DEVELOPMENT OF A BIENNIAL REVIEW PROCEDURE FOR UPDATING

LIQUIDATED DAMAGE RATES USED IN CONSTRUCTION CONTRACTS

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Clark Bradford Bailey

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# DEVELOPMENT OF A BIENNIAL REVIEW PROCEDURE FOR UPDATING LIQUIDATED DAMAGE RATES USED IN CONSTRUCTION CONTRACTS

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# VITA

Clark Bradford Bailey son of A. Bradford Bailey and Gail C. Bailey was born on December 2, 1982 in Auburn, Alabama. He graduated from Cottage Hill Christian Academy in Mobile, Alabama in 2001. Upon graduation, he attended Auburn University and graduated in 2006 with a Bachelors of Civil Engineering. He married Katherine M. Manifold daughter of Jack D. and Melissa Manifold on May 14, 2005. In May 2006 he entered the Graduate School at Auburn University to pursue a Master of Science degree in Civil Engineering.

THESIS ABSTRACT

DEVELOPMENT OF A BIENNIAL REVIEW PROCEDURE FOR UPDATING LIQUIDATED DAMAGE RATES USED IN CONSTRUCTION CONTRACTS

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This research effort sought to develop statistically justifiable means for developing a schedule of liquidated damage (LD) rates to be adopted by the Alabama Department of Transportation (ALDOT). The procedure outlined is to be used biennially to update the LD rates found in ALDOTs standard specifications for highway construction contracts, since their current schedule and review procedure has come under legal scrutiny. After a review of pertinent literature on the subject, it was determined that there was lack of documentation concerning State Highway Agencies (SHAs) use of LDs. As a result, an electronic survey was created and sent out to all SHAs to determine the state-of-the-practice regarding the use of LDs by SHAs in construction contracts. This survey

experienced a 100% response rate. Using the knowledge obtained from the survey, two statistically justifiable methodologies were developed to calculate LD rates using historical project cost accounting data: i.) a traditional LDs provision based on FHWA guidelines with the LD rates stipulated in a table as a function of the contract value, and ii.) a more complex table in which the LDs rates are categorized by contract value as well as by project type (i.e. bridge, road, building, etc.). These methods were then compared to the current ALDOT procedure. The first methodology which stipulates LD rates in a table by contract value was determined to be the most robust method. The project type method successfully stipulated LDs by both contract value and project type, but assumptions had to be made concerning the project type designations in the historical project data, introducing bias to the procedure weakening its objectivity. The final product of this research effort is a set of stepwise guidelines for practitioners to utilize on a biennially basis to update their schedule of LD rates. Future research stemming from this effort could develop a standardized method for determining LDs on a project specific basis allowing for the incorporation of road user costs; and a more detailed policy for the FHWA to use in providing guidance to SHAs in development of their LDs policy.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

# CHAPTER ONE

# INTRODUCTION

## 1.1 BACKGROUND

Contract time is an essential element in construction contracts, and a contracting agency must ensure the work is completed accordingly. Through administering a contract the contracting agency incurs costs associated with engineering, inspection, and supervision of the work being performed. If the work extends beyond the allotted contract time the owner will endure additional administrative costs that were not anticipated at the time of contract formation. Failure to meet a contract completion date constitutes a breach of contract that entitles the contracting agency to incurred damages (Allen, 1995). The contracting agency may be in a legal position to recover damages and additional costs, from the contractor, associated with late completion. A liquidated damages (LDs) clause may be stipulated in the contract to avoid the litigation related to the recovery of actual damages caused by a delay.

## 1.2 LIQUIDATED DAMAGES

Several activities may occur on construction projects to delay any given activity or the overall project. These delays increase both the contract completion time and the costs for many parties involved. A contractor is only liable for the time and costs associated with a non-excusable delay. A *non-excusable* delay is caused by the contractor or its

subcontractor that affects the project completion and additional time is not granted by the owner. In the case of a non-excusable delay, the contactor assumes the risk of cost and consequences; not only his own but possibly of all the parties involved as well. Non-excusable delays may be due to subcontractor's actions, inadequate supervision, failure to provide materials and equipments on time, and so forth. These non-excusable delays may constitute a breach of contract by the contractor and can result in termination of the contract (Bramble & Callahan, 1987).

LDs are a daily monetary rate stipulated in a contract to compensate the owning agency for additional costs incurred as a result of a project extending beyond its completion date due to a non-excusable delay. LDs must be based upon a reasonable forecast of loss of actual damages to the owning agency if the project is not completed on time. The purpose and intent of the LDs clause is to compensate the owning agency for loss of revenue and additional cost associated with the late completion, and not "financial castigation" of the contractor for breach of contract. Subsequently, a contractor has the option to extend a project beyond a completion date by reimbursing the owner through LDs. Historically, LDs that are disproportional to actual damages have been deemed as a penalty and unenforceable by the court of law (Jensen, 2000).

The calculation associated with computing LD rates may include additional costs associated with lost revenue, rental value, user costs, engineering and inspection, administrative costs, additional wages, and overhead fees. However, costs related to the impact on follow-on contracts are generally not considered. A follow-on contract is one that relies on the completion of a previous contract in order to begin; therefore, if the

preceding contract is delayed it will result in the delay of any succeeding (i.e. follow-on) contract. Typically, LDs are calculated at the time of contract formation and are included as a provision in the contract. According to Thomas et al. (1995), a LDs provision is a less expensive and time saving option than proving actual damages in court.

In the United States, it is the responsibility of each State Highway Agency (SHA) to build and maintain the transportation infrastructure in that state. The Federal Highway Administration (FHWA) distributes the majority of the funds associated with this construction. As a result, the FHWA places many requirements on SHAs for the way they develop contracts associated with Federal-aid projects. One such requirement is the incorporation of a LDs clause into the contract. As a minimum, the liquidated damage (LD) rate stipulated as a contract provision to recover damages attributable to contract schedule overrun must include the SHA's average daily construction engineering costs (23 CFR 635.127).

## 1.3 RESEARCH OBJECTIVES

The focus of this research project is to review and evaluate the Alabama Department of Transportation (ALDOT) current LDs provision used in construction contracts. ALDOT's existing LDs rates *(§108.10 and 108.11*) (ALDOT Specs, 2002) are outdated and have come under legal scrutiny. A need exists for the development of a statistically justifiable means of establishing appropriate LD rates to prepare for the possibility of future litigations. As a result, the primary goal of this research is to develop such a methodology for calculating LD rates to be included in ALDOT's standard specifications for highway construction that represent an accurate estimate of actual damages and are

justifiable in court. To develop an accurate methodology, two methods for calculating LDs using historical project cost accounting data were investigated: i.) a traditional LDs provision based on FHWA guidelines with the rates stipulated in a table as a function of the contract value, and ii.) a more complex table in which the LDs rates are categorized by contract value as well as by project type (i.e. bridge, road, building, etc.). The first step in developing the methodologies is to determine if this was an ALDOT specific problem or a problem being experienced nationwide. This would be accomplished by conducting a review of the current state-of-the-practice of SHAs' experiences with LD provisions in construction contracts through an online survey, polling each SHA on their LD practices.

The specific objectives of this research are as follows:

1. Administer a survey to determine the state-of-the-practice of SHAs' use of LD clauses.

2. Develop two methodologies to compute LDs that are statistically justifiable and entirely objective.

3. Compare the two methodologies to the current ALDOT method to identify the most appropriate method for computing LDs.

4. Develop guidelines for practitioners to use for updating LDs on a biennial basis.

The specific tasks to satisfy the abovementioned research objectives are as follows:

1. Identify, describe, evaluate, and critically assess pertinent literature on the use, applicability, and enforceability issues along with lessons learned with respect to LDs provisions in construction contracts.

2. Conduct a survey of other SHAs to determine the current provisions and policies utilized by SHAs nationwide, concerning the use and experiences with LDs on construction contracts, and determine the state-of-the-practice regarding LDs provisions on a national scale.

3. Acquire historical ALDOT specific accounting data (i.e. engineering and inspection costs) for completed projects, and additional data on the type of work the project encompassed.

4. Analyze the collected data and develop methodologies to determine LD rates and determine which methodology more accurately models the actual damages experienced.

5. Develop guidelines for applying the selected methodology, as well as, clear instructions on how to update the LDs rate on a biennial basis.

6. Provide future recommendations for the inclusion and calculations of additional costs in LD rates (i.e. road user costs), and revisions to the current FHWA guidelines.

## 1.4 ORGANIZATION OF THESIS

This thesis is divided into five chapters that organize, illustrate, and describe the steps taken to meet the defined research objectives throughout the duration of this project. Immediately following this chapter, Chapter 2: *Literature Review*, summarizes the body of knowledge pertaining to this study and synthesizes previous research efforts. The focus of the literature review is centered on the federal regulations governing SHAs' application of LD provisions, the application of LDs in the State of Alabama, the current body of knowledge concerning the development, implementation, and enforcement of LDs, and the current legal precedence of LDs set forth by court rulings throughout the nation and abroad. Chapter 3: *Survey Deployment and Procedures*, outlines the steps taken to develop and administer an online survey of SHAs' LDs practices. The information obtained from the survey is discussed to determine and synthesize best practices used among SHAs. Chapter 4: *Data Collection and Analysis*, discussed the effort in obtaining historical project data from ALDOT, the organization of this data, and the statistical analyses used to analyze this data. Chapter 5: *LDs Methodology Development and Guidelines*, describes ALDOT's current methodology for developing LDs and two objective and justifiable methods for determining LDs using the project data obtained from ALDOT. Finally, Chapter 6: *Conclusions and Recommendations*, provides input as to the best methodology for use by ALDOT to calculate future LD rates. Additionally, this chapter identifies the potential for further research that can be conducted to continue this research effort.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 INTRODUCTION

A contractor's timely performance in the construction arena is of essential importance on both public and private projects to an owner. When a contractor caused delay occurs, and the project extends beyond the specified contract completion date, the owning agency suffers damages associated with loss of revenue as well as additional administrative, engineering and inspection costs. The contractual mechanism of damage liquidation is used by owners in dealing with the event of inexcusable contractor delay in order to recover costs attributed to contract schedule overrun. An effective LDs clause will offer an estimate of damages that closely resembles actual damages. If a court finds that the LDs rate represents an arbitrary or unreasonable approximation of damages the courts will strike it down, deeming it a penalty and unenforceable.

In order to satisfy the research objectives identified in Section 1.3, the first critical task involved conducting a thorough literature review of several pertinent subjects. The literature review focused on examining: i.) the federal regulations governing how SHAs implement LDs within their construction contracts, ii.) the status of LDs in the state of Alabama, iii.) a summary of past court cases involving the application of LDs in contracts, and iv.) the existing body of knowledge concerning the development,

implementation, and enforcement of LDs. Each of these individual topics will be covered in more depth in subsequent sections.

## 2.2 FEDERAL REGULATION (23 CFR 635.127)

The FHWA provides SHAs with guidance on developing LD rates. In federal regulation 23 CFR 635.127, liquidated damages are defined as,

> "The daily amount set forth in the contract to be deducted from the contract price to cover additional costs incurred by a state transportation department because of contractor's failure to complete the contract work within the number of calendar days or workdays specified. The term may also mean total of all daily amounts deducted under the terms of a particular contract." (23 CFR 635.127)

This federal regulation requires each SHA to establish LD rates for projects contracted in that state. States may develop their rates either on a project specific basis or in the form of a table or schedule broken down for a range of project costs and/or project types. These rates, as a minimum should cover the estimated average daily construction engineering (CE) costs associated with the type and size of work encountered on the project.

SHAs are required to have their LD rates approved by the FHWA. Project specific rates must be approved on a project-by-project basis. In developing or maintaining their rates for a table or schedule, SHAs are required to review their rates on a minimum of every two years; rates are to be updated, when deemed necessary. This biennial evaluation requires the SHA to verify that their LD rates closely approximate the actual average daily CE costs and submit these findings to FHWA for review.

SHAs may include additional amounts in LDs to cover the anticipated costs associated with project-related delays that result in inconveniences to either the SHAs or the public. (e.g. road-user costs, cost of retaining detours for an extended time, etc.). The federal regulation permits the use of an incentive/disincentive (I/D) provision for early completion concurrently with the LD rates as long as they are assessed separately. I/Ds differ from LDs in that they offer an motivation for early completion as well as a penalty for late completion. The I/D rate does not necessarily have to be justifiable, but it must have an equal incentive offered for early completion. In contrast, a LDs provision must be presented in justifiable, non-arbitrary amounts.

## 2.3 LIQUIDATED DAMAGES IN THE STATE OF ALABAMA

The ALDOT Standard Specifications for Highway Construction, 2002 edition, contains the following LDs provision (*§108.10*) and a schedule of LDs (*§108.11*) based on a range of contract dollar amounts as shown in Figure 2.1.

The current rates being used by ALDOT for the assessment of LDs (*§108.10 and 108.11*) are outdated. These LDs rates have been challenged in the court in the recent past, and the Alabama courts have been ruling in favor of the contractor, deeming ALDOT's LD rates arbitrary and thus unenforceable. Therefore, a need exists for a detailed investigation and analysis of the LD rates utilized by ALDOT in construction contracts. Furthermore, the need for development of a statistically justifiable means for calculating LD rates in Alabama exists as well. This methodology must be robust enough to stand up to the scrutiny of the courts. In Alabama, legal precedence has established that LD provisions are ruled unenforceable unless ALDOT can prove that: i.) the damages

incurred, caused by a breach of nonperformance are difficult or impossible to accurately estimate, ii.) the intentions of the contracting parties was to provide for damages rather than a penalty, and iii.) the LDs amount stipulated is a reasonable pre-estimate of the probable anticipated loss determined during contract formation. The Alabama courts look to see if the stipulated sum bears a rational relationship to the injury.

**"§108.10 Failure to Complete Work Within Contract Time.**
Should the Contractor, or in case of default, the surety, fail to complete the work within the time stipulated in the contract or the adjusted time as granted under the provisions of Article 108.09, a deduction for each calendar day or work day that any work shall remain uncompleted, an amount indicated by the Liquidated Damages Schedule shown in Article 108.11 or provided in the contract documents shall be deducted from any monies due to the Contractor on monthly estimates. Any adjustments due to approved time extensions or overruns in the contract amount will be made on the monthly, semi-final or final estimate as may be appropriate.

Liquidated damages assessed as provided in these Specifications is not a penalty, but is intended to compensate the State for increased time in administering the contract, supervision, inspection and engineering, particularly that engineering and inspection which requires maintaining normal field project engineering forces for a longer time on any construction operation or phase than originally contemplated when the contract period was agreed upon in the contract.

Permitting the Contractor to continue and finish the work or any part of it after the time fixed for its completion, or after the date to which the time for completion may be extended, will in no way operate as a wavier on the part of the Department of any of its rights under contract.

**§108.11 Schedule of Liquidated Damages.**

| Original Contract Amount | | Liquidated Damages Daily Charge | |
|---|---|---|---|
| More Than | To and including | Calendar Day or Fixed Date | Work Day |
| $ 0 | $ 100,000 | $ 120 | $ 200 |
| 100,000 | 200,000 | 180 | 300 |
| 200,000 | 500,000 | 300 | 500 |
| 500,000 | 1,000,000 | 480 | 800 |
| 1,000,000 | 2,000,000 | 660 | 1,100 |
| 2,000,000 | 5,000,000 | 840 | 1,400 |
| 5,000,000 | 10,000,000 | 1,020 | 1,700 |
| 10,000,000 | - - - - - - - | 1,200 | 2,000 |

When the contract time is on the calendar day or date basis, the schedule for calendar days shall be used. When the contract time is on a work day basis, the schedule for work days shall be used."

**Figure 2.1 LDs Provision in ALDOT's Standard Specifications.**

## 2.4 TYPES OF DELAY

Construction delays are categorized as i.) non-excusable, ii.) compensable, and iii.) excusable. As mentioned in section 1.2, non-excusable delays result from a contractors untimely performance. A *compensable delay* is the delay caused by the owner or its representative in which additional time and costs should be granted to the contractor to complete the project. For example, design related delays are caused by the Architect/Engineer who acts as an owner's representative. For compensable delays, the contractor is typically entitled to a time extension and damages for additional cost incurred due to the delay (Kraiem, 1987). An *excusable delay* is defined as the delay caused by the factors beyond the control of the contractor or owner. Delays caused due to severe weather, labor disputes, acts of God, war, and so forth are classified as excusable delays since these delays excuse the contractor from meeting a contract completion date (Bramble & Callahan, 1987). Thus, in the event of excusable delay, additional time is granted to the contractor.

Concurrent delays involve a combination of any of the three above cases. In the event of a concurrent delay, care must be taken in order to fairly determine the amount of time to extend the contract as well as the amount of time in which damages are applicable. For instance, if concurrent delays occur where both the owner (compensable delays) and contractor (non-excusable delays) are responsible for delays in completing the work, there are two different approaches to resolve the issue. In the first, less complicated resolution, LDs are not allowed; instead the court settles on providing a time extension to the contractor, extending the contract completion date. The second resolution involves

the apportionment of LDs. It is crucial for records to explicitly establish the extent of fault attributable to each party involved in the delay (Kraiem and Diekmann, 1987).

## 2.5 CALCULATING LDs

Allen (1995) compared methods of calculating LDs rates for the Boston Harbor Project, and the Central Artery/Third Harbor Tunnel Project (CA/T). Each of these projects were composed of multiple contracts being carried out simultaneously. For the Boston Harbor Project, the Massachusetts Water Resources Authority (MWRA) used a linear function that applied engineering & inspection (E&I) costs based on contract amount and duration. It did not take into consideration the interdependence between a contractor's performance, the nature of contract work, and schedule logic. For example, inspection costs on complicated work would be more than inspection costs accrued during common construction. Also, longer duration contracts may require more daily expenses than the shorter duration contracts of equal cost. As a result, MWRA's method used for calculating LDs was challenged in court. However, the case was settled before trial leaving these issues unanswered.

For CA/T, the Massachusetts Highway Department (MHD) determined LDs rates on a case-by-case basis. MHD reviewed the scope of each individual contract with respect to entire project schedule, extent of additional costs that would be required if the project is delayed, costs associated with permits, licenses, fees, and impact of delayed milestones or contract completion on other contractors. By adjusting historical data for the probability of affecting other works as well as individual estimates of E&I costs, MHD computed LDs for each individual contract. MHD also took into consideration project

postponement and the cost of financing the project by applying cost escalation factors. MHD's systematic analysis of impacts on a contract-by-contract basis eliminates chances of LDs being challenged in the court (Allen, 1995).

McCormick (2003) studied past legal cases involving LDs, identified common "pitfalls", and proposed guidelines for formation and calculation of LDs. The author states that if the damages are difficult to measure, the owner should assess LDs and if damages are easy to measure, the owner should assess actual damages. In the event LDs are ruled unenforceable, the owner can always pursue actual damages. Along with LDs, I/D provisions may be incorporated in the contract. When intentions of the owner are explicitly stated in the contract along with the method of calculation, I/D provisions are enforceable. However, the author maintains that the safest and infallible method is to provide a LDs clause without incorporating actual or I/D provisions.

Multi-prime projects are typically large projects consisting of multiple contracts. Many of these contracts, called follow-on contracts, are dependent on the completion of a previous contract in order to proceed. According to McCormick (2003), forming a LDs clause for multi-prime projects requires the development of a proper schedule for project completion that shows the interrelationships of follow-on contracts within the same project, as well as third party projects that are dependent upon the particular project under consideration. Excluding these items would make proving the reasonableness of the LDs a difficult task. For a LDs clause to be enforceable, the contract should clearly define the owner's intention, interim milestones, substantial/final completion, and document all the calculations along with assumptions. If specified in the contract, LDs may be assessed

for delay in reaching intermediate milestones, substantial completion, and final completion (Thomas et al., 1995). In such cases, LDs may accrue across more than one missed milestone and through to completion (Allen, 1995). LDs and milestones formulated after the award of the contract are enforceable if there is a bilateral agreement between the owner and the contractor. In addition, in order to be enforceable, the LDs calculated should be based on a realistic perception of damages at the time of contract formation and have no tie to actual damages. The author believes that since the owner has the right to assess anticipatory LDs, he should take a proactive role in enforcing the LDs provision. If a contractor is terminated before the project completion and the owner has not retained any money for anticipatory LDs, the bonding company takes over. Since the bonding company has now become responsible for any LDs incurred, if a milestone is not met, they can file a claim against the owner for not protecting their interest under the bonding program (McCormick, 2003).

Leon et al., (1993), examined LD estimating methods and their application to multiple-prime contractor projects. According to the authors, if more than one milestone is used in the LDs provision, upon breach of each milestone the contract should clearly define the impact of each LDs on both, the successive milestone, and entire project completion. The impacted contractor has no accountability for the delay caused by the preceding contractor and LDs should be transferred to the contractor who caused the impact. The authors used historic data that consisted of 14 projects in the range of $1.2 million to $194 million, completed between 1984 and 1994, to create a method for estimating time-dependent jobsite cost per diem. The following formula was utilized to calculate time-dependent jobsite cost per diem:

$$L = CV * l / u \quad (2.1)$$

where,

*L* = the time-dependent jobsite cost per diem for desired contract value ($ per calendar day),

*CV* = contract value in millions of dollars,

*l* = the time-dependent jobsite cost per diem (based on historical data of above mentioned project), and

*u* = the unit on which *l* is based in millions of dollars.

The authors utilized the Eichleay formula (described below) to calculate office overheads for impacted contracts and statistical methods, like the normal distribution, to determine the probability of impacted delay. They applied these techniques to the CA/T project, which was ongoing at the time the study was conducted, to determine level of LDs for about 20 contracts awarded through 1992. They concluded that, with the exception of one contract, the LDs rate for substantial completion was directly related to both the size of the contract and size of interfaces with other contracts.

### 2.5.1 Eichleay Formula

While bidding for a project, contractors take into consideration both job site overhead and home office overhead. Extended home office overhead are the costs incurred after the original contract completion date incurred as a result of compensable delays. When delay occurs on a particular project, that project ceases to contribute in paying for overheads. Since overhead costs are assigned to all the projects and cannot be tied to a specific

project, these are difficult to estimate. The Eichleay formula is one of the techniques that a contractor may employ to calculate extended overheads allocable to a particular project.

The Eichleay formula was first adopted in 1960 by the Armed Services Board of Contract Appeals to determine a contractor's unabsorbed home office overhead costs. Overhead includes the cost of running the home office as well as job site office. "The Eichleay formula creates a per diem rate for overheads attributable to a single project, multiplying that rate by the number of days of delay to arrive at a total home office overhead award" (Sweet & Schneier, 2004).

Before employing the Eichleay formula to calculate these damages, the contractor must prove that: i.) the owning agency caused the delay, ii.) the contractor was on partial or complete suspension of work, and iii.) their inability to take on another project was directly affected due to the uncertainty of the delay duration. The basic Eichleay formula is usually applied at project completion. The damage is calculated as follows:

1. *Allocable Overhead:* this step calculates the portion of home office overhead that should be allocated to the particular project under consideration. It is calculated as:

$$O_P = \frac{B_P}{B_T} \times O_T \tag{2.2}$$

Where,

$O_P$ = project's allocable overhead,

$B_P$ = total contract billings,

$B_T$ = total company billings, and

$O_T$ = total home office overhead.

2. *Daily Allocable Overhead:* this step determines the daily rate for the allocation of home office overhead as follows:

$$B = O_P / D \tag{2.3}$$

Where,

$B$ = daily allocable overhead rate,

$O_P$ = project's allocable home office overhead, and

$D$ = number of days of contract performance including delay days.

3. *Home Office Overhead Damages:* this step computes the home office overhead damages by simply multiplying daily allocable rate calculated in step two by the number of compensable delay days.

$$B \times d = E \tag{2.4}$$

Where,

$B$ = daily allocable overhead rate,

$d$ = number of days of compensable delay, and

$E$ = home office overhead damages or amount recoverable.

The Eichleay formula is one of the methods used to calculate unabsorbed home office overheads in public construction delay cases. Some courts demand actual evidence of extended overheads and do not allow the use of a formula while other courts recognize

difficulties of proving actual losses and encourage the use of the formula. Though not perfect, the Eichleay formula provides a rough estimate of a difficult to establish loss (Sweet & Schneier, 2004).

### 2.5.2 Validity of LDs

In ascertaining the validity of LDs provisions, the US courts apply a "three-pronged test". The three-pronged test includes: i.) the intent test, ii.) the difficulty test, and iii.) the reasonable test (Jensen, 2000). The *intent test* determines whether at the time of contract, the contracting parties had intentions to liquidate damages that are likely to occur in the event of late completion of the project. The intent test reviews the actions, words, and circumstances of contracting parties during the contract formation (Jensen, 2000). Thus, contractual provisions should clearly define the assessment period, specific start and end dates, whether assessment is for workdays or calendar days, and if weekends and holidays are included. If the intent of the clause is to prevent a breach or to secure full performance by the contractor, the clause is deemed to be a penalty (Thomas et al., 1995).

The *difficulty test* ascertains the degree of difficulty involved in developing an accurate pre-estimation of anticipated future damages. For the courts, the more improbable the calculation of the damages is to determine in advance, the more valid the LDs clause becomes. On the other hand, the less difficult the value of actual damages are to estimate, the more likely the court will be to interpret the LDs clause a penalty and thus deem it invalid (Jensen, 2000). Thomas et al. (1995) describes how difficulty in pre-estimating damages was discussed in City of Fargo, ND v. Case Development Company,

401 N.W.2d 529 (1987). In 1984, Case agreed to develop a city-owned building into an office complex for the city of Fargo. Later, Case abandoned the project for financial reasons. The city assessed LDs of $100,000 per the contract for delaying the project. This was challenged in court by Case. The court found that the benefits to the public and the monetary loss to the city were impossible to determine at the time of the contract. Therefore the court upheld the LDs clause (Thomas et al., 1995).

The *reasonable test* compares the LDs rates charged to the contractor with the actual damages incurred by the owner. If the difference is significant, the court will likely deem the LDs clause a penalty and not enforceable (Jensen, 2000). A penalty is a specified monetary amount that is disproportional to the actual damages incurred by the owning agency. It is meant to compel contractual performance by the contractor or to enrich the owning agency beyond compensation (Jensen, 2000; Thomas et al., 1995).

If challenged, the owning agency must demonstrate how the forecast of actual damages was estimated. Lack of proper documentation may indicate that LDs were arbitrarily determined (Allen, 1995). Usually, courts do not require evidence of actual damages while evaluating a LDs clause. Whether the actual damages did or did not occur does not prevent recovery of damages. By entering into the contract, each party takes a calculated risk and agrees that a reasonable LD provision will be substituted for any and all damages incurred (Thomas et al., 1995).

Jensen (2000) conducted a quantitative study to measure the application preference and time of preference for the intent test applied by the appellate courts in order to ascertain the validity of LDs clause. This research employed statistical methods such as chi-square

test and Stuart-Cox sign test to analyze court rulings dating from 1853 to 1991. The study concluded that when the courts apply the intent test to determine the validity of the LDs provision in a construction contract, the preferred application time period is the time of contract formation and not the time of trial.

Thomas et al. (1995) examined more than 80 appellate decisions and identified the primary inquiries made by the court to resolve disputes over LDs. The issues they identified were the: i.) review of LDs clause in the contract, ii.) intention of the owner, iii.) the level of difficulty in predicting actual damages, and iv.) reasonability of the specified LDs rate. To verify the validity of these issues, the authors studied 10 appellate court cases since 1965 and inferred that the reasonable test was the deciding factor in most of the cases. The reasonable test ensures that specified LDs were a reasonable estimate of potential damages. The authors also maintain that the intent test helps in differentiating LDs from penalties and traditionally, courts consider the time of contract formation and not the time after the breach.

Scott et al. (2006) examined the use of LDs as an embedded option in contracts. When LDs are viewed as compensation and not a penalty, as intended, non-excusable delay becomes a contract option. The contractor may find that incurring the additional cost of LDs allows him a benefit. For instance, by directing a work force to an alternative job, a contractor may accumulate LDs on the first job, but the incentive to complete the alternative job may be higher than the LD charges incurred on the first job.

## 2.6 COURT CASES

### 2.6.1 State of Alabama Highway Dept. v. Milton Construction Company, Inc.

In this case Milton Construction Company, Inc. brought suit against the State and the Highway Department of Alabama in August of 1991 on the basis that LDs charges it had accrued were unenforceable due to them being a penalty. Milton Construction was contracted by the state to widen and repair a portion of Interstate 65 in Jefferson County for concrete pavement rehabilitation, as well as, an addition of median lanes to a portion of Interstate 59 in Jefferson County. The two contracts contained identical I/D and LDs clauses, therefore the contracts were tried as one. The I-65 contract was for $7,745,320.29 and the I-59 was $4,399,883.25. The disputed amounts that were withheld by the Highway Department are $300,000 and $240,000 for the I-65 and I-59 projects, respectively. The case originated in the Circuit Court, Montgomery County, No. CV-89-1192, in which the judge, H. Randall Thomas, ruled in favor of the defendant, the State; the plaintiff appealed. The appeal reached the Supreme Court of Alabama which held that the clause in the contract for disincentive payments for projects not completed by the deadline was void and unenforceable as a penalty. It was determined that the disincentive portion sought to recover costs already recovered by the LDs provision. In further proceedings the court denied the Highway Department a recovery of user costs and ordered the Highway Department to pay the money withheld. (Milton, 1991)

### 2.6.2 Williams Construction Co., Inc. v. Maryland State Highway Administration

The Maryland SHA contracted Williams Construction to build a portion of I-97. The project consisted of a six-lane divided freeway, as well as the grading, paving, drainage, lighting, signing, reconstruction of ramps and intersections, traffic management, and

sediment and erosion control associated with the project. The contract was awarded in 1994 for $11,149,787.89. The contract stipulated the project was to be completed by October 31, 1995, this was later extended to December 6, 1995, and it advised the contractor of LDs of $2,630 per calendar day over. The project extended beyond this date; as a result, the contractor was responsible for 134 days of delay equaling $352,420 in LDs. Williams Construction filed an appeal with the State of Maryland Board of Contract Appeal contesting that the LD rate was unreasonable. The court found that the rate was reasonable since, the parties agreed to the rate at the time of contract formation and the rate was determined using a process and guidelines that the SHA had been following for 20 years without objection. The $2,630 rate was stipulated in the SHA's standard specification for contracts between $11 million and $14 million. The LD rate was based on two components: i.) the cost to the SHA for the work of its inspectors and ii.) the cost to the SHA for its administrative expenses (i.e. overhead). The costs on which the monetary amount was based were actual historical costs. The guidelines used for the calculation of this LDs rate had been updated one year before the contract formation (Williams, 2001).

### 2.6.3 Melwood Construction Corp. v. State of New York

Melwood Construction Corporation contracted with the State of New York on May 10, 1977 for the rehabilitation of four bridge structures. The contract stipulated that the contractor must complete the project by April 1, 1978, however Melwood did not finish the project until December 20, 1978 resulting in $55,500 in LDs accumulated at a rate of $500 per day. The State acknowledged that the LDs were not intended to compensate the government, but "were intended solely as a compensation for the inconvenience to the

public" (Melwood, 1984). As a result, Melwood claimed that injury suffered by the public did not constitute actual damages to the State; therefore, the LDs were an unenforceable penalty and must be struck down. The court found that since the government is a trustee of its citizens, it may impose LDs to compensate for actual damages imposed to the public by a contractor's delay.

### 2.6.4 Pennsylvania, DOT v. Interstate Contractors Supply Co.

In this case the Commonwealth Court of Pennsylvania reversed a decision in favor of Interstate Contractors Supply Company that claimed the LDs imposed by the Department constituted a penalty. The case stemmed from a contract between the two parties originating on February 24, 1986 for the painting and cleaning of six county bridges. PennDOT imposed LDs for overdue work amounting to $8,600. The Board of Claims originally ruled that the LDs were not a probable estimate of damages, but were a form of punishment meant to prevent a breach. They cited that the State would not show actual damages incurred or express dissatisfaction in the work performed. The Commonwealth found that the Board erred in implementing the law. It cited that there was no requirement for State to show actual damages or for LDs to be based on dissatisfaction in order to administer LDs. As a result the original ruling was reversed in favor of the State. (PennDOT, 1990)

### 2.6.5 Kingston Contractors, Inc. v. Washington Metro. Area Transit Authority

Kingston Contractors entered into a contract with Washington Metropolitan Area Transit Authority (WMATA) for removal, destruction, and replacement of electrical transformers. The contract stipulated LDs of $1,000 per day for the late completion.

WMATA found that the newly installed transformers were defective and required the contractor to redesign them. Because of design issues and rejection of the transformers, the project was delayed and WMATA assessed LDs. Kingston Contractors filed an appeal with the Corps of Engineering Board of Contract Appeals. The board found that LDs included Environmental Protection Agency (EPA) penalties that would not be assessed against the project under consideration and therefore the board reduced LDs to $500 per day (Loulakis et al., 1997).

Although the board reduced the LDs rate, Kingston contractors appealed to the District court for District of Columbia. The court found that since the original LDs provision was unreasonable, the LDs clause must be stricken as an unenforceable penalty. Therefore, the new $500 per day rate was deemed unenforceable because the LDs clause had already been determined unenforceable and must be struck down in its entirety (Loulakis et al., 1997).

### 2.6.6 Pete Vicari General Contractors, Inc. vs. Naval Facilities Engineering

Pete Vicari General Contractor was awarded the contract for construction of two buildings and renovation of an existing building at a naval air station. The project had three phases: (A) site work, (B) construction of two buildings, and (C) renovation. Each phase had a phase specific LDs rate. All the three phases were granted time extensions. Even after these time extensions, Phase A was delayed by 62 days, phase B by 32 days and phase C by 0 days. Thus, the entire project was completed with the delay of 34 days (after granting time extensions). The LDs clause in the contract clearly stated that

extensions did not waive the government's right to assess LDs for the delay in completion of the immediately preceding phase (Pete, 2001).

The government assessed the LDs of $200 per calendar day for Phase A ($12,400) and $2,113 per calendar day for Phase B ($67,616). Pete Vicari General Contractors filed an appeal with the Armed Services Board of Contract Appeals for complete recovery of LDs for Phase B. The contractor argued that: i.) LDs can be assessed only for the delay in overall project completion and no LDs are due for the late completion of Phase B; ii.) the overall delay was only 34 days. Furthermore, the contractor claimed that the LDs rate of $2,113 for Phase B was unreasonable and any delay in completion of Phase B would have been caused by delay in completion of Phase A and no delay in completion of Phase C (since it was the renovation of an existing building). Since the government had already withheld LDs for Phase A, the contractor demanded release of LDs for Phase B. Because the contractor could not provide evidence that, the LDs rate for Phase B was unreasonable and since the LDs clause was well defined and documented by the government, the contractor's claim was denied (Pete, 2001).

### 2.6.7 Leighton Contractors Pvt. Ltd vs. State of Tasmania (Australia)

Leighton Contractors were selected to design, construct, and maintain a new highway in Tasmania in Australia for ten years. A dispute arose when the state maintained that the design documents were not in accordance with the contract and directed Leighton to redesign the highway. Leighton proceeded to construct the highway accordingly, however, claimed it was entitled to a change order and time extension. The state rejected Leighton's claim and assessed LDs for late completion. A LDs rate for late completion

in Australian currency was $8,000 per day that was comprised of the state's additional E&I costs. The court found the estimate of daily charges for some of the personnel was extremely high and speculative. The court noted that the LDs were calculated for each calendar day while additional costs were only incurred by the state on six days of the week. The court also considered the fact that the state was claiming for only additional inspection costs and not for loss of revenue and public money each day as a result of the delay. Therefore, the Court concluded that the LDs rate was totally disproportionate to the anticipated actual damages and deemed to be a penalty (Jaques, 2004).

### 2.6.8 McAlpine vs. Tilebox Ltd. (UK)

Tilebox Ltd. awarded a building contract to McAlpine. The contract stipulated LDs of £45,000 (pounds) per week for the late completion. The LDs rate was negotiated with McAlpine and was based on minimum weekly rental value of the completed building. The project was delayed and McAlpine filed an appeal. In 2005, The judge maintained that "there had to be a substantial discrepancy between the level of damages stipulated and the level of damages likely to be suffered, before the stipulated LDs would become unreasonable (Rose, 2005)." At the time of contract formation, Tilebox's foreseeable weekly losses arising from the late completion were greater than £45,000 (pounds) a week. Therefore the court ruled that the LDs were a reasonable pre-estimate of actual damages and were enforceable. The Court drew support from the fact that the amount of LDs had survived scrutiny by both parties during contract negotiations. The court did not consider the fact that the actual loss suffered was less than the estimated damages since the discrepancy was not significant that it demonstrated the sum could not have been a

genuine pre-estimate of the likely loss. Therefore, it is wise to retain evidence demonstrating how LDs were calculated along with proof of negotiations, if any.

## 2.7 SUMMARY

In order to create a robust LDs provision it is clear that the "three-pronged test" should be applied to verify the intent, difficulty, and reasonableness of the LDs clause. Furthermore, in the event of litigation, the provision needs to have documentation that shows that the LDs rates are calculated and are not arbitrary. From the abovementioned review, it is evident that significant amounts of research have been conducted regarding the enforceability of LDs, however there is lack of research on LD practices used by SHAs and the methodologies used to compute LD rates. Therefore, an objective of this research is to review the current state-of-the-practice regarding SHAs computational procedures and assessments of LDs, and recommend best practices used by SHA to develop guidelines for practitioners to follow when developing LD rates for future projects.

# CHAPTER THREE

# SURVEY DEPLOYMENT AND PROCEDURE

## 3.1 INTRODUCTION

To obtain a better understanding of the state-of-the-practice concerning SHAs use of LD provisions and policies, an Internet based electronic survey (e-survey) was conducted in May of 2006. Prior to the survey, a review of the current LD provisions used by each state was conducted. While the majority of SHAs use a table or schedule to denote the amount of LDs to be charged based on contract value, similar to ALDOT's provision, only a select few had experienced litigation issues. Many of the states used LD rates as a bargaining chip for closing out jobs by agreeing to waive LD charges in exchange for the completion of outstanding work. With a 100% response rate for the survey, a complete overview of SHAs use of LDs was deduced.

## 3.2 CURRENT SHAs' LDs POLICIES

During the development of the questions for the e-survey, current SHAs' LD provisions were examined. The policies were obtained from each state's Standard Specifications via the internet. As later confirmed in the survey, the majority of the states use a table or schedule to designate LDs rates. Similar to ALDOT, these rates are a function of contract value. Appendix A contains an exhaustive compilation of the tables used in each SHA's Standard Specification.

The tables of LD rates were compiled for comparison purposes. Since each state designates different contract value ranges to stipulate LD amounts, seven representative contract values were used to calculate the resulting LD amount for each state. These values were compiled into a box-plot in Figure 3.1. ALDOT's LD rates were plotted on the same chart to gain perspective on how their rates compare to other SHAs nationally.

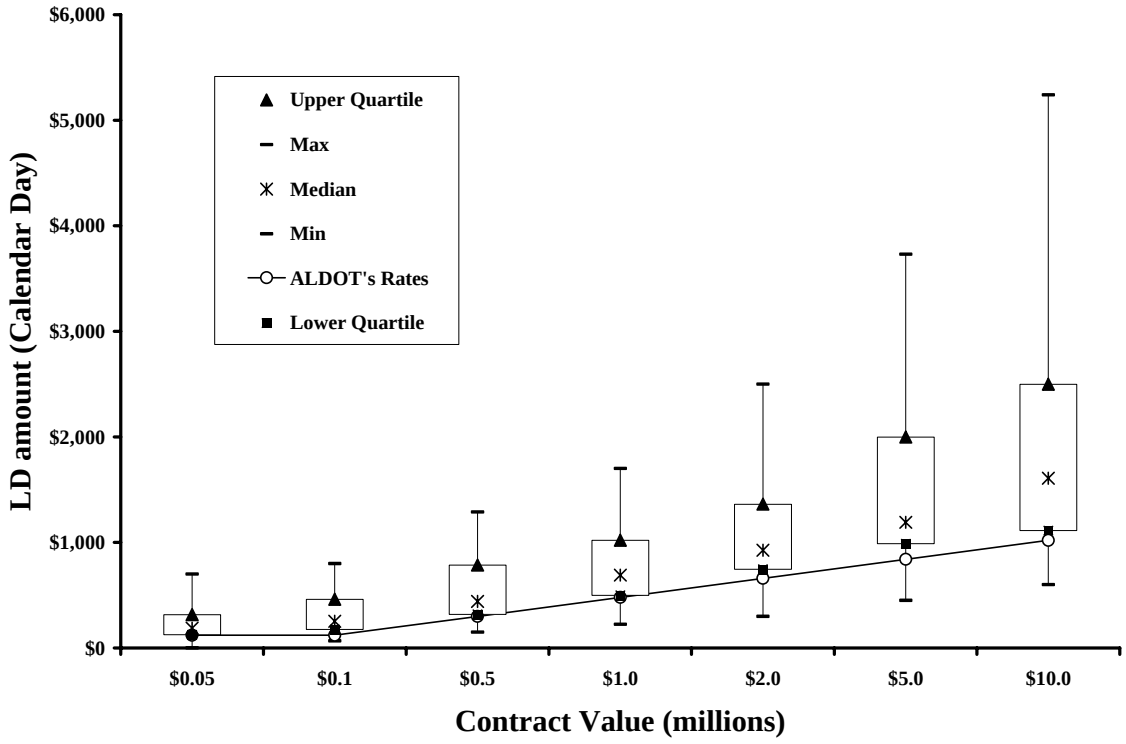


**Figure 3.1 Box-plot of Each State's Table of LD Rates.**

The most notable feature realized from Figure 3.1 is the increase in variability as the contract value increases. This shows the wide range of LDs rates used across the country. The median and quartile range increase with contract value, as well, further emphasizing the trend for LDs to increase as the contract amount increases. Also note

that ALDOT's rates are very low compared to the rest of the nation. It seems counter-intuitive that ALDOT's rates are among the lowest yet, as determined from the survey, they have experienced highest levels of litigation in the nation. One may presume that a contractor would not challenge such relatively low rates, as this may lead to an increase in the rates. However, the contractor is most likely unaware of the relationship of ALDOT's rates to the rest of the nation and, he would not be concerned as much with future rates as he is with the current charges he has incurred.

The LD provisions of ALDOT and the surrounding southeastern states were compared since these states experience similar environmental conditions, labor and material availability concerns, and tend to work with the same contractors. This was done to determine inconsistencies in ALDOT's LD provision that may have contributed to the higher litigation experienced.

ALDOT and adjacent southeastern states, (Florida (FDOT), Georgia (GDOT), Tennessee (TDOT), Louisiana (LaDOT), and Mississippi (MissDOT)) all have similar LDs policies. None of these agencies use incremental LDs based on construction status such as substantial completion, physical completion, etc. LaDOT is the only state which assesses LDs for working in excess of typical 8 hr work day. Each state uses LD rates based on a range of contract amounts and does not take into consideration nature of the work. Design-bid-build (DBB) is the most widely used project delivery system among the group. Even though agencies such as FDOT and MissDOT contract many design-build (DB) projects, they use the same standard schedule of LD rates for DB contracts and do not compute project specific LDs. Except for MissDOT, none of the agencies have either

an established procedure to calculate LDs or a standard project staffing plan for resource estimating. None of the states do a comparison of LD rates with actual damages.

While LDs are waived or reduced by granting time extensions at the state level, the determination of the substantial completion/final completion/acceptance is typically carried out by the local/resident engineer. Except for ALDOT (for LDs) and LaDOT (for road user costs), the LD provisions of these southeastern agencies have never been challenged in court.

Though all these agencies have similar LD policies, Table 3.1 indicates that their schedule of LDs rates varies substantially. While other agencies modify their rates every 3-5 years, ALDOT's rate have remained constant for over a decade.

**Table 3.1 Comparison of the Southeastern States LD Schedules**

| Agency | Min. Contract Value | Max. Contract Value | Min. Daily Charge | Max. Daily Charge |
|---|---|---|---|---|
| Alabama | $0 | ≥ $10,000,000 | $120 | $1,200 |
| Florida | ≤ $50,000 | ≥ $20,000,000 | $544 | $ 8,624 (+ 0.00027 of any amount over $20 million |
| Georgia | $0 | ≥ $10,000,000 | $75 | $2,100 |
| Louisiana | $0 | ≥ $10,000,000 | $80 | $630 |
| Mississippi | $0 | ≥ $10,000,000 | $140 | $1,400 |
| Tennessee | $0 | ≥ $10,000,000 | $80 | $1,400 |

Figure 3.2 presents a chart similar to Figure 3.1 which plots ALDOT's LD rates against a box-plot of the southeastern states' provisions. This figure further emphasizes the reasonableness of ALDOT's rates compared to its neighboring states. As seen in the chart, ALDOT's LD rates are close to the median values. Since each of the agencies do not use a standard methodology to compute the LDs rates, future litigation, such as that

experienced by ALDOT, may be on the horizon. One inconsistency observed from this comparison is the frequency of updates of LD rates. ALDOT has not updated its rates in the past decade; this may have been a factor in the increased litigation it has experienced.

In an effort to determine the best practices of SHAs' use of LD provisions, the standard construction specifications for each state were collected and analyzed. As later confirmed in the survey, the majority of SHAs use a schedule of LDs that specifies their rates as a function of the contract value. The majority of the remaining agencies' specifications state that LD rates will be specified in the construction contract. In other words, they use project specific method for applying LD rates.

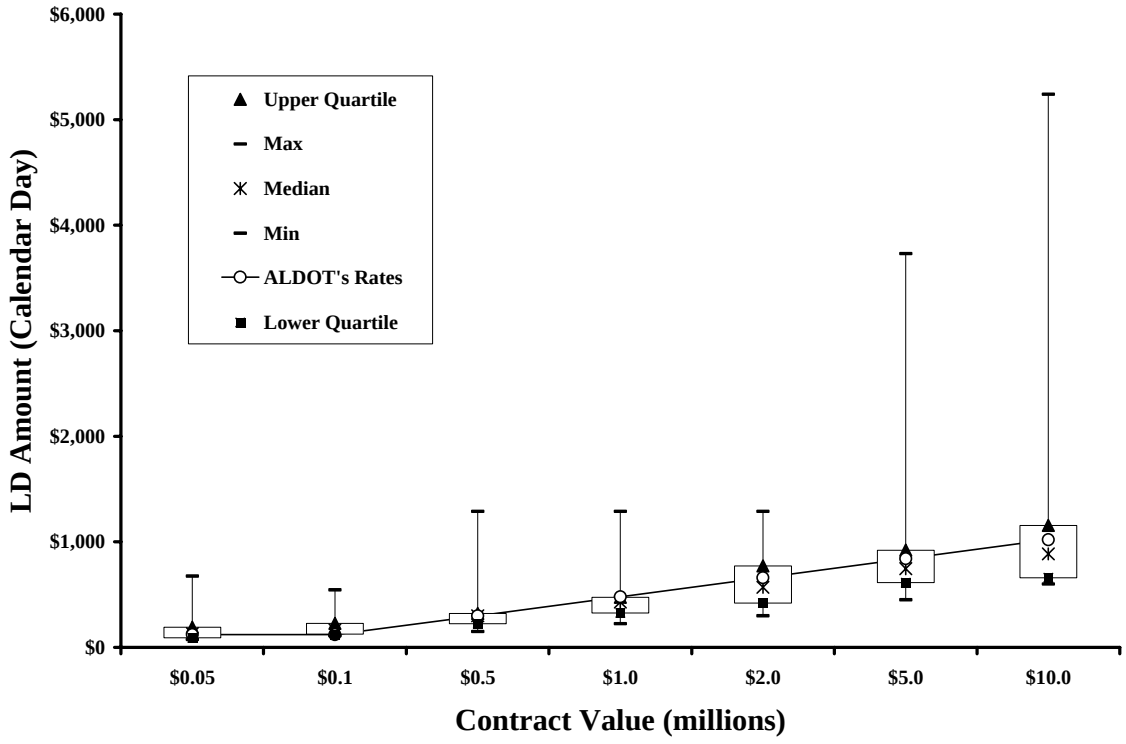


**Figure 3.2 Box-plot of Southeastern States' Table of LD rates.**

The purpose of this research effort was to develop a non-project-specific methodology to determine LD rates. However, some project specific methodologies were evaluated due to their progressive nature. Both Nebraska and Washington State specify a formula for determining LD rates. The formulas used by these states follow the same form and function as equation 3.1

$$LD = \frac{R \cdot C}{T} \tag{3.1}$$

where,

$LD$ = LDs per working day or calendar day,

$C$ = Original contract amount,

$T$ = Original number of calendar days or working days (whichever was specified in the contract), and

$R$ = calculated coefficient (different for working and calendar days).

According to this formula the LDs to be applied on a job are a function of the original contract amount and the number of days specified in the contract. This takes the typical LDs table, which specifies LDs only by contract amount, to the next level by specifying LDs by both contract value and contract length.

The California Department of Transportation (CALTRANS) specifies a formula similar to equation 3.1 but includes project type as an additional factor. This method was of particular interest to this research since one of the methodologies being developed adds the project type designation as a factor in specifying LDs. For the equation used by CALTRANS, a table gave differing values for the *R* value in equation 3.1. The *R* values

were specified as a function of the "project estimate" and project type. The table specified 6 project type categories: i.) Resurfacing/Rehab, ii.) New Highway, iii.) Realignment/Widening, iv.) Landscaping, v.) Soundwalls, and vi.) Other. The specifications do not divulge on how the *R* values were calculated or how the project type categories were determined. Nevertheless, the survey (outlined below) and follow-up interviews revealed that CALTRANS will be moving away from this method to a more traditional table which only specifies the LDs by contract value.

## 3.3 SURVEY DEVELOPMENT

Several methods of conducting surveys such as postal surveys, telephonic surveys, and electronic surveys were discussed. After considering advantages and disadvantages of all the methods an e-survey (internet/web based survey) was chosen as a medium to launch the survey. An internet-based survey is one of the most widely used data collection techniques for conducting surveys. With this method, the survey can be launched in two ways: i.) creating a website and providing the respondents the website address (URL), where individual responses are stored in a database and, ii.) sending out the survey in the form of an email and asking the respondents to send their responses as an attachment with the return email. For this research the former was used and a website was created using the software "Zoomerang™". Respondents were contacted by email to provide them with the website address location (URL) of the online survey.

The main advantages of an e-survey include:

1. *Geographic coverage*: e-surveys are a means of gathering a large amount of information at a minimum expense in terms of finance, human resources, and cost

2. *Economy*: e-surveys offer wide geographical coverage, resulting into relatively high validity of the results.

3. *Speed*: e-surveys are the quickest method of developing a survey. The responses can be received within minutes from the time of launch. Reminders can be sent to those who have not responded.

4. *Analysis of Data*: computer software allows for data and survey responses to be in a digital format making analysis easier.

The limitations of an e-survey include:

1. *Inflexible technique*: e-surveys do not give an opportunity for probing. If clarification is required or a response is misleading, e-surveys are unproductive. Usually e-surveys are followed by telephonic conversations/personal interviews.

2. *No control over respondents*: no guarantee that the right person will complete the survey, and no guarantee that the recipient will respond.

3. *Fatigue*: Universities, government agencies, companies receive a "steady stream" of questionnaires and given the pressures of one's profession, surveys are a lower priority.

To overcome some of the limitations associated with the e-survey approach, follow-up interviews were conducted as suggested by Naoum (1998). Therefore, to facilitate

further communication, detailed contact information was requested from each of the survey respondents. The survey was launched with the assistance of practitioners from ALDOT to help increase the response rate.

The response rate for the survey was 100%, with all 50 SHAs responding along with Puerto Rico, New Jersey Turnpike, and Washington, D.C. A total of 53 agencies' responses were received and analyzed. Unclear or incomplete responses were followed-up with a telephone interview to better understand the respondent's answer.

The survey consisted of 30 questions that were classified into the following six categories: i.) Contractual Principles, ii.) Current LD Contract Provisions, iii.) Contract Administration, iv.) Cost Estimation Practices, v.) Legal Issues, and vi.) Miscellaneous. Most of the questions were asked in a structured 'yes/no' format allowing for both quick responses and straightforward analysis. Comment boxes were included with each question to allow the respondents the opportunity to the express their views in greater detail or to use in clarifying their response. A sample of the survey has been attached as Appendix A and a summary of the survey results is presented in Appendix B.

The next three sections discuss the findings and insights realized from the survey responses regarding contractual, estimating, and administrative practices related to LD provisions among the participating SHAs.

## 3.4 CONTRACTUAL PRACTICES

Contractual practices encompass procedural choices made by agencies with respect to contract provisions. There are five distinct choices relating to damages for late

completion which include: damage clauses, contract time, contract milestones, differentiated LD rates, and LDs with I/D clauses. These five procedural choices are discussed in the following section.

### 3.4.1 Damage Clause

The first choice among this list of five is whether or not damages will be pre-specified within the contract. At the agencies discretion, an alternative contract provision may be written to provide for actual damages to be back-charged to the contractor or perhaps litigated in court. In the absence of such a provision, actual damages are generally permitted for any breach of the contract. All 53 responding agencies (100%) indicate that LDs are utilized in their contracts in lieu of recovering actual damages for a contractor's failure to complete the project by the fixed completion date. At first glance pre-specified LDs might be considered strictly as a benefit to the owner in administering the contract. However, a significant benefit accrues to the contractor in that a known monetary value represents the assessable damages and thus quantifies this risk component both during bid preparation and as completion options are assessed late in the overall performance of a project.

### 3.4.2 Contract Time

The second choice affecting LDs is the unit of time used in the contract. Of the 53 responding agencies 38 use working days (72%) while 15 use calendar days (28%). The remaining 10 agencies indicated that some other form of contract time is used in special project specific situations.

This is more than a trivial choice since the contract unit of time chosen establishes the contract administration practice in managing contract time. With working days the contract time is essentially managed by the agency's field representative, where with some measure of discretion, days are either charged to the contract or not. Alternatively, with a calendar day contract the time is expended automatically and then managed retrospectively by the central office.

Contract time can even be defined on an hourly time interval per day making it possible to assign damages for hours worked beyond the allowed daily timeframe. Only 8 agencies (15%) reported that on specific projects they assess hourly LDs for work beyond a given daily maximum or work outside of a particular daily time window. These project specific cases tend to be high profile projects that will severely impact the traveling public subsequently resulting in excess RUCs. Therefore SHAs limit the construction operation to certain periods of the day where inconveniences will be minimized. The other 45 agencies (85%) indicate they do not use an hourly charge on projects.

### 3.4.3 Contract Milestones

The third choice affecting LDs is how the status of the project will be judged complete. This determination along with expended time establishes the assessment of LDs. There are two aspects to this contractual choice: i.) substantial completion and ii.) project phases (i.e. milestones).

Substantial completion defines a point short of final completion where damage assessments would end because the project is basically complete and the SHA can beneficially use the facility. The definition of substantial completion is included in 36 of

the states' contracts (68%) while 17 agencies (32%) do not use this term. The comments provided suggest that most states are moving away from using an ill-defined term such as substantial completion and toward the requirement that contractual time stops when the contract is 100% complete and finally accepted. It should be noted that substantial completion has less flexibility on a calendar day contract where time elapses automatically in comparison to a work day contract where discretion in contract time is provided in the field by the project engineer.

Project phases allow SHAs to incrementally judge the work for completeness with separate damages per increment or phase. Damages are assessed on project phases in 30 state agencies (57%), while 23 agencies (43%) indicate they do not. The comments provided by the respondents, however, indicate a slightly different perspective. It seems a project phase damage clause is used by nearly all agencies on a project-specific contract basis when RUCs represent a significant portion of the LD rate. A subsequent question asked if finishing the overall project on time would waive the agency's right to assess damages on intermediate phases. Four agencies (7%) indicate it does waive their rights, while 47 agencies (89%) indicate that it does not. Two agencies (4%) didn't respond to this question.

### 3.4.4 Differentiated LD Rates

The fourth choice is whether to differentiate the likely damages based on project characteristics such as construction status, project types, or delivery methods. Incremental damage rates based on construction status is used in 15 of the responding agencies (28%) and not by the other 38 agencies (72%). A comment made by one state

mentioned that they use varying LD rates stipulating that the LD rates drop to half when a roadway is opened to the public in order to encourage the contractor to open the roadway as soon as possible. With regard to project types (i.e. bridge, highway, maintenance, etc.), 47 responding agencies (89%) indicate they do not vary LDs by project type, while 6 (11%) indicate they do. In the comments to this question many respondents indicated that LD rates vary with contract value, not type.

When asked about the contract delivery methods utilized in contracts, the respondents indicated their continued reliance on the "Design-Bid-Build" style of delivery with 45 of the 53 responses indicating their use of this technique. However other methods were used by agencies including design-build used by 12, construction management at risk used by 3, and construction management at agency by 7. Some agencies indicated that they used more than one method. When this question was succeeded with whether or not the delivery method varied the LD rates, 42 agencies (79%) said 'no', 9 (17%) said 'yes', and 2 agencies (4%) did not respond. Follow-up questions determined that comments indicating that the rates vary are reflecting a project specific approach to LDs more so than focusing strictly on delivery methods.

### 3.4.5 LDs with Incentive/Disincentive (I/D) Clauses

The fifth choice considered is whether or not to combine LDs along with a separate I/D clause. In responding to the survey, 45 of the respondents (85%) indicated they use both, while only 8 (15%) said that they do not. Some states indicated that their agency incorporates I/D clauses on a project specific basis and it is included as a special

provision in the contract. The I/D values are typically based on whether or not the construction activity imposes a significant impact or inconvenience to the road user.

### 3.4.6 Summary of Contractual Practices

Summarizing this section, there are five LD related choices that are made by agencies and subsequently implemented into their contracts. The first choice among the five is whether to use liquidated or actual damages. In response to this choice, all 53 agencies indicated that they use LDs. The second choice is what time unit should be utilized within the contract. The majority of states use working days which provides field level discretion in regards to assessing contract time. The third choice is how projects are judged complete with respect to LDs. Most states use only final completion as a milestone toward the end of the project, rather than incorporating a form of substantial completion. Project phases are also used as an intermediate completion date for LDs where the rates reflect significant RUCs. The fourth choice is to vary LD rates based on project types, delivery methods, or construction status. Most states vary rates with contract amount rather than with project types or delivery methods. Construction status is used by some agencies to reduce rates once project status changes (i.e. roadways/ramps are opened to traffic). The fifth choice is combining LDs with I/D contract clauses which is done by 45 of the 53 responding agencies.

Next, the discussion will focus on estimating practices used by state agencies in developing LD rates.

## 3.5 ESTIMATING PRACTICES

Estimating practices discussed here are those used by agencies in developing their contractually specified LD rates. These practices fall into five distinct areas: estimating process, recoverable costs, estimate details, revision cycle, and auditing.

### 3.5.1 Estimating Process

First among these is the estimating process itself which includes methodologies, worksheets, design aids, and the responsible SHA department for developing LD rates. An established method for estimating LDs goes a long way in demonstrating that the rates were not developed arbitrarily and do bear a relationship to actual anticipated damages. Lacking an estimating methodology does exactly the opposite, with rates appearing to be arbitrarily selected and without relationship to actual anticipated damages. Forty-two responding agencies (79%) indicated they use an established methodology in estimating LD rates, while 11 (21%) indicated they do not. It is interesting to note that 4 of these agencies that do not have a methodology, belong in a group of 11 SHAs reporting recent litigation on their LDs provision. In 14 of the state agencies (26%) this methodology was incorporated into a worksheet.

The task of undertaking this estimating process is most frequently done by the construction bureau in 32 of the 53 agencies (60%), followed by the engineering design bureau in 13 agencies (25%), while the remaining is spread among a variety of miscellaneous departments. Interestingly, the accounting department is responsible for developing rates in only one state agency, even though it may be expected that the

accounting department generally has the most knowledgeable personnel to compile the supporting financial information.

### 3.5.2 Recoverable Costs

The second area of practice involves the categories of recoverable costs utilized in determining the LD rates. FHWA stipulates that at a minimum the LD rates will include daily construction engineering costs, but may also include other costs as well, such as RUCs. In response to what costs are covered, the majority of SHAs (33) indicate they include only the minimum construction engineering costs, while 20 agencies stipulate that other costs such as RUCs are included in their rates on a project specific basis.

### 3.5.3 Estimate Detail

The third area of estimating practice is related to the level of detail incorporated into the estimate. In probing this area, the question was asked about how LD rates are placed into the contract specifications. There are essentially two approaches used, a generic rate that is scaled based on total contract amount, or a project specific rate that is placed in the contractual arrangement. Thirty of the states use a table of average costs to set contract rates, while 13 use project specific costs, and 10 indicated they use something else. However, upon closer inspection many of these agencies use a table of average costs. The responses suggest LD rates represent order-of-magnitude estimates of anticipated actual costs more so than project specific costs.

In a similar vein, state agencies were asked if a resource staffing plan was utilized as a basis for developing the estimate. While 10 agencies report that they do use staffing plans in developing rates, 43 of the 53 agencies report they do not.

### 3.5.4 Revision Cycle

The fourth area of practice is the cycle on which rates are updated. FHWA requires all the agencies to update their non-project specific LD rates, at a minimum, every two years. One state updates every year, while 6 states indicated they only use project specific LD rates. A significant number of the states, 22 of the 53 responding, update every two years; 1 state updates their rates every year, 11 states update every 3 to 4 years, 8 states update every 5 years, while 3 states indicate they never update. Six states use project specific rates and two states did not respond to this question.

### 3.5.5 Auditing

The fifth area deals with auditing the estimates. A pre-estimate of incurred damages invites the question of how close did these estimates come to actual costs experienced. The states were asked if they conduct cost analysis or audits on selected projects to see how accurate their pre-estimate of damages comes to actual damages. Forty-one of the reporting agencies indicated that they do not perform a formal review, while 12 states indicated that they do. Many of the reviews are informal reviews performed by internal staff as indicated by clarifying comments to the questions.

### 3.5.6 Summary of Estimating Practices

Summarizing the discussion within this section, there are five topic areas queried within estimating practices including: estimating process, recoverable costs, estimate details, revision cycle, and auditing. Forty-two states have established a methodology in estimating LD rates and 14 of these states have developed worksheets to reflect these methods. The estimating process is largely left to the construction bureaus to undertake.

With respect to recoverable costs, most states agencies include only the construction engineering costs, which is the FHWA minimum. States largely chose to use broad order-of-magnitude rates reflected within specification tables of average costs made specific to a project by the total contract amount. The update cycle for rates is usually biennial, but in some states updates are infrequent. Auditing these pre-estimates against actual project experience is accomplished in only 12 states, often by an informal internal review.

Next, the discussion will review the survey results related to how the contract terms and LD rates are administered during contract performance, followed by considering the legal challenges states have encountered with LD provisions.

## 3.6 ADMINISTRATIVE PRACTICES AND LEGAL CHALLENGES

Administrative practices reveal how LD provisions and related contract clauses are implemented when project completion extends beyond the contract time. Although these contract provisions are written into the contract to recover late completion damages, it is ultimately the administration of these contract clauses that yield the desired cost recovery results. There are two contract administrative practices that are of interest with respect to LDs. First, is the practice of determining when the contract is in fact, complete. Second, are the practices involved with the administrative assessment and/or reassessment of the LD amounts actually due under the contract.

Along with administratively setting aside LD amounts, courts may be asked to set aside these contractual remedies based on legal challenges as well. Information was collected

suggesting just how common these challenges are among SHAs and to what extent, if any, courts have dictated how LD terms are to be crafted into contracts.

### 3.6.1 Contract Completeness

The first area of administrative practice explored was determining contract completion (e.g. substantial completion), a determination that would stop time on the project. This is important to a contractor because this would be the point in time when LDs would no longer be assessed. Of the 53 responding agencies 42 rely on the resident/project engineer to make that determination, either fully, or in the case of 5 agencies, in conjunction with the district engineer. Next, in order of frequency, is the district/area engineer where 10 states rely on these individuals to determine completion. Four agencies selected the choice 'other' and their comments indicated they don't use substantial completion, relying instead on the project being either complete or not. One agency did not respond to the question. None of the state agencies indicated that consultants would make that determination of completeness, although one state suggested in their comment that their consultant would if they were in the role of project engineer. These responses reflect the opinion that contract time is a field level contractual determination.

### 3.6.2 Administrative Actions

The second area involves administrative actions that alter LD amounts that are being withheld under the contracts. A structured question ta all SHAs asked how often LD provisions are waived/reduced during or after construction. There were three possible

responses: Never, Sometimes, or Often. Only one SHA respondent answered 'Never', while 46 (87%) answered 'Sometimes', and 6 (11%) answered 'Often'.

This question was followed with another inquiring how LDs are waived/reduced. Multiple selections were permitted within the provided responses. The most frequent response was by SHAs granting time extensions, 48 SHA respondents selected this response. Three agencies selected 'adjusting payment documents during processing'. Five agencies selected 'Other'. Additional comments to this question were offered by 22 respondents which mostly indicated that time extensions are granted based upon the justification of submitted contractor claims requesting additional time on the contract.

A second follow up question asked at what level is the decision to waive LDs made. Two choices were provided to the respondents, either at the 'State Level' (which includes Division/District/Bureaus/etc.) or at the 'Local Level' (which includes Project/Resident/Field/etc). For 40 of the SHA responding, this decision is made at the state level, while 11 responding agencies indicate it is made at the local level. Two agencies didn't respond to the question.

LDs are clearly seen as an element of the contract close-out process. Contractors are seeking extra time on the project in part to avoid the assignment of LDs. From the provided responses, agencies view LDs as part of the bargaining process to resolve outstanding issues at contract close-out. The agencies found that they can persuade a contractor to finish incomplete work by waiving the LDs charges. In many cases, the LDs are no longer a means of reimbursing the state, but are a leveraging tool.

### 3.6.3 Legal Challenges

The problem that began this research effort was the increasing legal challenges experienced by ALDOT in regards to their LD provision. The concern was that this was a nationwide problem; however, few states have experienced legal challenges with regard to their LDs provision. Of the responding agencies, 42 report their agency's provision has never been challenged in court. For the 11 that indicated their provision has been challenged, two of these were where local agencies incorporating state provisions into their contracts. Even though the number of legal challenges is low, appearing to be insignificant, this may be an indication of potential future trends associated with an increase in contractors challenging LD rates.

A subsequent question was limited to the 11 respondents that indicated their SHA has experienced legal challenges. The question asked for an indication about the level of actual or pending litigation over the last decade. Three structured responses were provided for selection by the respondents: i.) high level (quantified for the respondents as more that 10 challenges), ii.) medium level (between 5 and 10 challenges), and iii.) a low level (less than 5). None of the 11 respondents placed their states in the high category; only one selected the medium (which was the state sponsoring this research effort); and the other 10 selected low.

Again limited to those respondents that indicate a challenge, the survey probed whether or not that an agency would pursue actual damages if their provision for LDs were deemed unenforceable. Four of the 11 (36%) indicated their states would seek actual

damages, two indicated their states would not, and five admitted they were not sure of the action their states would pursue in this matter.

Finally, the question was asked about legal precedents dictating how LDs were to be assessed. This again was limited to the eleven indicating a past legal challenge. Six answered 'yes' and five respondents answered 'no'.

At this time, legal challenges to the LD provisions in state contracts are not seen as a nationwide problem. Only 11 states have been challenged on their contract provision and even then, ten of these indicate little intensity.

### 3.6.4 Summary of Administrative Practices and Legal Challenges

In summarizing this section, there are two administrative practices of interests related to LD provisions. First, who judges the project as complete and thereby ends the assessment of LDs on the contract. As reflected in the responses, contract time is seen as a field level determination owing to the fact that most states rely on their project engineers to assess completion. Second, how regimented is the administration of the LD contract provisions. Responses to the survey tell a story of flexibility in the application of these contract terms. LDs are largely seen by both the agencies and contractors as part of the contract close-out process. From the agency's perspective, these funds become a "bargaining tool" in seeking closure on outstanding issues. Or, from the contractor's perspective contract time is sought from a variety of avenues specifically to make them whole on withheld monies. Legal challenges related to these provisions are rare. Only 11 states have experienced any type of court action over their provisions. Two of these weren't challenged directly; their provisions were challenged when used inappropriately

by local agencies. Only one state among the eleven faces what might be considered a medium level of lawsuits on this issue over the last decade.

## 3.7 SUMMARY AND CONCLUSIONS

The findings reported here are from a comprehensive survey of all SHAs within the US on their LD practices. This survey queried the states on their contractual, rate estimating, and administration practices associated with LDs; along with the level of litigation they are currently experiencing or have experienced in the recent past on their LDs provision.

Contractual practices reflect choices made by SHAs that are implemented into their contracts. Five contractual choices SHAs typically make in relation to their LDs provision include: 1) damages for late completion are recovered through LDs provision in lieu of actual damages; 2) contract time is most frequently measured in working days, where time is administered in the field; 3) contracts are either fully complete or not, and SHAs do not want to include intermediate stages of completion, such as substantial completion. However, project phases are used by states to set damages when RUCs are part of the rate; 4) LD rates are a function of contract amount, but not of project types or delivery method; and 5) LDs provisions combined with I/D clauses are considered for use by most SHAs but on a project specific basis.

Estimating practices utilized by states fall into five categories: 1) estimating processes follow established methods by most states, although few have developed worksheets to support these methods. The construction bureau most frequently undertakes this process for the SHAs; 2) states typically limit recoverable costs to the minimum required by the

FHWA, choosing to recover only construction engineering costs; 3) estimates are developed at the order-of-magnitude scale, infrequently having detailed resource staffing plans to underpin their calculations; 4) LDs rate reviews are generally mandated by the FHWA every two years; however, some states exceed that period; and 5) few states actually audit their estimates in relation to actual project costs.

Administrative practices can be summarized within two general statements: 1) contract completion is most frequently assessed by field personnel; and 2) contract LD provisions are administered with some flexibility. Additionally, legal challenges to the LDs provision are infrequently experienced by SHAs.

When comparing implementation of ALDOT's LD provision to its neighboring southeastern states, only one major difference was found. Unlike its neighbor's, ALDOT had not updated its LD rates in recent years.

Six conclusions may be drawn from these findings and are as follows:

1. LD provisions are the universal choice for SHAs to use in recovering their additional costs for contractor delayed completions.

2. Contractual terms are selected by states so that LD provisions are essentially administered at field level within state organizations.

3. LD rate estimates are developed at an order-of-magnitude detail. Little effort seems to be expended in providing a detailed, comprehensive assessment of the

costs that are likely to be incurred on projects that overrun completion times stipulated in the contract.

4. LD rates are kept low by the state agencies, covering only the minimum category of costs. This provides the contractor with an unreasonably low estimate to factor in when facing a potential delayed completion. This may be why few states have their provisions challenged in court.

5. Administrative practices reflect a higher priority in closing out projects, than collecting LDs.

6. Legal challenges to these LD provisions are infrequent.

Using these conclusions, the formation of a standard methodology to compute LDs was initiated. The first step was to obtain historical project data from ALDOT. The following chapter discusses this process as well as how the data was organized and evaluated to determine proper LD rates to be used by ALDOT.

# CHAPTER FOUR

# DATA COLLECTION AND ANALYSIS

## 4.1 INTRODUCTION

The primary goal of this research effort was to develop two entirely objective methodologies for ALDOT to utilize when calculating LD rates during biennial reviews and updates that are based on historical project data. The first step in developing the methodologies was to acquire historical project data from ALDOT. Using this dataset, it would be possible to determine the daily costs incurred on a project based on the contract size and project type. Since the LD rates are meant to be pre-estimates of a typical project, an outlier analysis had to be conducted to purge the project data of atypical projects.

## 4.2 DETERMINATION OF REQUISITE DATA

LDs are a pre-estimation of the daily costs to administer a project. The most effective way to estimate the daily administrative costs on a project is to base the amounts on actual costs incurred from past projects. In ALDOT's case, the daily administrative costs are represented as engineering and inspection (E&I) costs. ALDOT's recordkeeping system records E&I costs as the actual administrative costs incurred as a result of a specific job. This value may be composed of the salaries of employees working on the job, the fringe benefits associated with the employees, the employees' vehicles, materials

testing, office supplies, etc. It is not an estimated value, but the actual expense incurred from administrating a particular project. Since the E&I costs are actual costs incurred on a project, it was important to use the actual days used to complete a project and not the number of days specified in the contract. It is not uncommon for a project when computing daily E&I charges to be completed in a different number of days than what is specified in the contract. Therefore, if the days specified in the contract were used to calculate daily E&I values, the rate would frequently be different than the daily costs associated with actual days used.

ALDOT uses two methods of specifying a project's length in contracts: i.) calendar days and ii.) work days. For a calendar day project each day that passes on a calendar is deducted from the allotted time specified in the contract. So, whether or not work is accomplished on a project during a day, the day is expended and counted against the contract.

Workday projects are charged days against the contract only when work is completed. This is typically at the discretion of a field representative working for the SHA. ALDOT's Standard Specifications define a work day as, "Any Calendar Day from midnight to midnight, exclusive of Saturdays and Legal Holidays, on which the Contractor could proceed with construction operations for a period of six hours or more with the normal working forces engaged in performing work on the controlling item or items of work" (ALDOT, 2006). So, for instance, if inclement weather prevents a contractor from completing six hours of work in a day, the project will not lose any of the days specified in the contract to complete the work. On the other hand, if it is determined

that the contractor could have worked for six hours but he doesn't, the day will still be charged.

Due to the different ways time is charged to projects, contracts using calendar days tend to allot a higher number of days to complete the project than a workday project of equal stature. On the backside of a project, this results in a different number of the recorded days used to complete a project. Since the days used is a major factor in calculating the daily E&I costs on a project, the contract time is an important aspect to consider when calculating LDs. The projects must be separated into their respective contract time categories, otherwise, the daily E&I costs would be skewed due to the different number of days used. For instance, calendar day projects have much lower daily E&I costs than work day projects. This does not mean that calendar day projects are administered more efficiently, just that the total E&I cost for the project are spread over an additional number of days than work day projects.

When specifying LD rates it is important to specify them for both calendar day and work day projects, since the rates are different. Therefore, it was important to obtain the contract time and days used of each project during the collection of historical project data.

In addition to the above mentioned data requirements, the original contract values and project type designations were required to categorize the LD rates by type of project. The first methodology to be developed by this research effort consists of a schedule of LDs categorized by contract value. This is the most prominent method used by the SHAs

across the country, and is the method currently used by ALDOT. The second methodology specifies LDs by both contract size and project type.

## 4.3 COLLECTION OF DATA

The required project data was downloaded from ALDOT's Mainframe Construction Status file. This database outputs a single mainframe file using the VSAM file format (a record key file that is a precursor to database files). The historical data was comprised of all projects with a completion date occurring in 2003, 2004, and 2005, totaling 856 projects. The projects were composed of 726 working day projects and 130 calendar day projects. The data were obtained in a space delimited text file that was imported into a spreadsheet program. Each project listing consisted of, among other things, the original contract amount, days used to complete the project, total E&I amount for the project, a Comprehensive Project Management System (CPMS) project number, and a contract size designation. The contract size designation was a number from 1 to 8 which grouped the projects by the original contract amount based on ALDOT's current LDs provision. The breakdown of the contract size values is shown in Table 4.1 below.

**Table 4.1 Contract Values for Each Contract Size Group**

| Group | Contract Amount | |
|---|---|---|
| | From | To and Including |
| 1 | $0 | $100,000 |
| 2 | $100,000 | $200,000 |
| 3 | $200,000 | $500,000 |
| 4 | $500,000 | $1,000,000 |
| 5 | $1,000,000 | $2,000,000 |
| 6 | $2,000,000 | $5,000,000 |
| 7 | $5,000,000 | $10,000,000 |
| 8 | $10,000,000 | ---------- |

It should be noted that the data obtained from the Mainframe Construction Status file by ALDOT lacked a project type description. This occurred because the project type description for each project is stored in a separate file system. Therefore, ALDOT accessed the other system and developed a file which was composed of selected columns from their preconstruction and letting system. This system is based on TRNSPORT which is a suite of software owned by the American Association of State Highway and Transportation Officials (AASHTO) who allows its member states to license the software.

## 4.4 ANALYSIS OF COLLECTED DATA

### 4.4.1 Organization of Data

Once the historical data had been obtained from ALDOT and imported into a spreadsheet program, it was organized for analysis. The 856 projects were first divided into their respective contract time groups. This resulted in 726 (84.9%) working day projects on one worksheet and 130 (15.1%) calendar day projects on another. Calendar day projects were excluded from further analysis due to their small sample size once subdivided into contract value ranges.

For the second methodology developed in this research, the project type designation was required for each of the project listings. Since the project type designation was obtained from a separate database system than the rest of the project data, the two files had to be linked together. To do this the two files were imported into Microsoft Access where they were linked together using the CPMS project number. This number is a 9 digit project number that is assigned to each project in ALDOT's CPMS. The project type

designations given by the TRNSPORT software are only three letter abbreviations. A third file containing a key to the full name of each project type designation was created and linked to the project type abbreviations. Once linked, the three files were queried to produce a single file containing the complete project data including the project type designation. Because the TRNSPORT software that contains the project type designation has only been implemented in the past few years, not all the projects contained a project type designation. For analysis purposes, the projects lacking a project type description were categorized manually as "unclassified".

### 4.4.2 Determination of Daily E&I Amounts

The daily E&I costs for each of the past projects collected were computed using the equation 4.1.

$$DailyE\&I = \frac{E\&Icosts}{\#ofDaysUsed} \tag{4.1}$$

According to equation 4.1, the data needed to compute the daily E&I costs for each project are: i.) the E&I costs associated with past the projects and ii.) the days used to complete the project. These calculated values were the basis for the determination of LDs.

### 4.4.3 Elimination of Outliers

Since the schedule of LD rates developed from this research will be utilized to determine an appropriate rate for a typical project, the historical project data used for the rate calculation needed to be composed of only typical projects. Therefore, all abnormal and atypical projects needed to be removed from the data pool. However, in order to create a

method for determining LD rates that was statistically justifiable, each step in the process had to be entirely objective. As a result, the tedious process of evaluating each project individually to determine whether it was a typical or atypical project would not only be inefficient, but it would be invalid, as well. Instead, a statistical method was used to evaluate the data and determine the outliers, or projects which are significantly different from the others. Because the outlier analysis was blind to the specifics of each project and focused only on its relationship to the other projects, it would not only determine atypical projects, but also projects that may have been keyed into the system incorrectly.

As mentioned earlier, the daily E&I values of the historical project data were used as a basis for the calculation of the LD rates. Since daily E&I is a calculated value composed of a project's total E&I costs and the total number of days used to complete the project, it was important to evaluate outliers in the data using the total E&I values and total days used, independently. If, instead, the calculated daily E&I values were used for analysis, then projects which would have been considered outliers according only to their total E&I costs, may be skewed back into the majority of the projects due to the days used for the project, and vise versa. For instance, take a project which has an extraordinarily large total E&I costs. This may be a specialty project which required a lot of administrative personnel. Due to its atypically high E&I costs, it should be considered an outlier. But, when the number of days used, which may be consistent with projects of similar contract value, are applied as in equation 4.1, the daily E&I value resulting may not be abnormal enough for the project to be labeled an outlier. On the other hand, conducting an outlier analysis based on daily E&I costs as a parameter for outlier analysis could incorrectly identify typical projects as atypical and eliminate them from the dataset.

In order to conduct the outlier analysis, the total E&I costs as well as the total days used were adjusted using the project's contract value. Since both the E&I costs and days used on a project increase as the contract value increases, the values had to be made relative to each other by applying their respective contract values. As a result, E&I costs were transformed into E&I as a percentage of contract value as shown in equation 4.2. Using this equation, projects which had an atypical amount of E&I costs in relation the general population of projects could be identified.

$$\%EI = \frac{E\&I}{CV} \tag{4.2}$$

where,

$\%EI$ = E&I as a percent of contract value,

$E\&I$ = total E&I for the project, and

$CV$ = Original contract amount.

The number of days used to complete a project was evaluated by converting days used to dollars placed per day, as seen in equation 4.3. This parameter compared the days used to complete a project to the total contract value of that project. As a result, projects with an abnormal amount of days used could be identified as outliers.

$$\$/day = \frac{CV}{d} \tag{4.3}$$

where,

$\$/day$ = dollars placed per day,

$d$ = Total number of days used for the project, and

$CV$ = Original contract amount.

By evaluating the projects according to these two parameters, the projects can be analyzed according to how typical they are regardless of their contract size. For all the working day projects the average percent E&I was found to be 10.25% and the average dollars placed per day was $15,785.

For the projects to be analyzed to identify outliers, a normal distribution was required. In statistics, a normal distribution is a probability distribution in which the highest frequency of data is concentrated at the mean and it decreases as the distance from the mean increases. It is most commonly characterized by a bell-shaped curve on a histogram. Since the parameters being evaluated (E&I as a percentage of contract value and dollars placed per day) have an absolute minimum of zero, they produce a log-normal distribution, which was verified using a chi-squared test. In a log-normal distribution the bell-curve is skewed to one side; in our case, it was skewed to the left. The data was made normal by performing a logarithmic transformation on the parameters. In other words, this involves taking the *log* of the percent E&I and dollars placed per day for each project.

Once the data had been transformed into a normal distribution, it was evaluated to determine atypical projects. This was done using a 95% confidence interval which was represented by two standard deviations from either side of the mean. Using the 95% confidence interval makes the assumption that 95% of ALDOT's projects are considered "typical" projects, while the other 5% are either atypical or recording errors. The 95% confidence interval was used because it is a standard acceptable statistical practice. It was confirmed to be a valid measure after conducting a sensitivity analysis. In the

sensitivity analysis, the effect of more or less standard deviations on the relationship between the average and median values of each parameter were evaluated. The sensitivity analysis charts for both percent E&I and dollars placed per day can be seen in Figure 4.1 and Figure 4.2, respectively.

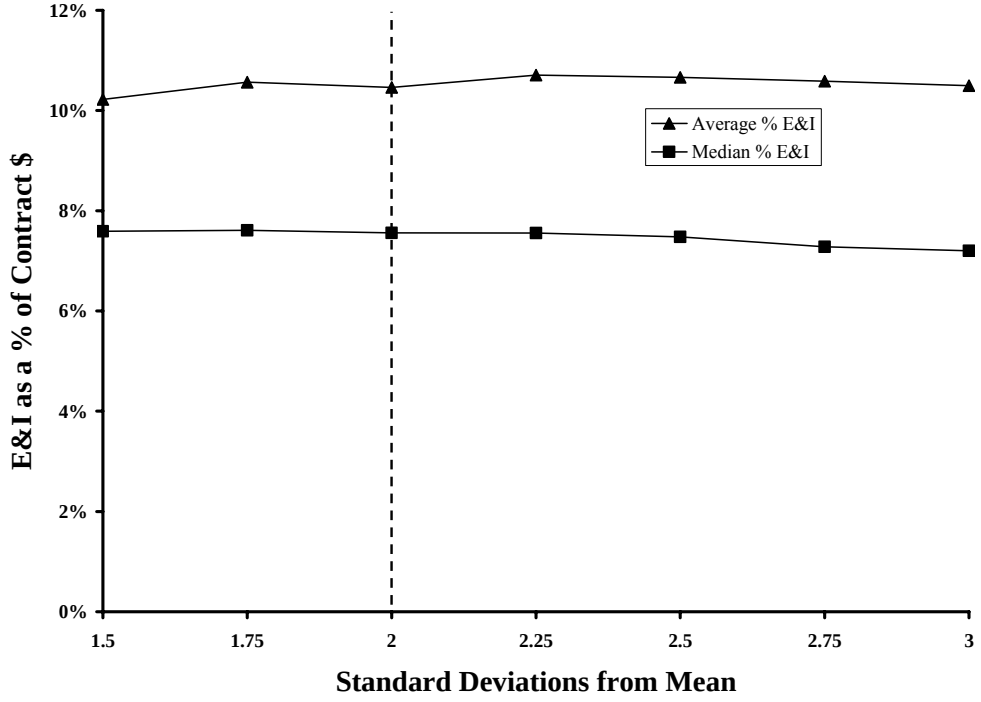


**Figure 4.1 Sensitivity Analysis of Percent E&I.**

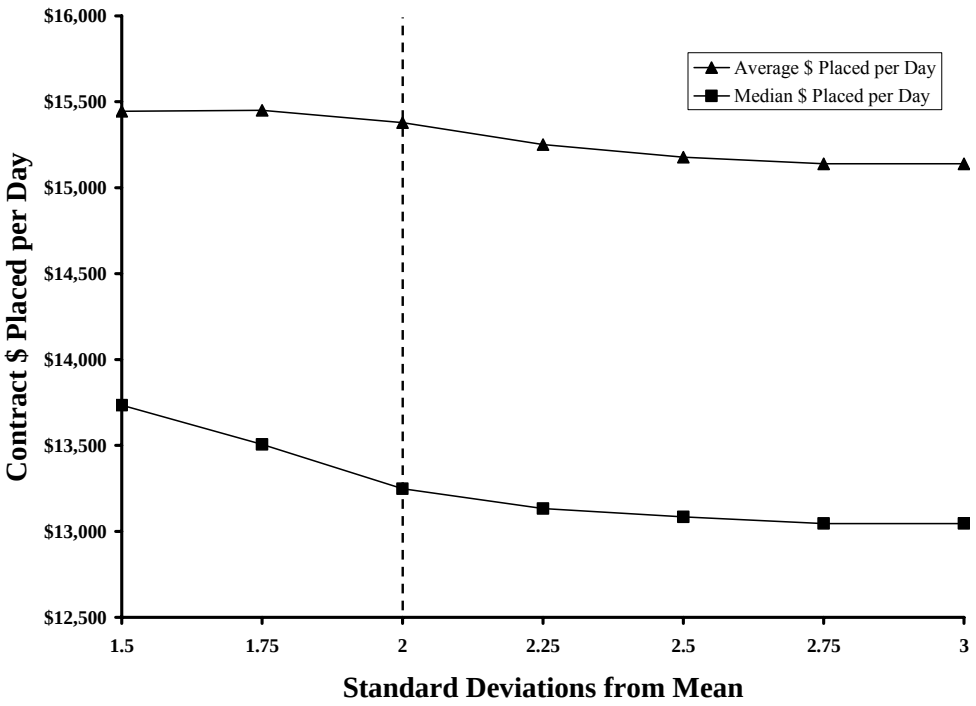


**Figure 4.2 Sensitivity Analysis of Contract Dollars per Day.**

To conduct the sensitivity analysis, all the projects contained within each standard deviation from 1.5 to 3 are used to calculate the average and median values. Then, the two values are graphed to analyze the relationship. From the chart, it is evident that ±2 standard deviations was an acceptable limit since only minor differences between the averages and medians were observed when any value beyond ±2 standard deviations from the mean were utilized. Therefore, all projects, in which the percent E&I and/or the dollars placed per day values were more than ±2 standard deviations from the mean, were removed from the pool of projects and the remainder was used for analysis.

### 4.4.4 Remaining Data

The outlier analysis identified 36 (5.0%) atypical projects according to their E&I costs as a percentage of contract value, 24 (3.3%) projects according to the dollars placed per day,

and 1 project which was an outlier under both parameters. The 61 projects identified as outliers represent 8.4% of the data. This closely resembles the expected percentage of outliers of 5% resulting from the ±2 standard deviation criteria. This resulted in 665 remaining projects to be used for the calculation of LDs. The complete set of data used for this research, with outliers, can be found in Appendix E.

Figure 4.3 illustrates the outliers that were identified using ±2 standard deviations from the average percent E&I (squares). The dashed lines represent the upper and lower limits determined by ±2 standard deviations from the mean.

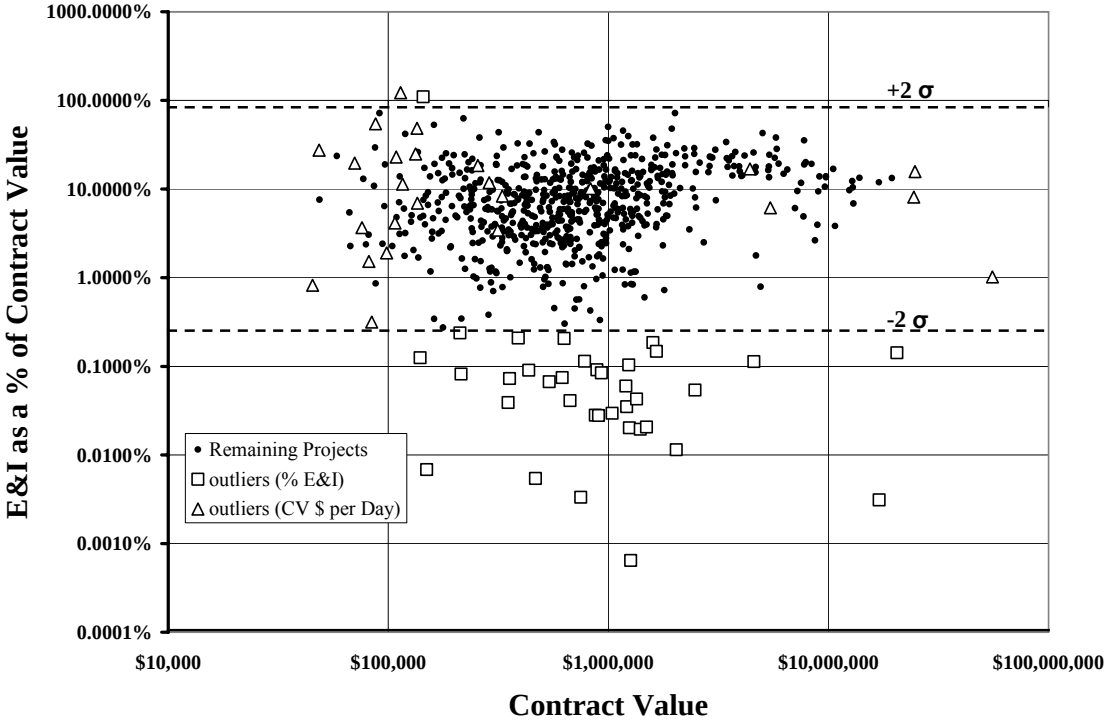


**Figure 4.3 Results of Outlier Analysis by Percent E&I.**

From Figure 4.3 it can be seen that the vast majority of the outlying projects according to E&I as a percentage of contract value lie below the lower limit. These outliers represent projects which had abnormally low E&I costs in relation to their contract value.

Figure 4.4 shows the same data as Figure 4.3 except the y-axis has been changed to dollars placed per day to show the ±2 standard deviation limiting criteria. The outliers identified using dollars placed per day (triangles) are more evenly distributed above and below the limiting criteria, however, the majority are still located below the lower limit. These "low" projects are characterized as projects which had an abnormally high amount of days used in relation to the contract amount.

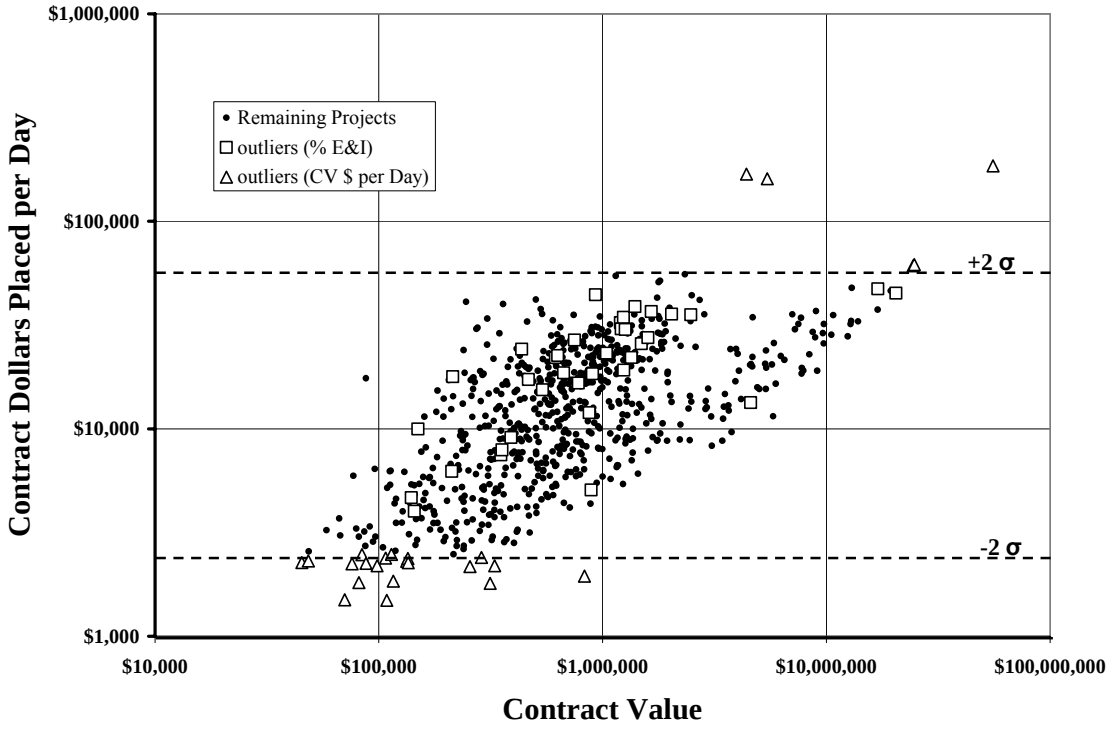


**Figure 4.4 Results of Outlier Analysis by Dollars per Day.**

Figures Figure 4.4 and Figure 4.5 show the limiting criteria, individually, for projects which were eliminated using E&I as a percentage of contract value and the dollars placed per day. When viewing these charts, many projects which are outliers according to the parameter not represented on the y-axis seem to lie within the acceptable bounds. This is because according to that parameter they are acceptable. By changing the axes of the graph to be dollars placed per day versus E&I as a percent of contract value, the outlying projects according to both parameters are clearly defined. Figure 4.5 shows this relationship with the limiting criteria represented by dotted lines. From this view, there is no confusion as to which projects are outliers and which are not, since the axes represent both of the evaluated parameters.

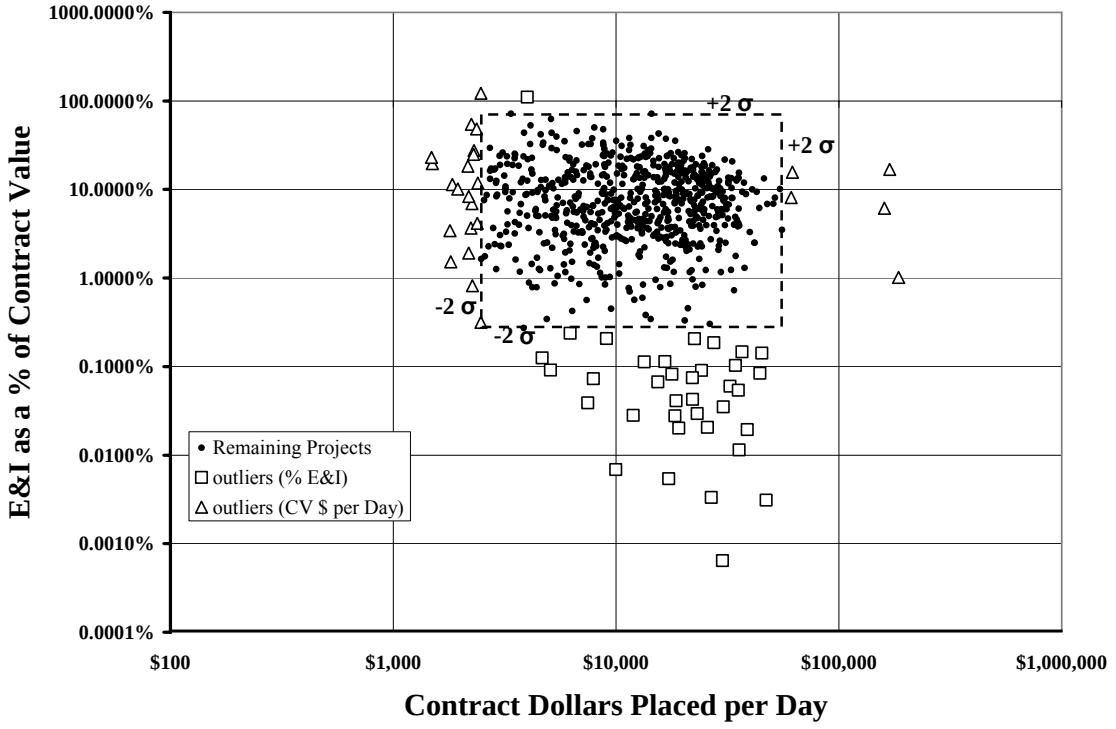


**Figure 4.5 Outliers Identified by Analysis by Percent E&I vs. Dollars per Day.**

Lastly, the daily E&I values were plotted as a function of the contract value in Figure 4.6. Since the daily E&I value are representative of potential LDs, it is important to look at the distribution of projects which will be used and which were identified as outliers. It is interesting to note that some of the outlying projects fall among the distribution of typical projects. This proves the theory, mentioned earlier, that using the daily E&I values for outlier analysis would not accurately identify all the atypical projects.

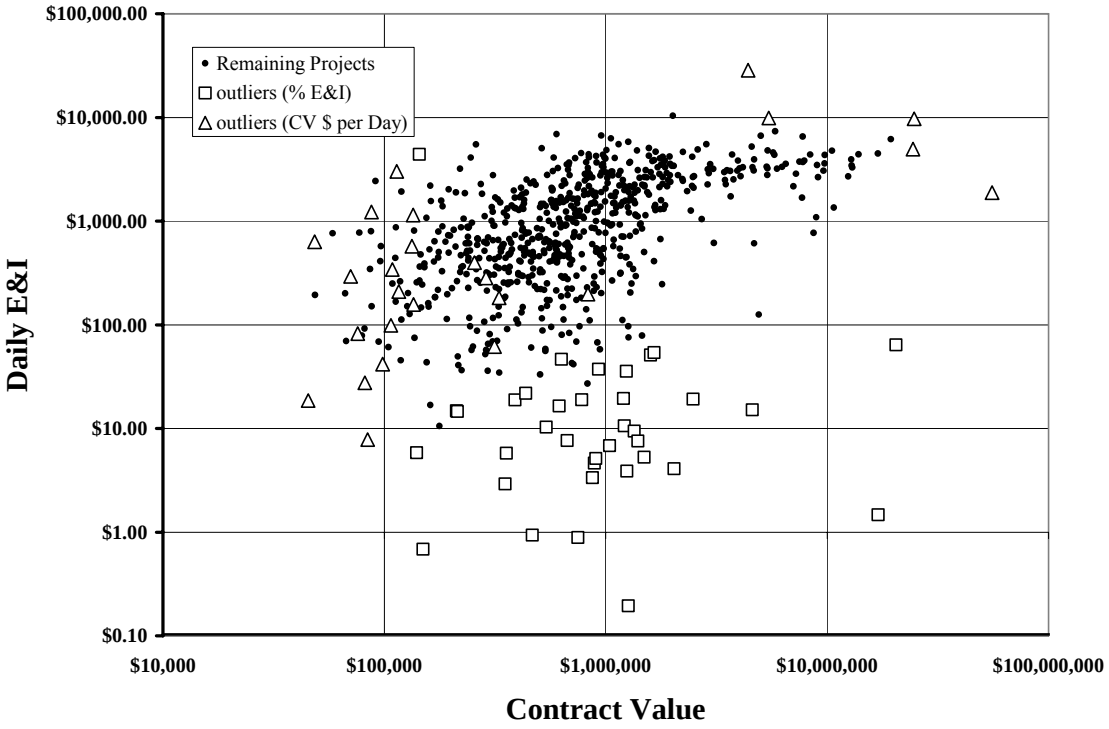


**Figure 4.6 Outliers Plotted as Daily E&I.**

Upon removal of the outliers by the statistical technique described in this chapter, the development of the methodologies for determining LD rates could commence. Chapter 5 outlines the current procedure used by ALDOT to update their own rates, as well as two new methodologies developed under this research. Comparisons between the current and

proposed procedures are conducted in order to identify an acceptable biennial review procedure to be adopted by ALDOT.

# CHAPTER FIVE

# METHODOLOGY DEVELOPMENT AND GUIDELINES

## 5.1 INTRODUCTION

This research effort sought to develop two methodologies for calculating a schedule of LD rates that would be statistically justifiable and hold up to the scrutiny of the courts. The first of which calculates LDs and presents them in a table as a function of contract value. The second methodology uses the same data set and follows the same basic steps, yet it presents them, not only as a function of contract size, but also as a function of project type.

The methodologies developed from this research are based, in their most basic form, on the guidelines set forth by the FHWA in 23 CFR 635.127. These guidelines stipulate that each SHA must, "develop and maintain their own LD rates that will cover, as a minimum, the SHA's average daily construction engineering costs attributable to a contract overrun" (23 CFR 635.127). It provides minimal direction as how a SHA is to calculate LDs, but does indicate that each SHA must review their LD rates at a minimum of every two years and update them if necessary. Due to: i.) an influx in litigation experienced by ALDOT, ii.) a review of pertinent literature on the subject, and iii.) a survey of all SHAs' LD provisions; it has become apparent that a LDs clause used in construction contracts must be robust, objective, statistically justifiable, and solid in the

eye of the court. As a result, this research effort has produced two methods for the determination of LD rates for use by ALDOT.

## 5.2 ALDOT'S CURRENT METHOD

For comparison purposes, the current procedure used by ALDOT to calculate LD rates is described in this section. This description is not meant to scrutinize the current method used, but to compare it to the methodologies developed in this research.

In December of 2006, ALDOT released an update to the LD rates they had been using for over a decade. The previous rates were established in 1988 and reviewed in 1990, but were developed the same way as the recent update. This update, was meant to estimate current daily construction engineering costs more accurately and be used as an interim provision until results of this project were completed.

The method used by ALDOT to determine its current LD rates is as follows:

### *Step One: Collection and Organization of Data*

The historical project data used by ALDOT for the estimation of future daily construction engineering costs consisted of three previous years (2003, 2004, 2005) of project data collected from the ALDOT Mainframe Construction Status File that includes: i.) contract value, ii.) contract type (i.e. working day or calendar day), iii.) E&I costs, and iv.) the number of days used to complete the project. For the recent update, this project data was composed of all projects with a completion date in 2003 though 2005. With the data in-hand, all the calendar day projects were removed from the data set and only working day projects were considered for further analysis because, the total number of working day

projects far outweighed the number of calendar day projects. ALDOT did not perform any sort of outlier elimination on the historical project data because they could not justify the elimination of particular projects. All the working day projects were organized by contract size by arranging them into the groups shown in Table 5.1.

**Table 5.1 Contract Values for Each Contract Size Group**

| Group | Contract Amount | |
|---|---|---|
| | From | To and Including |
| 1 | $0 | $100,000 |
| 2 | $100,000 | $200,000 |
| 3 | $200,000 | $500,000 |
| 4 | $500,000 | $1,000,000 |
| 5 | $1,000,000 | $2,000,000 |
| 6 | $2,000,000 | $5,000,000 |
| 7 | $5,000,000 | $10,000,000 |
| 8 | $10,000,000 | -------- |

***Step Two: Calculation of Working Day LD Rates***

The overall daily E&I costs for each contract size grouping were calculated by dividing the *total* E&I costs for that group by the *total* number of days used in that group.

$$DailyE\&I_i = \frac{\sum_{j=1}^{n} E\&Icosts_{ij}}{\sum_{j=1}^{n} \#ofDaysUsed_{ij}} \tag{5.1}$$

where,

$DailyE\&I_i$ = daily E&I cost for all projects in group *i*,

$E\&Icosts_{ij}$ = E&I costs for project *j* in group *i*, and

$\#ofDaysUsed_i$ = number of days used project *j* in group *i*.

At this point, the calculated daily E&I costs for each group can be seen in Table 5.2 below. Using engineering judgment, contract size groups which had similar daily E&I

values (e.g. groups 1, 2, and 3) were combined into a single group and LD rates were determined based on the findings in Table 5.2.

**Table 5.2 Overall Daily E&I Values for Each Contract Size Group**

| Group | Daily E&I |
|---|---|
| 1 | $488.31 |
| 2 | $613.76 |
| 3 | $571.94 |
| 4 | $1,023.23 |
| 5 | $1,955.77 |
| 6 | $3,096.29 |
| 7 | $3,742.44 |
| 8 | $3,657.13 |

***Step Three: Calculation of Calendar Day LD Rates***

With the working day LD rates determined, the focus turned to calculating the calendar day rates. Since the number of calendar day projects was limited, a statistical analysis, similar to the one performed on working days, would not be feasible. Instead, historical rainfall data was examined to determine the number of working days for each calendar month. In this procedure, experienced ALDOT engineers calculated the number of possible working days for each month based on historical project data. First, all Saturdays, Sundays, and Legal Holidays were excluded. Then, by examining the amount of rainfall each day, the engineers, using past on-site experience, determined if that day would be a feasible workday based on the amount of rainfall experienced. If so, it was counted. This process was carried out for each month and for four geographic regions in Alabama. The regions were: North Alabama (Divisions 1 & 2), Central Alabama (Divisions 3, 4, & 5), Southeast Alabama (Divisions 6 & 7), and Southwest Alabama

(Divisions 8 & 9). Figure 5.1 provides an illustration of the aforementioned ALDOT divisions.

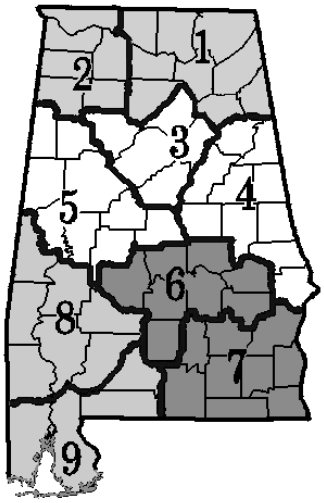


**Figure 5.1 Map of ALDOT Divisions.**

In each region, multiple sites were used to determine the feasibility of working on any given day. Overall, a statewide average number of work days per calendar year was determined to be 189. This is equivalent to 52% of the year which was rounded to an even two to one ratio. The data used to determine this ratio is shown in Table 5.3.

**Table 5.3 Table of the Average Available Workdays**

| Average Available Workdays | | | | | |
|---|---|---|---|---|---|
| **Month** | **Division** | | | | **Statewide Average** |
| | **1 & 2** | **3, 4 & 5** | **6 & 7** | **8 & 9** | |
| January | 11 | 12 | 15 | 16 | 13.5 |
| February | 10 | 12 | 15 | 15 | 13.0 |
| March | 15 | 16 | 16 | 16 | 15.8 |
| April | 16 | 17 | 17 | 18 | 17.0 |
| May | 16 | 17 | 18 | 19 | 17.5 |
| June | 15 | 15 | 15 | 15 | 15.0 |
| July | 16 | 16 | 15 | 16 | 15.8 |
| August | 18 | 17 | 18 | 17 | 17.5 |
| September | 16 | 16 | 16 | 17 | 16.3 |
| October | 18 | 19 | 19 | 19 | 18.8 |
| November | 16 | 16 | 16 | 16 | 16.0 |
| December | 10 | 13 | 15 | 14 | 13.0 |
| **Total:** | 177 | 186 | 195 | 198 | 189.0 |
| **% of 365** | 48% | 51% | 53% | 54% | **52%** |

Since calendar days occur twice as often as actual workable days, the calendar LD rates can be computed as 50% of the working day rates. The resulting LD rates, for both working days and calendar days from the outlined procedure are presented in Table 5.4.

**Table 5.4 Table of LD Rates Calculated by ALDOT**

| **Contract Value** | | **LD rates** | |
|---|---|---|---|
| **From** | **To & Including** | **Working Day** | **Calendar Day** |
| $0 | $500,000 | $500 | $250 |
| $500,000 | $1,000,000 | $1,000 | $500 |
| $1,000,000 | $2,000,000 | $1,800 | $900 |
| $2,000,000 | $5,000,000 | $2,600 | $1,300 |
| $5,000,000 | $10,000,000 | $3,200 | $1,600 |
| $10,000,000 | ---------- | $3,600 | $1,800 |

These results are also presented in a graphical context in Figure 5.2. In this chart, the distribution of projects, as well as, the contract size categories are depicted.

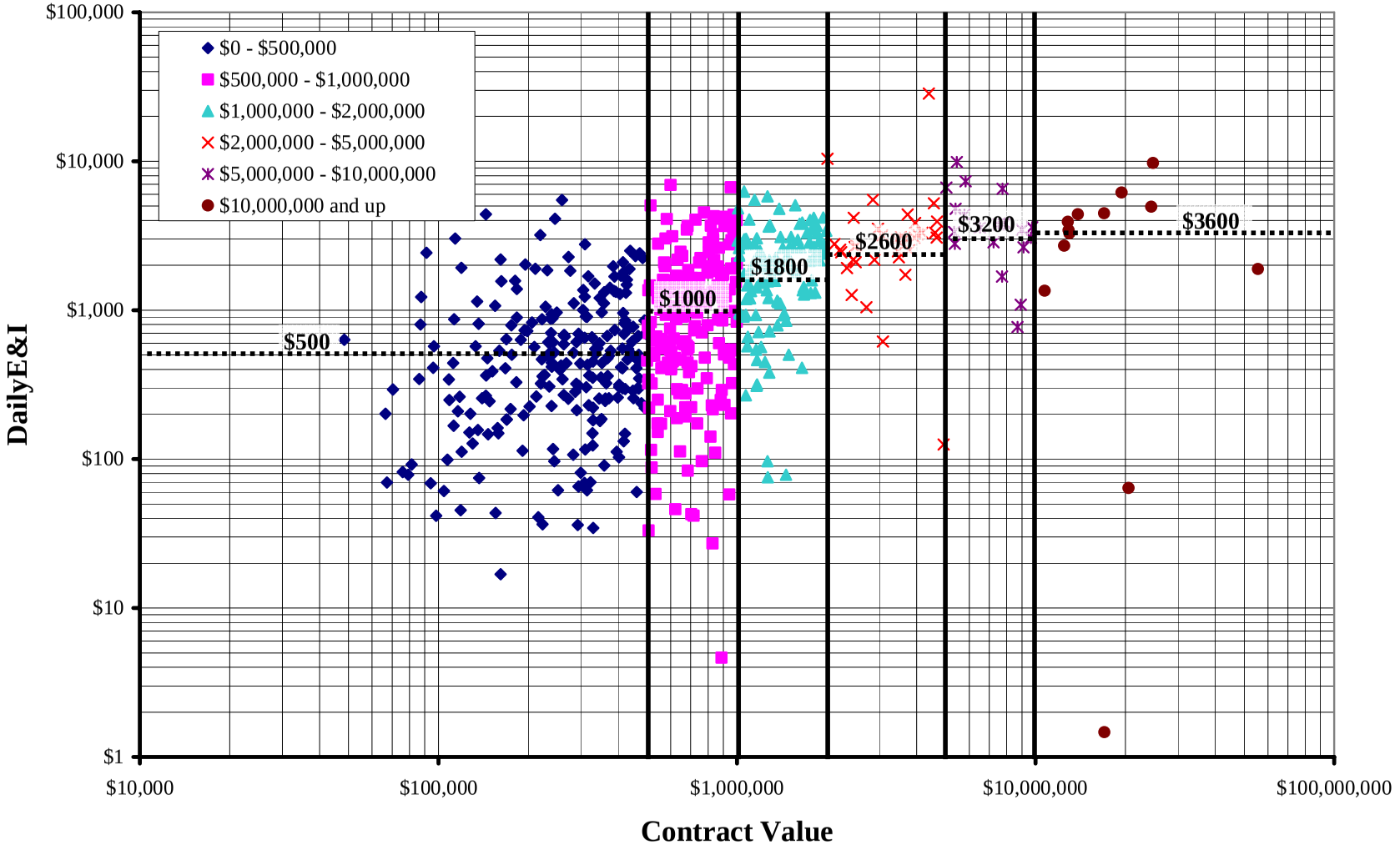


**Figure 5.2 ALDOT Method's Distribution of LD Rates.**

## 5.3 PROPOSED CONTRACT VALUE METHODOLOGY

The first methodology proposed by this research effort calculates LD rates and presents them in the traditional table by contract size. This method is meant to be statistically justifiable and defendable in court. The process used to determine the LD rates for this first methodology is as follows:

### *Step One: Collection and Organization of Data*

The acquisition and modification of the historical project data used for this methodology is described in detail in Chapter 4. This process consisted of collecting three previous years (2003 – 2005) of project data from the ALDOT Mainframe Construction Status File comprised of: i.) contract value, ii.) contract type (i.e. working day or calendar day), iii.) E&I costs, and iv.) the number of days used to complete each project. It also involved the removal of all calendar day projects, and an outlier analysis which identified and removed all atypical working day projects. For this methodology, the collection and linking of the project type designation was not necessary. The outlier analysis in Chapter 4 resulted in 665 working day projects that were used for the calculation of LD rates by this methodology.

### *Step Two: Calculation of Daily E&I Values*

The first step in calculating the LD rates was to determine the daily E&I costs for each *individual* project. The daily E&I costs were calculated using equation 5.2.

$$DailyE\&I = \frac{E\&Icosts}{\#ofDaysUsed} \tag{5.2}$$

where,

*DailyE&I* = Daily E&I costs of each project,

*E&I costs* = Total E&I costs for each project, and

*#ofDaysUsed* = Total number of days used to complete each project.

***Step Three: Determination of Contract Size Groups***

Once the daily E&I values for each project had been calculated, a statistical procedure to determine which contract size groups were statistically different from the others had to be performed. This is important because if there is a statistically significant variance in the averages for different sized projects, then each contract group should have separate averages. On the other hand, if there are not statistically significant variances between the groups then they should be combined into one group.

To test for these variances in the populations it was important to know if the data follows a normal distribution. This will determine the type of test that can be used to ascertain if there are any statistically significant differences. If the dataset is normally distributed, then the one way analysis of variance (ANOVA) test can be performed. If the dataset is not normally distributed then other non-parametric tests can be conducted such as the Kruskal-Wallis (K-W) test.

Parametric refers to a statistical method that makes assumptions about the distribution of the population (Navidi, 2006). The ANOVA test is a parametric statistical test because it assumes that the dataset follows the normal distribution, and the K-W test is non-parametric statistical technique because it makes no assumptions about the distribution of the data being tested. The K-W test is a more complicated procedure, but it offers more flexibility, in that, a data set does not have to be normally distributed, although it can be.

Since the data used were not normally distributed and future data sets may or may not be normally distributed, the test for variance needed to be non-parametric. Therefore, the K-W test was used.

The K-W test does not assume that the data follows the normal distribution; instead, it rank orders the data. This is done by ranking all the data from the groups together from 1 to *N*. The K-W test determines the test statistic *K* using equation 5.3.

$$K = \frac{12\sum_{i=1}^{g} n_i \left( \frac{\sum_{j=1}^{n_g} \overline{r_{ij}}}{n_i} - \overline{r} \right)^2}{N(N+1)} \tag{5.3}$$

where,

$K$ = test statistic,

$n_g$ = number of observations in group $g$,

$\overline{r_{ij}}$ = is the rank (among all observations) of observation $i$ from group $g$,

$\overline{\boldsymbol{r}}$ = average rank of all the observations, equal to ($N$+1)/2, and

$N$ = total number of observations across all groups.

Once the K was determined, a p-value was approximated using equation 5.4.

$$\Pr\left(\chi^2_{g-1} \geq K\right) \tag{5.4}$$

where,

$K$ = test statistic (probability distribution) and

$\chi^2_{g-1}$ = chi-squared distribution.

The probability distribution of the outcome should approximately follow that of the chi-square distribution, with greater variances occurring between groups with a *N* less than 5. The null hypothesis used for this test is that there is no difference in the groups, and the alternative hypothesis is that there is at least one difference in the groups. Similar to a ANOVA test, the difference is not indicated, only that there is some variance between the two groups (Wikipedia, 2007). For this reason, each group was tested against all the other groups individually using the K-W test. To expedite the many iterations required to evaluate the data, MINITAB™ statistical software was used for the K-W tests. The p-value used to test for significance during the tests was 0.05. This means that when the outcome of the K-W test was less than 0.05, for two groups being tested, the groups were determined to be significantly different from each other. A p-value of 0.05 was chosen because it is a typical value used that balances the chances of a Type I error with those of a Type II error. With the 0.05 indicating that there is at most a 5% chance that the data has random variance that causes it to have a Type II error. (Navidi, 2006) A Type I error rejects the null hypothesis when it is true (indicating that there is no difference in the two groups when one actually exists), while a Type II error fails to reject the null hypothesis when it is false (indicating that there is a difference when one does not actually exist) (Navidi, 2006). If the p-value for the groups was 0.05 or greater then the groups were statistically similar and were combined into a single group. For example, if the contract size groups 1 and 2 are being compared to each other, all the daily E&I values of 1 and 2 are ranked from smallest to largest in one group. If any of the daily E&I values are the

same, then the ranks the data points would have received are averaged and the like-values are all given the averaged rank. The test then computes the median of the ranks corresponding to each contract size group. It then compares the medians of each group to determine if there is a statistically significant difference between two groups.

The K-W test was performed on each group against all other groups to determine the new contract size groups. This resulted in combining groups 1 and 2 together as well as combining groups 7 and 8 together.

Once the contract size groups had been determined, the average daily E&I for each group was calculated using equation 5.5.

$$AvgDailyE\&I_i = \frac{\sum_{j=1}^{n} DailyE\&I_{ij}}{n_i} \tag{5.5}$$

where,

$AvgDailyE\&I_i$ = average daily E&I costs for all projects in group *i*,

$DailyE\&I_{ij}$ = daily E&I costs for project *j* in group *i*, and

$n_i$ = total number of projects in group *i*.

The LD rates were calculated by rounding the average daily E&I for each group to the nearest $100. The contract size groupings along with the average calculated daily E&I values and LD rates for each grouping are shown in Table 5.5.

**Table 5.5 Contract Groups and LD Rates**

| Contract Value | | Average Daily E&I | Working Day LD Rate |
|---|---|---|---|
| From | To & Including | | |
| $0 | $200,000 | $518.23 | $500 |
| $200,000 | $500,000 | $728.94 | $700 |
| $500,000 | $1,000,000 | $1,283.73 | $1,300 |
| $1,000,000 | $2,000,000 | $2,027.23 | $2,000 |
| $2,000,000 | $5,000,000 | $3,055.27 | $3,100 |
| $5,000,000 | --------- | $3,704.43 | $3,700 |

***Step Four: Calculation of Calendar Day LD Rates***

With the working day LD rates determined, calculation of calendar day rates could proceed. The same procedure used by ALDOT to determine calendar day rates was used for this first procedure. The resulting LD rates, for both working days and calendar days as calculated by this methodology are presented in Table 5.6 and in a graphical context in Figure 5.3.

**Table 5.6 Overall Daily E&I Values for Each Contract Size Group**

| Contract Value | | LD rates | |
|---|---|---|---|
| From | To & Including | Working Day | Calendar Day |
| $0 | $200,000 | $500 | $250 |
| $200,000 | $500,000 | $700 | $350 |
| $500,000 | $1,000,000 | $1,300 | $650 |
| $1,000,000 | $2,000,000 | $2,000 | $1,000 |
| $2,000,000 | $5,000,000 | $3,100 | $1,550 |
| $5,000,000 | ---------- | $3,700 | $1,850 |

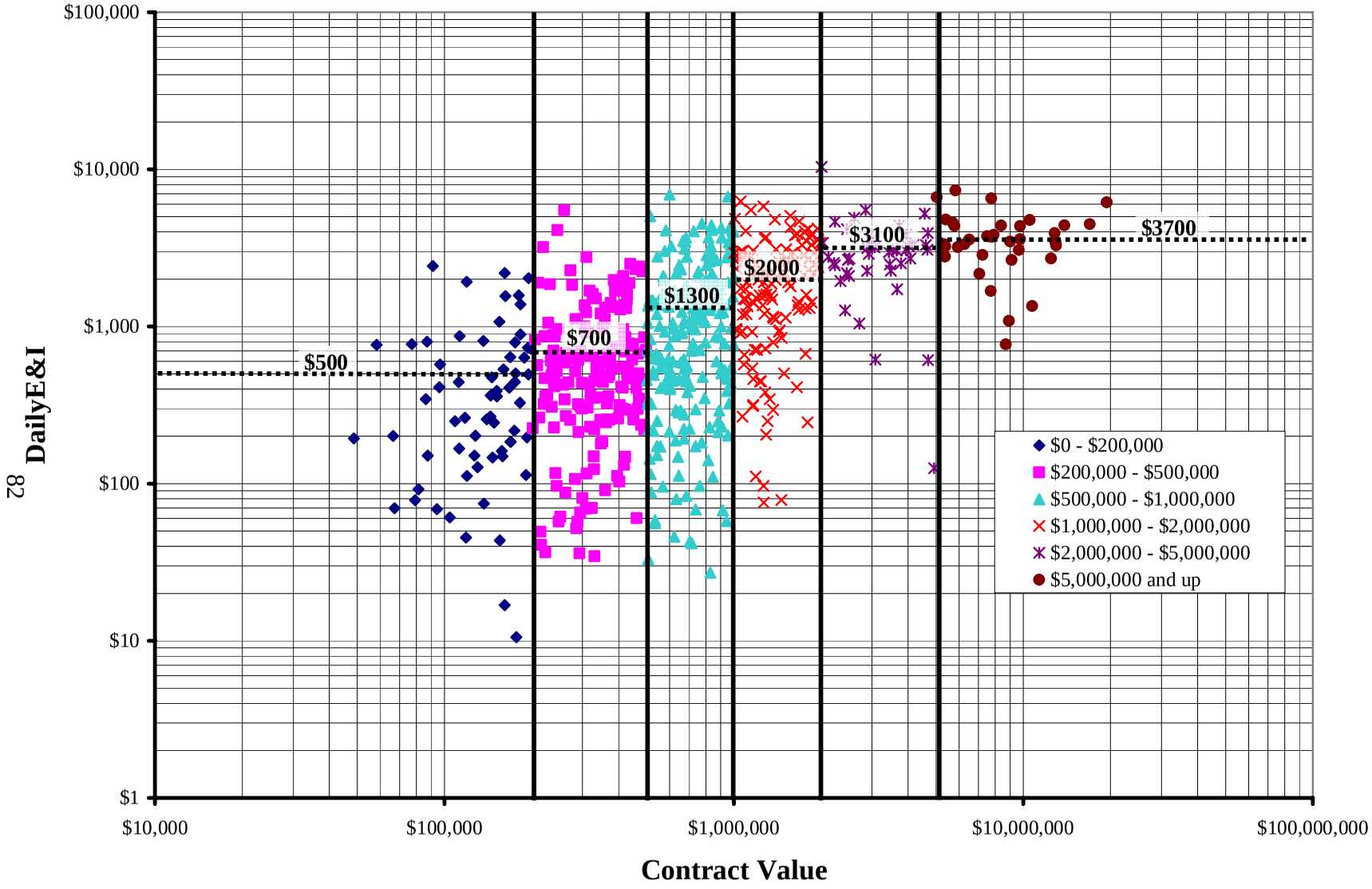


**Figure 5.3 Contract Value Method's Distribution of LD Rates.**

## 5.4 PROPOSED PROJECT TYPE METHODOLOGY

SHAs contract many different types of projects in an effort to satisfy the public's transportation demands. They spend a lot of money on resurfacing and rehabilitating in-place pavements, renovating and building bridges, and maintaining existing structures. The broad range of work even includes pavement striping, lighting roadways, and landscaping the right-of-way. The characteristics of each of these projects differ, as do the costs to manage them. A bridge replacement project requires a different amount of personnel and materials testing than a resurfacing project of equal contract size. The purpose of this second methodology is stipulate LDs not only by contract size, but also by the project type in an effort to account for these differences. Doing so can result in a more accurate estimate of the actual costs incurred by a SHA on a daily basis.

The second proposed methodology of this research closely follows that of the first; however, the project type designations were incorporated into the analysis as described in Section 4.4.1. The process used to determine the LD rates for this second methodology is as follows:

### *Step One: Collection and Organization of Data*

The first step in this methodology is identical to that used in the first methodology outlined in section 5.3, however, it also incorporates the collection of the project type designation from the TRNSPORT software.

***Step Two: Calculation of Daily E&I Values***

The calculation of the daily E&I values for each project was determined using the same procedure outlined in section 5.3 using equation 5.2.

***Step Three: Determination of Contract Size and Project Type Groups***

The contract size groupings were determined using the non-parametric K-W test as described in the first methodology in section 5.3. Once the contract size groups were determined, the same K-W procedure was followed to determine which project type groups are statistically different from the others. Table 5.7 lists the all the project type groups available in the TRANSPORT database system.

**Table 5.7 Project Type Designations**

| CODE DESCRIPTION |
|---|
| Building Work |
| Bridge Repair, Bridge Rehabilitation |
| Bridge Replacement Only |
| Bridge Painting |
| Clearing, Clearing and Grubbing |
| Bridge Culvert and Culvert/Pipe Ext. |
| Erosion Control, Rip Rap, Slide/Drainage |
| Grade Drain Base Pave or Bridge & Approach |
| Guardrail |
| Intersection Improvements, Turn Lanes |
| Lighting |
| Landscaping |
| Road Side Mowing |
| Pavement Rehab, Resurfacing |
| Rest Area Building, Rehab, Complete |
| Roadway Widening, Add'l Lanes, Pass Lane |
| Railroad Work |
| Signals, Markings, Signalization |
| Signing, Sign Rehab, Delineators |
| Structure Removal |
| Soil Remediation, Tank Removal |
| Traffic Striping, Pavement Markings |
| Unclassified |
| Wetland Mitigation |
| Weigh Station |

Table 5.7 reveals the vast number of different project type designations present in the ALDOT database system. In order to conduct the K-W procedure based on project type, groups which were similar were combined based on their name to reduce the total number of groups and to increase the sample size for each group. Table 5.8 shows the regrouping of the original project type groups which were used for analysis.

**Table 5.8 Project Type Group Consolidation**

| Groups Used for Analysis | Categories Included in Each Group |
|---|---|
| Bridge | Bridge Repair, Bridge Rehabilitation |
| | Bridge Replacement Only |
| | Bridge Culvert and Culvert/Pipe Ext. |
| Grade, Drain, Base, & Pave | Grade Drain Base Pave or Bridge & Approach |
| Signals & Markings | Signals, Markings, Signalization |
| | Traffic Striping, Pavement Markings |
| Road and Pavement | Intersection Improvements, Turn Lanes |
| | Pavement Rehab, Resurfacing |
| | Roadway Widening, Add'l Lanes, Pass Lane |
| Miscellaneous | Structure Removal |
| | Lighting |
| | Guardrail |
| | Erosion Control, Rip Rap, Slide/Drainage |
| | Unclassified |
| Unused Categories | Bridge Painting |
| | Building Work |
| | Clearing, Clearing and Grubbing |
| | Landscaping |
| | Road Side Mowing |
| | Rest Area Building, Rehab, Complete |
| | Railroad Work |
| | Signing, Sign Rehab, Delineators |
| | Soil Remediation, Tank Removal |
| | Wetland Mitigation |
| | Weigh Station |

The K-W analysis was run on the five categories in the left-hand column of Table 5.8 by comparing the daily E&I values. The procedure resulted in three statistically different project size groups: i.) 'Bridge', ii.) 'Road and Pavement', and iii.) 'Miscellaneous'. The 'Grade, Drain, Base & Pave' and 'Signals & Markings' groups were combined into the

'Miscellaneous' group. Once the contract size and project type groups had been determined, the LD rates were calculated the average daily E&I for each group and rounding the value to the nearest $100.

***Step Four: Calculation of Calendar Day LD Rates***

Once the working day LD rates had been determined, calendar rates were calculated using the same procedure as before, which is outlined in section 5.2. The resulting LD rates, for both working days and calendar days as calculated by this methodology are presented in Table 5.4 and graphically in Figure 5.4. The chart in Figure 5.4 illustrates how the LD rates for the different project type groups change in relation to each other as the contract value changes.

**Table 5.9 LD Rates by Contract Size and Project Type**

| | | Daily Liquidated Damages Rates | | | | | |
|---|---|---|---|---|---|---|---|
| Contract Value | | Bridge | | Road | | Miscellaneous | |
| From | To & Including | Work Day | Calendar Day | Work Day | Calendar Day | Work Day | Calendar Day |
| $0 | $200,000 | $400 | $200 | $700 | $350 | $500 | $250 |
| $200,000 | $500,000 | $400 | $200 | $800 | $400 | $800 | $400 |
| $500,000 | $1,000,000 | $600 | $300 | $800 | $400 | $1,600 | $800 |
| $1,000,000 | $2,000,000 | $1,500 | $750 | $1,100 | $550 | $2,200 | $1,100 |
| $2,000,000 | $5,000,000 | $3,800 | $1,900 | $3,900 | $1,950 | $2,800 | $1,400 |
| $5,000,000 | ---------- | $3,300 | $1,650 | $2,700 | $1,350 | $3,800 | $1,900 |

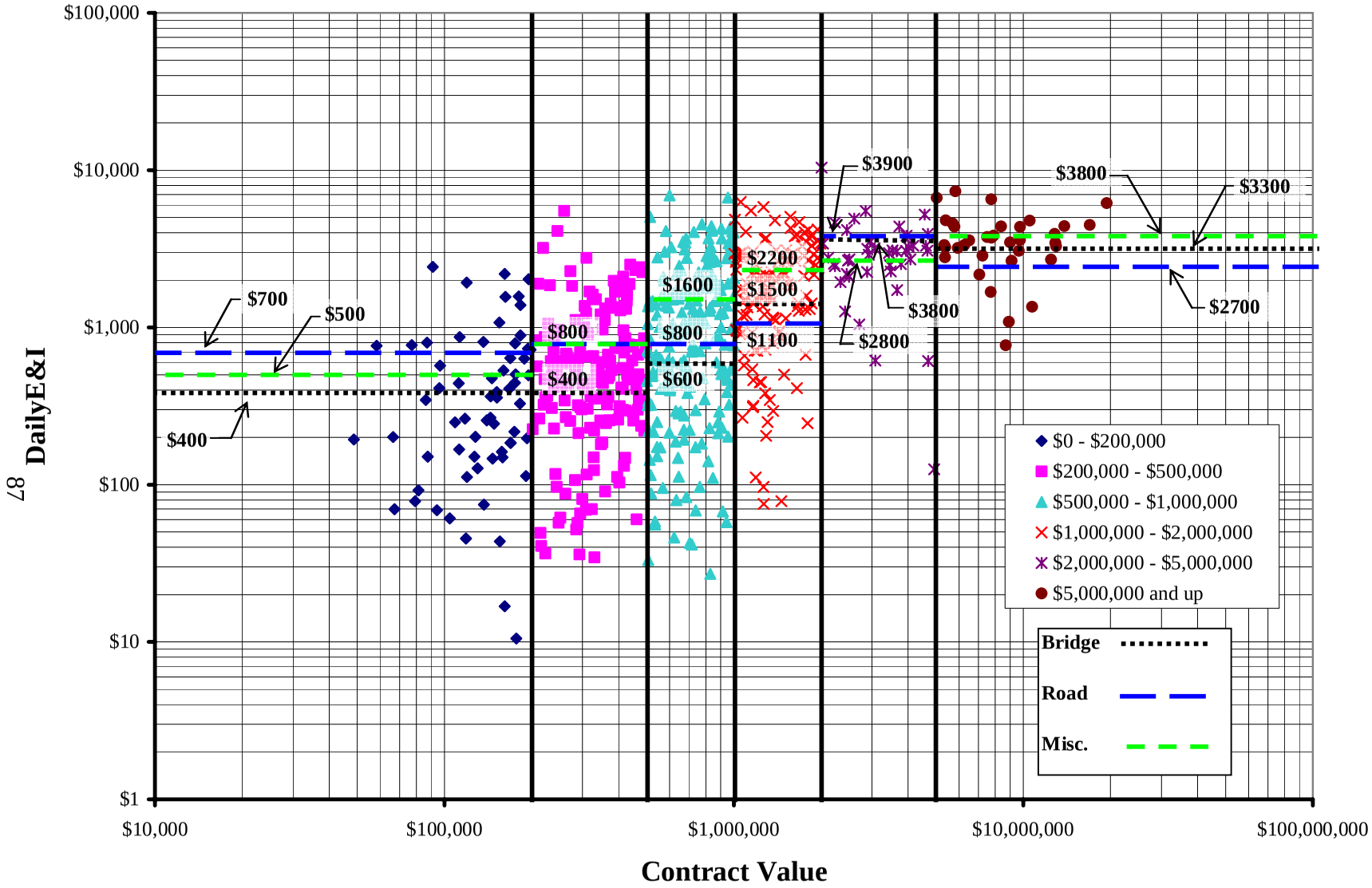


**Figure 5.4 Project Type Method's Distribution of LD rates.**

## 5.5 EVALUATION OF METHODS AND RECOMMENDATIONS

The three methodologies stipulated in this chapter for calculating LDs all follow a similar procedure. They each use historical project data to calculate a daily E&I value in order to estimate what LD charges should be used on future projects. The purpose of this research was to develop a statistically justifiable method for calculating LDs, since ALDOT's current policy has come under legal scrutiny. Therefore, the two methodologies proposed in this research effort were designed to be the most robust methods possible for calculating LDs. In order to compare the methodologies and determine the best procedure for calculating LDs, six criteria were used to objectively evaluate the methods relative to each other: i.) the statistical justification of the method, ii.) the repeatability of the method, and iii.) the accuracy of the resulting LD rates, iv.) ease of development of the LD rates, v.) the acceptability of the procedure, and vi.) the ease of comprehending the procedure. The methods were assessed on how well they fulfilled each criterion by rating them as *weak*, *moderate*, or *strong*. The results of this evaluation are presented in Table 5.10.

From Table 5.10 it is clear that the contract value methodology proposed under this research is most adequate at determining LD rates for ALDOT on a biennial basis. This method presents LD rates in the same way that ALDOT's current policy does. However, the process used to attain the rates differs. It uses statistical procedures to eliminate atypical projects from the data pool, and to determine which contract size groups are significantly different from the others. Finally, it adds a standardized method for determining the LDs rate based on the calculated daily E&I average for each group. By eliminating subjectivity, this methodology the is most robust and least susceptible to

failing under legal scrutiny. A stepwise guide for ALDOT to follow depicting the steps used to complete this procedure is available in Appendix D.

**Table 5.10 Evaluation of Methodologies**

| Evaluation Criteria | Method | | |
|---|---|---|---|
| | ALDOT | Contract Value | Project Type |
| **Statistical Justification** | **Weak**. The ALDOT method did not employ statistical techniques to evaluate the data, determine contract size groupings, or to calculate the LD rates. | **Strong.** The first method proposed under this research follows a statistical procedure that objectively eliminates outliers, determines contract size groupings and calculates the LD rates. | **Moderate.** The second method proposed under this research followed the same statistical procedures as the contract value method to eliminate outliers, determine contract size & project type groupings, and calculate the LD rates, but required some assumptions. |
| **Repeatability** | **Weak**. Due to the use of engineering judgment for determining the contract size groupings as well as the LD rates, the repeatability of this procedure is weak. | **Strong.** Since this methodology follows a stepwise procedure to determine the LD rates from historical data, it can be easily repeated by any practitioner for biennial updates. | **Moderate.** While this method follows the same stepwise procedure as the first proposed method, it does involve engineering judgment to consolidate the project type groupings. This reduces the repeatability of this procedure. |
| **LD Rate Accuracy** | **Weak**. The ALDOT method does not identify or eliminate outliers from the data. As a result, atypical projects and even typographical errors could potentially skew the resulting LD rates to be inaccurate. | **Moderate.** Through the use of an outlier analysis to eliminate atypical projects, this method produces accurate estimated daily E&I costs corresponding to a contract size range for typical projects. | **Strong.** By incorporating the same statistical procedure as the contract value method to eliminate outliers and by stipulating LDs by both contract size and project type, the resulting LD rates more accurately resemble actual daily E&I costs encountered. |

(continued below)

**Table 5.10 Evaluation of Methodologies (continued)**

| Evaluation Criteria | Method | | |
|---|---|---|---|
| | ALDOT | Contract Value | Project Type |
| **Ease of Development** | **Moderate.** The ALDOT method does not involve many steps to determine LD rate, however, up to this point, the steps have not been documented and require specialized knowledge to make engineering judgments | **Strong.** LDs are determined by following the stepwise guide developed under this research. No specialized training is necessary. | **Moderate.** This procedure involves a more complicated process than calculating LDs by just contract size. Since assumptions are required in order to determine some project types, this procedure requires specialized knowledge. |
| **Acceptability of Procedure** | **Weak.** Clearly this procedure has not been accepted well due to the high level of litigation it has encountered. | **Strong.** Due to the statistical stepwise procedure involved in the determination of the LD rates, this method would be more inclined to be accepted. | **Moderate.** Even though the procedure consists of a stepwise method, it still requires assumptions to be made which may weaken the method in the eyes of its critics. |
| **Ease of Comprehension** | **Weak.** Before the method had been documented in this research it was difficult to understand. It involves a process only known to those that perform it and includes steps which require engineering judgment. | **Moderate.** While this procedure involves statistical techniques which the average person is not familiar with, it follows a logical stepwise process. The results produce a schedule of LD rates familiar to the majority of practitioners. | **Moderate.** The project type method is a fairly original way to stipulate LDs. Since it is new, practitioners are not currently familiar with it. Also the many steps involved in the procedure add to its complexity. |

The project type methodology proposed by this research is an extension of the contract value method. The same procedure is followed to determine the contract size groups. Then, in order to create more detailed presentation of the LD rates, project type designations are incorporated into the analysis. The historical project data is organized according to the type of project performed and a statistical analysis is performed to determine which project types have significantly different daily E&I costs than the others. The main hurdle this method encountered was the limited number of projects in

the data pool with a project type designation. Also, the project type groups have not been standardized by ALDOT, so there are numerous groups, some of which are redundant, requiring the consolidation of some categories into a single group using subjective engineering intuition.

Applying the lessons learned from the literature review and SHA survey; and comparing the two new methodologies developed under this research with ALDOT's current policy; it is recommended that the first methodology proposed by this research be adopted by ALDOT for future calculations of LD rates. While the second method allows the LD rates to be stipulated in a more detailed and consequently a more accurate format, this research found that the assumptions required to incorporate the project type designations into the method, weakened the objectivity of this procedure. In the future, standardized project type categories and better record keeping may allow this second methodology to be incorporated by ALDOT. At the time being, the recommended methodology seems to be sufficiently based on the current state-of-the-practice of LDs used by SHAs across the country.

# CHAPTER SIX

# SUMMARY AND CONCLUSIONS

## 6.1 INTRODUCTION

This research project focused on four specific goals: i.) to administer a survey to determine the state-of-the-practice on a national scale of SHAs' use of LD provisions in construction contracts, ii.) to develop two methodologies to compute LDs that are statistically justifiable, entirely objective, and flexible enough to be used biennially to update LD rates, iii.) to compare the two methodologies to the current ALDOT method to identify the most appropriate method for computing LDs, and iv.) develop guidelines for practitioners to use for updating LDs on a biennial basis. The successes, shortcomings, and recommendations for future work in all four areas will be addressed in the following sections.

## 6.2 SURVEY OF THE STATE-OF-THE-PRACTICE

The first step in achieving the ultimate goal of this research was to obtain a better understanding of the state-of-the-practice concerning SHAs use of LD policies. This was accomplished through the use of an online survey. The initial response rate was low, but through follow-up interviews, responses from all 50 states, Washington D.C, Puerto Rico, and the New Jersey Turnpike Authority, were obtained. The survey first revealed that LD rates are kept low by the state agencies, covering only the minimum category of

costs. This provides the contractor with an unreasonably low estimate to factor in when facing a potential delayed completion. This may be why few states have their provisions challenged in court. Secondly, administrative practices reflect a higher priority in closing out projects, than collecting LDs. Finally, legal challenges to these LD provisions are infrequent which contradicts the situation experienced by ALDOT.

## 6.3 LDs METHODOLOGY DEVELOPMENT

The second objective of this research was to develop two new methodologies for the calculation of LDs. The procedures were meant to be statistically justifiable and lack subjectivity. The purpose was to develop a method for calculating LDs that had no weaknesses which could be scrutinized by the courts. The first method that was developed accomplished these goals. The procedure involved collecting historical project data, statistically eliminating atypical projects, statistically determining contract size groups, and objectively calculating and stipulating LD rates in a tabular format by contract size. The second methodology followed the same initial steps as the first one. In an effort to stipulate LDs in a more detailed format, a project type designation was applied to the data. The method was able to successfully produce a LDs table in which the rates were specified by both contract size and project type. However, assumptions had to be made in order to accomplish this by: classifying projects without a type description as "unclassified" and consolidating the many project type categories. It is a relatively new procedure for ALDOT to record the project type designation. As a result, not all of the projects used for analysis contained this designation. Also, there is no standardized set of project type categories resulting in an excessive number of and

redundancy in the categories. These assumptions weaken the procedure by introducing bias into the methodology.

## 6.4 COMPARISON AND RECOMMENDATION OF LD METHODOLOGIES

From the two methodologies developed in the research effort, the first methodology which stipulates LDs in a traditional table categorized by contract size is recommended to ALDOT for adoption. It was determined to be the most effective for calculating LD rates in a statistically justifiable procedure. This was determined by evaluating the two proposed methodologies against ALDOT's current method according to six criteria. A synopsis of the results of this comparison can be seen in Table 6.1.

**Table 6.1 Comparison of Methodologies**

| Evaluation Criteria | Method | | |
|---|---|---|---|
| | ALDOT | Contract Value | Project Type |
| **Statistical Justification** | ● | ●●● | ●● |
| **Repeatability** | ● | ●●● | ●● |
| **LD Rate Accuracy** | ● | ●● | ●●● |
| **Ease of Development** | ●● | ●●● | ●● |
| **Acceptability of Procedure** | ● | ●●● | ●● |
| **Ease of Comprehension** | ● | ●● | ●● |

●●● = Strong
●● = Moderate
● = Weak

The contract value method proposed under this research follows a stepwise procedure lacking subjectivity and incorporates statistical techniques to verify the results. While the project type method allows the LD rates to be stipulated in a more detailed and

consequently a more accurate format, this research found that the assumptions required to incorporate the project type designations into the method, weakened the overall objectivity of that procedure. In the future, standardized project type categories and better record keeping may allow this second methodology to become completely subjective and potentially be incorporated by ALDOT.

## 6.5 DEVELOPMENT OF GUIDELINES FOR CALCULATING LDs

The final objective of this research was to develop guidelines which can be used by practitioners at ALDOT to update their rates biennially. This was successfully accomplished and a stepwise guide was developed for the recommended methodology. The FHWA requires that states review their LD policies at a minimum of every two years and update them if necessary. These guidelines clearly define the steps required for ALDOT to complete the process outlined in this research and obtain updated LD rates above and beyond the guidance provided by the FHWA. The guidelines present a robust set of policies and procedures for the biennial evaluation of LD rates.

## 6.6 USEFULNESS TO THE PRACTICE

The formulation of an easily understood guideline for developing LDs gives practitioners a mechanism for developing statistically justifiable LD rates. The methods obtained from this research will allow ALDOT to stipulate LD rates accurately, preventing future litigation. By eliminating the additional costs and time of defending LDs in the courts, the new methodology could reduce ALDOT's overhead considerably. This research fills a gap in the general knowledge in regards to SHAs development of LDs provisions.

Used as a resource, the results of the survey and this research could aid other states in the development of more robust LD policies and procedures.

## 6.7 RECOMMENDED FURTHER RESEARCH

### 6.7.1 Development of a Project Specific LD Calculation Methodology

The methodologies developed under this research stipulate LD rates in a tabular format to be used to easily attain LD charges for a typical project. However, SHAs frequently encounter projects which are either atypical in form or require the incorporation of additional costs into LDs. The federal regulations for LDs permit SHAs to include additional amounts into LD charges to cover other anticipated costs such as delays or inconveniences to the SHA or the public. The regulation specifies road user costs (RUC) as one of the additional costs (23 CFR 635.127). In order to include such items, the LD charges would need to be evaluated on a project specific basis, since the additional costs would vary so much from project to project. Therefore, further research needs to be conducted to develop a project specific methodology for computing LDs. This method would also include a method for determining the amount of RUCs a project requires. RUC are defined as the estimates of incremental daily costs to the traveling public which results from construction work being performed (Daniels et al., 2000). These costs are primarily the result of time lost to the public due to added delays of detours, reduced roadway capacity, or a delay in the opening of a new facility.

The most obvious scenario for the incorporation of RUC is on high-profile urban freeway reconstruction projects, since there is a strong potential for very high motorist delay costs. These projects would require the assistance of traffic modeling software to

estimate the effects a construction project will have on public delay. But, by evaluating historical project data and comparing it to traffic models, it may be feasible to develop expected RUC based on a project's characteristics. Presented in tabular form, the estimated RUC for smaller projects could be quickly and efficiently determined for LD estimation.

### 6.7.2 Adaptation of New LD Guidelines by the FHWA

The current guidelines provided by the FHWA on the development of a LDs provision are broad, leaving the method for calculation up to the SHAs. As a result, the policies developed by many SHAs could potentially face future litigation if they are not sound methods. There exists a need for updated federal guidelines directing SHAs on how to properly determine LD rates. The results of this research would provide a basis for the guidelines. The federal provision would need to be general enough to accommodate the different administrative practices of the SHAs but, at the same time, remain detailed enough to provide sufficient guidance. Furthermore, the results of future research could be incorporated into a workshop in which SHA official could attend and receive hands-on training on how do develop a proper LDs policy.

## REFERENCES


1. Alabama Department of Transportation Standard Specifications for Highway Construction, 2002 Edition. Retrieved February 26, 2006, from the World Wide Web: http://www.dot.state.al.us/internetdocs/pdfs/bureaus/construction/spec_2002/2002_aldot_spec_book.pdf.

2. Allen, R. (1995, Spring-Summer). "Estimation of Construction Contract Liquidated Damages." *Civil Engineering Practice*, Boston School of Civil Engineering, Boston. Vol.10, No.1, pp.7-17

3. Bramble, B., Callahan, M. (1987). "Construction Delay Claims" Wiley Law Publications, Canada. pp 1-12, 47-52

4. Daniels, G., Stockton W. R., Hundley, R., *Estimating Road User Costs Associated with Highway Construction Projects.* Transpotation Research Record. 2000, Issue 1732, pp 70-79. No. 00-0328

5. Jaques, M. (2004). "*Construction Update-14 December 2004."* Recent issues on liquidated damages. Retrieved February 16, 2006, from the World Wide Web: http://www.mallesons.com/publications/Construction_update/7682501w.htm

6. Jensen, D. (2000, Summer). "Liquidated Damages: Testing when in Time the Intent Test is Applied'. *Journal of Construction Education*, Vol.5, No.2, pp 162-176

7. Kraiem, Z.M. and Diekmann, J.E. (1987) *Concurrent Delays in Construction Projects,* ASCE Journal of Construction Engineering and Management, Vol 113, No. 4, pp 591-602.

8. Leon, G., Klanac, G., Edwards, W. (1993). "Liquidated Damages for Multi-prime Project." *AACE International Transactions*, ABI/INFORM Global, pp. CD15.1 – 15.7.

9. Loulakis, M., Santiago, S. (1997, March). "Successfully Challenging a Liquidated Damages Claim." *Civil engineering*, ABI/INFORM Complete, pp. 35

10. Marascuilo, Leonard A., and Maryellen McSweene. *Nonparametric and Distribution-Free Methods for the Social Sciences*. Monterey, California: Brooks/Cole Publishing Company, 1977.

11. McCormick, C. R. (2003). "Make Liquidated Damages Work." *AACE International Transactions*, ABI/INFORM Global, pp. CD15.1 – 15.7.

12. Melwood Construction Corp., V. State of New York. No. 63926. Court of Claims of New York. 26 Oct. 1984.

13. Milton Construction Company, Inc. V. State of Alabama Highway Department. No. 1900731. Supreme Court of Alabama. 23 Aug. 1991. 1 June 2005 <http://web2.westlaw.com/result/documenttextr.aspx?cfid=1&rltdb=CLID_DB433016&vr=2....>.

14. Navidi, William. Statistics for Engineers and Scientists. New York, New York: McGraw-Hill, 2006.

15. Naoum, S. (1998). "Dissertation Research and Writing-for construction students." Elsevier, Burlington, MA, pp 54-55, 70-71

16. Pennsylvania Department of Transportation V. Interstate Contractors Supply Company. No. 2379. Commonwealth Court of Pennsylvania. 2 Jan. 1990.

17. Pete Vicari General Contractor, Inc. V. Naval Facilities Engineering. No. 54982. Armed Services Board of Contract Appeals. 21 Nov. 2005.

18. Rose, Norton. *Alfred McAlpine Capital Projects Ltd v Tilebox Ltd* Royal Institution of Chartered Surveyers, May 19, 2005.

19. Sweet, J., Schneier, M. (2004). "Legal aspects of Architecture, Engineering, and the Construction Process". Seventh edition, Thomson, Canada. pp. 576-581

20. Scott, Robert E., and George G. Triantis. "Anticipating litigation in contract design." *Yale Law Journal* 115.4 (Jan 2006): 814(66).

21. Thomas, H. R., Smith, G. R., and Cummings, D. J. (Dec 1995). "Enforcement of Liquidated Damages." *Journal of Construction Engineering and Management*,Vol. 121, No. 4, pp. 459-463.

22. U.S. Code of Federal Regulations, 23 CFR 635.127. Retrieved January 22, 2006, from the World Wide Web: http://www.access.gpo.gov/nara/cfr/waisidx_00/23cfr635_00.html

23. Wikipedia. *Kruskal-Wallis One-way Analysis of Variance*. Last Modified 5 May 2007. Accessed 14 May 2007. http://en.wikipedia.org/wiki/Kruskal-Wallis_one-way_analysis_of_variance.

24. Williams Construction Company, Inc. V. Maryland State Highway Administration. No. 2179. State of Maryland Board of Contract Appeals. 17 Oct. 2001.

# APPENDICES

# APPENDIX A

# SHAS' LIQUIDATED DAMAGES TABLES

## ALABAMA (PRE-2006)

| Contract Value | | Daily Liquidated Damages Rate | |
|---|---|---|---|
| More Than | To and Including | Calendar Day | Work Day |
| $0 | $100,000 | $120 | $200 |
| $100,000 | $200,000 | $180 | $300 |
| $200,000 | $500,000 | $300 | $500 |
| $500,000 | $1,000,000 | $480 | $800 |
| $1,000,000 | $2,000,000 | $660 | $1,100 |
| $2,000,000 | $5,000,000 | $840 | $1,400 |
| $5,000,000 | $10,000,000 | $1,020 | $1,700 |
| $10,000,000 | --- | $1,200 | $2,000 |

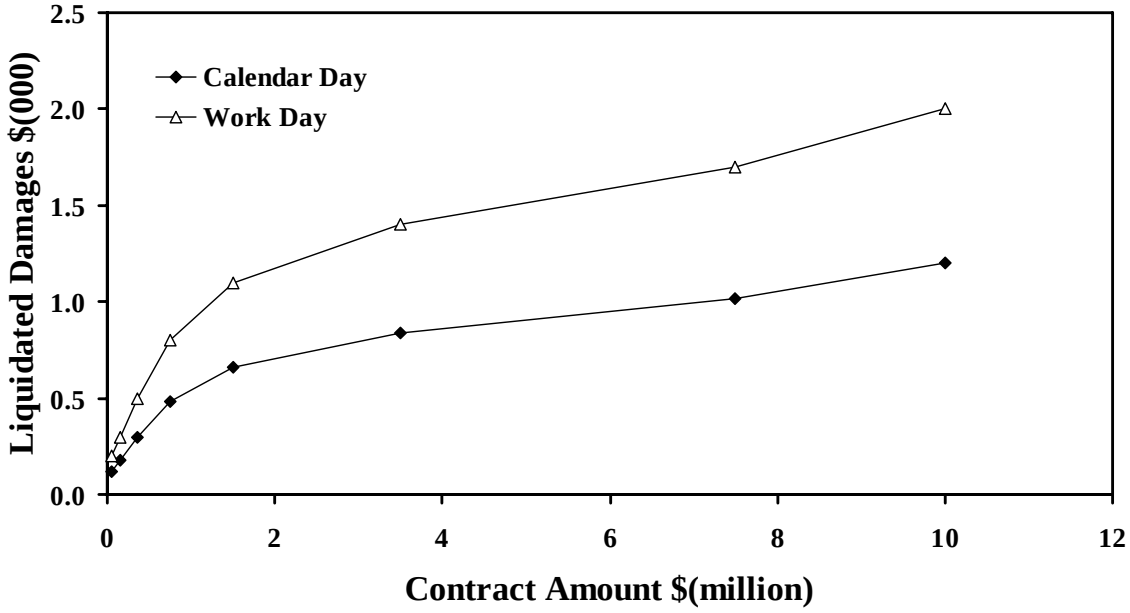


**Figure A-1 Alabama DOT Schedule of Liquidated Damages**

## ALABAMA (2006)

| Contract Value | | Daily Liquidated Damages Rate | |
|---|---|---|---|
| More Than | To and Including | Calendar Day | Work Day |
| $0 | $500,000 | $250 | $500 |
| $500,000 | $1,000,000 | $500 | $1,000 |
| $1,000,000 | $2,000,000 | $900 | $1,800 |
| $2,000,000 | $5,000,000 | $1,300 | $2,600 |
| $5,000,000 | $10,000,000 | $1,600 | $3,200 |
| $10,000,000 | --- | $1,800 | $3,600 |

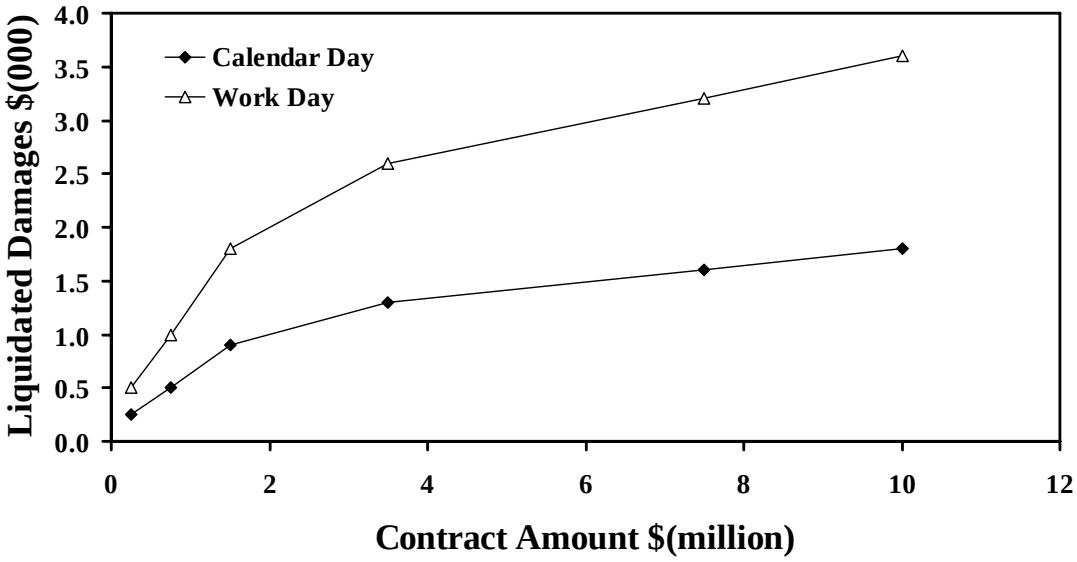


**Figure A-1 Alabama DOT Schedule of Liquidated Damages**

## ALASKA

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Calendar Day |
| $0 | $100,000 | $300 |
| $100,000 | $500,000 | $550 |
| $500,000 | $1,000,000 | $750 |
| $1,000,000 | $2,000,000 | $1,000 |
| $2,000,000 | $5,000,000 | $1,500 |
| $5,000,000 | $10,000,000 | $2,500 |
| $10,000,000 | --- | $3,000 |

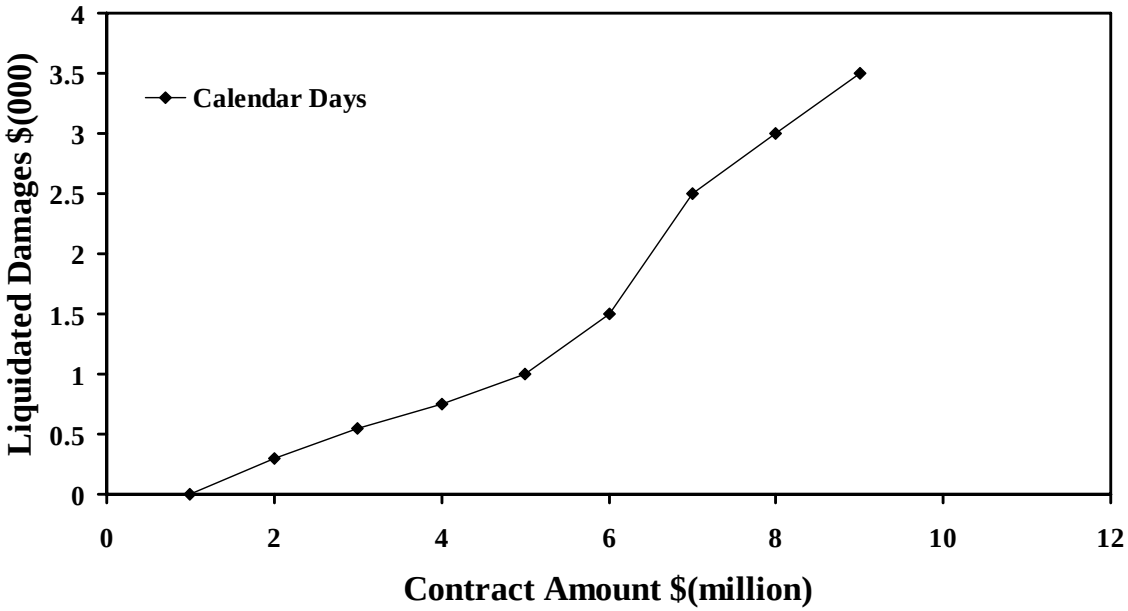


**Figure A-3 Alaska DOT Schedule of Liquidated Damages**

## COLORADO

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Calendar Day |
| $0 | $100,000 | $67 |
| $100,000 | $250,000 | $174 |
| $250,000 | $500,000 | $430 |
| $500,000 | $1,000,000 | $1,086 |
| $1,000,000 | $2,000,000 | $1,778 |
| $2,000,000 | $4,000,000 | $2,363 |
| $4,000,000 | $10,000,000 | $3,240 |
| $10,000,000 | --- | $3,240 plus $583 per additional $1,000,000 over $10,000000 |

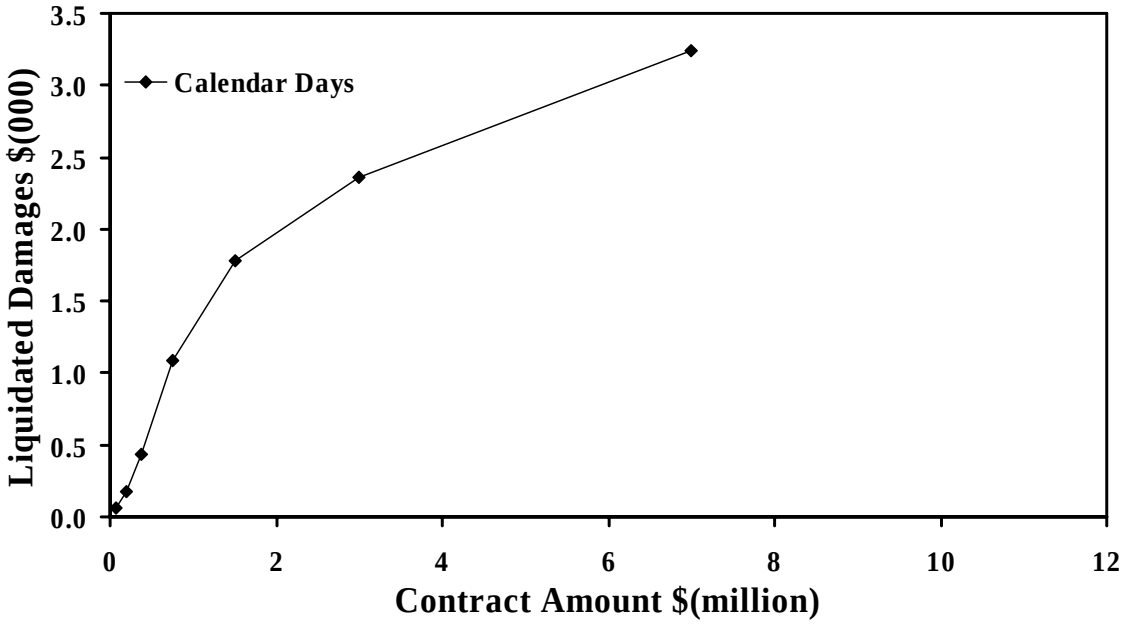


**Figure A-4 Colorado DOT Schedule of Liquidated Damages**

## DELAWARE

| Contract Value | | Daily Liquidated Damages Rate | |
|---|---|---|---|
| More Than | To and Including | Work Day | Calendar Day |
| $0 | $25,000 | $380 | $275 |
| $25,000 | $50,000 | $400 | $290 |
| $50,000 | $100,000 | $540 | $390 |
| $100,000 | $500,000 | $840 | $600 |
| $500,000 | $1,000,000 | $1,090 | $780 |
| $1,000,000 | $2,000,000 | $1,350 | $960 |
| $2,000,000 | $5,000,000 | $1,410 | $1,010 |
| $5,000,000 | $10,000,000 | $1,590 | $1,130 |
| $10,000,000 | $15,000,000 | $2,510 | $1,790 |
| $15,000,000 | $20,000,000 | $4,180 | $2,990 |
| $20,000,000 | $25,000,000 | $5,850 | $4,180 |
| $25,000,000 | $30,000,000 | $7,520 | $5,370 |
| $30,000,000 | $35,000,000 | $9,190 | $6,570 |
| $35,000,000 | --- | $10,870 | $7,760 |

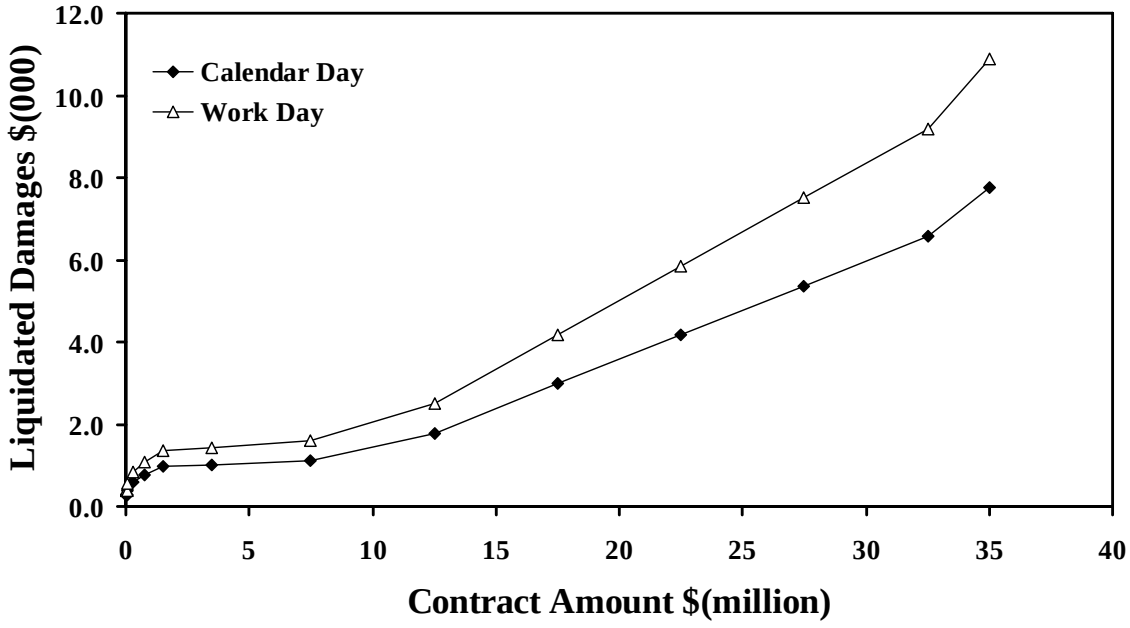


**Figure A-5 Delaware DOT Schedule of Liquidated Damages**

## DISTRICT OF COLUMBIA

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Calendar Day |
| $0 | $100,000 | $200 |
| $100,000 | $500,000 | $400 |
| $500,000 | $1,000,000 | $650 |
| $1,000,000 | $2,000,000 | $800 |
| $2,000,000 | $4,000,000 | $950 |
| $4,000,000 | $7,000,000 | $1,100 |
| $7,000,000 | $10,000,000 | $1,350 |
| $10,000,000 | $20,000,000 | $1,500 |
| $20,000,000 | --- | $1,700 |

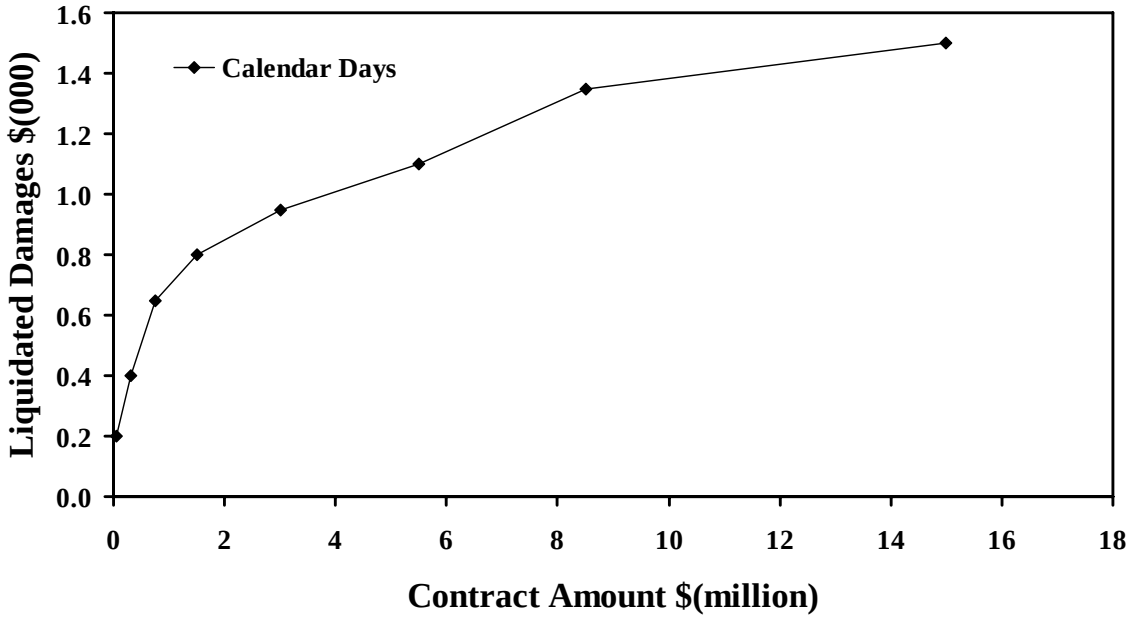


**Figure A-6 District of Columbia DOT Schedule of Liquidated Damages**

## FLORIDA

| Contract Value | | Daily LD Rate |
|---|---|---|
| **More Than** | **To and Including** | **Calendar Day** |
| $0 | $50,000 | $674 |
| $50,000 | $250,000 | $544 |
| $250,000 | $500,000 | $634 |
| $500,000 | $2,500,000 | $1,288 |
| $2,500,000 | $5,000,000 | $2,470 |
| $5,000,000 | $10,000,000 | $3,370 |
| $10,000,000 | $15,000,000 | $5,240 |
| $15,000,000 | $20,000,000 | $6,078 |
| $20,000,000 | --- | $8,624 + 0.00027 of any amount over $20 million |

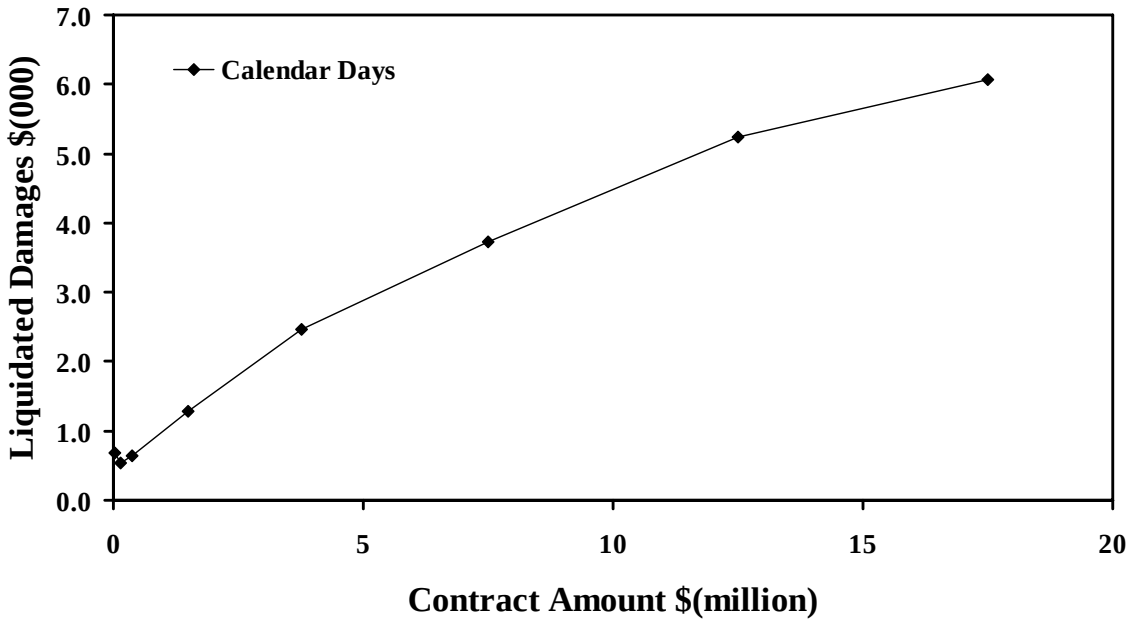


**Figure A-7 Florida DOT Schedule of Liquidated Damages**

## GEORGIA

| Contract Value | | Daily Liquidated Damages Rate | |
|---|---|---|---|
| More Than | To and Including | Work Day | Calendar Day |
| $0 | $50,000 | $105 | $75 |
| $50,000 | $100,000 | $150 | $110 |
| $100,000 | $500,000 | $210 | $150 |
| $500,000 | $1,000,000 | $350 | $225 |
| $1,000,000 | $2,000,000 | $420 | $300 |
| $2,000,000 | $5,000,000 | $630 | $450 |
| $5,000,000 | $10,000,000 | $840 | $600 |
| $10,000,000 | $20,000,000 | $1,050 | $800 |
| $20,000,000 | $40,000,000 | $1,900 | $1,000 |
| $40,000,000 | --- | $4,000 | $2,990 |

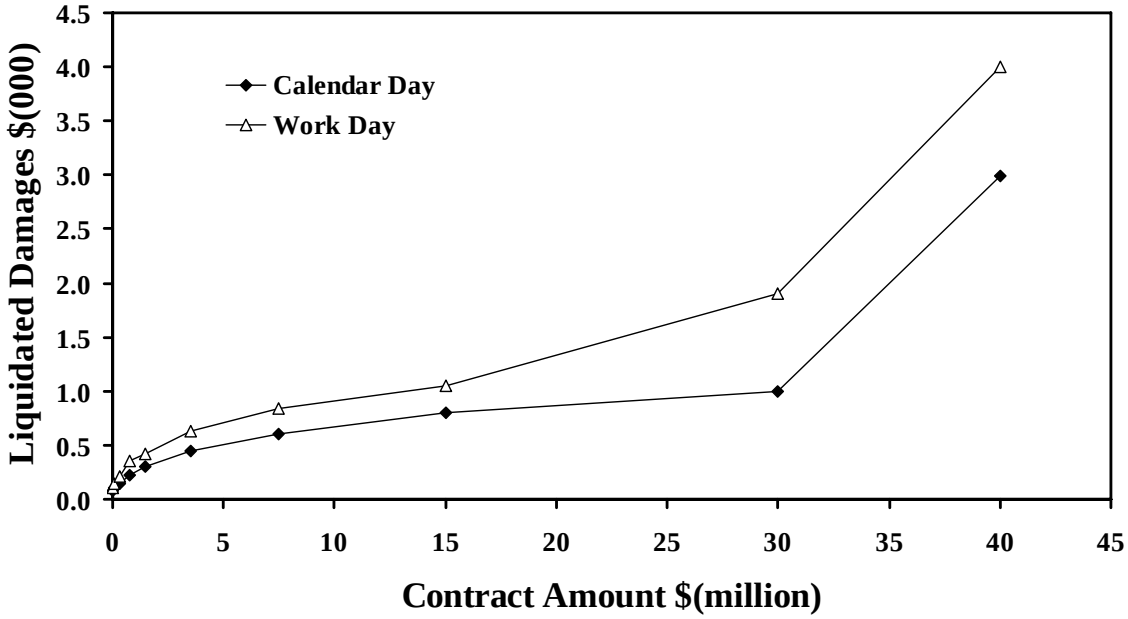


**Figure A-8 Georgia DOT Schedule of Liquidated Damages**

## ILLINOIS

| Contract Value | | Daily Liquidated Damages Rate | |
|---|---|---|---|
| More Than | To and Including | Work Day | Calendar Day |
| $0 | $25,000 | $60 | $50 |
| $25,000 | $50,000 | $125 | $100 |
| $50,000 | $100,000 | $250 | $200 |
| $100,000 | $500,000 | $515 | $370 |
| $500,000 | $1,000,000 | $800 | $575 |
| $1,000,000 | $2,000,000 | $1,025 | $735 |
| $2,000,000 | $3,000,000 | $1,250 | $895 |
| $3,000,000 | $5,000,000 | $1,475 | $1,055 |
| $5,000,000 | $7,500,000 | $1,700 | $1,215 |
| $7,500,000 | $10,000,000 | $2,000 | $1,425 |
| $10,000,000 | $15,000,000 | $2,700 | $1,925 |
| $15,000,000 | $20,000,000 | $3,400 | $2,425 |
| $20,000,000 | $25,000,000 | $4,100 | $2,925 |
| $25,000,000 | $30,000,000 | $4,800 | $3,425 |
| $30,000,000 | $35,000,000 | $5,500 | $3,925 |
| $35,000,000 | --- | $6,200 | $4,425 |

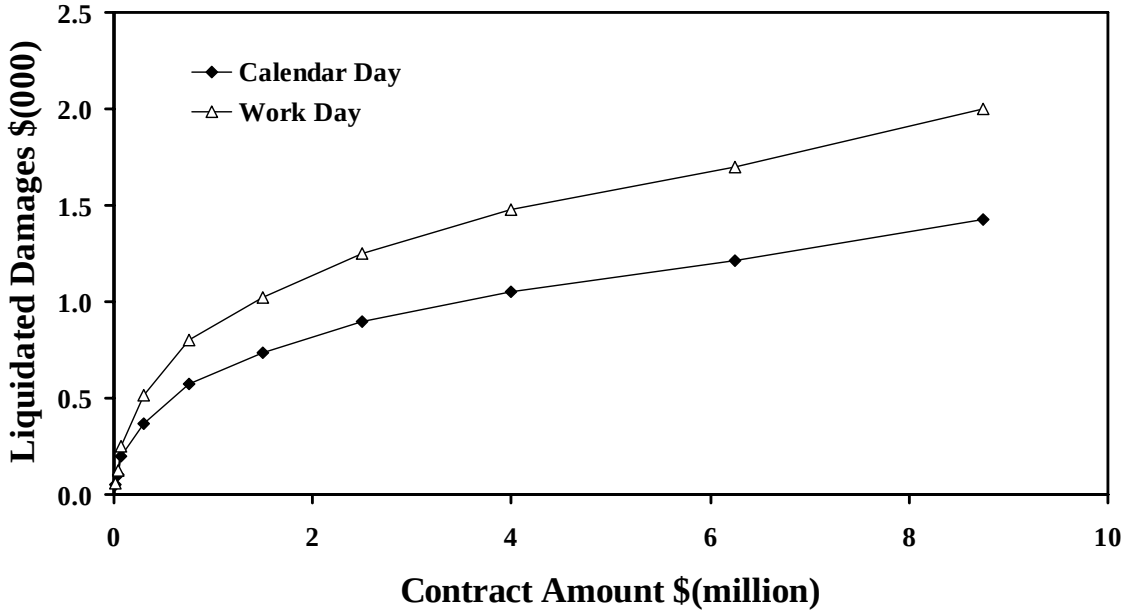


**Figure A-9 Illinois DOT Schedule of Liquidated Damages**

## INDIANA

| Contract Value | | Daily Liquidated Damages Rate | |
|---|---|---|---|
| **More Than** | **To and Including** | **Calendar Day** | **Work Day** |
| $0 | $500,000 | $500 | $700 |
| $500,000 | $1,000,000 | $1,000 | $800 |
| $1,000,000 | $5,000,000 | $1,500 | $1,100 |
| $5,000,000 | $10,000,000 | $2,000 | $2,000 |
| $10,000,000 | --- | $2,500 | $3,000 |

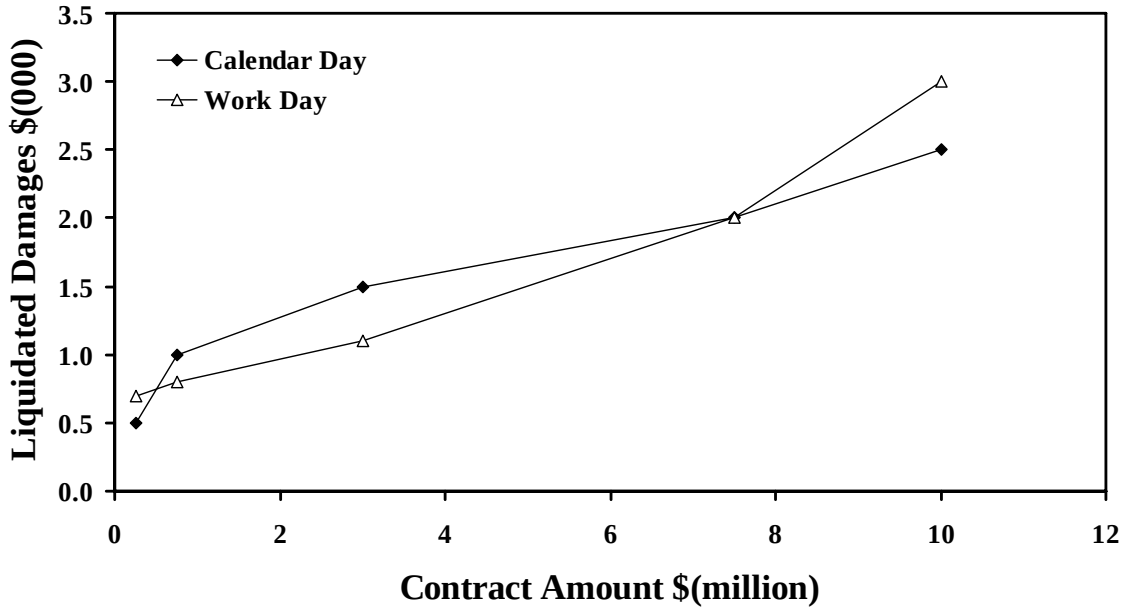


**Figure A-10 Indiana DOT Schedule of Liquidated Damages**

## KANSAS

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Calendar Day |
| $0 | $25,000 | $75 |
| $25,000 | $50,000 | $125 |
| $50,000 | $100,000 | $200 |
| $100,000 | $500,000 | $400 |
| $500,000 | $1,000,000 | $600 |
| $1,000,000 | $2,000,000 | $925 |
| $2,000,000 | $5,000,000 | $1,375 |
| $5,000,000 | $10,000,000 | $2,000 |
| $10,000,000 | --- | $3,000 |

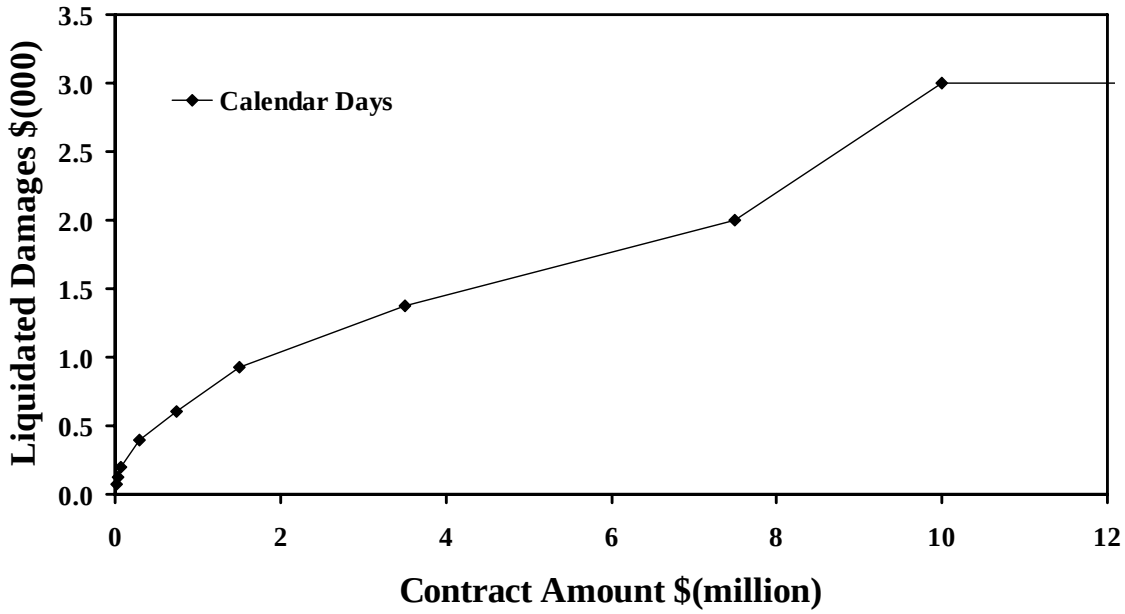


**Figure A-11 Kansas DOT Schedule of Liquidated Damages**

## KENTUCKY

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Daily Charge |
| $0 | $100,000 | $150 |
| $100,000 | $500,000 | $200 |
| $500,000 | $1,000,000 | $300 |
| $1,000,000 | $2,000,000 | $400 |
| $2,000,000 | $5,000,000 | $600 |
| $5,000,000 | $10,000,000 | $800 |
| $10,000,000 | $20,000,000 | $1,600 |
| $20,000,000 | --- | $3,000 |

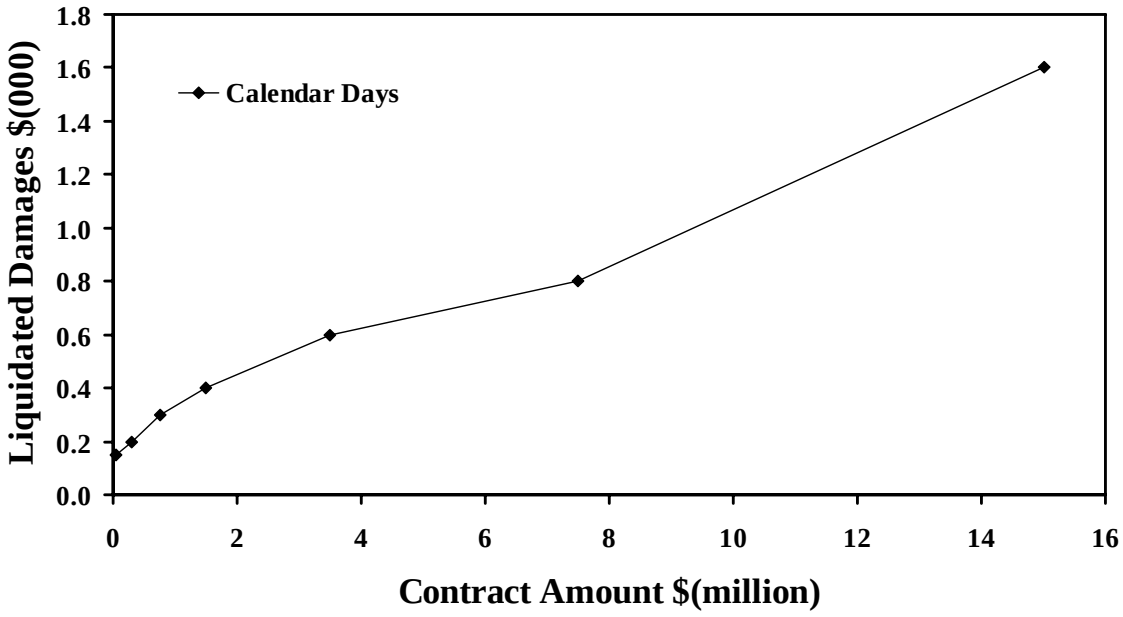


**Figure A-12 Kentucky DOT Schedule of Liquidated Damages**

## LOUISIANA

| Contract Value | | Daily Liquidated Damages Rate | |
|---|---|---|---|
| More Than | To and Including | Work Day | Calendar Day |
| $0 | $25,000 | $195 | $80 |
| $25,000 | $50,000 | $345 | $210 |
| $50,000 | $100,000 | $400 | $240 |
| $100,000 | $500,000 | $510 | $270 |
| $500,000 | $1,000,000 | $595 | $330 |
| $1,000,000 | $2,000,000 | $695 | $400 |
| $2,000,000 | $5,000,000 | $825 | $480 |
| $5,000,000 | $10,000,000 | $975 | $600 |
| $10,000,000 | --- | $1,115 | $630 |

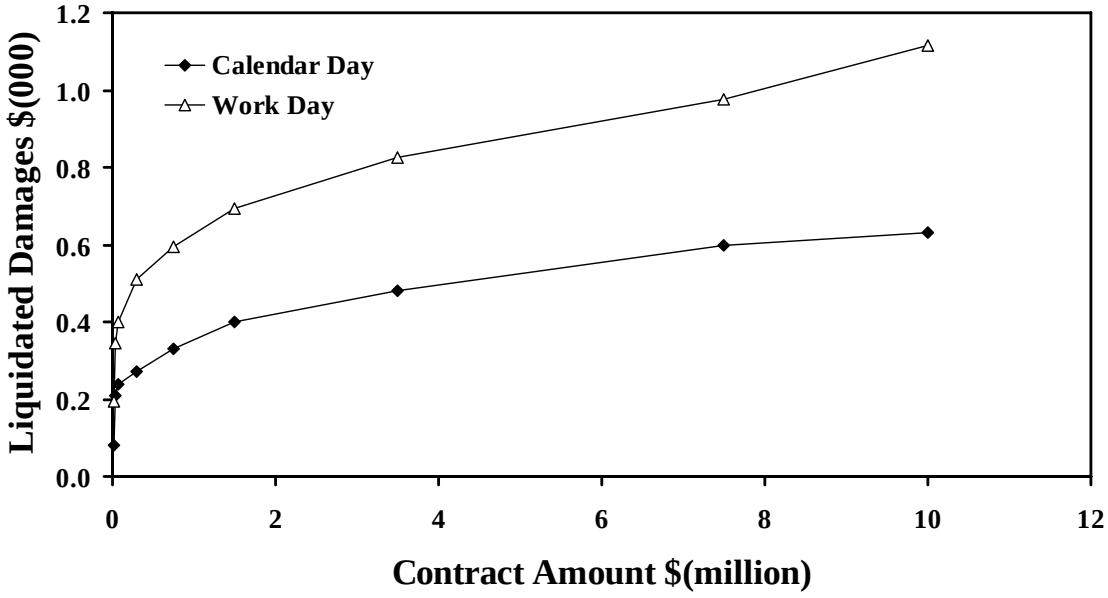


**Figure A-13 Louisiana DOT Schedule of Liquidated Damages**

## MAINE

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Calendar Day |
| $0 | $100,000 | $100 |
| $100,000 | $300,000 | $175 |
| $300,000 | $500,000 | $250 |
| $500,000 | $1,000,000 | $325 |
| $1,000,000 | $2,000,000 | $500 |
| $2,000,000 | $4,000,000 | $750 |
| $4,000,000 | --- | $1,000 |

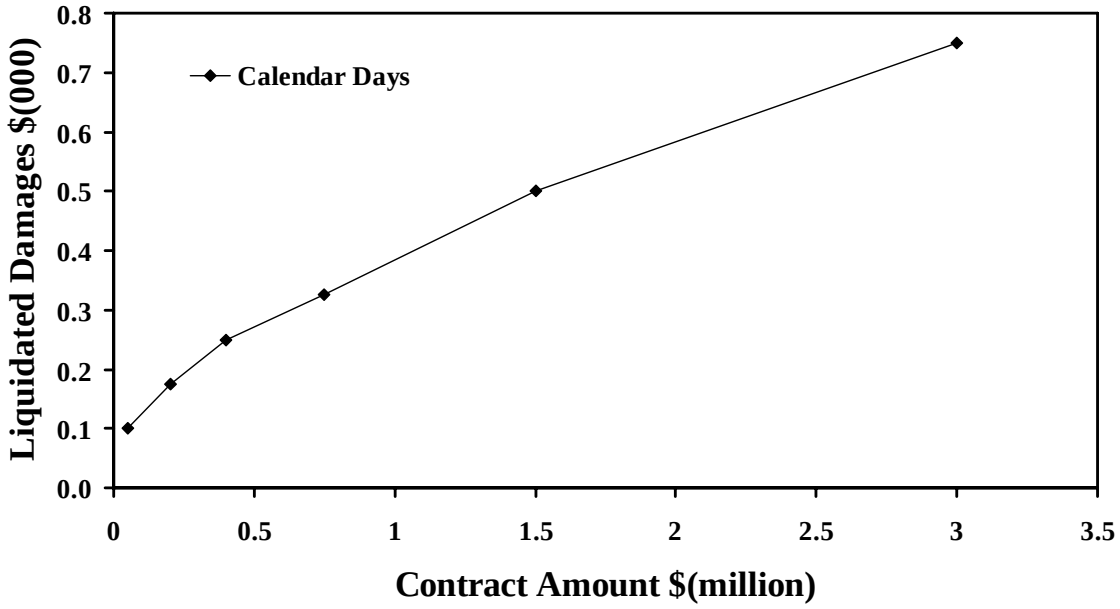


**Figure A-14 Maine DOT Schedule of Liquidated Damages**

## MICHIGAN

| Contract Value | | Daily LD Rate |
|---|---|---|
| From | To | Calendar Day |
| $0 | $49,999 | $75 |
| $50,000 | $99,999 | $150 |
| $100,000 | $499,999 | $450 |
| $500,000 | $999,999 | $900 |
| $1,000,000 | $1,999,999 | $1,300 |
| $2,000,000 | $4,999,999 | $1,550 |
| $5,000,000 | $9,999,999 | $2,650 |
| $10,000,000 | --- | $3,000 |

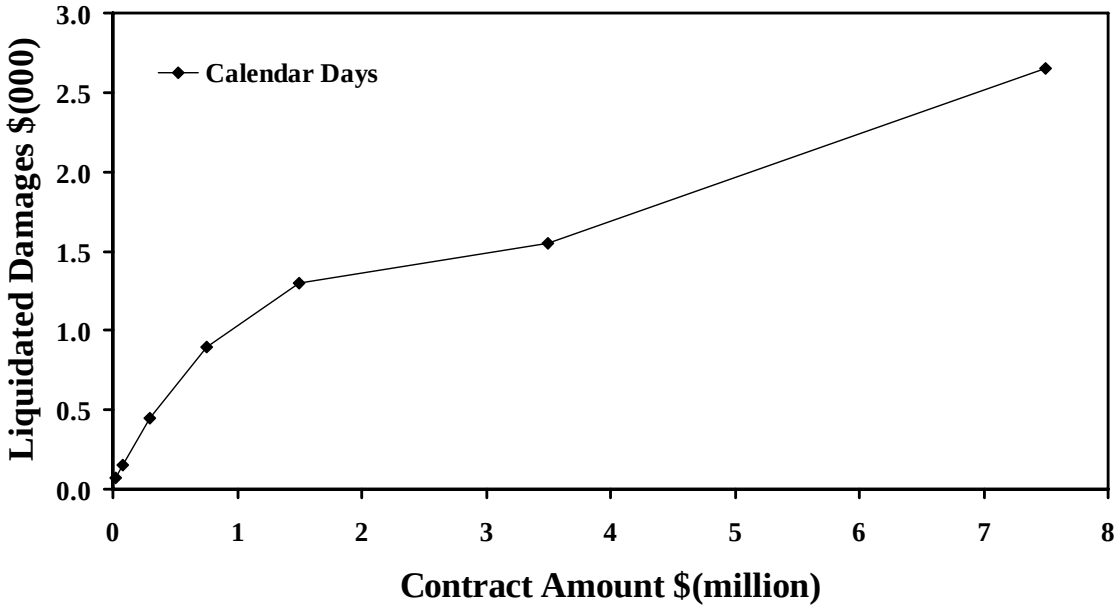


**Figure A-15 Michigan DOT Schedule of Liquidated Damages**

## MINNESOTA

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Calendar Day |
| $0 | $25,000 | $150 |
| $25,000 | $100,000 | $300 |
| $100,000 | $500,000 | $600 |
| $500,000 | $1,000,000 | $1,000 |
| $1,000,000 | $2,000,000 | $1,500 |
| $2,000,000 | $5,000,000 | $2,000 |
| $5,000,000 | $10,000,000 | $3,000 |
| $10,000,000 | --- | $3,500 |

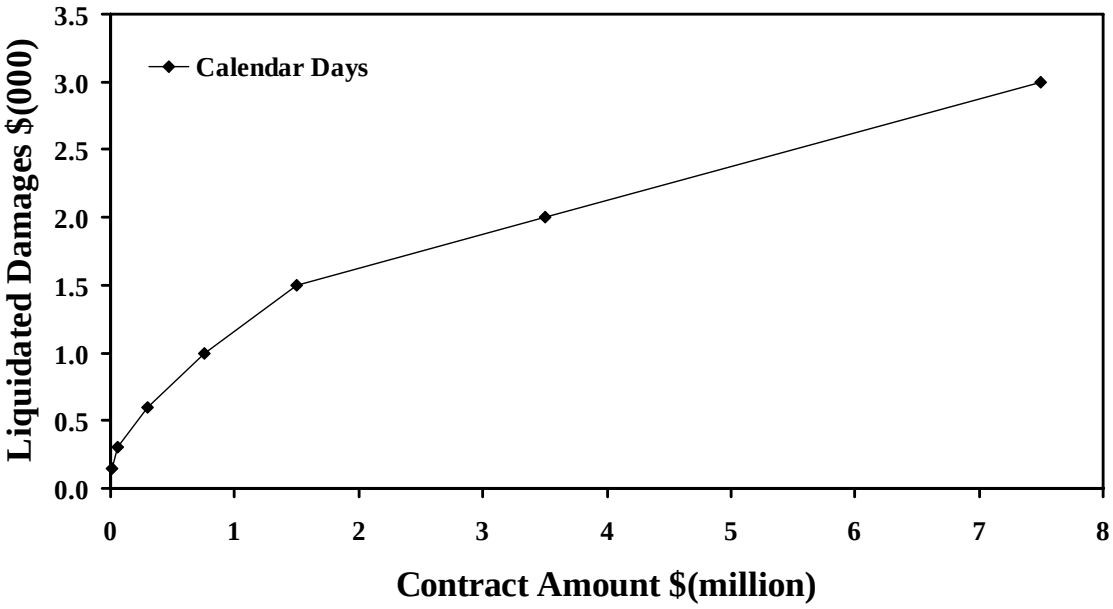


**Figure A-16 Minnesota DOT Schedule of Liquidated Damages**

## MISSISSIPPI

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Calendar Day |
| $0 | $100,000 | $140 |
| $100,000 | $500,000 | $200 |
| $500,000 | $1,000,000 | $300 |
| $1,000,000 | $2,000,000 | $400 |
| $2,000,000 | $5,000,000 | $650 |
| $5,000,000 | $10,000,000 | $750 |
| $10,000,000 | --- | $1,400 |

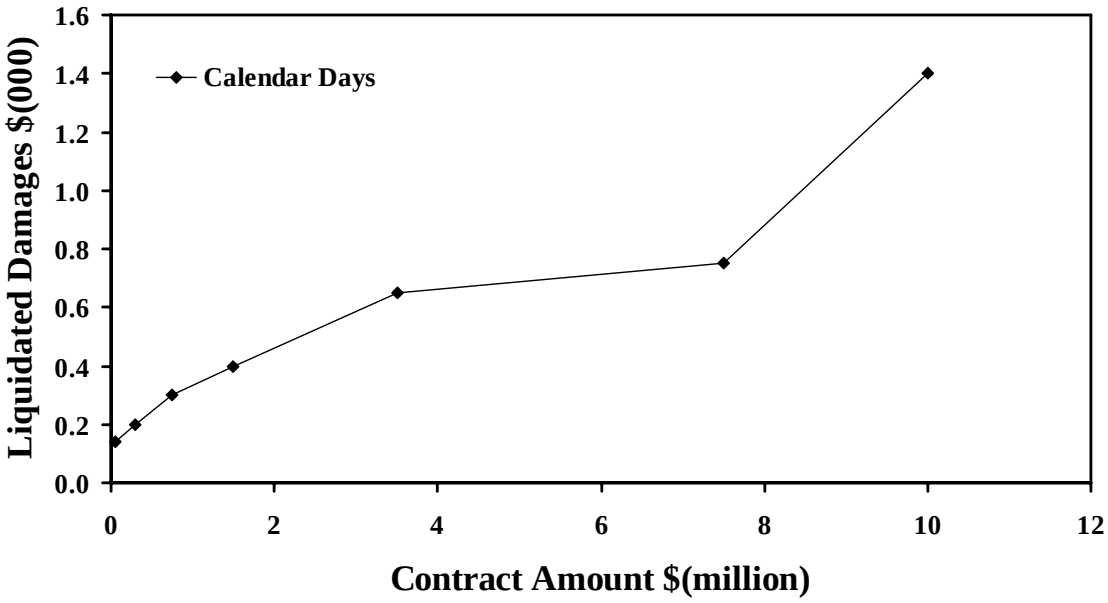


**Figure A-17 Mississippi DOT Schedule of Liquidated Damages**

## MONTANA

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Calendar or Working Day |
| $0 | $50,000 | $478 |
| $50,000 | $100,000 | $618 |
| $100,000 | $500,000 | $967 |
| $500,000 | $1,000,000 | $1,171 |
| $1,000,000 | $2,000,000 | $1,505 |
| $2,000,000 | $5,000,000 | $2,341 |
| $5,000,000 | $10,000,000 | $2,804 |
| $10,000,000 | --- | $3,379 |

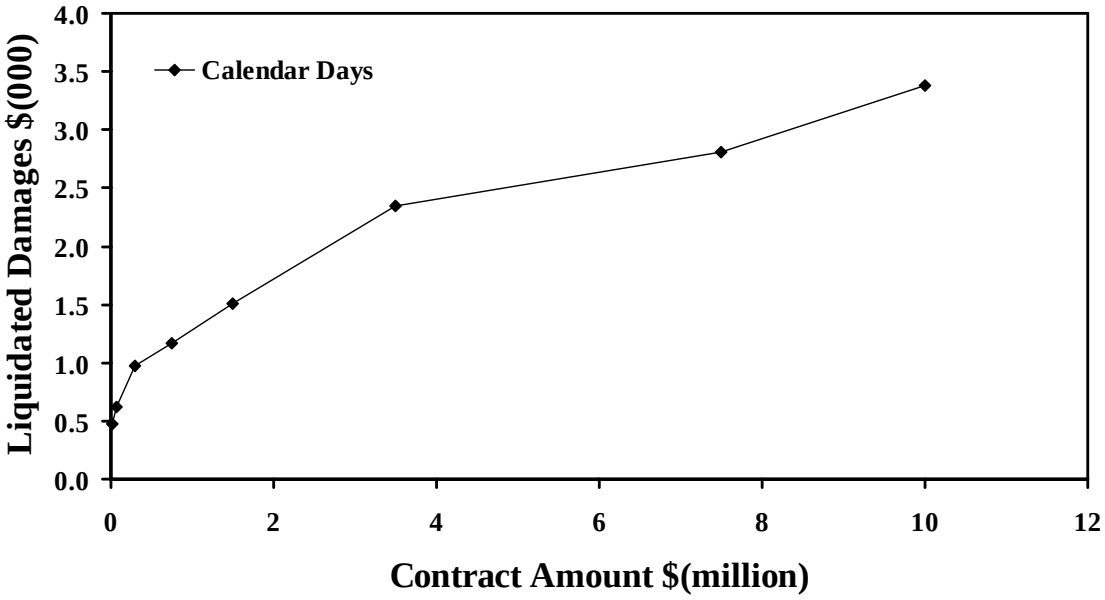


**Figure A-18 Montana DOT Schedule of Liquidated Damages**

## NEW HAMPSHIRE

| Contract Value | | Daily Liquidated Damages Rate | |
|---|---|---|---|
| More Than | To and Including | Work Day | Calendar Day |
| $0 | $25,000 | $200 | $135 |
| $25,000 | $50,000 | $250 | $165 |
| $50,000 | $100,000 | $400 | $265 |
| $100,000 | $500,000 | $450 | $300 |
| $500,000 | $1,000,000 | $800 | $535 |
| $1,000,000 | $2,000,000 | $1,200 | $800 |
| $2,000,000 | $5,000,000 | $1,600 | $1,065 |
| $5,000,000 | $10,000,000 | $2,000 | $1,335 |
| $10,000,000 | --- | $2,400 | $1,600 |

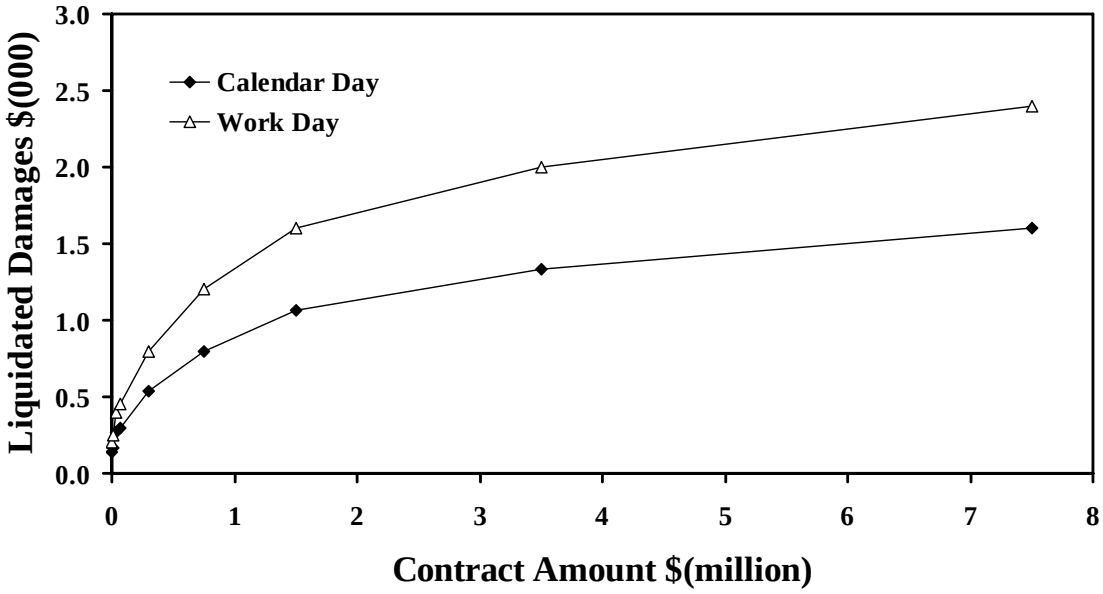


**Figure A-19 New Hampshire DOT Schedule of Liquidated Damages**

## NEW MEXICO

| Contract Value | | Daily Liquidated Damages Rate | |
|---|---|---|---|
| More Than | To and Including | Work Day | Calendar Day |
| $100,000 | $500,000 | $1,000 | $800 |
| $500,000 | $1,000,000 | $1,400 | $1,000 |
| $1,000,000 | $2,000,000 | $1,900 | $1,400 |
| $2,000,000 | $4,000,000 | $2,300 | $1,600 |
| $4,000,000 | $7,000,000 | $2,900 | $2,000 |
| $7,000,000 | --- | $3,200 | $2,300 |

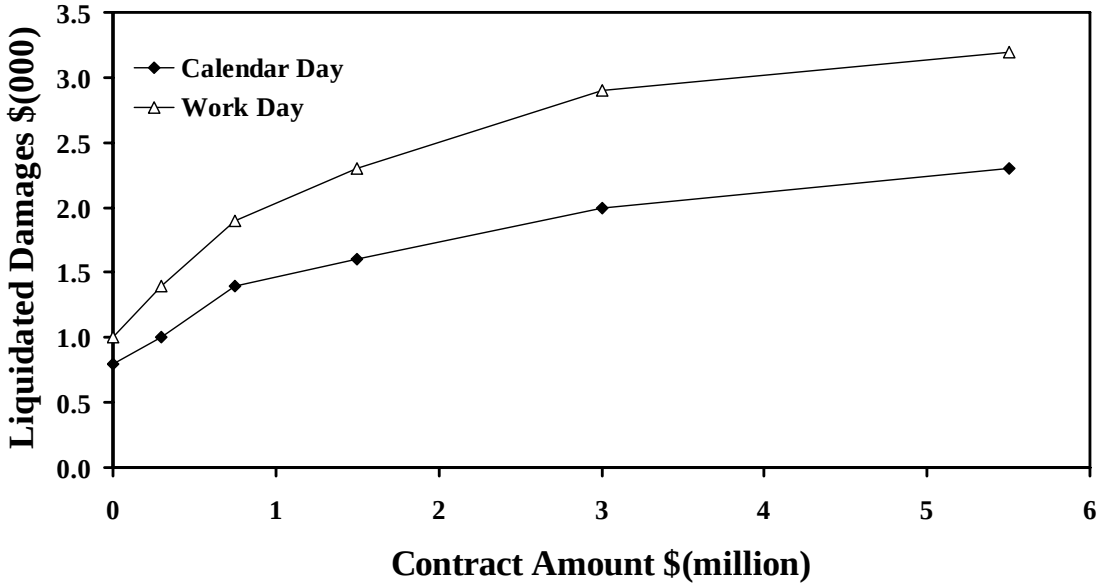


**Figure A-20 New Mexico DOT Schedule of Liquidated Damages**

## NEW YORK

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Calendar Day |
| $0 | $100,000 | $500 |
| $100,000 | $500,000 | $1,000 |
| $500,000 | $2,000,000 | $1,500 |
| $2,000,000 | $5,000,000 | $2,000 |
| $5,000,000 | $10,000,000 | $2,500 |
| $10,000,000 | $20,000,000 | $4,000 |
| $20,000,000 | --- | $7,000 |

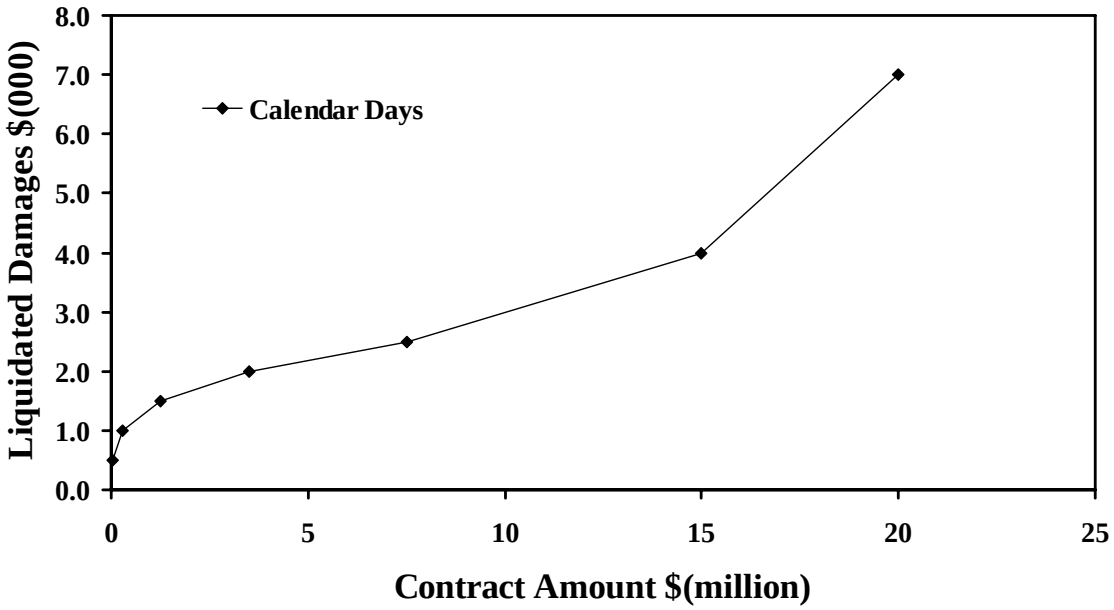


**Figure A-21 New York DOT Schedule of Liquidated Damages**

## NORTH DAKOTA

| Contract Value | | Daily Liquidated Damages Rate | |
|---|---|---|---|
| **More Than** | **To and Including** | **Work Day** | **Calendar Day** |
| $0 | $50,000 | $250 | $200 |
| $50,000 | $100,000 | $550 | $400 |
| $100,000 | $250,000 | $700 | $500 |
| $250,000 | $500,000 | $875 | $650 |
| $500,000 | $1,000,000 | $1,100 | $800 |
| $1,000,000 | $2,000,000 | $1,350 | $950 |
| $2,000,000 | $3,000,000 | $1,700 | $1,200 |
| $3,000,000 | $5,000,000 | $2,075 | $1,475 |
| $5,000,000 | $8,000,000 | $2,575 | $1,800 |
| $8,000,000 | --- | $3,200 | $2,225 |

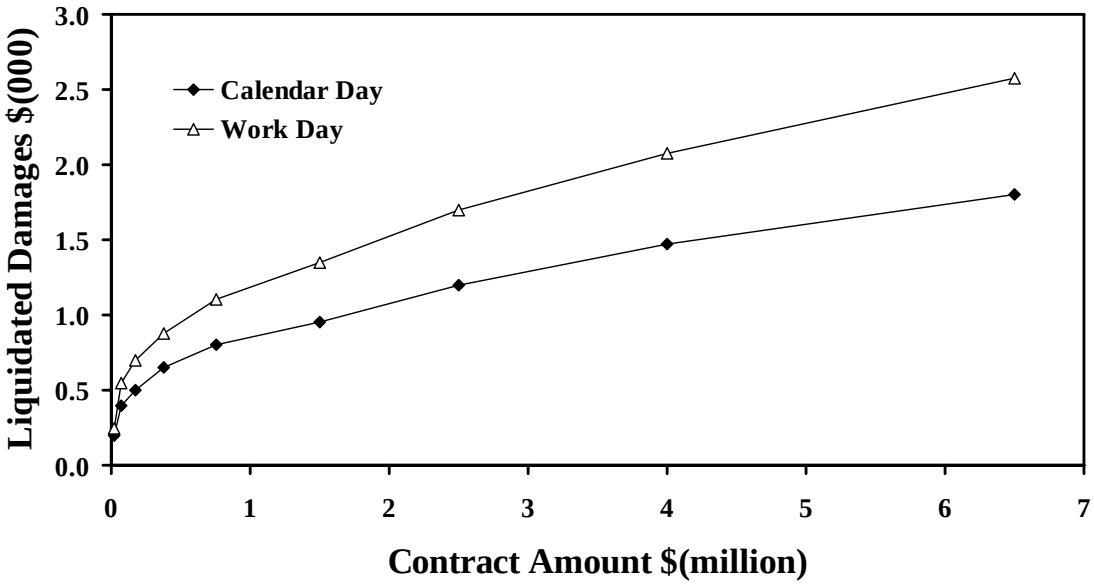


**Figure A-22 North Dakota DOT Schedule of Liquidated Damages**

## OHIO

| Contract Value | | Daily Liquidated Damages Rate |
|---|---|---|
| More Than | To and Including | Calendar Day |
| $0 | $500,000 | $700 |
| $500,000 | $2,000,000 | $760 |
| $2,000,000 | $10,000,000 | $1,250 |
| $10,000,000 | --- | $2,000 |

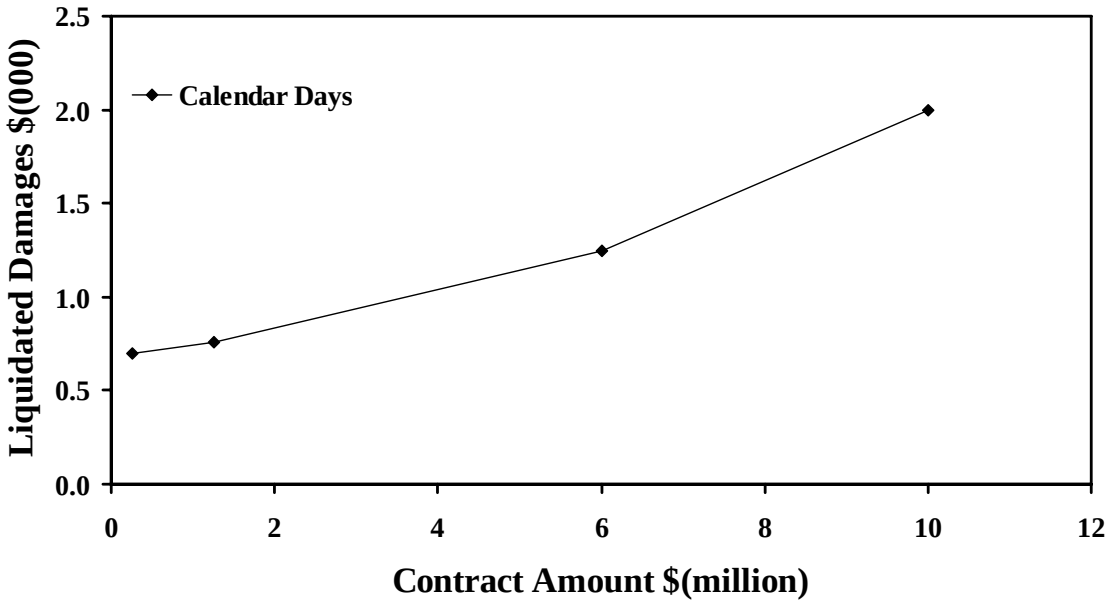


**Figure A-23 Ohio DOT Schedule of Liquidated Damages**

## PENNSYLVANIA

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Calendar Day |
| $0 | $400,000 | $350 |
| $400,000 | $1,000,000 | $700 |
| $1,000,000 | $5,000,000 | $925 |
| $5,000,000 | $10,000,000 | $1,200 |
| $10,000,000 | $15,000,000 | $1,500 |
| $15,000,000 | --- | $1,975 |

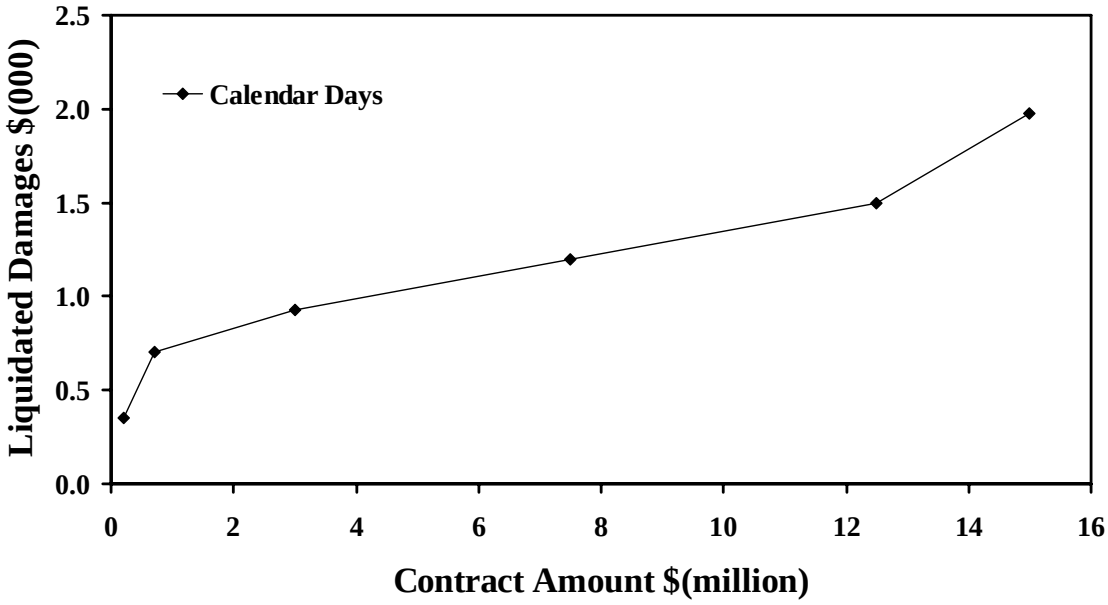


**Figure A-24 Pennsylvania DOT Schedule of Liquidated Damages**

## PUERTO RICO

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Calendar Day |
| $0 | $100,000 | $150 |
| $100,000 | $500,000 | $200 |
| $500,000 | $1,000,000 | $400 |
| $1,000,000 | $2,000,000 | $500 |
| $2,000,000 | --- | $600 |

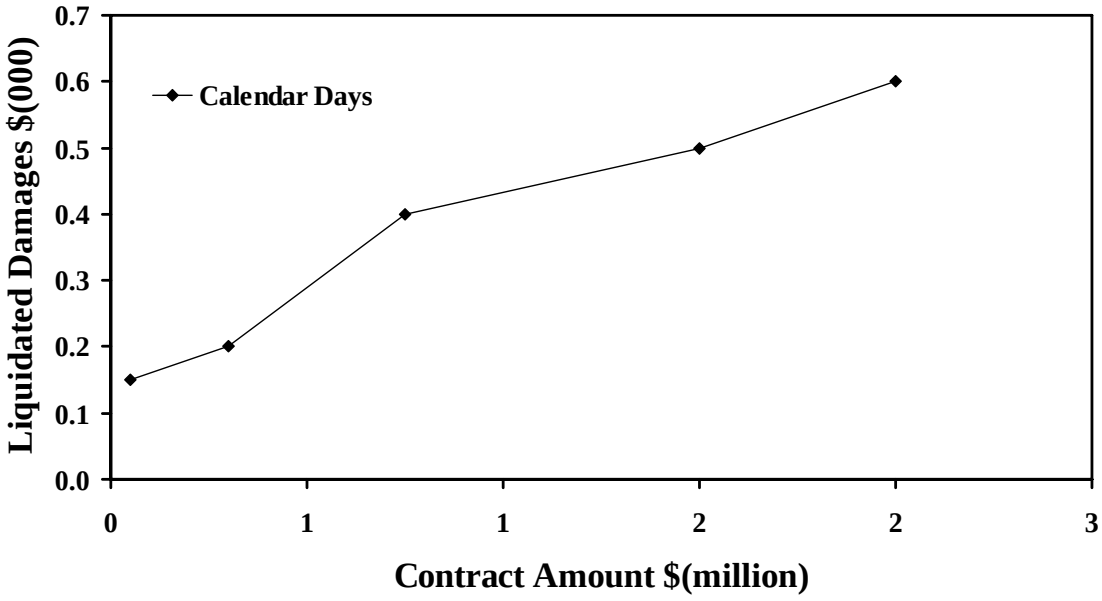


**Figure A-25 Puerto Rico DOT Schedule of Liquidated Damages**

## RHODE ISLAND

| Contract Value | | Daily Liquidated Damages Rate | |
|---|---|---|---|
| More Than | To and Including | Work Day | Calendar Day |
| $0 | $25,000 | $250 | $200 |
| $25,000 | $50,000 | $400 | $300 |
| $50,000 | $100,000 | $600 | $450 |
| $100,000 | $500,000 | $750 | $550 |
| $500,000 | $1,000,000 | $1,250 | $900 |
| $1,000,000 | $2,000,000 | $1,650 | $1,200 |
| $2,000,000 | $4,000,000 | $2,050 | $1,500 |
| $4,000,000 | $6,000,000 | $2,450 | $1,750 |
| $6,000,000 | $10,000,000 | $3,150 | $2,250 |
| $10,000,000 | --- | $3,700 | $2,700 |

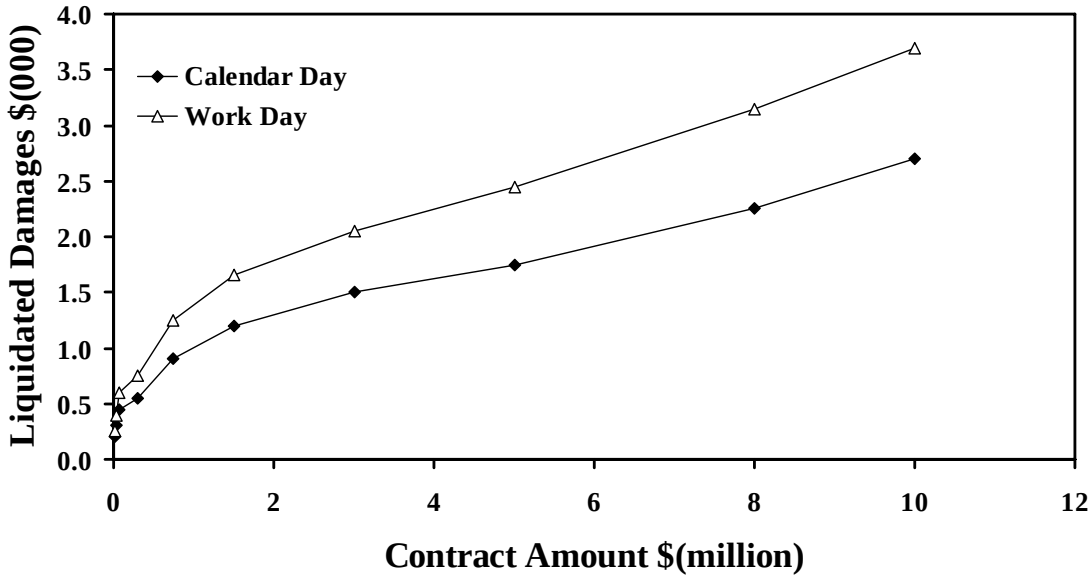


**Figure A-26 Rhode Island DOT Schedule of Liquidated Damages**

## SOUTH CAROLINA

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Calendar or Fixed Day |
| $0 | $50,000 | $100 |
| $50,000 | $100,000 | $200 |
| $100,000 | $500,000 | $400 |
| $500,000 | $1,000,000 | $600 |
| $1,000,000 | $2,000,000 | $800 |
| $2,000,000 | $5,000,000 | $1,100 |
| $5,000,000 | $10,000,000 | $1,400 |
| $10,000,000 | --- | $1,800 |

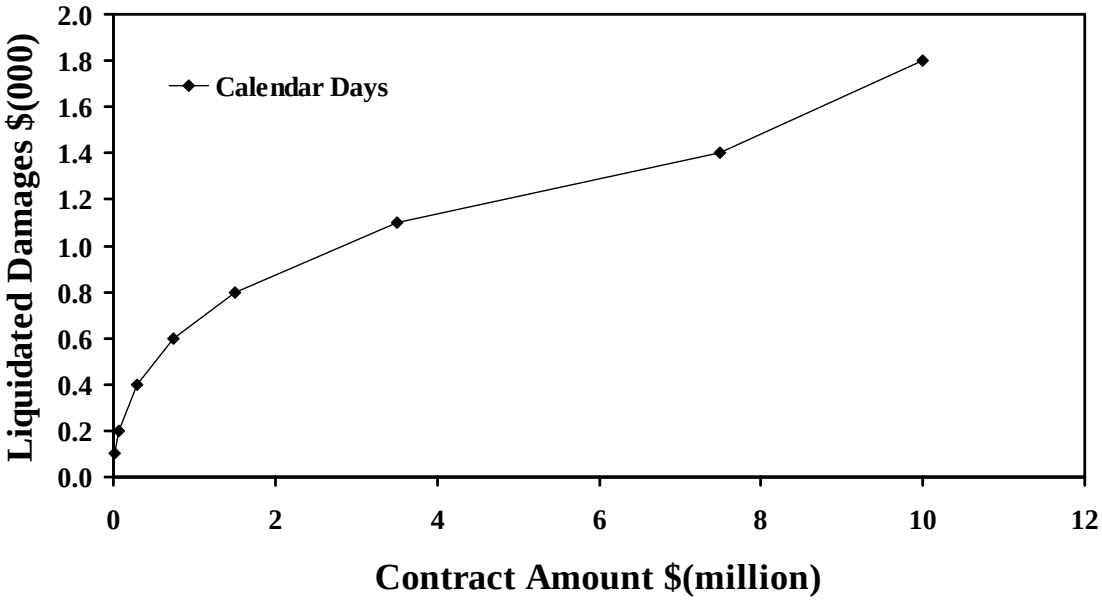


**Figure A-27 South Carolina DOT Schedule of Liquidated Damages**

## SOUTH DAKOTA

| Contract Value | | Daily LD Rate |
|---|---|---|
| **More Than** | **To and Including** | **Calendar or Fixed Day** |
| $0 | $50,000 | $250 |
| $50,000 | $100,000 | $325 |
| $100,000 | $500,000 | $500 |
| $500,000 | $1,000,000 | $725 |
| $1,000,000 | $2,000,000 | $900 |
| $2,000,000 | $4,000,000 | $1,450 |
| $4,000,000 | $6,000,000 | $1,650 |
| $6,000,000 | $8,000,000 | $1,800 |
| $8,000,000 | $10,000,000 | $2,150 |
| $10,000,000 | --- | $2,300 |

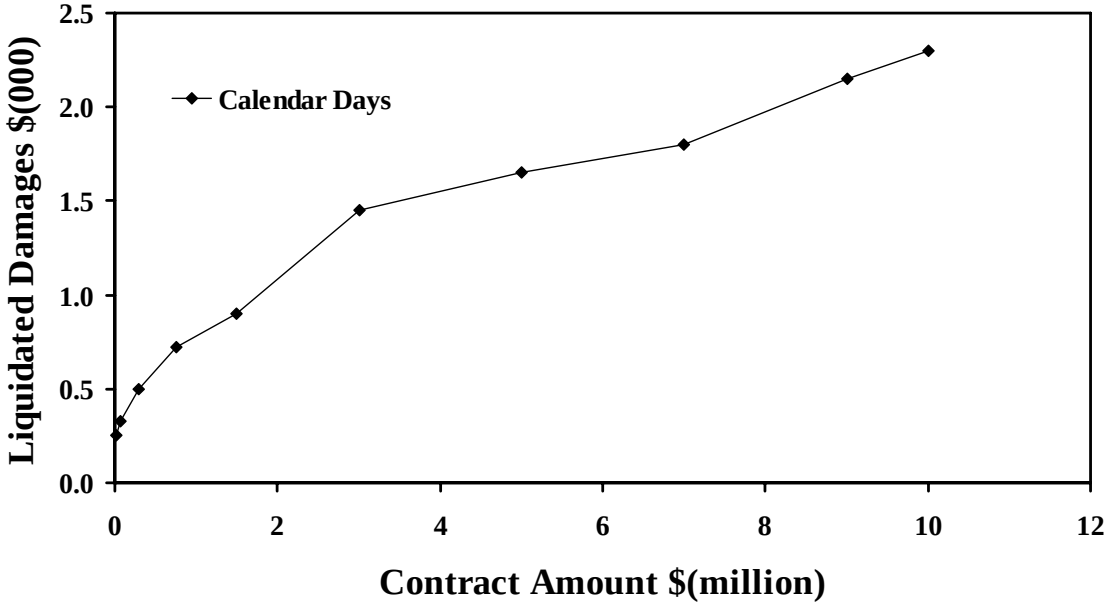


**Figure A-28 South Dakota DOT Schedule of Liquidated Damages**

## TENNESSEE

| Contract Value | | Daily Liquidated Damages Rate | |
|---|---|---|---|
| More Than | To and Including | Work Day | Calendar Day |
| $0 | $100,000 | $270 | $80 |
| $100,000 | $500,000 | $410 | $190 |
| $500,000 | $1,000,000 | $710 | $300 |
| $1,000,000 | $2,000,000 | $1,080 | $460 |
| $2,000,000 | $5,000,000 | $1,690 | $810 |
| $5,000,000 | $10,000,000 | $2,260 | $950 |
| $10,000,000 | --- | $2,850 | $1,200 |

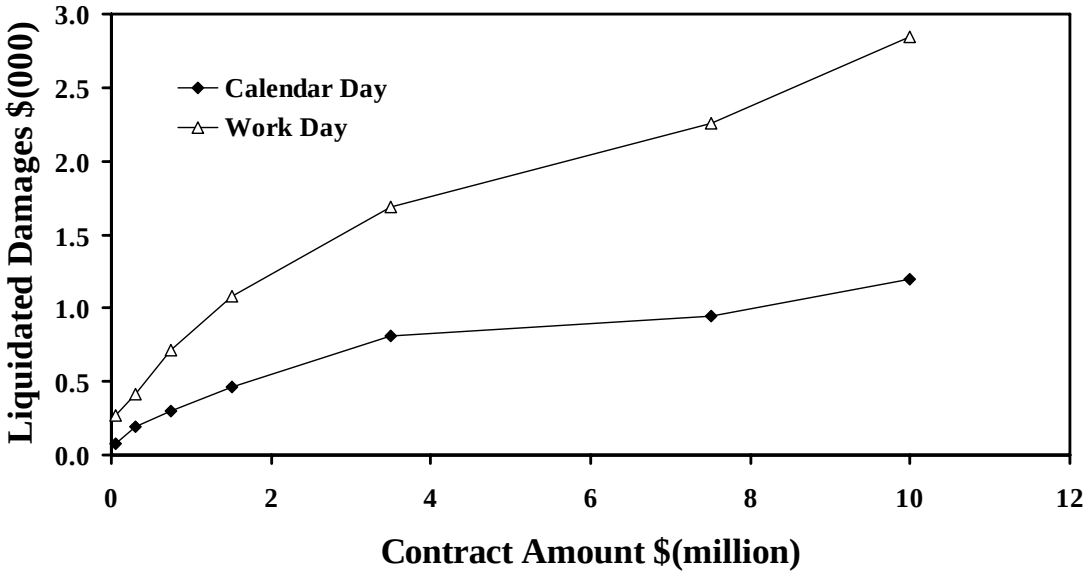


**Figure A-29 Tennessee DOT Schedule of Liquidated Damages**

## UTAH

| Contract Value | | Daily Liquidated Damages Rate | |
|---|---|---|---|
| More Than | To and Including | Work Day | Calendar Day |
| $0 | $100,000 | $830 | $210 |
| $100,000 | $500,000 | $950 | $450 |
| $500,000 | $1,000,000 | $1,380 | $680 |
| $1,000,000 | $5,000,000 | $2,170 | $1,270 |
| $5,000,000 | $10,000,000 | $2,950 | $1,860 |
| $10,000,000 | $30,000,000 | $4,930 | $2,770 |
| $30,000,000 | --- | $8,240 | $4,100 |

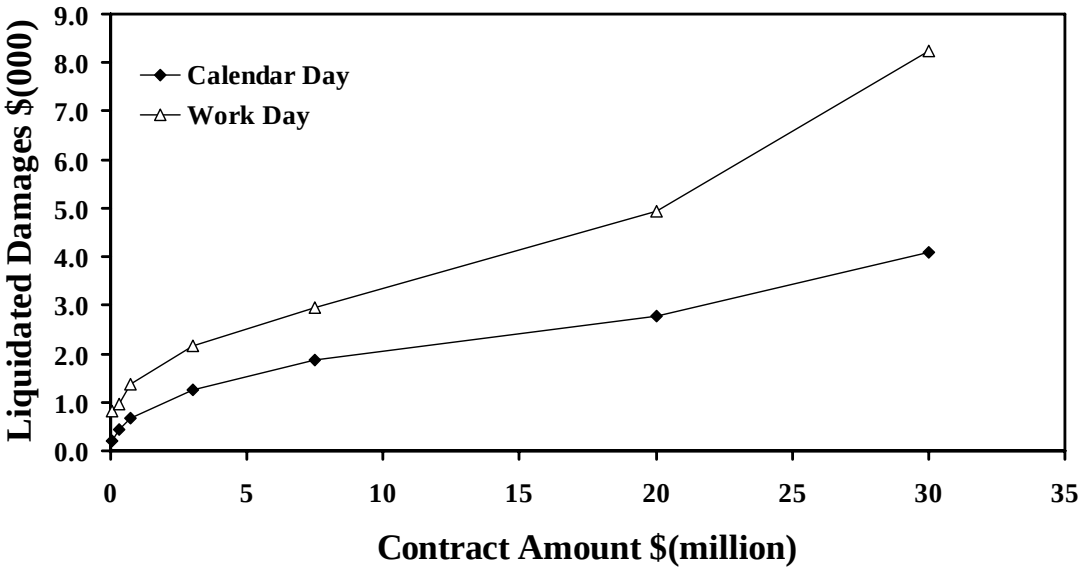


**Figure A-30 Utah DOT Schedule of Liquidated Damages**

## VERMONT

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Daily Charge |
| $0 | $300,000 | $390 |
| $300,000 | $500,000 | $670 |
| $500,000 | $1,000,000 | $1,000 |
| $1,000,000 | $1,500,000 | $1,700 |
| $1,500,000 | $3,000,000 | $2,500 |
| $3,000,000 | $5,000,000 | $3,500 |
| $5,000,000 | $10,000,000 | $3,500 |
| $10,000,000 | --- | $3,500 |

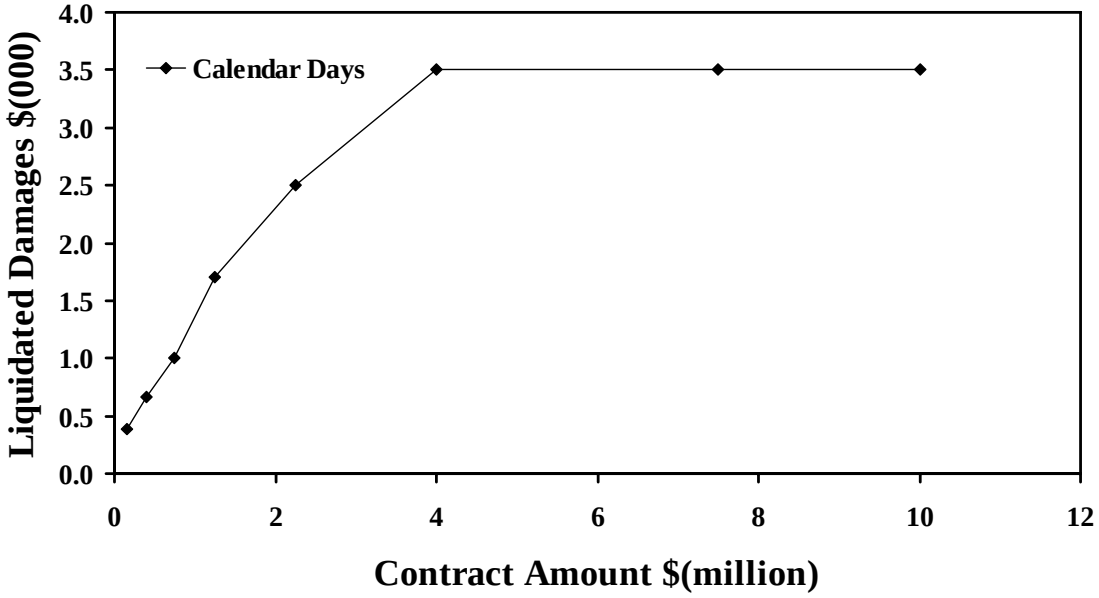


**Figure A-31 Vermont DOT Schedule of Liquidated Damages**

## VIRGINIA

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Daily Charge |
| $0 | $100,000 | $175 |
| $100,000 | $500,000 | $350 |
| $500,000 | $2,000,000 | $600 |
| $2,000,000 | $8,000,000 | $1,000 |
| $8,000,000 | $15,000,000 | $1,100 |
| $15,000,000 | --- | $1,400 |

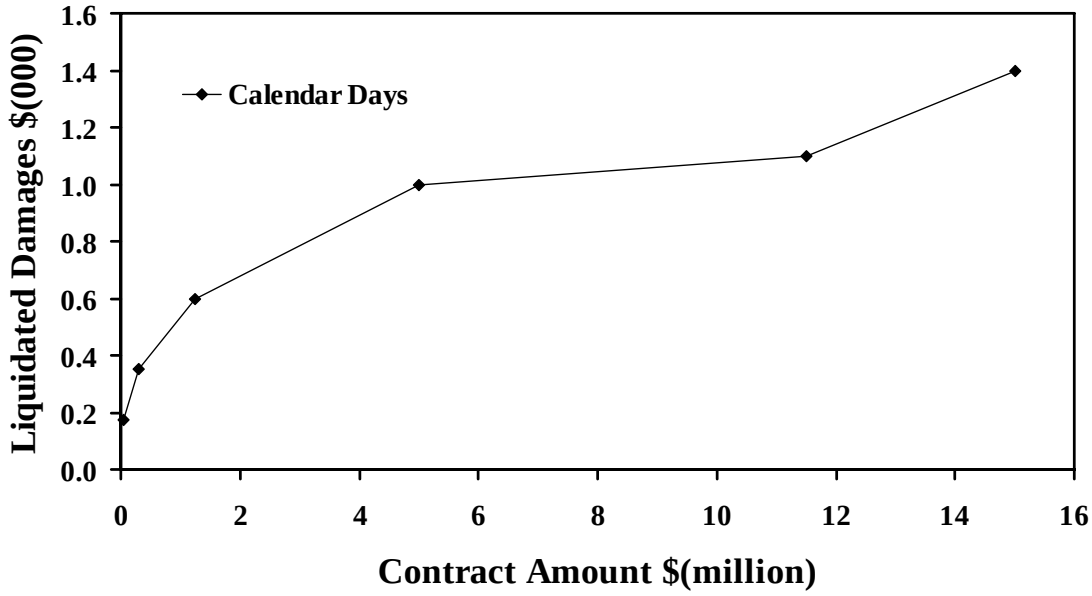


**Figure A-32 Virginia DOT Schedule of Liquidated Damages**

## WEST VIRGINIA

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Daily Charge |
| $0 | $25,000 | $120 |
| $25,000 | $100,000 | $150 |
| $100,000 | $500,000 | $290 |
| $500,000 | $1,000,000 | $490 |
| $1,000,000 | $2,000,000 | $840 |
| $2,000,000 | $5,000,000 | $1,390 |
| $5,000,000 | $10,000,000 | $2,220 |
| $10,000,000 | --- | $3,870 |

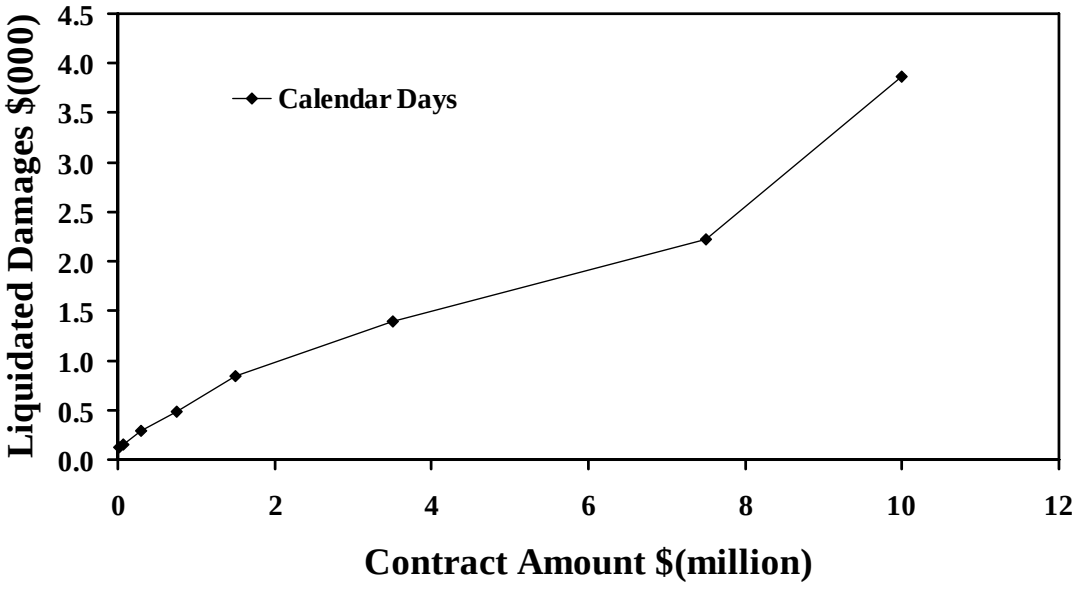


**Figure A-33 West Virginia DOT Schedule of Liquidated Damages**

## WISCONSIN

| Contract Value | | Daily Liquidated Damages Rate | |
|---|---|---|---|
| More Than | To and Including | Work Day | Calendar Day |
| $0 | $100,000 | $610 | $305 |
| $100,000 | $300,000 | $760 | $380 |
| $300,000 | $500,000 | $1,140 | $570 |
| $500,000 | $1,000,000 | $1,470 | $735 |
| $1,000,000 | --- | $2,230 | $1,115 |

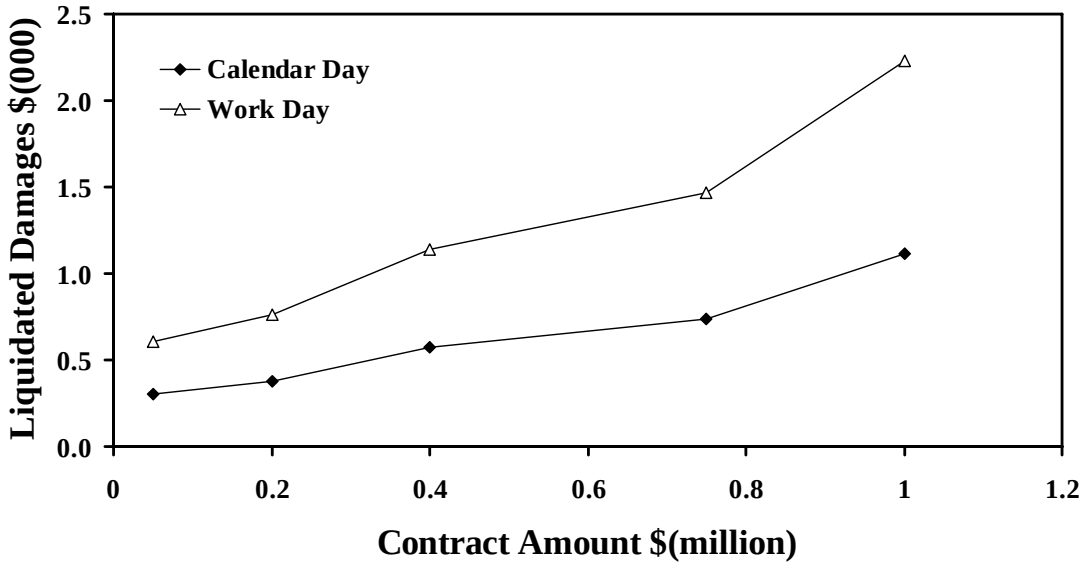


**Figure A-34 Wisconsin DOT Schedule of Liquidated Damages**

## WYOMING

| Contract Value | | Daily LD Rate |
|---|---|---|
| More Than | To and Including | Working Day |
| $0 | $50,000 | $250 |
| $50,000 | $100,000 | $500 |
| $100,000 | $500,000 | $750 |
| $500,000 | $2,000,000 | $1,500 |
| $2,000,000 | $5,000,000 | $1,800 |
| $5,000,000 | $7,500,000 | $2,000 |
| $7,500,000 | $10,000,000 | $2,500 |
| $10,000,000 | $15,000,000 | $3,000 |
| $15,000,000 | $20,000,000 | $3,500 |
| $20,000,000 | --- | $4,000 |

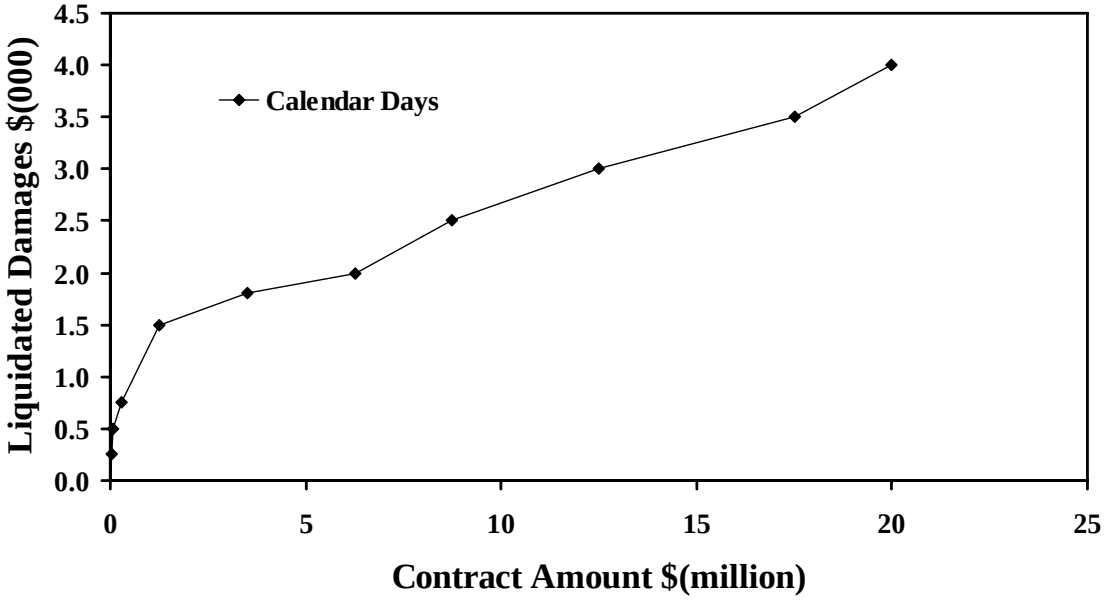


**Figure A-35 Wyoming DOT Schedule of Liquidated Damages**

# APPENDIX B

## COPY OF ELECTRONIC SURVEY SUBMITTED TO SHAS

# Evaluation and Assessment of SHA Liquidated Damages Provision

Thank you in advance for your participation.
Completed surveys will be used to evaluate the state-of-the-practice on the use of Liquidated Damages (LDs) by the State Highway Agencies (SHA). This e-survey of LD practices is divided into the following sections:

A. Contractual Principles
B. Current LD Contract Provisions
C. Contract Administration
D. Cost Estimation Practices
E. Legal Issues
F. Miscellaneous

Respondents to the survey will receive a summary of the survey results.

Start Survey!

---




## Evaluation and Assessment of SHA Liquidated Damages Provision

1

Contact Information (To enable follow-up contact if required)

| | |
|---|---|
| Responding Agency | |
| Responding Individual | |
| Title | |
| Street Address | |
| Unit,Suite, or Apt# | |
| City, State | |
| Zip Code | |
| Telephone Number | |
| Email | |

## A. CONTRACTUAL PRINCIPLES

**2**

Does your agency stipulate Liquidated Damages (in lieu of recovering actual damages) as a contract provision on state and/or federal funded construction projects?

*If your response is "NO", please discontinue survey and submit.* Thank you!

YES NO

*Please use comment box to provide clarifying remarks*

Survey Page 1

# Evaluation and Assessment of SHA Liquidated Damages Provision

**3**

Does your agency have any declarative statements as to the purpose, scope, range, and intent of LD clauses in contractual documents or other agency manuals?

YES NO

*Please use comment box to provide clarifying remarks*

## B. CONTRACT PROVISIONS

4

The duration of contracts subject to Liquidated Damages is specified using which of the following? *[check all that apply]*

- [ ] Calendar Days
- [ ] Work Days
- [ ] Fixed Calendar Date
- [ ] Other [please specify]

5

Does your agency assess hourly liquidated damages for working in excess of a typical 8-hour workday?

- Yes
- Yes, but project specific
- No

6

Does the contractual rate stipulated for Liquidated Damages by your agency vary based on project type? [i.e. Bridge, Highway, Maintenance Works, Widening, Buildings etc.]

YES NO

*Please use comment box to provide clarifying remarks*

**7**

Does your agency use incremental LD rates based on construction status? [i.e. Substantial completion; Physical Completion; Contract Completion]

YES NO

*Please use comment box to provide clarifying remarks*

**8**

Does your agency assess LDs by project phase?[i.e. intermediate phases, milestones, etc.]

YES NO

*Please use comment box to provide clarifying remarks*

**9**

Does completion of the project on time waive your agency's right to assess liquidated damages for delays in completing any intermediate phases?

YES NO

*Please use comment box to provide clarifying remarks*

**10**

What project delivery system does your agency typically use?

- [ ] Design-Bid-Build
- [ ] Design-Build
- [ ] Construction Management at Risk
- [ ] Construction Management at Agency
- [ ] Other [please specify]

**11**

Do the LD rates vary per delivery system?

YES NO

*Please use comment box to provide clarifying remarks*

**12**

Does your agency use and assess both Incentive/Disincentive and LD provisions simultaneously on construction contracts?

YES NO

*Please use comment box to provide clarifying remarks*

**13**

Is the definition of substantial completion written in the contract?

YES NO

*Please use comment box to provide clarifying remarks*



# Evaluation and Assessment of SHA Liquidated Damages Provision

## C. COST ANALYSIS PROCEDURES | TECHNIQUES

**14**

Does your agency follow an established cost estimating technique/methodology in preparing liquidated damage estimates?

YES NO

**15**

Does your state have a standard project-staffing plan that is used as a framework for resource estimating associated with LD's?

YES NO

*Please use comment box to provide clarifying remarks*

**16**

Does your agency consider any factors other than basic engineering and inspection when computing LD rates?

YES NO

*Please use comment box to provide clarifying remarks*

**17**

Does your agency have worksheets that are used to calculate the individualized LD rates for specific projects?

YES NO

*Please use comment box to provide clarifying remarks*

**18**

How does your agency specify LD rates in contract specifications?

- Table of Average Costs
- Project Specific Cost
- Other [please specify]

**19**

Which department within your agency develops the liquidated damages rates? *[check all that apply]*

- Accounting
- Construction Bureau

- [ ] Engineering Design Bureau
- [ ] Administrative Staff
- [ ] Other [please specify]



## Evaluation and Assessment of SHA Liquidated Damages Provision

### D. CONTRACT ADMINISTRATION

**20**

Who makes the determination of substantial completion? [e.g. resident engineer, chief engineer, consultants, etc.]

**21**

How often are LD provisions waived/reduced during or after construction?

- [ ] Never
- [ ] Sometime
- [ ] Often

**22**

How are the LDs waived/reduced?

- [ ] Granting Time Extensions
- [ ] Disregarding Contractual Provisions
- [ ] Adjusting Payment Documents during Processing
- [ ] Other [please specify]

**23**

If the LDs are waived, at what level is this decision made?

- [ ] State Level (e.g. Division / District / Bureau / etc)
- [ ] Local Level (e.g. Project / Resident / Field / etc)

**24**

Does your agency conduct a cost analysis/audit on selected projects to compare LDs to actual costs incurred? [i.e. a comparison of estimated damages vs. actual]

YES NO

*If yes, is it a formalized review or an informal review?*

*Please use comment box to provide clarifying remarks*

## Evaluation and Assessment of SHA Liquidated Damages Provision

### E. LEGAL ISSUES

**25**

Has your LD provision ever been challenged in court?

YES NO

If yes, what was the verdict?



## Evaluation and Assessment of SHA Liquidated Damages Provision

**26**

What is the level of actual or pending litigation pertaining to liquidated damages for State DOT construction projects over the last decade?

- High (challenged more than 10 times)
- Medium (challenged 5 to 10 times)
- Low (challenged less than 5 times)
- None

**27**

If a court ruling voids the LD provision in a contract, would your agency pursue recovering the actual costs incurred?

- Yes
- No
- Not sure

**28**

Is there a legal precedent in your state that dictates how LDs are assessed?

YES NO

*Please use comment box to provide clarifying remarks*

Survey Page 6

## Evaluation and Assessment of SHA Liquidated Damages Provision

### F. MISCELLANEOUS

**29**

How often does your agency update the schedule of liquidated damages rates being utilized in contracts?

30

Would your state be interested in adopting a model LD provisions?

- Highly Interested
- Moderately Interested
- Low Intrest
- No Interest
- Undecided

# APPENDIX C

# SUMMARY OF SURVEY RESULTS

AUBURN

SAMUEL GINN
COLLEGE OF ENGINEERING

# A Review and Evaluation of ALDOT's Liquidated Damages Provision

## Summary of Survey Results

**Abstract:**
The following document is the summary of results from a survey that was conducted to evaluate the state-of-the-practice on the use of Liquidated Damages (LDs) by State Highway Agencies (SHA) across the nation. The e-survey tool used to evaluated LD practices consisted of 30 questions and was divided into the following sections: A. *Contractual Principles*, B. *Current LD Contract Provisions*, C. *Contract Administration*, D. *Cost Estimation Practices*, E. *Legal Issues*, and F. *Miscellaneous*. A 100% survey response rate was achieved. Fifty-three agencies responded that included all 50 DOTs, the District DOT (Washington, D.C.), the NJ Turnpike Authority, and the Puerto Rico Highway and Transportation Authority (PRHTA).

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www.eng.auburn.edu/research/centers/hrc.html

| Responding Agency | Abbreviation |
|---|---|
| Alabama Department of Transportation | ALDOT |
| Alaska Department of Transportation | AKDOT |
| Arkansas State Highway and Transportation Dept. | AHTD |
| Arizona Department of Transportation | ADOT |
| California Department of Transportation (Caltrans) | CALTRANS |
| Colorado Department of Transportation | CDOT |
| Connecticut Department of Transportation | ConnDOT |
| Delaware Department of Transportation | DelDOT |
| District Department of Transportation DDOT (District of Columbia) | DDOT |
| Florida Department of Transportation | FDOT |
| Georgia Department. of Transportation | GDOT |
| Hawaii Department of Transpiration | HDOT |
| Idaho Transportation Department | ITD |
| Illinois Department of Transportation | IDOT |
| Indiana Department of Transportation | INDOT |
| Iowa Department of Transportation | Iowa DOT |
| Kansas Department of Transportation | KDOT |
| Kentucky Department of Transportation | KYTC |
| Louisiana Department of Transportation & Development | LaDOTD |
| Maine Department of Transportation | MDOT (Maine) |
| Maryland Department of Transportation | MDOT (Maryland) |
| Massachusetts Department of Transportation | MHD |
| Michigan Department of Transportation | MDOT (Mich.) |
| Minnesota Department of Transportation | MnDOT |
| Mississippi Department of Transportation | MDOT (Miss.) |
| Missouri Department of Transportation | MoDOT |
| Montana Department of Transportation | MDT |
| Nebraska Department of Roads | NDOR |
| Nevada Department of Transportation | NDOT |
| New Hampshire Department of Transportation | NHDOT |
| New Jersey Department of Transportation | NJDOT |
| New Jersey Turnpike Authority | NJTA |
| New Mexico Department of Transportation | NMDOT |
| District Department of Transportation DDOT (NY) | NYSDOT |
| North Carolina Department of Transportation | NCDOT |
| North Dakota Department of Transportation | NDDOT |
| Ohio Department of Transportation | ODOT (Ohio) |
| Oklahoma Department of Transportation | ODOT (Okla.) |
| Oregon Department of Transportation | ODOT (Oregon) |
| Pennsylvania Department Of Transportation | PennDOT |
| Puerto Rico Highway and Transportation Authority | PRHTA |
| Rhode Island Dept of Transportation | RIDOT |
| South Carolina Department of Transportation | SCDOT |
| South Dakota Department of Transportation | SDDOT |
| Texas Department of Transportation | TxDOT |
| Tennessee Department of Transportation | TennDOT |
| Utah Department of Transportation | UDOT |
| Vermont Agency of Transportation | VDOT (Vermont) |
| Virginia Department of Transportation | VDOT (Virginia) |
| Washington State Department of Transportation | WSDOT |
| West Virginia Dept of Transportation, Division of Highways | WVDOT |
| Wisconsin Department of Transportation | WisDOT |
| Wyoming Department of Transportation | WYDOT |

**A. CONTRACTUAL PRINCIPLES**

***QUESTION 2:*** *Does your agency stipulate Liquidated Damages (in lieu of recovering actual damages) as a contract provision on state and/or federal funded construction projects? If your response is "NO", please discontinue survey and submit. Thank you!*

| Total Responses | YES | NO | No Response |
|---|---|---|---|
| 53 | 53 | 0 | 0 |
| 100% | 100% | 0% | 0% |

*Please use comment box to provide clarifying remarks.*

| Responding Agency | Response | Comments |
|---|---|---|
| ALDOT | Yes | ALDOT specifies LD rates in Article 108.11 of Standard Specifications |
| AHTD | Yes | For each calendar day or working day, as specified, that work remains uncompleted after the contract time has expired, the sum specified in the proposal and Contract will be deducted from any money due the Contractor, not as a penalty, but as liquidated damages. |
| CALTRANS | Yes | Estimated rates based on general administrative costs, construction engineering costs, and field office overhead costs applicable to the project. |
| KDOT | Yes | We use a graduated table that is included in our Std. Specifications. |
| LaDOTD | Yes | On some projects, Louisiana uses A + B bidding & uses the same daily road user cost used in bidding as the late completion charge. |
| MDOT (Maine) | Yes | We have a schedule of liquidated damages based on the original contract amount. |
| NHDOT | Yes | We assess liquidated damages when a Contractor fails to complete the work by the Contract Completion Date. The Completion Date is adjusted for reason beyond the control of the contractor. |
| NCDOT | Yes | Liquidated damages are stipulated for all contracts. |
| PennDOT | Yes | We utilize Road Users Liquidated Damages (RULD) which are calculated based on a specific formula. |
| TennDOT | Yes | On some projects incentive/disincentive would be used in lieu of liquidated damages. The thought is that the administrative costs would be included in the I/D amount. |
| VDOT (Virginia) | Yes | VDOT has a standard table of Liquidated Damages based on awarded contract amounts. |

***QUESTION 2 continued:*** *Does your agency stipulate Liquidated Damages (in lieu of recovering actual damages) as a contract provision on state and/or federal funded construction projects? If your response is "NO", please discontinue survey and submit. Thank you!*

| Responding Agency | Response | Comments |
|---|---|---|
| WSDOT[1] | Yes | Liquidated Damages may be assessed for failure to open lanes to traffic, these are based on cost to the traveling public. We may also assess liquidated damages for failure to complete project on time. |
| WSDOT[2] | Yes | See Standard Specification http://www.wsdot.wa.gov/fasc/EngineeringPublications/Manuals/2006SS.htm |

Notes:

1. David M. Jones, Assistant Construction Engineer of the WSDOT was the respondent.
2. Craig McDaniel, State Construction Engineer of the WSDOT was the respondent.

**A. CONTRACTUAL PRINCIPLES**

***QUESTION 3****: Does your agency have any declarative statements as to the purpose, scope, range, and intent of LD clauses in contractual documents or other agency manuals?*

| Total Responses | YES | NO | No Response |
|---|---|---|---|
| 53 | 48 | 4 | 1 |
| 100% | 91% | 8% | 2% |

| States responding "NO" | | |
|---|---|---|
| DDOT | Iowa DOT | RIDOT |
| WYDOT | | |

*Please use comment box to provide clarifying remarks.*

| Responding Agency | Response | Comments |
|---|---|---|
| ALDOT | Yes | Article 108.10 of Standard Specifications states that LDs are not a penalty, but are intended to compensate the State for increased time in administering the contract, supervision, inspection and engineering |
| ADOT | Yes | Section 108-1.07 Failure to complete on time of our Standard Specification for Highway Construction. |
| GDOT | Yes | Within our specifications we have such language as follows: For each day that any physical work remains uncompleted after the Required Completion date, the sum per day specified in the following schedule, unless otherwise stated in the proposal, will be deducted from money due or to become due. This deduction is not a penalty, but as Construction Engineering liquidated Damages. |
| KYTC | Yes | The entire statements---Because the prosecution of work in connection with the construction of road and bridge projects will inconvenience the public, obstruct traffic, and interfere with business, complete the work as quickly as practical. Also, the Department's costs for the administration of the Contract, including inspection, engineering, supervision, and maintaining detours, increases with the time that the Contractor takes to execute the work. When the Department allows the Contractor to continue and to finish the project beyond the Contract time, such permission does not operate as a waiver by the Department of any of its rights under the Contract. |
| LaDOTD | Yes | "the sum specified in table 108-1 will be deducted from payments for the work, not as a penalty but as stipulated damages." |
| MDOT (Maryland) | Yes | MD has a general provision for Liquidated Damages |
| MDT | Yes | The following is from the specification: "This deduction is for liquidated damages for added Department contract administration costs for failure to complete the work on time." There is additional background information in a write up to the Transportation Commission. |
| MDOT (Mich.) | Yes | C. Assessment Of Liquidated Damages. Sums assessed as Liquidated Damages shall be considered and treated not as a penalty but as fixed, agreed upon and liquidated damages due the Department from the Contractor by reason of inconvenience to the public, added cost of Engineering and supervision, maintenance of detours and other items that have caused an expenditure of public funds resulting from the Contractor's failure to complete the work or open the project to traffic within the time specified in the contract. |

***QUESTION 3 continued** : Does your agency have any declarative statements as to the purpose, scope, range, and intent of LD clauses in contractual documents or other agency manuals?*

| Responding Agency | | Comments |
|---|---|---|
| NHDOT | Yes | LD is discussed in our Standard Specifications only (section 108.09). To my knowledge no other information is provided to the contractor. |
| NJDOT | Yes | NJDOT 2001 Standard Specifications state: "The Contractor and the Department recognize that delay in Completion results in damages to the State in terms of the effect of the delay on the use of the Project, upon the public convenience and economic development of the State, and also results in additional costs to the State for engineering, inspection, and administration of the Contract. Because it is difficult or impossible to accurately estimate the damages incurred; therefore, the parties agree that if the Contractor fails to complete the Contract within the time stated in these Special Provisions, or within such further time as may have been granted according to the provisions of the Contract, the Contractor shall pay the State liquidated damages according to those provided in the Special Provisions. Such liquidated damages shall be paid for each and every day, as hereafter, defined that the Contractor is in default to complete the Contract." |
| NJTA | Yes | 107.07 Failure to Complete on Time. The Contractor and the Authority recognize that delay in completion of the Project will result in damage to the New Jersey Turnpike Authority in terms of the effect of the delay in the use of the Project upon the public convenience and the business reputation, economic status and loss of revenue of the New Jersey Turnpike, and will also result in additional cost to the Authority for engineering, inspection and administration of the Contract. Because some of this damage is difficult or impossible to calculate or estimate, the parties agree that if the Contractor fails to complete the Project and each and every part and appurtenance thereof fully, entirely, and in conformity with the provisions of the Contract within the time stated in the Contract, or within such further extension of time as may have been granted, the Contractor shall pay the Authority liquidated damages in the amounts set forth in the contract agreement in lieu of the above stated actual damage. Such liquidated damages shall be paid for each and every day that he is in default on time to complete the work. |
| NYSDOT | Yes | We have a liquidated damage provision for failing to complete the overall contract on time. We also have liquidated damage provisions in contracts with Time Related Provisions, i.e., contracts with milestones, Incentive/Disincentive, A+B Bidding, Lane Rental, etc. We also have a liquidated damage provisions in our M&PT specs for repeated failure to comply with the M&PT Provisions. |
| ODOT (Oklahoma) | Yes | Currently addressed in section 108.09 of specifications and will enhance the language with spec re-write underway |
| UDOT | Yes | Defined as: A predetermined sum to be assessed the Contractor. This sum is not considered as a penalty, but as liquidated damages due the Department by reason of inconvenience to the public, added cost of engineering and supervision, and other items for extra expenditures of public funds for the Contractor's failure as specified. |
| VDOT (Vermont) | Yes | We define the term in the Standard Specification. The Section 108.12 Failure to complete Work on Time also states "..not as a penalty but as liquidated damages to defray the cost to the Agency of the administration of the Contract, including but not limited to, the cost of engineering, inspection, supervision, inconvenience to the public, obstruction of traffic, and interference with business" |
| VDOT (Virginia) | Yes | The Road and Bridge Specifications, Section 108.12 states "The following Schedule of Liquidated Damages, representing the cost of administration, engineering, supervision, inspection and other expenses, will be charged against the Contractor for each calendar day beyond the contract time in which the Contract remains in an incomplete state." |
| WSDOT | Yes | http://www.wsdot.wa.gov/fasc/EngineeringPublications/ See page 1-50 of the construction manual |

***QUESTION 3 continued** : Does your agency have any declarative statements as to the purpose, scope, range, and intent of LD clauses in contractual documents or other agency manuals?*

| Responding Agency | Response | Comments |
|---|---|---|
| IDOT | Yes | Our Standard Specifications explain this as follows: 108.09 Failure to Complete the Work on Time. Time is of the essence to the contract. Should the Contractor fail to complete the work within the working days stipulated in the contract or on or before the completion date stipulated in the contract or within such extended time as may have been allowed, the Contractor shall be liable and shall pay to the Department the amount shown in the following schedule of deductions, not as a penalty but as liquidated damages, for each day of overrun in the contract time or such extended time as may have been allowed. The liquidated damages for failure to complete the contract on time are approximate, due to the impracticality of calculating and proving actual delay costs. This schedule of deductions establishes the cost of delay to account for administration, engineering, inspection, and supervision during periods of extended and delayed performance.<br>The costs of delay represented by this schedule are understood to be a fair and reasonable estimate of the costs that will be borne by the Department during extended and delayed performance by the Contractor of the work, remaining incidental work, correction of work improperly completed, or repair of work damaged I as a result of the Contractor. The liquidated damage amount specified will accrue and be assessed until final completion of the total physical work of the contract even though the work may be substantially complete. The Department will deduct these liquidated damages from any monies due or to become due to the Contractor from the Department. Art. 108.10 Prosecution and Progress 52 Schedule of Deductions for Each Day of Overrun in Contract Time Original Contract Amount Daily Charges From More Than To and Including Calendar Day Work Day $ 0 $ 25,000 $ 300 $ 400 25,000 100,000 375 500 100,000 500,000 550 750 500,000 1,000,000 725 1,000 1,000,000 2,000,000 900 1,250 2,000,000 3,000,000 1,100 1,500 3,000,000 5,000,000 1,300 1,800 5,000,000 7,500,000 1,450 2,000 7,500,000 And over 1,650 2,300<br><br>When a completion date is specified, the daily charge shall be made for every day shown on the calendar beyond the specified completion date. When the time limit is specified as working days, the daily charge shall be made for each additional working day, computed as specified in Article 108.04. If contracts are awarded on the basis of a multiple bid, the contract amounts of the individual contracts comprising the multiple bid shall be totaled and the daily charge shall be that required for such total amount. |

**B. CONTRACT PROVISIONS**

***QUESTION 4:*** *The duration of contracts subject to Liquidated Damages is specified using which of the following? [check all that apply]*

| Total Responses | Calendar Days | Work Days | Fixed Calendar Date | Other |
|---|---|---|---|---|
| 53 | 15 | 38 | 1 | 9 |
| 100% | 28% | 72% | 2% | 17% |

| Responding Agency | Other [please specify] |
|---|---|
| LaDOTD | A + B bidding, but b not called stipulated damages |
| MDOT (Miss.) | We use time units, which are similar to work days |
| MoDOT | A+B Incentive |
| NJDOT | Lane Occupancy Charges - applied per hour |
| PennDOT | Milestone Dates |
| VDOT (Vermont) | Interim completions for specific items or portions |
| WSDOT | Opening lanes to traffic |

**B. CONTRACT PROVISIONS**

***QUESTION 5:*** *Does your agency assess hourly liquidated damages for working in excess of a typical 8-hour workday?*

| Total Responses | Yes | No | Yes, but project specific |
|---|---|---|---|
| 53 | 0 | 45 | 8 |
| 100% | 0% | 85% | 15% |

| Agencies that responded "Yes, but project specific" |
|---|
| ADOT |
| IDOT |
| KDOT |
| LaDOTD |
| NDOT |
| NJDOT |
| TxDOT |
| VDOT (Virginia) |

**B. CONTRACT PROVISIONS**

***QUESTION 6*** *: Does the contractual rate stipulated for Liquidated Damages by your agency vary based on project type? [i.e. Bridge, Highway, Maintenance Works, Widening, Buildings etc.]*

| Total Responses | Yes | No | No Response |
|---|---|---|---|
| 53 | 6 | 47 | 0 |
| 100% | 11% | 89% | 0% |

*Please use comment box to provide clarifying remarks.*

| Responding Agency | Response | Comments |
|---|---|---|
| CALTRANS | Yes | Currently it does, however, our next biannual revised rates will not vary by project-type criteria. They will only vary by bid amount ranges that will be provided in the next version of the Standard Specifications. |
| CDOT | No | Based on contract value. |
| FDOT | No | Based on dollar amount of the contract. |
| GDOT | No | Generally not but in some cases where inconvenience to the traveling public will be greater we increase the LD's. |
| HDOT | No | Traffic Volume |
| IDOT | No | See specs for comment regarding this. |
| INDOT | No | Based on contract amount |
| KYTC | No | Our rate varies by size of the project. On some large projects involving high traffic volumes, we set up incentive/disincentive clauses to encourage early completion. Lately, we have been mostly specifying extra disincentives, similarly to LD's. This rates are much higher than normal, usually around $10,000 per day. |
| LaDOTD | No | Louisiana calls them stipulated damages, but cost is the average inspection costs for all construction projects. |
| MDOT (Maryland) | No | based on the staff required for the dollar value of the contract |
| MHD | No | No it is based on the project value. Higher PV equals higher LD's. |
| MDT | No | The rates do not vary by work type, but vary by contract size (e.g. $0-$50,000, $50,001-$100,000, etc.). |

***QUESTION 6 continued** : Does the contractual rate stipulated for Liquidated Damages by your agency vary based on project type? [i.e. Bridge, Highway, Maintenance Works, Widening, Buildings etc.]*

| Responding Agency | Response | Comments |
|---|---|---|
| NJDOT | No | NJDOT 2001 Standard Specifications state: "The Contractor and the Department recognize that delay in Completion results in damages to the State in terms of the effect of the delay on the use of the Project, upon the public convenience and economic development of the State, and also results in additional costs to the State for engineering, inspection, and administration of the Contract. Because it is difficult or impossible to accurately estimate the damages incurred; therefore, the parties agree that if the Contractor fails to complete the Contract within the time stated in these Special Provisions, or within such further time as may have been granted according to the provisions of the Contract, the Contractor shall pay the State liquidated damages according to those provided in the Special Provisions. Such liquidated damages shall be paid for each and every day, as hereafter, defined that the Contractor is in default to complete the Contract." |
| NHDOT | No | We use a graduated charge based on the contract value. |
| NCDOT | No | Liquidated damages are based upon estimated CEI cost and road user cost and/or benefit. |
| NYSDOT | No | Standard Specifications - based on project bid value in a table. Sometimes altered by project specific provisions. |
| SCDOT | Yes | A+B Bid projects have LDs stipulated as the dollar value of the B-portion |
| UDOT | No | Based on dollar amount of contract and specified contract time...working day, calendar day, or completion date. |
| VDOT (Virginia) | No | VDOT has Schedule of LD's based on original contract amount for construction projects, but sometimes uses project specific LD's determined using Road User Impacts. |
| WYDOT | No | It is not by type but rather by contract dollar size. |

**Agencies that responded "Yes"**

| |
|---|
| CALTRANS |
| DDOT |
| NJTA |
| ODOT (Ohio) |
| PRHTA |
| SCDOT |

**B. CONTRACT PROVISIONS**

***QUESTION 7*** *: Does your agency use incremental LD rates based on construction status? [i.e. Substantial completion; Physical Completion; Contract Completion]*

| Total Responses | Yes | No | No Response |
|---|---|---|---|
| 53 | 15 | 38 | 0 |
| 100% | 28% | 72% | 0% |

*Please use comment box to provide clarifying remarks.*

| Responding Agency | Response | Comments |
|---|---|---|
| ADOT | No | It is by original contract amount |
| CALTRANS | Yes | Standard LDs apply until contract acceptance (completion), Additional LDs based on road user delay costs may also apply if it is a contract utilizing A+B bidding (contractor also bids contract working days). Additional LDs apply if lane closures are continuing after expiration of contract working days. |
| FDOT | No | LD's begin being assessed when allowable contract time is exceeded. |
| IDOT | No | See specs for comment regarding this. |
| Iowa DOT | No | We are considering this |
| KYTC | Yes | Half rates when the road reopens to through traffic. This encourages the contractor to get the road to where the public has some use of it. |
| MHD | Yes | Once project is substantially complete and open to traffic the daily rate is reduced in half. |
| MnDOT | No | we do have a provision for waiving all or a portion of the LD assessment if the work is substantially complete |
| MoDOT | Yes | not as routine but sometimes the rates may drop after critical milestones or phases of construction |
| MDT | No | Liquidated damages are assessed when the physical work is complete (time charges are discontinued). Any charges for intermediate milestones are a penalty and are based on the road user impacts. |
| NJDOT | Yes | Typically NJDOT includes a rate for Substantial Completion and for Contract Completion. |
| NCDOT | Yes | Substantial completion is used on contracts with significant road user cost. |

***QUESTION 7 continued:*** *: Does your agency use incremental LD rates based on construction status? [i.e. Substantial completion; Physical Completion; Contract Completion]*

| Responding Agency | Response | Comments |
|---|---|---|
| UDOT | Yes | Tabulated LD rates are for Substantial Completion. Contracts also stipulate the smallest (least) daily rate in the table for Substantial Completion to be used for failure to reach Physical Completion within 30 days of Substantial Completion, and $100/day for failure to reach Contract Completion within 30 days of Physical Completion |
| VDOT (Virginia) | No | Liquidated Damages are based on contract completion. Occasionally, VDOT will set millstone dates during the contract that have Incentive/Disincentive amounts tied to them. |
| WYDOT | Yes | It is not by type but rather by contract dollar size. |

| Agencies responding "Yes" |
|---|
| ADOT |
| DDOT |
| CALTRANS |
| HDOT |
| KDOT |
| KYTC |
| MHD |
| MoDOT |
| NCDOT |
| NJDOT |
| NDOT |
| PennDOT |
| UDOT |
| WSDOT |
| WYDOT |

**B. CONTRACT PROVISIONS**

***QUESTION 8****: Does your agency assess LDs by project phase? [i.e. intermediate phases, milestones, etc.]*

| Total Responses | Yes | No | No Response |
|---|---|---|---|
| 53 | 30 | 23 | 0 |
| 100% | 57% | 43% | 0% |

*Please use comment box to provide clarifying remarks.*

| Responding Agency | Response | Comments |
|---|---|---|
| ALDOT | No | The majority of ALDOT projects do not vary from the LDs listed in Article 108.11, but occasionally a project will contain a reduced LD rate for work to be accomplished in a particular phase of work. For example, if the work in that phase is estimated to equal 30% of the total cost of the work, the LD rate would be set at 30% of rate specified for the overall contract. This type of LD assessment would typically be used in a project with an I/D phase followed by a reduced LD rate phase. |
| CALTRANS | Yes | Yes, in standard special provisions, various project specific milestone assessments by both time and/or by dates |
| ConnDOT | No | On some projects, not on the majority of projects. |
| DelDOT[1] | Yes | This is done on a project specific basis. If there is a high road user cost, we may assess damages on interim milestones. |
| DelDOT[2] | | We use user costs typically when tied to a milestone date. |
| FDOT | No | We do sometimes let contracts with incentive/disincentive clauses tied to milestones but these are not associated with LD's. LD's only begin being assessed when allowable contract time is exceeded. |
| GDOT | Yes | Not on all projects. |
| HDOT | Yes | There is a reduced LD amount after partial acceptance. |
| IDOT | Yes | 1. On a project by project basis. 2. Project Specific |
| KYTC | Yes | This is a rare event. |
| MDOT (Maine) | No | Not a Standard Specification but added as a Special Provision on some projects. |
| MDOT (Mich.) | No | Some projects do assess interim LD's. This is a project specific LD issue and not a statewide specification issue. |
| MnDOT | No | In the past we have assessed LD's on intermediate phases. In the future we plan to assess LD's only on project completion. |
| MDOT (Miss) | No | Generally no. Rarely, for specific situations, we will have LD for failure to meet an intermediate deadline. |

Notes:

1. Natalie Barnhart, Assistant Director, South Construction of DelDOT was the respondent.

2. Tom Greve, Group Engineer, South I Construction of DelDOT was the respondent.

***QUESTION 8 continued** : Does your agency assess LDs by project phase? [i.e. intermediate phases, milestones, etc.]*

| Responding Agency | Response | Comments |
|---|---|---|
| MoDOT | Yes | In some contracts we have an open to traffic date and a final completion date. |
| MDT | No | Any charges for intermediate milestones are a penalty and are based on the road user impacts. |
| NDOT | Yes | Again, we normally call these incentives/disincentives |
| NJDOT | Yes | NJDOT may include completion dates for intermediate milestones, such as completion of a stage, opening of a ramp or bridge. These are used less frequently. |
| NHDOT | Yes | We use the standard when assessing LD for intermediate completion dates. |
| ODOT (Okla.) | No | We use a "disincentive rate" for milestones when needed by project specific specifications |
| PennDOT | Yes | Milestones and they are classified as Road Users LD |
| PRHTA | Yes | IF PROJECT IS A COMPLEX ONE (Puerto Rico Highway and Transportation Authority) |
| TennDOT | Yes | This has been done on a very limited basis. We generally look at I/D clauses on intermediate phases or milestones. |
| UDOT | No | Not generally, but sometimes on a project-by-project basis |
| VDOT (Vermont) | Yes | A design may require portions of a project be complete by specific days and liquidated damaged have been applied for failure to meet the interim completion. Example would be opening a bridge to traffic by a certain date. |
| VDOT (Virginia) | Yes | Used occasionally on specific projects where appropriate milestones can be determined. |
| WSDOT | Yes | Seldom and project specific |
| WisDOT | Yes | If added by special provision |
| WYDOT | Yes | These are established on a project by project basis in a construction requirement. |

**B. CONTRACT PROVISIONS**

***QUESTION 9:*** *Does completion of the project on time waive your agency's right to assess liquidated damages for delays in completing any intermediate phases?*

| Total Responses | Yes | No | No Response |
|---|---|---|---|
| 53 | 4 | 47 | 2 |
| 100% | 8% | 89% | 4% |

*Please use comment box to provide clarifying remarks.*

| Responding Agency | Response | Comments |
|---|---|---|
| CALTRANS | No | Milestone (by specific date or internal time limit) assessment is completely separate from whole work assessment. However, a project with A+B bidding doesn't assess additional LDs when completion of project is on time. |
| CDOT | No | LD's can not be charged for intermediate phases. LD's are a charge to recover CDOT CE costs. There would be no lost CE costs at an intermediate phase of a project. |
| DelDOT | No | It would unless the contract documents specify that interim damages apply. Those damages would be assessed at the time of occurrence, not at the end of the project. |
| FDOT | No | FDOT doesn't tie LD's to intermediate phases of work so answer is really N/A. |
| HDOT | No | We have a reduced LD amount until final completion. |
| INDOT | No | Intermediate is most usually established by special provision to certain contracts. |
| KYTC | No | Again, it is rare for us to specify intermediate phase milestones to include LD's or other Disincentives. |
| MDOT (Mich.) | No | Assessment of LD's for intermediate phases is a project specific issue that the statewide specifications do not waive. |
| MDOT (Miss.) | Yes | We use incentive/disincentive clauses for intermediate completion dates. |
| MoDOT | No | damages may occur on internal milestones |
| MDT | No | Since penalties on intermediate milestones are based on road user impacts, this does not affect the assessment of liquidated damages. On select projects, the liquidated damages are included in the milestone incentive/disincentive. If this is done, liquidated damages are not assessed, as this would be assessing the same value twice. |
| NYSDOT | No | See previous response regarding different types of LD provisions. |
| ODOT (Okla.) | No | Not if specified by project specific provisions for disincentive rates, see Q8. |

***QUESTION 9 continued:*** *Does completion of the project on time waive your agency's right to assess liquidated damages for delays in completing any intermediate phases?*

| Responding Agency | Response | Comments |
|---|---|---|
| PennDOT | No | Milestones are independent to the Completion of the project |
| SDDOT | No | Does not apply as we doe not assess based on interim milestones or phases. |
| TennDOT | No | When specified intermediate phases or milestones would stand on their own. |
| VDOT (Virginia) | No | Depends on the contract language as noted in question 8. The contract must be structured accordingly. |
| VDOT (Vermont) | No | Cannot come up with an example, but do not think this would waive our rights to assess on intermediate phases. |

**B. CONTRACT PROVISIONS**

***QUESTION 10*** *: What project delivery system does your agency typically use?*

| Total Responses | Design-Bid-Build | Design-Build | Const. Mgmt at Risk | Const. Mgmt at Agency | Other |
|---|---|---|---|---|---|
| 52 | 45 | 12 | 3 | 7 | 1 |
| 100% | 87% | 23% | 6% | 16% | 8% |

| Responding Agency | Other [please specify] |
|---|---|
| ITD | Low Bidder |

| Responding Agency | Response | Comment |
|---|---|---|
| FDOT | DBB | FDOT does many contracts with DB, some CM@risk |
| PennDOT | DBB, DB | Design Build Best Value |
| SCDOT | DBB, DB | A+B where A = Line Items B = Time bid. A+B+C where A=Line Items, B = Time Bid for entire project, and C= Bridge Closure Time |
| UDOT | DBB, DB | CMGC |
| VDOT (Vermont) | DBB | Agency design, bid and construction oversight. |

**B. CONTRACT PROVISIONS**

***QUESTION 11*** *: Do the LD rates vary per delivery system? - Please use comment box to provide clarifying remarks*

| Total Responses | Yes | No | No Response |
|---|---|---|---|
| 53 | 9 | 42 | 2 |
| 100% | 17% | 79% | 4% |

*Please use comment box to provide clarifying remarks.*

| Responding Agency | Response | Comments |
|---|---|---|
| ALDOT | Yes | Article 108.11 specifies LD rates under two headings: Working Day projects and Calendar Day/Date projects. |
| AHTD | No | Only use Design-Bid-Build. We are currently working towards Design Build. |
| IDOT | No | We basically only use Design-Bid-Build, but assume it would vary. |
| INDOT | No | Not by our Standard Specifications. Special Provisions to certain contracts could vary. |
| MDOT (Maryland) | No | varies by the staff required |
| MDOT (Mich.) | No | The other delivery systems have not been used enough to provide a comment. |
| MDOT[1] (Miss.) | No | Not necessarily for delivery systems. On projects we have contracted for CE&I, we will tie the LD to the approximate monthly cost to retain the CE&I contractor. |
| MDOT[2] (Miss.) | | LD rates do vary but it's driven by project specifics more than delivery type. Rate would also vary for CE&I projects. |
| MoDOT | No | vary with impact to public and cost to MoDOT |
| ODOT (Oregon) | No | It could by special provision, but probably not because of a specific delivery system. |
| PennDOT | No | The LD calculations are based on user delays, ADT, and other factors. |
| UDOT | Yes | I'm not actually sure about this, but suspect at least some Design-Build projects have addressed LDs differently from the Department's standard specifications |
| WVDOT | No | Presently, this is our only project delivery system (DBB). |
| WYDOT | No | NA |

Notes:

1. Brad Lewis, State Construction Engineer of the MsDOT was the respondent.

2. Billy R. Wilson, Assistant State Construction Engineer of the MsDOT was the respondent.

**B. CONTRACT PROVISIONS**

***QUESTION 12*** *: Does your agency use and assess both Incentive/Disincentive and LD provisions simultaneously on construction contracts?*

| Total Responses | Yes | No | No Response |
|---|---|---|---|
| 53 | 45 | 8 | 0 |
| 100% | 85% | 15% | 0% |

*Please use comment box to provide clarifying remarks.*

| Responding Agency | Response | Comments |
|---|---|---|
| ADOT | Yes | On only one or two projects a year |
| CALTRANS | Yes | Decisions to use incentives and disincentives is made at the district level, however, justification is needed. |
| ConnDOT | Yes | Occasionally, but not the norm. |
| GDOT | Yes | On selected projects. |
| INDOT | Yes | By Special Provision only. |
| Iowa DOT | No | Not currently. We used to do this, but have separated the I/D portion. |
| KYTC | Yes | Technically yes, but it has never came into play. Our LD's are part of the standard specs, and we would have to put in special contract language to make the LD's not apply |
| LaDOTD | Yes | Louisiana uses the same daily road user cost for late completion, but does not refer to them as LDs. |
| MDOT (Maine) | No | Occasionally. 1 or 2 projects a year |
| MHD | No | We currently do not used incentive/disincentive provisions. |
| MoDOT | Yes | Where applicable |
| NJDOT | Yes | Incentive/Disincentives are not commonly used. NJDOT uses them only on large projects with very significant traffic impacts. |
| NJTA | Yes | very few projects |
| NHDOT | Yes | We don't use I/D clauses in our contracts and when we do, more times than not we don't waive the LD clause of our contracts. We do however try not to penalize a contractor twice for the same delay. |
| NDDOT | Yes | Sometimes we do not assess both. |
| ODOT (Okla.) | Yes | We have specific language that states each rate represents different costs and the can be addressed concurrently |
| PRHTA | Yes | For special projects |

***QUESTION 12 continued** : Does your agency use and assess both Incentive/Disincentive and LD provisions simultaneously on construction contracts?*

| Responding Agency | Response | Comments |
|---|---|---|
| TennDOT | No | Generally no, some projects may have stipulated both. |
| UDOT | Yes | Sometimes Not that incentives and disincentives are based on user costs (excluding engineering costs) and LDs are based on engineering costs (exclude user costs) |
| VDOT | Yes | Only a limited number of contracts have Incentive/Disincentive provisions, all contracts have Liquidated Damages |
| WVDOT | Yes | When I/D clauses are used. |

**B. CONTRACT PROVISIONS**

***QUESTION 13:*** *Is the definition of substantial completion written in the contract?*

| Total Responses | Yes | No | No Response |
|---|---|---|---|
| 53 | 36 | 17 | 0 |
| 100% | 68% | 32% | 0% |

*Please use comment box to provide clarifying remarks.*

| Responding Agency | Response | Comments |
|---|---|---|
| ALDOT | No | Article 105.15 addresses "Acceptance" but does not specifically define substantial completion. |
| AHTD | Yes | When all pay items are completed. |
| ADOT | Yes | See Section 101-1.03 Definitions. |
| CALTRANS | No | Instead, we have "...in case all the work called for under the contract in all parts and requirements is not finished or completed within the number of working days...and it is therefore agreed the Contractor will pay...the sum set forth..." This requires more than just "substantial completion". I would recommend avoiding use of "substantial completion," because it is a vague, subjective, ambiguous phrase, that would lead to disputes. Would lead to dispute over what is considered essential. Some parts of the contract, such as clean-up, removal of signs, grading, etc could be considered nonessential, and therefore not part of a "substantial completion" requirement. |
| FDOT | No | FDOT allows partial acceptance only for moveable bridges. All others are based on FDOT determination of Final Acceptance. |
| IDOT | Yes | We use the date specified in the contract or working days provided with a definition of completion in the standard specs. |
| INDOT | Yes | In our Standard Specifications. |
| Iowa DOT | Yes | Article 1108.09 provides conditions for which LDs may be waived. |
| MDOT (Maine) | No | We got away from "substantially complete" a few years ago since this term is open to interpretation. We only have "complete" now. |
| MHD | Yes | Substantial completion is when 99% of the work is done. |
| MnDOT | No | sometimes addressed in the Special Provisions (i.e. ... roadway open to two lanes of traffic..) |
| MDOT (Miss.) | Yes | Substantial completion is not a part of our standard specifications, however it is defined in the contracts in which it is used. |
| MoDOT | No | do have provision for partial acceptance |
| NHDOT | Yes | The Work will be considered substantially complete when all necessary signing, striping, guardrail, and other safety appurtenances have been installed. |
| NYSDOT | No | We have language that details Final Acceptance and Final Agreement. |

***QUESTION 13 continued:*** *Is the definition of substantial completion written in the contract?*

| Responding Agency | Response | Comments |
|---|---|---|
| ODOT (Oregon) | No | Oregon does not use the term substantial completion. We do have a term called Second Notice which is similar and is defined in our specifications as follows: (g) End of Contract Time - When the Engineer determines that the Work has been completed, except for the items listed below, the Engineer will issue a Second Notification. The Second Notification will list: • The date the time charges stopped; • Final trimming and cleanup tasks (See 00140.90); • Equipment to be removed from the Project Site; • Minor corrective work not involving additional payment to be completed; and • Submittals, including without limitation all required certifications, bills, forms, warranties, certificate of insurance coverage (00170.70(b)), and other documents, required to be provided to the Engineer before Third Notification will issue. |
| ODOT (Okla.) | Yes | In the contract for I/D provisions. Otherwise it is in the specifications as a general definition |
| PennDOT | Yes | For the purposes of conducted the Final Inspection |
| TennDOT | Yes | We define "Acceptance" and "Determination of Time for Completion" of which both are very broad in nature. |
| VDOT (Vermont) | Yes | "Substantial Completion date shall be the date when, in the opinion of the engineer, the work under the Contract has been sufficiently completed, to enable use of the project or facilities by the Agency for the purpose originally intended" We are careful to apply this consistently for similar scopes of work across the State. |
| VDOT[1] (Vir.) | Yes | This varies. We do define Substantial Completion on design-build projects, but do not routinely do so on design-bid-build projects. |
| VDOT[2] (Vir.) | | VDOT only occasionally defines substantial completion in a contract |
| WSDOT | Yes | See page 1-84 of the Standard Specifications |
| WVDOT | No | And this sometimes causes problems. Substantial completion can vary by District and their opinion. |

Notes:

1. Kerry A. Bates, Assistant Director - Innovative Project Delivery of VDOT, was the respondent.
2. Dennis W. Motley, Engineer II of VDOT was the respondent.

## C. COST ANALYSIS PROCEDURES/TECHNIQUES

***QUESTION 14:*** *Does your agency follow an established cost estimating technique/methodology in preparing liquidated damage estimates?*

| Total Responses | Yes | No | No Response |
|---|---|---|---|
| 53 | 42 | 11 | 0 |
| 100% | 79% | 21% | 0% |

| Agencies responding "No" |
|---|
| ALDOT |
| ADOT |
| DDOT |
| InDOT |
| KYTC |
| NYSDOT |
| ODOT (Ohio) |
| ODOT (Okla.) |
| PRHTA |
| RIDOT |
| WYDOT |

**C. COST ANALYSIS PROCEDURES/TECHNIQUES**

***QUESTION 15*** *: Does your state have a standard project-staffing plan that is used as a framework for resource estimating associated with LD's?*

| Total Responses | Yes | No | No Response |
|---|---|---|---|
| 53 | 10 | 43 | 0 |
| 100% | 19% | 81% | 0% |

*Please use comment box to provide clarifying remarks.*

| Responding Agency | Response | Comments |
|---|---|---|
| FDOT | No | FDOT uses the historical Consultant and in-house CEI costs in determining LD rates. |
| IDOT | Yes | We use actual staffing and time based on past projects. |
| InDOT | No | Currently developing a plan. |
| MDOT (Maine) | No | LDs based on actual average charges to past projects. |
| MDOT (Maryland) | Yes | Staffing plan based on dollar value of contract and inspection requirements |
| MDOT (Mich.) | Yes | As I understand it, somewhat of a standard staffing plan was used when the LD's were estimated numerous years ago. |
| MDOT (Miss.) | Yes | generalized project staffing requirements based on contract amounts. |
| MDT | No | The LD rates are established using historical data, not future projections. |
| NJDOT | Yes | Road User Cost Manual can be found at: http://www.state.nj.us/transportation/eng/documents/RUCM/index.shtml |
| NCDOT | No | One component of liquidated damages is CEI cost based upon the estimate contract value. |
| NDDOT | No | We look at actual engineering and inspection costs to set our LD rates |
| ODOT (Okla.) | No | Are currently evaluation historical costs on previous projects. |
| SCDOT | No | Historical Data |
| WYDOT | No | we used a range of various projects and then obtained the actual costs charged by the department personnel. Used this information to set the damages. |

| Agencies that responded "Yes" | |
|---|---|
| ADOT | MDOT (Mich.) |
| CALTRANS | MDOT (Miss.) |
| HDOT | NDOT |
| IDOT | NJDOT |
| MDOT (Maryland) | PennDOT |

**C. COST ANALYSIS PROCEDURES/TECHNIQUES**

***QUESTION 16:*** *Does your agency consider any factors other than basic engineering and inspection when computing LD rates?*

| Total Responses | Yes | No | No Response |
|---|---|---|---|
| 53 | 20 | 33 | 0 |
| 100% | 38% | 62% | 0% |

*Please use comment box to provide clarifying remarks.*

| Responding Agency | Response | Comments |
|---|---|---|
| CALTRANS | Yes | also some general administrative costs and all field office overhead costs. |
| CDOT | Yes | At the time the LD table is calculated the current CE rate is the factor. |
| ConnDOT | Yes | Supervision also. |
| FDOT | Yes | Florida Statutes 337 require use of Road User costs and CEI costs for determination of LD rates. |
| GDOT | Yes | On some major projects. |
| HDOT | Yes | We also use traffic volume. |
| IDOT | No | However, for incentive/disincentive clauses we may include user delay costs. |
| InDOT | Yes | Occasionally estimate user costs for high profile projects. |
| Iowa DOT | No | Not typically. Occasionally user costs are considered. |
| LaDOTD | No | Answer is no because we don't refer to them as LDs on A + B projects. |
| MDOT (Maine) | No | Rarely we include user costs |
| MDOT (Mich.) | No | To the best of my knowledge and based on discussion with previous staff I do not think so. The rates were calculated numerous year ago and we are in the process of reviewing and updating our rates. |
| MDOT (Miss.) | No | on some projects we have used road user costs in addition to engineering and inspection costs. |
| MoDOT[1] | Yes | Traffic volumes. |
| MoDOT[2] | Yes | impact to public and impact to MoDOT |
| NDOR | Yes | We calculate our total in-house operational cost for our field offices, materials testing and central construction office. |

Notes:

1. David Ahlvers, State Construction & Materials Engineer of MoDOT was the respondent.
2. Al Kladiva, Assistant State Construction & Materials Engineer of MoDOT was the respondent.

***QUESTION 16 continued:*** *Does your agency consider any factors other than basic engineering and inspection when computing LD rates?*

| Responding Agency | Response | Comments |
|---|---|---|
| NDOT | Yes | we include vehicle and flagger costs as well as consultant staffing costs |
| NJDOT | Yes | NJDOT includes road user costs, but caps those costs at $10,000/day. |
| NCDOT | Yes | Road user cost and/or benefit. |
| NYSDOT | Yes | For normal contract completion, LDs are based on contract bid value as detailed in Standard Specifications. For Time Related Provisions, LDs are based on the calculated/estimated actual user delay or impact costs. |
| ODOT (Ohio) | No | ODOT's process for determining LDs is as follows: 1. Obtain all projects closed within the last calendar year. 2. Divide them into the different categories by original contract amount. 3. Count the number of projects in each category, and randomly take a sample o each category. 4. From that sample, we need to calculate the number of work days there were for each project. We count all business days and 25% of the weekends. 5. Then determine if there were any days waived from liquidated damages on the project. If so, deduct them from the number of original work days. This will become the actual work days. 6. Then get the Actual Construction Engineering Cost for TMS. 7. Then we multiply this figure by 2.5 in order to arrive at the actual overhead & fringe benefit rate of 150%. (Note: we only bill FHWA for overhead/fringe at a rate of 100% but our true overhead/fringe rate for 2002 was approximately 152%. Therefore, in calculating the liquidated damages we round to 150% to ensure actual costs plus true overhead/fringe cost are accounted for) 8. These costs are then divided by the actual number of work days less waived days to get the actual rate.<br><br>9. Then take an average of all sample projects in each category to determine the average amount. |
| ODOT (Okla.) | No | May use a multiplier to CE&I costs to represent overhead, in the future. |
| PENNDOT | Yes | Inconvenience to user. |
| SCDOT | Yes | on A+B projects user delays are included; on A+B+C projects, user delays or detour routes |
| VDOT (Virginia) | Yes | Sometimes include Road User Impacts as approved by FHWA. |

**C. COST ANALYSIS PROCEDURES/TECHNIQUES**

***QUESTION 17*** *: Does your agency have worksheets that are used to calculate the individualized LD rates for specific projects?*

| Total Responses | Yes | No | No Response |
|---|---|---|---|
| 53 | 14 | 39 | 0 |
| 100% | 26% | 74% | 0% |

*Please use comment box to provide clarifying remarks.*

| Responding Agency | Response | Comments |
|---|---|---|
| AHTD | Yes | A chart attached as a Special Provision in all contracts. |
| CALTRANS | Yes | Currently "Yes", a formula is used by the designer. For the next biannual LD calc revision "No", we will eliminate the formula and use only bid amount ranges for LD rates and show them in the Standard Specifications. |
| FDOT | No | FDOT uses historical records (spreadsheets) in determining LD rates. These are tabulated and included in the Standard specifications and are updated every two years. |
| IDOT | Yes | We have a table in our standard specs. |
| InDOT | Yes | For calculating user costs |
| MDOT (Maryland) | Yes | chart based on staffing required for dollar value of the contract |
| MDOT (Miss.) | No | x dollars per day specified in either std specifications or the contract. |
| MDT | No | LD's are not calculated for specific projects. An Oracle report is used to generate the rate table using historical data. |
| TennDOT | No | We use actual administrative costs assigned to completed projects over the previous two year period. The projects are sorted based on size and the LD are derived from an average of the projects in a specific dollar range. |
| SCDOT | Yes | FHWA Program for calculating Impacts |
| VDOT (Vermont) | No | The LD values are tabulated for project construction costs and included in the Standard Specifications. |
| WVDOT | No | We look at our cost for this on a 2 year cycle and publish in the contract provisions prior to bid. |

**C. COST ANALYSIS PROCEDURES/TECHNIQUES**

***QUESTION 18*** *: How does your agency specify LD rates in contract specifications?*

| Total Responses | Table of Average Costs | Project Specific Cost | Other |
|---|---|---|---|
| 53 | 30 | 13 | 10 |
| 100% | 57% | 25% | 19% |

| Responding Agency | Other [please specify] |
|---|---|
| AHTD | Table of Daily Charge/Contract Amount |
| ADOT | Table of Average cost and Project specific |
| GDOT | by contract amount. |
| Iowa DOT | LD rate listed on each proposal |
| NJDOT | stated in contract agreement |
| NCDOT | Both Table of Avg Cost and Project Specific Cost |
| NYSDOT | See answer to #16. |
| PRHTA | Instruction to Bidders |
| TxDOT | LD Rates per Total Project Cost |
| WSDOT | Formula |

| Responding Agency | Response | Comments |
|---|---|---|
| MDOT (Mich.) | Table | LD rates are specified by original contract amount |
| ODOT (Okla.) | Proj. Spec. | will use "table" in future contracts, currently implementing. |

**C. COST ANALYSIS PROCEDURES/TECHNIQUES**

***QUESTION 19*** *: Which department within your agency develops the liquidated damages rates? [check all that apply]*

| Total Responses | Accounting | Construction Bureau | Engineering Design Bureau | Administrative Staff | Other |
|---|---|---|---|---|---|
| 53 | 1 | 32 | 13 | 2 | 9 |
| 100% | 2% | 60% | 25% | 4% | 28% |

*Please use comment box to provide clarifying remarks.*

| Responding Agency | Other [please specify] |
|---|---|
| ADOT | Design & Construction Standards |
| CDOT | Project Development Branch |
| DelDOT | Quality Section in charge of maintaining Standards |
| Iowa DOT | Office of Contracts |
| MDOT (Miss.) | Audit Division |
| MDOT (Maine) | Contracts Section |
| NJDOT | Quality Management Services - Value Management |
| NCDOT | Traffic Engineering, and Contracting Office |
| ODOT (Ohio) | We are negotiating with DOJ at this time. |
| PRHTA | Estimates and Contracting Office |

| Responding Agency | Response | Comments |
|---|---|---|
| CALTRANS | Const., Eng | Construction develops, but Design calcs for proj. |
| ODOT (Okla.) | Const. | Our contracts and proposal (Office Engineer) division |
| VDOT (Vermont) | Const. | Specification Committee & FHWA |
| WSDOT | Eng.. | Transportation Data Office, interim LD's |

Notes:

3 agencies checked both Construction and Engineering Bureaus: CALTRANS, DDOT, VDOT

1 agency checked both Engineering Bureau and Administrative Staff: MoDOT

**D. CONTRACT ADMINISTRATION**

***QUESTION 20:*** *Who makes the determination of substantial completion? [e.g. resident engineer, chief engineer, consultants, etc.]*

| Total Responses | Resident [Project] Engineer* | Chief Engineer | Consultants | District [Area] Engineer* | Other | No Response |
|---|---|---|---|---|---|---|
| 53 | 42 | 1 | 0 | 10 | 4 | 1 |
| 100% | 79% | 2% | 0% | 19% | 8% | 2% |

| Responding Agency | Other [please specify] |
|---|---|
| CALTRANS | no one determines "substantial completion". The resident engineer determines when all work included in the contract is entirely finished and completed. |
| MDOT (Maine) | We only have complete or not complete |
| MoDOT | We do not use substantial completion |
| NYSDOT | Engineer-in Charge, together with Regional Construction Engineer. |

| Responding Agency | Response | Comments |
|---|---|---|
| MDOT (Maryland) | District | Resident engineer notifies District office. |
| MDOT (Mich.) | Resident | Project Engineer (This can be the Resident Engineer or a Consultant Engineer, if hired, or the Local Agency Engineer if a local agency project). |
| VDOT (Vermont) | Resident | Resident Engineer, usually will consult with Regional Construction Engineer. Some Contract documents will specify what must be complete for SC. |

Notes:

* 5 agencies checked both Resident and District Engineers: DelDOT, GDOT, NDOT, NHDOT, VDOT

**D. CONTRACT ADMINISTRATION**

***QUESTION 21*** *: How often are LD provisions waived/reduced during or after construction?*

| Total Responses | Never | Sometimes | Often | No Response |
|---|---|---|---|---|
| 53 | 1 | 46 | 6 | 0 |
| 100% | 2% | 87% | 11% | 0% |

Notes:

PRHTA responded "Never"

**D. CONTRACT ADMINISTRATION**

***QUESTION 22:*** *How are the LDs waived/reduced?*

| Total Responses | Granting Time Extensions* | Disregarding Contractual Provisions | Adjusting Payment Documents during Processing* | Other | No Response |
|---|---|---|---|---|---|
| 53 | 48 | 0 | 3 | 5 | 0 |
| 100% | 91% | 0% | 6% | 9% | 0% |

| Responding Agency | Other [please specify] |
|---|---|
| CALTRANS | by Director Days, grants time ext/partial relief |
| MDOT (Maine) | Meeting with DOT & FHWA to determine |
| MHD | When there are extenuating circumstances |
| MnDOT | based on contract provisions or claim settlement |
| NDOT | Bargaining tool for claim avoidance |

Notes:

* 3 agencies checked both Time Extensions and Payment Adjusting: FDOT, MoDOT, NYSDOT

| Responding Agency | Response | Comments |
|---|---|---|
| ALDOT | Time Ext. | Time extensions/suspensions often reduce LDs |
| ASDOT | Time Ext. | By Change Order. |
| CDOT | Time Ext. | Adjusting Time charges |
| FDOT | Time/Pmnt | Assessment of actual costs on occasion when differ |
| IDOT[1] | Time Ext. | Not appropriately applied. Contractor requests ext. |
| IDOT[2] | Time Ext. | Contractor Claims or special circumstances |
| KDOT | Time Ext. | very seldom, situations beyond control |
| LaDOTD | Time Ext. | Must have valid justification for extension. |
| MDOT (Mich.) | Time Ext. | Processing Contract Modifications |
| MDOT (Miss.) | Time Ext. | time extension based on actual final quantities |
| MDT | Time Ext. | Adjusting the time assessments, if justifiable. |
| NJDOT | Time Ext. | LDs may be included in a claim settlement |
| NCDOT | Time Ext. | LDs are waived as provided by specifications. |
| NYSDOT | Time/Pmnt | based on CPM analysis |
| PENNDOT | Time Ext. | For specific issues outside contractor's control. |
| VDOT (Vermont) | Time Ext. | Settling claims |
| WyDOT | Time Ext. | Processing of contract amendments for change |

Notes:

1. Roger Drisk, Engineer of Construction of IDOT, was the respondent.
2. Michael Renner, Construction Operations Engineer of IDOT, was the respondent.

**D. CONTRACT ADMINISTRATION**

***QUESTION 23*** *: If the LDs are waived, at what level is this decision made?*

| Total Responses | State Level[1] | Local Level[2] | No Response[3] |
|---|---|---|---|
| 53 | 40 | 11 | 2 |
| 100% | 75% | 21% | 4% |

Notes:

1. State Level includes: Division / District / Bureau / etc.
2. Local Level includes: Project / Resident / Field / etc.
3. The non-responding agencies were NJTA and NYSDOT

**D. CONTRACT ADMINISTRATION**

***QUESTION 24:*** *Does your agency conduct a cost analysis/audit on selected projects to compare LDs to actual costs incurred? [i.e. a comparison of estimated damages vs. actual]*

| Total Responses | Yes | No | No Response |
|---|---|---|---|
| 53 | 12 | 41 | 0 |
| 100% | 23% | 77% | 0% |

*If yes, is it a formalized review or informal review? Please use comment box to provide clarifying remarks.*

| Responding Agency | Response | Comments |
|---|---|---|
| ADOT | Yes | Informal review by our Specifications Engineer. |
| CALTRANS | No | Has not been needed to be done. Probably would if requested by our Legal Division. |
| ConnDOT | Yes | Formalized |
| IDOT[1] | No | However, actual costs in the past are what are used to determine the LD's |
| ODOT (Ohio) | No | Time adjustments of up to 14 days are at the local level, anything above that is at the State level. |
| MDOT (Maine) | Yes | Average of all projects |
| MNDOT | Yes | formal review |
| MDT | Yes | An informal review may be performed. |
| ODOT (Okla.) | Yes | Currently, trying to formalize has been informal in the past |
| SCDOT | Yes | Informal |
| VDOT (Virginia) | Yes | Occasionally do informal reviews, normally at Local level (Residency) |
| WyDOT | Yes | Only when updating the specifications for liquidated damages. Usually at time of new spec book development. |

| Agencies that responded "Yes" |
|---|
| AHTD |
| AKDOT |
| ConnDOT |
| MDOT (Maryland) |
| MDOT (Maine) |
| MNDOT |
| MODOT |
| MDT |
| ODOT (Okla.) |
| SCDOT |
| VDOT (Virginia) |
| WYDOT |

Notes:

1. Roger Drisk, Engineer of Construction of IDOT, was the respondent.

2. Michael Renner, Construction Operations Engineer of IDOT, was the respondent.

**E. LEGAL ISSUES**

***QUESTION 25*** *: Has your LD provision ever been challenged in court?*

| Total Responses | Yes | No | No Response |
|---|---|---|---|
| 53 | 11 | 42 | 0 |
| 100% | 21% | 79% | 0% |

*If yes, what was the verdict?*

| Responding Agency | Response | Comments |
|---|---|---|
| ALDOT | Yes | Two suits were settled out of court. Others are still on-going. |
| CALTRANS | Yes | Re. our standard LD provision: Challenged in arbitration. Verdict for the State. Re. LD provisions edited at district (local) level: challenged in arbitration and some verdicts for the Contractor due to district level failures in editing. |
| IDOT | Yes | Not on the State level. A Local Agency, using our specs, was taken to court. The judge ruled the damages were excessive. |
| Iowa DOT | Yes | The daily rate was challenged on a County project. The County lost because they had established an arbitrary rate. |
| LaDOTD | No | No, But presently having first case challenging our daily road user cost used for late completion. |
| MDOT (Maryland) | Yes | both ways, but as long as we could prove that the cost was strictly for the salaries of the staff we usually win |
| MDOT (Mich.) | Yes | From what I understand it has always been upheld in the courts. |
| MoDOT | Yes | [No comment supplied] |
| MDT | Yes | The provision is currently being challenged. The outcome has yet to be determined. |
| NYSDOT | Yes | [No comment supplied] |
| PennDOT | Yes | upheld due to the reasonable basis of our calculations |
| SCDOT | Yes | Amount of LD was challenged and we had to reduce out actual cost incurred. This was not on an A+B project, in which case we would have included our user delays etc. in the LD |
| VDOT (Virginia) | No | Not for design-build projects. |

**E. LEGAL ISSUES**

***QUESTION 26*** *: What is the level of actual or pending litigation pertaining to liquidated damages for State DOT construction projects over the last decade?*

| Total Responses | High[1] | Medium[2] | Low[3] | None |
|---|---|---|---|---|
| 11 | 0 | 1 | 10 | 0 |
| 100% | 0% | 9% | 91% | 0% |

Notes:

1. High = challenged more than 10 times
2. Medium = challenged 5 to 10 times
3. Low = challenged less than 5 times



| Responding Agency | Level |
|---|---|
| ALDOT | Medium |
| CALTRANS | Low |
| Iowa DOT | Low |
| MDOT (Maryland) | Low |
| MDOT (Mich.) | Low |
| MoDOT | Low |
| MDT | Low |
| NYSDOT | Low |
| ODOT (Okla.) | Low |
| PennDOT | Low |
| SCDOT | Low |

**E. LEGAL ISSUES**

***QUESTION 27*** *: If a court ruling voids the LD provision in a contract, would your agency pursue recovering the actual costs incurred?*

| Total Responses | Yes | No | Not Sure | No Response |
|---|---|---|---|---|
| 11 | 4 | 2 | 5 | 0 |
| 100% | 36% | 18% | 45% | 0% |

| Responding Agency | Response |
|---|---|
| MoDOT | Yes |
| IDOT | Yes |
| PennDOT | Yes |
| SCDOT | Yes |
| CALTRANS | No |
| NYSDOT | No |
| ALDOT | Not sure |
| Iowa DOT | Not sure |
| MDOT (Maryland) | Not sure |
| MDOT (Mich.) | Not sure |
| MDT | Not sure |
| ODOT (Okla.) | Not sure |

**E. LEGAL ISSUES**

***QUESTION 28*** *: Is there a legal precedent in your state that dictates how LDs are assessed?*

| Total Responses | Yes | No | No Response |
|---|---|---|---|
| 11 | 6 | 5 | 0 |
| 100% | 55% | 45% | 0% |

*Please use comment box to provide clarifying remarks.*

| Responding Agency | Response | Comments |
|---|---|---|
| CALTRANS | Yes | PCC 10226 - cannot be "manifestly unreasonable" and are deducted from costs owed to the contractor. |
| MDOT (Maryland) | Yes | [No Comment] |
| MDOT (Mich.) | Yes | As I understand it, the Court enforced MDOT's liquidated damages clause over a decade ago in a court case. |
| MDT | No | LDs are assessed per CFR. |
| NYSDOT | Yes | I believe so. |
| PennDOT | Yes | [No Comment] |
| ODOT (Okla.) | No | Not that I am aware of |
| SCDOT | Yes | Only recoup actual damages of contested |

**F. MISCELLANEOUS**

***Question 29*** *: How often does your agency update the schedule of liquidated damages rates being utilized in contracts?*

| Total Responses | Every Year | Every 2 Years | Every 3 to 4 Years | Every 5 Years | Never | Use Project Specific Rates | No Response |
|---|---|---|---|---|---|---|---|
| 53 | 1 | 22 | 11 | 8 | 3 | 6 | 2 |
| 100% | 2% | 42% | 21% | 15% | 6% | 11% | 4% |

**F. MISCELLANEOUS**

***QUESTION 30*** *: Would your state be interested in adopting a model LD provisions?*

| Total Responses | Highly Interested | Moderately Interested | Low Interest | No Interest | Undecided | No Response |
|---|---|---|---|---|---|---|
| 53 | 4 | 24 | 4 | 5 | 16 | 0 |
| 100% | 8% | 45% | 8% | 9% | 30% | 0% |

# APPENDIX D

# GUIDELINES FOR CALCULATING LDS

## Guide for Developing Liquidated Damage (LD) Rates

Software Needed:
Microsoft Excel
Minitab 14.1

Data Collection and Organization

1. Obtain project data from ALDOT mainframe. This data should be comprised of all projects with completion dates occurring in previous 3 years. For each project, the following project characteristics should be included:
    1) Original contract amount
    2) Contract type (e.g. Calendar day/Work day (C/W))
    3) Total engineering and inspection (E&I)
    4) Days used to complete project (NOT number allotted in contract)
    5) Contract size (number 1-8 representing the contract size group as seen in Table D-1)

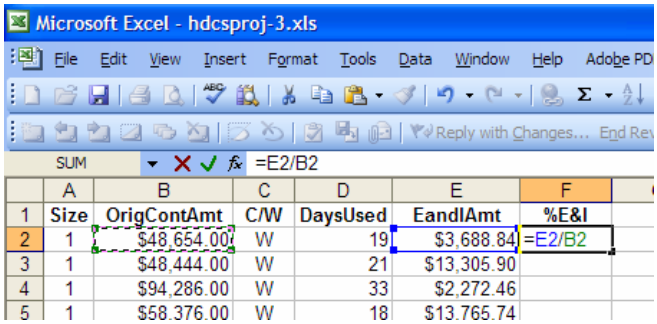
**Table D-1 Contract Values for Each Contract Size Group**

| Group | Contract Amount | |
|---|---|---|
| | From | To and Including |
| 1 | $0 | $100,000 |
| 2 | $100,000 | $200,000 |
| 3 | $200,000 | $500,000 |
| 4 | $500,000 | $1,000,000 |
| 5 | $1,000,000 | $2,000,000 |
| 6 | $2,000,000 | $5,000,000 |
| 7 | $5,000,000 | $10,000,000 |
| 8 | $10,000,000 | - |

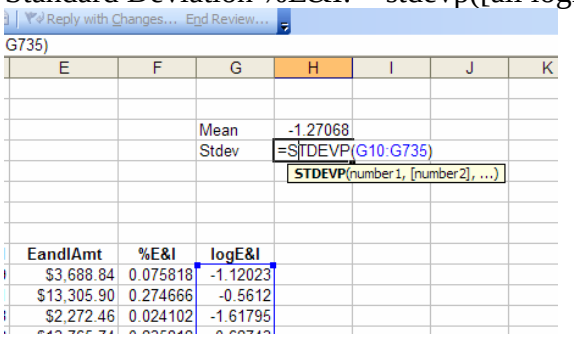
2. Open the file acquired from the ALDOT mainframe using Microsoft Excel™. For simplicity purposes, eliminate columns which deviate from the required data shown in step 1. Remove all non-working day projects. This removes all the calendar day projects from further analysis due to their small sample size. The calendar day LD rates will be determined using the working day rate and average number of working days per year. This procedure is discussed later.

Outlier Analysis

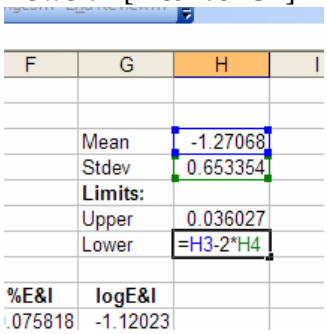
3. Identify outliers using E&I as a percentage of contract value
    a. Calculate %E&I for each project in a new column using the formula: =[E&IAmt]/[OrigContAmt]




    b. Calculate the log of %E&I for each project using the formula: =log([%E&I])
    c. Calculate the mean and standard deviations of the logE&I values (it may be more convenient to insert 5 or 6 rows above the project data to perform these calculations):
        1. Mean %E&I: =average([all logE&I values])
        2. Standard Deviation %E&I: =stdevp([all logE&I values])

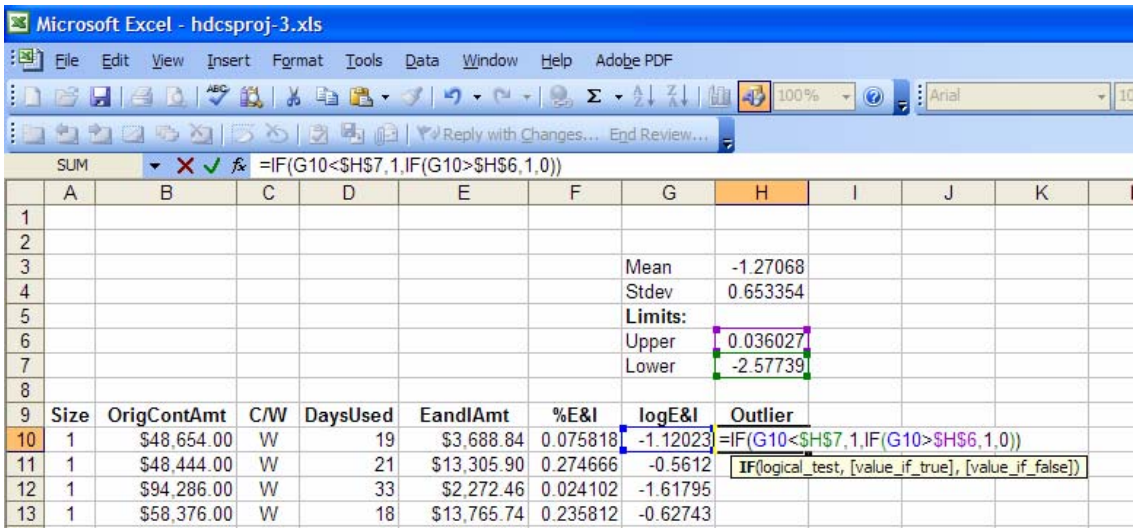



    d. Determine the ±2 standard deviation limits for the log values:
        1. Upper: =[mean%E&I]+2*[stdev%E&I]
        2. Lower: =[mean%E&I]-2*[stdev%E&I]

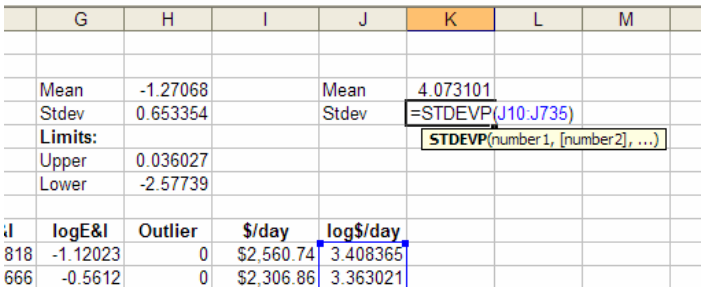



    e. Use an “IF” statement to determine which projects are considered outliers:

=IF([log%E&I]<[lower limit],1,IF([log%E&I]>[lower limit],1,0))
This IF statement compares the logE&I value for a project to both the upper and lower limits. If it is outside of these limits a 1 is placed in the cell, otherwise a 0 is placed. Tip: Use "$" in front of the letter and number of the cell reference for the upper and lower limits to "lock" the reference in while copying the formula (see screen capture below).




4. Identify outliers using dollars placed per day. This is the same process used in step 3, except the variable has been changed to dollars placed per day.
    a. Calculate $/day in a new column using the formula: =[OrigContAmt]/[DaysUsed]
    b. Calculate the log of $/day using the formula: =log([$/day])
    c. Calculate the mean and standard deviations of the log$/day values (it may be more convenient to insert 5 or 6 rows above the project data to perform these calculations):
        1. Mean $/day: =average([all log$/day values])
        2. Standard Deviation $/day: =stdevp([all log$/day values])

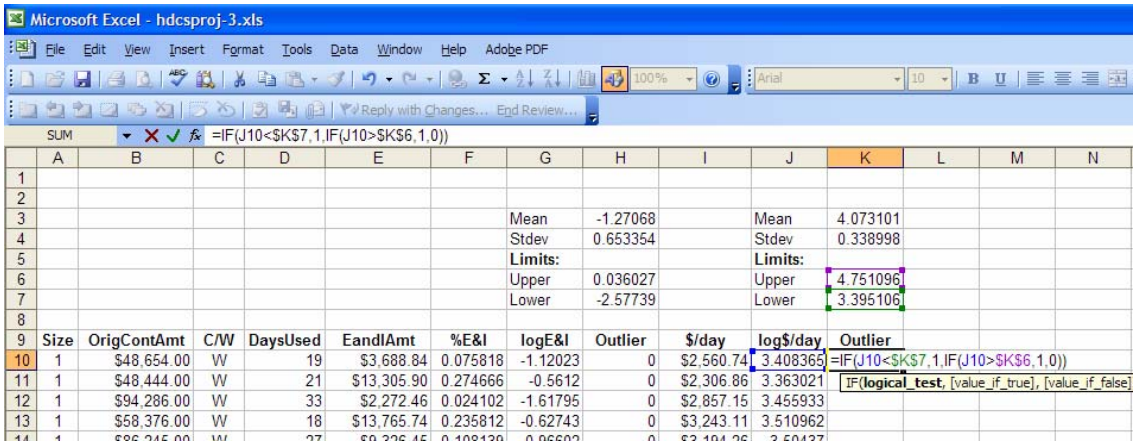



    d. Determine the ±2 standard deviation limits for the log values:
        1. Upper: =[mean$/day]+2*[stdev$/day]
        2. Lower: =[mean$/day]-2*[stdev$/day]

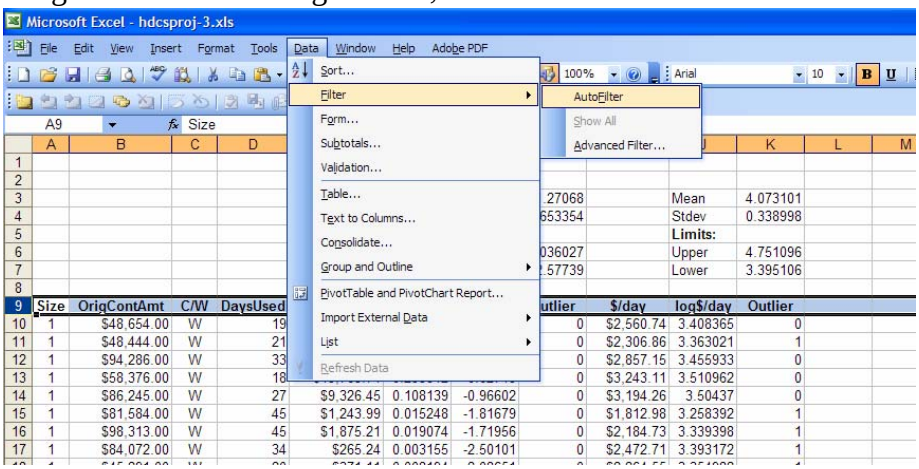
e. Use an "if" statement to determine which projects are considered outliers:

=IF([log$/day]<[lower limit],1,IF([log$/day]>[lower limit],1,0))

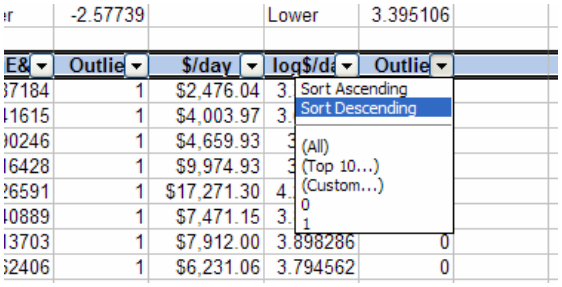
This IF statement compares the log$/day value of a project to both the upper and lower limits. If it is outside of these limits a 1 is placed in the cell, otherwise a 0 is placed. Tip: Use "$" in front of the letter and number of the cell reference for the upper and lower limits to "lock" the reference in while copying the formula (see screen capture below).




5. Delete all projects which were identified as outliers according to both the %E&I as well as $/day. They must be all deleted at one time, otherwise, the upper and lower limiting criteria will change as the pool of projects change. The best way to do this is to sort the projects by the outlier columns. To do this, choose the row containing the column headings. Then, click **Data → Filter → Auto Filter**.




There will now be drop-down menus for each column that can be used to sort the data. For the two outlier columns consecutively choose **Sort Descending**.




At this point, all the outlier projects (those with a 1 in either outlier column) will be moved to the top of the project list. Highlight the outlier projects and delete them all at once. The remaining projects are what will be used for the determination of LDs. Delete all the columns created in steps 3 and 4, since this information is no longer needed.

6. Create a new column and calculate the dailyE&I values for each project using the formula: =[E&IAmt]/[DaysUsed]

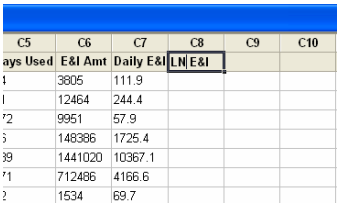
7. The projects should then be sorted according to their contract size groups. These contract size groups will be compared with each other to determine which are statistically different from the others. Minitab will be used for this step which is described below.

**Determination of Contract Size Groups**

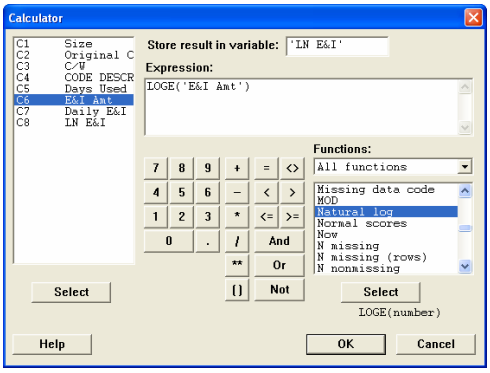
8. Copy all the data from excel into a new Minitab worksheet.

9. The dailyE&I values do not fit a normal curve. As a result, a data transformation is needed to more accurately reflect the normal distribution.

10. Create a new data column to hold the transformed dailyE&I values by double clicking on the topmost row of the desired column and inputting **LN dailyE&I**.

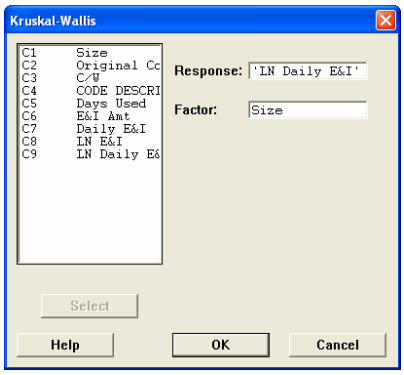



11. Transform the data using the natural logarithm (LN) by selecting "**Calc**" from the toolbar. From the drop down menu select "**Calculator**". In the left hand side you will see a list of the current columns, double click on the name of the column to hold LN E&I. That name will now be listed in "**Store result in variable:**" at the top of the window. Enter the equation that you want into the area under "**Expression:**" in this



case scroll down the right hand side to "**Natural Log**" and double click on it. In the Expression box you will see "**LOGE**(number)" replace "number" with **Daily E&I Amt**. Then click "**Okay**" and the column will be filled in with each row's LN DailyE&I values.

12. To determine if any of the groups based on size category are statistically different run the Kruskal-Wallis test. To do this, first create a new worksheet by selecting "**File**" → "**New**" and selecting "**Worksheet**" in the window. Then copy and paste all the projects from the first two contract size groups (1 & 2) into the new worksheet. The Kruskal-Wallis test will tell if these two groups are statistically different. To run the test, select "**Stat**" → "**Nonparametrics**" → "**Kruskal-Wallis**". Select the LN daily E&I column as the "**Response**" and the size variable as the "**Factor**". If the P-value is greater than or equal to 0.05 then the groups are statistically the same and can be combined. If the P-value is less than 0.05 then the groups are different and can not be combined.




13. Repeat step 12 until all the groups have been evaluated against each other.

**Determination of LD rates**

14. Calculate the Average Daily E&I values for each of the new groups determined in steps 12-13.

15. Round the average daily E&I values to the nearest $100. These rounded values represent the LD rates for their respective contract size groups. Place them in a table along with the contract size groups similar to Table D-2.

**Table D-2 Example of LD rate Table**

| Contract Value | | Daily Liquidated Damages Rate | |
|---|---|---|---|
| **More Than** | **To and Including** | **Calendar Day** | **Work Day** |
| $0 | $100,000 | $120 | $200 |
| $100,000 | $200,000 | $180 | $300 |
| $200,000 | $500,000 | $300 | $500 |
| $500,000 | $1,000,000 | $480 | $800 |
| $1,000,000 | $2,000,000 | $660 | $1,100 |
| $2,000,000 | $5,000,000 | $840 | $1,400 |
| $5,000,000 | $10,000,000 | $1,020 | $1,700 |
| $10,000,000 | --- | $1,200 | $2,000 |

# APPENDIX E

## HISTORICAL PROJECT DATA USED FOR CALCULATIONS

represents an outlier based on E&I as a percentage of Contract Value

represents an outlier identified by both

represents an outlier based on Dollars used per day

Data Used for LD calculations

| Outlier Analysis | | | | | |
|---|---|---|---|---|---|
| | % | | Log % | | Log % |
| | 10.251% | Average | -1.271 | Average | 4.073 |
| | 11.350% | stdev | 0.653 | stdev | 0.339 |
| | | # of stdev | 2 | # of stdev | 2 |
| | 108.649% | upper | 0.04 | upper | 4.75 |
| | 0.265% | lower | -2.58 | lower | 3.40 |

| CPMS Proj # | Size | Original Contract Amt | C/W | Code Description | Completion Date | Days Used | E&I Amt | Daily E&I | % E&I to CV | Log % E&I | outlier (2stdev) | Contract $$ per Day | Log $perDay | outlier (2stdev) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100042754 | 2 | $113,898 | W | Unclassified | 12/16/2003 | 46 | $139,219.59 | $3,026.51 | 122.2318% | 0.08718 | 1 | $2,476.04 | 3.3938 | 1 |
| 100043023 | 2 | $139,798 | W | Unclassified | 10/27/2003 | 30 | $175.00 | $5.83 | 0.1252% | -2.90246 | 1 | $4,659.93 | 3.6684 | 0 |
| 100041521 | 2 | $144,143 | W | Traffic Striping, Pave | 12/19/2003 | 36 | $158,638.53 | $4,406.63 | 110.0564% | 0.04162 | 1 | $4,003.97 | 3.6025 | 0 |
| 100042967 | 2 | $149,624 | W | Unclassified | 7/13/2003 | 15 | $10.25 | $0.68 | 0.0069% | -4.16428 | 1 | $9,974.93 | 3.9989 | 0 |
| 100041176 | 3 | $211,856 | W | Unclassified | 1/22/2003 | 34 | $503.48 | $14.81 | 0.2377% | -2.62406 | 1 | $6,231.06 | 3.7946 | 0 |
| 100042464 | 3 | $214,089 | W | Unclassified | 7/22/2003 | 12 | $175.00 | $14.58 | 0.0817% | -3.08756 | 1 | $17,840.75 | 4.2514 | 0 |
| 100044609 | 3 | $351,144 | W | Unclassified | 1/4/2005 | 47 | $136.96 | $2.91 | 0.0390% | -3.40889 | 1 | $7,471.15 | 3.8734 | 0 |
| 100045875 | 3 | $356,040 | W | Unclassified | 10/15/2005 | 45 | $259.70 | $5.77 | 0.0729% | -3.13703 | 1 | $7,912.00 | 3.8983 | 0 |
| 100044442 | 3 | $390,052 | W | Unclassified | 1/11/2005 | 43 | $810.55 | $18.85 | 0.2078% | -2.68234 | 1 | $9,070.98 | 3.9577 | 0 |
| 100044379 | 3 | $435,548 | W | Unclassified | 11/19/2004 | 18 | $393.32 | $21.85 | 0.0903% | -3.04429 | 1 | $24,197.11 | 4.3838 | 0 |
| 100044462 | 3 | $466,325 | W | Unclassified | 8/30/2004 | 27 | $25.28 | $0.94 | 0.0054% | -4.26591 | 1 | $17,271.30 | 4.2373 | 0 |
| 100039279 | 4 | $538,995 | W | Unclassified | 9/30/2003 | 35 | $360.68 | $10.31 | 0.0669% | -3.17446 | 1 | $15,399.86 | 4.1875 | 0 |
| 100037723 | 4 | $616,788 | W | Unclassified | 10/25/2004 | 28 | $460.51 | $16.45 | 0.0747% | -3.12690 | 1 | $22,028.14 | 4.3430 | 0 |
| 100033867 | 4 | $630,342 | W | Unclassified | 4/28/2004 | 28 | $1,301.77 | $46.49 | 0.2065% | -2.68504 | 1 | $22,512.21 | 4.3524 | 0 |
| 100042902 | 4 | $670,163 | W | Unclassified | 12/15/2003 | 36 | $275.00 | $7.64 | 0.0410% | -3.38685 | 1 | $18,615.64 | 4.2699 | 0 |
| 100042821 | 4 | $750,169 | W | Unclassified | 4/19/2004 | 28 | $24.91 | $0.89 | 0.0033% | -4.47879 | 1 | $26,791.75 | 4.4280 | 0 |
| 100041093 | 4 | $779,863 | W | Unclassified | 8/1/2003 | 47 | $887.82 | $18.89 | 0.1138% | -2.94369 | 1 | $16,592.83 | 4.2199 | 0 |
| 100044286 | 4 | $872,517 | W | Unclassified | 3/21/2005 | 73 | $245.46 | $3.36 | 0.0281% | -3.55079 | 1 | $11,952.29 | 4.0775 | 0 |
| 100040399 | 4 | $888,226 | W | Bridge Replacement | 12/2/2003 | 175 | $811.37 | $4.64 | 0.0913% | -3.03930 | 1 | $5,075.58 | 3.7055 | 0 |
| 100044404 | 4 | $902,751 | W | Unclassified | 9/15/2004 | 49 | $251.74 | $5.14 | 0.0279% | -3.55462 | 1 | $18,423.49 | 4.2654 | 0 |
| 100045674 | 4 | $929,845 | W | Unclassified | 11/8/2005 | 21 | $783.04 | $37.29 | 0.0842% | -3.07463 | 1 | $44,278.33 | 4.6462 | 0 |
| 100043347 | 5 | $1,041,696 | W | Unclassified | 1/13/2004 | 45 | $306.82 | $6.82 | 0.0295% | -3.53086 | 1 | $23,148.80 | 4.3645 | 0 |
| 100044403 | 5 | $1,202,136 | W | Unclassified | 8/21/2004 | 37 | $720.03 | $19.46 | 0.0599% | -3.22260 | 1 | $32,490.16 | 4.5118 | 0 |
| 100044278 | 5 | $1,212,634 | W | Unclassified | 5/25/2004 | 40 | $425.00 | $10.63 | 0.0350% | -3.45534 | 1 | $30,315.85 | 4.4817 | 0 |
| 100044381 | 5 | $1,239,266 | W | Unclassified | 3/3/2005 | 36 | $1,281.04 | $35.58 | 0.1034% | -2.98560 | 1 | $34,424.06 | 4.5369 | 0 |
| 100042706 | 5 | $1,246,226 | W | Unclassified | 4/9/2004 | 65 | $251.74 | $3.87 | 0.0202% | -3.69464 | 1 | $19,172.71 | 4.2827 | 0 |
| 100042943 | 5 | $1,264,798 | W | Unclassified | 9/10/2003 | 42 | $8.15 | $0.19 | 0.0006% | -5.19086 | 1 | $30,114.24 | 4.4788 | 0 |
| 100042773 | 5 | $1,345,930 | W | Unclassified | 10/10/2003 | 61 | $575.00 | $9.43 | 0.0427% | -3.36935 | 1 | $22,064.43 | 4.3437 | 0 |
| 100045489 | 5 | $1,397,290 | W | Unclassified | 6/16/2005 | 36 | $272.16 | $7.56 | 0.0195% | -3.71046 | 1 | $38,813.61 | 4.5890 | 0 |
| 100045702 | 5 | $1,491,355 | W | Unclassified | 11/8/2005 | 58 | $307.13 | $5.30 | 0.0206% | -3.68626 | 1 | $25,713.02 | 4.4102 | 0 |
| 100044284 | 5 | $1,594,928 | W | Unclassified | 2/25/2005 | 58 | $2,960.24 | $51.04 | 0.1856% | -2.73141 | 1 | $27,498.76 | 4.4393 | 0 |
| 100044924 | 5 | $1,654,514 | W | Unclassified | 10/27/2005 | 45 | $2,430.93 | $54.02 | 0.1469% | -2.83290 | 1 | $36,766.98 | 4.5655 | 0 |
| 100042825 | 6 | $2,036,155 | W | Unclassified | 10/22/2004 | 57 | $232.92 | $4.09 | 0.0114% | -3.94160 | 1 | $35,722.02 | 4.5529 | 0 |
| 100042867 | 6 | $2,480,870 | W | Unclassified | 5/5/2004 | 70 | $1,340.70 | $19.15 | 0.0540% | -3.26727 | 1 | $35,441.00 | 4.5495 | 0 |
| 100004693 | 6 | $4,591,964 | W | Grade Drain Base P | 4/5/2005 | 343 | $5,185.32 | $15.12 | 0.1129% | -2.94722 | 1 | $13,387.65 | 4.1267 | 0 |
| 100009927 | 8 | $17,017,062 | W | Grade Drain Base P | 5/13/2003 | 360 | $528.69 | $1.47 | 0.0031% | -4.50768 | 1 | $47,269.62 | 4.6746 | 0 |
| 100016578 | 8 | $20,486,034 | W | Unclassified | 8/23/2004 | 454 | $29,057.99 | $64.00 | 0.1418% | -2.84819 | 1 | $45,123.42 | 4.6544 | 0 |
| 100044610 | 1 | $45,291 | W | Unclassified | 11/9/2004 | 20 | $371.11 | $18.56 | 0.8194% | -2.08651 | 0 | $2,264.55 | 3.3550 | 1 |
| 100040994 | 1 | $48,444 | W | Unclassified | 5/5/2004 | 21 | $13,305.90 | $633.61 | 27.4666% | -0.56120 | 0 | $2,306.86 | 3.3630 | 1 |
| 100040270 | 1 | $70,439 | W | Unclassified | 6/16/2003 | 47 | $13,804.63 | $293.72 | 19.5980% | -0.70779 | 0 | $1,498.70 | 3.1757 | 1 |
| 100042603 | 1 | $75,908 | W | Bridge Replacement | 7/22/2003 | 34 | $2,790.20 | $82.06 | 3.6758% | -1.43465 | 0 | $2,232.59 | 3.3488 | 1 |
| 100044606 | 1 | $81,584 | W | Unclassified | 1/14/2005 | 45 | $1,243.99 | $27.64 | 1.5248% | -1.81679 | 0 | $1,812.98 | 3.2584 | 1 |
| 100045876 | 1 | $84,072 | W | Unclassified | 11/24/2005 | 34 | $265.24 | $7.80 | 0.3155% | -2.50101 | 0 | $2,472.71 | 3.3932 | 1 |
| 100041065 | 1 | $87,575 | W | Intersection Improve | 1/23/2004 | 39 | $47,737.68 | $1,224.04 | 54.5106% | -0.26352 | 0 | $2,245.51 | 3.3513 | 1 |
| 100041966 | 1 | $98,313 | W | Bridge Culvert and C | 4/30/2003 | 45 | $1,875.21 | $41.67 | 1.9074% | -1.71956 | 0 | $2,184.73 | 3.3394 | 1 |
| 100043217 | 2 | $107,176 | W | Grade Drain Base P | 12/11/2003 | 45 | $4,448.28 | $98.85 | 4.1504% | -1.38191 | 0 | $2,381.69 | 3.3769 | 1 |
| 100042619 | 2 | $108,577 | W | Grade Drain Base P | 7/22/2003 | 73 | $24,993.76 | $342.38 | 23.0194% | -0.63791 | 0 | $1,487.36 | 3.1724 | 1 |
| 100042410 | 2 | $116,162 | W | Unclassified | 8/17/2004 | 63 | $13,191.87 | $209.39 | 11.3564% | -0.94476 | 0 | $1,843.84 | 3.2657 | 1 |
| 100041942 | 2 | $133,200 | W | Bridge Replacement | 4/23/2003 | 58 | $33,199.70 | $572.41 | 24.9247% | -0.60337 | 0 | $2,296.55 | 3.3611 | 1 |
| 100043076 | 2 | $134,945 | W | Unclassified | 3/12/2004 | 57 | $65,237.81 | $1,144.52 | 48.3440% | -0.31566 | 0 | $2,367.46 | 3.3743 | 1 |
| 100044031 | 2 | $135,572 | W | Unclassified | 10/27/2004 | 60 | $9,404.18 | $156.74 | 6.9367% | -1.15885 | 0 | $2,259.53 | 3.3540 | 1 |
| 100042150 | 3 | $255,531 | W | Bridge Replacement | 10/29/2003 | 118 | $46,963.58 | $398.00 | 18.3788% | -0.73568 | 0 | $2,165.52 | 3.3356 | 1 |
| 100043005 | 3 | $287,552 | W | Unclassified | 4/20/2004 | 120 | $33,951.19 | $282.93 | 11.8070% | -0.92786 | 0 | $2,396.27 | 3.3795 | 1 |
| 100043077 | 3 | $314,444 | W | Unclassified | 9/7/2004 | 175 | $10,800.24 | $61.72 | 3.4347% | -1.46411 | 0 | $1,796.82 | 3.2545 | 1 |
| 100042782 | 3 | $329,683 | W | Grade Drain Base P | 6/22/2004 | 151 | $27,537.78 | $182.37 | 8.3528% | -1.07817 | 0 | $2,183.33 | 3.3391 | 1 |
| 100012131 | 4 | $830,581 | W | Bridge Replacement | 1/13/2003 | 426 | $84,263.91 | $197.80 | 10.1452% | -0.99374 | 0 | $1,949.72 | 3.2900 | 1 |
| 100005166 | 6 | $4,394,989 | W | Grade Drain Base P | 9/3/2004 | 26 | $741,209.19 | $28,508.05 | 16.8649% | -0.77302 | 0 | $169,038.04 | 5.2280 | 1 |
| 100045696 | 7 | $5,450,000 | W | Bridge Replacement | 12/4/2004 | 34 | $335,513.35 | $9,868.04 | 6.1562% | -1.21069 | 0 | $160,294.12 | 5.2049 | 1 |
| 100009931 | 8 | $24,440,147 | W | Grade Drain Base P | 11/18/2003 | 400 | $1,980,667.79 | $4,951.67 | 8.1042% | -1.09129 | 0 | $61,100.37 | 4.7860 | 1 |
| 100033212 | 8 | $24,759,806 | W | Erosion Control, Rip | 9/11/2003 | 400 | $3,889,615.74 | $9,724.04 | 15.7094% | -0.80384 | 0 | $61,899.52 | 4.7917 | 1 |
| 100002787 | 8 | $55,601,668 | W | Bridge Replacement | 8/1/2003 | 300 | $566,336.83 | $1,887.79 | 1.0186% | -1.99201 | 0 | $185,338.89 | 5.2680 | 1 |
| 100045960 | 1 | $48,654 | W | Unclassified | 11/14/2005 | 19 | $3,688.84 | $194.15 | 7.5818% | -1.12023 | 0 | $2,560.74 | 3.4084 | 0 |
| 100044324 | 1 | $58,376 | W | Unclassified | 10/19/2005 | 18 | $13,765.74 | $764.76 | 23.5812% | -0.62743 | 0 | $3,243.11 | 3.5110 | 0 |
| 100042217 | 1 | $66,558 | W | Pavement Rehab, R | 7/14/2003 | 18 | $3,622.12 | $201.23 | 5.4421% | -1.26424 | 0 | $3,697.67 | 3.5679 | 0 |
| 100043541 | 1 | $67,278 | W | Bridge Replacement | 12/11/2003 | 22 | $1,534.27 | $69.74 | 2.2805% | -1.64197 | 0 | $3,058.09 | 3.4855 | 0 |
| 100043268 | 1 | $77,088 | W | Unclassified | 2/4/2004 | 13 | $10,053.25 | $773.33 | 13.0413% | -0.88468 | 0 | $5,929.85 | 3.7730 | 0 |
| 100042890 | 1 | $79,250 | W | Unclassified | 10/14/2003 | 24 | $1,884.21 | $78.51 | 2.3776% | -1.62387 | 0 | $3,302.08 | 3.5188 | 0 |
| 100043067 | 1 | $81,437 | W | Unclassified | 1/14/2004 | 27 | $2,484.57 | $92.02 | 3.0509% | -1.51557 | 0 | $3,016.19 | 3.4795 | 0 |
| 100043209 | 1 | $86,245 | W | Bridge Replacement | 9/30/2003 | 27 | $9,326.45 | $345.42 | 10.8139% | -0.96602 | 0 | $3,194.26 | 3.5044 | 0 |
| 100043241 | 1 | $87,079 | W | Bridge Replacement | 2/18/2004 | 32 | $25,614.75 | $800.46 | 29.4155% | -0.53142 | 0 | $2,721.22 | 3.4348 | 0 |
| 100047122 | 1 | $87,650 | W | Unclassified | 11/21/2005 | 5 | $754.97 | $150.99 | 0.8613% | -2.06482 | 0 | $17,530.00 | 4.2438 | 0 |
| 100042687 | 1 | $91,294 | W | Unclassified | 9/26/2003 | 27 | $65,596.04 | $2,429.48 | 71.8514% | -0.14356 | 0 | $3,381.26 | 3.5291 | 0 |
| 100043205 | 1 | $94,286 | W | Unclassified | 8/16/2004 | 33 | $2,272.46 | $68.86 | 2.4102% | -1.61795 | 0 | $2,857.15 | 3.4559 | 0 |
| 100044182 | 1 | $96,000 | W | Bridge Replacement | 6/24/2004 | 15 | $6,155.85 | $410.39 | 6.4123% | -1.19298 | 0 | $6,400.00 | 3.8062 | 0 |
| 100042232 | 1 | $96,579 | W | Bridge Replacement | 5/5/2003 | 32 | $18,316.25 | $572.38 | 18.9650% | -0.72205 | 0 | $3,018.09 | 3.4797 | 0 |
| 100043558 | 2 | $104,417 | W | Unclassified | 4/7/2004 | 39 | $2,378.89 | $61.00 | 2.2783% | -1.64240 | 0 | $2,677.36 | 3.4277 | 0 |
| 100042887 | 2 | $108,993 | W | Unclassified | 4/28/2004 | 21 | $5,236.05 | $249.34 | 4.8040% | -1.31839 | 0 | $5,190.14 | 3.7152 | 0 |
| 100037162 | 2 | $112,153 | W | Pavement Rehab, R | 4/30/2003 | 18 | $7,952.43 | $441.80 | 7.0907% | -1.14931 | 0 | $6,230.72 | 3.7945 | 0 |
| 100043899 | 2 | $112,621 | W | Unclassified | 5/13/2004 | 21 | $3,515.61 | $167.41 | 3.1216% | -1.50562 | 0 | $5,362.90 | 3.7294 | 0 |
| 100043237 | 2 | $112,910 | W | Bridge Replacement | 12/8/2003 | 18 | $15,631.29 | $868.41 | 13.8440% | -0.85874 | 0 | $6,272.78 | 3.7975 | 0 |
| 100044180 | 2 | $117,891 | W | Pavement Rehab, R | 2/8/2005 | 27 | $7,088.83 | $262.55 | 6.0130% | -1.22091 | 0 | $4,366.33 | 3.6401 | 0 |
| 100042888 | 2 | $118,768 | W | Unclassified | 3/10/2004 | 46 | $2,089.98 | $45.43 | 1.7597% | -1.75456 | 0 | $2,581.91 | 3.4119 | 0 |
| 100037225 | 2 | $119,474 | W | Pavement Rehab, R | 7/18/2005 | 26 | $50,099.05 | $1,926.89 | 41.9330% | -0.37744 | 0 | $4,595.15 | 3.6623 | 0 |
| 100042600 | 2 | $119,560 | W | Bridge Culvert and C | 6/6/2003 | 34 | $3,804.71 | $111.90 | 3.1823% | -1.49726 | 0 | $3,516.47 | 3.5461 | 0 |
| 100043573 | 2 | $126,926 | W | Unclassified | 12/10/2003 | 36 | $5,429.44 | $150.82 | 4.2776% | -1.36880 | 0 | $3,525.72 | 3.5472 | 0 |
| 100044142 | 2 | $127,918 | W | Unclassified | 6/1/2004 | 32 | $6,458.64 | $201.83 | 5.0490% | -1.29679 | 0 | $3,997.44 | 3.6018 | 0 |
| 100042786 | 2 | $130,171 | W | Bridge Replacement | 7/7/2003 | 21 | $2,670.94 | $127.19 | 2.0519% | -1.68785 | 0 | $6,198.62 | 3.7923 | 0 |
| 100043236 | 2 | $136,494 | W | Unclassified | 8/23/2004 | 44 | $35,601.03 | $809.11 | 26.0825% | -0.58365 | 0 | $3,102.14 | 3.4917 | 0 |
| 100043473 | 2 | $137,053 | W | Unclassified | 5/19/2004 | 31 | $2,316.54 | $74.73 | 1.6903% | -1.77205 | 0 | $4,421.06 | 3.6455 | 0 |
| 100042785 | 2 | $140,028 | W | Unclassified | 9/4/2003 | 26 | $6,668.84 | $256.49 | 4.7625% | -1.32216 | 0 | $5,385.69 | 3.7312 | 0 |
| 100042817 | 2 | $144,272 | W | Bridge Replacement | 10/1/2003 | 27 | $7,200.83 | $266.70 | 4.9911% | -1.30180 | 0 | $5,343.41 | 3.7278 | 0 |
| 100043756 | 2 | $144,644 | W | Bridge Replacement | 6/24/2004 | 30 | $10,929.95 | $364.33 | 7.5564% | -1.12168 | 0 | $4,821.47 | 3.6832 | 0 |
| 100041320 | 2 | $145,973 | W | Pavement Rehab, R | 9/5/2003 | 53 | $25,199.24 | $475.46 | 17.2629% | -0.76289 | 0 | $2,754.21 | 3.4400 | 0 |
| 100043240 | 2 | $146,868 | W | Bridge Replacement | 11/12/2003 | 40 | $5,862.70 | $146.57 | 3.9918% | -1.39883 | 0 | $3,671.70 | 3.5649 | 0 |
| 100041201 | 2 | $148,370 | W | Bridge Culvert and C | 7/11/2003 | 51 | $12,464.24 | $244.40 | 8.4008% | -1.07568 | 0 | $2,909.22 | 3.4638 | 0 |
| 100042221 | 2 | $151,742 | W | Pavement Rehab, R | 6/25/2003 | 36 | $13,989.74 | $388.60 | 9.2194% | -1.03530 | 0 | $4,215.06 | 3.6248 | 0 |

| CPMS Proj # | Size | Original Contract Amt | C/W | Code Description | Completion Date | Days Used | E&I Amt | Daily E&I | % E&I to CV | Log % E&I | outlier (2stdev) | Contract $$ per Day | Log $perDay | outlier (2stdev) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100047187 | 2 | $151,844 | W | Unclassified | 11/22/2005 | 28 | $10,036.76 | $358.46 | 6.6099% | -1.17980 | 0 | $5,423.00 | 3.7342 | 0 |
| 100038988 | 2 | $155,000 | W | Unclassified | 8/31/2004 | 20 | $21,446.84 | $1,072.34 | 13.8367% | -0.85897 | 0 | $7,750.00 | 3.8893 | 0 |
| 100042274 | 2 | $155,475 | W | Unclassified | 5/16/2003 | 42 | $1,828.87 | $43.54 | 1.1763% | -1.92948 | 0 | $3,701.79 | 3.5684 | 0 |
| 100043620 | 2 | $157,943 | W | Pavement Rehab, R | 8/27/2004 | 27 | $4,362.64 | $161.58 | 2.7622% | -1.55875 | 0 | $5,849.74 | 3.7671 | 0 |
| 100042091 | 2 | $158,691 | W | Pavement Rehab, R | 9/8/2003 | 35 | $5,225.47 | $149.30 | 3.2929% | -1.48243 | 0 | $4,534.03 | 3.6565 | 0 |
| 100042081 | 2 | $159,996 | W | Pavement Rehab, R | 6/12/2003 | 14 | $7,466.56 | $533.33 | 4.6667% | -1.33099 | 0 | $11,428.29 | 4.0580 | 0 |
| 100038606 | 2 | $161,456 | W | Intersection Improve | 6/24/2003 | 39 | $85,475.26 | $2,191.67 | 52.9403% | -0.27621 | 0 | $4,139.90 | 3.6170 | 0 |
| 100042276 | 2 | $161,535 | W | Pavement Rehab, R | 7/24/2003 | 33 | $555.60 | $16.84 | 0.3440% | -2.46350 | 0 | $4,895.00 | 3.6898 | 0 |
| 100042644 | 2 | $162,424 | W | Bridge Replacement | 1/12/2004 | 20 | $31,260.02 | $1,563.00 | 19.2459% | -0.71566 | 0 | $8,121.20 | 3.9096 | 0 |
| 100043602 | 2 | $167,778 | W | Pavement Rehab, R | 8/10/2004 | 29 | $11,831.77 | $407.99 | 7.0520% | -1.15169 | 0 | $5,785.45 | 3.7623 | 0 |
| 100044534 | 2 | $168,779 | W | Grade Drain Base P | 8/14/2004 | 40 | $25,516.95 | $637.92 | 15.1186% | -0.82049 | 0 | $4,219.48 | 3.6253 | 0 |
| 100042262 | 2 | $169,336 | W | Bridge Replacement | 8/28/2003 | 29 | $5,348.18 | $184.42 | 3.1583% | -1.50054 | 0 | $5,839.17 | 3.7664 | 0 |
| 100043568 | 2 | $169,687 | W | Bridge Replacement | 6/14/2004 | 52 | $9,593.09 | $184.48 | 5.6534% | -1.24769 | 0 | $3,263.21 | 3.5136 | 0 |
| 100043017 | 2 | $174,668 | W | Bridge Replacement | 12/10/2003 | 27 | $5,861.21 | $217.08 | 3.3556% | -1.47423 | 0 | $6,469.19 | 3.8108 | 0 |
| 100042831 | 2 | $175,151 | W | Unclassified | 6/3/2004 | 32 | $14,223.73 | $444.49 | 8.1208% | -1.09040 | 0 | $5,473.47 | 3.7383 | 0 |
| 100043412 | 2 | $175,610 | W | Unclassified | 10/4/2004 | 50 | $39,561.47 | $791.23 | 22.5280% | -0.64728 | 0 | $3,512.20 | 3.5456 | 0 |
| 100043211 | 2 | $176,187 | W | Unclassified | 5/20/2004 | 44 | $22,115.22 | $502.62 | 12.5521% | -0.90128 | 0 | $4,004.25 | 3.6025 | 0 |
| 100044321 | 2 | $177,365 | W | Unclassified | 1/20/2005 | 46 | $484.75 | $10.54 | 0.2733% | -2.56335 | 0 | $3,855.76 | 3.5861 | 0 |
| 100041562 | 2 | $180,807 | W | Pavement Rehab, R | 8/27/2003 | 15 | $23,649.76 | $1,576.65 | 13.0801% | -0.88339 | 0 | $12,053.80 | 4.0811 | 0 |
| 100041345 | 2 | $182,460 | W | Pavement Rehab, R | 4/23/2003 | 25 | $8,190.01 | $327.60 | 4.4887% | -1.34788 | 0 | $7,298.40 | 3.8632 | 0 |
| 100042292 | 2 | $183,010 | W | Grade Drain Base P | 7/16/2003 | 52 | $46,333.00 | $891.02 | 25.3172% | -0.59658 | 0 | $3,519.42 | 3.5465 | 0 |
| 100043559 | 2 | $183,320 | W | Pavement Rehab, R | 5/17/2004 | 12 | $16,627.39 | $1,385.62 | 9.0701% | -1.04239 | 0 | $15,276.67 | 4.1840 | 0 |
| 100007785 | 2 | $188,905 | W | Bridge Replacement | 6/24/2003 | 58 | $36,742.85 | $633.50 | 19.4504% | -0.71107 | 0 | $3,256.98 | 3.5128 | 0 |
| 100043220 | 2 | $191,591 | W | Unclassified | 6/1/2004 | 37 | $4,203.71 | $113.61 | 2.1941% | -1.65874 | 0 | $5,178.14 | 3.7142 | 0 |
| 100039408 | 2 | $192,758 | W | Pavement Rehab, R | 1/21/2003 | 22 | $4,334.42 | $197.02 | 2.2486% | -1.64808 | 0 | $8,761.73 | 3.9426 | 0 |
| 100042840 | 2 | $194,566 | W | Pavement Rehab, R | 6/25/2003 | 17 | $12,438.03 | $731.65 | 6.3927% | -1.19432 | 0 | $11,445.06 | 4.0586 | 0 |
| 100042820 | 2 | $195,339 | W | Unclassified | 4/27/2004 | 68 | $33,696.61 | $495.54 | 17.2503% | -0.76320 | 0 | $2,872.63 | 3.4583 | 0 |
| 100042756 | 2 | $195,554 | W | Unclassified | 12/19/2003 | 14 | $28,389.01 | $2,027.79 | 14.5172% | -0.83812 | 0 | $13,968.14 | 4.1451 | 0 |
| 100042618 | 2 | $198,515 | W | Bridge Replacement | 6/10/2003 | 66 | $47,740.63 | $723.34 | 24.0489% | -0.61891 | 0 | $3,007.80 | 3.4782 | 0 |
| 100043539 | 3 | $202,178 | W | Grade Drain Base P | 8/16/2004 | 45 | $10,140.42 | $225.34 | 5.0156% | -1.29968 | 0 | $4,492.84 | 3.6525 | 0 |
| 100045351 | 3 | $205,940 | W | Unclassified | 8/12/2005 | 12 | $9,907.48 | $825.62 | 4.8109% | -1.31778 | 0 | $17,161.67 | 4.2346 | 0 |
| 100043386 | 3 | $209,756 | W | Bridge Replacement | 2/10/2004 | 31 | $17,560.84 | $566.48 | 8.3720% | -1.07717 | 0 | $6,766.32 | 3.8304 | 0 |
| 100044390 | 3 | $211,032 | W | Unclassified | 11/19/2004 | 17 | $32,223.07 | $1,895.47 | 15.2693% | -0.81618 | 0 | $12,413.65 | 4.0939 | 0 |
| 100043569 | 3 | $212,837 | W | Bridge Replacement | 10/14/2004 | 64 | $16,829.03 | $262.95 | 7.9070% | -1.10199 | 0 | $3,325.58 | 3.5219 | 0 |
| 100042730 | 3 | $214,953 | W | Unclassified | 9/16/2003 | 15 | $740.99 | $49.40 | 0.3447% | -2.46253 | 0 | $14,330.20 | 4.1563 | 0 |
| 100041377 | 3 | $216,106 | W | Grade Drain Base P | 2/3/2004 | 87 | $3,544.29 | $40.74 | 1.6401% | -1.78514 | 0 | $2,483.98 | 3.3951 | 0 |
| 100040881 | 3 | $219,699 | W | Traffic Striping, Pave | 6/22/2004 | 43 | $137,604.06 | $3,200.09 | 62.6330% | -0.20320 | 0 | $5,109.28 | 3.7084 | 0 |
| 100041375 | 3 | $220,330 | W | Grade Drain Base P | 5/1/2003 | 69 | $22,203.62 | $321.79 | 10.0774% | -0.99665 | 0 | $3,193.19 | 3.5042 | 0 |
| 100044313 | 3 | $221,852 | W | Pavement Rehab, R | 6/10/2004 | 30 | $14,042.19 | $468.07 | 6.3295% | -1.19863 | 0 | $7,395.07 | 3.8689 | 0 |
| 100041522 | 3 | $222,371 | W | Signals, Markings, S | 3/8/2004 | 63 | $54,780.11 | $869.53 | 24.6346% | -0.60846 | 0 | $3,529.70 | 3.5477 | 0 |
| 100007548 | 3 | $223,340 | W | Grade Drain Base P | 8/31/2004 | 82 | $29,501.65 | $359.78 | 13.2093% | -0.87912 | 0 | $2,723.66 | 3.4352 | 0 |
| 100041577 | 3 | $223,533 | W | Unclassified | 3/12/2004 | 77 | $2,814.06 | $36.55 | 1.2589% | -1.90001 | 0 | $2,903.03 | 3.4629 | 0 |
| 100041791 | 3 | $226,647 | W | Bridge Replacement | 2/13/2003 | 34 | $12,467.02 | $366.68 | 5.5006% | -1.25959 | 0 | $6,666.09 | 3.8239 | 0 |
| 100043669 | 3 | $228,380 | W | Unclassified | 3/25/2004 | 36 | $37,960.28 | $1,054.45 | 16.6215% | -0.77933 | 0 | $6,343.89 | 3.8024 | 0 |
| 100041096 | 3 | $231,458 | W | Unclassified | 7/21/2003 | 25 | $46,413.52 | $1,856.54 | 20.0527% | -0.69783 | 0 | $9,258.32 | 3.9665 | 0 |
| 100041995 | 3 | $233,333 | W | Pavement Rehab, R | 3/21/2003 | 24 | $14,629.38 | $609.56 | 6.2697% | -1.20275 | 0 | $9,722.21 | 3.9878 | 0 |
| 100043788 | 3 | $234,752 | W | Grade Drain Base P | 9/13/2004 | 51 | $24,922.74 | $488.68 | 10.6166% | -0.97401 | 0 | $4,602.98 | 3.6630 | 0 |
| 100042935 | 3 | $235,406 | W | Unclassified | 9/18/2003 | 45 | $13,850.41 | $307.79 | 5.8836% | -1.23035 | 0 | $5,231.24 | 3.7186 | 0 |
| 100043675 | 3 | $236,715 | W | Bridge Replacement | 3/31/2004 | 30 | $15,522.66 | $517.42 | 6.5575% | -1.18326 | 0 | $7,890.50 | 3.8971 | 0 |
| 100043466 | 3 | $237,379 | W | Unclassified | 6/10/2004 | 18 | $11,011.64 | $611.76 | 4.6388% | -1.33359 | 0 | $13,187.72 | 4.1202 | 0 |
| 100037209 | 3 | $237,717 | W | Unclassified | 6/9/2004 | 27 | $23,725.79 | $878.73 | 9.9807% | -1.00084 | 0 | $8,804.33 | 3.9447 | 0 |
| 100044769 | 3 | $238,666 | W | Unclassified | 12/16/2004 | 26 | $18,275.90 | $702.92 | 7.6575% | -1.11591 | 0 | $9,179.46 | 3.9628 | 0 |
| 100044823 | 3 | $239,446 | W | Unclassified | 3/7/2005 | 10 | $8,614.92 | $861.49 | 3.5979% | -1.44396 | 0 | $23,944.60 | 4.3792 | 0 |
| 100044027 | 3 | $239,488 | W | Unclassified | 8/28/2004 | 91 | $20,694.43 | $227.41 | 8.6411% | -1.06343 | 0 | $2,631.74 | 3.4202 | 0 |
| 100043069 | 3 | $239,789 | W | Bridge Replacement | 12/19/2003 | 54 | $22,495.56 | $416.58 | 9.3814% | -1.02773 | 0 | $4,440.54 | 3.6474 | 0 |
| 100045528 | 3 | $240,000 | W | Structure Removal | 7/18/2005 | 88 | $39,031.49 | $443.54 | 16.2631% | -0.78880 | 0 | $2,727.27 | 3.4357 | 0 |
| 100043234 | 3 | $241,385 | W | Unclassified | 8/20/2004 | 60 | $52,841.40 | $880.69 | 21.8909% | -0.65974 | 0 | $4,023.08 | 3.6046 | 0 |
| 100042096 | 3 | $241,998 | W | Roadway Widening, | 7/14/2003 | 13 | $7,913.49 | $608.73 | 3.2701% | -1.48544 | 0 | $18,615.23 | 4.2699 | 0 |
| 100042961 | 3 | $242,184 | W | Unclassified | 10/6/2003 | 51 | $5,957.17 | $116.81 | 2.4598% | -1.60911 | 0 | $4,748.71 | 3.6766 | 0 |
| 100043107 | 3 | $244,290 | W | Bridge Replacement | 11/29/2004 | 26 | $2,514.43 | $96.71 | 1.0293% | -1.98747 | 0 | $9,395.77 | 3.9729 | 0 |
| 100042792 | 3 | $244,318 | W | Unclassified | 8/12/2003 | 31 | $16,084.32 | $518.85 | 6.5834% | -1.18155 | 0 | $7,881.23 | 3.8966 | 0 |
| 100046011 | 3 | $245,724 | W | Pavement Rehab, R | 11/23/2005 | 6 | $24,613.62 | $4,102.27 | 10.0168% | -0.99927 | 0 | $40,954.00 | 4.6123 | 0 |
| 100042970 | 3 | $248,084 | W | Unclassified | 5/24/2004 | 70 | $4,009.11 | $57.27 | 1.6160% | -1.79155 | 0 | $3,544.06 | 3.5495 | 0 |
| 100041576 | 3 | $249,041 | W | Intersection Improve | 3/18/2004 | 30 | $28,931.25 | $964.38 | 11.6171% | -0.93490 | 0 | $8,301.37 | 3.9191 | 0 |
| 100043019 | 3 | $251,805 | W | Bridge Replacement | 5/3/2004 | 40 | $2,467.99 | $61.70 | 0.9801% | -2.00872 | 0 | $6,295.13 | 3.7990 | 0 |
| 100041911 | 3 | $257,757 | W | Pavement Rehab, R | 9/10/2003 | 15 | $6,380.58 | $425.37 | 2.4754% | -1.60635 | 0 | $17,183.80 | 4.2351 | 0 |
| 100042822 | 3 | $259,589 | W | Unclassified | 11/3/2003 | 18 | $98,984.16 | $5,499.12 | 38.1311% | -0.41872 | 0 | $14,421.61 | 4.1590 | 0 |
| 100042874 | 3 | $260,282 | W | Bridge Replacement | 6/28/2004 | 90 | $30,909.14 | $343.43 | 11.8753% | -0.92536 | 0 | $2,892.02 | 3.4612 | 0 |
| 100042809 | 3 | $262,131 | W | Unclassified | 5/20/2004 | 23 | $2,015.97 | $87.65 | 0.7691% | -2.11403 | 0 | $11,397.00 | 4.0568 | 0 |
| 100042620 | 3 | $263,000 | W | Grade Drain Base P | 10/3/2003 | 57 | $33,605.43 | $589.57 | 12.7777% | -0.89355 | 0 | $4,614.04 | 3.6641 | 0 |
| 100043616 | 3 | $263,087 | W | Pavement Rehab, R | 6/12/2004 | 15 | $4,035.90 | $269.06 | 1.5341% | -1.81416 | 0 | $17,539.13 | 4.2440 | 0 |
| 100043101 | 3 | $263,288 | W | Unclassified | 11/25/2003 | 72 | $48,799.76 | $677.77 | 18.5347% | -0.73201 | 0 | $3,656.78 | 3.5631 | 0 |
| 100045258 | 3 | $264,254 | W | Unclassified | 11/16/2005 | 17 | $11,573.93 | $680.82 | 4.3799% | -1.35854 | 0 | $15,544.35 | 4.1916 | 0 |
| 100042634 | 3 | $265,144 | W | Pavement Rehab, R | 8/13/2003 | 15 | $9,960.28 | $664.02 | 3.7566% | -1.42521 | 0 | $17,676.27 | 4.2474 | 0 |
| 100041959 | 3 | $268,366 | W | Pavement Rehab, R | 6/12/2003 | 16 | $7,042.28 | $440.14 | 2.6241% | -1.58101 | 0 | $16,772.88 | 4.2246 | 0 |
| 100041994 | 3 | $272,107 | W | Unclassified | 2/4/2003 | 45 | $11,432.47 | $254.05 | 4.2015% | -1.37660 | 0 | $6,046.82 | 3.7815 | 0 |
| 100043468 | 3 | $272,975 | W | Pavement Rehab, R | 5/10/2004 | 9 | $20,503.65 | $2,278.18 | 7.5112% | -1.12429 | 0 | $30,330.56 | 4.4819 | 0 |
| 100046048 | 3 | $276,475 | W | Pavement Rehab, R | 9/9/2005 | 9 | $16,520.98 | $1,835.66 | 5.9756% | -1.22362 | 0 | $30,719.44 | 4.4874 | 0 |
| 100041968 | 3 | $282,755 | W | Unclassified | 1/22/2004 | 88 | $9,402.96 | $106.85 | 3.3255% | -1.47815 | 0 | $3,213.13 | 3.5069 | 0 |
| 100045670 | 3 | $283,035 | W | Unclassified | 9/12/2005 | 28 | $17,627.77 | $629.56 | 6.2281% | -1.20564 | 0 | $10,108.39 | 4.0047 | 0 |
| 100042886 | 3 | $283,596 | W | Unclassified | 6/25/2004 | 43 | $22,236.31 | $517.12 | 7.8408% | -1.10564 | 0 | $6,595.26 | 3.8192 | 0 |
| 100046022 | 3 | $284,219 | W | Unclassified | 7/1/2005 | 15 | $16,688.79 | $1,112.59 | 5.8718% | -1.23123 | 0 | $18,947.93 | 4.2776 | 0 |
| 100043782 | 3 | $285,707 | W | Unclassified | 2/25/2005 | 21 | $1,090.94 | $51.95 | 0.3818% | -2.41812 | 0 | $13,605.10 | 4.1337 | 0 |
| 100007564 | 3 | $288,692 | W | Grade Drain Base P | 8/11/2004 | 64 | $3,651.72 | $57.06 | 1.2649% | -1.89794 | 0 | $4,510.81 | 3.6543 | 0 |
| 100042356 | 3 | $289,464 | W | Bridge Replacement | 7/10/2003 | 84 | $26,889.30 | $320.11 | 9.2893% | -1.03202 | 0 | $3,446.00 | 3.5373 | 0 |
| 100039813 | 3 | $290,375 | W | Signals, Markings, S | 12/1/2004 | 56 | $34,188.21 | $610.50 | 11.7738% | -0.92908 | 0 | $5,185.27 | 3.7148 | 0 |
| 100041953 | 3 | $290,744 | W | Pavement Rehab, R | 4/23/2003 | 16 | $3,404.99 | $212.81 | 1.1711% | -1.93139 | 0 | $18,171.50 | 4.2594 | 0 |
| 100042365 | 3 | $293,225 | W | Unclassified | 1/9/2004 | 72 | $2,594.86 | $36.04 | 0.8849% | -2.05309 | 0 | $4,072.57 | 3.6099 | 0 |
| 100041807 | 3 | $294,610 | W | Pavement Rehab, R | 6/24/2003 | 16 | $11,128.28 | $695.52 | 3.7773% | -1.42282 | 0 | $18,413.13 | 4.2651 | 0 |
| 100042534 | 3 | $294,741 | W | Bridge Replacement | 2/23/2004 | 58 | $3,801.11 | $65.54 | 1.2896% | -1.88953 | 0 | $5,081.74 | 3.7060 | 0 |
| 100043384 | 3 | $295,264 | W | Unclassified | 12/12/2003 | 56 | $17,422.43 | $311.11 | 5.9006% | -1.22910 | 0 | $5,272.57 | 3.7220 | 0 |
| 100043218 | 3 | $298,537 | W | Unclassified | 11/13/2003 | 67 | $29,326.34 | $437.71 | 9.8234% | -1.00774 | 0 | $4,455.78 | 3.6489 | 0 |
| 100042692 | 3 | $298,800 | W | Unclassified | 6/21/2004 | 29 | $8,722.46 | $300.77 | 2.9192% | -1.53474 | 0 | $10,303.45 | 4.0130 | 0 |
| 100044714 | 3 | $299,817 | W | Pavement Rehab, R | 8/18/2005 | 26 | $2,108.74 | $81.11 | 0.7033% | -2.15283 | 0 | $11,531.42 | 4.0619 | 0 |
| 100042841 | 3 | $305,219 | W | Roadway Widening, | 10/15/2003 | 12 | $12,032.48 | $1,002.71 | 3.9422% | -1.40426 | 0 | $25,434.92 | 4.4054 | 0 |
| 100044945 | 3 | $305,908 | W | Pavement Rehab, R | 6/8/2005 | 9 | $12,297.88 | $1,366.43 | 4.0201% | -1.39576 | 0 | $33,989.78 | 4.5313 | 0 |
| 100042598 | 3 | $308,405 | W | Bridge Replacement | 12/15/2003 | 52 | $3,595.69 | $69.15 | 1.1659% | -1.93334 | 0 | $5,930.87 | 3.7731 | 0 |
| 100042120 | 3 | $308,991 | W | Bridge Replacement | 2/19/2003 | 48 | $59,036.10 | $1,229.92 | 19.1061% | -0.71883 | 0 | $6,437.31 | 3.8087 | 0 |
| 100043064 | 3 | $309,491 | W | Unclassified | 7/23/2004 | 90 | $58,666.07 | $651.85 | 18.9557% | -0.72226 | 0 | $3,438.79 | 3.5364 | 0 |
| 100042946 | 3 | $310,121 | W | Unclassified | 11/4/2003 | 21 | $58,181.37 | $2,770.54 | 18.7609% | -0.72675 | 0 | $14,767.67 | 4.1693 | 0 |
| 100045809 | 3 | $310,129 | W | Unclassified | 11/4/2005 | 30 | $3,480.43 | $116.01 | 1.1223% | -1.94991 | 0 | $10,337.63 | 4.0144 | 0 |
| 100041508 | 3 | $311,691 | W | Bridge Replacement | 2/5/2003 | 81 | $73,532.32 | $907.81 | 23.5914% | -0.62725 | 0 | $3,848.04 | 3.5852 | 0 |
| 100040633 | 3 | $312,908 | W | Bridge Replacement | 8/5/2003 | 58 | $17,644.89 | $304.22 | 5.6390% | -1.24880 | 0 | $5,394.97 | 3.7320 | 0 |
| 100043651 | 3 | $314,483 | W | Bridge Replacement | 4/14/2004 | 44 | $39,714.29 | $902.60 | 12.6284% | -0.89865 | 0 | $7,147.34 | 3.8541 | 0 |
| 100042408 | 3 | $315,811 | W | Pavement Rehab, R | 1/26/2004 | 41 | $17,605.16 | $429.39 | 5.5746% | -1.25379 | 0 | $7,702.71 | 3.8866 | 0 |
| 100041515 | 3 | $317,392 | W | Signals, Markings, S | 12/1/2003 | 82 | $138,453.95 | $1,688.46 | 43.6224% | -0.36029 | 0 | $3,870.63 | 3.5878 | 0 |

| CPMS Proj # | Size | Original Contract Amt | C/W | Code Description | Completion Date | Days Used | E&I Amt | Daily E&I | % E&I to CV | Log % E&I | outlier (2stdev) | Contract $$ per Day | Log $perDay | outlier (2stdev) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100043167 | 3 | $318,762 | W | Pavement Rehab, R | 5/6/2004 | 45 | $10,357.80 | $230.17 | 3.2494% | -1.48820 | 0 | $7,083.60 | 3.8503 | 0 |
| 100041466 | 3 | $319,972 | W | Bridge Replacement | 1/27/2003 | 110 | $40,077.20 | $364.34 | 12.5252% | -0.90221 | 0 | $2,908.84 | 3.4637 | 0 |
| 100041948 | 3 | $323,375 | W | Bridge Replacement | 6/30/2003 | 107 | $7,483.16 | $69.94 | 2.3141% | -1.63562 | 0 | $3,022.20 | 3.4803 | 0 |
| 100042837 | 3 | $325,823 | W | Unclassified | 11/20/2003 | 15 | $24,207.03 | $1,613.80 | 7.4295% | -1.12904 | 0 | $21,721.53 | 4.3369 | 0 |
| 100042085 | 3 | $326,931 | W | Roadway Widening, | 9/14/2005 | 30 | $19,724.09 | $657.47 | 6.0331% | -1.21946 | 0 | $10,897.70 | 4.0373 | 0 |
| 100041532 | 3 | $328,558 | W | Unclassified | 12/19/2003 | 81 | $12,085.69 | $149.21 | 3.6784% | -1.43434 | 0 | $4,056.27 | 3.6081 | 0 |
| 100039977 | 3 | $328,896 | W | Bridge Replacement | 11/19/2003 | 67 | $8,273.36 | $123.48 | 2.5155% | -1.59938 | 0 | $4,908.90 | 3.6910 | 0 |
| 100043212 | 3 | $329,007 | W | Unclassified | 9/10/2004 | 46 | $16,177.99 | $351.70 | 4.9172% | -1.30828 | 0 | $7,152.33 | 3.8544 | 0 |
| 100041950 | 3 | $329,636 | W | Grade Drain Base P | 5/14/2003 | 88 | $39,724.86 | $451.42 | 12.0511% | -0.91897 | 0 | $3,745.86 | 3.5736 | 0 |
| 100043021 | 3 | $329,820 | W | Unclassified | 7/1/2004 | 42 | $9,282.31 | $221.01 | 2.8144% | -1.55062 | 0 | $7,852.86 | 3.8950 | 0 |
| 100042366 | 3 | $330,342 | W | Unclassified | 2/9/2004 | 75 | $2,589.15 | $34.52 | 0.7838% | -2.10581 | 0 | $4,404.56 | 3.6439 | 0 |
| 100038734 | 3 | $334,071 | W | Intersection Improve | 1/16/2004 | 65 | $98,091.24 | $1,509.10 | 29.3624% | -0.53221 | 0 | $5,139.55 | 3.7109 | 0 |
| 100042293 | 3 | $335,401 | W | Roadway Widening, | 9/4/2003 | 27 | $14,828.97 | $549.22 | 4.4213% | -1.35445 | 0 | $12,422.26 | 4.0942 | 0 |
| 100042098 | 3 | $336,033 | W | Pavement Rehab, R | 6/11/2003 | 22 | $11,172.62 | $507.85 | 3.3249% | -1.47823 | 0 | $15,274.23 | 4.1840 | 0 |
| 100042129 | 3 | $341,299 | W | Grade Drain Base P | 1/22/2004 | 68 | $37,671.05 | $553.99 | 11.0376% | -0.95713 | 0 | $5,019.10 | 3.7006 | 0 |
| 100044566 | 3 | $342,278 | W | Unclassified | 10/18/2004 | 27 | $15,938.02 | $590.30 | 4.6565% | -1.33194 | 0 | $12,676.96 | 4.1030 | 0 |
| 100043349 | 3 | $346,084 | W | Pavement Rehab, R | 11/13/2003 | 27 | $6,893.51 | $255.32 | 1.9919% | -1.70074 | 0 | $12,817.93 | 4.1078 | 0 |
| 100043201 | 3 | $346,106 | W | Pavement Rehab, R | 11/21/2003 | 12 | $7,199.82 | $599.99 | 2.0802% | -1.68189 | 0 | $28,842.17 | 4.4600 | 0 |
| 100045090 | 3 | $347,057 | W | Unclassified | 5/20/2005 | 27 | $32,593.16 | $1,207.15 | 9.3913% | -1.02727 | 0 | $12,853.96 | 4.1090 | 0 |
| 100042976 | 3 | $347,580 | W | Bridge Replacement | 5/17/2004 | 39 | $7,032.88 | $180.33 | 2.0234% | -1.69392 | 0 | $8,912.31 | 3.9500 | 0 |
| 100041467 | 3 | $350,165 | W | Bridge Replacement | 3/21/2003 | 88 | $31,086.81 | $353.26 | 8.8778% | -1.05170 | 0 | $3,979.15 | 3.5998 | 0 |
| 100042348 | 3 | $351,970 | W | Bridge Replacement | 11/11/2003 | 66 | $12,281.28 | $186.08 | 3.4893% | -1.45726 | 0 | $5,332.88 | 3.7270 | 0 |
| 100042688 | 3 | $352,181 | W | Unclassified | 10/23/2003 | 36 | $34,906.76 | $969.63 | 9.9116% | -1.00386 | 0 | $9,782.81 | 3.9905 | 0 |
| 100044763 | 3 | $353,009 | W | Pavement Rehab, R | 4/29/2005 | 24 | $10,614.65 | $442.28 | 3.0069% | -1.52188 | 0 | $14,708.71 | 4.1676 | 0 |
| 100045228 | 3 | $358,358 | W | Pavement Rehab, R | 5/17/2005 | 22 | $24,451.82 | $1,111.45 | 6.8233% | -1.16601 | 0 | $16,289.00 | 4.2119 | 0 |
| 100044912 | 3 | $359,143 | W | Unclassified | 6/21/2005 | 40 | $3,624.06 | $90.60 | 1.0091% | -1.99607 | 0 | $8,978.58 | 3.9532 | 0 |
| 100045552 | 3 | $359,460 | W | Unclassified | 8/10/2005 | 9 | $11,878.20 | $1,319.80 | 3.3045% | -1.48090 | 0 | $39,940.00 | 4.6014 | 0 |
| 100042998 | 3 | $361,957 | W | Unclassified | 7/27/2004 | 75 | $18,426.79 | $245.69 | 5.0909% | -1.29321 | 0 | $4,826.09 | 3.6836 | 0 |
| 100043355 | 3 | $363,030 | W | Pavement Rehab, R | 11/19/2003 | 97 | $24,741.55 | $255.07 | 6.8153% | -1.16652 | 0 | $3,742.58 | 3.5732 | 0 |
| 100041518 | 3 | $363,906 | W | Unclassified | 9/1/2005 | 128 | $61,175.69 | $477.94 | 16.8108% | -0.77441 | 0 | $2,843.02 | 3.4538 | 0 |
| 100041494 | 3 | $365,025 | W | Bridge Replacement | 4/29/2003 | 61 | $19,711.58 | $323.14 | 5.4001% | -1.26760 | 0 | $5,984.02 | 3.7770 | 0 |
| 100042400 | 3 | $367,484 | W | Pavement Rehab, R | 7/21/2003 | 30 | $20,110.22 | $670.34 | 5.4724% | -1.26182 | 0 | $12,249.47 | 4.0881 | 0 |
| 100044947 | 3 | $368,419 | W | Pavement Rehab, R | 3/2/2005 | 32 | $15,238.00 | $476.19 | 4.1361% | -1.38341 | 0 | $11,513.09 | 4.0612 | 0 |
| 100042810 | 3 | $369,179 | W | Grade Drain Base P | 9/30/2003 | 57 | $20,619.95 | $361.75 | 5.5854% | -1.25295 | 0 | $6,476.82 | 3.8114 | 0 |
| 100044948 | 3 | $371,966 | W | Unclassified | 6/1/2005 | 22 | $10,842.07 | $492.82 | 2.9148% | -1.53539 | 0 | $16,907.55 | 4.2281 | 0 |
| 100042856 | 3 | $372,598 | W | Bridge Replacement | 12/16/2003 | 127 | $32,547.83 | $256.28 | 8.7354% | -1.05872 | 0 | $2,933.84 | 3.4674 | 0 |
| 100043866 | 3 | $374,192 | W | Unclassified | 4/19/2005 | 42 | $25,890.62 | $616.44 | 6.9191% | -1.15995 | 0 | $8,909.33 | 3.9498 | 0 |
| 100042312 | 3 | $375,675 | W | Unclassified | 8/18/2003 | 23 | $32,526.73 | $1,414.21 | 8.6582% | -1.06257 | 0 | $16,333.70 | 4.2131 | 0 |
| 100045204 | 3 | $377,698 | W | Unclassified | 6/17/2005 | 19 | $10,137.80 | $533.57 | 2.6841% | -1.57120 | 0 | $19,878.84 | 4.2984 | 0 |
| 100045608 | 3 | $384,917 | W | Unclassified | 9/9/2005 | 36 | $71,026.95 | $1,972.97 | 18.4525% | -0.73394 | 0 | $10,692.14 | 4.0291 | 0 |
| 100041520 | 3 | $387,544 | W | Intersection Improve | 1/8/2004 | 94 | $126,445.97 | $1,345.17 | 32.6275% | -0.48642 | 0 | $4,122.81 | 3.6152 | 0 |
| 100042076 | 3 | $388,616 | W | Unclassified | 6/2/2004 | 18 | $30,317.18 | $1,684.29 | 7.8013% | -1.10783 | 0 | $21,589.78 | 4.3342 | 0 |
| 100045666 | 3 | $389,274 | W | Unclassified | 9/30/2005 | 40 | $29,477.09 | $736.93 | 7.5723% | -1.12077 | 0 | $9,731.85 | 3.9882 | 0 |
| 100042689 | 3 | $392,264 | W | Unclassified | 8/7/2003 | 30 | $39,863.28 | $1,328.78 | 10.1624% | -0.99301 | 0 | $13,075.47 | 4.1165 | 0 |
| 100044409 | 3 | $395,833 | W | Unclassified | 1/6/2005 | 52 | $5,825.57 | $112.03 | 1.4717% | -1.83217 | 0 | $7,612.17 | 3.8815 | 0 |
| 100043755 | 3 | $399,016 | W | Unclassified | 11/15/2004 | 60 | $15,554.94 | $259.25 | 3.8983% | -1.40912 | 0 | $6,650.27 | 3.8228 | 0 |
| 100043407 | 3 | $402,433 | W | Unclassified | 9/15/2004 | 143 | $14,734.37 | $103.04 | 3.6613% | -1.43636 | 0 | $2,814.22 | 3.4494 | 0 |
| 100043467 | 3 | $403,231 | W | Pavement Rehab, R | 12/12/2003 | 40 | $12,200.82 | $305.02 | 3.0258% | -1.51916 | 0 | $10,080.78 | 4.0035 | 0 |
| 100041901 | 3 | $403,338 | W | Pavement Rehab, R | 4/11/2003 | 52 | $16,413.92 | $315.65 | 4.0695% | -1.39046 | 0 | $7,756.50 | 3.8897 | 0 |
| 100042599 | 3 | $405,954 | W | Roadway Widening, | 8/4/2003 | 27 | $34,612.45 | $1,281.94 | 8.5262% | -1.06924 | 0 | $15,035.33 | 4.1771 | 0 |
| 100042479 | 3 | $408,540 | W | Pavement Rehab, R | 6/25/2003 | 43 | $17,810.79 | $414.20 | 4.3596% | -1.36055 | 0 | $9,500.93 | 3.9778 | 0 |
| 100041799 | 3 | $408,647 | W | Roadway Widening, | 3/11/2005 | 46 | $78,170.25 | $1,699.35 | 19.1290% | -0.71831 | 0 | $8,883.63 | 3.9486 | 0 |
| 100043625 | 3 | $413,489 | W | Pavement Rehab, R | 9/26/2004 | 17 | $9,381.14 | $551.83 | 2.2688% | -1.64421 | 0 | $24,322.88 | 4.3860 | 0 |
| 100042249 | 3 | $413,713 | W | Grade Drain Base P | 5/9/2003 | 58 | $23,608.06 | $407.04 | 5.7064% | -1.24364 | 0 | $7,132.98 | 3.8533 | 0 |
| 100043472 | 3 | $414,426 | W | Grade Drain Base P | 12/13/2004 | 130 | $38,841.57 | $298.78 | 9.3724% | -1.02815 | 0 | $3,187.89 | 3.5035 | 0 |
| 100043562 | 3 | $414,778 | W | Unclassified | 11/15/2004 | 27 | $56,643.34 | $2,097.90 | 13.6563% | -0.86467 | 0 | $15,362.15 | 4.1865 | 0 |
| 100040940 | 3 | $416,079 | W | Bridge Replacement | 1/9/2003 | 99 | $94,879.33 | $958.38 | 22.8032% | -0.64200 | 0 | $4,202.82 | 3.6235 | 0 |
| 100043357 | 3 | $417,213 | W | Unclassified | 10/12/2004 | 128 | $16,868.71 | $131.79 | 4.0432% | -1.39328 | 0 | $3,259.48 | 3.5131 | 0 |
| 100041960 | 3 | $417,998 | W | Pavement Rehab, R | 9/15/2003 | 40 | $27,717.94 | $692.95 | 6.6311% | -1.17841 | 0 | $10,449.95 | 4.0191 | 0 |
| 100044399 | 3 | $419,439 | W | Unclassified | 11/19/2004 | 21 | $38,040.04 | $1,811.43 | 9.0693% | -1.04243 | 0 | $19,973.29 | 4.3004 | 0 |
| 100040107 | 3 | $419,689 | W | Grade Drain Base P | 5/9/2003 | 71 | $57,689.81 | $812.53 | 13.7458% | -0.86183 | 0 | $5,911.11 | 3.7717 | 0 |
| 100042833 | 3 | $419,997 | W | Unclassified | 3/22/2004 | 57 | $78,136.29 | $1,370.81 | 18.6040% | -0.73039 | 0 | $7,368.37 | 3.8674 | 0 |
| 100042648 | 3 | $421,955 | W | Bridge Replacement | 6/26/2003 | 55 | $8,136.74 | $147.94 | 1.9283% | -1.71482 | 0 | $7,671.91 | 3.8849 | 0 |
| 100043606 | 3 | $422,405 | W | Unclassified | 11/9/2004 | 40 | $11,812.45 | $295.31 | 2.7965% | -1.55339 | 0 | $10,560.13 | 4.0237 | 0 |
| 100041936 | 3 | $422,501 | W | Pavement Rehab, R | 5/13/2003 | 40 | $34,121.15 | $853.03 | 8.0760% | -1.09280 | 0 | $10,562.53 | 4.0238 | 0 |
| 100042944 | 3 | $424,795 | W | Unclassified | 9/18/2003 | 23 | $30,103.65 | $1,308.85 | 7.0866% | -1.14956 | 0 | $18,469.35 | 4.2665 | 0 |
| 100042368 | 3 | $427,158 | W | Pavement Rehab, R | 9/6/2005 | 19 | $28,105.78 | $1,479.25 | 6.5797% | -1.18179 | 0 | $22,482.00 | 4.3518 | 0 |
| 100044776 | 3 | $428,249 | W | Unclassified | 9/10/2004 | 31 | $15,696.72 | $506.35 | 3.6653% | -1.43589 | 0 | $13,814.48 | 4.1403 | 0 |
| 100043013 | 3 | $428,554 | W | Bridge Replacement | 10/10/2003 | 48 | $76,920.89 | $1,602.52 | 17.9489% | -0.74596 | 0 | $8,928.21 | 3.9508 | 0 |
| 100042396 | 3 | $429,646 | W | Unclassified | 11/13/2003 | 60 | $28,016.84 | $466.95 | 6.5209% | -1.18569 | 0 | $7,160.77 | 3.8550 | 0 |
| 100043400 | 3 | $432,027 | W | Unclassified | 1/30/2004 | 42 | $23,003.18 | $547.69 | 5.3245% | -1.27372 | 0 | $10,286.36 | 4.0123 | 0 |
| 100041150 | 3 | $435,783 | W | Unclassified | 3/25/2003 | 50 | $38,872.10 | $777.44 | 8.9201% | -1.04963 | 0 | $8,715.66 | 3.9403 | 0 |
| 100041958 | 3 | $435,798 | W | Pavement Rehab, R | 8/1/2003 | 44 | $33,233.04 | $755.30 | 7.6258% | -1.11772 | 0 | $9,904.50 | 3.9958 | 0 |
| 100042790 | 3 | $436,693 | W | Unclassified | 8/24/2003 | 21 | $39,652.91 | $1,888.23 | 9.0803% | -1.04190 | 0 | $20,794.90 | 4.3180 | 0 |
| 100043150 | 3 | $438,986 | W | Grade Drain Base P | 5/25/2004 | 57 | $142,868.32 | $2,506.46 | 32.5451% | -0.48751 | 0 | $7,701.51 | 3.8866 | 0 |
| 100045136 | 3 | $445,608 | W | Unclassified | 8/26/2005 | 22 | $13,542.34 | $615.56 | 3.0391% | -1.51726 | 0 | $20,254.91 | 4.3065 | 0 |
| 100042347 | 3 | $448,544 | W | Pavement Rehab, R | 6/26/2003 | 32 | $15,876.60 | $496.14 | 3.5396% | -1.45105 | 0 | $14,017.00 | 4.1467 | 0 |
| 100043165 | 3 | $448,581 | W | Pavement Rehab, R | 5/19/2004 | 25 | $7,202.03 | $288.08 | 1.6055% | -1.79439 | 0 | $17,943.24 | 4.2539 | 0 |
| 100042092 | 3 | $449,713 | W | Pavement Rehab, R | 8/8/2003 | 44 | $33,990.38 | $772.51 | 7.5582% | -1.12158 | 0 | $10,220.75 | 4.0095 | 0 |
| 100043044 | 3 | $450,413 | W | Unclassified | 9/3/2004 | 88 | $22,530.04 | $256.02 | 5.0021% | -1.30085 | 0 | $5,118.33 | 3.7091 | 0 |
| 100042643 | 3 | $456,094 | W | Pavement Rehab, R | 9/9/2003 | 23 | $11,054.46 | $480.63 | 2.4237% | -1.61552 | 0 | $19,830.17 | 4.2973 | 0 |
| 100041822 | 3 | $457,250 | W | Roadway Widening, | 8/22/2003 | 50 | $115,645.12 | $2,312.90 | 25.2914% | -0.59703 | 0 | $9,145.00 | 3.9612 | 0 |
| 100043878 | 3 | $460,240 | W | Unclassified | 3/31/2004 | 14 | $5,696.45 | $406.89 | 1.2377% | -1.90738 | 0 | $32,874.29 | 4.5169 | 0 |
| 100042532 | 3 | $461,259 | W | Bridge Replacement | 11/9/2004 | 110 | $6,624.60 | $60.22 | 1.4362% | -1.84279 | 0 | $4,193.26 | 3.6226 | 0 |
| 100041961 | 3 | $463,238 | W | Pavement Rehab, R | 7/11/2003 | 47 | $22,522.33 | $479.20 | 4.8619% | -1.31319 | 0 | $9,856.13 | 3.9937 | 0 |
| 100043110 | 3 | $465,985 | W | Unclassified | 8/5/2004 | 52 | $15,583.59 | $299.68 | 3.3442% | -1.47570 | 0 | $8,961.25 | 3.9524 | 0 |
| 100044569 | 3 | $466,916 | W | Roadway Widening, | 11/10/2004 | 24 | $16,105.43 | $671.06 | 3.4493% | -1.46227 | 0 | $19,454.83 | 4.2890 | 0 |
| 100044770 | 3 | $467,428 | W | Unclassified | 5/10/2005 | 24 | $11,121.42 | $463.39 | 2.3793% | -1.62355 | 0 | $19,476.17 | 4.2895 | 0 |
| 100042263 | 3 | $468,790 | W | Unclassified | 10/15/2004 | 97 | $46,014.78 | $474.38 | 9.8156% | -1.00808 | 0 | $4,832.89 | 3.6842 | 0 |
| 100040563 | 3 | $468,934 | W | Bridge Replacement | 4/28/2004 | 123 | $61,809.17 | $502.51 | 13.1808% | -0.88006 | 0 | $3,812.47 | 3.5812 | 0 |
| 100045665 | 3 | $470,491 | W | Unclassified | 12/15/2005 | 53 | $18,409.96 | $347.36 | 3.9129% | -1.40750 | 0 | $8,877.19 | 3.9483 | 0 |
| 100044709 | 3 | $472,515 | W | Unclassified | 12/15/2004 | 24 | $57,859.55 | $2,410.81 | 12.2450% | -0.91204 | 0 | $19,688.13 | 4.2942 | 0 |
| 100041372 | 3 | $473,596 | W | Unclassified | 9/11/2003 | 150 | $68,038.15 | $453.59 | 14.3663% | -0.84266 | 0 | $3,157.31 | 3.4993 | 0 |
| 100042519 | 3 | $478,433 | W | Unclassified | 11/14/2003 | 68 | $16,101.51 | $236.79 | 3.3655% | -1.47295 | 0 | $7,035.78 | 3.8473 | 0 |
| 100037311 | 3 | $483,371 | W | Unclassified | 11/29/2004 | 94 | $210,801.98 | $2,242.57 | 43.6108% | -0.36041 | 0 | $5,142.24 | 3.7112 | 0 |
| 100042082 | 3 | $489,982 | W | Pavement Rehab, R | 4/1/2003 | 35 | $29,866.21 | $853.32 | 6.0954% | -1.21500 | 0 | $13,999.49 | 4.1461 | 0 |
| 100044885 | 3 | $491,271 | W | Unclassified | 6/21/2005 | 29 | $6,398.58 | $220.64 | 1.3025% | -1.88524 | 0 | $16,940.38 | 4.2289 | 0 |
| 100045584 | 3 | $496,254 | W | Unclassified | 9/30/2005 | 40 | $27,672.03 | $691.80 | 5.5762% | -1.25366 | 0 | $12,406.35 | 4.0936 | 0 |
| 100042384 | 3 | $497,257 | W | Bridge Replacement | 11/19/2003 | 90 | $63,830.01 | $709.22 | 12.8364% | -0.89156 | 0 | $5,525.08 | 3.7423 | 0 |
| 100045093 | 4 | $500,427 | W | Pavement Rehab, R | 9/15/2005 | 40 | $18,290.60 | $457.27 | 3.6550% | -1.43711 | 0 | $12,510.68 | 4.0973 | 0 |
| 100044705 | 4 | $503,411 | W | Pavement Rehab, R | 9/23/2005 | 50 | $35,975.70 | $719.51 | 7.1464% | -1.14591 | 0 | $10,068.22 | 4.0030 | 0 |
| 100045399 | 4 | $503,989 | W | Unclassified | 8/10/2005 | 12 | $12,628.22 | $1,052.35 | 2.5057% | -1.60108 | 0 | $41,999.08 | 4.6232 | 0 |
| 100039411 | 4 | $504,233 | W | Pavement Rehab, R | 5/27/2004 | 65 | $20,876.77 | $321.18 | 4.1403% | -1.38297 | 0 | $7,757.43 | 3.8897 | 0 |
| 100042476 | 4 | $505,293 | W | Bridge Replacement | 6/16/2004 | 67 | $91,191.98 | $1,361.07 | 18.0473% | -0.74359 | 0 | $7,541.69 | 3.8775 | 0 |
| 100045450 | 4 | $506,277 | W | Unclassified | 8/15/2005 | 120 | $3,975.57 | $33.13 | 0.7853% | -2.10499 | 0 | $4,218.98 | 3.6252 | 0 |
| 100043358 | 4 | $506,633 | W | Unclassified | 9/2/2004 | 129 | $44,051.13 | $341.48 | 8.6949% | -1.06074 | 0 | $3,927.39 | 3.5941 | 0 |

| CPMS Proj # | Size | Original Contract Amt | C/W | Code Description | Completion Date | Days Used | E&I Amt | Daily E&I | % E&I to CV | Log % E&I | outlier (2stdev) | Contract $$ per Day | Log $perDay | outlier (2stdev) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100042056 | 4 | $507,344 | W | Pavement Rehab, R | 9/22/2003 | 55 | $38,536.26 | $700.66 | 7.5957% | -1.11943 | 0 | $9,224.44 | 3.9649 | 0 |
| 100042601 | 4 | $508,552 | W | Unclassified | 10/16/2003 | 75 | $16,600.36 | $221.34 | 3.2642% | -1.48622 | 0 | $6,780.69 | 3.8313 | 0 |
| 100044147 | 4 | $511,591 | W | Unclassified | 10/28/2005 | 34 | $49,797.73 | $1,464.64 | 9.7339% | -1.01171 | 0 | $15,046.79 | 4.1774 | 0 |
| 100042515 | 4 | $512,615 | W | Unclassified | 9/9/2003 | 34 | $4,903.29 | $144.21 | 0.9565% | -2.01930 | 0 | $15,076.91 | 4.1783 | 0 |
| 100044393 | 4 | $514,218 | W | Unclassified | 5/27/2005 | 27 | $135,950.13 | $5,035.19 | 26.4382% | -0.57777 | 0 | $19,045.11 | 4.2798 | 0 |
| 100043065 | 4 | $515,054 | W | Grade Drain Base P | 5/5/2004 | 80 | $66,394.15 | $829.93 | 12.8907% | -0.88972 | 0 | $6,438.18 | 3.8088 | 0 |
| 100043224 | 4 | $515,905 | W | Unclassified | 7/22/2004 | 87 | $10,020.29 | $115.18 | 1.9423% | -1.71169 | 0 | $5,929.94 | 3.7731 | 0 |
| 100044696 | 4 | $518,183 | W | Unclassified | 4/29/2005 | 60 | $5,276.05 | $87.93 | 1.0182% | -1.99217 | 0 | $8,636.38 | 3.9363 | 0 |
| 100046032 | 4 | $518,186 | W | Pavement Rehab, R | 11/16/2005 | 44 | $14,167.23 | $321.98 | 2.7340% | -1.56320 | 0 | $11,776.95 | 4.0710 | 0 |
| 100042731 | 4 | $524,341 | W | Unclassified | 1/30/2004 | 30 | $44,040.34 | $1,468.01 | 8.3992% | -1.07576 | 0 | $17,478.03 | 4.2425 | 0 |
| 100044936 | 4 | $526,352 | W | Pavement Rehab, R | 6/22/2005 | 40 | $20,782.21 | $519.56 | 3.9483% | -1.40358 | 0 | $13,158.80 | 4.1192 | 0 |
| 100042851 | 4 | $527,893 | W | Unclassified | 8/19/2003 | 32 | $6,930.52 | $216.58 | 1.3129% | -1.88178 | 0 | $16,496.66 | 4.2174 | 0 |
| 100041956 | 4 | $529,139 | W | Roadway Widening, | 2/6/2004 | 31 | $19,392.64 | $625.57 | 3.6649% | -1.43593 | 0 | $17,069.00 | 4.2322 | 0 |
| 100042097 | 4 | $529,141 | W | Pavement Rehab, R | 10/10/2003 | 14 | $6,882.46 | $491.60 | 1.3007% | -1.88583 | 0 | $37,795.79 | 4.5774 | 0 |
| 100042500 | 4 | $533,948 | W | Bridge Replacement | 5/7/2004 | 117 | $6,545.14 | $55.94 | 1.2258% | -1.91158 | 0 | $4,563.66 | 3.6593 | 0 |
| 100043476 | 4 | $534,236 | W | Bridge Replacement | 3/23/2004 | 78 | $4,555.36 | $58.40 | 0.8527% | -2.06921 | 0 | $6,849.18 | 3.8356 | 0 |
| 100045189 | 4 | $536,883 | W | Unclassified | 8/24/2005 | 15 | $20,982.42 | $1,398.83 | 3.9082% | -1.40802 | 0 | $35,792.20 | 4.5538 | 0 |
| 100044492 | 4 | $537,946 | W | Unclassified | 9/7/2004 | 50 | $33,332.40 | $666.65 | 6.1962% | -1.20787 | 0 | $10,758.92 | 4.0318 | 0 |
| 100042291 | 4 | $542,158 | W | Unclassified | 4/25/2004 | 25 | $30,023.81 | $1,200.95 | 5.5378% | -1.25666 | 0 | $21,686.32 | 4.3362 | 0 |
| 100042635 | 4 | $543,018 | W | Bridge Replacement | 5/11/2004 | 94 | $16,312.15 | $173.53 | 3.0040% | -1.52230 | 0 | $5,776.79 | 3.7617 | 0 |
| 100042966 | 4 | $543,140 | W | Bridge Replacement | 7/23/2004 | 87 | $13,222.22 | $151.98 | 2.4344% | -1.61361 | 0 | $6,242.99 | 3.7954 | 0 |
| 100041243 | 4 | $543,440 | W | Bridge Replacement | 7/16/2003 | 86 | $21,520.16 | $250.23 | 3.9600% | -1.40231 | 0 | $6,319.07 | 3.8007 | 0 |
| 100041818 | 4 | $544,648 | W | Pavement Rehab, R | 4/30/2003 | 23 | $64,159.49 | $2,789.54 | 11.7800% | -0.92886 | 0 | $23,680.35 | 4.3744 | 0 |
| 100044539 | 4 | $553,529 | W | Pavement Rehab, R | 12/22/2004 | 36 | $23,023.26 | $639.54 | 4.1594% | -1.38097 | 0 | $15,375.81 | 4.1868 | 0 |
| 100042394 | 4 | $553,684 | W | Pavement Rehab, R | 9/5/2003 | 40 | $40,261.57 | $1,006.54 | 7.2716% | -1.13837 | 0 | $13,842.10 | 4.1412 | 0 |
| 100041647 | 4 | $557,314 | W | Roadway Widening, | 1/24/2003 | 48 | $26,440.66 | $550.85 | 4.7443% | -1.32383 | 0 | $11,610.71 | 4.0649 | 0 |
| 100011660 | 4 | $557,793 | W | Unclassified | 7/12/2004 | 77 | $13,301.31 | $172.74 | 2.3846% | -1.62258 | 0 | $7,244.06 | 3.8600 | 0 |
| 100042743 | 4 | $558,532 | W | Unclassified | 2/18/2004 | 55 | $22,372.97 | $406.78 | 4.0057% | -1.39732 | 0 | $10,155.13 | 4.0067 | 0 |
| 100042083 | 4 | $558,678 | W | Unclassified | 1/21/2004 | 82 | $50,503.26 | $615.89 | 9.0398% | -1.04384 | 0 | $6,813.15 | 3.8333 | 0 |
| 100041327 | 4 | $560,897 | W | Grade Drain Base P | 12/3/2003 | 116 | $72,429.32 | $624.39 | 12.9131% | -0.88897 | 0 | $4,835.32 | 3.6844 | 0 |
| 100039079 | 4 | $566,362 | W | Lighting | 12/19/2003 | 120 | $191,783.81 | $1,598.20 | 33.8624% | -0.47028 | 0 | $4,719.68 | 3.6739 | 0 |
| 100045600 | 4 | $567,897 | W | Unclassified | 6/9/2005 | 27 | $2,579.64 | $95.54 | 0.4542% | -2.34271 | 0 | $21,033.22 | 4.3229 | 0 |
| 100042685 | 4 | $570,159 | W | Unclassified | 9/8/2003 | 33 | $52,607.95 | $1,594.18 | 9.2269% | -1.03494 | 0 | $17,277.55 | 4.2375 | 0 |
| 100042783 | 4 | $570,721 | W | Unclassified | 10/29/2003 | 43 | $89,913.26 | $2,091.01 | 15.7543% | -0.80260 | 0 | $13,272.58 | 4.1230 | 0 |
| 100008420 | 4 | $572,297 | W | Pavement Rehab, R | 5/24/2003 | 122 | $182,173.45 | $1,493.23 | 31.8320% | -0.49714 | 0 | $4,690.96 | 3.6713 | 0 |
| 100041317 | 4 | $573,495 | W | Bridge Replacement | 5/16/2005 | 29 | $57,163.89 | $1,971.17 | 9.9676% | -1.00141 | 0 | $19,775.69 | 4.2961 | 0 |
| 100042066 | 4 | $576,071 | W | Roadway Widening, | 8/6/2003 | 44 | $18,305.81 | $416.04 | 3.1777% | -1.49789 | 0 | $13,092.52 | 4.1170 | 0 |
| 100044697 | 4 | $576,263 | W | Unclassified | 2/22/2005 | 39 | $79,305.07 | $2,033.46 | 13.7620% | -0.86132 | 0 | $14,775.97 | 4.1696 | 0 |
| 100041094 | 4 | $576,967 | W | Unclassified | 6/25/2003 | 25 | $75,690.97 | $3,027.64 | 13.1188% | -0.88211 | 0 | $23,078.68 | 4.3632 | 0 |
| 100039015 | 4 | $578,185 | W | Pavement Rehab, R | 3/14/2003 | 50 | $46,354.03 | $927.08 | 8.0172% | -1.09598 | 0 | $11,563.70 | 4.0631 | 0 |
| 100041424 | 4 | $581,991 | W | Grade Drain Base P | 3/25/2004 | 98 | $134,731.08 | $1,374.81 | 23.1500% | -0.63545 | 0 | $5,938.68 | 3.7737 | 0 |
| 100042852 | 4 | $582,421 | W | Unclassified | 2/4/2004 | 32 | $131,040.93 | $4,095.03 | 22.4993% | -0.64783 | 0 | $18,200.66 | 4.2601 | 0 |
| 100043203 | 4 | $587,064 | W | Pavement Rehab, R | 4/21/2004 | 45 | $19,917.66 | $442.61 | 3.3928% | -1.46945 | 0 | $13,045.87 | 4.1155 | 0 |
| 100045776 | 4 | $588,958 | W | Unclassified | 10/4/2005 | 36 | $16,830.95 | $467.53 | 2.8578% | -1.54398 | 0 | $16,359.94 | 4.2138 | 0 |
| 100045448 | 4 | $590,128 | W | Pavement Rehab, R | 12/6/2005 | 45 | $26,411.87 | $586.93 | 4.4756% | -1.34915 | 0 | $13,113.96 | 4.1177 | 0 |
| 100044568 | 4 | $590,257 | W | Roadway Widening, | 9/1/2005 | 21 | $28,849.48 | $1,373.78 | 4.8876% | -1.31090 | 0 | $28,107.48 | 4.4488 | 0 |
| 100044913 | 4 | $593,733 | W | Unclassified | 5/16/2005 | 42 | $26,015.85 | $619.43 | 4.3817% | -1.35835 | 0 | $14,136.50 | 4.1503 | 0 |
| 100044309 | 4 | $596,210 | W | Pavement Rehab, R | 11/19/2004 | 24 | $32,074.57 | $1,336.44 | 5.3797% | -1.26924 | 0 | $24,842.08 | 4.3952 | 0 |
| 100044815 | 4 | $597,002 | W | Pavement Rehab, R | 3/10/2005 | 35 | $26,349.29 | $752.84 | 4.4136% | -1.35521 | 0 | $17,057.20 | 4.2319 | 0 |
| 100043572 | 4 | $597,512 | W | Unclassified | 11/6/2004 | 114 | $61,399.39 | $538.59 | 10.2758% | -0.98818 | 0 | $5,241.33 | 3.7194 | 0 |
| 100042789 | 4 | $598,083 | W | Unclassified | 1/12/2004 | 50 | $78,142.52 | $1,562.85 | 13.0655% | -0.88387 | 0 | $11,961.66 | 4.0778 | 0 |
| 100043674 | 4 | $598,344 | W | Unclassified | 8/31/2004 | 77 | $16,498.82 | $214.27 | 2.7574% | -1.55950 | 0 | $7,770.70 | 3.8905 | 0 |
| 100042748 | 4 | $599,346 | W | Unclassified | 5/5/2003 | 18 | $124,470.70 | $6,915.04 | 20.7678% | -0.68261 | 0 | $33,297.00 | 4.5224 | 0 |
| 100039207 | 4 | $602,343 | W | Unclassified | 8/18/2004 | 126 | $50,247.18 | $398.79 | 8.3420% | -1.07873 | 0 | $4,780.50 | 3.6795 | 0 |
| 100041954 | 4 | $602,761 | W | Pavement Rehab, R | 11/6/2003 | 60 | $31,166.47 | $519.44 | 5.1706% | -1.28646 | 0 | $10,046.02 | 4.0020 | 0 |
| 100042119 | 4 | $603,000 | W | Grade Drain Base P | 6/2/2003 | 87 | $35,747.08 | $410.89 | 5.9282% | -1.22708 | 0 | $6,931.03 | 3.8408 | 0 |
| 100045700 | 4 | $608,154 | W | Unclassified | 11/1/2005 | 24 | $77,719.56 | $3,238.32 | 12.7796% | -0.89348 | 0 | $25,339.75 | 4.4038 | 0 |
| 100043611 | 4 | $609,659 | W | Unclassified | 10/28/2004 | 33 | $14,901.18 | $451.55 | 2.4442% | -1.61187 | 0 | $18,474.52 | 4.2666 | 0 |
| 100044852 | 4 | $614,434 | W | Unclassified | 6/24/2005 | 45 | $27,050.18 | $601.12 | 4.4025% | -1.35631 | 0 | $13,654.09 | 4.1353 | 0 |
| 100039944 | 4 | $614,755 | W | Unclassified | 2/18/2005 | 93 | $98,044.20 | $1,054.24 | 15.9485% | -0.79728 | 0 | $6,610.27 | 3.8202 | 0 |
| 100040742 | 4 | $617,513 | W | Bridge Replacement | 11/10/2004 | 114 | $171,604.38 | $1,505.30 | 27.7896% | -0.55612 | 0 | $5,416.78 | 3.7337 | 0 |
| 100045968 | 4 | $618,947 | W | Unclassified | 10/28/2005 | 30 | $13,635.94 | $454.53 | 2.2031% | -1.65697 | 0 | $20,631.57 | 4.3145 | 0 |
| 100043200 | 4 | $621,197 | W | Pavement Rehab, R | 9/28/2004 | 31 | $14,767.60 | $476.37 | 2.3773% | -1.62392 | 0 | $20,038.61 | 4.3019 | 0 |
| 100042854 | 4 | $621,625 | W | Unclassified | 6/16/2004 | 117 | $5,389.95 | $46.07 | 0.8671% | -2.06194 | 0 | $5,313.03 | 3.7253 | 0 |
| 100039831 | 4 | $622,068 | W | Signals, Markings, S | 6/15/2004 | 93 | $90,643.90 | $974.67 | 14.5714% | -0.83650 | 0 | $6,688.90 | 3.8254 | 0 |
| 100044988 | 4 | $627,448 | W | Pavement Rehab, R | 3/17/2005 | 22 | $37,412.73 | $1,700.58 | 5.9627% | -1.22456 | 0 | $28,520.36 | 4.4552 | 0 |
| 100041912 | 4 | $627,487 | W | Pavement Rehab, R | 2/26/2003 | 52 | $45,189.24 | $869.02 | 7.2016% | -1.14257 | 0 | $12,067.06 | 4.0816 | 0 |
| 100042636 | 4 | $629,146 | W | Pavement Rehab, R | 10/17/2003 | 77 | $14,461.94 | $187.82 | 2.2987% | -1.63852 | 0 | $8,170.73 | 3.9123 | 0 |
| 100044185 | 4 | $629,972 | W | Unclassified | 3/9/2005 | 58 | $17,062.33 | $294.18 | 2.7084% | -1.56728 | 0 | $10,861.59 | 4.0359 | 0 |
| 100044391 | 4 | $633,007 | W | Unclassified | 9/20/2004 | 24 | $52,378.24 | $2,182.43 | 8.2745% | -1.08226 | 0 | $26,375.29 | 4.4212 | 0 |
| 100044384 | 4 | $633,210 | W | Unclassified | 10/2/2005 | 24 | $1,917.17 | $79.88 | 0.3028% | -2.51889 | 0 | $26,383.75 | 4.4213 | 0 |
| 100046196 | 4 | $641,233 | W | Unclassified | 11/23/2005 | 62 | $9,179.56 | $148.06 | 1.4315% | -1.84419 | 0 | $10,342.47 | 4.0146 | 0 |
| 100041893 | 4 | $643,479 | W | Bridge Replacement | 3/3/2003 | 85 | $24,148.47 | $284.10 | 3.7528% | -1.42564 | 0 | $7,570.34 | 3.8791 | 0 |
| 100042686 | 4 | $644,642 | W | Unclassified | 2/17/2004 | 35 | $53,424.22 | $1,526.41 | 8.2874% | -1.08158 | 0 | $18,418.34 | 4.2653 | 0 |
| 100042865 | 4 | $644,959 | W | Unclassified | 4/22/2004 | 81 | $9,103.10 | $112.38 | 1.4114% | -1.85034 | 0 | $7,962.46 | 3.9010 | 0 |
| 100043619 | 4 | $647,239 | W | Pavement Rehab, R | 8/31/2004 | 41 | $18,941.64 | $461.99 | 2.9265% | -1.53365 | 0 | $15,786.32 | 4.1983 | 0 |
| 100044290 | 4 | $647,817 | W | Unclassified | 1/4/2005 | 21 | $51,708.51 | $2,462.31 | 7.9820% | -1.09789 | 0 | $30,848.43 | 4.4892 | 0 |
| 100042552 | 4 | $654,732 | W | Pavement Rehab, R | 1/14/2004 | 79 | $22,693.02 | $287.25 | 3.4660% | -1.46017 | 0 | $8,287.75 | 3.9184 | 0 |
| 100042963 | 4 | $654,958 | W | Roadway Widening, | 7/16/2004 | 59 | $17,199.34 | $291.51 | 2.6260% | -1.58070 | 0 | $11,100.98 | 4.0454 | 0 |
| 100044380 | 4 | $656,077 | W | Unclassified | 8/30/2004 | 24 | $55,343.93 | $2,306.00 | 8.4356% | -1.07388 | 0 | $27,336.54 | 4.4367 | 0 |
| 100043431 | 4 | $656,670 | W | Unclassified | 5/28/2004 | 43 | $39,565.86 | $920.14 | 6.0252% | -1.22003 | 0 | $15,271.40 | 4.1839 | 0 |
| 100043615 | 4 | $656,717 | W | Unclassified | 12/27/2004 | 41 | $24,301.43 | $592.72 | 3.7004% | -1.43175 | 0 | $16,017.49 | 4.2046 | 0 |
| 100044747 | 4 | $657,306 | W | Pavement Rehab, R | 3/10/2005 | 40 | $36,111.90 | $902.80 | 5.4939% | -1.26012 | 0 | $16,432.65 | 4.2157 | 0 |
| 100044814 | 4 | $661,897 | W | Pavement Rehab, R | 9/6/2005 | 43 | $53,223.06 | $1,237.75 | 8.0410% | -1.09469 | 0 | $15,392.95 | 4.1873 | 0 |
| 100042948 | 4 | $663,120 | W | Unclassified | 11/25/2003 | 30 | $47,718.62 | $1,590.62 | 7.1961% | -1.14290 | 0 | $22,104.00 | 4.3445 | 0 |
| 100040303 | 4 | $664,299 | W | Pavement Rehab, R | 3/12/2003 | 75 | $68,825.33 | $917.67 | 10.3606% | -0.98462 | 0 | $8,857.32 | 3.9473 | 0 |
| 100044239 | 4 | $667,798 | W | Unclassified | 6/22/2004 | 26 | $91,356.67 | $3,513.72 | 13.6803% | -0.86390 | 0 | $25,684.54 | 4.4097 | 0 |
| 100041898 | 4 | $668,831 | W | Pavement Rehab, R | 4/16/2003 | 28 | $16,493.65 | $589.06 | 2.4660% | -1.60800 | 0 | $23,886.82 | 4.3782 | 0 |
| 100039050 | 4 | $672,113 | W | Bridge Replacement | 10/24/2003 | 153 | $34,143.31 | $223.16 | 5.0800% | -1.29414 | 0 | $4,392.90 | 3.6428 | 0 |
| 100044704 | 4 | $672,248 | W | Pavement Rehab, R | 11/15/2005 | 39 | $24,068.64 | $617.14 | 3.5803% | -1.44608 | 0 | $17,237.13 | 4.2365 | 0 |
| 100043074 | 4 | $672,725 | W | Pavement Rehab, R | 3/12/2004 | 84 | $16,233.97 | $193.26 | 2.4132% | -1.61741 | 0 | $8,008.63 | 3.9036 | 0 |
| 100043540 | 4 | $673,058 | W | Roadway Widening, | 6/15/2005 | 70 | $19,281.98 | $275.46 | 2.8648% | -1.54290 | 0 | $9,615.11 | 3.9830 | 0 |
| 100044157 | 4 | $673,132 | W | Unclassified | 3/22/2005 | 45 | $48,176.01 | $1,070.58 | 7.1570% | -1.14527 | 0 | $14,958.49 | 4.1749 | 0 |
| 100042801 | 4 | $675,854 | W | Unclassified | 2/2/2004 | 26 | $81,442.43 | $3,132.40 | 12.0503% | -0.91900 | 0 | $25,994.38 | 4.4149 | 0 |
| 100045681 | 4 | $677,450 | W | Unclassified | 10/31/2005 | 33 | $18,122.81 | $549.18 | 2.6752% | -1.57265 | 0 | $20,528.79 | 4.3124 | 0 |
| 100042753 | 4 | $678,124 | W | Unclassified | 11/18/2003 | 41 | $68,825.68 | $1,678.68 | 10.1494% | -0.99356 | 0 | $16,539.61 | 4.2185 | 0 |
| 100042849 | 4 | $679,512 | W | Unclassified | 2/20/2004 | 38 | $131,451.71 | $3,459.26 | 19.3450% | -0.71343 | 0 | $17,881.89 | 4.2524 | 0 |
| 100044370 | 4 | $680,161 | W | Unclassified | 2/21/2005 | 60 | $29,204.50 | $486.74 | 4.2938% | -1.36716 | 0 | $11,336.02 | 4.0545 | 0 |
| 100041472 | 4 | $681,548 | W | Unclassified | 3/22/2003 | 60 | $34,546.62 | $575.78 | 5.0688% | -1.29509 | 0 | $11,359.13 | 4.0553 | 0 |
| 100041322 | 4 | $682,351 | W | Pavement Rehab, R | 1/11/2003 | 69 | $37,249.06 | $539.84 | 5.4589% | -1.26289 | 0 | $9,889.14 | 3.9952 | 0 |
| 100044466 | 4 | $683,617 | W | Unclassified | 5/3/2005 | 48 | $176,131.55 | $3,669.41 | 25.7647% | -0.58898 | 0 | $14,242.02 | 4.1536 | 0 |
| 100042696 | 4 | $683,761 | W | Unclassified | 10/6/2004 | 82 | $36,477.89 | $444.85 | 5.3349% | -1.27287 | 0 | $8,338.55 | 3.9211 | 0 |
| 100042527 | 4 | $684,334 | W | Unclassified | 3/24/2004 | 117 | $9,765.71 | $83.47 | 1.4270% | -1.84556 | 0 | $5,849.01 | 3.7671 | 0 |
| 100042746 | 4 | $687,522 | W | Unclassified | 7/31/2003 | 33 | $61,286.26 | $1,857.16 | 8.9141% | -1.04992 | 0 | $20,834.00 | 4.3188 | 0 |
| 100042776 | 4 | $687,710 | W | Unclassified | 6/29/2005 | 39 | $108,085.98 | $2,771.44 | 15.7168% | -0.80364 | 0 | $17,633.59 | 4.2463 | 0 |
| 100040438 | 4 | $689,439 | W | Roadway Widening, | 5/7/2003 | 55 | $30,884.39 | $561.53 | 4.4796% | -1.34876 | 0 | $12,535.25 | 4.0981 | 0 |

| CPMS Proj # | Size | Original Contract Amt | C/W | Code Description | Completion Date | Days Used | E&I Amt | Daily E&I | % E&I to CV | Log % E&I | outlier (2stdev) | Contract $$ per Day | Log $perDay | outlier (2stdev) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100038235 | 4 | $692,065 | W | Grade Drain Base P | 9/30/2003 | 82 | $31,398.20 | $382.90 | 4.5369% | -1.34324 | 0 | $8,439.82 | 3.9263 | 0 |
| 100042690 | 4 | $698,455 | W | Unclassified | 1/7/2004 | 60 | $63,207.16 | $1,053.45 | 9.0496% | -1.04337 | 0 | $11,640.92 | 4.0660 | 0 |
| 100037740 | 4 | $699,724 | W | Unclassified | 6/23/2004 | 113 | $159,305.99 | $1,409.79 | 22.7670% | -0.64269 | 0 | $6,192.25 | 3.7918 | 0 |
| 100042958 | 4 | $703,523 | W | Pavement Rehab, R | 12/17/2003 | 74 | $3,157.80 | $42.67 | 0.4489% | -2.34789 | 0 | $9,507.07 | 3.9780 | 0 |
| 100044939 | 4 | $704,297 | W | Unclassified | 12/14/2005 | 55 | $12,243.89 | $222.62 | 1.7385% | -1.75984 | 0 | $12,805.40 | 4.1074 | 0 |
| 100041790 | 4 | $705,248 | W | Pavement Rehab, R | 3/24/2004 | 34 | $14,283.00 | $420.09 | 2.0252% | -1.69352 | 0 | $20,742.59 | 4.3169 | 0 |
| 100041112 | 4 | $707,541 | W | Unclassified | 2/19/2003 | 43 | $70,728.65 | $1,644.85 | 9.9964% | -1.00016 | 0 | $16,454.44 | 4.2163 | 0 |
| 100041376 | 4 | $714,000 | W | Grade Drain Base P | 8/23/2004 | 171 | $119,873.78 | $701.02 | 16.7890% | -0.77497 | 0 | $4,175.44 | 3.6207 | 0 |
| 100042803 | 4 | $714,395 | W | Unclassified | 5/26/2004 | 57 | $56,256.02 | $986.95 | 7.8746% | -1.10377 | 0 | $12,533.25 | 4.0981 | 0 |
| 100042420 | 4 | $715,822 | W | Unclassified | 3/17/2004 | 97 | $4,036.38 | $41.61 | 0.5639% | -2.24881 | 0 | $7,379.61 | 3.8680 | 0 |
| 100041998 | 4 | $719,568 | W | Roadway Widening, | 8/22/2003 | 27 | $19,703.59 | $729.76 | 2.7383% | -1.56253 | 0 | $26,650.67 | 4.4257 | 0 |
| 100044423 | 4 | $722,889 | W | Unclassified | 11/17/2004 | 42 | $32,767.12 | $780.17 | 4.5328% | -1.34363 | 0 | $17,211.64 | 4.2358 | 0 |
| 100043560 | 4 | $723,005 | W | Unclassified | 3/4/2005 | 117 | $153,154.97 | $1,309.02 | 21.1831% | -0.67401 | 0 | $6,179.53 | 3.7910 | 0 |
| 100043250 | 4 | $724,778 | W | Roadway Widening, | 12/22/2005 | 30 | $49,034.67 | $1,634.49 | 6.7655% | -1.16970 | 0 | $24,159.27 | 4.3831 | 0 |
| 100041061 | 4 | $727,561 | W | Unclassified | 2/11/2003 | 43 | $173,678.40 | $4,039.03 | 23.8713% | -0.62212 | 0 | $16,920.02 | 4.2284 | 0 |
| 100042787 | 4 | $729,489 | W | Unclassified | 4/21/2003 | 47 | $55,583.65 | $1,182.63 | 7.6195% | -1.11807 | 0 | $15,521.04 | 4.1909 | 0 |
| 100041957 | 4 | $736,744 | W | Roadway Widening, | 11/10/2003 | 43 | $41,288.98 | $960.21 | 5.6043% | -1.25148 | 0 | $17,133.58 | 4.2338 | 0 |
| 100004276 | 4 | $736,978 | W | Grade Drain Base P | 7/17/2003 | 93 | $16,117.16 | $173.30 | 2.1869% | -1.66017 | 0 | $7,924.49 | 3.8990 | 0 |
| 100044938 | 4 | $737,774 | W | Roadway Widening, | 12/20/2005 | 61 | $4,187.30 | $68.64 | 0.5676% | -2.24599 | 0 | $12,094.66 | 4.0826 | 0 |
| 100046245 | 4 | $737,860 | W | Unclassified | 10/6/2005 | 30 | $33,334.54 | $1,111.15 | 4.5177% | -1.34508 | 0 | $24,595.33 | 4.3909 | 0 |
| 100045558 | 4 | $738,681 | W | Unclassified | 9/14/2005 | 55 | $16,359.68 | $297.45 | 2.2147% | -1.65468 | 0 | $13,430.56 | 4.1281 | 0 |
| 100044291 | 4 | $743,758 | W | Unclassified | 11/19/2004 | 21 | $31,183.60 | $1,484.93 | 4.1927% | -1.37751 | 0 | $35,417.05 | 4.5492 | 0 |
| 100043463 | 4 | $747,312 | W | Unclassified | 7/28/2004 | 29 | $60,669.40 | $2,092.05 | 8.1183% | -1.09053 | 0 | $25,769.38 | 4.4111 | 0 |
| 100044360 | 4 | $747,724 | W | Unclassified | 4/15/2005 | 40 | $65,823.06 | $1,645.58 | 8.8031% | -1.05536 | 0 | $18,693.10 | 4.2717 | 0 |
| 100044364 | 4 | $755,222 | W | Unclassified | 3/23/2005 | 31 | $69,480.05 | $2,241.29 | 9.2000% | -1.03621 | 0 | $24,362.00 | 4.3867 | 0 |
| 100003839 | 4 | $762,000 | W | Structure Removal | 12/1/2003 | 81 | $90,940.03 | $1,122.72 | 11.9344% | -0.92320 | 0 | $9,407.41 | 3.9735 | 0 |
| 100039932 | 4 | $762,847 | W | Unclassified | 3/4/2004 | 120 | $11,623.41 | $96.86 | 1.5237% | -1.81710 | 0 | $6,357.06 | 3.8033 | 0 |
| 100040625 | 4 | $762,882 | W | Bridge Replacement | 10/21/2003 | 129 | $91,271.76 | $707.53 | 11.9641% | -0.92212 | 0 | $5,913.81 | 3.7719 | 0 |
| 100040436 | 4 | $764,026 | W | Pavement Rehab, R | 10/24/2003 | 88 | $110,817.48 | $1,259.29 | 14.5044% | -0.83850 | 0 | $8,682.11 | 3.9386 | 0 |
| 100042823 | 4 | $775,192 | W | Unclassified | 11/14/2003 | 34 | $6,202.00 | $182.41 | 0.8001% | -2.09688 | 0 | $22,799.76 | 4.3579 | 0 |
| 100039238 | 4 | $775,831 | W | Unclassified | 6/9/2003 | 44 | $198,972.56 | $4,522.10 | 25.6464% | -0.59097 | 0 | $17,632.52 | 4.2463 | 0 |
| 100042350 | 4 | $780,804 | W | Bridge Replacement | 1/23/2004 | 90 | $43,123.10 | $479.15 | 5.5229% | -1.25783 | 0 | $8,675.60 | 3.9383 | 0 |
| 100042327 | 4 | $790,421 | W | Unclassified | 9/19/2003 | 58 | $64,145.29 | $1,105.95 | 8.1153% | -1.09069 | 0 | $13,627.95 | 4.1344 | 0 |
| 100043000 | 4 | $793,618 | W | Grade Drain Base P | 5/25/2004 | 132 | $46,128.79 | $349.46 | 5.8125% | -1.23564 | 0 | $6,012.26 | 3.7790 | 0 |
| 100042135 | 4 | $796,718 | W | Unclassified | 3/1/2004 | 104 | $111,035.84 | $1,067.65 | 13.9367% | -0.85584 | 0 | $7,660.75 | 3.8843 | 0 |
| 100043912 | 4 | $797,100 | W | Unclassified | 7/26/2004 | 92 | $72,950.23 | $792.94 | 9.1520% | -1.03849 | 0 | $8,664.13 | 3.9377 | 0 |
| 100041795 | 4 | $797,979 | W | Unclassified | 2/14/2003 | 43 | $76,736.90 | $1,784.58 | 9.6164% | -1.01699 | 0 | $18,557.65 | 4.2685 | 0 |
| 100042788 | 4 | $799,920 | W | Unclassified | 8/20/2003 | 50 | $98,419.55 | $1,968.39 | 12.3037% | -0.90997 | 0 | $15,998.40 | 4.2041 | 0 |
| 100044368 | 4 | $804,938 | W | Unclassified | 6/22/2005 | 64 | $182,248.80 | $2,847.64 | 22.6413% | -0.64510 | 0 | $12,577.16 | 4.0996 | 0 |
| 100033471 | 4 | $805,577 | W | Unclassified | 5/28/2004 | 107 | $262,280.02 | $2,451.22 | 32.5580% | -0.48734 | 0 | $7,528.76 | 3.8767 | 0 |
| 100041144 | 4 | $816,420 | W | Unclassified | 4/28/2004 | 98 | $13,834.50 | $141.17 | 1.6945% | -1.77095 | 0 | $8,330.82 | 3.9207 | 0 |
| 100042311 | 4 | $817,448 | W | Unclassified | 10/28/2003 | 31 | $114,354.06 | $3,688.84 | 13.9892% | -0.85421 | 0 | $26,369.29 | 4.4211 | 0 |
| 100042745 | 4 | $821,875 | W | Unclassified | 4/6/2004 | 45 | $124,789.62 | $2,773.10 | 15.1835% | -0.81863 | 0 | $18,263.89 | 4.2616 | 0 |
| 100041471 | 4 | $824,054 | W | Bridge Replacement | 10/20/2003 | 117 | $26,753.82 | $228.67 | 3.2466% | -1.48857 | 0 | $7,043.20 | 3.8478 | 0 |
| 100041109 | 4 | $825,137 | W | Unclassified | 2/18/2003 | 45 | $57,399.28 | $1,275.54 | 6.9563% | -1.15762 | 0 | $18,336.38 | 4.2633 | 0 |
| 100044415 | 4 | $826,488 | W | Unclassified | 7/23/2004 | 33 | $85,927.26 | $2,603.86 | 10.3967% | -0.98311 | 0 | $25,045.09 | 4.3987 | 0 |
| 100041469 | 4 | $828,352 | W | Bridge Replacement | 9/25/2003 | 130 | $3,520.33 | $27.08 | 0.4250% | -2.37163 | 0 | $6,371.94 | 3.8043 | 0 |
| 100041153 | 4 | $829,016 | W | Unclassified | 10/20/2003 | 45 | $60,251.85 | $1,338.93 | 7.2679% | -1.13859 | 0 | $18,422.58 | 4.2654 | 0 |
| 100044385 | 4 | $831,864 | W | Unclassified | 10/19/2005 | 40 | $130,587.08 | $3,264.68 | 15.6981% | -0.80415 | 0 | $20,796.60 | 4.3180 | 0 |
| 100042681 | 4 | $832,564 | W | Unclassified | 12/8/2004 | 62 | $112,912.74 | $1,821.17 | 13.5620% | -0.86767 | 0 | $13,428.45 | 4.1280 | 0 |
| 100033237 | 4 | $832,940 | W | Grade Drain Base P | 1/12/2005 | 48 | $143,102.83 | $2,981.31 | 17.1804% | -0.76497 | 0 | $17,352.92 | 4.2394 | 0 |
| 100045654 | 4 | $837,644 | W | Unclassified | 11/30/2005 | 30 | $132,132.58 | $4,404.42 | 15.7743% | -0.80205 | 0 | $27,921.47 | 4.4459 | 0 |
| 100009106 | 4 | $839,658 | W | Lighting | 11/25/2003 | 63 | $259,125.48 | $4,113.10 | 30.8608% | -0.51059 | 0 | $13,327.90 | 4.1248 | 0 |
| 100040909 | 4 | $840,432 | W | Intersection Improve | 3/16/2005 | 51 | $110,883.46 | $2,174.19 | 13.1936% | -0.87964 | 0 | $16,479.06 | 4.2169 | 0 |
| 100044367 | 4 | $846,885 | W | Unclassified | 11/4/2004 | 51 | $144,614.36 | $2,835.58 | 17.0760% | -0.76761 | 0 | $16,605.59 | 4.2203 | 0 |
| 100042059 | 4 | $847,074 | W | Unclassified | 6/26/2003 | 103 | $11,356.19 | $110.25 | 1.3406% | -1.87269 | 0 | $8,224.02 | 3.9151 | 0 |
| 100042732 | 4 | $859,284 | W | Unclassified | 9/10/2004 | 45 | $66,291.48 | $1,473.14 | 7.7147% | -1.11268 | 0 | $19,095.20 | 4.2809 | 0 |
| 100042774 | 4 | $860,441 | W | Unclassified | 5/11/2004 | 79 | $150,456.30 | $1,904.51 | 17.4860% | -0.75731 | 0 | $10,891.66 | 4.0371 | 0 |
| 100044383 | 4 | $860,943 | W | Unclassified | 6/20/2005 | 50 | $73,678.95 | $1,473.58 | 8.5579% | -1.06763 | 0 | $17,218.86 | 4.2360 | 0 |
| 100042349 | 4 | $865,060 | W | Roadway Widening, | 10/25/2004 | 39 | $33,635.66 | $862.45 | 3.8882% | -1.41025 | 0 | $22,181.03 | 4.3460 | 0 |
| 100042695 | 4 | $865,337 | W | Unclassified | 12/10/2003 | 45 | $88,464.48 | $1,965.88 | 10.2231% | -0.99042 | 0 | $19,229.71 | 4.2840 | 0 |
| 100041922 | 4 | $870,599 | W | Unclassified | 2/25/2005 | 90 | $53,891.27 | $598.79 | 6.1901% | -1.20830 | 0 | $9,673.32 | 3.9856 | 0 |
| 100045096 | 4 | $871,044 | W | Unclassified | 11/10/2005 | 52 | $137,128.61 | $2,637.09 | 15.7430% | -0.80291 | 0 | $16,750.85 | 4.2240 | 0 |
| 100044908 | 4 | $882,456 | W | Pavement Rehab, R | 5/11/2005 | 40 | $8,506.56 | $212.66 | 0.9640% | -2.01594 | 0 | $22,061.40 | 4.3436 | 0 |
| 100040941 | 4 | $883,714 | W | Unclassified | 9/1/2004 | 203 | $50,596.56 | $249.24 | 5.7254% | -1.24219 | 0 | $4,353.27 | 3.6388 | 0 |
| 100041103 | 4 | $884,249 | W | Unclassified | 6/24/2003 | 36 | $64,391.12 | $1,788.64 | 7.2820% | -1.13775 | 0 | $24,562.47 | 4.3903 | 0 |
| 100044156 | 4 | $886,121 | W | Unclassified | 11/10/2005 | 30 | $45,516.52 | $1,517.22 | 5.1366% | -1.28932 | 0 | $29,537.37 | 4.4704 | 0 |
| 100043617 | 4 | $889,267 | W | Pavement Rehab, R | 8/19/2005 | 53 | $15,452.26 | $291.55 | 1.7376% | -1.76004 | 0 | $16,778.62 | 4.2248 | 0 |
| 100044398 | 4 | $892,392 | W | Unclassified | 12/6/2004 | 30 | $53,496.21 | $1,783.21 | 5.9947% | -1.22223 | 0 | $29,746.40 | 4.4734 | 0 |
| 100042806 | 4 | $893,585 | W | Unclassified | 3/31/2004 | 94 | $80,105.37 | $852.18 | 8.9645% | -1.04747 | 0 | $9,506.22 | 3.9780 | 0 |
| 100045243 | 4 | $894,898 | W | Pavement Rehab, R | 9/8/2005 | 29 | $35,279.38 | $1,216.53 | 3.9423% | -1.40425 | 0 | $30,858.55 | 4.4894 | 0 |
| 100040088 | 4 | $895,854 | W | Intersection Improve | 7/14/2003 | 31 | $46,056.07 | $1,485.68 | 5.1410% | -1.28895 | 0 | $28,898.52 | 4.4609 | 0 |
| 100042729 | 4 | $899,870 | W | Unclassified | 9/2/2004 | 44 | $82,677.02 | $1,879.02 | 9.1877% | -1.03679 | 0 | $20,451.59 | 4.3107 | 0 |
| 100042321 | 4 | $900,972 | W | Unclassified | 9/8/2004 | 40 | $69,054.84 | $1,726.37 | 7.6645% | -1.11552 | 0 | $22,524.30 | 4.3527 | 0 |
| 100042819 | 4 | $903,856 | W | Pavement Rehab, R | 7/8/2004 | 54 | $53,984.02 | $999.70 | 5.9726% | -1.22383 | 0 | $16,738.07 | 4.2237 | 0 |
| 100042045 | 4 | $905,077 | W | Unclassified | 8/28/2003 | 43 | $21,698.93 | $504.63 | 2.3975% | -1.62025 | 0 | $21,048.30 | 4.3232 | 0 |
| 100045603 | 4 | $906,270 | W | Unclassified | 10/28/2005 | 45 | $190,916.43 | $4,242.59 | 21.0662% | -0.67641 | 0 | $20,139.33 | 4.3040 | 0 |
| 100044376 | 4 | $907,217 | W | Unclassified | 4/4/2005 | 75 | $40,888.61 | $545.18 | 4.5070% | -1.34611 | 0 | $12,096.23 | 4.0826 | 0 |
| 100043208 | 4 | $909,494 | W | Pavement Rehab, R | 4/19/2004 | 72 | $16,597.43 | $230.52 | 1.8249% | -1.73876 | 0 | $12,631.86 | 4.1015 | 0 |
| 100042750 | 4 | $909,712 | W | Unclassified | 3/26/2004 | 41 | $150,750.88 | $3,676.85 | 16.5713% | -0.78064 | 0 | $22,188.10 | 4.3461 | 0 |
| 100042869 | 4 | $916,469 | W | Unclassified | 9/27/2004 | 45 | $3,039.52 | $67.54 | 0.3317% | -2.47931 | 0 | $20,365.98 | 4.3089 | 0 |
| 100039821 | 4 | $919,217 | W | Signals, Markings, S | 9/29/2004 | 86 | $106,170.65 | $1,234.54 | 11.5501% | -0.93741 | 0 | $10,688.57 | 4.0289 | 0 |
| 100044137 | 4 | $931,167 | W | Unclassified | 7/28/2004 | 30 | $23,280.32 | $776.01 | 2.5001% | -1.60204 | 0 | $31,038.90 | 4.4919 | 0 |
| 100042799 | 4 | $932,116 | W | Unclassified | 8/25/2005 | 40 | $21,063.62 | $526.59 | 2.2598% | -1.64594 | 0 | $23,302.90 | 4.3674 | 0 |
| 100041545 | 4 | $942,919 | W | Bridge Repair, Bridg | 8/4/2003 | 172 | $9,951.44 | $57.86 | 1.0554% | -1.97659 | 0 | $5,482.09 | 3.7389 | 0 |
| 100039976 | 4 | $943,131 | W | Grade Drain Base P | 2/3/2005 | 82 | $39,210.69 | $478.18 | 4.1575% | -1.38117 | 0 | $11,501.60 | 4.0608 | 0 |
| 100045715 | 4 | $945,941 | W | Unclassified | 8/22/2005 | 39 | $107,493.61 | $2,756.25 | 11.3637% | -0.94448 | 0 | $24,254.90 | 4.3848 | 0 |
| 100042798 | 4 | $946,201 | W | Unclassified | 8/25/2005 | 40 | $15,559.87 | $389.00 | 1.6445% | -1.78398 | 0 | $23,655.03 | 4.3739 | 0 |
| 100042363 | 4 | $946,397 | W | Pavement Rehab, R | 10/9/2003 | 48 | $66,074.99 | $1,376.56 | 6.9817% | -1.15604 | 0 | $19,716.60 | 4.2948 | 0 |
| 100044946 | 4 | $951,977 | W | Unclassified | 7/27/2005 | 64 | $29,726.65 | $464.48 | 3.1226% | -1.50548 | 0 | $14,874.64 | 4.1724 | 0 |
| 100042844 | 4 | $954,813 | W | Unclassified | 5/27/2004 | 31 | $207,397.23 | $6,690.23 | 21.7212% | -0.66312 | 0 | $30,800.42 | 4.4886 | 0 |
| 100043772 | 4 | $955,263 | W | Bridge Replacement | 11/8/2004 | 93 | $176,920.62 | $1,902.37 | 18.5206% | -0.73234 | 0 | $10,271.65 | 4.0116 | 0 |
| 100042631 | 4 | $955,495 | W | Bridge Replacement | 4/9/2004 | 118 | $23,853.38 | $202.15 | 2.4964% | -1.60268 | 0 | $8,097.42 | 3.9083 | 0 |
| 100041095 | 4 | $959,018 | W | Unclassified | 2/11/2003 | 34 | $100,211.55 | $2,947.40 | 10.4494% | -0.98091 | 0 | $28,206.41 | 4.4503 | 0 |
| 100044236 | 4 | $960,184 | W | Unclassified | 3/10/2005 | 39 | $133,373.26 | $3,419.83 | 13.8904% | -0.85729 | 0 | $24,620.10 | 4.3913 | 0 |
| 100040777 | 4 | $963,018 | W | Grade Drain Base P | 7/11/2003 | 120 | $38,797.92 | $323.32 | 4.0288% | -1.39483 | 0 | $8,025.15 | 3.9045 | 0 |
| 100032853 | 4 | $972,995 | W | Grade Drain Base P | 5/7/2004 | 97 | $344,981.71 | $3,556.51 | 35.4557% | -0.45031 | 0 | $10,030.88 | 4.0013 | 0 |
| 100045711 | 4 | $973,681 | W | Unclassified | 11/9/2005 | 28 | $122,160.96 | $4,362.89 | 12.5463% | -0.90148 | 0 | $34,774.32 | 4.5413 | 0 |
| 100041100 | 4 | $976,650 | W | Unclassified | 4/16/2003 | 49 | $161,727.45 | $3,300.56 | 16.5594% | -0.78096 | 0 | $19,931.63 | 4.2995 | 0 |
| 100043884 | 4 | $977,195 | W | Roadway Widening, | 1/4/2005 | 44 | $23,977.58 | $544.95 | 2.4537% | -1.61018 | 0 | $22,208.98 | 4.3465 | 0 |
| 100043612 | 4 | $977,302 | W | Unclassified | 3/3/2005 | 63 | $27,248.11 | $432.51 | 2.7881% | -1.55469 | 0 | $15,512.73 | 4.1907 | 0 |
| 100044989 | 4 | $977,980 | W | Pavement Rehab, R | 9/7/2005 | 55 | $29,711.04 | $540.20 | 3.0380% | -1.51741 | 0 | $17,781.45 | 4.2500 | 0 |
| 100043928 | 4 | $982,575 | W | Pavement Rehab, R | 7/8/2005 | 44 | $43,478.13 | $988.14 | 4.4249% | -1.35409 | 0 | $22,331.25 | 4.3489 | 0 |
| 100040692 | 4 | $988,477 | W | Unclassified | 5/27/2003 | 58 | $237,270.21 | $4,090.87 | 24.0036% | -0.61972 | 0 | $17,042.71 | 4.2315 | 0 |
| 100042705 | 4 | $993,079 | W | Unclassified | 2/19/2004 | 33 | $50,940.16 | $1,543.64 | 5.1295% | -1.28992 | 0 | $30,093.30 | 4.4785 | 0 |
| 100044910 | 4 | $998,463 | W | Unclassified | 6/8/2005 | 63 | $48,449.46 | $769.04 | 4.8524% | -1.31404 | 0 | $15,848.62 | 4.2000 | 0 |

| CPMS Proj # | Size | Original Contract Amt | C/W | Code Description | Completion Date | Days Used | E&I Amt | Daily E&I | % E&I to CV | Log % E&I | outlier (2stdev) | Contract $$ per Day | Log $perDay | outlier (2stdev) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100005025 | 4 | $998,626 | W | Unclassified | 10/4/2004 | 125 | $501,794.49 | $4,014.36 | 50.2485% | -0.29888 | 0 | $7,989.01 | 3.9025 | 0 |
| 100037307 | 4 | $1,000,000 | W | Unclassified | 6/13/2005 | 170 | $349,820.40 | $2,057.77 | 34.9820% | -0.45615 | 0 | $5,882.35 | 3.7696 | 0 |
| 100041794 | 5 | $1,005,082 | W | Unclassified | 8/4/2003 | 41 | $120,343.01 | $2,935.20 | 11.9735% | -0.92178 | 0 | $24,514.20 | 4.3894 | 0 |
| 100041170 | 5 | $1,008,398 | W | Unclassified | 8/1/2003 | 46 | $222,665.97 | $4,840.56 | 22.0812% | -0.65598 | 0 | $21,921.70 | 4.3409 | 0 |
| 100044412 | 5 | $1,015,999 | W | Unclassified | 5/20/2005 | 48 | $125,466.56 | $2,613.89 | 12.3491% | -0.90837 | 0 | $21,166.65 | 4.3257 | 0 |
| 100044365 | 5 | $1,018,100 | W | Pavement Rehab, R | 10/5/2004 | 36 | $34,739.96 | $965.00 | 3.4122% | -1.46696 | 0 | $28,280.56 | 4.4515 | 0 |
| 100042942 | 5 | $1,020,785 | W | Unclassified | 1/16/2004 | 45 | $104,780.18 | $2,328.45 | 10.2647% | -0.98866 | 0 | $22,684.11 | 4.3557 | 0 |
| 100044480 | 5 | $1,025,057 | W | Unclassified | 10/27/2004 | 60 | $56,850.42 | $947.51 | 5.5461% | -1.25601 | 0 | $17,084.28 | 4.2326 | 0 |
| 100039393 | 5 | $1,029,410 | W | Unclassified | 2/21/2003 | 50 | $140,748.77 | $2,814.98 | 13.6728% | -0.86414 | 0 | $20,588.20 | 4.3136 | 0 |
| 100043155 | 5 | $1,053,247 | W | Pavement Rehab, R | 1/21/2004 | 55 | $49,900.29 | $907.28 | 4.7378% | -1.32443 | 0 | $19,149.95 | 4.2822 | 0 |
| 100040703 | 5 | $1,056,105 | W | Unclassified | 3/6/2003 | 63 | $394,855.40 | $6,267.55 | 37.3879% | -0.42727 | 0 | $16,763.57 | 4.2244 | 0 |
| 100043672 | 5 | $1,056,812 | W | Intersection Improve | 6/9/2004 | 39 | $68,284.78 | $1,750.89 | 6.4614% | -1.18967 | 0 | $27,097.74 | 4.4329 | 0 |
| 100045714 | 5 | $1,058,502 | W | Unclassified | 6/21/2005 | 36 | $107,906.48 | $2,997.40 | 10.1943% | -0.99164 | 0 | $29,402.83 | 4.4684 | 0 |
| 100041116 | 5 | $1,069,984 | W | Pavement Rehab, R | 7/29/2003 | 79 | $73,440.34 | $929.62 | 6.8637% | -1.16344 | 0 | $13,544.10 | 4.1318 | 0 |
| 100044759 | 5 | $1,070,240 | W | Unclassified | 8/15/2005 | 49 | $13,077.23 | $266.88 | 1.2219% | -1.91297 | 0 | $21,841.63 | 4.3393 | 0 |
| 100044464 | 5 | $1,072,106 | W | Unclassified | 8/18/2005 | 57 | $171,674.33 | $3,011.83 | 16.0128% | -0.79553 | 0 | $18,808.88 | 4.2744 | 0 |
| 100040455 | 5 | $1,074,881 | W | Unclassified | 8/28/2003 | 40 | $110,661.82 | $2,766.55 | 10.2953% | -0.98736 | 0 | $26,872.03 | 4.4293 | 0 |
| 100038019 | 5 | $1,075,043 | W | Unclassified | 9/20/2005 | 150 | $177,943.84 | $1,186.29 | 16.5523% | -0.78114 | 0 | $7,166.95 | 3.8553 | 0 |
| 100044378 | 5 | $1,081,706 | W | Unclassified | 10/26/2004 | 34 | $50,777.28 | $1,493.45 | 4.6942% | -1.32844 | 0 | $31,814.88 | 4.5026 | 0 |
| 100040279 | 5 | $1,082,659 | W | Bridge Replacement | 4/19/2004 | 114 | $65,348.27 | $573.23 | 6.0359% | -1.21926 | 0 | $9,497.01 | 3.9776 | 0 |
| 100041003 | 5 | $1,087,794 | W | Bridge Replacement | 4/3/2003 | 190 | $125,749.38 | $661.84 | 11.5600% | -0.93704 | 0 | $5,725.23 | 3.7578 | 0 |
| 100041063 | 5 | $1,097,157 | W | Unclassified | 3/3/2003 | 44 | $65,494.04 | $1,488.50 | 5.9694% | -1.22407 | 0 | $24,935.39 | 4.3968 | 0 |
| 100040553 | 5 | $1,097,995 | W | Bridge Repair, Bridg | 7/15/2003 | 86 | $148,385.68 | $1,725.41 | 13.5142% | -0.86921 | 0 | $12,767.38 | 4.1061 | 0 |
| 100044358 | 5 | $1,099,673 | W | Unclassified | 3/30/2005 | 41 | $166,260.67 | $4,055.14 | 15.1191% | -0.82047 | 0 | $26,821.29 | 4.4285 | 0 |
| 100041900 | 5 | $1,105,358 | W | Pavement Rehab, R | 8/15/2003 | 50 | $60,058.69 | $1,201.17 | 5.4334% | -1.26493 | 0 | $22,107.16 | 4.3445 | 0 |
| 100042737 | 5 | $1,109,935 | W | Unclassified | 3/17/2004 | 52 | $98,411.60 | $1,892.53 | 8.8664% | -1.05225 | 0 | $21,344.90 | 4.3293 | 0 |
| 100044884 | 5 | $1,114,500 | W | Unclassified | 9/16/2005 | 49 | $65,799.30 | $1,342.84 | 5.9039% | -1.22886 | 0 | $22,744.90 | 4.3569 | 0 |
| 100003005 | 5 | $1,143,065 | W | Unclassified | 6/14/2004 | 130 | $362,286.77 | $2,786.82 | 31.6943% | -0.49902 | 0 | $8,792.81 | 3.9441 | 0 |
| 100045716 | 5 | $1,144,982 | W | Unclassified | 11/9/2005 | 21 | $115,844.69 | $5,516.41 | 10.1176% | -0.99492 | 0 | $54,522.95 | 4.7366 | 0 |
| 100042740 | 5 | $1,154,097 | W | Unclassified | 1/4/2005 | 63 | $138,667.19 | $2,201.07 | 12.0152% | -0.92027 | 0 | $18,319.00 | 4.2629 | 0 |
| 100042367 | 5 | $1,157,504 | W | Pavement Rehab, R | 6/21/2004 | 49 | $45,415.89 | $926.85 | 3.9236% | -1.40631 | 0 | $23,622.53 | 4.3733 | 0 |
| 100040875 | 5 | $1,157,766 | W | Pavement Rehab, R | 4/14/2005 | 177 | $96,010.31 | $542.43 | 8.2927% | -1.08130 | 0 | $6,541.05 | 3.8156 | 0 |
| 100044882 | 5 | $1,162,778 | W | Unclassified | 9/15/2005 | 46 | $14,304.45 | $310.97 | 1.2302% | -1.91003 | 0 | $25,277.78 | 4.4027 | 0 |
| 100042780 | 5 | $1,165,257 | W | Unclassified | 6/14/2004 | 50 | $71,363.11 | $1,427.26 | 6.1242% | -1.21295 | 0 | $23,305.14 | 4.3675 | 0 |
| 100009067 | 5 | $1,166,251 | W | Grade Drain Base P | 9/4/2003 | 175 | $531,813.75 | $3,038.94 | 45.6003% | -0.34103 | 0 | $6,664.29 | 3.8238 | 0 |
| 100044889 | 5 | $1,167,949 | W | Pavement Rehab, R | 10/6/2005 | 60 | $27,760.51 | $462.68 | 2.3769% | -1.62400 | 0 | $19,465.82 | 4.2893 | 0 |
| 100041988 | 5 | $1,168,752 | W | Pavement Rehab, R | 9/17/2003 | 129 | $40,887.48 | $316.96 | 3.4984% | -1.45613 | 0 | $9,060.09 | 3.9571 | 0 |
| 100039170 | 5 | $1,171,578 | W | Unclassified | 3/29/2005 | 176 | $248,971.99 | $1,414.61 | 21.2510% | -0.67262 | 0 | $6,656.69 | 3.8233 | 0 |
| 100042399 | 5 | $1,180,644 | W | Unclassified | 12/12/2003 | 87 | $61,950.56 | $712.08 | 5.2472% | -1.28007 | 0 | $13,570.62 | 4.1326 | 0 |
| 100037570 | 5 | $1,190,268 | W | Unclassified | 8/14/2003 | 90 | $10,000.00 | $111.11 | 0.8401% | -2.07564 | 0 | $13,225.20 | 4.1214 | 0 |
| 100038409 | 5 | $1,192,800 | W | Unclassified | 2/18/2005 | 118 | $179,899.50 | $1,524.57 | 15.0821% | -0.82154 | 0 | $10,108.47 | 4.0047 | 0 |
| 100044359 | 5 | $1,194,664 | W | Unclassified | 10/15/2004 | 40 | $99,729.09 | $2,493.23 | 8.3479% | -1.07842 | 0 | $29,866.60 | 4.4752 | 0 |
| 100044392 | 5 | $1,198,157 | W | Unclassified | 2/3/2005 | 50 | $111,952.91 | $2,239.06 | 9.3438% | -1.02948 | 0 | $23,963.14 | 4.3795 | 0 |
| 100043402 | 5 | $1,203,396 | W | Unclassified | 10/16/2004 | 77 | $54,569.13 | $708.69 | 4.5346% | -1.34346 | 0 | $15,628.52 | 4.1939 | 0 |
| 100044436 | 5 | $1,216,202 | W | Unclassified | 12/18/2004 | 52 | $103,305.62 | $1,986.65 | 8.4941% | -1.07088 | 0 | $23,388.50 | 4.3690 | 0 |
| 100043408 | 5 | $1,228,516 | W | Unclassified | 10/21/2004 | 113 | $178,056.43 | $1,575.72 | 14.4936% | -0.83882 | 0 | $10,871.82 | 4.0363 | 0 |
| 100043542 | 5 | $1,230,731 | W | Pavement Rehab, R | 11/18/2005 | 105 | $46,913.50 | $446.80 | 3.8118% | -1.41887 | 0 | $11,721.25 | 4.0690 | 0 |
| 100033518 | 5 | $1,234,117 | W | Bridge Replacement | 6/10/2003 | 228 | $488,114.83 | $2,140.85 | 39.5517% | -0.40283 | 0 | $5,412.79 | 3.7334 | 0 |
| 100043945 | 5 | $1,240,745 | W | Guardrail | 8/6/2004 | 58 | $26,047.11 | $449.09 | 2.0993% | -1.67792 | 0 | $21,392.16 | 4.3303 | 0 |
| 100044153 | 5 | $1,258,300 | W | Unclassified | 11/2/2005 | 55 | $74,892.08 | $1,361.67 | 5.9518% | -1.22535 | 0 | $22,878.18 | 4.3594 | 0 |
| 100041769 | 5 | $1,265,739 | W | Bridge Replacement | 5/7/2003 | 149 | $14,424.63 | $96.81 | 1.1396% | -1.94324 | 0 | $8,494.89 | 3.9292 | 0 |
| 100042847 | 5 | $1,266,429 | W | Unclassified | 5/10/2004 | 52 | $302,680.95 | $5,820.79 | 23.9003% | -0.62160 | 0 | $24,354.40 | 4.3866 | 0 |
| 100043154 | 5 | $1,269,075 | W | Unclassified | 8/16/2004 | 142 | $10,741.06 | $75.64 | 0.8464% | -2.07244 | 0 | $8,937.15 | 3.9512 | 0 |
| 100042781 | 5 | $1,269,253 | W | Unclassified | 1/10/2005 | 82 | $156,687.56 | $1,910.82 | 12.3449% | -0.90851 | 0 | $15,478.70 | 4.1897 | 0 |
| 100044382 | 5 | $1,271,900 | W | Unclassified | 12/2/2005 | 43 | $67,744.74 | $1,575.46 | 5.3263% | -1.27358 | 0 | $29,579.07 | 4.4710 | 0 |
| 100044410 | 5 | $1,274,727 | W | Unclassified | 1/14/2005 | 60 | $72,372.52 | $1,206.21 | 5.6775% | -1.24584 | 0 | $21,245.45 | 4.3273 | 0 |
| 100042324 | 5 | $1,278,515 | W | Unclassified | 3/25/2003 | 44 | $160,148.27 | $3,639.73 | 12.5261% | -0.90218 | 0 | $29,057.16 | 4.4633 | 0 |
| 100043555 | 5 | $1,282,349 | W | Grade Drain Base P | 4/5/2005 | 140 | $53,442.54 | $381.73 | 4.1676% | -1.38012 | 0 | $9,159.64 | 3.9619 | 0 |
| 100041130 | 5 | $1,283,067 | W | Unclassified | 4/7/2004 | 95 | $205,699.79 | $2,165.26 | 16.0319% | -0.79502 | 0 | $13,505.97 | 4.1305 | 0 |
| 100037479 | 5 | $1,286,738 | W | Pavement Rehab, R | 8/27/2004 | 89 | $64,180.34 | $721.13 | 4.9878% | -1.30209 | 0 | $14,457.73 | 4.1601 | 0 |
| 100008986 | 5 | $1,290,426 | W | Lighting | 8/2/2004 | 111 | $411,304.75 | $3,705.45 | 31.8736% | -0.49657 | 0 | $11,625.46 | 4.0654 | 0 |
| 100042800 | 5 | $1,293,071 | W | Unclassified | 8/23/2004 | 53 | $10,828.95 | $204.32 | 0.8375% | -2.07704 | 0 | $24,397.57 | 4.3873 | 0 |
| 100042791 | 5 | $1,296,274 | W | Unclassified | 3/29/2004 | 45 | $72,065.43 | $1,601.45 | 5.5594% | -1.25497 | 0 | $28,806.09 | 4.4595 | 0 |
| 100033171 | 5 | $1,299,348 | W | Signals, Markings, S | 11/16/2004 | 76 | $130,783.70 | $1,720.84 | 10.0653% | -0.99717 | 0 | $17,096.68 | 4.2329 | 0 |
| 100042778 | 5 | $1,309,210 | W | Unclassified | 4/2/2004 | 61 | $15,249.58 | $249.99 | 1.1648% | -1.93375 | 0 | $21,462.46 | 4.3317 | 0 |
| 100038691 | 5 | $1,328,186 | W | Unclassified | 11/9/2004 | 150 | $317,658.22 | $2,117.72 | 23.9167% | -0.62130 | 0 | $8,854.57 | 3.9472 | 0 |
| 100044151 | 5 | $1,331,535 | W | Unclassified | 11/29/2004 | 45 | $15,525.27 | $345.01 | 1.1660% | -1.93331 | 0 | $29,589.67 | 4.4711 | 0 |
| 100039398 | 5 | $1,342,597 | W | Unclassified | 3/4/2003 | 67 | $105,446.49 | $1,573.83 | 7.8539% | -1.10491 | 0 | $20,038.76 | 4.3019 | 0 |
| 100042812 | 5 | $1,349,710 | W | Unclassified | 10/25/2004 | 43 | $80,720.65 | $1,877.22 | 5.9806% | -1.22326 | 0 | $31,388.60 | 4.4968 | 0 |
| 100038297 | 5 | $1,350,150 | W | Unclassified | 6/24/2005 | 192 | $431,839.68 | $2,249.17 | 31.9846% | -0.49506 | 0 | $7,032.03 | 3.8471 | 0 |
| 100044280 | 5 | $1,357,728 | W | Unclassified | 1/18/2005 | 103 | $152,734.86 | $1,482.86 | 11.2493% | -0.94887 | 0 | $13,181.83 | 4.1200 | 0 |
| 100041311 | 5 | $1,363,629 | W | Unclassified | 4/25/2005 | 178 | $205,733.57 | $1,155.81 | 15.0872% | -0.82139 | 0 | $7,660.84 | 3.8843 | 0 |
| 100043108 | 5 | $1,367,310 | W | Bridge Replacement | 12/1/2004 | 152 | $120,507.11 | $792.81 | 8.8134% | -1.05485 | 0 | $8,995.46 | 3.9540 | 0 |
| 100035620 | 5 | $1,367,832 | W | Unclassified | 8/19/2003 | 137 | $40,423.84 | $295.06 | 2.9553% | -1.52940 | 0 | $9,984.18 | 3.9993 | 0 |
| 100044407 | 5 | $1,372,267 | W | Unclassified | 10/25/2004 | 60 | $68,043.39 | $1,134.06 | 4.9585% | -1.30465 | 0 | $22,871.12 | 4.3593 | 0 |
| 100042744 | 5 | $1,386,559 | W | Unclassified | 4/12/2004 | 39 | $186,913.06 | $4,792.64 | 13.4804% | -0.87030 | 0 | $35,552.79 | 4.5509 | 0 |
| 100042814 | 5 | $1,396,529 | W | Unclassified | 3/19/2004 | 60 | $118,813.59 | $1,980.23 | 8.5078% | -1.07018 | 0 | $23,275.48 | 4.3669 | 0 |
| 100044408 | 5 | $1,397,398 | W | Unclassified | 12/1/2004 | 60 | $66,526.44 | $1,108.77 | 4.7607% | -1.32233 | 0 | $23,289.97 | 4.3672 | 0 |
| 100045693 | 5 | $1,398,085 | W | Unclassified | 12/1/2005 | 63 | $195,431.71 | $3,102.09 | 13.9785% | -0.85454 | 0 | $22,191.83 | 4.3462 | 0 |
| 100037673 | 5 | $1,423,039 | W | Intersection Improve | 7/9/2003 | 119 | $311,025.48 | $2,613.66 | 21.8564% | -0.66042 | 0 | $11,958.31 | 4.0777 | 0 |
| 100041152 | 5 | $1,430,992 | W | Unclassified | 4/29/2003 | 67 | $61,992.59 | $925.26 | 4.3321% | -1.36330 | 0 | $21,358.09 | 4.3296 | 0 |
| 100038068 | 5 | $1,439,804 | W | Grade Drain Base P | 7/21/2003 | 237 | $224,213.84 | $946.05 | 15.5725% | -0.80764 | 0 | $6,075.12 | 3.7836 | 0 |
| 100004560 | 5 | $1,459,837 | W | Roadway Widening, | 4/14/2003 | 111 | $8,731.44 | $78.66 | 0.5981% | -2.22322 | 0 | $13,151.68 | 4.1190 | 0 |
| 100042694 | 5 | $1,461,651 | W | Unclassified | 7/27/2004 | 67 | $56,841.46 | $848.38 | 3.8889% | -1.41018 | 0 | $21,815.69 | 4.3388 | 0 |
| 100044414 | 5 | $1,464,087 | W | Unclassified | 3/23/2005 | 54 | $121,067.17 | $2,241.98 | 8.2691% | -1.08254 | 0 | $27,112.72 | 4.4332 | 0 |
| 100042964 | 5 | $1,491,990 | W | Unclassified | 4/7/2005 | 118 | $59,251.38 | $502.13 | 3.9713% | -1.40107 | 0 | $12,643.98 | 4.1019 | 0 |
| 100042742 | 5 | $1,496,793 | W | Unclassified | 5/7/2004 | 78 | $172,454.54 | $2,210.96 | 11.5216% | -0.93849 | 0 | $19,189.65 | 4.2831 | 0 |
| 100045723 | 5 | $1,497,620 | W | Unclassified | 11/14/2005 | 48 | $103,337.76 | $2,152.87 | 6.9001% | -1.16114 | 0 | $31,200.42 | 4.4942 | 0 |
| 100044361 | 5 | $1,498,895 | W | Unclassified | 10/6/2004 | 45 | $119,664.08 | $2,659.20 | 7.9835% | -1.09781 | 0 | $33,308.78 | 4.5226 | 0 |
| 100044870 | 5 | $1,512,364 | W | Pavement Rehab, R | 9/8/2005 | 70 | $79,776.31 | $1,139.66 | 5.2749% | -1.27778 | 0 | $21,605.20 | 4.3346 | 0 |
| 100042734 | 5 | $1,516,046 | W | Unclassified | 8/17/2004 | 53 | $164,453.27 | $3,102.89 | 10.8475% | -0.96467 | 0 | $28,604.64 | 4.4564 | 0 |
| 100042941 | 5 | $1,536,433 | W | Unclassified | 4/7/2004 | 60 | $158,698.08 | $2,644.97 | 10.3290% | -0.98594 | 0 | $25,607.22 | 4.4084 | 0 |
| 100042796 | 5 | $1,541,608 | W | Unclassified | 7/28/2004 | 99 | $188,507.01 | $1,904.11 | 12.2279% | -0.91265 | 0 | $15,571.80 | 4.1923 | 0 |
| 100042747 | 5 | $1,568,659 | W | Unclassified | 4/2/2004 | 58 | $293,271.38 | $5,056.40 | 18.6957% | -0.72826 | 0 | $27,045.84 | 4.4321 | 0 |
| 100011785 | 5 | $1,569,703 | W | Bridge Replacement | 3/8/2005 | 148 | $266,612.23 | $1,801.43 | 16.9849% | -0.76994 | 0 | $10,606.10 | 4.0256 | 0 |
| 100041102 | 5 | $1,569,863 | W | Unclassified | 8/9/2003 | 60 | $256,582.79 | $4,276.38 | 16.3443% | -0.78663 | 0 | $26,164.38 | 4.4177 | 0 |
| 100002480 | 5 | $1,598,919 | W | Bridge Replacement | 11/5/2004 | 204 | $603,959.81 | $2,960.59 | 37.7730% | -0.42282 | 0 | $7,837.84 | 3.8942 | 0 |
| 100042853 | 5 | $1,624,492 | W | Unclassified | 4/9/2004 | 75 | $285,180.84 | $3,802.41 | 17.5551% | -0.75560 | 0 | $21,659.89 | 4.3357 | 0 |
| 100004562 | 5 | $1,632,731 | W | Roadway Widening, | 9/16/2003 | 140 | $370,186.56 | $2,644.19 | 22.6728% | -0.64449 | 0 | $11,662.36 | 4.0668 | 0 |
| 100042621 | 5 | $1,652,324 | W | Bridge Replacement | 5/28/2004 | 148 | $60,856.52 | $411.19 | 3.6831% | -1.43379 | 0 | $11,164.35 | 4.0478 | 0 |
| 100037675 | 5 | $1,654,291 | W | Unclassified | 7/22/2004 | 119 | $460,919.35 | $3,873.27 | 27.8620% | -0.55499 | 0 | $13,901.61 | 4.1431 | 0 |
| 100044406 | 5 | $1,659,524 | W | Unclassified | 10/27/2004 | 49 | $66,761.14 | $1,362.47 | 4.0229% | -1.39546 | 0 | $33,867.84 | 4.5298 | 0 |
| 100042811 | 5 | $1,675,228 | W | Unclassified | 10/21/2004 | 69 | $98,794.83 | $1,431.81 | 5.8974% | -1.22934 | 0 | $24,278.67 | 4.3852 | 0 |
| 100002576 | 5 | $1,676,433 | W | Grade Drain Base P | 7/10/2003 | 184 | $234,554.82 | $1,274.75 | 13.9913% | -0.85414 | 0 | $9,111.05 | 3.9596 | 0 |
| 100045599 | 5 | $1,682,990 | W | Unclassified | 8/31/2005 | 48 | $224,198.59 | $4,670.80 | 13.3214% | -0.87545 | 0 | $35,062.29 | 4.5448 | 0 |
| 100032730 | 5 | $1,718,925 | W | Grade Drain Base P | 7/18/2003 | 90 | $297,346.84 | $3,303.85 | 17.2984% | -0.76199 | 0 | $19,099.17 | 4.2810 | 0 |

| CPMS Proj # | Size | Original Contract Amt | C/W | Code Description | Completion Date | Days Used | E&I Amt | Daily E&I | % E&I to CV | Log % E&I | outlier (2stdev) | Contract $$ per Day | Log $perDay | outlier (2stdev) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100044270 | 5 | $1,748,275 | W | Unclassified | 7/27/2005 | 74 | $210,802.93 | $2,848.69 | 12.0578% | -0.91873 | 0 | $23,625.34 | 4.3734 | 0 |
| 100037541 | 5 | $1,751,177 | W | Unclassified | 9/27/2005 | 200 | $425,818.48 | $2,129.09 | 24.3161% | -0.61411 | 0 | $8,755.89 | 3.9423 | 0 |
| 100042923 | 5 | $1,755,556 | W | Unclassified | 1/20/2004 | 41 | $165,219.03 | $4,029.73 | 9.4112% | -1.02635 | 0 | $42,818.44 | 4.6316 | 0 |
| 100003750 | 5 | $1,765,072 | W | Unclassified | 3/15/2005 | 200 | $260,597.45 | $1,302.99 | 14.7641% | -0.83079 | 0 | $8,825.36 | 3.9457 | 0 |
| 100044237 | 5 | $1,769,249 | W | Unclassified | 8/18/2004 | 61 | $40,919.58 | $670.81 | 2.3128% | -1.63586 | 0 | $29,004.08 | 4.4625 | 0 |
| 100045768 | 5 | $1,778,925 | W | Unclassified | 11/2/2005 | 51 | $81,105.73 | $1,590.31 | 4.5593% | -1.34111 | 0 | $34,880.88 | 4.5426 | 0 |
| 100044377 | 5 | $1,780,853 | W | Unclassified | 8/3/2005 | 35 | $122,691.59 | $3,505.47 | 6.8895% | -1.16181 | 0 | $50,881.51 | 4.7066 | 0 |
| 100042795 | 5 | $1,796,938 | W | Unclassified | 8/29/2005 | 53 | $13,022.79 | $245.71 | 0.7247% | -2.13983 | 0 | $33,904.49 | 4.5303 | 0 |
| 100044366 | 5 | $1,809,537 | W | Unclassified | 4/21/2005 | 35 | $146,260.11 | $4,178.86 | 8.0827% | -1.09244 | 0 | $51,701.06 | 4.7135 | 0 |
| 100042802 | 5 | $1,810,795 | W | Unclassified | 1/26/2005 | 63 | $168,078.24 | $2,667.91 | 9.2820% | -1.03236 | 0 | $28,742.78 | 4.4585 | 0 |
| 100003521 | 5 | $1,810,932 | W | Unclassified | 4/3/2003 | 191 | $437,413.35 | $2,290.12 | 24.1540% | -0.61701 | 0 | $9,481.32 | 3.9769 | 0 |
| 100044428 | 5 | $1,829,460 | W | Unclassified | 1/14/2005 | 72 | $264,948.35 | $3,679.84 | 14.4823% | -0.83916 | 0 | $25,409.17 | 4.4050 | 0 |
| 100041536 | 5 | $1,830,032 | W | Pavement Rehab, R | 3/5/2003 | 70 | $91,792.73 | $1,311.32 | 5.0159% | -1.29965 | 0 | $26,143.31 | 4.4174 | 0 |
| 100044288 | 5 | $1,850,076 | W | Unclassified | 11/1/2005 | 76 | $291,774.16 | $3,839.13 | 15.7709% | -0.80214 | 0 | $24,343.11 | 4.3864 | 0 |
| 100044597 | 5 | $1,855,460 | W | Unclassified | 4/23/2005 | 65 | $92,475.27 | $1,422.70 | 4.9840% | -1.30243 | 0 | $28,545.54 | 4.4555 | 0 |
| 100007789 | 5 | $1,856,838 | W | Grade Drain Base P | 11/9/2004 | 175 | $577,370.17 | $3,299.26 | 31.0943% | -0.50732 | 0 | $10,610.50 | 4.0257 | 0 |
| 100042808 | 5 | $1,886,542 | W | Unclassified | 6/30/2004 | 72 | $209,548.26 | $2,910.39 | 11.1075% | -0.95438 | 0 | $26,201.97 | 4.4183 | 0 |
| 100044363 | 5 | $1,894,851 | W | Unclassified | 2/15/2005 | 59 | $127,830.33 | $2,166.62 | 6.7462% | -1.17094 | 0 | $32,116.12 | 4.5067 | 0 |
| 100042827 | 5 | $1,915,418 | W | Unclassified | 10/18/2004 | 65 | $161,631.18 | $2,486.63 | 8.4384% | -1.07374 | 0 | $29,467.97 | 4.4694 | 0 |
| 100003305 | 5 | $1,944,489 | W | Bridge Replacement | 6/19/2003 | 222 | $931,009.34 | $4,193.74 | 47.8794% | -0.31985 | 0 | $8,758.96 | 3.9425 | 0 |
| 100038300 | 5 | $1,952,120 | W | Erosion Control, Rip | 12/5/2003 | 106 | $294,146.08 | $2,774.96 | 15.0680% | -0.82194 | 0 | $18,416.23 | 4.2652 | 0 |
| 100038732 | 5 | $1,956,115 | W | Grade Drain Base P | 12/17/2003 | 104 | $370,508.55 | $3,562.58 | 18.9410% | -0.72260 | 0 | $18,808.80 | 4.2744 | 0 |
| 100008800 | 5 | $1,958,707 | W | Grade Drain Base P | 2/17/2004 | 117 | $279,592.80 | $2,389.68 | 14.2744% | -0.84544 | 0 | $16,741.09 | 4.2238 | 0 |
| 100041132 | 5 | $1,992,223 | W | Unclassified | 6/9/2004 | 52 | $177,137.71 | $3,406.49 | 8.8915% | -1.05103 | 0 | $38,311.98 | 4.5833 | 0 |
| 100033033 | 6 | $2,009,535 | W | Bridge Repair, Bridg | 4/9/2003 | 139 | $1,441,019.89 | $10,367.05 | 71.7091% | -0.14443 | 0 | $14,457.09 | 4.1601 | 0 |
| 100037219 | 6 | $2,033,934 | W | Bridge Replacement | 12/14/2005 | 151 | $515,875.47 | $3,416.39 | 25.3634% | -0.59579 | 0 | $13,469.76 | 4.1294 | 0 |
| 100040704 | 6 | $2,121,496 | W | Unclassified | 1/28/2003 | 78 | $216,505.05 | $2,775.71 | 10.2053% | -0.99117 | 0 | $27,198.67 | 4.4345 | 0 |
| 100012283 | 6 | $2,217,991 | W | Bridge Replacement | 5/22/2003 | 250 | $635,381.75 | $2,541.53 | 28.6467% | -0.54293 | 0 | $8,871.96 | 3.9480 | 0 |
| 100003443 | 6 | $2,233,037 | W | Bridge Replacement | 6/25/2003 | 213 | $521,740.08 | $2,449.48 | 23.3646% | -0.63144 | 0 | $10,483.74 | 4.0205 | 0 |
| 100042531 | 6 | $2,234,565 | W | Unclassified | 5/12/2005 | 89 | $413,596.60 | $4,647.15 | 18.5090% | -0.73262 | 0 | $25,107.47 | 4.3998 | 0 |
| 100044369 | 6 | $2,335,505 | W | Unclassified | 10/17/2005 | 42 | $81,692.04 | $1,945.05 | 3.4978% | -1.45620 | 0 | $55,607.26 | 4.7451 | 0 |
| 100033138 | 6 | $2,424,189 | W | Unclassified | 6/28/2004 | 194 | $245,508.52 | $1,265.51 | 10.1274% | -0.99450 | 0 | $12,495.82 | 4.0968 | 0 |
| 100008878 | 6 | $2,455,928 | W | Unclassified | 10/26/2004 | 279 | $610,552.80 | $2,188.36 | 24.8604% | -0.60449 | 0 | $8,802.61 | 3.9446 | 0 |
| 100003259 | 6 | $2,459,812 | W | Bridge Repair, Bridg | 4/12/2005 | 171 | $712,486.44 | $4,166.59 | 28.9651% | -0.53813 | 0 | $14,384.87 | 4.1579 | 0 |
| 100044362 | 6 | $2,477,298 | W | Unclassified | 1/10/2005 | 75 | $199,399.06 | $2,658.65 | 8.0491% | -1.09426 | 0 | $33,030.64 | 4.5189 | 0 |
| 100038700 | 6 | $2,498,479 | W | Unclassified | 4/29/2005 | 185 | $388,209.82 | $2,098.43 | 15.5378% | -0.80861 | 0 | $13,505.29 | 4.1305 | 0 |
| 100042813 | 6 | $2,508,010 | W | Unclassified | 3/24/2004 | 57 | $154,567.99 | $2,711.72 | 6.1630% | -1.21021 | 0 | $44,000.18 | 4.6435 | 0 |
| 100040878 | 6 | $2,605,521 | W | Traffic Striping, Pave | 7/26/2005 | 105 | $515,612.80 | $4,910.60 | 19.7892% | -0.70357 | 0 | $24,814.49 | 4.3947 | 0 |
| 100045170 | 6 | $2,716,333 | W | Unclassified | 12/6/2005 | 65 | $67,954.80 | $1,045.46 | 2.5017% | -1.60176 | 0 | $41,789.74 | 4.6211 | 0 |
| 100038111 | 6 | $2,851,977 | W | Pavement Rehab, R | 10/25/2004 | 80 | $440,739.36 | $5,509.24 | 15.4538% | -0.81096 | 0 | $35,649.71 | 4.5521 | 0 |
| 100002775 | 6 | $2,888,100 | W | Unclassified | 9/28/2004 | 232 | $523,708.20 | $2,257.36 | 18.1333% | -0.74152 | 0 | $12,448.71 | 4.0951 | 0 |
| 100039713 | 6 | $2,894,190 | W | Unclassified | 9/12/2005 | 213 | $672,459.83 | $3,157.09 | 23.2348% | -0.63386 | 0 | $13,587.75 | 4.1331 | 0 |
| 100008432 | 6 | $2,925,424 | W | Grade Drain Base P | 1/13/2005 | 231 | $669,899.06 | $2,900.00 | 22.8992% | -0.64018 | 0 | $12,664.17 | 4.1026 | 0 |
| 100038286 | 6 | $2,968,171 | W | Grade Drain Base P | 5/21/2003 | 190 | $670,014.90 | $3,526.39 | 22.5733% | -0.64640 | 0 | $15,621.95 | 4.1937 | 0 |
| 100004085 | 6 | $3,061,380 | W | Grade Drain Base P | 10/15/2004 | 267 | $851,236.75 | $3,188.15 | 27.8057% | -0.55587 | 0 | $11,465.84 | 4.0594 | 0 |
| 100003776 | 6 | $3,080,221 | W | Bridge Replacement | 2/18/2003 | 372 | $229,251.30 | $616.27 | 7.4427% | -1.12827 | 0 | $8,280.16 | 3.9180 | 0 |
| 100007682 | 6 | $3,433,409 | W | Pavement Rehab, R | 6/25/2004 | 392 | $1,162,911.19 | $2,966.61 | 33.8705% | -0.47018 | 0 | $8,758.70 | 3.9424 | 0 |
| 100003969 | 6 | $3,458,036 | W | Grade Drain Base P | 11/2/2004 | 309 | $767,959.73 | $2,485.31 | 22.2080% | -0.65349 | 0 | $11,191.06 | 4.0489 | 0 |
| 100003469 | 6 | $3,488,000 | W | Grade Drain Base P | 5/18/2004 | 273 | $619,178.46 | $2,268.05 | 17.7517% | -0.75076 | 0 | $12,776.56 | 4.1064 | 0 |
| 100003753 | 6 | $3,530,086 | W | Bridge Replacement | 12/8/2003 | 240 | $742,522.49 | $3,093.84 | 21.0341% | -0.67708 | 0 | $14,708.69 | 4.1676 | 0 |
| 100039712 | 6 | $3,654,052 | W | Unclassified | 2/15/2005 | 282 | $857,772.53 | $3,041.75 | 23.4746% | -0.62940 | 0 | $12,957.63 | 4.1125 | 0 |
| 100013198 | 6 | $3,666,947 | W | Unclassified | 9/2/2003 | 300 | $518,236.73 | $1,727.46 | 14.1326% | -0.84978 | 0 | $12,223.16 | 4.0872 | 0 |
| 100005175 | 6 | $3,727,782 | W | Grade Drain Base P | 1/7/2003 | 154 | $676,074.69 | $4,390.10 | 18.1361% | -0.74146 | 0 | $24,206.38 | 4.3839 | 0 |
| 100008718 | 6 | $3,779,732 | W | Unclassified | 8/25/2005 | 392 | $988,886.51 | $2,522.67 | 26.1629% | -0.58231 | 0 | $9,642.17 | 3.9841749 | 0 |
| 100003873 | 6 | $3,932,357 | W | Grade Drain Base P | 10/7/2003 | 232 | $710,379.41 | $3,061.98 | 18.0650% | -0.74316 | 0 | $16,949.81 | 4.229165 | 0 |
| 100007703 | 6 | $3,954,675 | W | Grade Drain Base P | 6/30/2004 | 163 | $625,872.55 | $3,839.71 | 15.8261% | -0.80062 | 0 | $24,261.81 | 4.3849232 | 0 |
| 100013061 | 6 | $4,022,113 | W | Unclassified | 10/28/2003 | 175 | $565,220.69 | $3,229.83 | 14.0528% | -0.85224 | 0 | $22,983.50 | 4.3614162 | 0 |
| 100001739 | 6 | $4,071,161 | W | Unclassified | 9/12/2005 | 214 | $580,226.32 | $2,711.34 | 14.2521% | -0.84612 | 0 | $19,024.12 | 4.2793045 | 0 |
| 100004849 | 6 | $4,166,720 | W | Unclassified | 7/20/2005 | 300 | $990,921.16 | $3,303.07 | 23.7818% | -0.62376 | 0 | $13,889.07 | 4.1426731 | 0 |
| 100004277 | 6 | $4,569,048 | W | Unclassified | 10/24/2005 | 225 | $1,175,716.94 | $5,225.41 | 25.7322% | -0.58952 | 0 | $20,306.88 | 4.3076432 | 0 |
| 100005168 | 6 | $4,608,340 | W | Pavement Rehab, R | 5/6/2003 | 225 | $744,365.72 | $3,308.29 | 16.1526% | -0.79176 | 0 | $20,481.51 | 4.311362 | 0 |
| 100009855 | 6 | $4,665,913 | W | Grade Drain Base P | 7/14/2003 | 234 | $720,717.20 | $3,079.99 | 15.4464% | -0.81117 | 0 | $19,939.80 | 4.2997208 | 0 |
| 100016530 | 6 | $4,681,805 | W | Grade Drain Base P | 9/22/2005 | 211 | $829,601.51 | $3,931.76 | 17.7197% | -0.75154 | 0 | $22,188.65 | 4.3461309 | 0 |
| 100042751 | 6 | $4,686,809 | W | Unclassified | 7/12/2004 | 136 | $83,151.15 | $611.41 | 1.7742% | -1.75101 | 0 | $34,461.83 | 4.5373383 | 0 |
| 100004692 | 6 | $4,920,650 | W | Unclassified | 6/8/2004 | 311 | $38,956.22 | $125.26 | 0.7917% | -2.10145 | 0 | $15,822.03 | 4.1992621 | 0 |
| 100008292 | 7 | $5,022,376 | W | Unclassified | 7/21/2003 | 323 | $2,150,531.98 | $6,657.99 | 42.8190% | -0.36836 | 0 | $15,549.15 | 4.1917067 | 0 |
| 100001605 | 7 | $5,337,717 | W | Unclassified | 8/24/2004 | 260 | $869,570.61 | $3,344.50 | 16.2911% | -0.78805 | 0 | $20,529.68 | 4.3123822 | 0 |
| 100004688 | 7 | $5,367,554 | W | Unclassified | 11/25/2003 | 345 | $962,745.29 | $2,790.57 | 17.9364% | -0.74627 | 0 | $15,558.13 | 4.1919573 | 0 |
| 100001666 | 7 | $5,379,592 | W | Unclassified | 8/31/2005 | 226 | $731,117.41 | $3,235.03 | 13.5906% | -0.86676 | 0 | $23,803.50 | 4.3766409 | 0 |
| 100005176 | 7 | $5,394,947 | W | Grade Drain Base P | 4/25/2003 | 274 | $1,314,206.24 | $4,796.37 | 24.3599% | -0.61332 | 0 | $19,689.59 | 4.2942366 | 0 |
| 100038011 | 7 | $5,712,375 | W | Unclassified | 9/20/2005 | 280 | $1,284,017.09 | $4,585.78 | 22.4778% | -0.64825 | 0 | $20,401.34 | 4.3096587 | 0 |
| 100007457 | 7 | $5,784,901 | W | Unclassified | 12/8/2003 | 504 | $2,202,617.42 | $4,370.27 | 38.0753% | -0.41936 | 0 | $11,477.98 | 4.0598654 | 0 |
| 100040092 | 7 | $5,831,711 | W | Grade Drain Base P | 1/13/2005 | 225 | $1,653,095.42 | $7,347.09 | 28.3467% | -0.54750 | 0 | $25,918.72 | 4.4136135 | 0 |
| 100026220 | 7 | $5,940,775 | W | Grade Drain Base P | 8/24/2004 | 360 | $1,150,528.10 | $3,195.91 | 19.3666% | -0.71295 | 0 | $16,502.15 | 4.2175406 | 0 |
| 100004225 | 7 | $6,259,451 | W | Grade Drain Base P | 2/4/2003 | 279 | $930,278.50 | $3,334.33 | 14.8620% | -0.82792 | 0 | $22,435.31 | 4.350932 | 0 |
| 100033297 | 7 | $6,506,591 | W | Unclassified | 9/16/2005 | 303 | $1,081,642.25 | $3,569.78 | 16.6238% | -0.77927 | 0 | $21,473.90 | 4.3319109 | 0 |
| 100032727 | 7 | $7,048,554 | W | Unclassified | 11/10/2005 | 198 | $429,204.78 | $2,167.70 | 6.0893% | -1.21544 | 0 | $35,598.76 | 4.5514348 | 0 |
| 100033156 | 7 | $7,238,991 | W | Pavement Rehab, R | 3/16/2004 | 240 | $686,273.50 | $2,859.47 | 9.4802% | -1.02318 | 0 | $30,162.46 | 4.4794668 | 0 |
| 100033157 | 7 | $7,506,951 | W | Unclassified | 4/20/2005 | 235 | $881,600.80 | $3,751.49 | 11.7438% | -0.93019 | 0 | $31,944.47 | 4.5043957 | 0 |
| 100032014 | 7 | $7,716,156 | W | Pavement Rehab, R | 4/29/2003 | 225 | $378,318.32 | $1,681.41 | 4.9029% | -1.30954 | 0 | $34,294.03 | 4.5352185 | 0 |
| 100016521 | 7 | $7,755,946 | W | Grade Drain Base P | 5/27/2004 | 420 | $2,741,116.45 | $6,526.47 | 35.3421% | -0.45171 | 0 | $18,466.54 | 4.2663855 | 0 |
| 100004985 | 7 | $7,772,659 | W | Grade Drain Base P | 8/4/2004 | 396 | $1,470,022.53 | $3,712.18 | 18.9127% | -0.72325 | 0 | $19,627.93 | 4.2928744 | 0 |
| 100008439 | 7 | $7,896,112 | W | Unclassified | 5/21/2003 | 414 | $1,585,671.05 | $3,830.12 | 20.0817% | -0.69720 | 0 | $19,072.73 | 4.280413 | 0 |
| 100002568 | 7 | $8,395,121 | W | Grade Drain Base P | 5/25/2004 | 368 | $1,614,296.45 | $4,386.68 | 19.2290% | -0.71604 | 0 | $22,812.83 | 4.3581791 | 0 |
| 100009919 | 7 | $8,695,276 | W | Grade Drain Base P | 8/13/2004 | 297 | $228,652.84 | $769.87 | 2.6296% | -1.58011 | 0 | $29,277.02 | 4.4665269 | 0 |
| 100004521 | 7 | $8,928,205 | W | Grade Drain Base P | 7/19/2003 | 324 | $352,216.94 | $1,087.09 | 3.9450% | -1.40395 | 0 | $27,556.19 | 4.4402191 | 0 |
| 100033214 | 7 | $9,004,494 | W | Pavement Rehab, R | 1/13/2003 | 244 | $845,934.11 | $3,466.94 | 9.3946% | -1.02712 | 0 | $36,903.66 | 4.5670695 | 0 |
| 100032090 | 7 | $9,105,522 | W | Traffic Striping, Pave | 2/7/2003 | 478 | $1,265,832.14 | $2,648.18 | 13.9018% | -0.85693 | 0 | $19,049.21 | 4.279877 | 0 |
| 100009948 | 7 | $9,647,732 | W | Grade Drain Base P | 3/24/2004 | 334 | $1,023,170.26 | $3,063.38 | 10.6053% | -0.97448 | 0 | $28,885.43 | 4.4606788 | 0 |
| 100032096 | 7 | $9,744,072 | W | Unclassified | 4/30/2003 | 378 | $1,361,089.14 | $3,600.76 | 13.9684% | -0.85485 | 0 | $25,777.97 | 4.4112487 | 0 |
| 100004224 | 7 | $9,752,654 | W | Grade Drain Base P | 12/12/2003 | 305 | $1,327,561.17 | $4,352.66 | 13.6123% | -0.86607 | 0 | $31,975.91 | 4.504823 | 0 |
| 100016531 | 8 | $10,529,621 | W | Grade Drain Base P | 9/10/2004 | 371 | $1,769,702.62 | $4,770.09 | 16.8069% | -0.77451 | 0 | $28,381.73 | 4.4530388 | 0 |
| 100004942 | 8 | $10,730,938 | W | Unclassified | 4/29/2005 | 304 | $410,860.10 | $1,351.51 | 3.8287% | -1.41694 | 0 | $35,299.14 | 4.5477641 | 0 |
| 100009921 | 8 | $12,466,740 | W | Grade Drain Base P | 8/31/2004 | 447 | $1,208,652.20 | $2,703.92 | 9.6950% | -1.01345 | 0 | $27,889.80 | 4.4454454 | 0 |
| 100004752 | 8 | $12,846,920 | W | Unclassified | 11/12/2003 | 402 | $1,578,999.85 | $3,927.86 | 12.2909% | -0.91042 | 0 | $31,957.51 | 4.504573 | 0 |
| 100009945 | 8 | $12,924,031 | W | Grade Drain Base P | 8/27/2003 | 391 | $1,346,599.32 | $3,443.99 | 10.4193% | -0.98216 | 0 | $33,053.79 | 4.5192212 | 0 |
| 100032588 | 8 | $12,997,911 | W | Bridge Replacement | 6/11/2003 | 272 | $893,326.01 | $3,284.29 | 6.8728% | -1.16286 | 0 | $47,786.44 | 4.6793047 | 0 |
| 100009942 | 8 | $13,858,327 | W | Grade Drain Base P | 4/18/2003 | 421 | $1,851,409.09 | $4,397.65 | 13.3595% | -0.87421 | 0 | $32,917.64 | 4.5174287 | 0 |
| 100009947 | 8 | $16,959,487 | W | Grade Drain Base P | 11/26/2003 | 452 | $2,024,967.75 | $4,480.02 | 11.9400% | -0.92299 | 0 | $37,520.99 | 4.5742743 | 0 |
| 100009925 | 8 | $19,415,331 | W | Grade Drain Base P | 4/2/2004 | 420 | $2,588,764.84 | $6,163.73 | 13.3336% | -0.87505 | 0 | $46,226.98 | 4.6648955 | 0 |