1	2	1	60,210,000.00	67,703,466.00	12.45	719	954	33	21	356,831.71	12.45	0	0	0.00
159	555A	Biotechnology Sciences & Engineering -A	UTSA	8	2005	1	2	1	8,265,788.00	8,377,229.00	1.35	338	412	22	7	15,920.14	1.35	0	0	0.00
160	3050	Roadrunner Café	UTSA	8	2005	3	2	1	5,505,514.00	5,456,100.00	-0.90	255	454	78	9	-5,490.44	-0.90	0	0	0.00
161	17	Cowan Fine Arts Center	UTT	8	1997	1	4	1	19,298,000.00	18,942,288.00	-1.84	600	822	37	26	-13,681.35	-1.84	0	0	0.00
162	30	Longview University Center	UTT	8	2000	1	1	1	3,942,836.00	3,970,550.00	0.70	412	452	10	11	2,519.45	0.70	0	0	0.00
163	19	Braithwaite Building	UTT	8	2003	1	2	1	4,743,200.00	5,416,022.00	14.18	396	423	7	15	44,854.80	14.18	0	0	0.00
164	20	Herrington Patriot Center	UTT	8	2003	3	2	1	16,266,000.00	16,629,374.00	2.23	551	624	13	14	25,955.29	2.23	0	0	0.00
165	32	Patriot Village Building 1 ¹¹	UTT	8	2004	6	3	1	5,600,000.00	6,184,035.00	10.43	206	234	14	7	83,433.57	10.43	0	0	0.00
167	36	Ornelas Residence Hall	UTT	8	2006	6	2	1	12,017,321.00	12,422,421.00	3.37	540	659	22	6	67,516.67	3.37	0	0	0.00
168	34	Ratliff Building South	UTT	8	2006	1	2	1	27,979,305.00	29,392,491.00	5.05	500	727	45	17	83,128.59	5.05	0	0	0.00

Table 7. Continued.

ID	Bldg#	Building Name	Inst	Inst. Code	Year	T	P.D.M. CODE	P/N CODE	Original Cost (\$)	Final Cost (\$)	Cost over	Original Days	Actual Days	Time over	# of C.O.	AvgCOcost	CO asPer	# of Claims	claim yes or no	Cost of Claims
169	0SONA	School of Nursing and Student Commu	UTHSCH	8	2004	1	1	1	4,722,408.00	4,798,911.00	1.62	265	499	88	8	113,201.13	19.18	0	0	0.00
170	0SONB	School of Nursing and Student Commu	UTHSCH	8	2004	1	1	1	36,119,525.00	41,110,145.00	13.82	735	837	14	21	237,648.57	13.82	0	0	0.00
171	0UHA	University Housing Apartments	UTHSCH	8	2005	7	1	1	19,252,741.00	18,801,098.00	-2.35	386	389	1	21	-21,506.81	-2.35	0	0	0.00
172	0SRB	Fayez S. Sarofim Research Building	UTHSCH	8	2006	1	1	1	83,350,305.00	83,848,511.00	0.60	663	796	20	18	27,678.11	0.60	0	0	0.00
173		Brownsville RAHC	UTHSCH	8	2002	1		1	4,210,000.00	4,226,871.00	0.40	300	392	31	7	2,410.14	0.40	0	0	0.00
174	302	Allied Health/Research Bldg.	UTHSCSA	8	1998	1	4	1	14,239,000.00	14,191,772.50	-0.33	600	773	29	18	-2,623.78	-0.33	0	0	0.00
175	32	Parking Garage - Lot 4	UTHSCSA	8	1999	3	2	1	7,822,504.00	7,822,504.00	0.00	273	382	40	3	0.00	0.00	0	0	0.00
176	402	S Tx Ctrs for Biol in Medicine	UTHSCSA	8	2000	1	2	1	16,601,348.00	16,283,461.00	-1.91	550	550	0	8	-39,735.88	-1.91	0	0	0.00
177	404	Cafeteria @ Tx Res Park	UTHSCSA	8	2001	3	2	1	973,116.00	1,149,169.00	18.09	165	165	0	2	88,026.50	18.09	0	0	0.00
179	702	D.D. Hachar Bld. (Laredo, Tx)	UTHSCSA	8	2002	1	2	1	5,924,058.00	6,082,484.00	2.67	426	506	19	7	22,632.29	2.67	0	0	0.00
180	701	Harlingen RAHC (Harlingen, Tx)	UTHSCSA	8	2002	1	1	1	18,061,068.00	18,061,068.00	0.00	545	545	0	3	0.00	0.00	0	0	0.00
182	304	Children S CA Research Institute	UTHSCSA	8	2003	1	3	1	39,386,066.00	39,335,413.00	-0.13	668	774	16	20	-2,532.65	-0.13	0	0	0.00
183	35	Academic & Administration Bld.	UTHSCSA	8	2004	1	1	1	13,309,029.00	15,701,174.00	17.97	405	657	62	17	140,714.41	17.97	0	0	0.00
184	405	Sam & Ann Barshop Aging Institute	UTHSCSA	8	2005	1	1	1	15,259,202.00	14,778,078.00	-3.15	563	682	21	14	-34,366.00	-3.15	0	0	0.00
185	703	Edinburg Regional Acad. Hlth. Ctr.	UTHSCSA	8	2006	1	2	1	15,540,152.00	16,322,858.00	5.04	540	926	71	14	55,907.57	5.04	0	0	0.00
186	100T	Dock Building	UTMDACC	8	1998	1	4	1	5,445,000.00	6,047,916.00	11.07	365	574	57	15	40,194.40	11.07	0	0	0.00
187	100T-A	Dock Building - A	UTMDACC	8	1998	1	4	1	6,059,000.00	5,942,262.00	-1.93	320	366	14	7	-16,676.86	-1.93	0	0	0.00
190	129	Faculty Center	UTMDACC	8	2000	1	3	1	38,234,144.00	37,511,077.00	-1.89	365	437	20	14	-35,522.50	-1.30	0	0	0.00
191	132	South Campus Research Building I	UTMDACC	8	2002	1	3	1	30,882,023.00	31,293,296.00	1.33	561	651	16	7	58,753.29	1.33	0	0	0.00
192	131	Pressler Street Garage	UTMDACC	8	2003	3	3	1	18,319,456.00	18,003,151.01	-1.73	412	476	16	10	-31,630.50	-1.73	0	0	0.00
194	100V	George and Cynthia Mitchell Basic S	UTMDACC	8	2004	1	1	1	7,143,666.00	4,120,465.00	42.32	281	645	130	14	-215,942.93	-42.32	0	0	0.00
195	531	Visual Arts Studios	UTPB	8	1999	1	2	1	3,234,200.00	3,359,850.00	3.89	300	352	17	7	17,950.00	3.89	0	0	0.00
196	532	Library/Lecture Center	UTPB	8	2000	1	2	1	11,654,400.00	12,669,701.00	8.71	500	659	32	11	92,300.09	8.71	0	0	0.00
198	584	SH Phase II Residence Hall - 1 ¹²	UTPB	8	2004	6	2	1	7,265,933.00	7,151,423.00	-1.58	265	310	17	6	-19,085.00	-1.58	0	0	0.00
204	593	SH Phase III Residence Hall - 1 ¹³	UTPB	8	2005	6	2	1	5,833,000.00	5,734,845.00	-1.68	268	268	0	1	-98,155.00	-1.68	0	0	0.00
210	MA	Bryan Williams Center	UTSMCD	8	2002	1	3	1	6,506,722.00	6,454,072.00	-0.81	364	426	17	9	-5,850.00	-0.81	0	0	0.00
211	105	Science Building	UTPA	8	1997	1	4	1	20,330,000.00	21,325,340.00	4.90	545	607	11	8	124,417.50	4.90	0	0	0.00
212	125	International Trade and Technology	UTPA	8	1998	1	4	1	2,570,000.00	2,566,023.00	-0.15	310	310	0	4	-994.25	-0.15	0	0	0.00
213	75	Bronc Village Complex A ¹⁴	UTPA	8	2000	6	3	1	4,300,000.00	4,175,655.00	-2.89	158	158	0	2	-62,172.50	-2.89	0	0	0.00
215	61	Student Union	UTPA	8	2000	3	3	1	5,364,890.00	5,364,789.00	0.00	404	419	4	4	3,408.28	0.25	0	0	0.00

Table 7. Continued.

ID	Bldg#	Building Name	Inst	Inst. Code	Year	T	P.D.M. CODE	P/N CODE	Original Cost (\$)	Final Cost (\$)	Cost over	Original Days	Actual Days	Time over	# of C.O.	AvgCOcost	CO asPer	# of Claims	claim yes or no	Cost of Claims
216	355	Mathematics & General Classroom ¹⁵	UTPA	8	2001	1	3	1	13,600,000.00	13,599,136.00	-0.01	439	537	22	6	-144.00	-0.01	0	0	0.00
219	520	John & Reb. Moores Sch. Of Music	UH	9	1997	1		0	17,501,500.00	18,805,765.00	7.45				20	65,213.25	7.45	0	0	0.00
220	536	Center for Public Broadcasting	UH	9	2000	1		0	8,497,800.00	9,170,049.00	7.91	498	498	0	34	19,772.03	7.91	0	0	0.00
221	242	Bill Blackwood Lemit	SHSU	10	2000	1	4	0	5,585,580.00	5,898,070.95	5.59				9	-7,581.67	-1.22	0	0	0.00
222	10	Academic Building IV	SHSU	10	2002	1	4	0	9,810,000.00	10,234,319.58	4.33				14	17,736.45	2.53	0	0	0.00
223	275	Bearkat Village C Apt 54-71 ¹⁶	SHSU	10	2003	6	3	0	14,500,000.00	14,395,001.34	-0.72			0	2	-16,716.34	-0.23	0	0	0.00
234	303	Counselor Education Center	SHSU	10	2004	1	2	0	1,402,500.00	1,414,767.89	0.87				8	1,440.41	0.82	0	0	0.00
235	301	Sam Houston Parking Garage	SHSU	10	2004	3	3	0	4,500,000.00	4,656,452.73	3.48				8	-578.38	-0.10	0	0	0.00
236	299	Sam Houston Village	SHSU	10	2004	6	3	0	19,301,732.00	19,284,104.46	-0.09				9	25,755.44	1.20	0	0	0.00
237	270	South Paw	SHSU	10	2004	3	2	0	2,000,000.00	1,757,376.34	12.13				6	1,597.67	0.48	0	0	0.00
238	289	Basebal/Softball Facility	SHSU	10	2005	3	2	0	5,900,000.00	5,947,764.60	0.81				12	14,536.25	2.96	0	0	0.00
239	300	Chemistry and Forensic Science	SHSU	10	2005	1	2	0	18,000,000.00	17,683,885.99	-1.76				18	136,920.50	13.69	0	0	0.00
240	302	Recreational Sports	SHSU	10	2005	3	2	0	6,250,000.00	6,452,946.99	3.25			0	14	5,270.36	1.18	0	0	0.00
241	321	Raven Village	SHSU	10	2006	6	2	0	16,851,000.00	16,814,490.11	-0.22	474	424	-11	7	-98,540.43	-4.09	0	0	0.00
242	320	Weight Training Center	SHSU	10	2006	3	2	0	1,150,000.00	1,023,987.30	10.96	272	231	-15	2	-10,519.24	-1.83	0	0	0.00
243	271	Visitor and Alumni Center	SHSU	10	2006	1	2	0	3,200,000.00	3,446,331.25	7.70	478	494	3	5	24,524.40	3.83	0	0	0.00

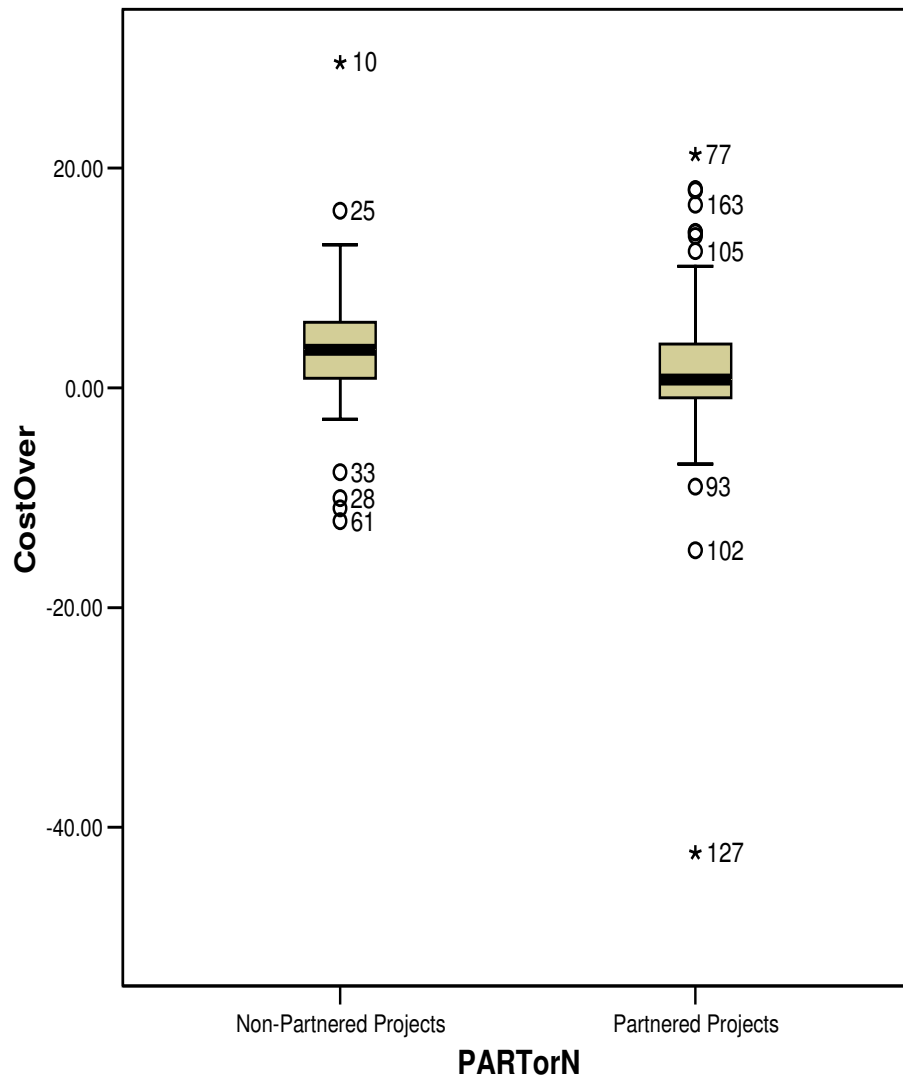
APPENDIX D

Results of the descriptive statistics along with box plots for partnered/non-partnered and building types.

	Descriptive Statistics							
	N		Mean		Std. Deviation		Skewness	
	Statistic	Std. Error	Statistic	Std. Error	Statistic	Std. Error	Statistic	Std. Error
iCost	166		1.4E+07		1.2E+07		2.003	.188
CostOver	166		2.6159		6.75138		-1.179	.188
TimeOver	155		17.0839		22.67156		1.856	.195
nCOs	166		11.17		7.791		1.555	.188
COper	166		2.99		6.620		-1.102	.188
nClaims	166		.32		1.473		5.811	.188
ClaimsCost	164		12409.6		85249.7		7.284	.190
Valid N (listwise)	153							

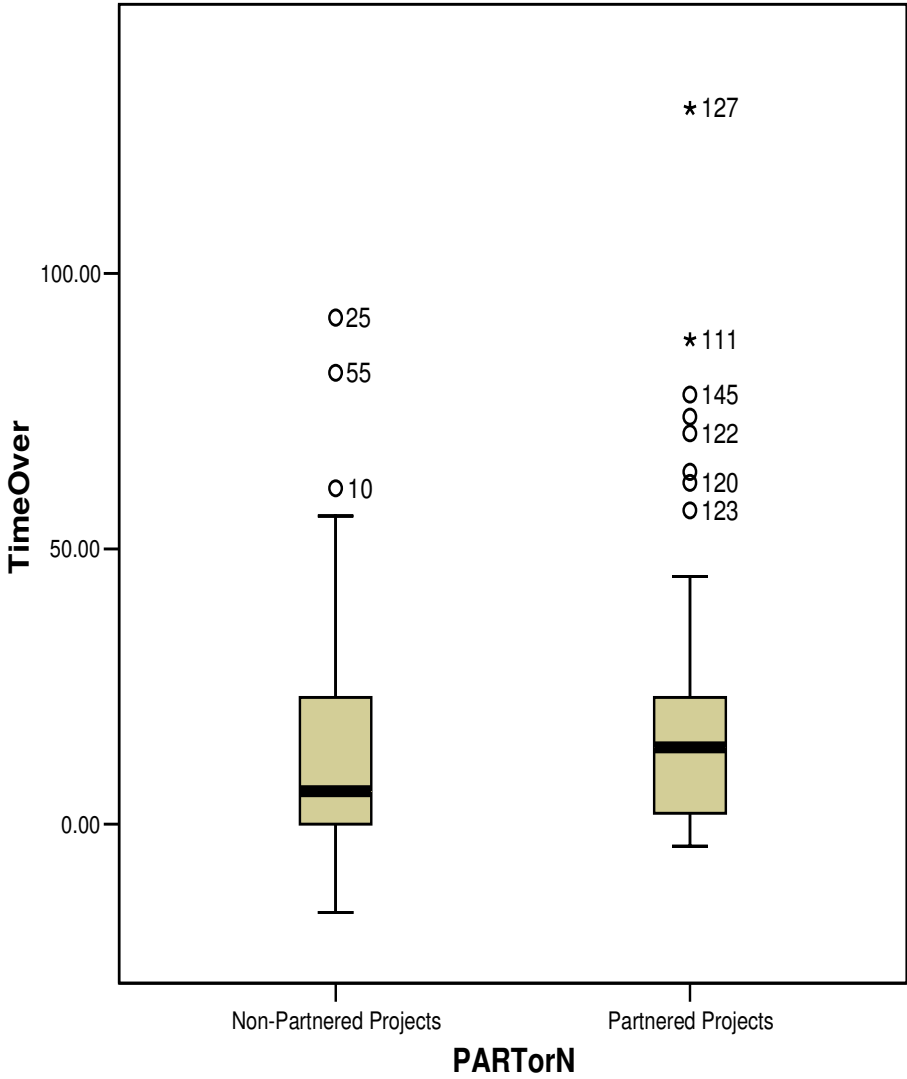
Case Processing Summary

CostOver	PARTorN	Valid		Cases Missing		Total	
		N	Percent	N	Percent	N	Percent
	Non-Partnered Projects	73	100.0%	0	.0%	73	100.0%
	Partnered Projects	93	100.0%	0	.0%	93	100.0%



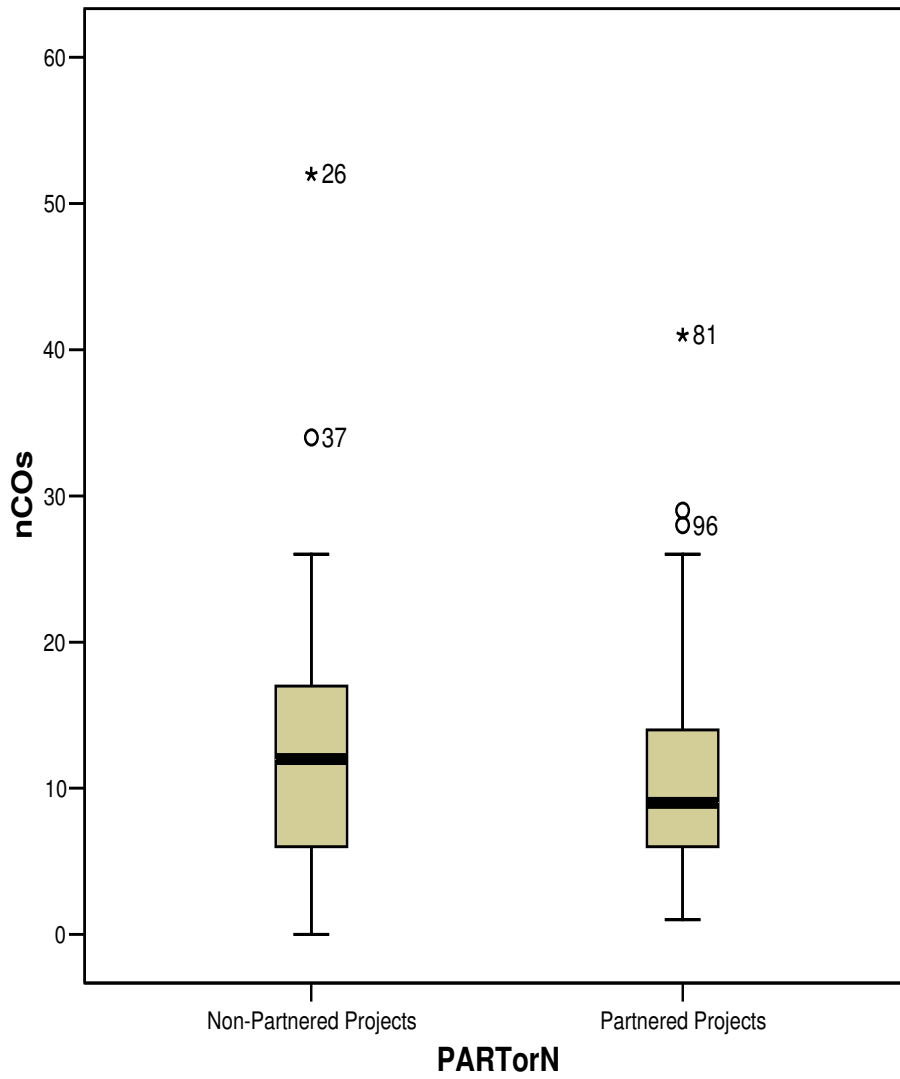
Case Processing Summary

TimeOver	PARTorN	Valid		Cases Missing		Total	
		N	Percent	N	Percent	N	Percent
	Non-Partnered Projects	62	84.9%	11	15.1%	73	100.0%
	Partnered Projects	93	100.0%	0	.0%	93	100.0%



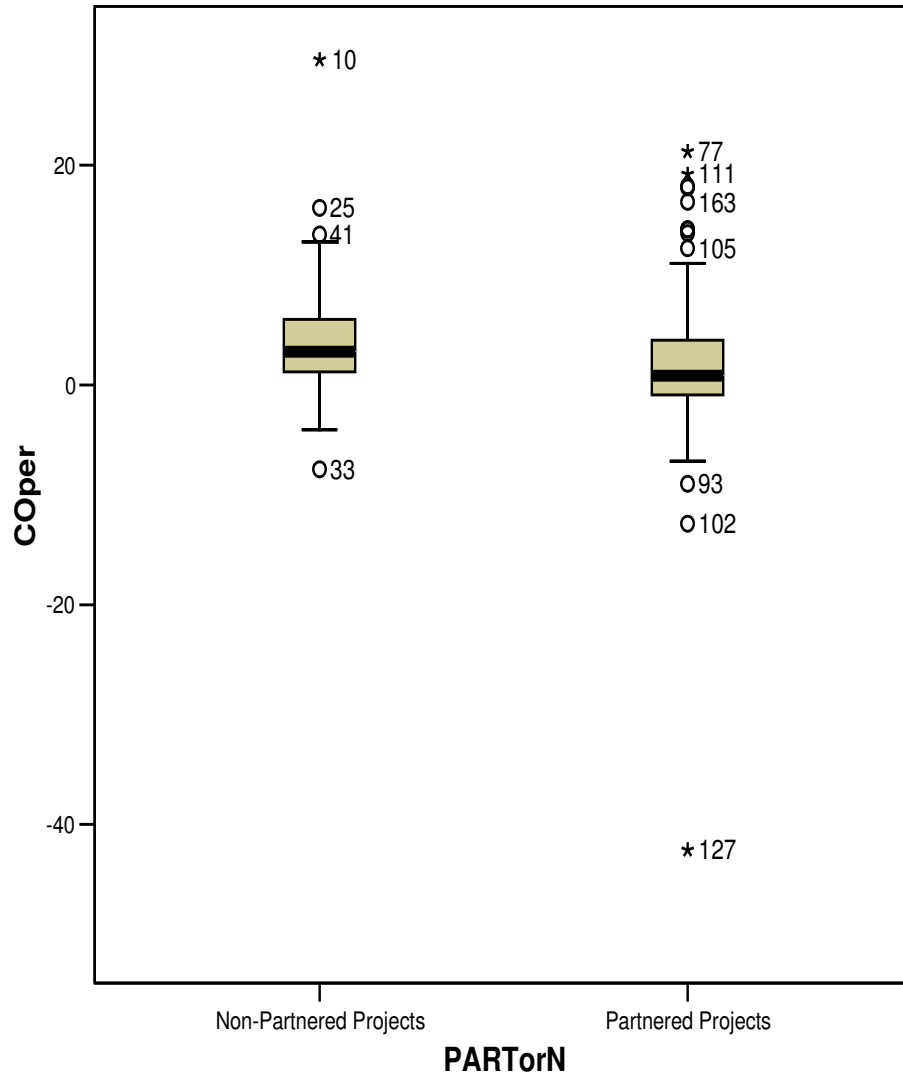
Case Processing Summary

nCOs	PARTorN	Valid		Cases Missing		Total	
		N	Percent	N	Percent	N	Percent
	Non-Partnered Projects	73	100.0%	0	.0%	73	100.0%
	Partnered Projects	93	100.0%	0	.0%	93	100.0%



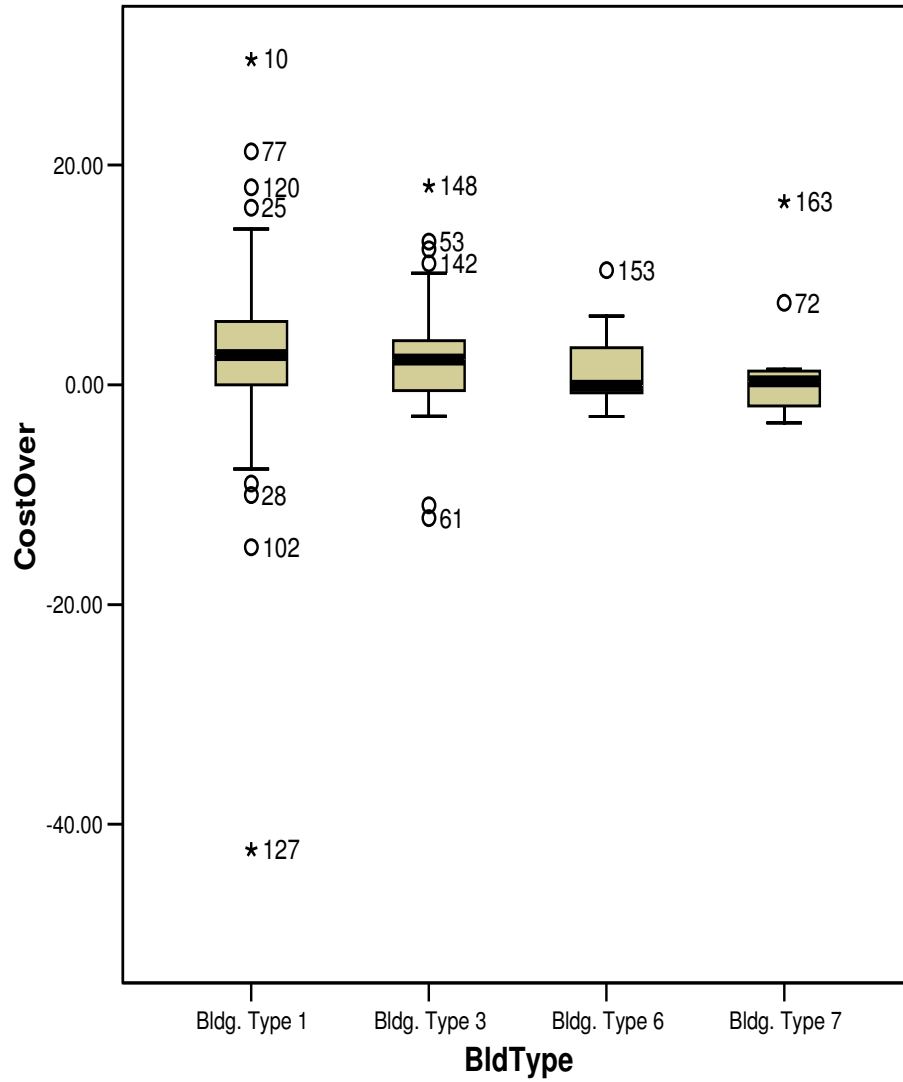
Case Processing Summary

PARTorN	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
Non-Partnered Projects	73	100.0%	0	.0%	73	100.0%
Partnered Projects	93	100.0%	0	.0%	93	100.0%



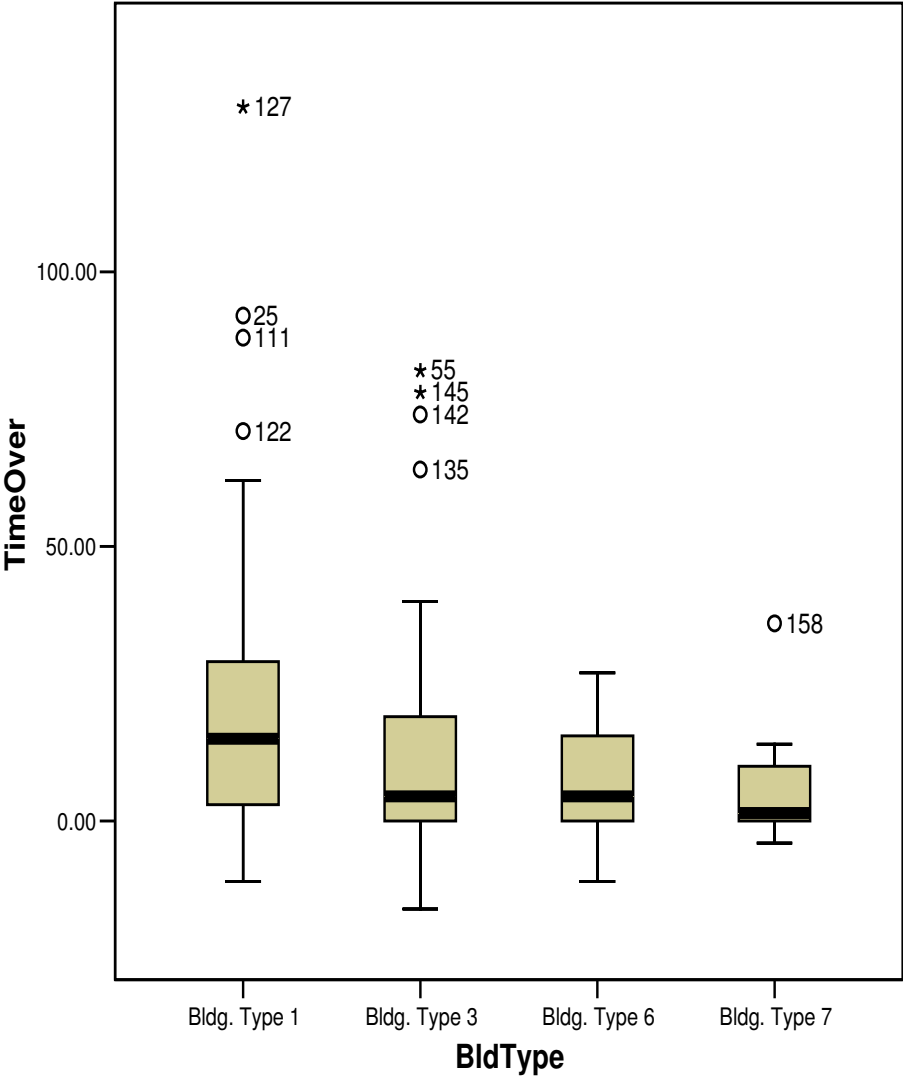
Case Processing Summary

CostOver	BldType	Valid		Cases Missing		Total	
		N	Percent	N	Percent	N	Percent
	Bldg. Type 1	102	100.0%	0	.0%	102	100.0%
	Bldg. Type 3	39	100.0%	0	.0%	39	100.0%
	Bldg. Type 6	13	100.0%	0	.0%	13	100.0%
	Bldg. Type 7	12	100.0%	0	.0%	12	100.0%



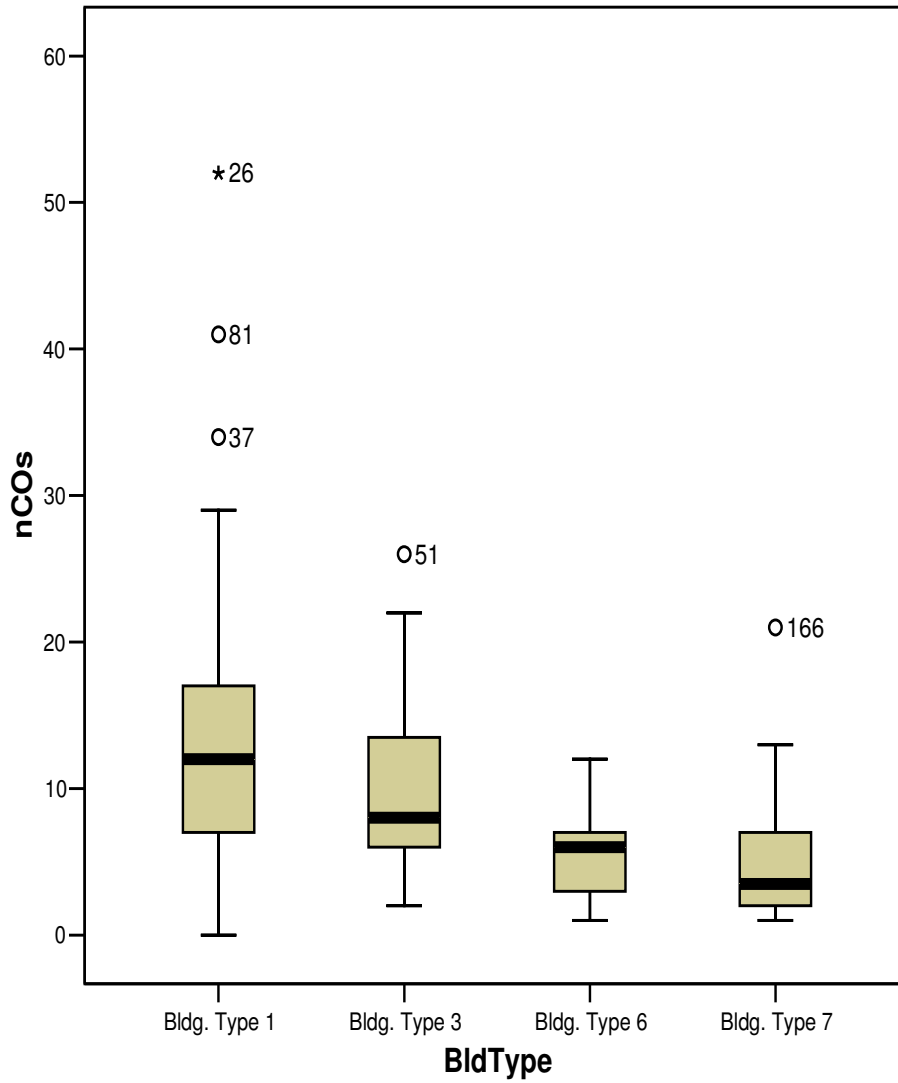
Case Processing Summary

BldType	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
Bldg. Type 1	97	95.1%	5	4.9%	102	100.0%
Bldg. Type 3	34	87.2%	5	12.8%	39	100.0%
Bldg. Type 6	12	92.3%	1	7.7%	13	100.0%
Bldg. Type 7	12	100.0%	0	.0%	12	100.0%



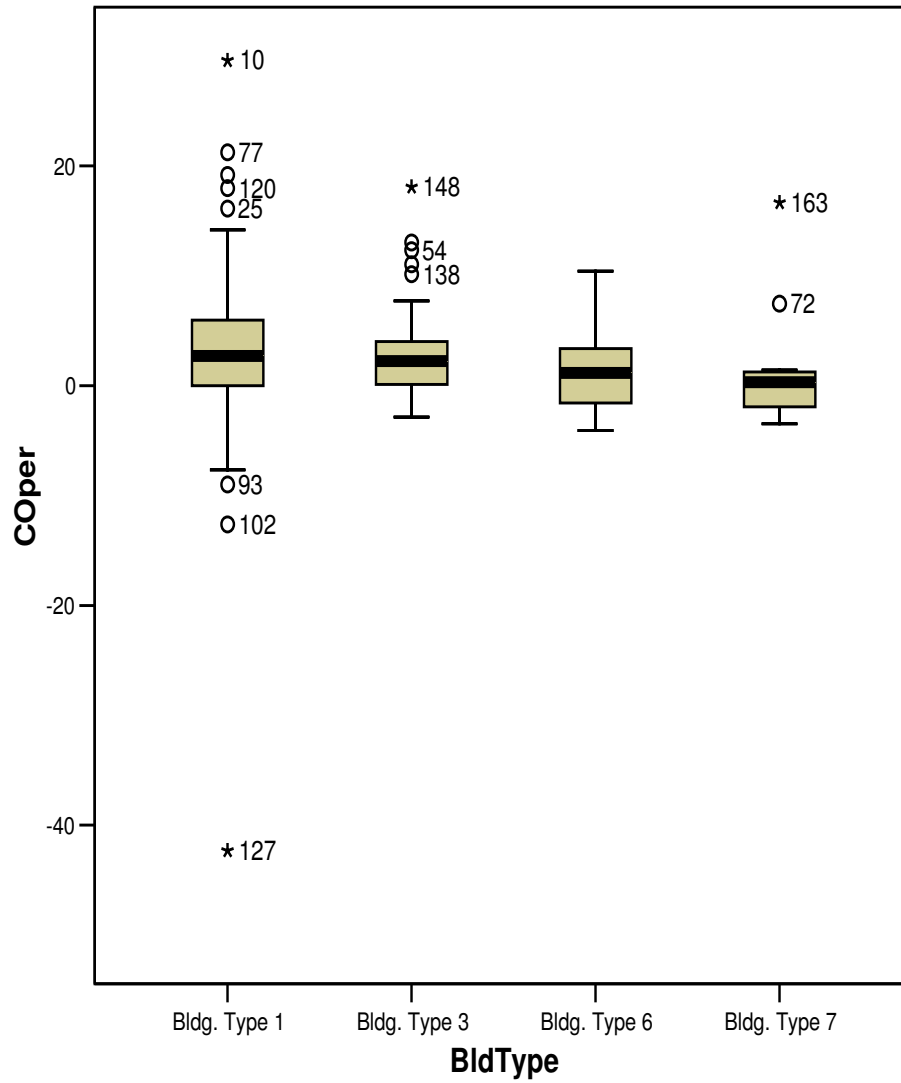
Case Processing Summary

nCOs	BldType	Valid		Cases Missing		Total	
		N	Percent	N	Percent	N	Percent
	Bldg. Type 1	102	100.0%	0	.0%	102	100.0%
	Bldg. Type 3	39	100.0%	0	.0%	39	100.0%
	Bldg. Type 6	13	100.0%	0	.0%	13	100.0%
	Bldg. Type 7	12	100.0%	0	.0%	12	100.0%



Case Processing Summary

	BldgType	Valid		Cases Missing		Total	
		N	Percent	N	Percent	N	Percent
COper	Bldg. Type 1	102	100.0%	0	.0%	102	100.0%
	Bldg. Type 3	39	100.0%	0	.0%	39	100.0%
	Bldg. Type 6	13	100.0%	0	.0%	13	100.0%
	Bldg. Type 7	12	100.0%	0	.0%	12	100.0%



APPENDIX E

Results of the MANOVA test for building types 1 and 3 with initial cost as covariate, partnering/non-partnering and building types as fixed factors.

Between-Subjects Factors		
	Value Label	N
PARTorN 0	Non-Partnered Projects	53
1	Partnered Projects	76
BldType 1	Bldg. Type 1	95
3	Bldg. Type 3	34

Descriptive Statistics

			Mean	Std. Deviation	N
CostOver	PARTorN Non-Partnered Projects	Bldg. Type 1	5.1014	5.73259	36
		Bldg. Type 3	2.9841	5.53968	17
		Total	4.4223	5.70587	53
	Partnered Projects	Bldg. Type 1	2.5693	6.13340	59
		Bldg. Type 3	3.1847	5.37688	17
		Total	2.7070	5.94357	76
	Total	Bldg. Type 1	3.5288	6.08050	95
		Bldg. Type 3	3.0844	5.37650	34
		Total	3.4117	5.88581	129
TimeOver	Non-Partnered Projects	Bldg. Type 1	19.6944	23.59881	36
		Bldg. Type 3	8.4706	22.40011	17
		Total	16.0943	23.60514	53
	Partnered Projects	Bldg. Type 1	19.4576	18.11393	59
		Bldg. Type 3	21.2353	27.20875	17
		Total	19.8553	20.30350	76
	Total	Bldg. Type 1	19.5474	20.24413	95
		Bldg. Type 3	14.8529	25.38090	34
		Total	18.3101	21.71074	129
nCOs	Non-Partnered Projects	Bldg. Type 1	15.03	9.238	36
		Bldg. Type 3	11.94	7.972	17
		Total	14.04	8.895	53
	Partnered Projects	Bldg. Type 1	11.88	7.630	59
		Bldg. Type 3	8.53	4.346	17
		Total	11.13	7.143	76
	Total	Bldg. Type 1	13.07	8.369	95
		Bldg. Type 3	10.24	6.555	34
		Total	12.33	8.006	129
AvgCOCost	Non-Partnered Projects	Bldg. Type 1	59182	76146.00	36
		Bldg. Type 3	40500	75710.93	17
		Total	53189	75788.37	53
	Partnered Projects	Bldg. Type 1	57096	210829.3	59
		Bldg. Type 3	32838	54701.10	17
		Total	51670	187392.0	76
	Total	Bldg. Type 1	57886	172005.5	95
		Bldg. Type 3	36669	65154.52	34
		Total	52294	151359.3	129
COper	Non-Partnered Projects	Bldg. Type 1	5.12	5.590	36
		Bldg. Type 3	3.69	4.226	17
		Total	4.66	5.194	53
	Partnered Projects	Bldg. Type 1	2.91	6.399	59
		Bldg. Type 3	3.20	5.368	17
		Total	2.98	6.150	76
	Total	Bldg. Type 1	3.75	6.169	95
		Bldg. Type 3	3.44	4.764	34
		Total	3.67	5.815	129

Multivariate Tests^b

Effect		Value	F	Hypothesis		Sig.	Partial Eta Squared
				df	Error df		
Intercept	Pillai's Trace	.426	17.824 ^a	5.000	120.000	.000	.426
	Wilks' Lambda	.574	17.824 ^a	5.000	120.000	.000	.426
	Hotelling's Trace	.743	17.824 ^a	5.000	120.000	.000	.426
	Roy's Largest Root	.743	17.824 ^a	5.000	120.000	.000	.426
iCost	Pillai's Trace	.284	9.502 ^a	5.000	120.000	.000	.284
	Wilks' Lambda	.716	9.502 ^a	5.000	120.000	.000	.284
	Hotelling's Trace	.396	9.502 ^a	5.000	120.000	.000	.284
	Roy's Largest Root	.396	9.502 ^a	5.000	120.000	.000	.284
PARTorN	Pillai's Trace	.098	2.617 ^a	5.000	120.000	.028	.098
	Wilks' Lambda	.902	2.617 ^a	5.000	120.000	.028	.098
	Hotelling's Trace	.109	2.617 ^a	5.000	120.000	.028	.098
	Roy's Largest Root	.109	2.617 ^a	5.000	120.000	.028	.098
BldType	Pillai's Trace	.018	.436 ^a	5.000	120.000	.822	.018
	Wilks' Lambda	.982	.436 ^a	5.000	120.000	.822	.018
	Hotelling's Trace	.018	.436 ^a	5.000	120.000	.822	.018
	Roy's Largest Root	.018	.436 ^a	5.000	120.000	.822	.018
PARTorN * BldType	Pillai's Trace	.045	1.126 ^a	5.000	120.000	.350	.045
	Wilks' Lambda	.955	1.126 ^a	5.000	120.000	.350	.045
	Hotelling's Trace	.047	1.126 ^a	5.000	120.000	.350	.045
	Roy's Largest Root	.047	1.126 ^a	5.000	120.000	.350	.045

a. Exact statistic

b. Design: Intercept+iCost+PARTorN+BldType+PARTorN * BldType

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III			F	Sig.	Partial Eta Squared
		Squares	df	Mean Square			
Corrected Model	CostOver	172.374 ^a	4	43.094	1.254	.292	.039
	TimeOver	2026.2 ^b	4	506.540	1.077	.371	.034
	nCOs	1941.9 ^c	4	485.469	9.613	.000	.237
	AvgCOCost	1.E+11 ^d	4	3.507E+10	1.557	.190	.048
	COper	125.407 ^e	4	31.352	.925	.452	.029
Intercept	CostOver	463.071	1	463.071	13.473	.000	.098
	TimeOver	13761	1	13761.275	29.266	.000	.191
	nCOs	3503.8	1	3503.816	69.378	.000	.359
	AvgCOCost	9.E+09	1	8.800E+09	.391	.533	.003
	COper	595.486	1	595.486	17.569	.000	.124
iCost	CostOver	23.742	1	23.742	.691	.407	.006
	TimeOver	88.139	1	88.139	.187	.666	.002
	nCOs	1419.9	1	1419.870	28.114	.000	.185
	AvgCOCost	1.E+11	1	1.284E+11	5.703	.018	.044
	COper	12.330	1	12.330	.364	.548	.003
PARTorN	CostOver	37.671	1	37.671	1.096	.297	.009
	TimeOver	917.572	1	917.572	1.951	.165	.015
	nCOs	363.913	1	363.913	7.206	.008	.055
	AvgCOCost	3.E+09	1	2.622E+09	.116	.734	.001
	COper	48.107	1	48.107	1.419	.236	.011
BldType	CostOver	6.882	1	6.882	.200	.655	.002
	TimeOver	439.077	1	439.077	.934	.336	.007
	nCOs	59.701	1	59.701	1.182	.279	.009
	AvgCOCost	8.E+08	1	846444238	.038	.847	.000
	COper	4.150	1	4.150	.122	.727	.001
PARTorN * BldType	CostOver	50.915	1	50.915	1.481	.226	.012
	TimeOver	1081.8	1	1081.795	2.301	.132	.018
	nCOs	4.996	1	4.996	.099	.754	.001
	AvgCOCost	2.E+08	1	187801412	.008	.927	.000
	COper	20.355	1	20.355	.601	.440	.005
Error	CostOver	4261.9	124	34.370			
	TimeOver	58307	124	470.221			
	nCOs	6262.4	124	50.504			
	AvgCOCost	3.E+12	124	2.252E+10			
	COper	4202.8	124	33.893			
Total	CostOver	5935.8	129				
	TimeOver	103582	129				
	nCOs	27802	129				
	AvgCOCost	3.E+12	129				
	COper	6064.6	129				
Corrected Total	CostOver	4434.3	128				
	TimeOver	60334	128				
	nCOs	8204.3	128				
	AvgCOCost	3.E+12	128				
	COper	4328.2	128				

a. R Squared = .039 (Adjusted R Squared = .008)

b. R Squared = .034 (Adjusted R Squared = .002)

c. R Squared = .237 (Adjusted R Squared = .212)

d. R Squared = .048 (Adjusted R Squared = .017)

e. R Squared = .029 (Adjusted R Squared = -.002)

Parameter Estimates

Dependent Variable	Parameter	B	Std. Error	t	Sig.	90% Confidence Interval		Partial Eta Squared
						Lower Bound	Upper Bound	
CostOver	Intercept	2.823	1.487	1.899	.060	.359	5.287	.028
	iCost	4.E-08	.000	.831	.407	-3.494E-08	1.052E-07	.006
	[PARTorN=0]	-.202	2.011	-.100	.920	-3.534	3.131	.000
	[PARTorN=1]	0 ^a	.	.	.	.	.	.
	[BldType=1]	-.901	1.650	-.546	.586	-3.636	1.833	.002
	[BldType=3]	0 ^a	.	.	.	.	.	.
	[PARTorN=0] *	2.884	2.369	1.217	.226	-1.043	6.810	.012
	[BldType=1]	0 ^a	.	.	.	.	.	.
	[PARTorN=1] *	0 ^a	.	.	.	.	.	.
	[BldType=1]	0 ^a	.	.	.	.	.	.
TimeOver	Intercept	20.539	5.500	3.735	.000	11.425	29.653	.101
	iCost	7.E-08	.000	.433	.666	-1.915E-07	3.270E-07	.002
	[PARTorN=0]	-12.767	7.438	-1.717	.089	-25.093	-.441	.023
	[PARTorN=1]	0 ^a	.	.	.	.	.	.
	[BldType=1]	-2.329	6.103	-.382	.703	-12.443	7.786	.001
	[BldType=3]	0 ^a	.	.	.	.	.	.
	[PARTorN=0] *	13.293	8.764	1.517	.132	-1.231	27.816	.018
	[BldType=1]	0 ^a	.	.	.	.	.	.
	[PARTorN=0] *	0 ^a	.	.	.	.	.	.
	[BldType=3]	0 ^a	.	.	.	.	.	.
nCOs	Intercept	5.735	1.802	3.182	.002	2.748	8.722	.075
	iCost	3.E-07	.000	5.302	.000	1.869E-07	3.568E-07	.185
	[PARTorN=0]	3.403	2.438	1.396	.165	-.637	7.442	.015
	[PARTorN=1]	0 ^a	.	.	.	.	.	.
	[BldType=1]	1.140	2.000	.570	.570	-2.174	4.455	.003
	[BldType=3]	0 ^a	.	.	.	.	.	.
	[PARTorN=0] *	.903	2.872	.315	.754	-3.856	5.663	.001
	[BldType=1]	0 ^a	.	.	.	.	.	.
	[PARTorN=0] *	0 ^a	.	.	.	.	.	.
	[BldType=3]	0 ^a	.	.	.	.	.	.
AvgCOCost	Intercept	6259.9	38058.117	.164	.870	-56811.382	69331.102	.000
	iCost	.003	.001	2.388	.018	.001	.004	.044
	[PARTorN=0]	7577.1	51469.441	.147	.883	-77719.830	92874.084	.000
	[PARTorN=1]	0 ^a	.	.	.	.	.	.
	[BldType=1]	3225.6	42234.627	.076	.939	-66767.065	73218.337	.000
	[BldType=3]	0 ^a	.	.	.	.	.	.
	[PARTorN=0] *	5538.5	60645.659	.091	.927	-94965.631	106042.584	.000
	[BldType=1]	0 ^a	.	.	.	.	.	.
	[PARTorN=0] *	0 ^a	.	.	.	.	.	.
	[BldType=3]	0 ^a	.	.	.	.	.	.
COper	Intercept	2.939	1.477	1.990	.049	.492	5.386	.031
	iCost	3.E-08	.000	.603	.548	-4.427E-08	9.494E-08	.003
	[PARTorN=0]	.490	1.997	.245	.807	-2.820	3.799	.000
	[PARTorN=1]	0 ^a	.	.	.	.	.	.
	[BldType=1]	-.492	1.639	-.300	.765	-3.207	2.224	.001
	[BldType=3]	0 ^a	.	.	.	.	.	.
	[PARTorN=0] *	1.823	2.353	.775	.440	-2.076	5.723	.005
	[BldType=1]	0 ^a	.	.	.	.	.	.
	[PARTorN=0] *	0 ^a	.	.	.	.	.	.
	[BldType=3]	0 ^a	.	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

General Estimable Function^a

Parameter	Contrast				
	L1	L2	L3	L5	L7
Intercept	1	0	0	0	0
iCost	0	1	0	0	0
[PARTorN=0]	0	0	1	0	0
[PARTorN=1]	1	0	-1	0	0
[BldType=1]	0	0	0	1	0
[BldType=3]	1	0	0	-1	0
[PARTorN=0] *	0	0	0	0	1
[BldType=1]					
[PARTorN=0] *	0	0	1	0	-1
[BldType=3]					
[PARTorN=1] *	0	0	0	1	-1
[BldType=1]					
[PARTorN=1] *	1	0	-1	-1	1
[BldType=3]					

a. Design: Intercept+iCost+PARTorN+BldType+PARTorN *
BldType

Estimates

Dependent Variable	PARTorN	Mean	Std. Error	90% Confidence Interval	
				Lower Bound	Upper Bound
CostOver	Non-Partnered Projects	4.143 ^a	.871	2.700	5.587
	Partnered Projects	2.903 ^a	.807	1.565	4.241
TimeOver	Non-Partnered Projects	14.276 ^a	3.222	8.937	19.615
	Partnered Projects	20.396 ^a	2.987	15.447	25.346
nCOs	Non-Partnered Projects	14.260 ^a	1.056	12.511	16.010
	Partnered Projects	10.406 ^a	.979	8.784	12.028
AvgCOCost	Non-Partnered Projects	57219 ^a	22294.705	20271.457	94166.587
	Partnered Projects	46873 ^a	20668.507	12620.084	81125.229
COper	Non-Partnered Projects	4.477 ^a	.865	3.043	5.910
	Partnered Projects	3.075 ^a	.802	1.746	4.404

a. Covariates appearing in the model are evaluated at the following values:
iCost = 15084863.0882.

Pairwise Comparisons

Dependent Variable	Variable (I)	PARTorN	(J) PARTorN	Mean Difference (I-J)	Std. Error	Sig. ^a	90% Confidence Interval for Difference ^a	
							Lower Bound	Upper Bound
CostOver	Non-Partnered Projects	PARTorN	Non-Partnered Projects	1.240	1.185	.297	- .723	3.203
			Partnered Projects	-1.240	1.185	.297	-3.203	.723
TimeOver	Non-Partnered Projects	PARTorN	Non-Partnered Projects	-6.121	4.382	.165	-13.382	1.141
			Partnered Projects	6.121	4.382	.165	-1.141	13.382
nCOs	Non-Partnered Projects	PARTorN	Non-Partnered Projects	3.855*	1.436	.008	1.475	6.234
			Partnered Projects	-3.855*	1.436	.008	-6.234	-1.475
AvgCOCost	Non-Partnered Projects	PARTorN	Non-Partnered Projects	10346.365	30320.124	.734	-39901.205	60593.935
			Partnered Projects	-10346.365	30320.124	.734	-60593.935	39901.205
COper	Non-Partnered Projects	PARTorN	Non-Partnered Projects	1.401	1.176	.236	-.548	3.351
			Partnered Projects	-1.401	1.176	.236	-3.351	.548

Based on estimated marginal means

*. The mean difference is significant at the .10 level.

^a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Multivariate Tests

	Value	Hypothesis			Sig.	Partial Eta Squared
		F	df	Error df		
Pillai's trace	.098	2.617 ^a	5.000	120.000	.028	.098
Wilks' lambda	.902	2.617 ^a	5.000	120.000	.028	.098
Hotelling's trace	.109	2.617 ^a	5.000	120.000	.028	.098
Roy's largest root	.109	2.617 ^a	5.000	120.000	.028	.098

Each F tests the multivariate effect of PARTorN. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

^a. Exact statistic

Univariate Tests

Dependent Variable		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
CostOver	Contrast	37.671	1	37.671	1.096	.297	.009
	Error	4261.9	124	34.370			
TimeOver	Contrast	917.572	1	917.572	1.951	.165	.015
	Error	58307	124	470.221			
nCOs	Contrast	363.913	1	363.913	7.206	.008	.055
	Error	6262.4	124	50.504			
AvgCOCost	Contrast	3.E+09	1	2.622E+09	.116	.734	.001
	Error	3.E+12	124	2.252E+10			
COper	Contrast	48.107	1	48.107	1.419	.236	.011
	Error	4202.8	124	33.893			

The F tests the effect of PARTorN. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Estimates

Dependent Variable	BldType	Mean	Std. Error	90% Confidence Interval	
				Lower Bound	Upper Bound
CostOver	Bldg. Type 1	3.793 ^a	.622	2.762	4.824
	Bldg. Type 3	3.253 ^a	1.026	1.553	4.952
TimeOver	Bldg. Type 1	19.495 ^a	2.301	15.682	23.308
	Bldg. Type 3	15.177 ^a	3.794	8.890	21.464
nCOs	Bldg. Type 1	13.129 ^a	.754	11.880	14.379
	Bldg. Type 3	11.537 ^a	1.243	9.477	13.597
AvgCOCost	Bldg. Type 1	55043 ^a	15920.526	28659.224	81427.329
	Bldg. Type 3	49048 ^a	26251.603	5543.328	92553.476
COper	Bldg. Type 1	3.986 ^a	.618	2.962	5.009
	Bldg. Type 3	3.566 ^a	1.018	1.878	5.254

^a. Covariates appearing in the model are evaluated at the following values: iCost = 15084863.0882.

Pairwise Comparisons

Dependent Variable	(I) Bldg. Type	(J) Bldg. Type	Mean Difference (I-J)		Std. Error	Sig. ^a	90% Confidence Interval for Difference ^a	
							Lower Bound	Upper Bound
CostOver	Bldg. Type 1	Bldg. Type 1						
		Bldg. Type 3	.541	1.208	.655	-1.461	2.542	
	Bldg. Type 3	Bldg. Type 1	-.541	1.208	.655	-2.542	1.461	
		Bldg. Type 3						
TimeOver	Bldg. Type 1	Bldg. Type 1						
		Bldg. Type 3	4.318	4.468	.336	-3.087	11.723	
	Bldg. Type 3	Bldg. Type 1	-4.318	4.468	.336	-11.723	3.087	
		Bldg. Type 3						
nCOs	Bldg. Type 1	Bldg. Type 1						
		Bldg. Type 3	1.592	1.464	.279	-.835	4.019	
	Bldg. Type 3	Bldg. Type 1	-1.592	1.464	.279	-4.019	.835	
		Bldg. Type 3						
AvgCOCost	Bldg. Type 1	Bldg. Type 1						
		Bldg. Type 3	5994.874	30920.017	.847	-45246.858	57236.607	
	Bldg. Type 3	Bldg. Type 1	-5994.874	30920.017	.847	-57236.607	45246.858	
		Bldg. Type 3						
COper	Bldg. Type 1	Bldg. Type 1						
		Bldg. Type 3	.420	1.200	.727	-1.568	2.408	
	Bldg. Type 3	Bldg. Type 1	-.420	1.200	.727	-2.408	1.568	
		Bldg. Type 3						

Based on estimated marginal means

^a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Multivariate Tests

	Value	F	df	Error df	Sig.	Partial Eta Squared
Pillai's trace	.018	.436 ^a	5.000	120.000	.822	.018
Wilks' lambda	.982	.436 ^a	5.000	120.000	.822	.018
Hotelling's trace	.018	.436 ^a	5.000	120.000	.822	.018
Roy's largest root	.018	.436 ^a	5.000	120.000	.822	.018

Each F tests the multivariate effect of BldType. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Univariate Tests

Dependent Variable		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
CostOver	Contrast	6.882	1	6.882	.200	.655	.002
	Error	4261.9	124	34.370			
TimeOver	Contrast	439.077	1	439.077	.934	.336	.007
	Error	58307	124	470.221			
nCOs	Contrast	59.701	1	59.701	1.182	.279	.009
	Error	6262.4	124	50.504			
AvgCOCost	Contrast	8.E+08	1	846444238	.038	.847	.000
	Error	3.E+12	124	2.252E+10			
COper	Contrast	4.150	1	4.150	.122	.727	.001
	Error	4202.8	124	33.893			

The F tests the effect of BldType. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

3. PARTorN * BldType

Dependent Variable	PARTorN	BldType	Mean	Std. Error	90% Confidence Interval	
					Lower Bound	Upper Bound
CostOver	Non-Partnered	Bldg. Type 1	5.134 ^a	.978	3.514	6.755
		Projects	3.152 ^a	1.436	.772	5.532
	Partnered Projects	Bldg. Type 1	2.452 ^a	.776	1.166	3.738
TimeOver	Non-Partnered	Bldg. Type 3	3.354 ^a	1.436	.973	5.734
		Projects	19.758 ^a	3.617	13.764	25.752
	Partnered Projects	Bldg. Type 1	19.232 ^a	2.871	14.475	23.990
nCOs	Non-Partnered	Bldg. Type 3	21.561 ^a	5.313	12.756	30.365
		Projects	15.282 ^a	1.185	13.318	17.247
	Partnered Projects	Bldg. Type 1	10.976 ^a	.941	9.417	12.535
AvgCOCost	Non-Partnered	Bldg. Type 3	9.836 ^a	1.741	6.950	12.721
		Projects	61601 ^a	25030.161	20120.220	103081.937
	Partnered Projects	Bldg. Type 1	52837 ^a	36759.194	-8081.656	113755.587
COper	Non-Partnered	Bldg. Type 3	48485 ^a	19865.789	15563.194	81407.756
		Projects	45260 ^a	36764.203	-15667.084	106186.762
	Partnered Projects	Bldg. Type 1	5.142 ^a	.971	3.533	6.752
	Non-Partnered	Bldg. Type 3	3.811 ^a	1.426	1.447	6.174
		Projects	2.829 ^a	.771	1.552	4.106
	Partnered Projects	Bldg. Type 1	3.321 ^a	1.426	.957	5.685

a. Covariates appearing in the model are evaluated at the following values: iCost = 15084863.0882.

APPENDIX F

Results of the Mann-Whitney U tests for the effect of partnering and building type on project performance measures.

Descriptive Statistics

	N	Mean	Std.		Minimum	Maximum
			Deviation			
CostOver	25	1.4448	4.57692		-3.45	16.66
TimeOver	24	6.9167	10.76192		-11.00	36.00
nCOs	25	5.80	4.592		1	21
AvgCOCost	25	15313	68210.99		-98540	140563
COper	25	1.48	4.738		-4	17
PARTorN	25	.64	.490		0	1

Ranks

	PARTorN	N	Mean Rank	Sum of
				Ranks
CostOver	Non-Partnered Projects	9	15.56	140.00
	Partnered Projects	16	11.56	185.00
	Total	25		
TimeOver	Non-Partnered Projects	8	10.50	84.00
	Partnered Projects	16	13.50	216.00
	Total	24		
nCOs	Non-Partnered Projects	9	10.67	96.00
	Partnered Projects	16	14.31	229.00
	Total	25		
AvgCOCost	Non-Partnered Projects	9	14.78	133.00
	Partnered Projects	16	12.00	192.00
	Total	25		
COper	Non-Partnered Projects	9	14.78	133.00
	Partnered Projects	16	12.00	192.00
	Total	25		

Test Statistics^b

	CostOver	TimeOver	nCOs	AvgCOCost	COper
Mann-Whitney U	49.000	48.000	51.000	56.000	56.000
Wilcoxon W	185.000	84.000	96.000	192.000	192.000
Z	-1.302	-.999	-1.197	-.906	-.906
Asymp. Sig. (2-tailed)	.193	.318	.231	.365	.365
Exact Sig. [2*(1-tailed Sig.)]	.207 ^a	.350 ^a	.251 ^a	.388 ^a	.388 ^a

a. Not corrected for ties.

b. Grouping Variable: PARTorN

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
CostOver	25	1.4448	4.57692	-3.45	16.66
TimeOver	24	6.9167	10.76192	-11.00	36.00
nCOs	25	5.80	4.592	1	21
AvgCOCost	25	15313	68210.99	-98540	140563
COper	25	1.48	4.738	-4	17
BldType	25	6.48	.510	6	7

Ranks				
	BldType	N	Mean Rank	Sum of Ranks
CostOver	Bldg. Type 6	13	13.38	174.00
	Bldg. Type 7	12	12.58	151.00
	Total	25		
TimeOver	Bldg. Type 6	12	12.67	152.00
	Bldg. Type 7	12	12.33	148.00
	Total	24		
nCOs	Bldg. Type 6	13	13.96	181.50
	Bldg. Type 7	12	11.96	143.50
	Total	25		
AvgCOCost	Bldg. Type 6	13	12.85	167.00
	Bldg. Type 7	12	13.17	158.00
	Total	25		
COper	Bldg. Type 6	13	13.62	177.00
	Bldg. Type 7	12	12.33	148.00
	Total	25		

Test Statistics ^b					
	CostOver	TimeOver	nCOs	AvgCOCost	COper
Mann-Whitney U	73.000	70.000	65.500	76.000	70.000
Wilcoxon W	151.000	148.000	143.500	167.000	148.000
Z	-.272	-.118	-.685	-.109	-.435
Asymp. Sig. (2-tailed)	.786	.906	.493	.913	.663
Exact Sig. [2*(1-tailed Sig.)]	.810 ^a	.932 ^a	.503 ^a	.936 ^a	.689 ^a

a. Not corrected for ties.

b. Grouping Variable: BldType

APPENDIX G

Results of the crosstab tests for claims on partnered/non-partnered project and different building types.

Case Processing Summary

	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
Claims * PARTorN	166	100.0%	0	.0%	166	100.0%
Claims * BldType	166	100.0%	0	.0%	166	100.0%

Crosstab

		PARTorN		Total
		Non-Partnered Projects	Partnered Projects	
Claims No Claim	Count	59	93	152
	Expected Count	66.8	85.2	152.0
	% within PARTorN	80.8%	100.0%	91.6%
Claim	Count	14	0	14
	Expected Count	6.2	7.8	14.0
	% within PARTorN	19.2%	.0%	8.4%
Total	Count	73	93	166
	Expected Count	73.0	93.0	166.0
	% within PARTorN	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	19.478 ^b	1	.000		
Continuity ^a Correction	17.074	1	.000		
Likelihood Ratio	24.663	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	19.361	1	.000		
N of Valid Cases	166				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.16.

Symmetric Measures

		Value	Asymp. Std. Error ^a	Approx. T ^b	Approx. Sig.
Nominal by	Phi	-.343			.000
Nominal	Cramer's V	.343			.000
N of Valid Cases		166			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Crosstab

		BldType				
		Bldg. Type 1	Bldg. Type 3	Bldg. Type 6	Bldg. Type 7	Total
Claims No Claim	Count	91	36	13	12	152
	Expected Count	93.4	35.7	11.9	11.0	152.0
	% within BldType	89.2%	92.3%	100.0%	100.0%	91.6%
Claim	Count	11	3	0	0	14
	Expected Count	8.6	3.3	1.1	1.0	14.0
	% within BldType	10.8%	7.7%	.0%	.0%	8.4%
Total	Count	102	39	13	12	166
	Expected Count	102.0	39.0	13.0	12.0	166.0
	% within BldType	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.060 ^a	3	.382
Continuity Correction			
Likelihood Ratio	5.110	3	.164
Linear-by-Linear Association	2.986	1	.084
N of Valid Cases		166	

a. 3 cells (37.5%) have expected count less than 5. The minimum expected count is 1.01.

VITA

Name: Paul Francis

Address: 422A Langford, Department of Construction Science,
3137 TAMU, Texas A&M University, College Station, Texas

Email: paulfrancis@tamu.edu

Education: M.S., Construction Management, Texas A&M University, 2007
B.Arch., Bangalore University, 2003